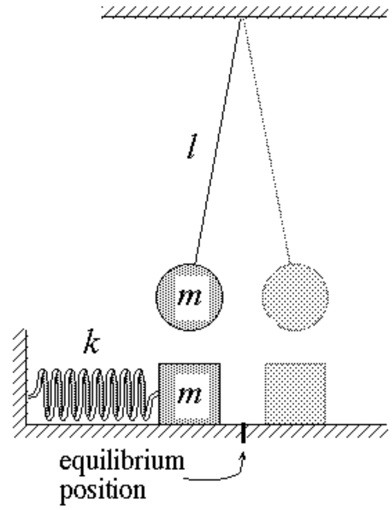


Part A: A block-and-spring system is directly below a pendulum. The block and pendulum bob both have mass m. The spring constant is k, and the length of the pendulum is l. All parameters have been chosen so that the block is directly below the pendulum bob at all times.

The following change is made: the mass of the block and the bob are each doubled. The objects are then released from rest at the same far left position as shown in the figure.

How has this change affected the magnitude of the net force on the block when it is at the far left position? *The magnitude of the net force on the block has increased by a factor of 2.*

How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? *The magnitude of the net force on the pendulum bob has increased by a factor of 2.*

Explain. *The spring is compressed more so it pushes harder, and the tension has a bigger angle so it has a bigger sine theta.*

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? *The magnitude of the acceleration of the block has increased by a factor of 2.*

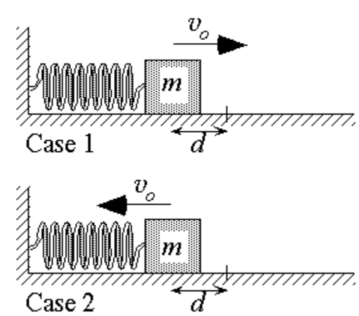
How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? *The magnitude of the acceleration of the pendulum bob has increased by a factor of 2.*

Explain. *F= ma, and mass is constant, so acceleration must have increased.*

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? *The time the block takes to travel to the equilibrium position has not changed.*

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? *The time the bob takes to travel to the equilibrium position has not changed.*

Explain. *It is the same every time, ignoring external forces.*



Part B: Two block-and-spring systems, Case 1 and Case 2, shown. The blocks each have mass m and are attached to identical, ideal springs of spring constant k. In each case, the block moves on a frictionless surface. At the instant shown, each block is a distance d to the left of equilibrium.

In Case 1, the block has instantaneous velocity v_o to the right. In Case 2, the block has instantaneous velocity v_o to the left.

At the instant shown, is the magnitude of the force on the block by the spring in case 1 greater than, less than, or equal to the magnitude of the force on the block by the spring in case 2? *The magnitude of the force on the block by the spring in case 1 is equal to the magnitude of the force on the block by the spring in case 2.*

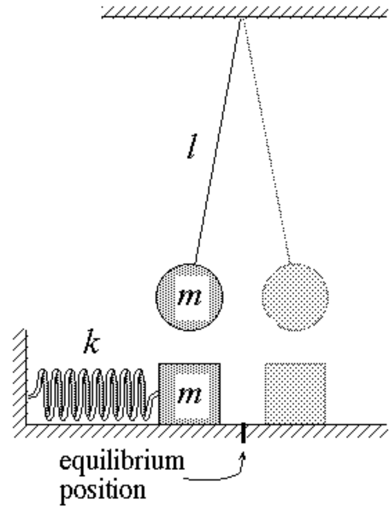
Explain. *The spring is just as compressed in both.*

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2?
The mark in case 1 will be at the same position as the mark in case 2.

Explain. *It should be the same, since there is no external force and the spring just goes back and forth the same amount.*

End of response



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The following change is made: the mass of the block and the bob are each doubled. The objects are then released from rest at the same far left position as shown in the figure.

How has this change affected the magnitude of the net force on the block when it is at the far left position? The magnitude of the net force on the block has not changed.

How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has increased by a factor of 2.

Explain. The same force is still applied to the block because the force applied is not dependant upon mass. The pend, however, has gravity acting on it which is a force that is dependent/affected by changes in it's mass.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has decreased by a factor of 2.

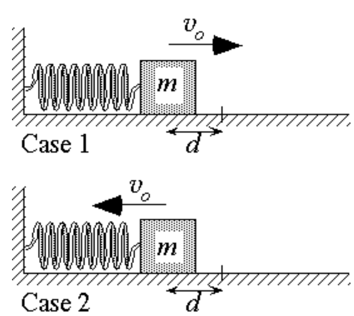
How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has not changed.

Explain. Because force (for the block) has remained constant and it's mass has double, the acceleration is then cut in half. While the mass has led to an increased net force on the object, acceleration due to gravity always reimains constant.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has increased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has not changed.

Explain. The block has a slower rate of acceleration, so it will take longer to reach its final point. The ball's acceleration has not been affected, so it therefore take the same amount of time to reach its final destination.



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Explain. The force applied by the spring is essentially constant depending on how copressed it is, so if two blocks have the spring compress the same amount, the spring is appying the same force. Because the block in case 1 is accelerating, however, it has a slightly smaller net force applied to it simply because it is accelerating rather than decelerating.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be at the same position as the mark in case 2.

Explain. The spring will turn block two around and having going it's opposite initial velocity when it reaches it's starting point again, so the blocks will end up in the same spot eventually because there are no losses to friction.

End of response

Part A: A block-and-spring system is directly below a pendulum. The block and pendulum bob both have mass m. The spring constant is k, and the length of the pendulum is l. All parameters have been chosen so that the block is directly below the pendulum bob at all times.

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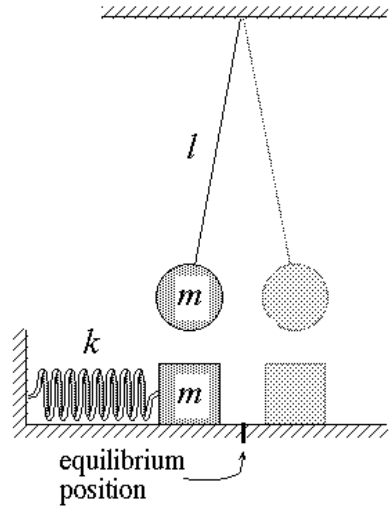


How has this change affected the magnitude of the net force on the block when it is at the far left position? The magnitude of the net force on the block has increased by a factor of 2.

How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has increased by a factor of 2.

Explain. The magnitude of the force is equal to the Fnet =ma, and since the only force on the pendulum bob is due to gravity, F=mg, and so, if the mass is twice as big, then the F will also be twice as big. I'm not sure why the F on the block is also twice, but the acc must be equal because they stay vertically on top of each other at all times.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has increased by a factor of 2.

How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has increased by a factor of 2.

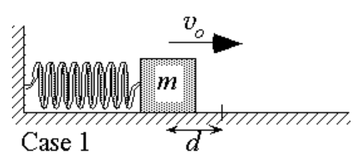
Explain. I am only guessing on this question. Because of Newton's Second Law, if the force increases, then the acceleration also increases. Thus, the acceleration of the pendulum bob increases because of the mass being twice as big.

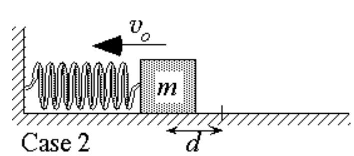
Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has not changed.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has not changed.

Explain. I do not think that a heavier mass increases pendulum time because of the relationship T = 2*pi(L/g) ^1/2. However, since I believe this answer is correct, some of my reasoning above is not consistent with this response.

Part B: Two block-and-spring systems, Case 1 and Case 2, shown. The blocks each have mass m and are attached to identical, ideal springs of spring constant k. In each case, the block moves on a frictionless surface. At the instant shown, each block is a distance d to the left of equilibrium.





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At the instant shown, is the magnitude of the force on the block by the spring in case 1 greater than, less than, or equal to the magnitude of the force on the block by the spring in case 2? The magnitude of the force on the block by the spring in case 1 is equal to the magnitude of the force on the block by the spring in case 2.

Explain. I believe that the magnitude of the two forces are equal. This is because the spring pushes on the block just as hard as the block pushes back on the spring. Even though the direction is different, there is the same resistence.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be at the same position as the mark in case 2.

Explain. Since the blocks have the same mass, and assuming the same spring (constant), then the will move with the same motion, given that the initial displacement of the block is the same. Thus the maximum right position will be the same, although the two blocks will reach that position at different times.

End of response

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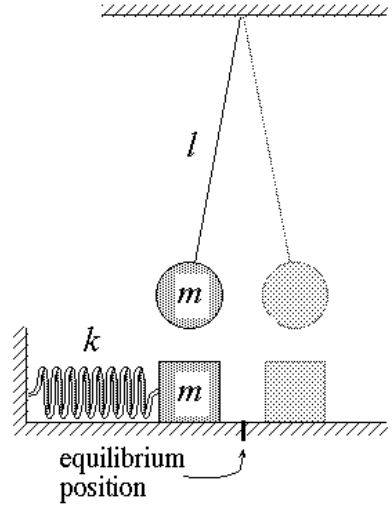

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How has this change affected the magnitude of the net force on the block when it is at the far left position? The magnitude of the net force on the block has not changed.

How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has increased by a factor of 2.

Explain. Force equals mass times acceleration, and we have doubled the mass and the acceleration is still the same, so the force has doubled.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has decreased by a factor of 2.

How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has decreased by a factor of 2.

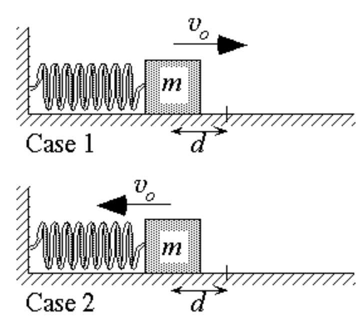
Explain. kinetic energy equals 1/2 mv^2, and the mass has doubled. To conserve KE the velocity will have to be cut as well.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has decreased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has not changed.

Explain. Objects hanging from a pendulum all will swing the same speed, just like all objects fall the same speed from gravity. With a spring though, the more massive the slower the acceleration.

Part B: Two block-and-spring systems, Case 1 and Case 2, shown. The blocks each have mass m and are attached to identical, ideal springs of spring constant k. In each case, the block moves on a frictionless surface. At the instant shown, each block is a distance d to the left of equilibrium.



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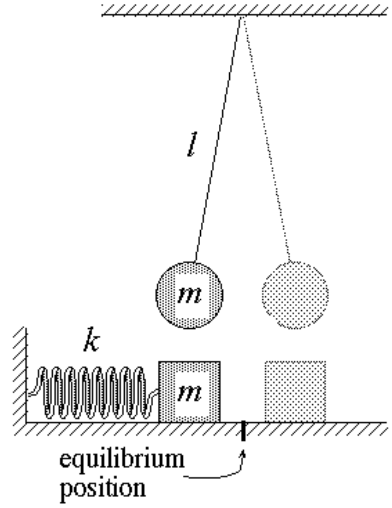
Explain. They are equal but in opposite directions because the spring is stretched the same distance in both cases, so it is exerting the same force in both cases.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be at the same position as the mark in case 2.

Explain. Everything is the same in both cases, so there is no reason why they wouldnt stretch out to the same point.

End of response



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How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has increased by a factor of 2.

Explain. F=ma

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has decreased by a factor of 2.

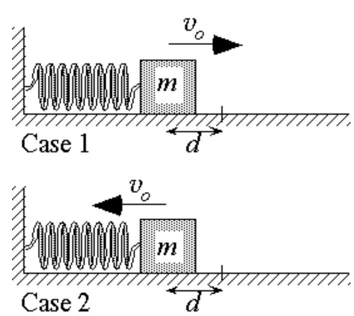
How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has not changed.

Explain. Question 8: F=kx and F=ma; k has not changed, so x must change since F has changed, which implies a change in acceleration.Question 9: F=ma, and the only force acting on it is gravity, which has a constant acceleration

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has decreased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has not changed.

Explain. Same reasoning as question 10



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In Case 1, the block has instantaneous velocity v_o to the right. In Case 2, the block has instantaneous velocity v_o to the left.

At the instant shown, is the magnitude of the force on the block by the spring in case 1 greater than, less than, or equal to the magnitude of the force on the block by the spring in case 2? The magnitude of the force on the block by the spring in case 1 is equal to the magnitude of the force on the block by the spring in case 2.

Explain. F=kx, and x and k are the same for both block

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be at the same position as the mark in case 2.

Explain. The spring - mass system oscillates, and vo points away from the amplitude of the oscillation.

End of response

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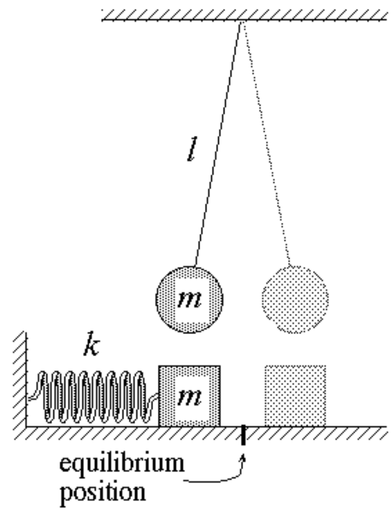


The following change is made: the mass of the block and the bob are each doubled. The objects are then released from rest at the same far left position as shown in the figure.

How has this change affected the magnitude of the net force on the block when it is at the far left position? The magnitude of the net force on the block has not changed.

How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has not changed.

Explain. the force does not change because no other force is acting upon the block or the pendulum.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has decreased by a factor of 2.

How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has decreased by a factor of 2.

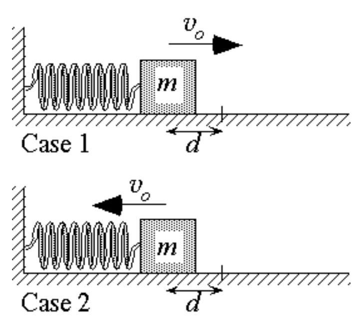
Explain. the acceleration of the block decreases by a factor of 2 in order to compensate for the increased mass and the constant force. the same reason holds true for the pendulum.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has decreased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has decreased.

Explain. the time has decreased because acceleration decreases.

Part B: Two block-and-spring systems, Case 1 and Case 2, shown. The blocks each have mass m and are attached to identical, ideal springs of spring constant k. In each case, the block moves on a frictionless surface. At the instant shown, each block is a distance d to the left of equilibrium.



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At the instant shown, is the magnitude of the force on the block by the spring in case 1 greater than, less than, or equal to the magnitude of the force on the block by the spring in case 2? The magnitude of the force on the block by the spring in case 1 is greater than the magnitude of the force on the block by the spring in case 2.

Explain. its greater than because the block is pushing against the spring, compressing it.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be to the left of the mark in case 2.

Explain. It should be the same because the spring constants are equal and the mass and accelerations of the blocks are equal.

End of response

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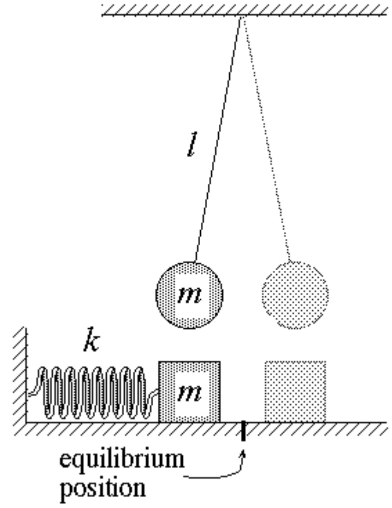

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How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has not changed.

Explain. Net force on a block concerns the mass of the block itself, while the increased mass of a pendulum is compensated by gravity.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has decreased by a factor of 2.

How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has not changed.

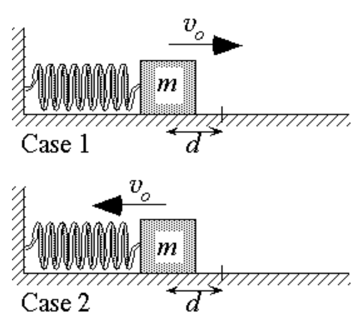
Explain. For the same reasons as above, the block has a greater net force to counteract the spring with, but the pendulum has the same net force. Therefore the acceleration does not change.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has increased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has not changed.

Explain. As the mass of the block increases, the acceleration has a slower effect, while on the pendulum the mass makes no difference.

Part B: Two block-and-spring systems, Case 1 and Case 2, shown. The blocks each have mass m and are attached to identical, ideal springs of spring constant k. In each case, the block moves on a frictionless surface. At the instant shown, each block is a distance d to the left of equilibrium.



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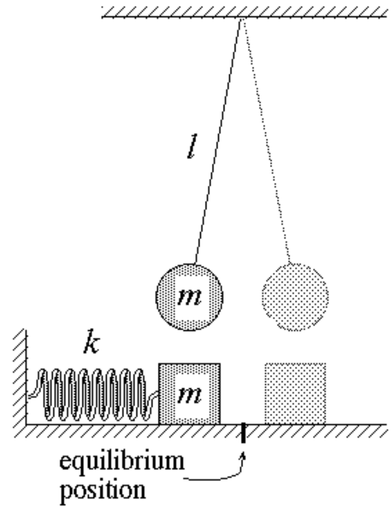
Explain. Case 1 is greater than case 2 because both the spring and initial velocity work in the same direction, while in case 2 the spring and block detract from each other.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be to the right of the mark in case 2.

Explain. Case 1 will have gone farther because the initial velocity was in the positive direction to begin with.

End of response



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How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has increased by a factor of 2.

Explain. The net force on the pendulum is from the force of gravity so if the mass is doubled then the force is doubled, and the same goes for block.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has decreased by a factor of 2.

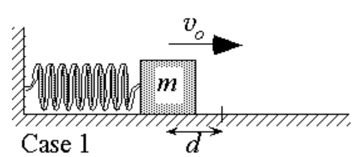
How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has decreased by a factor of 2.

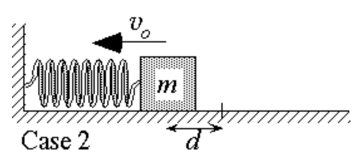
Explain. Mass is a measure of inertia, which is a measure of the objects tendency to resist change. So if it has twice the mass then it will accelerate slower.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has increased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has increased.

Explain. It will accelerate less quickly so the time it takes to get back to the equiliberium point is longer.





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In Case 1, the block has instantaneous velocity v_o to the right. In Case 2, the block has instantaneous velocity v_o to the left.

At the instant shown, is the magnitude of the force on the block by the spring in case 1 greater than, less than, or equal to the magnitude of the force on the block by the spring in case 2? The magnitude of the force on the block by the spring in case 1 is equal to the magnitude of the force on the block by the spring in case 2.

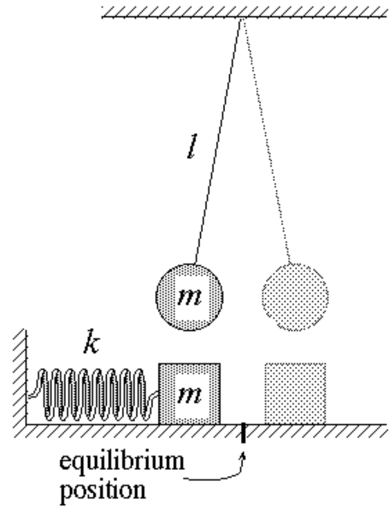
Explain. THe both have the same velocities in different directions, and so the force applied by the spring in each case is equal. The force on block 1 act to accelerate the block, and the force on block 2 is to decelerate the block.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be at the same position as the mark in case 2.

Explain. All momentum is conserved in the elastic collision so hypothetically the block will move the same distance each time.

End of response



Part A: A block-and-spring system is directly below a pendulum. The block and pendulum bob both have mass m. The spring constant is k, and the length of the pendulum is l. All parameters have been chosen so that the block is directly below the pendulum bob at all times.

The following change is made: the mass of the block and the bob are each doubled. The objects are then released from rest at the same far left position as shown in the figure.

How has this change affected the magnitude of the net force on the block when it is at the far left position? The magnitude of the net force on the block has increased by a factor of 2.

How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has increased by a factor of 2.

Explain. If you doubl ethe mass then the net force on the object doubles

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has decreased by a factor of 2.

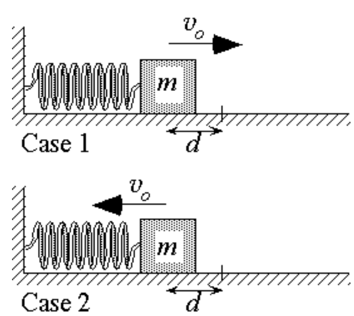
How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has decreased by a factor of 2.

Explain. Since there is more force, and the mass is the same, the acceleration must change accordingly

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has decreased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has decreased.

Explain. Since, acceleration decreases, so does the time it takes the block ot pendulum to travel a given distance.



Part B: Two block-and-spring systems, Case 1 and Case 2, shown. The blocks each have mass m and are attached to identical, ideal springs of spring constant k. In each case, the block moves on a frictionless surface. At the instant shown, each block is a distance d to the left of equilibrium.

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At the instant shown, is the magnitude of the force on the block by the spring in case 1 greater than, less than, or equal to the magnitude of the force on the block by the spring in case 2? The magnitude of the force on the block by the spring in case 1 is equal to the magnitude of the force on the block by the spring in case 2.

Explain. velocity does not affect the net force on the block

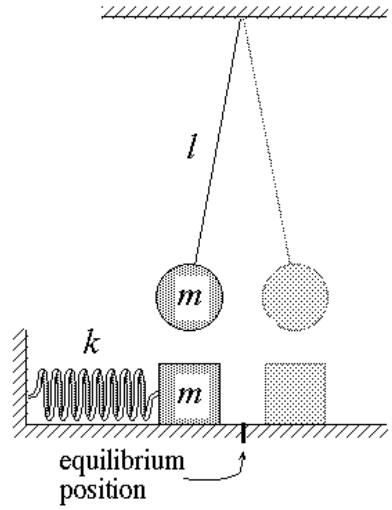
A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be at the same position as the mark in case 2.

Explain. The spring constant and the Force determine how far the block will travel, in this case, the same distance.

End of response

Part A: A block-and-spring system is directly below a pendulum. The block and pendulum bob both have mass m. The spring constant is k, and the length of the pendulum is l. All parameters have been chosen so that the block is directly below the pendulum bob at all times.



The following change is made: the mass of the block and the bob are each doubled. The objects are then released from rest at the same far left position as shown in the figure.

How has this change affected the magnitude of the net force on the block when it is at the far left position? The magnitude of the net force on the block has not changed.

How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has increased by a factor of 2.

Explain. The force on the block is the force of the spring which does not depend on the mass of the spring. The forces which act on the pendelum are gravity and tension. These forces are affected by mass.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has decreased by a factor of 2.

How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has increased by a factor of 2.

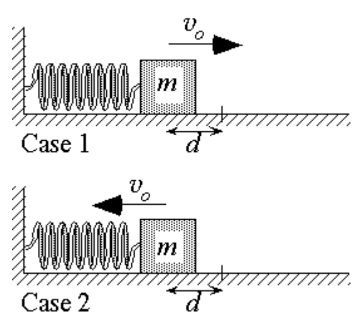
Explain. I am not sure about the pendulum. For the block F = ma, the force is the same however mass is incresed by two, so a decreases by two.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has increased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has decreased.

Explain. Responses based on accelerations.

Part B: Two block-and-spring systems, Case 1 and Case 2, shown. The blocks each have mass m and are attached to identical, ideal springs of spring constant k. In each case, the block moves on a frictionless surface. At the instant shown, each block is a distance d to the left of equilibrium.



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Explain. The force of the spring is kx, so they have the same k and x therefore the forces are equal.

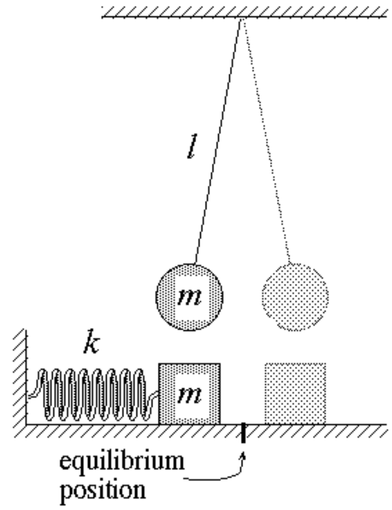
A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be at the same position as the mark in case 2.

Explain. The same mass and the same force, so same position.

End of response

Part A: A block-and-spring system is directly below a pendulum. The block and pendulum bob both have mass m. The spring constant is k, and the length of the pendulum is l. All parameters have been chosen so that the block is directly below the pendulum bob at all times.



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How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has not changed.

Explain. Since we know that net force is mass*acceleration, and if mass increases by two, then so will the net force.But we can assume that the acceleration of the block will decrease because things like friction and normal force will increase.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has decreased by a factor of 2.

How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has decreased by a factor of 2.

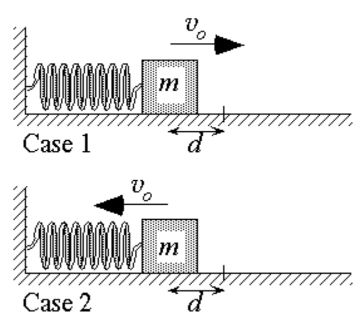
Explain. If the mass has increased by a factor of two, then the acceleration should decrease so that in the end the net force is the same.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has not changed.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has not changed.

Explain. the net force is the same, so the time does not change.

Part B: Two block-and-spring systems, Case 1 and Case 2, shown. The blocks each have mass m and are attached to identical, ideal springs of spring constant k. In each case, the block moves on a frictionless surface. At the instant shown, each block is a distance d to the left of equilibrium.



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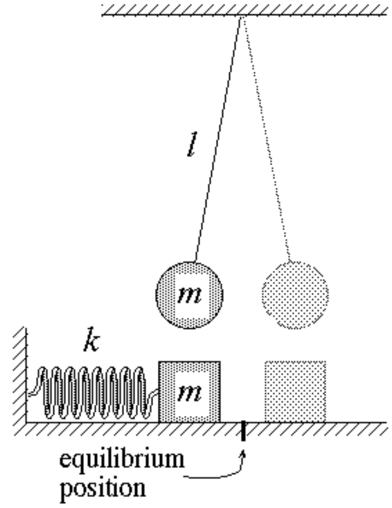
Explain. Even though their velocities are in different directions, they are both decelerating or accelerating at the same speeds, and their masses are the same, so theif net forces are equal.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be at the same position as the mark in case 2.

