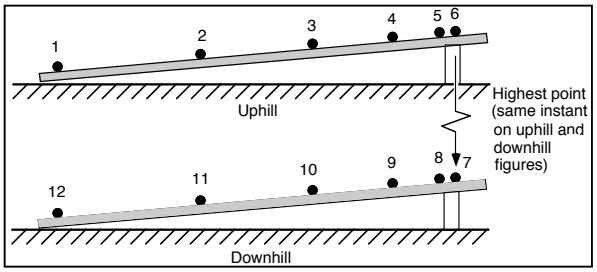
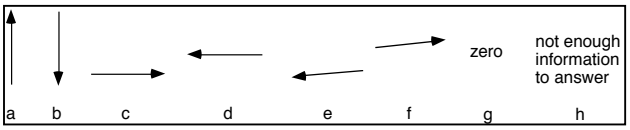
The strobe diagram at right represents the motion of the ball as it rolls up and then down the track. (In a strobe diagram, the position of an object is shown at instants separated by equal time intervals.)
Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.



Q4: Location 3: e
Q5: Location 6: e
Q6: Location 10: e



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. The ball is experiencing a constant gravity due to acceleration, pulling it downwards, which is force direction B. In this case, there is a component of force B acting on the ball, which is force E. As B is constant, so is E, and the direction of the acceleration will always be the same.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? remains the same
Q9: Explain. As in Question 8, force E is a component of acceleration due to gravity which is always constant, so it remains the same.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? remains the same
Q11: Explain. Same as Question 10. Acceleration due to gravity does not change, so does its components.

END OF RESPONSE

Student#: **NAME: ,**

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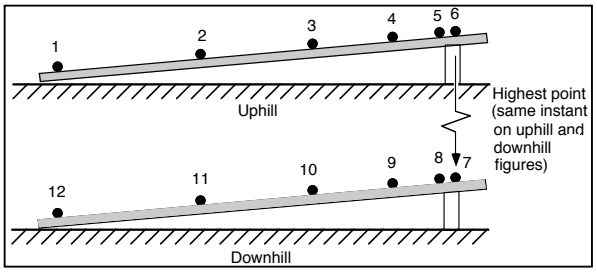
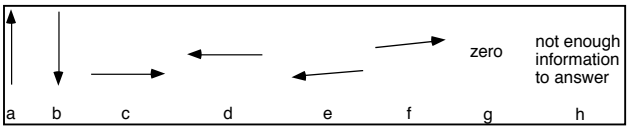


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.



Q4: Location 3: d

Q5: Location 6: g

Q6: Location 10: c

Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. Base on the fact that as the ball rolls up the incline it slows down and as the ball rolls down the incline it speeds up, I picked the arrow pointing to the right to represent a positive acceleration and the arrow pointing left to be a negative acceleration.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? decreases

Q9: Explain. the ball is slowing down thus it is deaccelerating.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? remains the same

Q11: Explain. it remains at a constance acceleration do to gravitiy being the only force acting on it

END OF RESPONSE

Student#: **NAME: ,**

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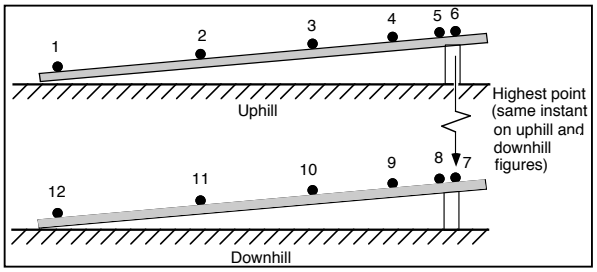
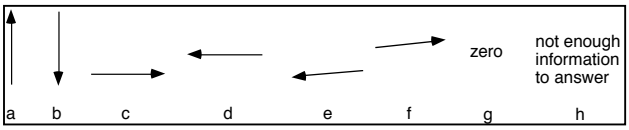


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: f

Q5: Location 6: g

Q6: Location 10: e



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. acceleration moves in the direction of the ball's motion