Explain. Same net force, same distance, same mark.

End of response



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How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has increased by a factor of 2.

Explain. gravity

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has decreased by a factor of 2.

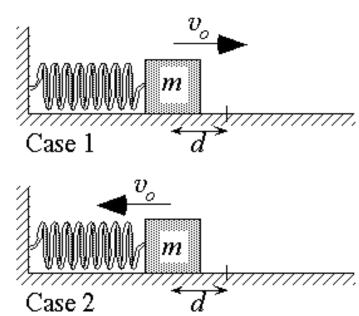
How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has increased by a factor of 2.

Explain. sum of force/mass= acceleration

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has increased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has decreased.

Explain. smaller acceleration for the block



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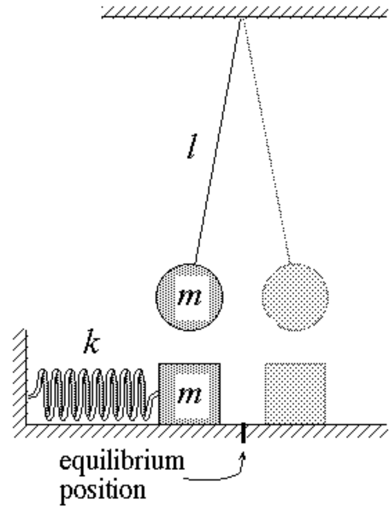
Explain. same spring constant and compresion distance

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be at the same position as the mark in case 2.

Explain. seems like the right answer

End of response



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How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has increased by a factor of 2.

Explain. The net force on the block only depends on teh spring constant and the position--not on the mass. the net force on the bob depends on teh force of gravity which IS affected by the mass.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has not changed.

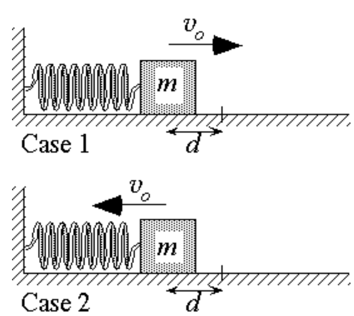
How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has decreased by a factor of 2.

Explain. the block's net acceleration is proportional to Fnet/m and since mass is not part of Fnet, doubling mass decreases the 'a' by 2. for the bob, the Fnet dependo on m but when doubled and then divided by 2m the 2m's cancel so it remains the same.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has increased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has not changed.

Explain. the time it tkaes is inversely proportional to a. for the block, 'a' decreased so 'v' also decreaseed so time increases. a is not affected in teh pendulum by mass changes, so neither does the time.



Part B: Two block-and-spring systems, Case 1 and Case 2, shown. The blocks each have mass m and are attached to identical, ideal springs of spring constant k. In each case, the block moves on a frictionless surface. At the instant shown, each block is a distance d to the left of equilibrium.

In Case 1, the block has instantaneous velocity v_o to the right. In Case 2, the block has instantaneous velocity v_o to the left.

At the instant shown, is the magnitude of the force on the block by the spring in case 1 greater than, less than, or equal to the magnitude of the force on the block by the spring in case 2? The magnitude of the force on the block by the spring in case 1 is equal to the magnitude of the force on the block by the spring in case 2.

Explain. the blocks will have the same force magnitude because for a spring F=kx, k is the same and x=d is the same so F is the same.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be at the same position as the mark in case 2.

Explain. they will be the same because the same force acts on them and the same amount of stretch occurs because the masses are the same.

End of response

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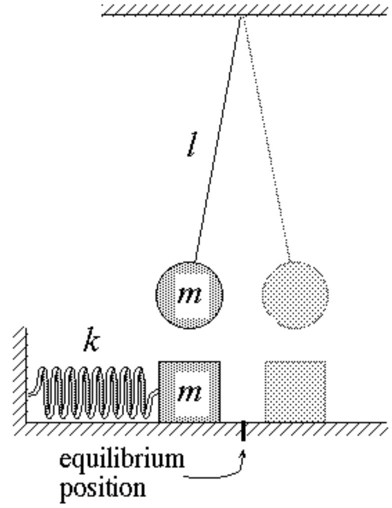

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How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has not changed.

Explain. the net force does not change for both objects because the there will be twice the amount of force opposing the extra mass added to the block and pendulum

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has decreased by a factor of 2.

How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has decreased by a factor of 2.

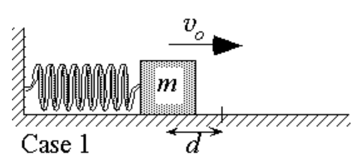
Explain. The more mass there are in both objects, the less acceleration it will go since gravity will act more when there is more mass.

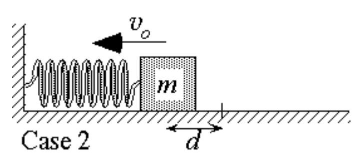
Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has increased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has increased.

Explain. The reason both time increase because it is the same concept as question 10 above. The more mass there are, the more gravity opposing the accleration and therefore making it move slower.

Part B: Two block-and-spring systems, Case 1 and Case 2, shown. The blocks each have mass m and are attached to identical, ideal springs of spring constant k. In each case, the block moves on a frictionless surface. At the instant shown, each block is a distance d to the left of equilibrium.





In Case 1, the block has instantaneous velocity v_o to the right. In Case 2, the block has instantaneous velocity v_o to the left.

At the instant shown, is the magnitude of the force on the block by the spring in case 1 greater than, less than, or equal to the magnitude of the force on the block by the spring in case 2? The magnitude of the force on the block by the spring in case 1 is less than the magnitude of the force on the block by the spring in case 2.

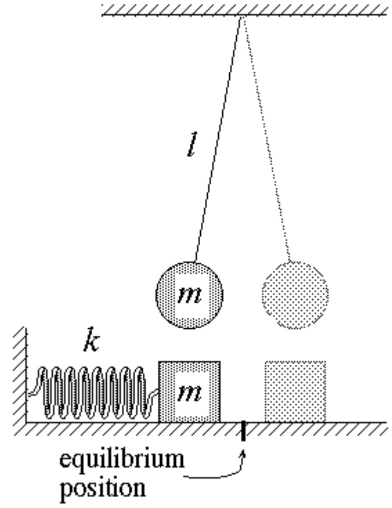
Explain. This is due to the compress springs because since both have the same masses, the only factor affecting the motion is the mass of the spring. when one spring is tightly compressed, it will pull the block back so the force is greater.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be to the right of the mark in case 2.

Explain. since the spring force on block 1 is less than the one on block 2, case one will go further out then in case 2. So therefore, the block mark of case one will be to the right of the mark on block 2.

End of response



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How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has increased by a factor of 2.

Explain. The pendulum force doubles because force is directly proportional to mass of the object. The force on the block is unchanged, because spring force does not depend on mass.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has not changed.

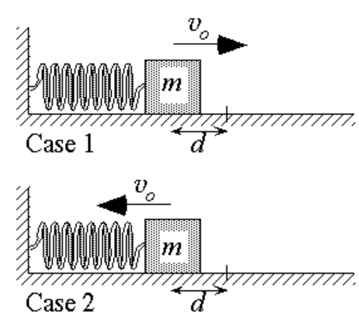
How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has decreased by a factor of 2.

Explain. The acceleration is unchanged on the block because although the force doubles, mass doubles also, so F/m is the same. The acceleration on the block is cut in half, because the force is the same, but mass doubles, so F/m is half of what it was before.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has increased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has not changed.

Explain. The block requires more time, because the acceleration is slower, so more time is required for the block to come to rest. The time for the bob to travel is unchanged, because the acceleration is also unchanged.



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At the instant shown, is the magnitude of the force on the block by the spring in case 1 greater than, less than, or equal to the magnitude of the force on the block by the spring in case 2? The magnitude of the force on the block by the spring in case 1 is equal to the magnitude of the force on the block by the spring in case 2.

Explain. The spring force only depends on the spring constant and the distance from the equilibrium point. Since those are the same in both cases, then the force is the same.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be at the same position as the mark in case 2.

Explain. The marks will be at the same point, because the blocks have the same initial velocity (although in opposite directions). It takes the same distance and time for a block to stop from v0 as it does to accelerate to v0 from rest, so because of that, the blocks will have the same maximum positions.

End of response

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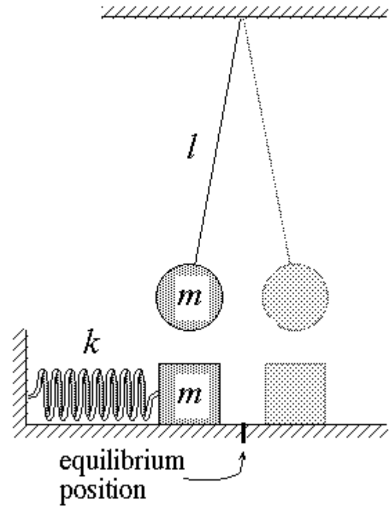

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How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has increased by a factor of 2.

Explain. the forces created by the spring, and by gravity increase if the mass increases

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has decreased by a factor of 2.

How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has not changed.

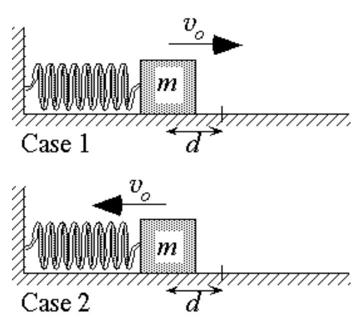
Explain. the block will come slower off the spring, unless the spring is stiffened. Gravity is the only force accelerating the pendulum, so it's effect does not change with increased mass

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has increased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has not changed.

Explain. same reasons as above

Part B: Two block-and-spring systems, Case 1 and Case 2, shown. The blocks each have mass m and are attached to identical, ideal springs of spring constant k. In each case, the block moves on a frictionless surface. At the instant shown, each block is a distance d to the left of equilibrium.



In Case 1, the block has instantaneous velocity v_o to the right. In Case 2, the block has instantaneous velocity v_o to the left.

At the instant shown, is the magnitude of the force on the block by the spring in case 1 greater than, less than, or equal to the magnitude of the force on the block by the spring in case 2? The magnitude of the force on the block by the spring in case 1 is equal to the magnitude of the force on the block by the spring in case 2.

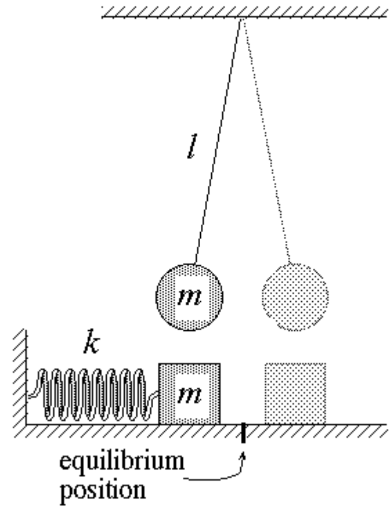
Explain. Assuming that the spring is stretched an equal length in both cases, the force on the block will be the same in both cases

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? unanswered

Explain. This question makes no sense without a complete diagram. What is to the right that forces the block back to the left???

End of response



Part A: A block-and-spring system is directly below a pendulum. The block and pendulum bob both have mass m. The spring constant is k, and the length of the pendulum is l. All parameters have been chosen so that the block is directly below the pendulum bob at all times.

The following change is made: the mass of the block and the bob are each doubled. The objects are then released from rest at the same far left position as shown in the figure.

How has this change affected the magnitude of the net force on the block when it is at the far left position? The magnitude of the net force on the block has increased by a factor of 2.

How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has not changed.

Explain. mg is for the pendulum, which takes mass into account, and 1/2kx^2 is for the block, which is spring potential energy and isn't based on mass.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has not changed.

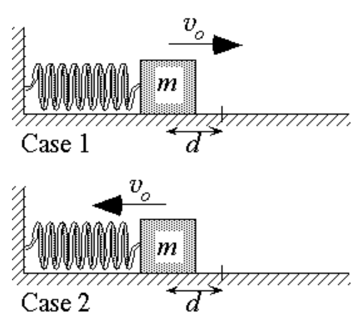
How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has increased by a factor of 2.

Explain. same as above, when applying F=MA

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has not changed.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has decreased.

Explain. the bob's net force is greater, so it will have a faster acceleration, whereas the block's net force is the same so it will travel the same.



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Explain. in case 1, the block is decreasing the spring's potential energy and not adding resistance to the spring, so it will push less on the block, for a smaller force than in case 2.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be to the left of the mark in case 2.

Explain. by increasing the spring's U by an initial Vo to the left, the spring system's total energy will increase, and it will be able to travel further in case 2.

End of response

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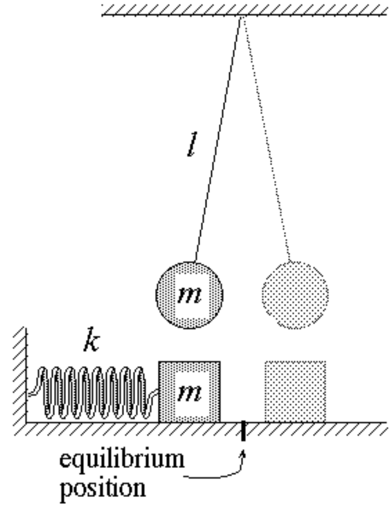

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How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has increased by a factor of 2.

Explain. because force is mass multiplied by acceleration, if you double the mass, you double the force.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has not changed.

How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has not changed.

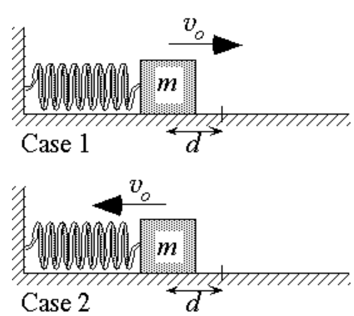
Explain. mass is not related to acceleration

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has increased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has decreased.

Explain. because the spring now has to do twice as much work to move it the same distance, where as gravity now has twice as much to act on so it falls faster.

Part B: Two block-and-spring systems, Case 1 and Case 2, shown. The blocks each have mass m and are attached to identical, ideal springs of spring constant k. In each case, the block moves on a frictionless surface. At the instant shown, each block is a distance d to the left of equilibrium.



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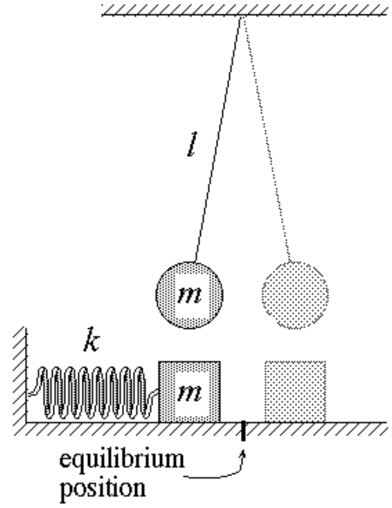
Explain. becasue the spring is still compressing in case two, the force has to be greater

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be to the left of the mark in case 2.

Explain. becasue the spring has more potential energy in case 2, the block will move farther

End of response



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Explain. based on labs and some guessing. but spring force = kx^2, and the distance doesn't change; it makes sense that the pendulum's net force wouldn't change either (i think that depends on the sqrt (k/l)?)

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has decreased by a factor of 2.

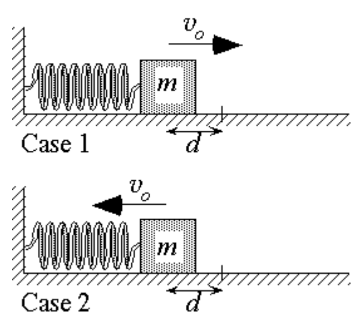
How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has decreased by a factor of 2.

Explain. again, net force doesn't change, but mass is double, so accel must be half (and the accel of the pendulum must be half, also, if it has the same linear accel and accel = R*alpha (but R is fixed at R=l)

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has increased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has increased.

Explain. accel smaller, so it takes longer for it to move the same amount



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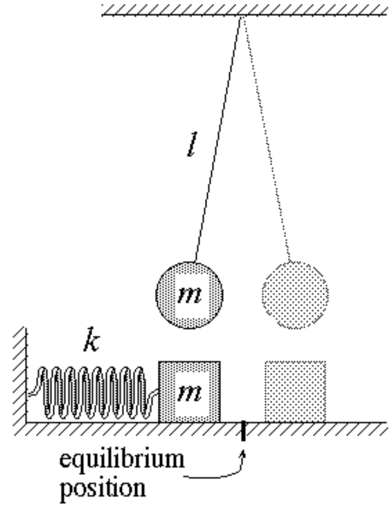
Explain. kx^2: same displacement, same spring constant, so same force

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be at the same position as the mark in case 2.

Explain. same position--they will travel at the same velocity, and each turn around at the same point

End of response



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How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has increased by a factor of 2.

Explain. The net force on the block is not going to change at all since the force the spring exerts does not depend on the mass of the block and the gravity and normal forces cancel out. The thension force on the pendulum will increase and therefore the net force will increase as well, since this upward force is acting at an angle and doesnt just cancel out with the force of gravity.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has decreased by a factor of 2.

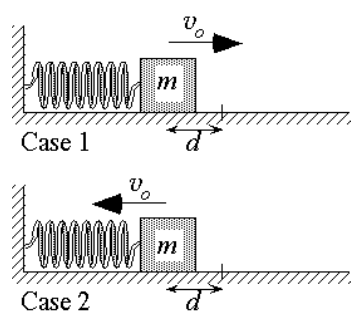
How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has not changed.

Explain. The magnitude of the acceleration of the block must decrease since there is more weight to move and therefore it will take longer to accelerate. The force of tension is dependent on the mass of the object, but so it the acceleration, so I would say that they woudl cancel out and the acceleration does not change due to change in mass.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has decreased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has not changed.

Explain. The acceleration decreased for the block, so therefore the travel time would be greater. The acceleration did not change for the pendulum and therefore the travel time would be equivalent.



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In Case 1, the block has instantaneous velocity v_o to the right. In Case 2, the block has instantaneous velocity v_o to the left.

At the instant shown, is the magnitude of the force on the block by the spring in case 1 greater than, less than, or equal to the magnitude of the force on the block by the spring in case 2? The magnitude of the force on the block by the spring in case 1 is equal to the magnitude of the force on the block by the spring in case 2.

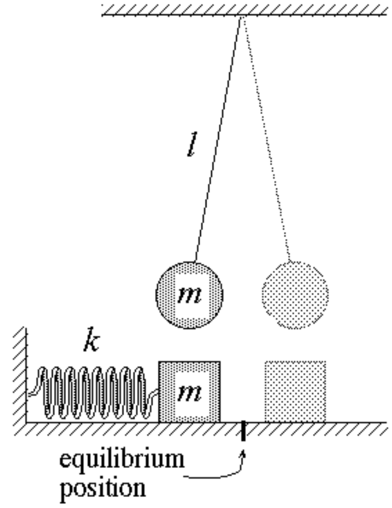
Explain. The force should be equal since the blocks are the same distance from the equilibrium position and the springs are stretched the same amount.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be at the same position as the mark in case 2.

Explain. All the factors are the same except the initial velocities, yet these velocities are at the same distance from the equilibrium point and therefore the motion will be the

End of response



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How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has increased by a factor of 2.

Explain. The spring force doesn't change because the block's mass has, however the force of the bob is dependent on the mass (weight)

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has decreased by a factor of 2.

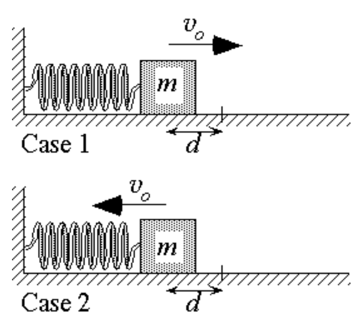
How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has not changed.

Explain. The acceleration is force divided by mass. Since the force did not change but the mass did, it decreased. For the bob, the force increased as well as the mass so the acceleration of the pendulum bob did not change

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has decreased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has not changed.

Explain. The acceleration of the block decreased, so the time it takes for it to get across decreased. The acceleration of the bob stayed the same so the time it takes for the bob has not changed



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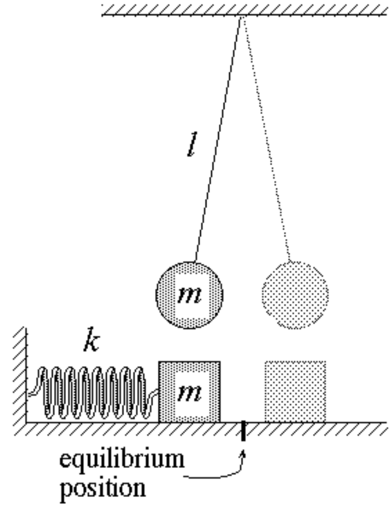
Explain. The distance the spring was squished is the same in both cases. The force due to spring is equal to the spring constant times the change in spring squish.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be to the right of the mark in case 2.

Explain. it had a greater amt of initial speed

End of response



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How has this change affected the magnitude of the net force on the block when it is at the far left position? The magnitude of the net force on the block has increased by a factor of 2.

How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has not changed.

Explain. The force exerted on an object depends on its mass, if the mass doubled, then so is the force. At its initial position, the pendelum is not experiencing any force because it has no acceleration.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has decreased by a factor of 2.

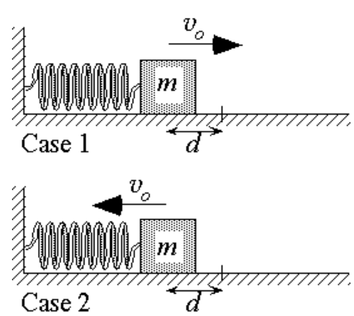
How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has decreased by a factor of 2.

Explain. More mass relates to a decrease in acceleration.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has increased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has increased.

Explain. Since the masses have doubled, then the acceleration is cut in half, so it takes more time to do the same amount of work.



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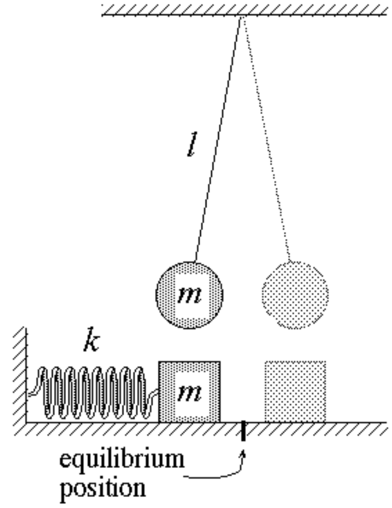
Explain. The spring is springing back to its original position so it takes more force to compress the spring.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be to the left of the mark in case 2.

Explain. Friction will cause a loss in distance.

End of response



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How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has increased by a factor of 2.

Explain. Since the block and the bob are doubled in mass, the magnitude of the energy must increased

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has decreased by a factor of 2.

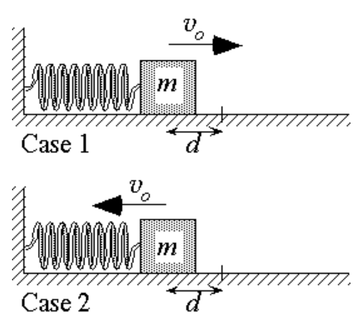
How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has increased by a factor of 2.

Explain. the bod is increased in mass, so it has more potential energy, and therefore can accelerate faster. The block is increased in mass, so the spring has to exert more force, and that decreases the acceleration of the block.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has not changed.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has not changed.

Explain. the potential energy of gravity and the spring are the same whether the masses are increases or decreased, so the time should not change.



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At the instant shown, is the magnitude of the force on the block by the spring in case 1 greater than, less than, or equal to the magnitude of the force on the block by the spring in case 2? The magnitude of the force on the block by the spring in case 1 is equal to the magnitude of the force on the block by the spring in case 2.

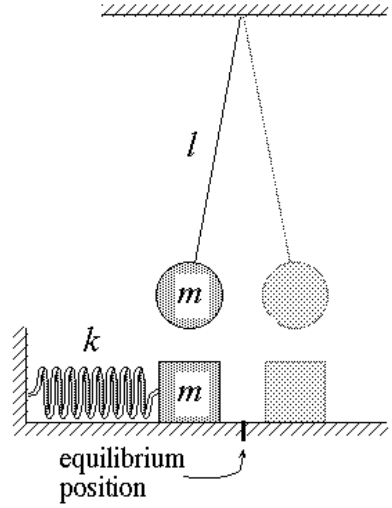
Explain. Equal because the distances of the two systems are equal.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be to the right of the mark in case 2.

Explain. to the right, because they are moving in opposite direction, and case on is ahead of case two.

End of response



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Explain.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has not changed.

How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has not changed.

Explain.

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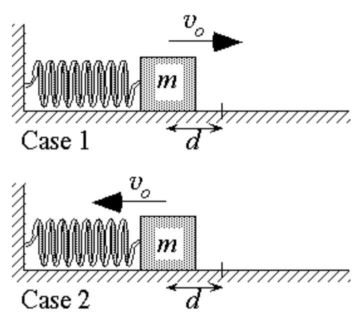
Explain.



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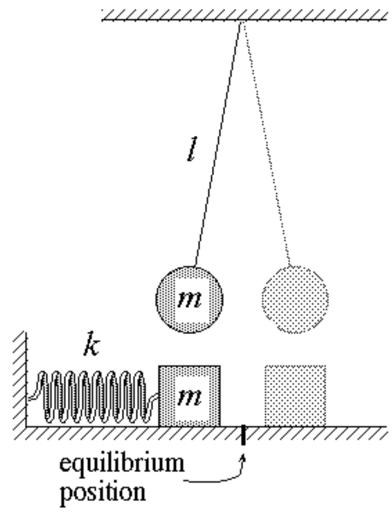
Explain.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be to the left of the mark in case 2.

Explain. Case 2 has an amplitude much greater than case 1, therefore, the minimum and maximum positions in case 2 will be farther away from the equilibrium position than in case 1.

End of response



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The following change is made: the mass of the block and the bob are each doubled. The objects are then released from rest at the same far left position as shown in the figure.

How has this change affected the magnitude of the net force on the block when it is at the far left position? The magnitude of the net force on the block has increased by a factor of 2.

How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has increased by a factor of 2.

Explain. Since the mass was double, the netforce must double.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has decreased by a factor of 2.

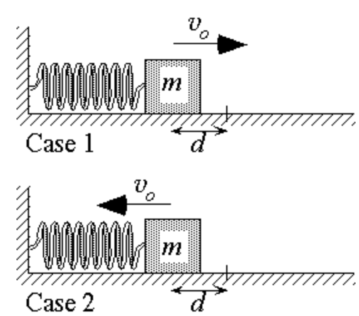
How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has decreased by a factor of 2.

Explain. Since the mass has doubled, it must have the acceleration to decrease by a factor of 2

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has not changed.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has not changed.

Explain. The time it takes for one 'Revolution' remains the same regardless of mass and is only dependent on string length.



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Explain. They are equidistant from the equilibrium position which is what determiens the force

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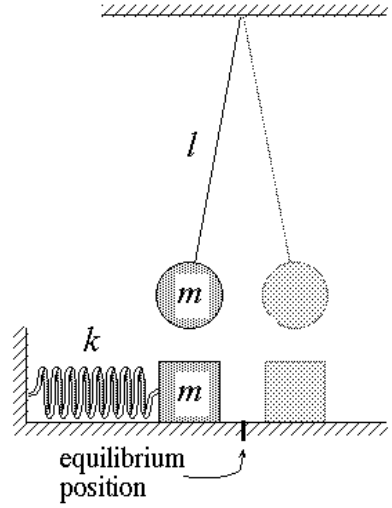
Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be to the right of the mark in case 2.

Explain. This is because there is a greater force at that max rightmost position

End of response



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How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has not changed.

Explain. The mass changes the net force because f = ma

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has decreased by a factor of 2.

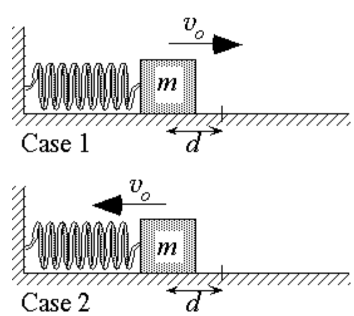
How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has not changed.

Explain. the acceleration is affected because of the force changes but the mass doesnt

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has decreased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has increased.

Explain. there is a greater force



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Explain. it doesnt matter the direction

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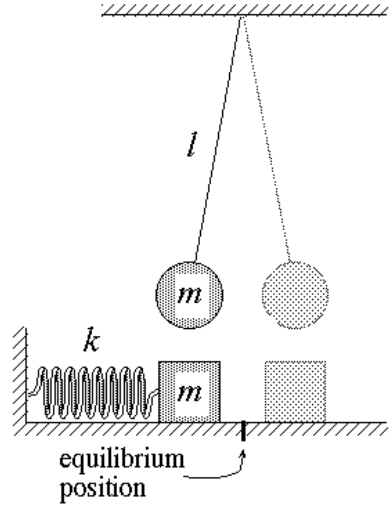
Explain. it doesnt matter the direction

End of response



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How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has increased by a factor of 2.

Explain. Since the net force is calculated by the acceleration times the mass, if the mass is dobubled, then so will the net force on each system.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has not changed.

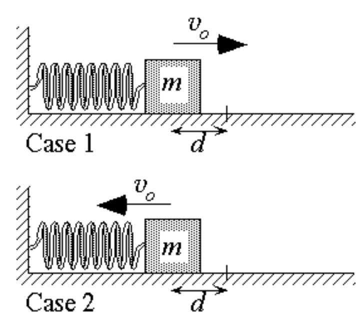
How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has not changed.

Explain. It is not moving there.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has increased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has increased.

Explain. They have both increased because the mass has also increased.



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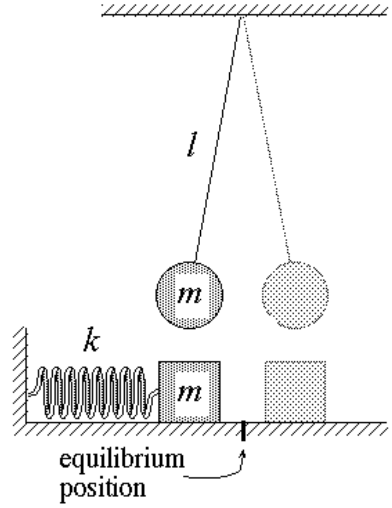
Explain. They are the same, because everything is the same, just maybe in opposite directions.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be at the same position as the mark in case 2.

Explain. They will be at the same position because the net force is still the same in both.

End of response



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Explain. i am not sure.. i have yet to determine why i think this is so

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has not changed.

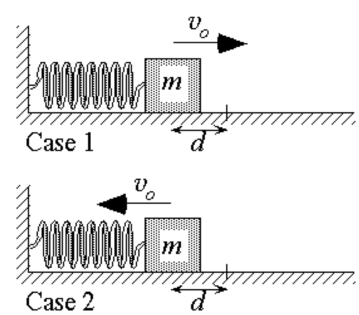
How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has not changed.

Explain. it will stay the same, its stationary

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has decreased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has not changed.

Explain. spring pushes the block so it would reach the equilibrium position faster, however the pendulum is swinging back and forth with same velocity... *mgh*



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In Case 1, the block has instantaneous velocity v_o to the right. In Case 2, the block has instantaneous velocity v_o to the left.

At the instant shown, is the magnitude of the force on the block by the spring in case 1 greater than, less than, or equal to the magnitude of the force on the block by the spring in case 2? The magnitude of the force on the block by the spring in case 1 is less than the magnitude of the force on the block by the spring in case 2.

Explain. in case 2 the spring has to work against the block, which is exerting a normal force and is moving at a speed of Vo into the spring.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be to the left of the mark in case 2.

Explain. case 2 block will travel further to the right then case 1 block

End of response

Part A: A block-and-spring system is directly below a pendulum. The block and pendulum bob both have mass m. The spring constant is k, and the length of the pendulum is l. All parameters have been chosen so that the block is directly below the pendulum bob at all times.

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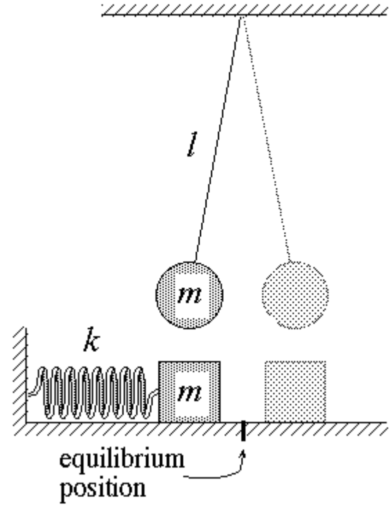

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How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has increased by a factor of 2.

Explain. Force relative to mass?

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has increased by a factor of 2.

How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has increased by a factor of 2.

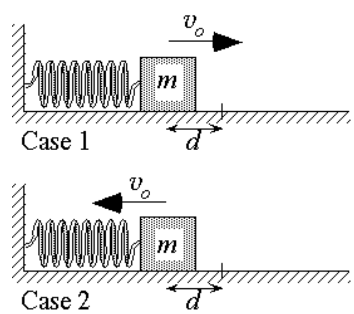
Explain. Acceleration relative to force

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has decreased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has decreased.

Explain. Acceleration increased

Part B: Two block-and-spring systems, Case 1 and Case 2, shown. The blocks each have mass m and are attached to identical, ideal springs of spring constant k. In each case, the block moves on a frictionless surface. At the instant shown, each block is a distance d to the left of equilibrium.



In Case 1, the block has instantaneous velocity v_o to the right. In Case 2, the block has instantaneous velocity v_o to the left.

At the instant shown, is the magnitude of the force on the block by the spring in case 1 greater than, less than, or equal to the magnitude of the force on the block by the spring in case 2? unanswered

Explain. Don't know

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? unanswered

Explain. sleepy, not thinking

End of response

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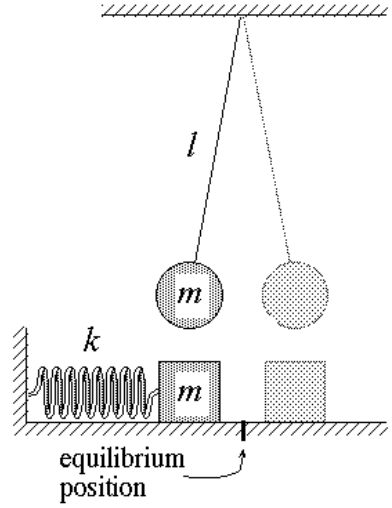

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How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has not changed.

Explain. The mass has doubled, but the acceleration has been reduced by a factor of 2.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has decreased by a factor of 2.

How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has decreased by a factor of 2.

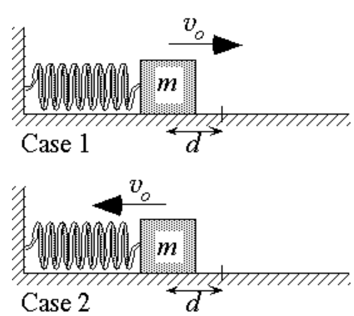
Explain. Because of the increased mass, the force of gravity (mg) is doubled, thus reducing the acceleration by a factor of 2

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has increased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has increased.

Explain. The acceleration has slowed down the motions of the pendulum and the spring/block, so the time has increased for one period.

Part B: Two block-and-spring systems, Case 1 and Case 2, shown. The blocks each have mass m and are attached to identical, ideal springs of spring constant k. In each case, the block moves on a frictionless surface. At the instant shown, each block is a distance d to the left of equilibrium.



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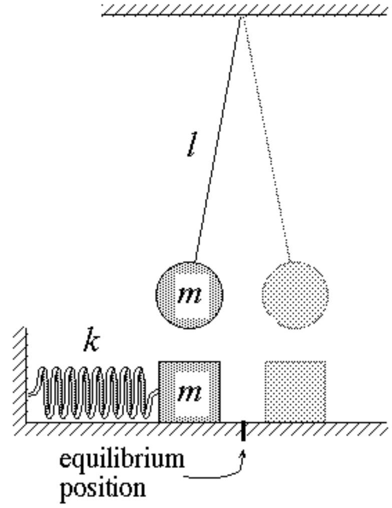
Explain. Since everything is the same except for the direction of the velocity, the magnitudes are the same in each case.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be at the same position as the mark in case 2.

Explain. Both systems have identical components, so the max extension of the springs will be the sam ein each case. The only difference is the time at which this occurs.

End of response



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How has this change affected the magnitude of the net force on the block when it is at the far left position? The magnitude of the net force on the block has increased by a factor of 2.

How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has increased by a factor of 2.

Explain. The two objects have doubled mass so it takes twice as much net force to move it to the same far left position.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has not changed.

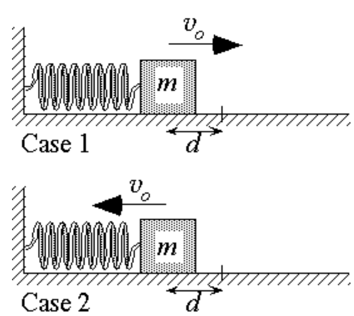
How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has not changed.

Explain. When both are at the far left acceleration does not change because f=ma but mass and force doubled so acceleration does not.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has not changed.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has not changed.

Explain. If acceleration does not change then it takes the same amount of time to travel for each situation.



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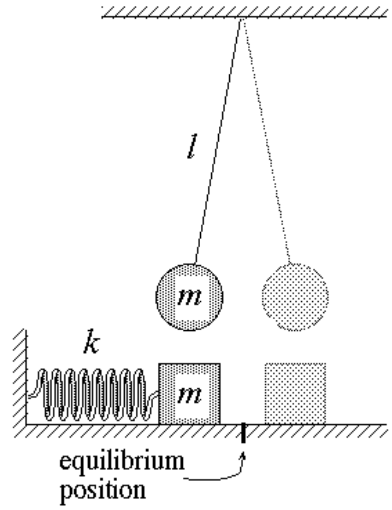
Explain. It is the same spring and the same distance from equilibrium so the magnitudes will also be the same.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be at the same position as the mark in case 2.

Explain. They have the same magnitude of force at the same distance from equilibrium so they will travel the same distances away from equilibrium.

End of response



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How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has increased by a factor of 2.

Explain. since mass is doubled than force is doubled since f = ma

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has decreased by a factor of 2.

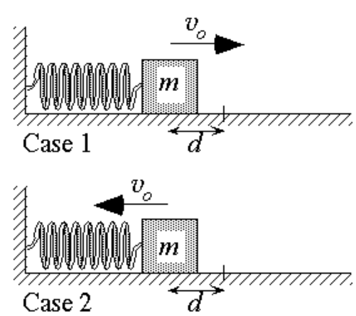
How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has not changed.

Explain. Just intuition

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has increased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has not changed.

Explain. force of g changes with mass while the other doesnot.



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Explain. same for back and forth.

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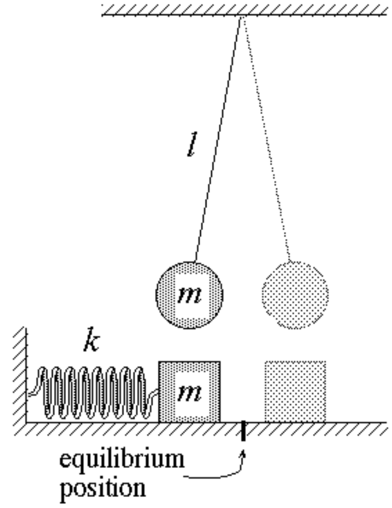
Explain. I cant explain it which maens I dont know it

End of response



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How has this change affected the magnitude of the net force on the block when it is at the far left position? The magnitude of the net force on the block has not changed.

How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has not changed.

Explain. Since they are at rest in the far left position the net force = 0.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has not changed.

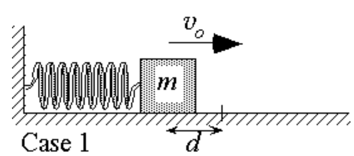
How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has not changed.

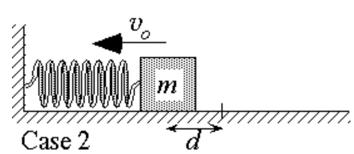
Explain. Again they are at rest so acceleration has not changed.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has not changed.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has increased.

Explain. Since the spring pushes with a greater force the block will reach at the same time. The pendulum however will swing faster.





Part B: Two block-and-spring systems, Case 1 and Case 2, shown. The blocks each have mass m and are attached to identical, ideal springs of spring constant k. In each case, the block moves on a frictionless surface. At the instant shown, each block is a distance d to the left of equilibrium.

In Case 1, the block has instantaneous velocity v_o to the right. In Case 2, the block has instantaneous velocity v_o to the left.

At the instant shown, is the magnitude of the force on the block by the spring in case 1 greater than, less than, or equal to the magnitude of the force on the block by the spring in case 2? The magnitude of the force on the block by the spring in case 1 is equal to the magnitude of the force on the block by the spring in case 2.

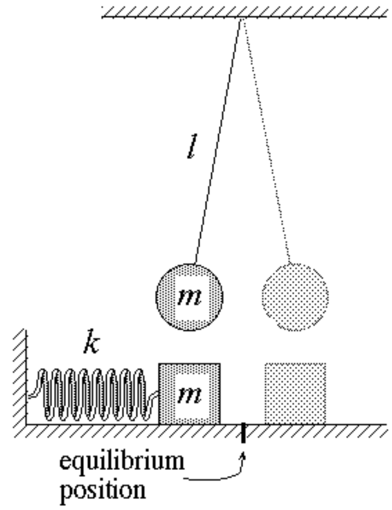
Explain. Only the spring is causing a force in the x direction and the block is at the same displacement at both times.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be at the same position as the mark in case 2.

Explain. The tabletop is frictionless so the block will rebound to the same spot.

End of response



Part A: A block-and-spring system is directly below a pendulum. The block and pendulum bob both have mass m. The spring constant is k, and the length of the pendulum is l. All parameters have been chosen so that the block is directly below the pendulum bob at all times.

The following change is made: the mass of the block and the bob are each doubled. The objects are then released from rest at the same far left position as shown in the figure.

How has this change affected the magnitude of the net force on the block when it is at the far left position? The magnitude of the net force on the block has not changed.

How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has not changed.

Explain. The forces on the block and ball have not changed, only the masses of the objects.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has decreased by a factor of 2.

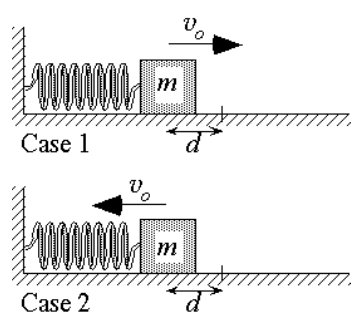
How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has decreased by a factor of 2.

Explain. The increased mass must be compensated for in the Newton's second law equation, since net force is the same.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has increased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has increased.

Explain. Their acceleration is less, therefore it takes longer to travel.



Part B: Two block-and-spring systems, Case 1 and Case 2, shown. The blocks each have mass m and are attached to identical, ideal springs of spring constant k. In each case, the block moves on a frictionless surface. At the instant shown, each block is a distance d to the left of equilibrium.

In Case 1, the block has instantaneous velocity v_o to the right. In Case 2, the block has instantaneous velocity v_o to the left.

At the instant shown, is the magnitude of the force on the block by the spring in case 1 greater than, less than, or equal to the magnitude of the force on the block by the spring in case 2? The magnitude of the force on the block by the spring in case 1 is equal to the magnitude of the force on the block by the spring in case 2.

Explain. The graph of the motion of this system is sinusoidal, with the max and mins being where the spring is the most condensed or stretched out. Therefore a point on the spring will have the same magnitude whether it is condensing or expanding at that point.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

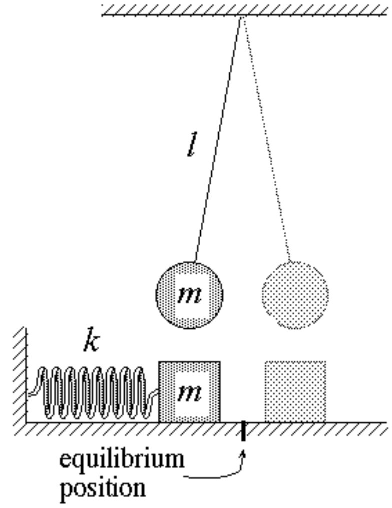
Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be at the same position as the mark in case 2.

Explain. It is the same system, so they will both have the same maximum rightmost position.

End of response

Part A: A block-and-spring system is directly below a pendulum. The block and pendulum bob both have mass m. The spring constant is k, and the length of the pendulum is l. All parameters have been chosen so that the block is directly below the pendulum bob at all times.

The following change is made: the mass of the block and the bob are each doubled. The objects are then released from rest at the same far left position as shown in the figure.



How has this change affected the magnitude of the net force on the block when it is at the far left position? The magnitude of the net force on the block has not changed.

How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has increased by a factor of 2.

Explain. force on the bob involves mass becasue the force is due to gravity. Force on the block is due to position only.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has decreased by a factor of 2.

How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has not changed.

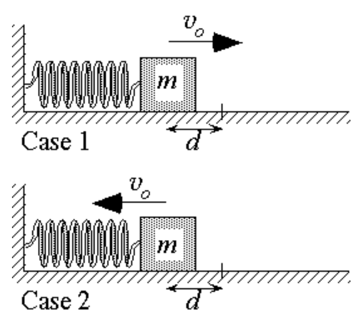
Explain. The mass of the block has changed but the force is still the same so the acceleration is lower. The foce and mass have chaged for the pendulm makeing the accelertion the same as before.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has decreased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has not changed.

Explain. Time to travel goes along with the change in acceleration for the two systems

Part B: Two block-and-spring systems, Case 1 and Case 2, shown. The blocks each have mass m and are attached to identical, ideal springs of spring constant k. In each case, the block moves on a frictionless surface. At the instant shown, each block is a distance d to the left of equilibrium.



In Case 1, the block has instantaneous velocity v_o to the right. In Case 2, the block has instantaneous velocity v_o to the left.

At the instant shown, is the magnitude of the force on the block by the spring in case 1 greater than, less than, or equal to the magnitude of the force on the block by the spring in case 2? The magnitude of the force on the block by the spring in case 1 is greater than the magnitude of the force on the block by the spring in case 2.

Explain.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

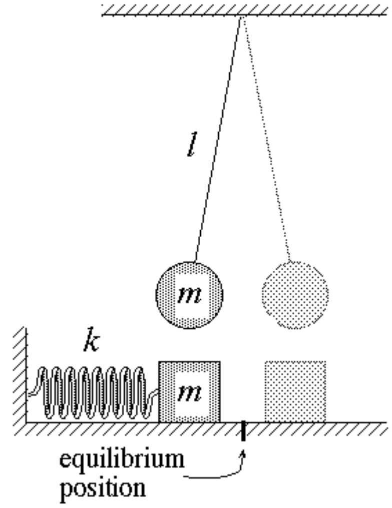
Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be to the right of the mark in case 2.

Explain.

End of response

Part A: A block-and-spring system is directly below a pendulum. The block and pendulum bob both have mass m. The spring constant is k, and the length of the pendulum is l. All parameters have been chosen so that the block is directly below the pendulum bob at all times.

The following change is made: the mass of the block and the bob are each doubled. The objects are then released from rest at the same far left position as shown in the figure.



How has this change affected the magnitude of the net force on the block when it is at the far left position? The magnitude of the net force on the block has decreased by a factor of 2.

How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has increased by a factor of 2.

Explain. the mass increses the force increases, by gravity and by the normal force of the spring.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has decreased by a factor of 2.

How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has not changed.

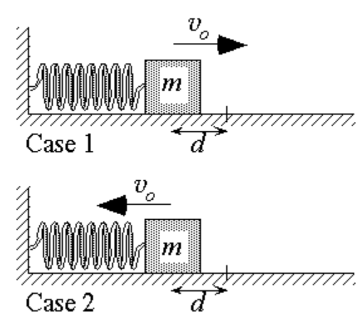
Explain. the mass of an object does not affect gravity.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has increased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has not changed.

Explain. again gravity is not affected by mass.

Part B: Two block-and-spring systems, Case 1 and Case 2, shown. The blocks each have mass m and are attached to identical, ideal springs of spring constant k. In each case, the block moves on a frictionless surface. At the instant shown, each block is a distance d to the left of equilibrium.



In Case 1, the block has instantaneous velocity v_o to the right. In Case 2, the block has instantaneous velocity v_o to the left.

At the instant shown, is the magnitude of the force on the block by the spring in case 1 greater than, less than, or equal to the magnitude of the force on the block by the spring in case 2? The magnitude of the force on the block by the spring in case 1 is equal to the magnitude of the force on the block by the spring in case 2.

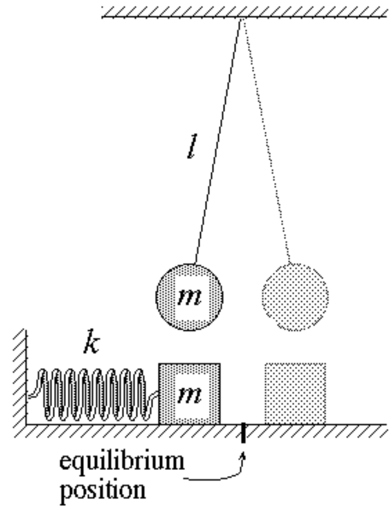
Explain. the spring applies the force the same for the same distance from the equilibrium.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be at the same position as the mark in case 2.

Explain. they are traveling at the same velocity at the same distance from the equilibrium.

End of response



Part A: A block-and-spring system is directly below a pendulum. The block and pendulum bob both have mass m. The spring constant is k, and the length of the pendulum is l. All parameters have been chosen so that the block is directly below the pendulum bob at all times.

The following change is made: the mass of the block and the bob are each doubled. The objects are then released from rest at the same far left position as shown in the figure.

How has this change affected the magnitude of the net force on the block when it is at the far left position? The magnitude of the net force on the block has not changed.

How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has not changed.

Explain. The force due to a spring is dependent on the distance from the equilibrium point and the spring constant. The net force on the block will remain the same. The net force on a pendulum bob is dependent on the force due to gravity. When the mass is doubled, this force with be doubled as well, but the tension force on the string will increase as well, causing the force to be unchanged.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has decreased by a factor of 2.

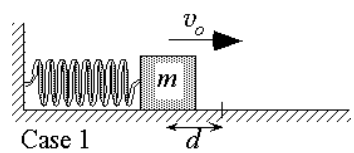
How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has not changed.

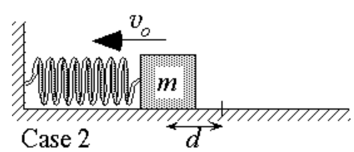
Explain. Fnet=ma for the block. If the force remains constant, and the mass is doubled, the acceleration must be reduced in order to compensate for the larger mass. The acceleration of the pendulum is due to the force of gravity, which has not changed.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has increased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has not changed.

Explain. The period of a pendulum bob does not depend on the mass of the bob itself. This causes the period to remain the same. The acceleration of the block is less than the original senario, so the time the block takes will have increased.





Part B: Two block-and-spring systems, Case 1 and Case 2, shown. The blocks each have mass m and are attached to identical, ideal springs of spring constant k. In each case, the block moves on a frictionless surface. At the instant shown, each block is a distance d to the left of equilibrium.

In Case 1, the block has instantaneous velocity v_o to the right. In Case 2, the block has instantaneous velocity v_o to the left.

At the instant shown, is the magnitude of the force on the block by the spring in case 1 greater than, less than, or equal to the magnitude of the force on the block by the spring in case 2? The magnitude of the force on the block by the spring in case 1 is equal to the magnitude of the force on the block by the spring in case 2.

Explain. The force done on and object is dependent on the spring constant and the distance the object is from the equilibrium point of the spring. These are equal for the two cases, so the forces should be equal.

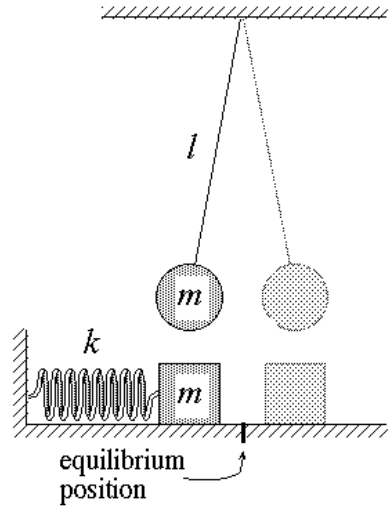
A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be at the same position as the mark in case 2.