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? remains the same

Q9: Explain. acceleration remains constant; velocity changes

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? remains the same

Q11: Explain. same as above

END OF RESPONSE

Student#: **NAME: ,**

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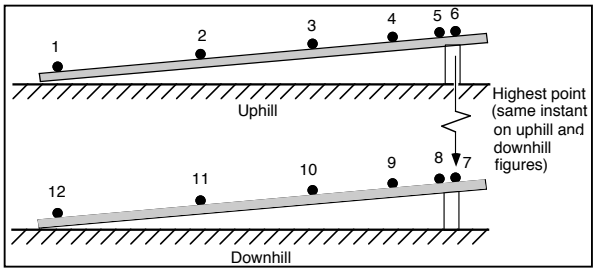
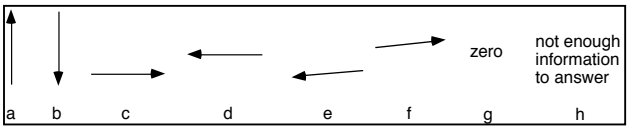


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.



Q4: Location 3: b

Q5: Location 6: g

Q6: Location 10: a

Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. As the ball moves up the ramp, the distance between consecutive positions is decreasing. Knowing that the time intervals are equivalent, one can infer that the ball is traveling a smaller amount per unit of time as it moves up the ramp. Similar reasoning holds for the max. height the ball reaches; at this point acceleration is neither increasing or decreasing. It is zero. As the ball goes down the ramp, the distance between consecutive positions is increasing, which means the ball travels a larger distance per unit time as it travels down the ramp.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? decreases

Q9: Explain. As the ball moves uphill, the time taken for it to move from point A to point B increases, which means that the magnitude acceleration of the ball is decreasing.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? increases

Q11: Explain. As the balkl moves downhill, the time taken for it to move from point B to point A decreases which means the magnitude of the accel. is increasing.

END OF RESPONSE

Student#: **NAME: ,**

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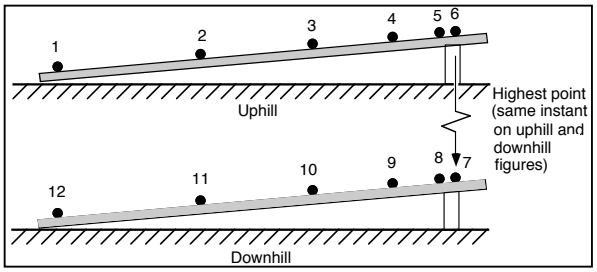
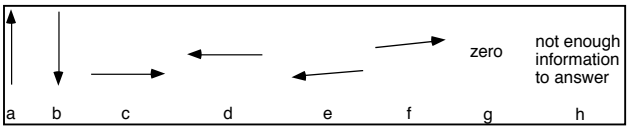


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.



Q4: Location 3: f

Q5: Location 6: g

Q6: Location 10: e

Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. The ball is being pulled down due to gravity, so it is being pulled downhill, so when it is being moved uphill is accelerating along the plane. When it gets to the top it is not accelerating, then it accelerates downhill

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? decreases

Q9: Explain. Gravity is pulling against the initial acceleration so the acceleration is slowing down

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? increases

Q11: Explain. The ball is moving in the same direction as it is beign pulled so it accelerates downhill.

END OF RESPONSE

Student#: **NAME: ,**

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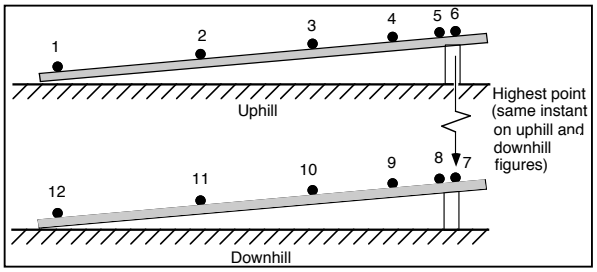
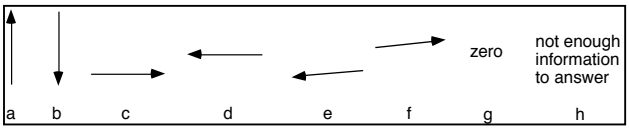


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.