Explain. The block is traveling at the same speed as the other block at the same given displacement. This although the velocities are in opposite directions, each block will be going the same speed as they return to the same point. This means that the point that the block can reach at the far right is the same as the other block.

End of response

Part A: A block-and-spring system is directly below a pendulum. The block and pendulum bob both have mass m. The spring constant is k, and the length of the pendulum is l. All parameters have been chosen so that the block is directly below the pendulum bob at all times.



The following change is made: the mass of the block and the bob are each doubled. The objects are then released from rest at the same far left position as shown in the figure.

How has this change affected the magnitude of the net force on the block when it is at the far left position? The magnitude of the net force on the block has not changed.

How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has not changed.

Explain. Force = mass * acceleration, and the mass is doubled and the acceleration is halved.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has decreased by a factor of 2.

How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has decreased by a factor of 2.

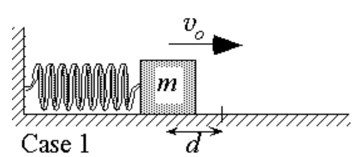
Explain. The force remains constant and the mass is doubled, so the acceleration is halved.

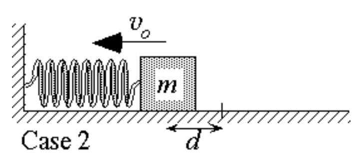
Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has decreased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has decreased.

Explain. The magnitude of the restoring force is greater.

Part B: Two block-and-spring systems, Case 1 and Case 2, shown. The blocks each have mass m and are attached to identical, ideal springs of spring constant k. In each case, the block moves on a frictionless surface. At the instant shown, each block is a distance d to the left of equilibrium.





In Case 1, the block has instantaneous velocity v_o to the right. In Case 2, the block has instantaneous velocity v_o to the left.

At the instant shown, is the magnitude of the force on the block by the spring in case 1 greater than, less than, or equal to the magnitude of the force on the block by the spring in case 2? The magnitude of the force on the block by the spring in case 1 is equal to the magnitude of the force on the block by the spring in case 2.

Explain. Equal, because the magnitude of the force is independent of velocity.

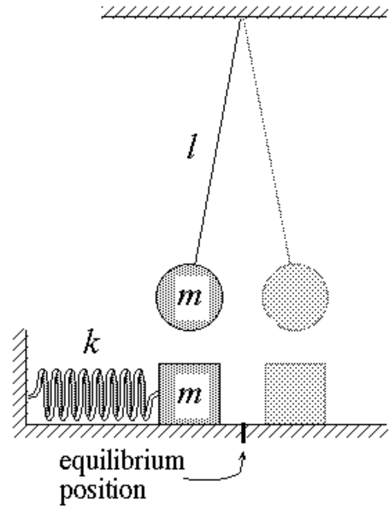
A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be at the same position as the mark in case 2.

Explain. Once again, velocity plays no part in the length of motion of the spring.

End of response

Part A: A block-and-spring system is directly below a pendulum. The block and pendulum bob both have mass m. The spring constant is k, and the length of the pendulum is l. All parameters have been chosen so that the block is directly below the pendulum bob at all times.



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How has this change affected the magnitude of the net force on the block when it is at the far left position? The magnitude of the net force on the block has not changed.

How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has increased by a factor of 2.

Explain. Since the net force equals the summation of mass times acceleration, the pendulum will have a force twice the previous force since it will accelerate at the same magnitude, while the block on the spring will have the same force applied to it, resulting in an acceleration twice as slow as before, leaving the force the same.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has decreased by a factor of 2.

How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has not changed.

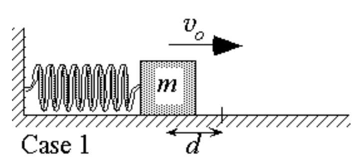
Explain. Gravity is a constant acceleration, while the spring has a constant force.

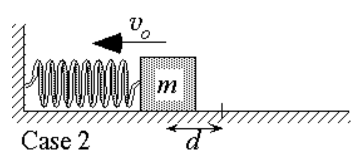
Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has increased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has not changed.

Explain. The spring has the same amount of force to apply to the block, so it will accelerate slower, and the pendulum will reach the equilibruim point at the same time due to the constance of gravity.

Part B: Two block-and-spring systems, Case 1 and Case 2, shown. The blocks each have mass m and are attached to identical, ideal springs of spring constant k. In each case, the block moves on a frictionless surface. At the instant shown, each block is a distance d to the left of equilibrium.





In Case 1, the block has instantaneous velocity v_o to the right. In Case 2, the block has instantaneous velocity v_o to the left.

At the instant shown, is the magnitude of the force on the block by the spring in case 1 greater than, less than, or equal to the magnitude of the force on the block by the spring in case 2? The magnitude of the force on the block by the spring in case 1 is equal to the magnitude of the force on the block by the spring in case 2.

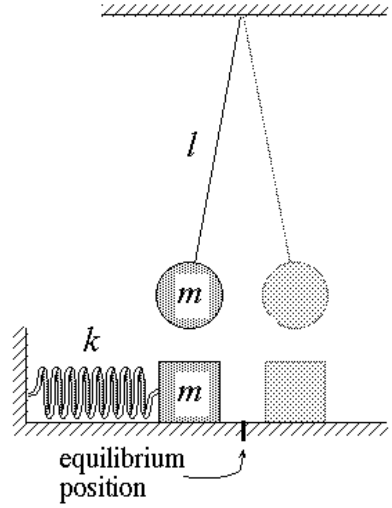
Explain. Since both are moving with the same velocity, and the springs are compressed the same value, the force acting on each will be equal in magnitude, opposite in direction.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be at the same position as the mark in case 2.

Explain. since the forces are the same, and the velocities are the same, the maximum positions of the blocks will be the same.

End of response



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The following change is made: the mass of the block and the bob are each doubled. The objects are then released from rest at the same far left position as shown in the figure.

How has this change affected the magnitude of the net force on the block when it is at the far left position? The magnitude of the net force on the block has decreased by a factor of 2.

How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has increased by a factor of 2.

Explain. The magnitude of the net force acting on the block will decrease by two because the increase in mass will increase the size of the frictional force which will detract from the force of the spring which determins the motion. The magnitude of the net force on the bob will increase becuase the gravitational force will double and since it helps the net force, it too will double.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has decreased by a factor of 2.

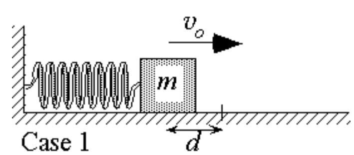
How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has increased by a factor of 2.

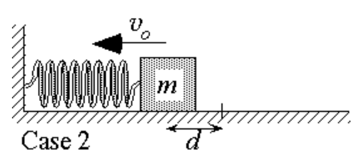
Explain. For the same reasons as above, since the acceleration of the object is directly dependant upon the net force action on it.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has increased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has decreased.

Explain. If the acceleration changes in a given way, then the time it takes for it to travel a given distance will change accordingly. So if acceleration increases, time will decrease, and if acceleration decreases, then time will increase.





Part B: Two block-and-spring systems, Case 1 and Case 2, shown. The blocks each have mass m and are attached to identical, ideal springs of spring constant k. In each case, the block moves on a frictionless surface. At the instant shown, each block is a distance d to the left of equilibrium.

In Case 1, the block has instantaneous velocity v_o to the right. In Case 2, the block has instantaneous velocity v_o to the left.

At the instant shown, is the magnitude of the force on the block by the spring in case 1 greater than, less than, or equal to the magnitude of the force on the block by the spring in case 2? The magnitude of the force on the block by the spring in case 1 is equal to the magnitude of the force on the block by the spring in case 2.

Explain. If there is no friction, then the only force is that of the spring. And the force due to the string is dependant upon the distance from equilibrium, which are equal.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

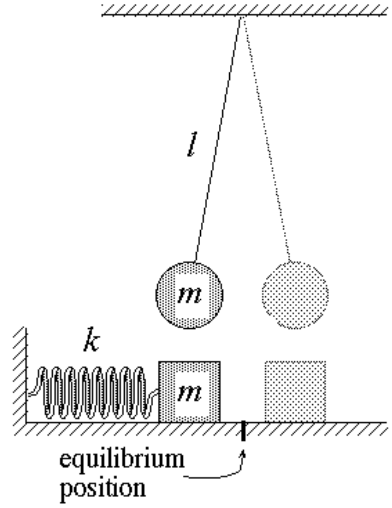
Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be to the left of the mark in case 2.

Explain. Because initially case 2 has a velocity to the left which means that when it finally comes to rest on the left side, it will have depressed the string further and thus have a greater force acting on it as it moves to the right.

End of response

Part A: A block-and-spring system is directly below a pendulum. The block and pendulum bob both have mass m. The spring constant is k, and the length of the pendulum is l. All parameters have been chosen so that the block is directly below the pendulum bob at all times.

The following change is made: the mass of the block and the bob are each doubled. The objects are then released from rest at the same far left position as shown in the figure.



How has this change affected the magnitude of the net force on the block when it is at the far left position? The magnitude of the net force on the block has not changed.

How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has increased by a factor of 2.

Explain. The force on the mass by the spring is unchanged since force is determined by the equation F=kx, and therefore, mass has no factor in the force. On the other hand, since the pendulum is swinging, there is a force caused by gravity, and therefore by increasing the weight by 2, the quantity mg will increase by a factor of 2 as well.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has decreased by a factor of 2.

How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has not changed.

Explain. Since F=ma, and F=kx, and kx was found to be constant in both situations, when you divided by the mass to find acceleration, the value will turn out to be half as large as before. For the pendulum, however, since the force was increased by a factor of two, even when the force is divided by the new mass, the acceleration will be the same.

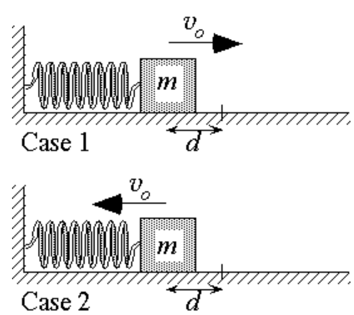
Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has decreased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has not changed.

Explain. Since the accleration of the block decreases, it will take longer for it to reach the equilibrium position. Similarly, since the acceleration of the pendulum is unchanged, it will take the same amount of time as before for the pendulum.

Part B: Two block-and-spring systems, Case 1 and Case 2, shown. The blocks each have mass m and are attached to identical, ideal springs of spring constant k. In each case, the block moves on a frictionless surface. At the instant shown, each block is a distance d to the left of equilibrium.

In Case 1, the block has instantaneous velocity v_o to the right. In Case 2, the block has instantaneous velocity v_o to the left.



At the instant shown, is the magnitude of the force on the block by the spring in case 1 greater than, less than, or equal to the magnitude of the force on the block by the spring in case 2? The magnitude of the force on the block by the spring in case 1 is equal to the magnitude of the force on the block by the spring in case 2.

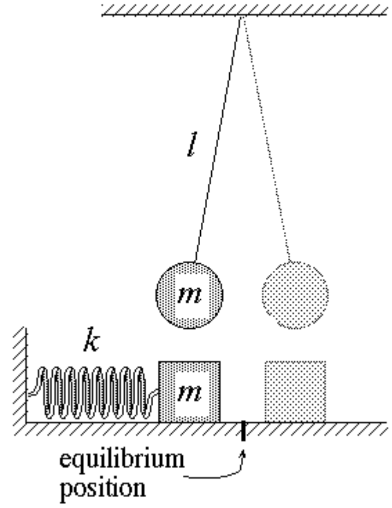
Explain. Since both springs have a constant of k, and their distance from equilibrium are both equal, the force on each block will be equal.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be at the same position as the mark in case 2.

Explain. The mark will be the same since the force on each block is the same. Also, since both blocks have identical magnitude of velocity at the distance x from equilibrium, it indicates that both blocks are behaving in an identical manner.

End of response



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How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has not changed.

Explain. The forces on the block and pendulum are not dependant upon thhe mass.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has not changed.

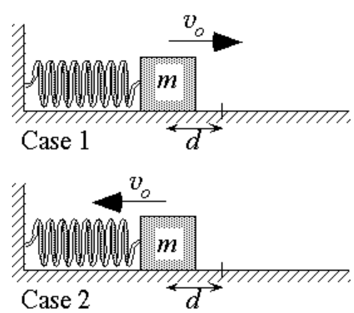
How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has not changed.

Explain. Same reason. Given by equations -kx and square root of l/g

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has not changed.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has not changed.

Explain. NOt depedant.



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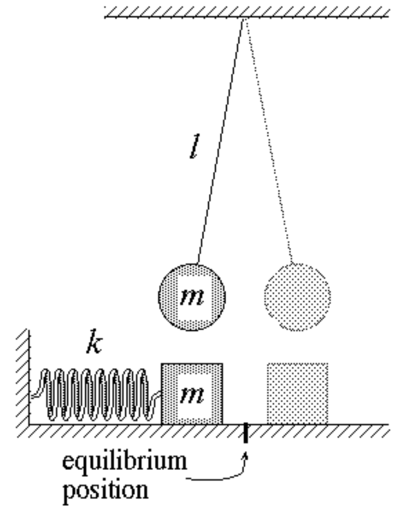
Explain. given by equation F=-kx, have same x and k

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be at the same position as the mark in case 2.

Explain. no energy lost due to friction, same work, same distance

End of response



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How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has not changed.

Explain. The net force is not dependant on the mass. F = -kx

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has increased by a factor of 2.

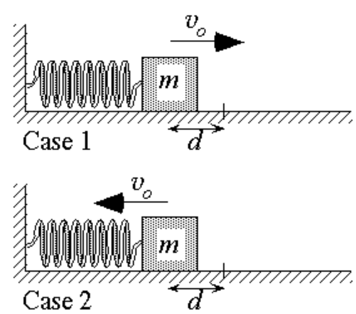
How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has increased by a factor of 2.

Explain. It will take longer to slow down the heavier block with the same force.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has increased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has increased.

Explain. The masses are larger, so it will take longer to slow them down with the same force.



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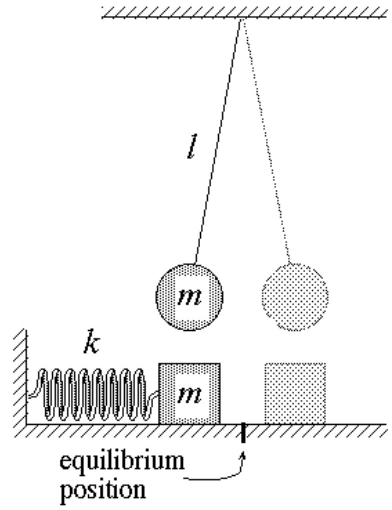
Explain. Force from the spring is only dependant on the distance from displacement.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be at the same position as the mark in case 2.

Explain. Since there are no other forces acting on the blocks, the maximum rightmost position will be the same in both cases.

End of response



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How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has increased by a factor of 2.

Explain. Since the mass is twice as large, the kinetic energy of the spring system, for example, is larger. Or at the left, the potential energy is twice as large.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has not changed.

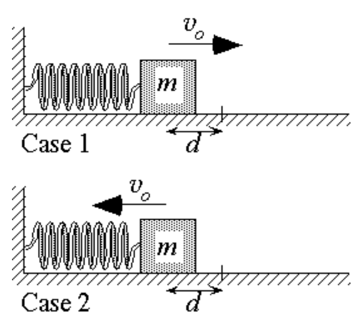
How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has not changed.

Explain. Since the mass has doubled, and the net force has doubled, the acceleration will remain the same (by using F=ma(.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has increased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has increased.

Explain. Since the pendulum will start from a higher position, it will take that much longer for the ball to reach equilibrium position.



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In Case 1, the block has instantaneous velocity v_o to the right. In Case 2, the block has instantaneous velocity v_o to the left.

At the instant shown, is the magnitude of the force on the block by the spring in case 1 greater than, less than, or equal to the magnitude of the force on the block by the spring in case 2? The magnitude of the force on the block by the spring in case 1 is equal to the magnitude of the force on the block by the spring in case 2.

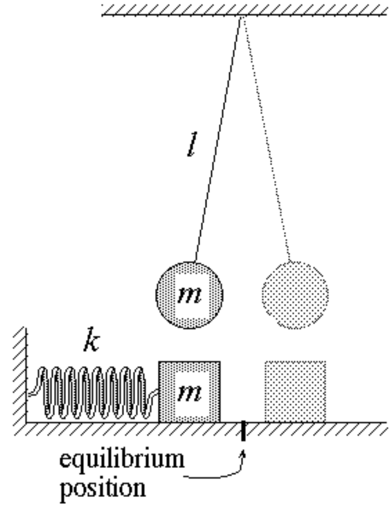
Explain. Since they have the same acceleration, but negatives of eachother, and the masses are the same, so then F will be the same also.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be at the same position as the mark in case 2.

Explain. They have the same net force, so therefore they spring will allow the block to travel the same distance out.

End of response



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How has this change affected the magnitude of the net force on the block when it is at the far left position? The magnitude of the net force on the block has increased by a factor of 2.

How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has increased by a factor of 2.

Explain. Since f=ma and mgsintheta represents the force of the objects moving, if m is doubled, then f is doubled for both as well.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has decreased by a factor of 2.

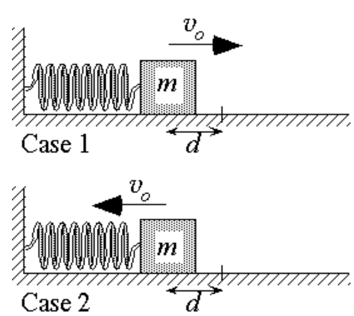
How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has not changed.

Explain. If mass was doubled for the block then a is half the amount as it was with the original m. For the pendulum, mgsintheta=ma so the mass does not affect acceleration.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has increased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has not changed.

Explain. If acceleration is less for the block, it would take more time to get to the equilibrium position. For the pendulum, it takes the same time because acceleration is not affected.



Part B: Two block-and-spring systems, Case 1 and Case 2, shown. The blocks each have mass m and are attached to identical, ideal springs of spring constant k. In each case, the block moves on a frictionless surface. At the instant shown, each block is a distance d to the left of equilibrium.

In Case 1, the block has instantaneous velocity v_o to the right. In Case 2, the block has instantaneous velocity v_o to the left.

At the instant shown, is the magnitude of the force on the block by the spring in case 1 greater than, less than, or equal to the magnitude of the force on the block by the spring in case 2? The magnitude of the force on the block by the spring in case 1 is equal to the magnitude of the force on the block by the spring in case 2.

Explain. According to hooke's law, F=kx so if k is constant and x is the same, the force is the same.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be at the same position as the mark in case 2.

Explain. I don't know why, i guessed.

End of response

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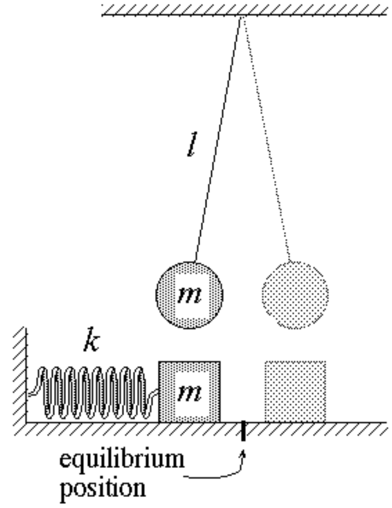

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How has this change affected the magnitude of the net force on the block when it is at the far left position? The magnitude of the net force on the block has not changed.

How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has increased by a factor of 2.

Explain. The fact that the block mass is greater is not going to effect how hard the spring is pushing on it. The force that the sprng exerts only depends on the spring constant and how far past it's equilibrium position is has been pushed

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has not changed.

How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has increased by a factor of 2.

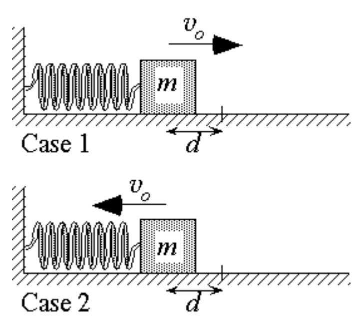
Explain. with more weight being added onto the string there is a greater weight force added onto it. This weight force will create a greater accereration of the pendulum.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has increased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? unanswered

Explain. since the acceration has increased for the pendulum the time it takes for the pendulum to moce across will decrease.

Part B: Two block-and-spring systems, Case 1 and Case 2, shown. The blocks each have mass m and are attached to identical, ideal springs of spring constant k. In each case, the block moves on a frictionless surface. At the instant shown, each block is a distance d to the left of equilibrium.



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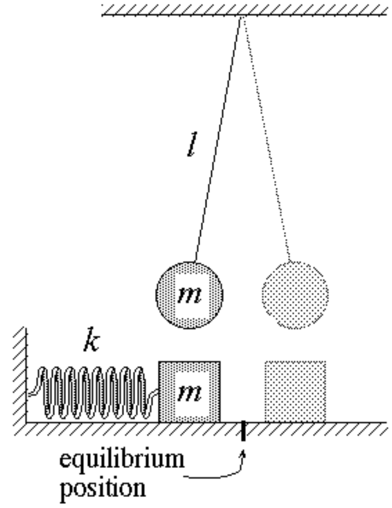
Explain. by hookes law F = K * X. They are both the same distance from there equilibrium positions so they will both have the same forces ac

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? unanswered

Explain.

End of response



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How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has decreased by a factor of 2.

Explain. Net force is determined by mass times acceleration, and therefore doubling the mass will double the net force.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has not changed.

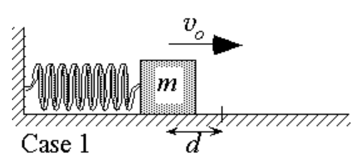
How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has not changed.

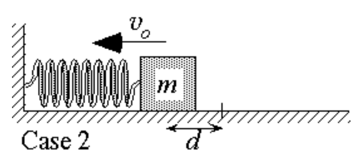
Explain. The mass of the pendulum should not affect its acceleration. The increased mass will cause a smaller acceleration since 1/2kx^2 is not affected by mass and so must remain constant.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has increased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has increased.

Explain. With a smaller acceleration, the block will take longer to reach the finish line. Since the acceleration of the bob remains the same, it will have the same time.





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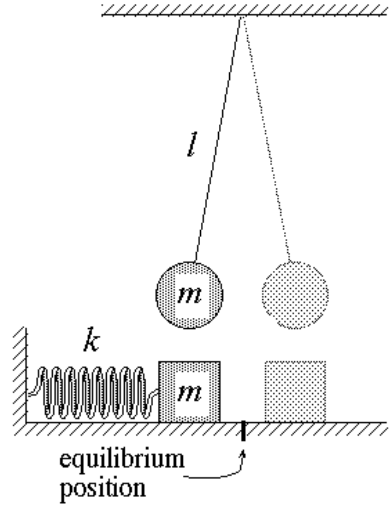
Explain. The blocks are both experiencing acceleration from the compression of the spring, but just opposite in direction.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be to the right of the mark in case 2.

Explain. The collision of the block in the second case will cause the block to lose energy, and so it will not travel as far as block 1

End of response



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How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has increased by a factor of 2.

Explain. Th friction force on the block has not changed because it is a funtion of normal force and weight, but the net force on the pedulum has doubled because of the tenison and weight that does not cancel.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has decreased by a factor of 2.

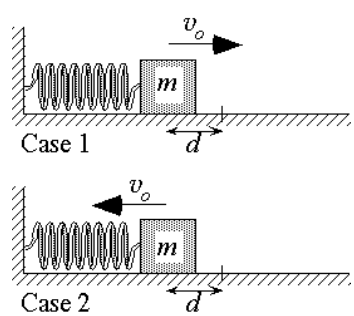
How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has not changed.

Explain. The friction force has doubled on the block, so it will slow down twice as much, but the force on the pedulum will not change.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has increased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has not changed.

Explain. because of the friction it will take longer to move, but will not change anything for the pendulum.



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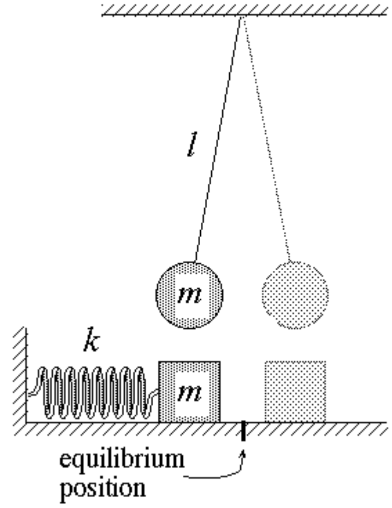
Explain. IF you draw a FBD you will see that the forces acting on the blocks are the same in each case with friction not taken into account.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be at the same position as the mark in case 2.

Explain. They will be the same because in case 2, after the sping is depressed, it will look the same as case one does in the picture above.

End of response



Part A: A block-and-spring system is directly below a pendulum. The block and pendulum bob both have mass m. The spring constant is k, and the length of the pendulum is l. All parameters have been chosen so that the block is directly below the pendulum bob at all times.

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How has this change affected the magnitude of the net force on the block when it is at the far left position? The magnitude of the net force on the block has not changed.

How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has not changed.

Explain. If I understand the system correctly, the far left position the bob and mass are stationary, which implies no net force

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has not changed.

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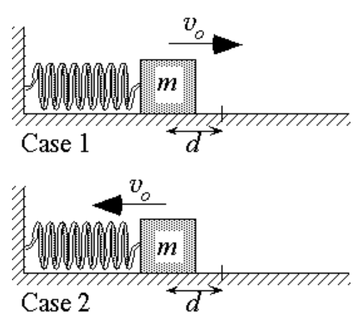
Explain. The same as Quection 7 response

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has not changed.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has not changed.

Explain. Foreces have also increased along with the mass, so it will take the same amount of time to reach equilibrium



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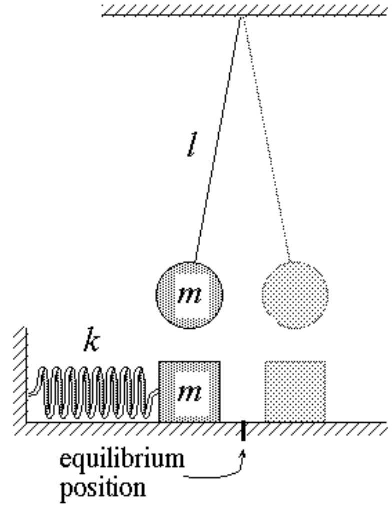
Explain. block causes same compression in each instant

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be at the same position as the mark in case 2.