Q4: Location 3: e

Q5: Location 6: g

Q6: Location 10: f

Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. For #5 I chose e because the acceleration is negative and decreasing. For #6 the ball has come to rest so it has no acceleration so I chose g. For #7, the acceleration is positive and increasing so I chose f.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? decreases

Q9: Explain. The acceleration is decreasing because the velocity is decreasing as time passes. It is evident that the velocity is decreasing because the distance traveled decreases.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? increases

Q11: Explain. The acceleration increases because the velocity is increasing with respect to time. It is visible that the velocity increases because the distance traveled increases.

END OF RESPONSE

Student#: **NAME: ,**

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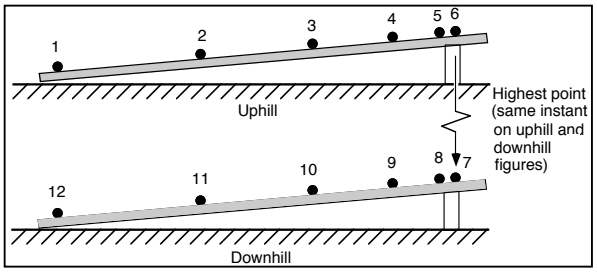
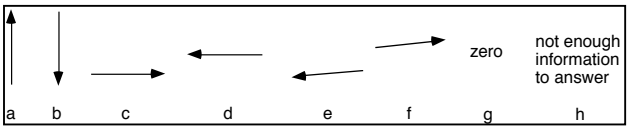


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.



Q4: Location 3: e

Q5: Location 6: e

Q6: Location 10: e

Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. The ball was given an inital velocity but the only acceleration acting on the ball after the person's hand is removed is gravity, which has a component of force acting down the ramp. The gravity is actually accelerating the ball straight down but I considered the component of force that causes the ball's direction of movement for answering the questions.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? remains the same

Q9: Explain. Gravity acts the same the whole time. Gravity has constant acceleration.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? remains the same

Q11: Explain. The velocity may change due to acceleration however, but acceleration is the same.

END OF RESPONSE

Student#: **NAME: ,**

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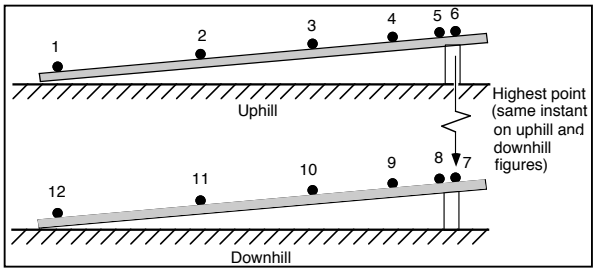
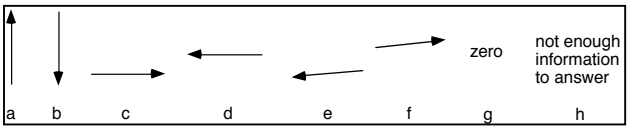


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: g

Q5: Location 6: h

Q6: Location 10: g



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. Point 3 looks like it has constant speed but going to the right. Point 6 looks like it has stopped, but i don't know if it has. Then point 10 looks like it has constant speed so zero acceleration

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? decreases

Q9: Explain. The ball slows down so the acceleration slows down

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? increases

Q11: Explain. the ball speeds up as it goes down hill

END OF RESPONSE

Student#: **NAME: ,**

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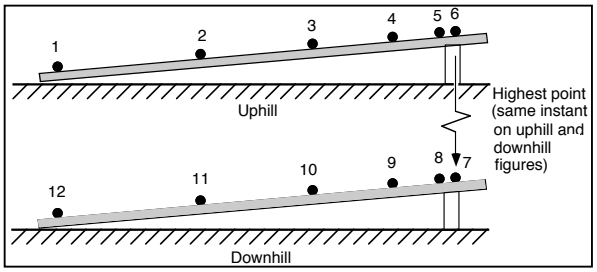
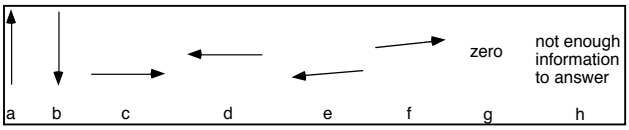


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: e

Q5: Location 6: g

Q6: Location 10: e



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. 5)Although moving uphill, the ball's change in velocity is downhill, which is why it is slowing down.6)The ball is no longer moving, so has no more acceleration.7)It is rolling down, so it gaining velocity (acceleration) downhill.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? decreases

Q9: Explain. It's velocity is decreasing as it is moving uphill, so the acceleration becomes smaller

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? increases

Q11: Explain. As it rolls down, it is picking up speed making the acceleration greater.

END OF RESPONSE

Student#: **NAME: ,**

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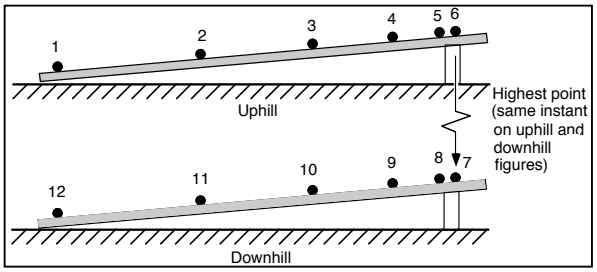
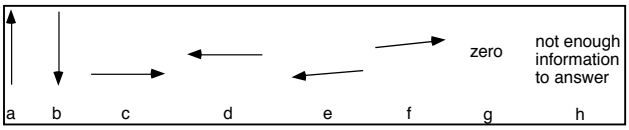


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: b

Q5: Location 6: b

Q6: Location 10: b



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. Three of them is accelerated due to the gravitational force. And the gravitational force is pointing downwards.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? remains the same

Q9: Explain. Since the gravity acting on the ball is the same, therefore, the acceleration remains the same.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? remains the same

Q11: Explain. Since the gravity acting on the ball is the same, therefore, the acceleration remains the same.

END OF RESPONSE

Student#: **NAME: ,**

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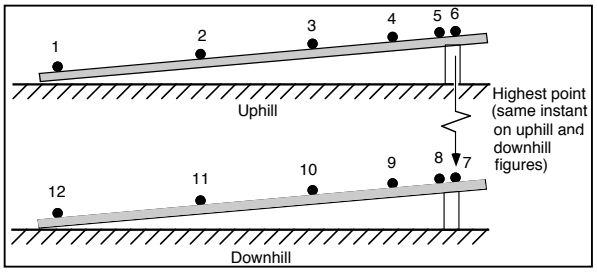
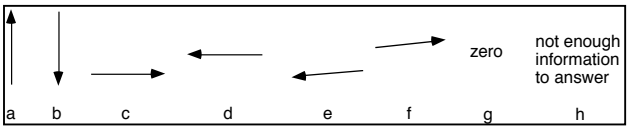


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: e

Q5: Location 6: e

Q6: Location 10: e



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. because the direction of the force pulled on the object is e.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? remains the same

Q9: Explain. because the force remains the combination of gravity and the force from the hill.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? remains the same

Q11: Explain. the same as question 10

END OF RESPONSE

Student#: **NAME: ,**

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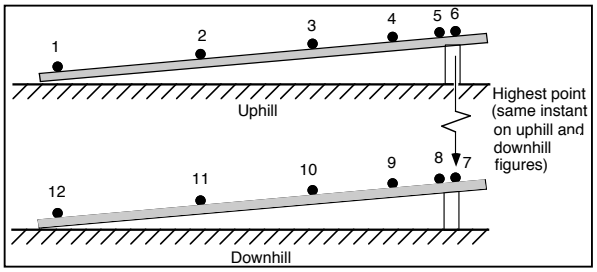
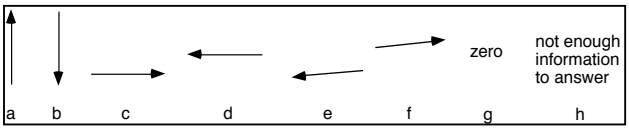


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: e

Q5: Location 6: e

Q6: Location 10: e



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. the acceleration remains constant because the slope of the surface does not change

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? remains the same

Q9: Explain. the acceleration remains constant because the slope of the surface does not change

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? remains the same

Q11: Explain. the acceleration remains constant because the slope of the surface does not change