Explain. same spring, same block

End of response



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How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has increased by a factor of 2.

Explain. Because Net Force depends on mass.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has decreased by a factor of 2.

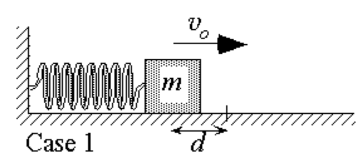
How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has decreased by a factor of 2.

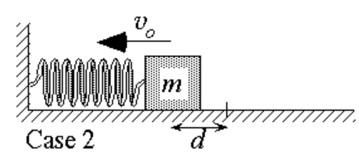
Explain. Because the mass is doubled, the acceleration decreased.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has decreased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has decreased.

Explain. Because the mass id doubled, the acceleration is decreased therefore it takes longer to reach the equilibrium position.





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Explain. Because Force depends on the distance and spring constant. It is independent of velocity.

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Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be to the right of the mark in case 2.

Explain. Because the case 1 will move to the right while case 2 is to the left.

End of response

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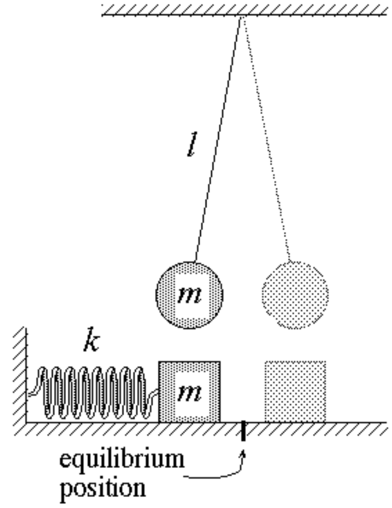

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How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has not changed.

Explain. The net force on the pendulum does not change because the tension still cancels the weight. The magnitude of the force on the spring, though, depends on mass.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has increased by a factor of 2.

How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has not changed.

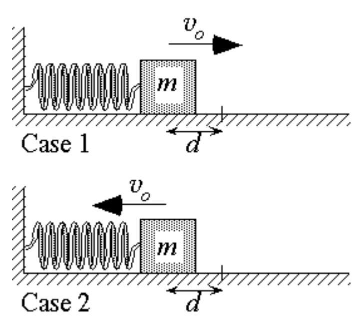
Explain. If the force does not change, the acceleration cannot change

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has decreased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has not changed.

Explain.

Part B: Two block-and-spring systems, Case 1 and Case 2, shown. The blocks each have mass m and are attached to identical, ideal springs of spring constant k. In each case, the block moves on a frictionless surface. At the instant shown, each block is a distance d to the left of equilibrium.



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Explain. Mass and K are the same

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Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be at the same position as the mark in case 2.

Explain. Same v, same k, same m. These will make the blocks move in the same way.

End of response

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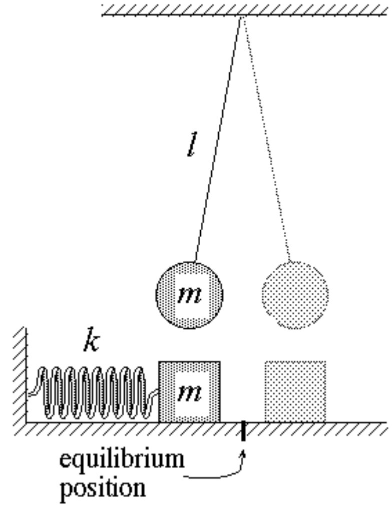

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Explain. the net force is not dependet on the weight of the blockthe net force of the ball is dependent on the weight

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has not changed.

How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has increased by a factor of 2.

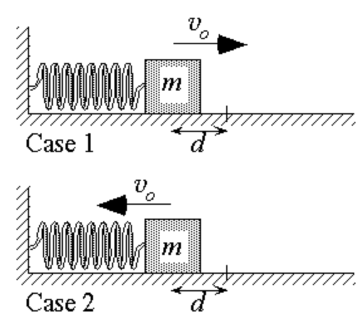
Explain. it coorisponds to the net force.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has not changed.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has decreased.

Explain. the block has not increased in acceleration so time has not increasedthe ball is going faster so time is less

Part B: Two block-and-spring systems, Case 1 and Case 2, shown. The blocks each have mass m and are attached to identical, ideal springs of spring constant k. In each case, the block moves on a frictionless surface. At the instant shown, each block is a distance d to the left of equilibrium.



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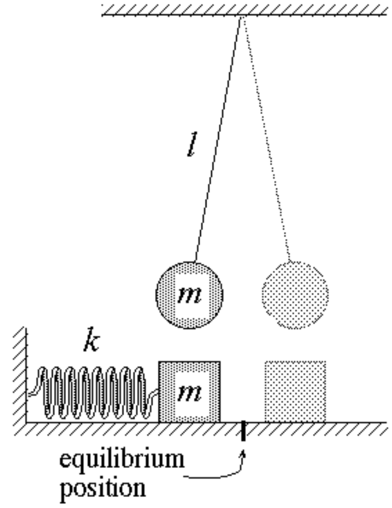
Explain. the spring is depresed the same amount

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? unanswered

Explain.

End of response



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Explain. F=ma since the mass is doubled the force is doubled

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has increased by a factor of 2.

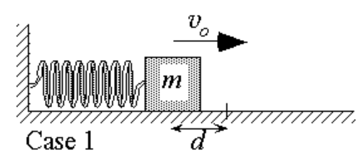
How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has increased by a factor of 2.

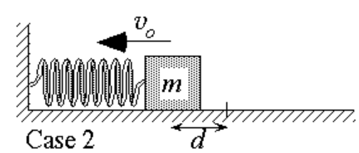
Explain. the mass doubled by two.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has increased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has increased.

Explain. the mass increased so the equilibrium increased.





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Explain. the magnitude of the forces are equal. Some is in the postive dircetion and the other is in the negative direction

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be at the same position as the mark in case 2.

Explain. they have the same spring constant, same mass and the same velocity.

End of response

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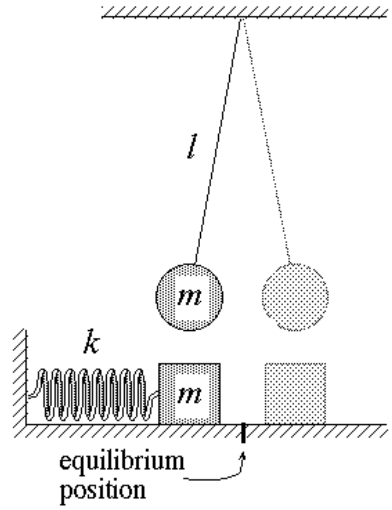

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How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has decreased by a factor of 2.

Explain. I think F=ma applies to both situations. We did this in the lab, as long as the angles of the pendulum are small.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has decreased by a factor of 2.

How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has not changed.

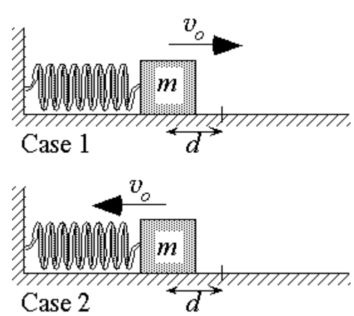
Explain. I think the heavier mass will have less acceleration from the spring since the spring has more work to do. However, the pendulum motion should be unafected because g is constant

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has increased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has not changed.

Explain. I hope this is right. The spring will move the mass slower so it will take longer. But the pendulum will swing at the same speed

Part B: Two block-and-spring systems, Case 1 and Case 2, shown. The blocks each have mass m and are attached to identical, ideal springs of spring constant k. In each case, the block moves on a frictionless surface. At the instant shown, each block is a distance d to the left of equilibrium.



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Explain. F=kx is proportional to distance and not direction

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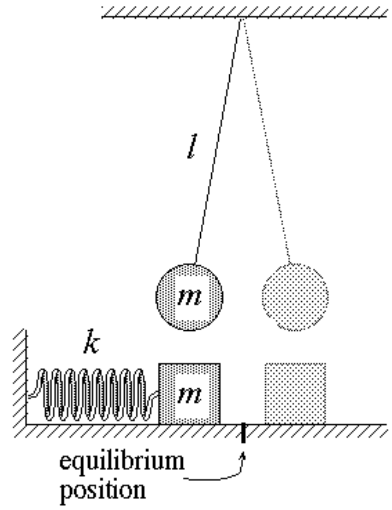
Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be at the same position as the mark in case 2.

Explain. I don't really understand the question. How can the block ossilate? Won't it just make one cycle and be static? However, I believe this is the correct answer because the F applied by the spring is the same in both cases, and v is the same. I think.

End of response



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How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has increased by a factor of 2.

Explain. The only force that contibitrs to net forge on the block is the spring which has not changed. While the force of gravity in the bob has doubled.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has decreased by a factor of 2.

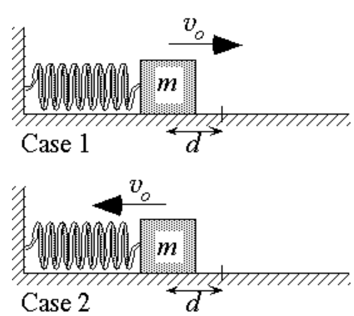
How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has increased by a factor of 2.

Explain. now the same force is trying to move a block that is twice the mass so it will accel. slower. While the bob will accel. faster since the force of gravity has increased.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has increased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has decreased.

Explain. time is directly related to the acceleration



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Explain. since both blocks have the same mass and the same v and are the same distance from equilibrium they must have the same force a

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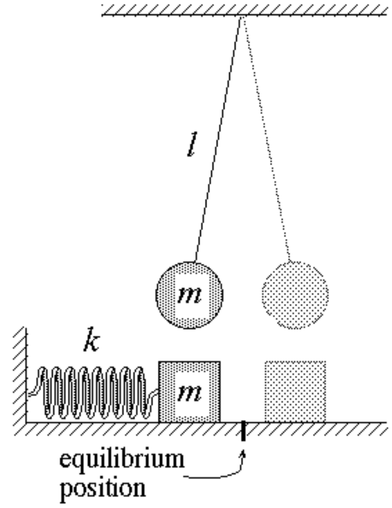
Explain.

End of response



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How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has not changed.

Explain. If the spring is compressed to the same position as it was previously increasing the mass of the object would not increase the amount of forst which the spring is pusing on the block. I think the net force on the pendulum will remain the same because the potential energy due to gravity is related to it's postion, not its mass.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has decreased by a factor of 2.

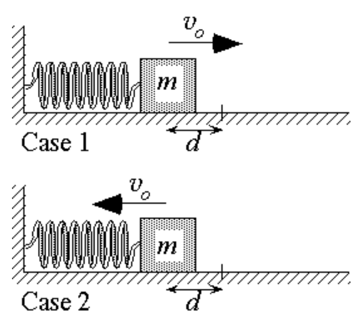
How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has not changed.

Explain. The block will not accelerate as fast because it is experiencing the same force with a greater mass, therefor the aceleration must decrease. The pendulum's acceleration will not change because the only thing effecting it is gravity, which is not related to mass.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has increased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has not changed.

Explain. The block will take longer to travel the distance because of the increased mass and lower acceleration. The pendlum will remain the same since the acceleration is the same.



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Explain. The spring is decompressed the same in both situations and the blocks are of equal mass, therefore at that instant the forces acting on the blocks are the same.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be at the same position as the mark in case 2.

Explain. Since the blocks are experiencing the same force by identical springs I think that the spring will move the blocks to the same position.

End of response

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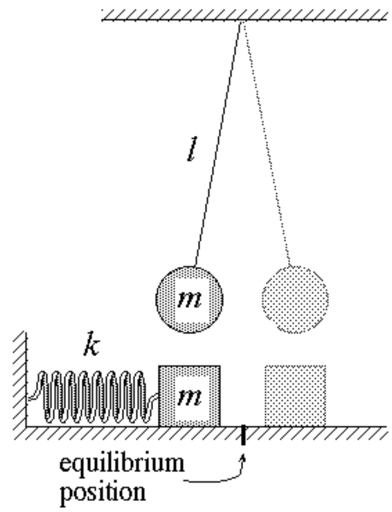


The following change is made: the mass of the block and the bob are each doubled. The objects are then released from rest at the same far left position as shown in the figure.

How has this change affected the magnitude of the net force on the block when it is at the far left position? The magnitude of the net force on the block has not changed.

How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has not changed.

Explain. while the masses of the two objects have increased, the forces have remained the same.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has decreased by a factor of 2.

How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has decreased by a factor of 2.

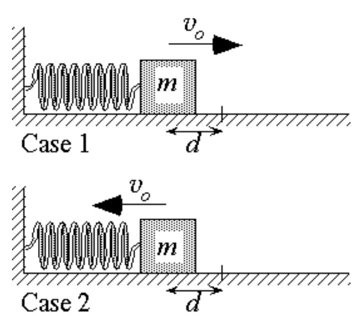
Explain. while the forces remained the same, the masses doubled, causing the accelerations to decrease by a factor of two.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has increased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has increased.

Explain. because acceleration was reduced, it now takes longer for the objects to travel.

Part B: Two block-and-spring systems, Case 1 and Case 2, shown. The blocks each have mass m and are attached to identical, ideal springs of spring constant k. In each case, the block moves on a frictionless surface. At the instant shown, each block is a distance d to the left of equilibrium.



In Case 1, the block has instantaneous velocity v_o to the right. In Case 2, the block has instantaneous velocity v_o to the left.

At the instant shown, is the magnitude of the force on the block by the spring in case 1 greater than, less than, or equal to the magnitude of the force on the block by the spring in case 2? The magnitude of the force on the block by the spring in case 1 is equal to the magnitude of the force on the block by the spring in case 2.

Explain. while the velocities are in different directions, the accelerations remain the same, meaning that the magnitude of the forces must also be the same.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be to the right of the mark in case 2.

Explain. if there is friction, then the mark will slowly move closer to the center of the swing. if there is no friction, then the mark will be equal to what it was in case 1.

End of response

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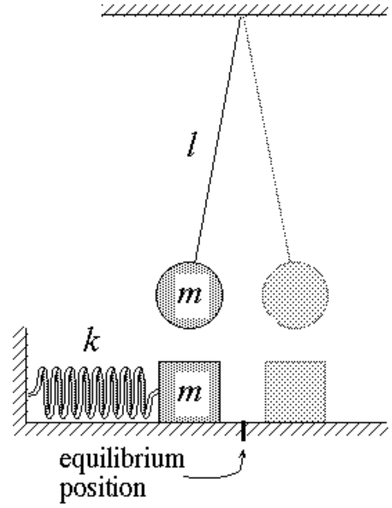

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How has this change affected the magnitude of the net force on the block when it is at the far left position? The magnitude of the net force on the block has increased by a factor of 2.

How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has increased by a factor of 2.

Explain. because net force is mass times the accleration, if the mass has increased twice as much, the force will have increased twice as much as well.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has not changed.

How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has not changed.

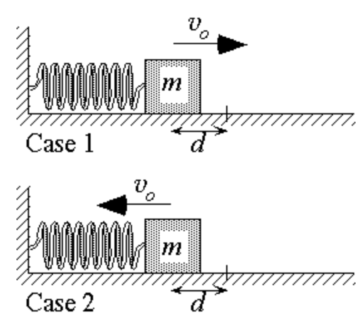
Explain. I dont see why it could've changed the acceleration when the mass has changed.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has increased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has not changed.

Explain. ??

Part B: Two block-and-spring systems, Case 1 and Case 2, shown. The blocks each have mass m and are attached to identical, ideal springs of spring constant k. In each case, the block moves on a frictionless surface. At the instant shown, each block is a distance d to the left of equilibrium.



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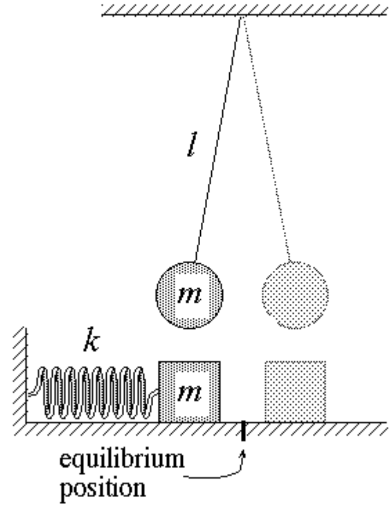
Explain.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be to the left of the mark in case 2.

Explain.

End of response



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How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has not changed.

Explain. Mass has no effect on the net force of the two objects, because all the idividual forces change proportationally to each other.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has not changed.

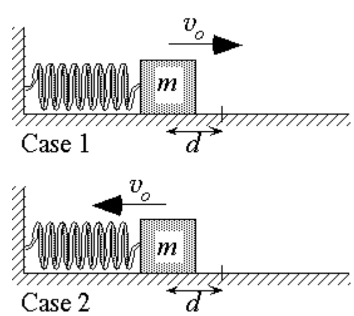
How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has not changed.

Explain. Because net force does not change, neither does the accelerations of the two objects.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has not changed.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has not changed.

Explain. Because the acceleration does not change, the time it takes for the two objects to make their periodic motion does not change either.



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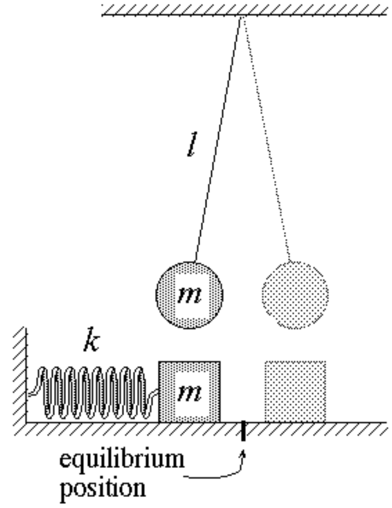
Explain. Just because their velocities are in opposite directions does not mean that the force exterted on them by the spring changes, because the mass m, distance d, and spring constant k remain the same for both blocks.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be at the same position as the mark in case 2.

Explain. The mark will be the same because as the block in case two passes its equilibrium position, it will have a maximum velocity to the right. Because the table is frictionless and all other factors are the same for both blocks, the spring on block two will compress and stretch the same amount as that for block one.

End of response



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How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has not changed.

Explain. For the block, F = kx, and k and x are still the same, so F has not changed. For the pendulum, F = ma = mg - T. If the mass doubles, then gravity and tension force will also double, canceling each other out.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has decreased by a factor of 2.

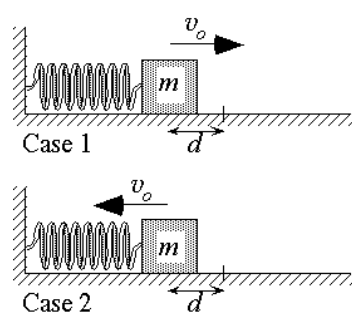
How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has increased by a factor of 2.

Explain. For the block, F = kx = ma. If F is constant and the mass doubles, then accel will have to decrease by a factor of 2. For the pendulum, F = ma = mg - T. If F is constant, and m has doubled

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? unanswered

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? unanswered

Explain.



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In Case 1, the block has instantaneous velocity v_o to the right. In Case 2, the block has instantaneous velocity v_o to the left.

At the instant shown, is the magnitude of the force on the block by the spring in case 1 greater than, less than, or equal to the magnitude of the force on the block by the spring in case 2? unanswered

Explain.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

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Explain.

End of response

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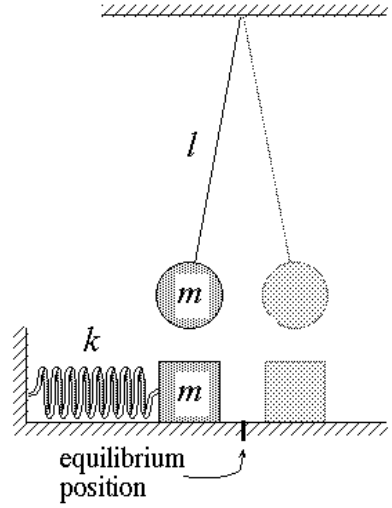

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Explain. spring force is kx,,, which does not involve mass, while a pendulum is pulled with a force proportionate to the weight force (mg), so if m increses, so does the force on m

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has decreased by a factor of 2.

How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has not changed.

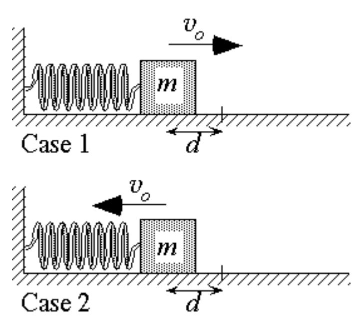
Explain. acceleration due to gravity is always the same, so the pendulum will not accelerate at any greater rate. there is, however, more inertia to over come for the spring, and so the acceleration is less for the block (conserving momentum... same force goes into the system, same momentum will come out

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has increased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has not changed.

Explain. if acceleration increases, the time will decrease, but if not, time will be the same all over

Part B: Two block-and-spring systems, Case 1 and Case 2, shown. The blocks each have mass m and are attached to identical, ideal springs of spring constant k. In each case, the block moves on a frictionless surface. At the instant shown, each block is a distance d to the left of equilibrium.



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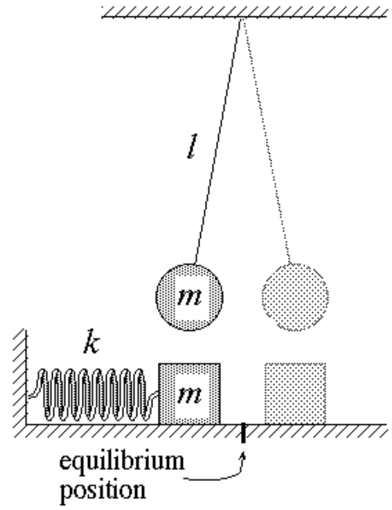
Explain. because kx (or kd, in this case) is the same

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be at the same position as the mark in case 2.

Explain. the force will push it as far beyond equilibrium as always if velocity is back, then it'll build up potential energy until it comes back to that position and wil look the same as case one... the rightmost point will be the same (assuming the table is frictionless, else mark 2 is less, because friction acted for longer, losing energy in this system.)

End of response



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How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has increased by a factor of 2.

Explain. the block will not come back with any more force than before since it is released in the same manner, if anything it will come back with less force. the bob has an increased gravity force without a normal force to oppose it, so it has a greater force on it.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has not changed.

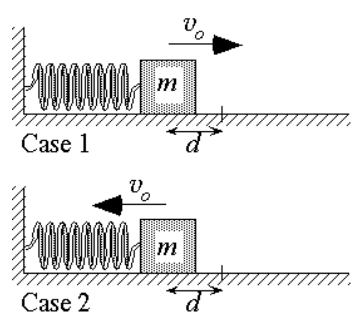
How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has increased by a factor of 2.

Explain. i used the same ideas previously discussed.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has not changed.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has not changed.

Explain. i am not sure about his one



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In Case 1, the block has instantaneous velocity v_o to the right. In Case 2, the block has instantaneous velocity v_o to the left.

At the instant shown, is the magnitude of the force on the block by the spring in case 1 greater than, less than, or equal to the magnitude of the force on the block by the spring in case 2? The magnitude of the force on the block by the spring in case 1 is equal to the magnitude of the force on the block by the spring in case 2.

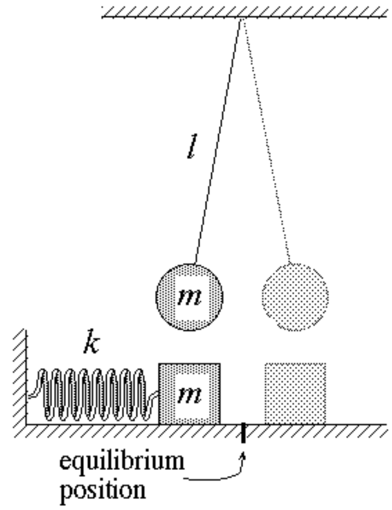
Explain. the direction of movement does not affect the force on th block in this case.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? unanswered

Explain.

End of response



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How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has increased by a factor of 2.

Explain. The spring will still push on the block with the same force; the force due to gravity on the pendulum is mg, since the mass doubles, this force must double.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has decreased by a factor of 2.

How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has increased by a factor of 2.

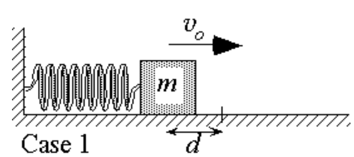
Explain. Because the force on the block doesn't change and it gains more mass, the acceleration will be slower; the force on the pendulum due to gravity doubles and therefore the acceleration must also double.

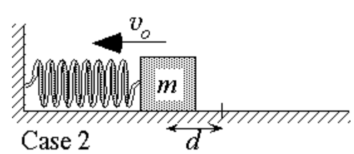
Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has decreased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has increased.

Explain. The block has a slower acceleration so it will take a shorter duration to reach equilibrium. Because the pendulum accelerates, it will take more swings to reach equilibruim; hence a longer time.

Part B: Two block-and-spring systems, Case 1 and Case 2, shown. The blocks each have mass m and are attached to identical, ideal springs of spring constant k. In each case, the block moves on a frictionless surface. At the instant shown, each block is a distance d to the left of equilibrium.





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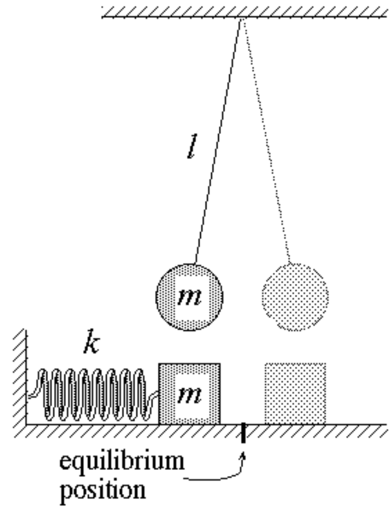
Explain. The spring is exerting the same amount of force for each; however the momentum of the individual blocks is different.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be to the left of the mark in case 2.