END OF RESPONSE

Student#: **NAME: ,**

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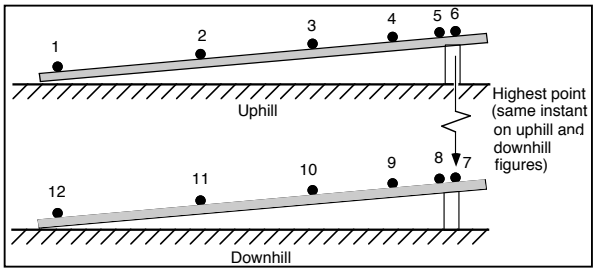
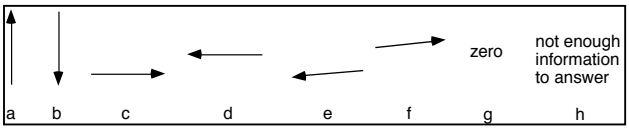


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: e

Q5: Location 6: g

Q6: Location 10: e



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. At point 3, the ball is decelerating, or accelerating but slowing down, so its acceleration must be down the ramp.At point 6 the ball is stopped, so there is no acceleration.At point 10 the ball is accelerating down the ramp due to gravity.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? remains the same

Q9: Explain. The acceleration due to the downward force of gravity is a constant either way, up or down, even though the velocity and position change.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? remains the same

Q11: Explain. The acceleration due to the downward force of gravity is a constant either way, up or down, even though the velocity and position change.

END OF RESPONSE

Student#: **NAME: ,**

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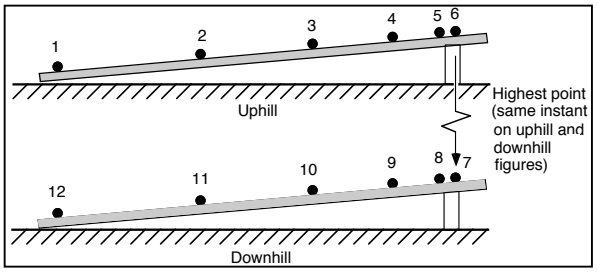
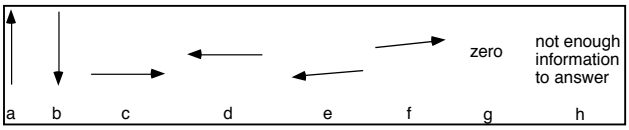


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: f

Q5: Location 6: g

Q6: Location 10: e



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. I just though about how a ball would roll at that instant. For example at position 6 the ball had just come to a halt and therefore it is not rolling at all. In position 10 the ball is in the middle of accelerating down and left.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? decreases

Q9: Explain. As the ball rolls uphill gravity and friction work to slow it down. Thus it gradually loses its speed and therefore its magnitute of acceleration decreases.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? increases

Q11: Explain. As the ball rolls downhill it get going faster and faster through the work of gravity. Therefore the magnitude of its accleration increases.

END OF RESPONSE

Student#: **NAME: ,**

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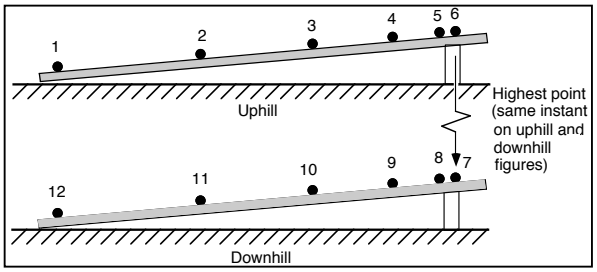
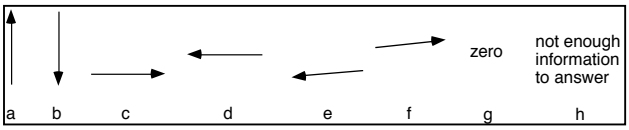


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: e

Q5: Location 6: e

Q6: Location 10: e



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. The acceleration is constant and in the direction down the slope due to gravity ?

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? remains the same

Q9: Explain. gravity is the only force acting on the ball, neglecting friction so i don't see why it would slow or speed up

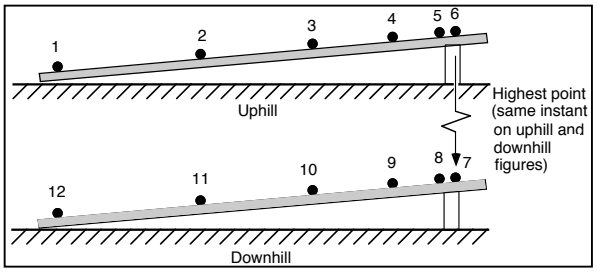
Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? remains the same

Q11: Explain. hmmm ...