Explain. The momentum of the block going into the spring will compress the string further and therefore cause a greater force to be exterted on it; it will then travel further than block 1.

End of response



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How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has not changed.

Explain. The net force has not changed because the force of friction on the block is doubled becasue its mass is doubled and the force from the spring is doubled becasue it has to counter the force. Since these two oppose each other but the motion still has to be the same the net force does not change.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has not changed.

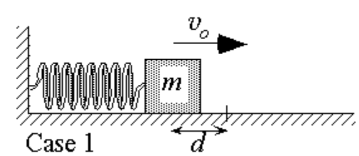
How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has not changed.

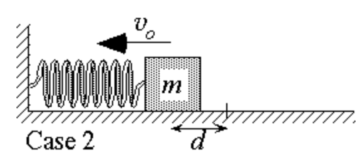
Explain. When either object is in the far left position the acceleration is the same because it is going to the right at the same magnitude as before.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has decreased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has decreased.

Explain. Both have decreased because for the pendulum bob it has a greater mass so it will be affected by gravity more and so it will ahve a greater acceleration. The block it will decrease becasue the pressure taht builds up in the spring will be greater and give it a faster acceleration.





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At the instant shown, is the magnitude of the force on the block by the spring in case 1 greater than, less than, or equal to the magnitude of the force on the block by the spring in case 2? The magnitude of the force on the block by the spring in case 1 is less than the magnitude of the force on the block by the spring in case 2.

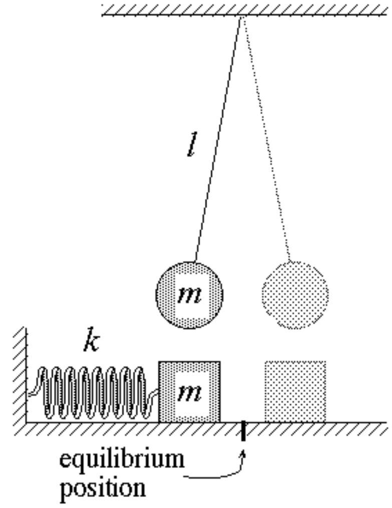
Explain. It is less than because in case two when the block is pushing into the spring the force builds between the two so the force by the spring is greater here than in case one.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be to the left of the mark in case 2.

Explain. To the left because case two is pushing down so that the spring will extend farther when it is pushed out so its final distance for case two will be farther to the right.

End of response



Part A: A block-and-spring system is directly below a pendulum. The block and pendulum bob both have mass m. The spring constant is k, and the length of the pendulum is l. All parameters have been chosen so that the block is directly below the pendulum bob at all times.

The following change is made: the mass of the block and the bob are each doubled. The objects are then released from rest at the same far left position as shown in the figure.

How has this change affected the magnitude of the net force on the block when it is at the far left position? The magnitude of the net force on the block has decreased by a factor of 2.

How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? unanswered

Explain. momentum is conserved for the bob but it is not for hte block.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has decreased by a factor of 2.

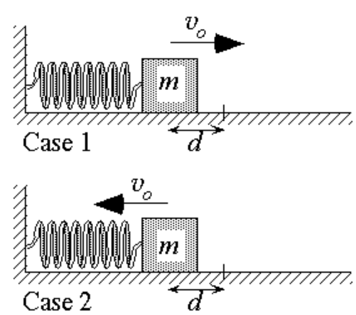
How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has not changed.

Explain. If velocity is changed in question 5 and 6 then the acceleration has also changed.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has increased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has not changed.

Explain. if aceleration is the same then the time would be the same, but if it is different, in the case of the bob (less accel), then the time would be increased.



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In Case 1, the block has instantaneous velocity v_o to the right. In Case 2, the block has instantaneous velocity v_o to the left.

At the instant shown, is the magnitude of the force on the block by the spring in case 1 greater than, less than, or equal to the magnitude of the force on the block by the spring in case 2? The magnitude of the force on the block by the spring in case 1 is equal to the magnitude of the force on the block by the spring in case 2.

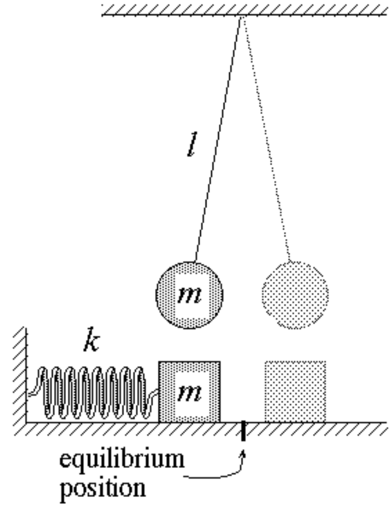
Explain. the force is governed the acceleration which is governed by its kinetic energy which is governed by the spring and the mass attached. If they are all equal then the forces should be equal.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be to the left of the mark in case 2.

Explain. since the two are opposite sides of each other in oscialltion, if case 1 is on the right, then case 2 will be on the left

End of response



Part A: A block-and-spring system is directly below a pendulum. The block and pendulum bob both have mass m. The spring constant is k, and the length of the pendulum is l. All parameters have been chosen so that the block is directly below the pendulum bob at all times.

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How has this change affected the magnitude of the net force on the block when it is at the far left position? The magnitude of the net force on the block has not changed.

How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has not changed.

Explain. The tension force increases and so does the weight force so the net force is the same. And the spring does not change due to the weight.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has decreased by a factor of 2.

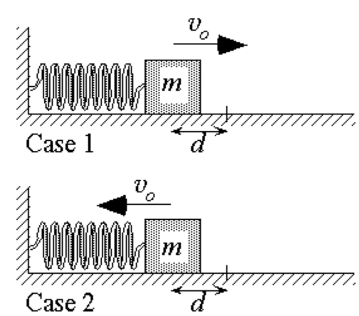
How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has not changed.

Explain. Net force = mass times acceleration, same net force twice the mass, half the acceleration.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has not changed.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has not changed.

Explain. Mass does not affect the period of rotation of simple harmonic motion.



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Explain. Same velocity.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be at the same position as the mark in case 2.

Explain. It takes the same time.

End of response

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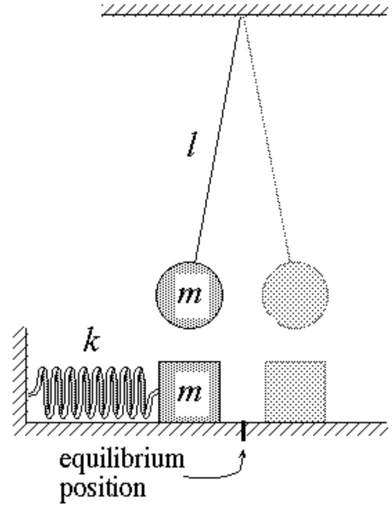

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How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has decreased by a factor of 2.

Explain. If mass is doubled for the block then the force is doubled, if the mass is doubled for the pendilum the gravitational force causes the net force on the pendelum to decrease.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has decreased by a factor of 2.

How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has decreased by a factor of 2.

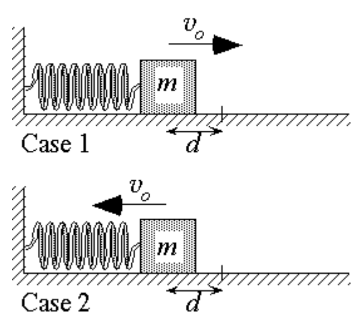
Explain. The increase in mass causes both systems to decrease by that factor.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has decreased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has increased.

Explain. There is more potential energy pulling the pendilum down now, and the block needs more force to be pushed as far.

Part B: Two block-and-spring systems, Case 1 and Case 2, shown. The blocks each have mass m and are attached to identical, ideal springs of spring constant k. In each case, the block moves on a frictionless surface. At the instant shown, each block is a distance d to the left of equilibrium.



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Explain. Because case two is already passed it's equilibrium position.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? unanswered

Explain.

End of response

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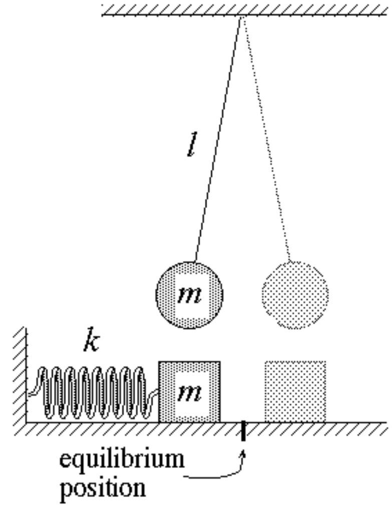

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How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has increased by a factor of 2.

Explain. The force of gravity increases with the increase in mass and the force exerted by the spring does not change.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has decreased by a factor of 2.

How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has not changed.

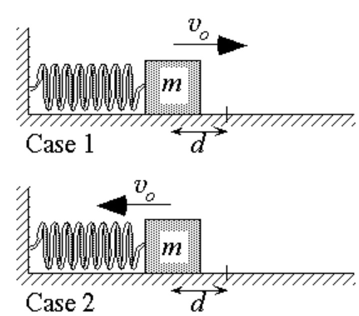
Explain. Acceleration due to gravity is constant and the block has the same force exerted on it but more mass so acceleration (a=F/m) is less.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has increased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has not changed.

Explain. If acceleration is the same then it will take the same time to reach a given position, if it has decreased, it will take more time.

Part B: Two block-and-spring systems, Case 1 and Case 2, shown. The blocks each have mass m and are attached to identical, ideal springs of spring constant k. In each case, the block moves on a frictionless surface. At the instant shown, each block is a distance d to the left of equilibrium.



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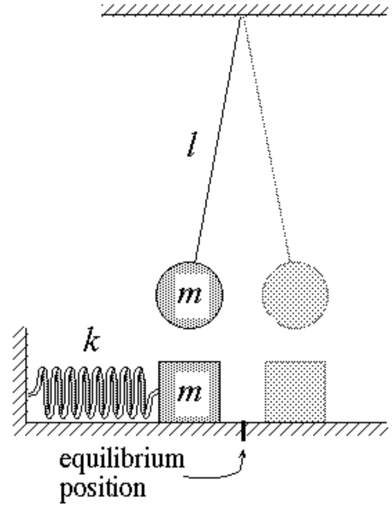
Explain. The compression of the spring is what causes the force to be exerted, not the velocity of these objects.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be at the same position as the mark in case 2.

Explain. The acceleration of the two blocks is the same and the spring will not allow the blocks to go any further than their acceleration will

End of response



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Explain.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has increased by a factor of 2.

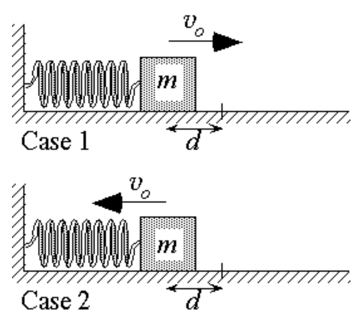
How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has increased by a factor of 2.

Explain.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has decreased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has decreased.

Explain.



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Explain.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be to the left of the mark in case 2.

Explain.

End of response

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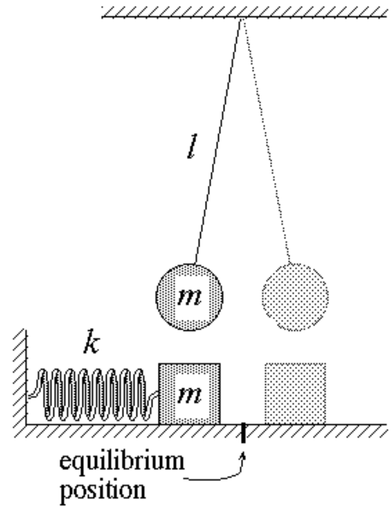

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How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has increased by a factor of 2.

Explain. In the case of the spring, the force is not dependent on mass, it depends on the compression of the spring. For the pendulum, the force is dependent on the mass (F = mg)

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has decreased by a factor of 2.

How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has not changed.

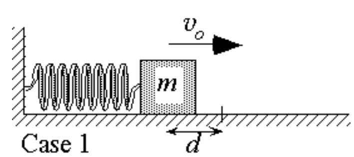
Explain. For the block, ma is dependent on the mass of the block, the force is the same as before, but the mass is greater, so the acceleration will be less.

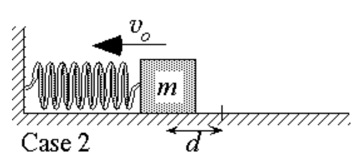
Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has increased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has decreased.

Explain. Acceleration is less for the block.

Part B: Two block-and-spring systems, Case 1 and Case 2, shown. The blocks each have mass m and are attached to identical, ideal springs of spring constant k. In each case, the block moves on a frictionless surface. At the instant shown, each block is a distance d to the left of equilibrium.





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Explain. The have compressed the spring the exact same DISTANCE.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be at the same position as the mark in case 2.

Explain. They are the SAME system. All the variable are defined to be the same, so the behavior of each has to be the same, if only offset in time by some constant.

End of response

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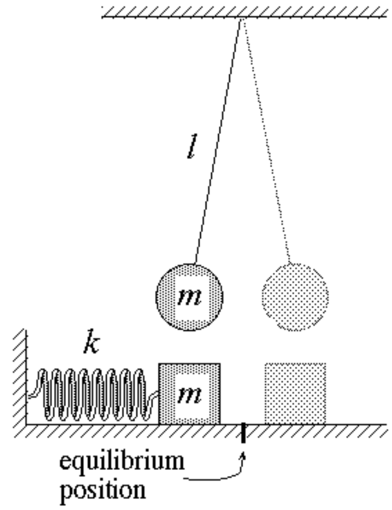

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Explain. Because two objects are moving in same motion.And the total energy they have are same.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has increased by a factor of 2.

How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has not changed.

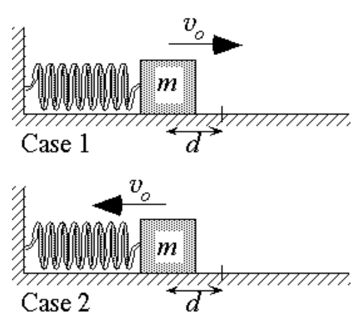
Explain. Because two objects are moving in same motion.And the total energy they have are same.Potential energy for spring is converted to kinetic energy.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has increased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has decreased.

Explain. The hanger has kinetic energy, plus potential energy.Potential energy for spring is converted to kinetic energy.

Part B: Two block-and-spring systems, Case 1 and Case 2, shown. The blocks each have mass m and are attached to identical, ideal springs of spring constant k. In each case, the block moves on a frictionless surface. At the instant shown, each block is a distance d to the left of equilibrium.



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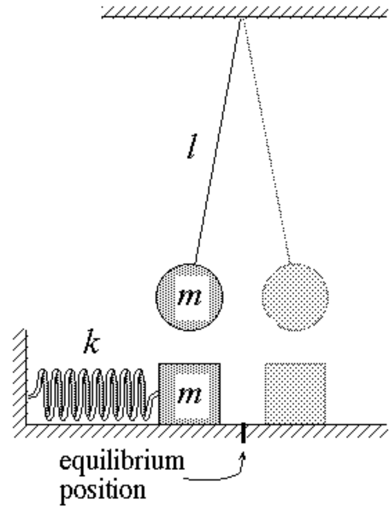
Explain. They are equal in magnitude, but opposite in direction.Because the total energy is conserved.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be to the right of the mark in case 2.

Explain. Same as the last question. They are equal in magnitude, but opposite in direction.Because the total energy is conserved.

End of response



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How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has not changed.

Explain. The net force hasn't changed because the normal force and the tension force just increase to compensate for the greater weight.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has decreased by a factor of 2.

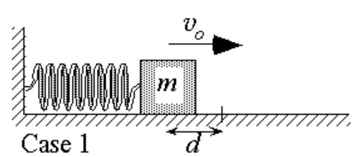
How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has not changed.

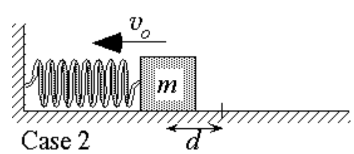
Explain. There will be more friction between the block and the surface so it will take more force to move it.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has increased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has not changed.

Explain. Since the acceleration of the block changed but didn't for the bob, then this is why it happens.





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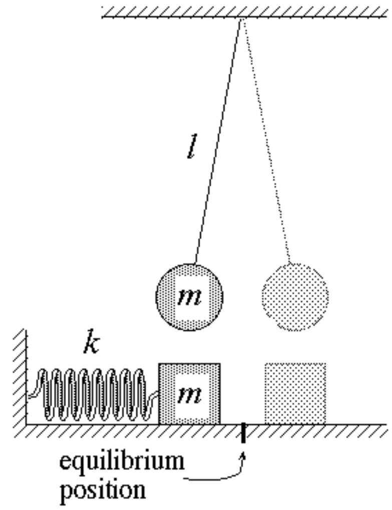
Explain. Just because there is an intial velocity doesn't mean there is more net force and since the spring is compressed the same distance, they should be the same.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be to the left of the mark in case 2.

Explain. Since the intial velocity is greater towards the spring at instant 2, thenit will compress more and then have more force to push it back out.

End of response



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The following change is made: the mass of the block and the bob are each doubled. The objects are then released from rest at the same far left position as shown in the figure.

How has this change affected the magnitude of the net force on the block when it is at the far left position? The magnitude of the net force on the block has not changed.

How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has increased by a factor of 2.

Explain. sum of Forces = mass times acceleration. Since mass was doubled, the force of gravity on the pendulum would also double (thus making the net force double). The same is true for the block but that force downward does not influence it's horizontal acceleration.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has decreased by a factor of 2.

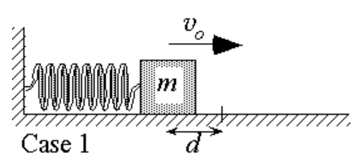
How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has not changed.

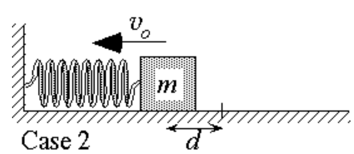
Explain. sum of Forces = mass times acceleration. Since net force is constant for the block, acceleration must be cut in half to keep the F=ma equation balenced. For the pendulum, acceleration must remain constant for F=ma to be balenced.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has increased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has not changed.

Explain. Acceleration remains the same for the pendulum while the block's acceleration has decreased.





Part B: Two block-and-spring systems, Case 1 and Case 2, shown. The blocks each have mass m and are attached to identical, ideal springs of spring constant k. In each case, the block moves on a frictionless surface. At the instant shown, each block is a distance d to the left of equilibrium.

In Case 1, the block has instantaneous velocity v_o to the right. In Case 2, the block has instantaneous velocity v_o to the left.

At the instant shown, is the magnitude of the force on the block by the spring in case 1 greater than, less than, or equal to the magnitude of the force on the block by the spring in case 2? The magnitude of the force on the block by the spring in case 1 is less than the magnitude of the force on the block by the spring in case 2.

Explain. Since the block in case 2 is moving into the spring, it required more force to push the spring out and return to it's equilibrium position compared to block 1.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

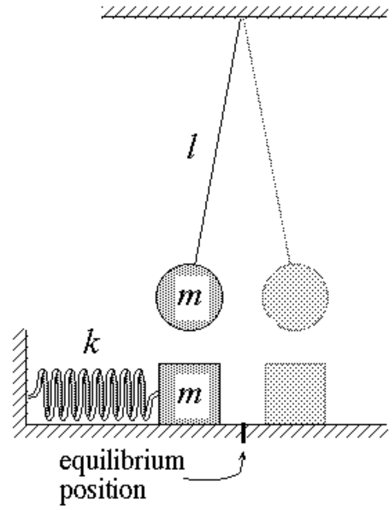
Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be to the left of the mark in case 2.

Explain. The spring in case 2 has more force than the spring in case 1. Since the masses are equal for the blocks, the system with more force will have more acceleration thus giving the furthur distance travelled.

End of response

Part A: A block-and-spring system is directly below a pendulum. The block and pendulum bob both have mass m. The spring constant is k, and the length of the pendulum is l. All parameters have been chosen so that the block is directly below the pendulum bob at all times.

The following change is made: the mass of the block and the bob are each doubled. The objects are then released from rest at the same far left position as shown in the figure.



How has this change affected the magnitude of the net force on the block when it is at the far left position? The magnitude of the net force on the block has not changed.

How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has increased by a factor of 2.

Explain. Since F = kx, the force on the block is not related to its mass, given that it is in the same position. The tension in the pendulum, however, will increase, because it is dependant on the mass it is holding up.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has decreased by a factor of 2.

How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has not changed.

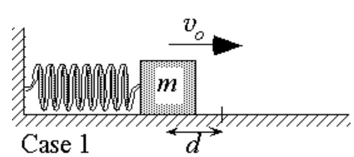
Explain. Same force on block with double mass = 1/2 acceleation. Since the pendulum has double the force, but also double the mass, acceleration remains constant.

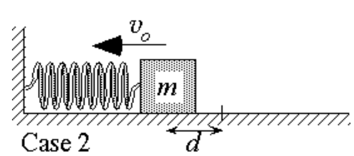
Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has increased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has not changed.

Explain. Sicnce the acceleration of the block is decreased, it will take more time since it moves at a slower velocity. Since the pendulum has the same acceleration, it will get there at the same time as before.

Part B: Two block-and-spring systems, Case 1 and Case 2, shown. The blocks each have mass m and are attached to identical, ideal springs of spring constant k. In each case, the block moves on a frictionless surface. At the instant shown, each block is a distance d to the left of equilibrium.





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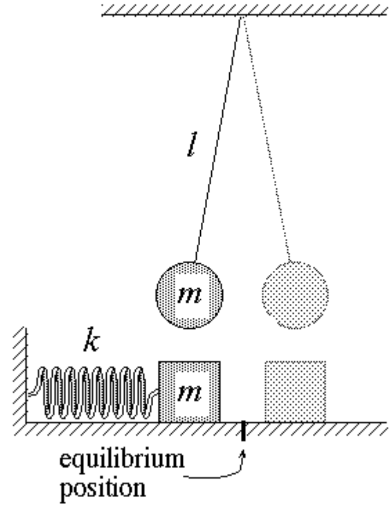
Explain. F = kx. The force only depends on the spring constant, which doesnt change, and the extension, which is the same at that point.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be at the same position as the mark in case 2.

Explain. They both have equal total energy at that point, assuming v1 = -v2. Therefore, their kinetic energies and potential energies must be the same. At the maximum extension, all energy is potential, and since their energies are the same, they must have the same extension.

End of response



Part A: A block-and-spring system is directly below a pendulum. The block and pendulum bob both have mass m. The spring constant is k, and the length of the pendulum is l. All parameters have been chosen so that the block is directly below the pendulum bob at all times.

The following change is made: the mass of the block and the bob are each doubled. The objects are then released from rest at the same far left position as shown in the figure.

How has this change affected the magnitude of the net force on the block when it is at the far left position? The magnitude of the net force on the block has increased by a factor of 2.

How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has increased by a factor of 2.

Explain. Because force and mass are linearly and directly related the magnitude of the force will increase by a factor of 2 if the mass is doubled.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has not changed.

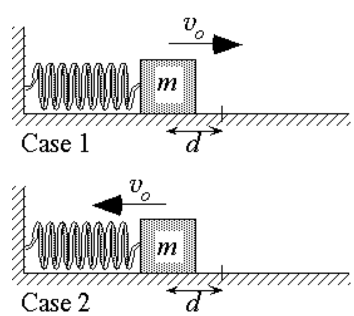
How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has not changed.

Explain. If both force and mass increase by a factor of 2 then the acceleration will not be affected.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has not changed.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has not changed.

Explain. Since the acceleration remains the same the time does not change.



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In Case 1, the block has instantaneous velocity v_o to the right. In Case 2, the block has instantaneous velocity v_o to the left.

At the instant shown, is the magnitude of the force on the block by the spring in case 1 greater than, less than, or equal to the magnitude of the force on the block by the spring in case 2? The magnitude of the force on the block by the spring in case 1 is equal to the magnitude of the force on the block by the spring in case 2.

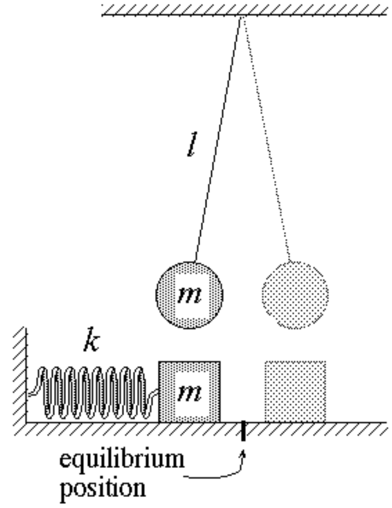
Explain. Since F = -kx, and since k and x are equal in magnitude, so will the force.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be to the right of the mark in case 2.

Explain. Because in case1 the initial velocity is to the right.

End of response



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The following change is made: the mass of the block and the bob are each doubled. The objects are then released from rest at the same far left position as shown in the figure.

How has this change affected the magnitude of the net force on the block when it is at the far left position? The magnitude of the net force on the block has not changed.

How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has not changed.

Explain. i have no idea how this change would be relevant to the change in net force, so i said no change..

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has not changed.

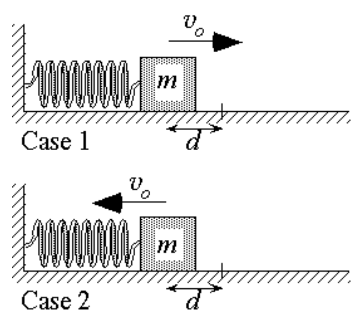
How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has not changed.

Explain. agan, same answer, if there is no change in net force, there will be no change in acceleration..

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has increased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has increased.

Explain. since it is heavier, it chould take longer to reach the end point, because of all the friction and all...



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In Case 1, the block has instantaneous velocity v_o to the right. In Case 2, the block has instantaneous velocity v_o to the left.

At the instant shown, is the magnitude of the force on the block by the spring in case 1 greater than, less than, or equal to the magnitude of the force on the block by the spring in case 2? The magnitude of the force on the block by the spring in case 1 is greater than the magnitude of the force on the block by the spring in case 2.

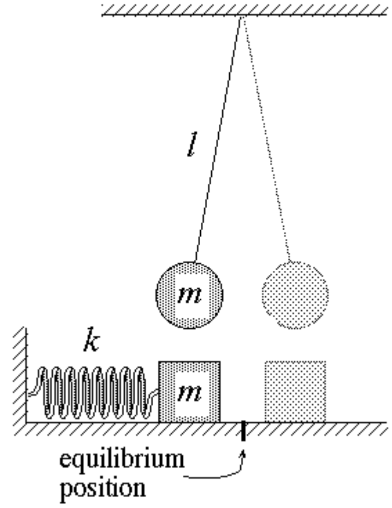
Explain. i'm not really sure about this one...

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be to the left of the mark in case 2.

Explain. same as for the previous answer...

End of response



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The following change is made: the mass of the block and the bob are each doubled. The objects are then released from rest at the same far left position as shown in the figure.

How has this change affected the magnitude of the net force on the block when it is at the far left position? The magnitude of the net force on the block has not changed.

How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has not changed.

Explain. Since the block of doubled mass is released from the same position as the original block, the initial magnitudes of the net forces on them remains the same as well. The net force on the bob remains the same since the only forces acting upon it are the tension from the string and its weight. Though its mass changes, the tension force changes as well in order to keep the net force the same.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has decreased by a factor of 2.

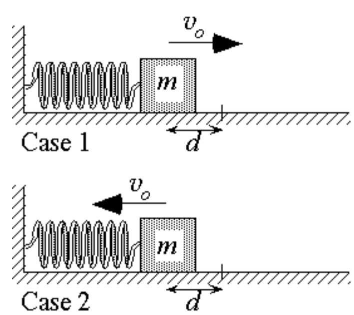
How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has increased by a factor of 2.

Explain. The heavier mass of the block requires more force on the part of the spring to move at the same acceleration as the original block. Since the spring exerts the same force on both blocks, the heavier block accelerates less. The pendulum bob has increased acceleration with greater mass since its initial motion is falling, which is affected by the falling object's mass.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has increased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? unanswered

Explain. Since the second block is heavier and accelerates less, it travels the same distance as the original block in a long period of time. The pendulum bob reaches the equilibrium position sooner, as its acceleration is faster than the original bob.



Part B: Two block-and-spring systems, Case 1 and Case 2, shown. The blocks each have mass m and are attached to identical, ideal springs of spring constant k. In each case, the block moves on a frictionless surface. At the instant shown, each block is a distance d to the left of equilibrium.

In Case 1, the block has instantaneous velocity v_o to the right. In Case 2, the block has instantaneous velocity v_o to the left.

At the instant shown, is the magnitude of the force on the block by the spring in case 1 greater than, less than, or equal to the magnitude of the force on the block by the spring in case 2? unanswered

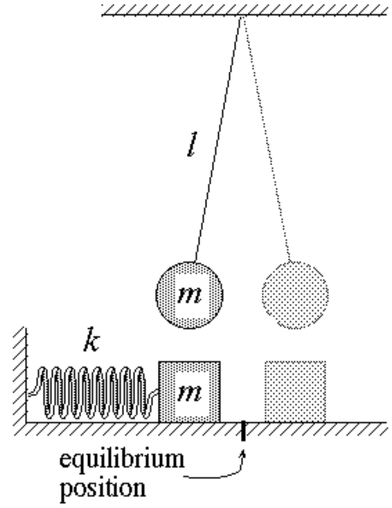
Explain.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? unanswered

Explain.

End of response



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The following change is made: the mass of the block and the bob are each doubled. The objects are then released from rest at the same far left position as shown in the figure.

How has this change affected the magnitude of the net force on the block when it is at the far left position? The magnitude of the net force on the block has increased by a factor of 2.

How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has increased by a factor of 2.

Explain. As the mass increases the force will increase because they are directly proportional in the equation F=ma.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has not changed.

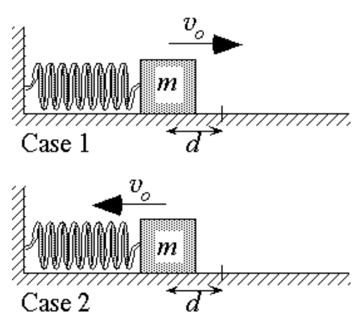
How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has not changed.

Explain. The acceleration has not changed.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has not changed.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has not changed.

Explain. The time has not changed.



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In Case 1, the block has instantaneous velocity v_o to the right. In Case 2, the block has instantaneous velocity v_o to the left.

At the instant shown, is the magnitude of the force on the block by the spring in case 1 greater than, less than, or equal to the magnitude of the force on the block by the spring in case 2? The magnitude of the force on the block by the spring in case 1 is equal to the magnitude of the force on the block by the spring in case 2.

Explain. The force on the block by the spring are equal in both cases.

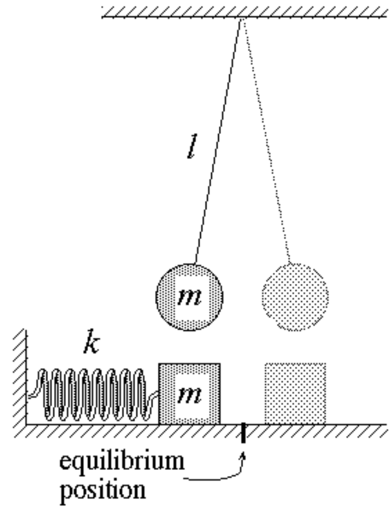
A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be at the same position as the mark in case 2.

Explain. Yes becasue of the same spring constant.

End of response

Part A: A block-and-spring system is directly below a pendulum. The block and pendulum bob both have mass m. The spring constant is k, and the length of the pendulum is l. All parameters have been chosen so that the block is directly below the pendulum bob at all times.



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How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has not changed.

Explain. F = m * aF constant m double a must be reduced by half

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has decreased by a factor of 2.

How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has decreased by a factor of 2.

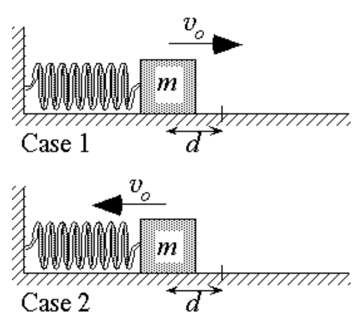
Explain. F = m * aF constant m double a must be reduced by half

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has decreased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has decreased.

Explain. a is smaller

Part B: Two block-and-spring systems, Case 1 and Case 2, shown. The blocks each have mass m and are attached to identical, ideal springs of spring constant k. In each case, the block moves on a frictionless surface. At the instant shown, each block is a distance d to the left of equilibrium.



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At the instant shown, is the magnitude of the force on the block by the spring in case 1 greater than, less than, or equal to the magnitude of the force on the block by the spring in case 2? The magnitude of the force on the block by the spring in case 1 is less than the magnitude of the force on the block by the spring in case 2.

Explain. in case 1 the force acting on the block is speeding up the blockin case 2 the force acting on the block is retarding the block while compressing the spring

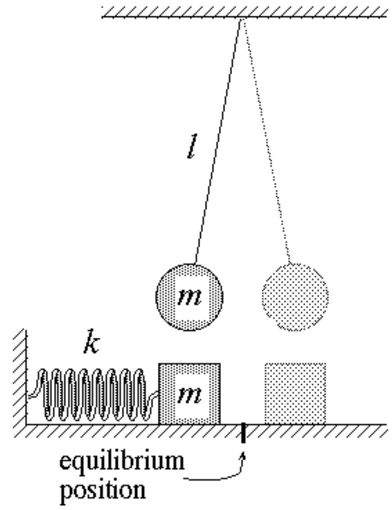
A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be to the left of the mark in case 2.

Explain. the spring in case 2 will have more potential energy to release since the spring is still being compressed at this point.

End of response

Part A: A block-and-spring system is directly below a pendulum. The block and pendulum bob both have mass m. The spring constant is k, and the length of the pendulum is l. All parameters have been chosen so that the block is directly below the pendulum bob at all times.



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How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has not changed.

Explain. Force=m*a. If the mass doubles, then the force must also double.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has not changed.

How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has not changed.

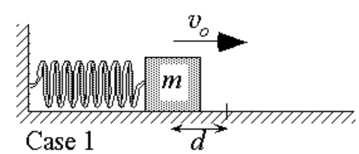
Explain. Force is dependent upon mass, but acceleration is not. The acceleration remains the same regardless of mass.

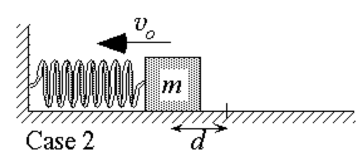
Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has not changed.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has not changed.

Explain. It hasn't changed because the acceleration of the block has not changed at all. Therefore the time will be the same.

Part B: Two block-and-spring systems, Case 1 and Case 2, shown. The blocks each have mass m and are attached to identical, ideal springs of spring constant k. In each case, the block moves on a frictionless surface. At the instant shown, each block is a distance d to the left of equilibrium.





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Explain. the velocities are equal so the force must be equal.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be to the right of the mark in case 2.

Explain. Case one already has velocity in the same direction as the force so it will go farther than case 2.

End of response

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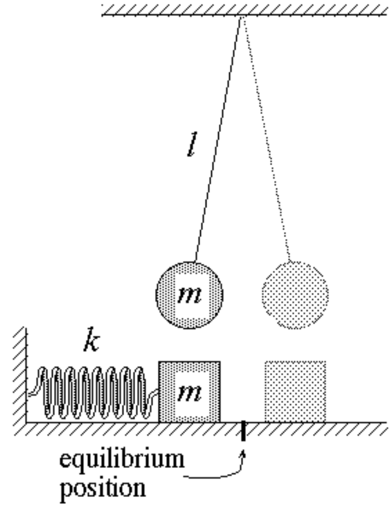


The following change is made: the mass of the block and the bob are each doubled. The objects are then released from rest at the same far left position as shown in the figure.

How has this change affected the magnitude of the net force on the block when it is at the far left position? The magnitude of the net force on the block has not changed.

How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has not changed.

Explain. Although the mass doubles, there are no extra forces, so the acceleration must be half its original, or the net force staying the same.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has decreased by a factor of 2.

How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has decreased by a factor of 2.

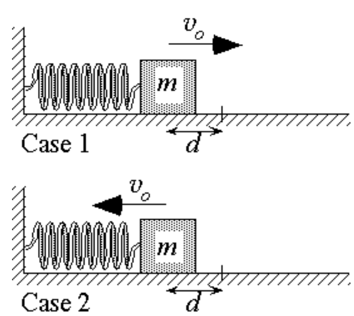
Explain. There are no extra forces, so the acceleration must decrease by a factor of 2.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has increased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has increased.

Explain. Because there is more mass and everything else stays the same, the time to travel must be greater than if the mass was only m.

Part B: Two block-and-spring systems, Case 1 and Case 2, shown. The blocks each have mass m and are attached to identical, ideal springs of spring constant k. In each case, the block moves on a frictionless surface. At the instant shown, each block is a distance d to the left of equilibrium.



In Case 1, the block has instantaneous velocity v_o to the right. In Case 2, the block has instantaneous velocity v_o to the left.

At the instant shown, is the magnitude of the force on the block by the spring in case 1 greater than, less than, or equal to the magnitude of the force on the block by the spring in case 2? The magnitude of the force on the block by the spring in case 1 is less than the magnitude of the force on the block by the spring in case 2.

Explain. Because the block is being pushed into the spring, this causes more force to be exerted on block 2.

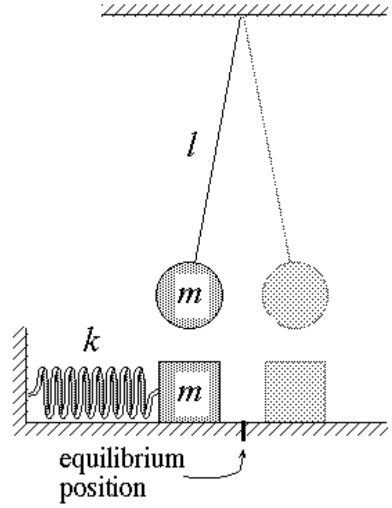
A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be to the left of the mark in case 2.

Explain. The block in case 2 goes farther because it has the extra force of the spring working with it that block 1 doesn't have.

End of response

Part A: A block-and-spring system is directly below a pendulum. The block and pendulum bob both have mass m. The spring constant is k, and the length of the pendulum is l. All parameters have been chosen so that the block is directly below the pendulum bob at all times.



The following change is made: the mass of the block and the bob are each doubled. The objects are then released from rest at the same far left position as shown in the figure.

How has this change affected the magnitude of the net force on the block when it is at the far left position? The magnitude of the net force on the block has increased by a factor of 2.

How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has not changed.

Explain. Since force of spring can be defined as F = kx , the far left it is at, the greater the force exerts on the block. On the other hand, gravity is only force exerting on the bob, and gravity is constant, so no matter how far lest it is at, net force has not changed.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has increased by a factor of 2.

How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has increased by a factor of 2.

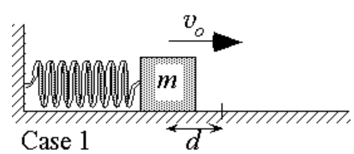
Explain. Since acceleration is defined as a = F/m, where F is net force, and proportional to the distance the blcok is pushed toward the spring, acceleartion is increased when it is at the far left position. On the other hand, even though next force has not changed for the pendulum bob, angle between gravity and tension force becomes greater, which makes the component force which is parallel to the acceleration direction greater too. Therefore, acceleration is increased too.

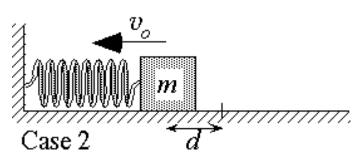
Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has not changed.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has not changed.

Explain. The far left the block is at, the greater disctance it has to travel to reach the equilibrium position, so total time taken is not changed. So does the pendulum bob. The greater acceleration it has, it has to swing for the greater distance.

Part B: Two block-and-spring systems, Case 1 and Case 2, shown. The blocks each have mass m and are attached to identical, ideal springs of spring constant k. In each case, the block moves on a frictionless surface. At the instant shown, each block is a distance d to the left of equilibrium.





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At the instant shown, is the magnitude of the force on the block by the spring in case 1 greater than, less than, or equal to the magnitude of the force on the block by the spring in case 2? The magnitude of the force on the block by the spring in case 1 is equal to the magnitude of the force on the block by the spring in case 2.

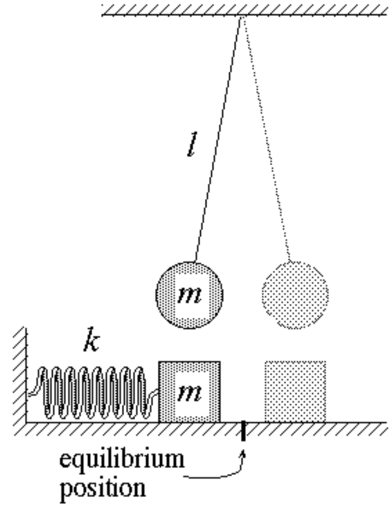
Explain. Since velocity is the same for both cases, KE is the same too. Potential energy for spring is U=1/2kx^2

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? unanswered

Explain.

End of response



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How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has increased by a factor of 2.

Explain. Force equals mass times acceleration. When the mass is increased, so is the force.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has not changed.

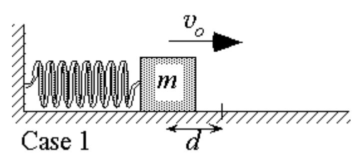
How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has not changed.

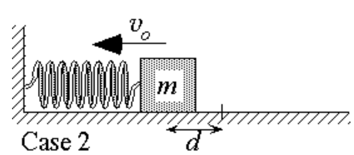
Explain. the acceleration os the bob is due to gravity which is constant. the blocks acceleration is also the same.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has not changed.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has not changed.

Explain. Since the acceleration has not changed, the time is still the same.





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In Case 1, the block has instantaneous velocity v_o to the right. In Case 2, the block has instantaneous velocity v_o to the left.

At the instant shown, is the magnitude of the force on the block by the spring in case 1 greater than, less than, or equal to the magnitude of the force on the block by the spring in case 2? The magnitude of the force on the block by the spring in case 1 is equal to the magnitude of the force on the block by the spring in case 2.

Explain. This is a result of Newton's third law. Since both blocks are in the same position, the force is equal.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be at the same position as the mark in case 2.

Explain. It will be in the same position as the other one because it has the same speed at the same position just in the opposite direction.

End of response

Part A: A block-and-spring system is directly below a pendulum. The block and pendulum bob both have mass m. The spring constant is k, and the length of the pendulum is l. All parameters have been chosen so that the block is directly below the pendulum bob at all times.

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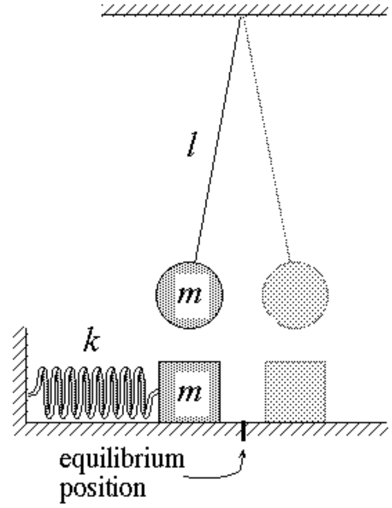

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How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has not changed.

Explain.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has decreased by a factor of 2.

How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has decreased by a factor of 2.

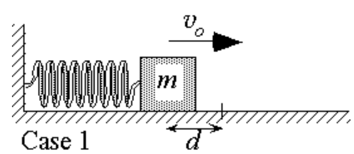
Explain.

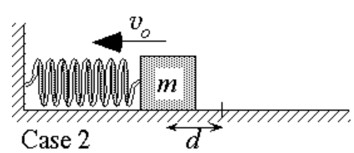
Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has not changed.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has not changed.

Explain.

Part B: Two block-and-spring systems, Case 1 and Case 2, shown. The blocks each have mass m and are attached to identical, ideal springs of spring constant k. In each case, the block moves on a frictionless surface. At the instant shown, each block is a distance d to the left of equilibrium.





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At the instant shown, is the magnitude of the force on the block by the spring in case 1 greater than, less than, or equal to the magnitude of the force on the block by the spring in case 2? The magnitude of the force on the block by the spring in case 1 is greater than the magnitude of the force on the block by the spring in case 2.

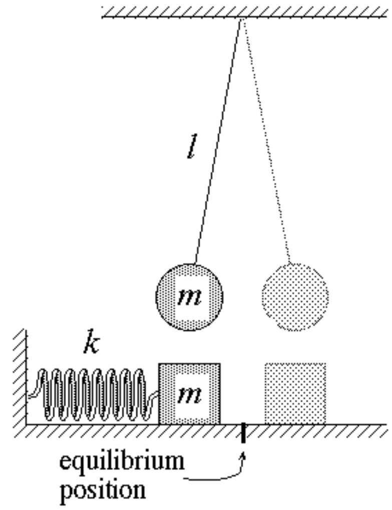
Explain. must have net force -> so the spring must be exerting a greater -> force to be moving in that direction

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be at the same position as the mark in case 2.

Explain. same spring constant

End of response



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The following change is made: the mass of the block and the bob are each doubled. The objects are then released from rest at the same far left position as shown in the figure.

How has this change affected the magnitude of the net force on the block when it is at the far left position? The magnitude of the net force on the block has not changed.

How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has increased by a factor of 2.

Explain. The force on the block only has to do with the spring constant, the force on the pendulum changes with weight because the tension changes.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has decreased by a factor of 2.

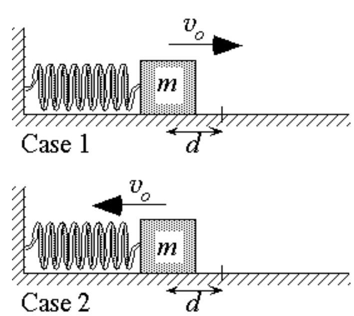
How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has increased by a factor of 2.

Explain. The block will accelerate slower since the weight is greater. The pendulum will accelerate greater as gravity acts more on the greater weight.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has increased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has decreased.

Explain. The same amount of force is acting on the block and it is accelerating slower so it takes longer. The pendulum is accelerating faster and has more force acting on it so it gets to the equlilibrium point faster.



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In Case 1, the block has instantaneous velocity v_o to the right. In Case 2, the block has instantaneous velocity v_o to the left.

At the instant shown, is the magnitude of the force on the block by the spring in case 1 greater than, less than, or equal to the magnitude of the force on the block by the spring in case 2? The magnitude of the force on the block by the spring in case 1 is equal to the magnitude of the force on the block by the spring in case 2.

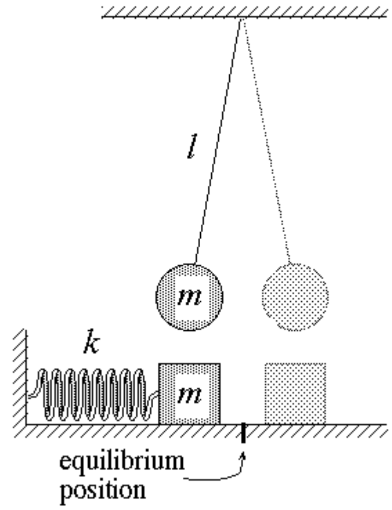
Explain. The forces does not have anything to do with the velocity, only with the distance and the spring constant. Since both are equal for both blocks the forces are equal.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be at the same position as the mark in case 2.

Explain. They are just opposite of each other, but moving with the same speeds.

End of response



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The following change is made: the mass of the block and the bob are each doubled. The objects are then released from rest at the same far left position as shown in the figure.

How has this change affected the magnitude of the net force on the block when it is at the far left position? The magnitude of the net force on the block has increased by a factor of 2.

How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has increased by a factor of 2.

Explain. If mass is multipled by 2 then so is the net force acting on it.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has increased by a factor of 2.

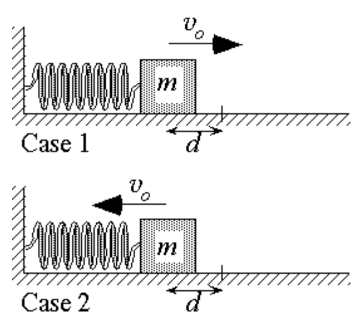
How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has increased by a factor of 2.

Explain. if mass doubles then so does acceleration because they are directly porportional.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has decreased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has decreased.

Explain. If the acceleration increases the time interval from point to point decreares.



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In Case 1, the block has instantaneous velocity v_o to the right. In Case 2, the block has instantaneous velocity v_o to the left.

At the instant shown, is the magnitude of the force on the block by the spring in case 1 greater than, less than, or equal to the magnitude of the force on the block by the spring in case 2? The magnitude of the force on the block by the spring in case 1 is equal to the magnitude of the force on the block by the spring in case 2.

Explain. They move at the same spped and same distance so nothing suggusts that they would have unequal forces.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be at the same position as the mark in case 2.

Explain. they are the same spring so move the same when given the same force.

End of response

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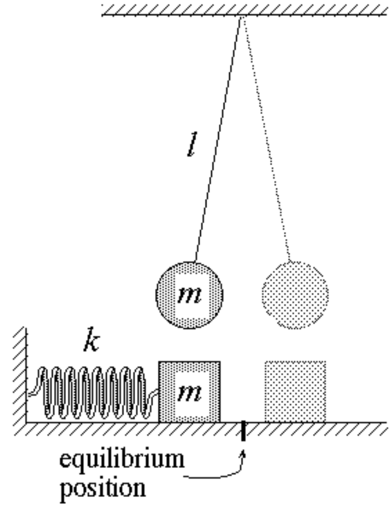

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How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has not changed.

Explain. The magnitude of the force does not change because it is still the same spring and the same length of pendulum.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has decreased by a factor of 2.

How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has decreased by a factor of 2.

Explain. The block and ball will accelerate slower because it is experiencing the same net force as before but has twice the mass.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has decreased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has decreased.

Explain. Since they are accelerating slower, they are oscilating slower

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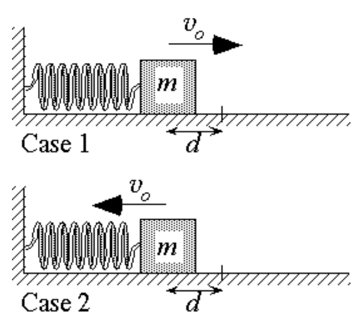

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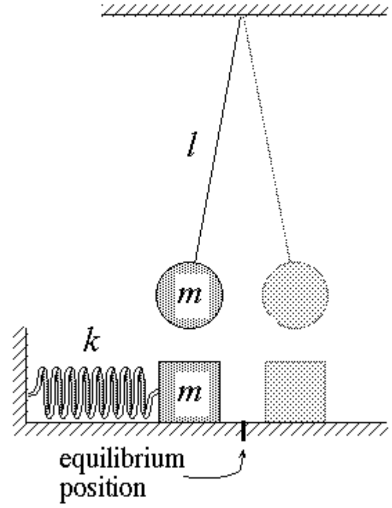
Explain. The spring is in the same position, so it is creating the same force on the block.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be at the same position as the mark in case 2.

Explain. It will be in the same position because the spring is exerting the same force and the blocks are in the same position.

End of response



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How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has increased by a factor of 2.

Explain. sintheta==theta for small theta. so, G*theta is 2x cause m*g. Fspring only depends on disp. from equi. so its the same

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has decreased by a factor of 2.

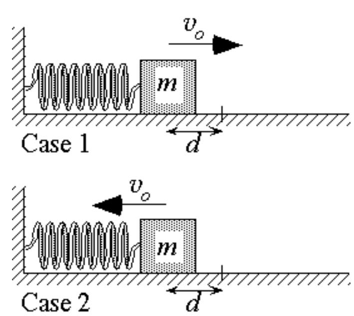
How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has not changed.

Explain. Fnet = ma.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has increased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has not changed.

Explain. by the acceleration



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At the instant shown, is the magnitude of the force on the block by the spring in case 1 greater than, less than, or equal to the magnitude of the force on the block by the spring in case 2? The magnitude of the force on the block by the spring in case 1 is equal to the magnitude of the force on the block by the spring in case 2.