END OF RESPONSE

Student#: **NAME: ,**

The strobe diagram at right represents the motion of the ball as it rolls up and then down the track. (In a strobe diagram, the position of an object is shown at instants separated by equal time intervals.)

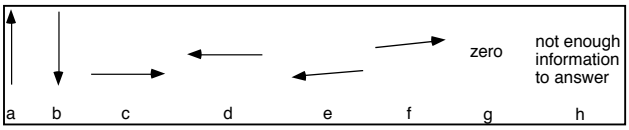


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: e

Q5: Location 6: g

Q6: Location 10: f



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. at the location 6, the ball is at the point that it stops moving therefore, the acceleration is 0

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? decreases

Q9: Explain. Because the ball is slowing down before it stops and accelerates again going down

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? increases

Q11: Explain. it accelerates going down hill

END OF RESPONSE

Student#: **NAME: ,**

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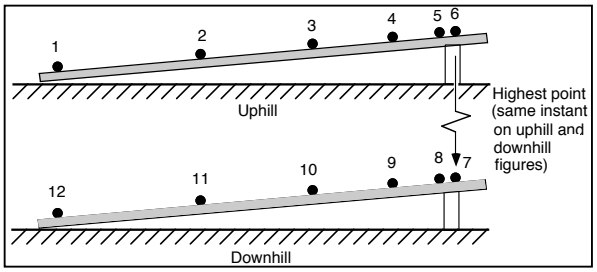
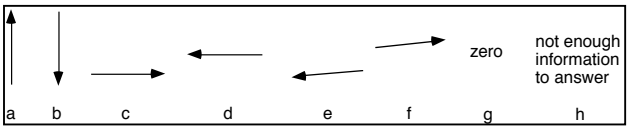


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: e

Q5: Location 6: e

Q6: Location 10: e



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. The ball is under constant acceleration due to gravity. While rolling uphill, the ball appears to slow down because the direction of its initial velocity is opposite the direction of its acceleration due to gravity. Realistically, the force of gravity pulls the ball straight down, but the resulting accleration is slanted because the ball is on an inclined slope. The acceleration vector is the product of the force of gravity (pointing down) and the normal vector of the slope (pointing up at a slight angle).

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? remains the same

Q9: Explain. The acceleration of the ball is constant because all objects fall within a gravitational speed at the same, uniform acceleration. The only thing that could decrease the magnitude of acceleration is if one part of the hill had a higher coefficient of friction than the other part of the hill. The available data does not seem to support this possibility.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? remains the same

Q11: Explain. Same as above.

END OF RESPONSE

Student#: **NAME: ,**

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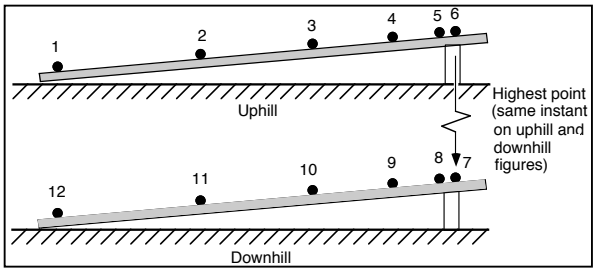
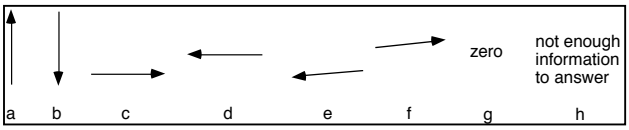


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: e

Q5: Location 6: g

Q6: Location 10: e



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. As the ball climbs the hill after being given an initial velocity it slows to a stop, and hence accelerates in the opposite direction of motion. The moment it is at rest its velocity and acceleration are both zero since it is not moving. As it rolls back down the hill, gravity is accelerating the object down the hill.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? remains the same

Q9: Explain. The only assumed force acting on the ball is that due to gravity, which remains constant as long as the object only moves in one dimension, so the acceleration of the ball moving along that single dimension is also constant.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? remains the same

Q11: Explain. Same as question 10.