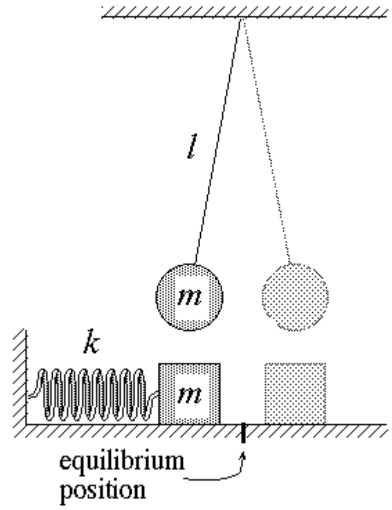
Explain. kx=F

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be to the right of the mark in case 2.

Explain. oscillates around equilib

End of response



Part A: A block-and-spring system is directly below a pendulum. The block and pendulum bob both have mass m. The spring constant is k, and the length of the pendulum is l. All parameters have been chosen so that the block is directly below the pendulum bob at all times.

The following change is made: the mass of the block and the bob are each doubled. The objects are then released from rest at the same far left position as shown in the figure.

How has this change affected the magnitude of the net force on the block when it is at the far left position? The magnitude of the net force on the block has increased by a factor of 2.

How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has increased by a factor of 2.

Explain. The mass has doubled so the force applied by gravity is also doubled.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has not changed.

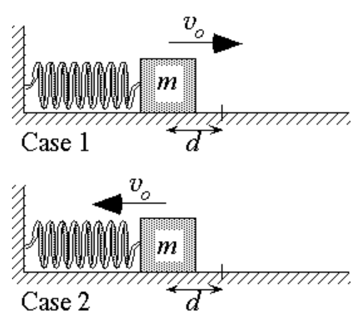
How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has not changed.

Explain. The force is doubled and so is the mass so the coefficients of the mass and force cancel yielding the same magnitude of acceleration.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has not changed.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has not changed.

Explain. The acceleration is still the same so the time it takes is the same.



Part B: Two block-and-spring systems, Case 1 and Case 2, shown. The blocks each have mass m and are attached to identical, ideal springs of spring constant k. In each case, the block moves on a frictionless surface. At the instant shown, each block is a distance d to the left of equilibrium.

In Case 1, the block has instantaneous velocity v_o to the right. In Case 2, the block has instantaneous velocity v_o to the left.

At the instant shown, is the magnitude of the force on the block by the spring in case 1 greater than, less than, or equal to the magnitude of the force on the block by the spring in case 2? The magnitude of the force on the block by the spring in case 1 is equal to the magnitude of the force on the block by the spring in case 2.

Explain. They do the same amount of work.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be at the same position as the mark in case 2.

Explain. The force exerted on each is the same so they will exhibit the same behavior of motion.

End of response

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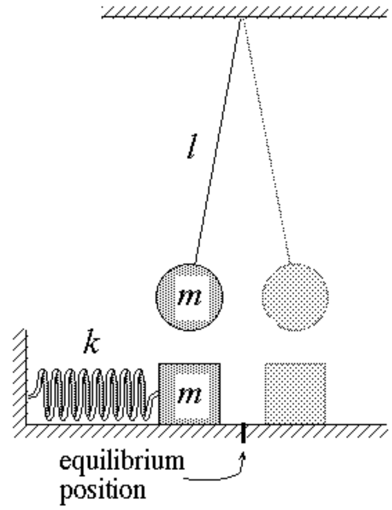
The following change is made: the mass of the block and the bob are each doubled. The objects are then released from rest at the same far left position as shown in the figure.



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How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has not changed.

Explain. They are in the same positions relative to their equiliberum position.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has not changed.

How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has not changed.

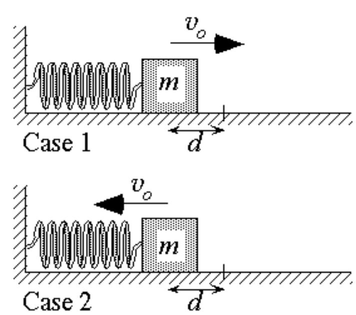
Explain. The acceleration relates to the force.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has not changed.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has not changed.

Explain. Because the magnitude of the acceleration is the same therefore it shoudl take the same amount of time.

Part B: Two block-and-spring systems, Case 1 and Case 2, shown. The blocks each have mass m and are attached to identical, ideal springs of spring constant k. In each case, the block moves on a frictionless surface. At the instant shown, each block is a distance d to the left of equilibrium.



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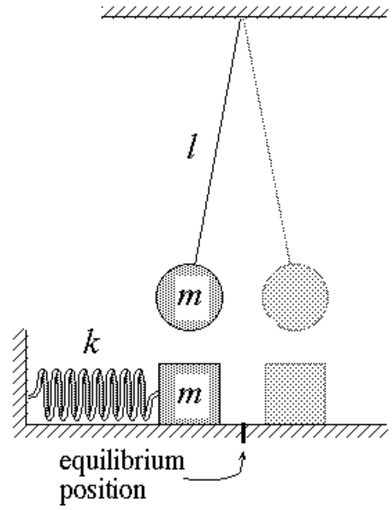
Explain. Becuaase the spring is still compressed to the same level.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be at the same position as the mark in case 2.

Explain. The will be in the same position on opposite sides of the equiliberum position.

End of response



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How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has increased by a factor of 2.

Explain. since force equals mass multiplied by acceleration the net force is increased by a factor of two because the masses are increased by a factor of two.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has not changed.

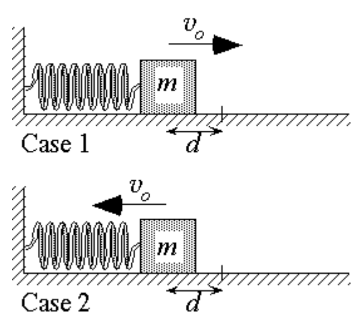
How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has not changed.

Explain. The magnitude of the acceleration has not changed although the net forces have

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has increased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has decreased.

Explain. these are oppostie because there is a greater force acting to bring the ball back to equilibrium while the force affect the frictional force and works against the motion back to equilibrium



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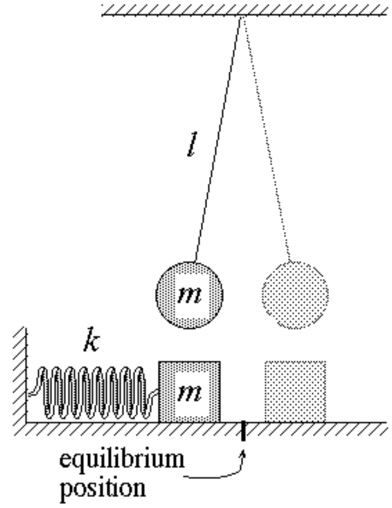
Explain. because force of spring equals k*x where x is the distance from equilibrium

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be at the same position as the mark in case 2.

Explain. because they have the same velocity at the same point, the distance they travel to the right will be equal.

End of response



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The following change is made: the mass of the block and the bob are each doubled. The objects are then released from rest at the same far left position as shown in the figure.

How has this change affected the magnitude of the net force on the block when it is at the far left position? The magnitude of the net force on the block has not changed.

How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has increased by a factor of 2.

Explain. The force exerted on the block is related to the distance from the point of equilibrium and the K value for the spring, not the mass. The forces exerted on the Bob are gravity and tension, both of which are based on the mass The component of gravity is double and so is the opposing tension force. The net down force is doubled from the difference between gravity and tension and the net force in the x direction is doubled because of the tension force.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has increased by a factor of 2.

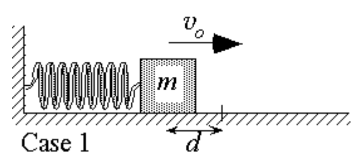
How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has not changed.

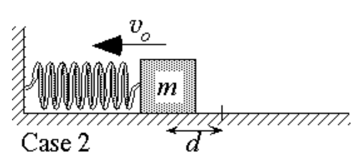
Explain. The mass has been doubled so force is doubled, but the acceleration remains consant because acceleration only would increase if the increased force was greater than a magnitude of two.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has increased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has not changed.

Explain. Because the force needed to move the





Part B: Two block-and-spring systems, Case 1 and Case 2, shown. The blocks each have mass m and are attached to identical, ideal springs of spring constant k. In each case, the block moves on a frictionless surface. At the instant shown, each block is a distance d to the left of equilibrium.

In Case 1, the block has instantaneous velocity v_o to the right. In Case 2, the block has instantaneous velocity v_o to the left.

At the instant shown, is the magnitude of the force on the block by the spring in case 1 greater than, less than, or equal to the magnitude of the force on the block by the spring in case 2? unanswered

Explain.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? unanswered

Explain.

End of response

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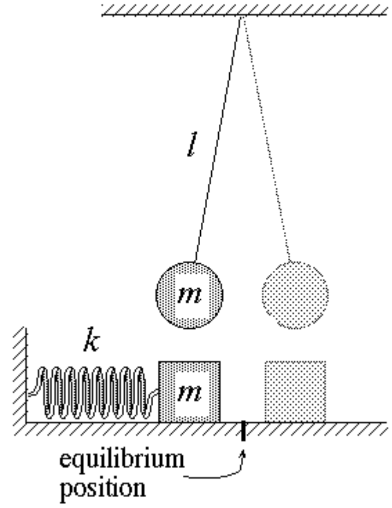

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Explain. F equals k times x. at the right the k remains same while x increases by two. so force is increased by two. the distance from equilibrium is same on either side. force on both sides increase by factor of two.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has increased by a factor of 2.

How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has increased by a factor of 2.

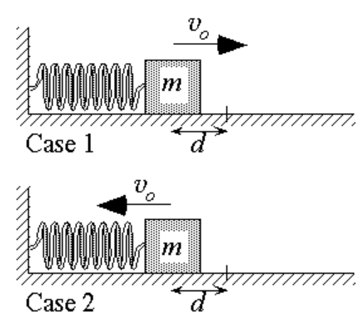
Explain. since force increased in both prior situations, and f equals m times a, where m is constant, then a must increase to make f larger.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has increased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has increased.

Explain. with greater acceleration, the oscillation takes longer to reach equilibrium.

Part B: Two block-and-spring systems, Case 1 and Case 2, shown. The blocks each have mass m and are attached to identical, ideal springs of spring constant k. In each case, the block moves on a frictionless surface. At the instant shown, each block is a distance d to the left of equilibrium.



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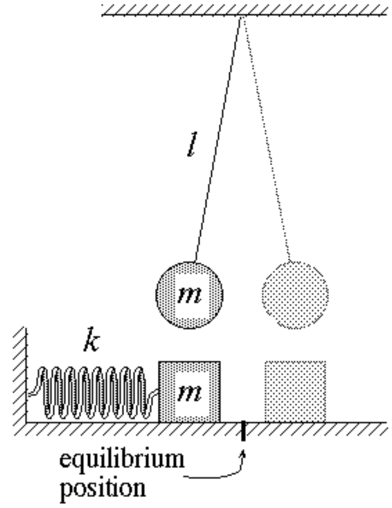
Explain. the force in spring1 included to push of the spring, while spring 2 is being compressed.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be to the left of the mark in case 2.

Explain. spring 2 will go farther because it first compresses the spring before being pushed to the right.

End of response



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How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has increased by a factor of 2.

Explain. The pendulum has teh same acceleration at all times, so if the mass is doubled the force must double to because F=ma

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has not changed.

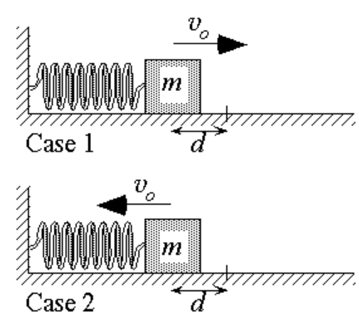
How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has not changed.

Explain. Acceleration is a constant.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has increased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has increased.

Explain. SInce the system has more force, it takes longer to stop.



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In Case 1, the block has instantaneous velocity v_o to the right. In Case 2, the block has instantaneous velocity v_o to the left.

At the instant shown, is the magnitude of the force on the block by the spring in case 1 greater than, less than, or equal to the magnitude of the force on the block by the spring in case 2? The magnitude of the force on the block by the spring in case 1 is equal to the magnitude of the force on the block by the spring in case 2.

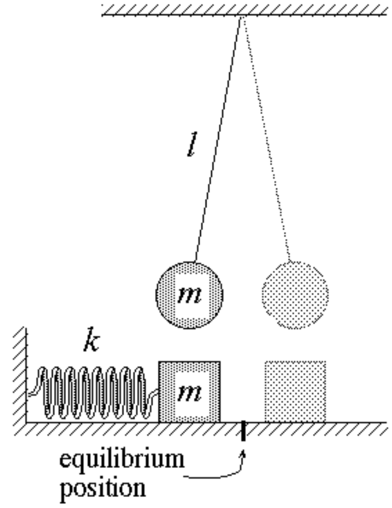
Explain. Velocity of the block doesn't change the amount of force the spring acts on it.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be at the same position as the mark in case 2.

Explain. The spring will change the velocity around to be exactly the same.

End of response



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How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has increased by a factor of 2.

Explain. Both of the objects will increase by a factor of two, because net force is equal to ma, so so since the mass has doubled, so will the net force on both.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has increased by a factor of 2.

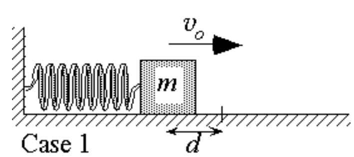
How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has not changed.

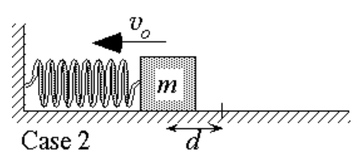
Explain. The acceleration will not change, because the mass has nothing to do with the acceleration of the pendulum. For the pendulum, acceleration is equal to v^2/r. For the block though, the acceleration of the object is calculated by adding all the forces and then setting them equal to ma. In this case, the block acceleration will double.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has decreased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has decreased.

Explain. Both the block and the pendulum's time has decreased because the force has increased. It would take half the time it did the first time.





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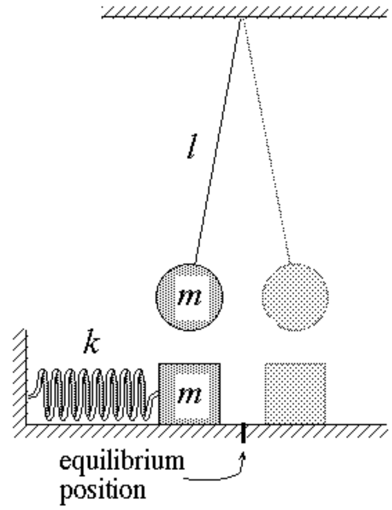
Explain. It is less than, because in case 2 the spring is being compressed, so the block needs more force to compress the spring, and the spring must give an equal and opposite force since the block is moving with instantaneous velocity.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be at the same position as the mark in case 2.

Explain. Since they are both moving with the same instantaneous velocity the mark will be the same for both cases.

End of response



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How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has not changed.

Explain. The only thing that has changed on both objects are the masses. Although the mass has increased, acceleration of the objects would decrease, creating the same magnitute of Force.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has decreased by a factor of 2.

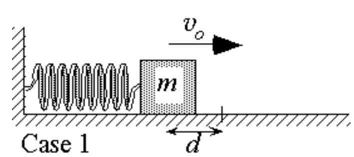
How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has decreased by a factor of 2.

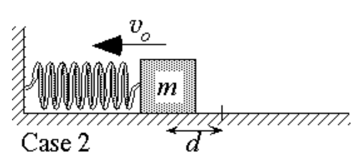
Explain. Since the mass has doubled, the accelerations have to have decreased by a factor of 2 in order to maintain the same magnitude of force.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has increased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has increased.

Explain. Since the mass has increased but the accelerations have decreased, it takes more time to reach the equilibrium point.





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At the instant shown, is the magnitude of the force on the block by the spring in case 1 greater than, less than, or equal to the magnitude of the force on the block by the spring in case 2? The magnitude of the force on the block by the spring in case 1 is greater than the magnitude of the force on the block by the spring in case 2.

Explain. In case 2, the block is working against the spring instead of having its force added onto the mass' force.

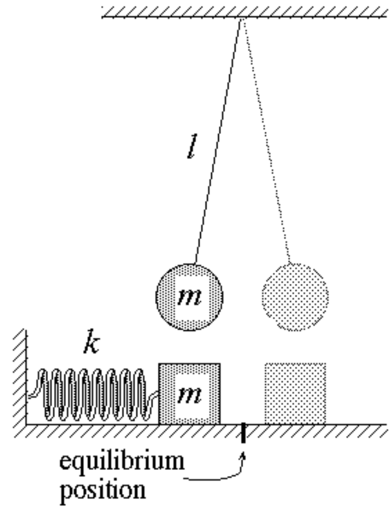
A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be to the left of the mark in case 2.

Explain. Since the blocks are moving back and forth, the block in case 2 would have a greater amount of force added onto it from the spring because of the compression, sending it further out to the right than block 1.

End of response

Part A: A block-and-spring system is directly below a pendulum. The block and pendulum bob both have mass m. The spring constant is k, and the length of the pendulum is l. All parameters have been chosen so that the block is directly below the pendulum bob at all times.



The following change is made: the mass of the block and the bob are each doubled. The objects are then released from rest at the same far left position as shown in the figure.

How has this change affected the magnitude of the net force on the block when it is at the far left position? The magnitude of the net force on the block has increased by a factor of 2.

How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has increased by a factor of 2.

Explain. By Hooke's Law F=km

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has increased by a factor of 2.

How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has increased by a factor of 2.

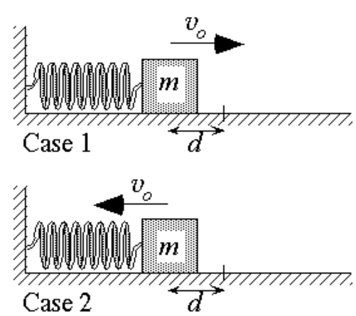
Explain. F=ma?

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has increased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has increased.

Explain. If the acceleration and force both increase, so will the distance.

Part B: Two block-and-spring systems, Case 1 and Case 2, shown. The blocks each have mass m and are attached to identical, ideal springs of spring constant k. In each case, the block moves on a frictionless surface. At the instant shown, each block is a distance d to the left of equilibrium.



In Case 1, the block has instantaneous velocity v_o to the right. In Case 2, the block has instantaneous velocity v_o to the left.

At the instant shown, is the magnitude of the force on the block by the spring in case 1 greater than, less than, or equal to the magnitude of the force on the block by the spring in case 2? The magnitude of the force on the block by the spring in case 1 is equal to the magnitude of the force on the block by the spring in case 2.

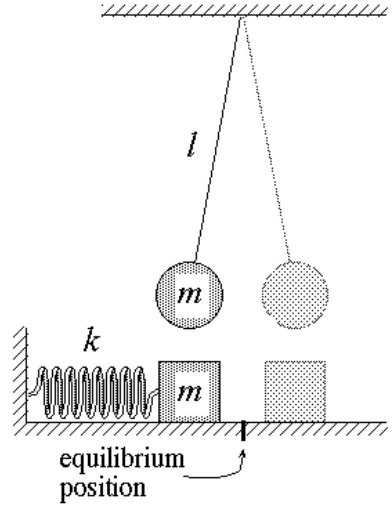
Explain. Everything on the diagram is equal in magnitude, only different in direction.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be to the right of the mark in case 2.

Explain. Block two is as far to the right as it will get, so block one's position will be further to the right.

End of response



Part A: A block-and-spring system is directly below a pendulum. The block and pendulum bob both have mass m. The spring constant is k, and the length of the pendulum is l. All parameters have been chosen so that the block is directly below the pendulum bob at all times.

The following change is made: the mass of the block and the bob are each doubled. The objects are then released from rest at the same far left position as shown in the figure.

How has this change affected the magnitude of the net force on the block when it is at the far left position? The magnitude of the net force on the block has not changed.

How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has increased by a factor of 2.

Explain. Since the spring exerts the force on the block, then the mass of the block does not factor into the net force on the block.Since the bob's force is equal to mgh, and m is doubles, so then is mgh.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has decreased by a factor of 2.

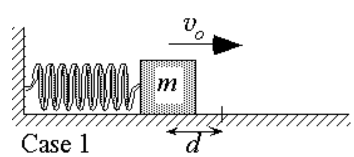
How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has increased by a factor of 2.

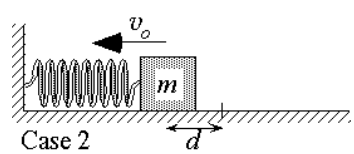
Explain. Force = ma, and for the block m has doubled, so a must be halved.for the bob, F=ma, and since the force is doubled, the acceleration must as well.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has decreased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has decreased.

Explain. Since acceleration for the block is less, the time is less.Since acceleration for the bob is more, it will take less time.





Part B: Two block-and-spring systems, Case 1 and Case 2, shown. The blocks each have mass m and are attached to identical, ideal springs of spring constant k. In each case, the block moves on a frictionless surface. At the instant shown, each block is a distance d to the left of equilibrium.

In Case 1, the block has instantaneous velocity v_o to the right. In Case 2, the block has instantaneous velocity v_o to the left.

At the instant shown, is the magnitude of the force on the block by the spring in case 1 greater than, less than, or equal to the magnitude of the force on the block by the spring in case 2? The magnitude of the force on the block by the spring in case 1 is equal to the magnitude of the force on the block by the spring in case 2.

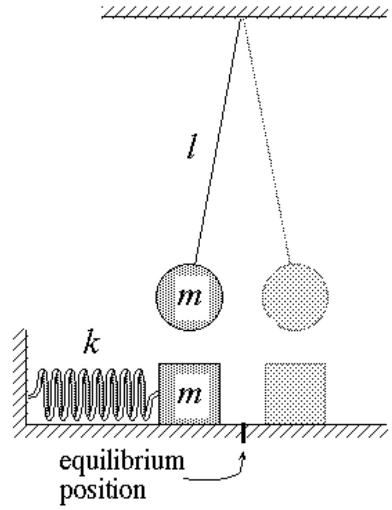
Explain. spring force is kx, and both k and x are the same, so the force exerted on the blocks will be the same.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be at the same position as the mark in case 2.

Explain. They will be the same since the both will start out with the energy of kx plus 1/2mv^2 . While case 2's kinetic energy will be transfered into spring energy before it is transfered back, they will still have the same energy.

End of response



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How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has increased by a factor of 2.

Explain. F=kx for blockFor pendulum restoring force is off weight.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has decreased by a factor of 2.

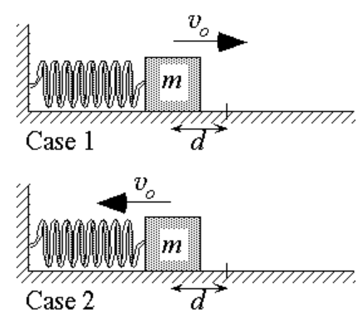
How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has not changed.

Explain. F=ma

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has increased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has not changed.

Explain. The block will be affected, not the pendulum.



Part B: Two block-and-spring systems, Case 1 and Case 2, shown. The blocks each have mass m and are attached to identical, ideal springs of spring constant k. In each case, the block moves on a frictionless surface. At the instant shown, each block is a distance d to the left of equilibrium.

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Explain. F=kx

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be at the same position as the mark in case 2.

Explain.

End of response

Part A: A block-and-spring system is directly below a pendulum. The block and pendulum bob both have mass m. The spring constant is k, and the length of the pendulum is l. All parameters have been chosen so that the block is directly below the pendulum bob at all times.

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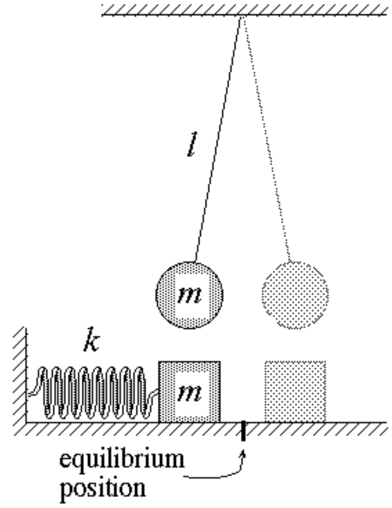

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How has this change affected the magnitude of the net force on the pendulum bob when it is at the far left position? The magnitude of the net force on the pendulum bob has increased by a factor of 2.

Explain. f = ma. the mass is doubled, and assuming the acceleration has stayed the same, the net force will double.

How has this change affected the magnitude of the acceleration of the block when it is at the far left position? The magnitude of the acceleration of the block has not changed.

How has this change affected the magnitude of the acceleration of the pendulum bob when it is at the far left position? The magnitude of the acceleration of the pendulum bob has not changed.

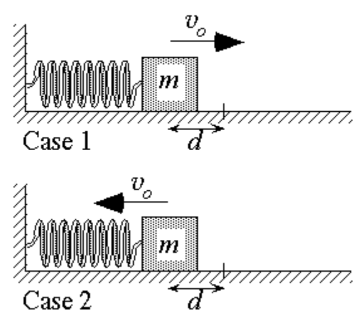
Explain. i do not think that the magnitude of the acceleration of the block has changed at all.

Has the time it takes the block to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the block takes to travel to the equilibrium position has increased.

Has the time it takes the pendulum bob to travel from the far left position to the equilibrium position increased, decreased, or remained the same? The time the bob takes to travel to the equilibrium position has increased.

Explain. there is more mass, meaning more energy to move it, so it will take a little bit longer than it had previously.

Part B: Two block-and-spring systems, Case 1 and Case 2, shown. The blocks each have mass m and are attached to identical, ideal springs of spring constant k. In each case, the block moves on a frictionless surface. At the instant shown, each block is a distance d to the left of equilibrium.



In Case 1, the block has instantaneous velocity v_o to the right. In Case 2, the block has instantaneous velocity v_o to the left.

At the instant shown, is the magnitude of the force on the block by the spring in case 1 greater than, less than, or equal to the magnitude of the force on the block by the spring in case 2? The magnitude of the force on the block by the spring in case 1 is less than the magnitude of the force on the block by the spring in case 2.

Explain. using newton's second law, we can see that the magnitiude of the force on the block by the spring ends up being less than the magnitiude of the block by whatever else.

A student observes the blocks moving back and forth. In each case, when the block is at its maximum rightmost position, the student marks that location on the table.

Will the mark in case 1 be to the right of, to the left of, or at the same position as the mark in case 2? The mark in case 1 will be at the same position as the mark in case 2.

Explain. i am guessing on this one. i am not sure at all.

End of response