END OF RESPONSE

Student#: **NAME: ,**

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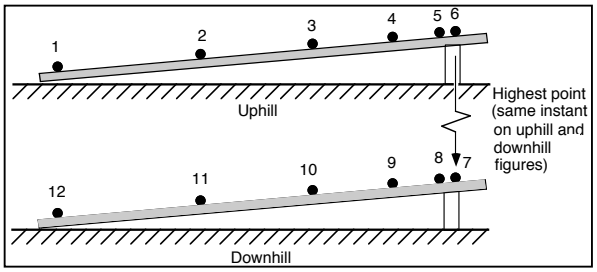
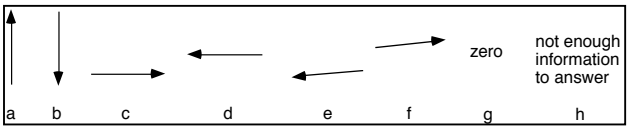


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: e

Q5: Location 6: b

Q6: Location 10: e



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. For point 3, the direction of acceleration was determined by the force of gravity which is continually down and the friction force determined by the slope of the ramp for the ball.At point 6, the velocity of the ball is zero and at that point there is no horizontal motion by the ball so therefore, the only force acting upon the ball is the force of gravity.Lastly at point 10, the force of gravity and the force generated by the slope of the ramp and the ball's mass determined the direction of acceleration.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? remains the same

Q9: Explain. The acceleration remains the same during the movement of the ball because there is no other forces acting upon the system such as the conitunal push of a hand that would change the acceleration of the ball and the force of gravity remains constant throughtout the system.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? remains the same

Q11: Explain. The acceleration remains the same through this part of the movement because from the highest point of the ramp, there are no other forces that are introduced into the system and the forces that acted upon the ball in the uphill movement have not been changed in any way in the system.

END OF RESPONSE

Student#: **NAME: ,**

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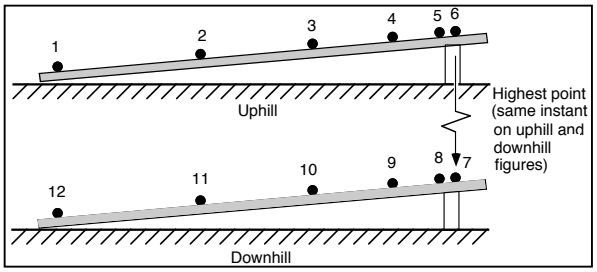
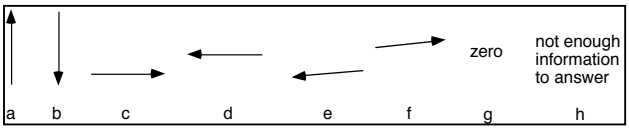


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: e

Q5: Location 6: e

Q6: Location 10: e



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. As the ball rolls up the ramp, it is accelerating in the opposite direction that it is moving. At the peak the ball, although it is not moving is still being pulled down the ramp by gravity. Rolling down, the ball is accelerating in the direction it is moving.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? remains the same

Q9: Explain. Gravity is constant, the ball is losing velocity at a constant rate.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? remains the same

Q11: Explain. the ball accumulates velocity at a constant rate due to gravity.

END OF RESPONSE

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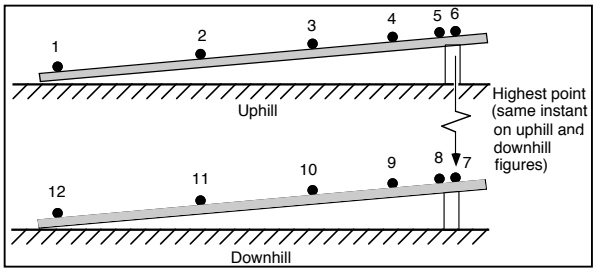
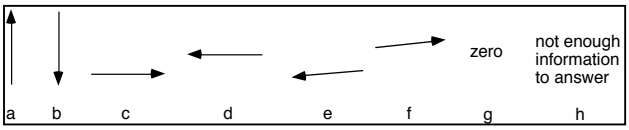


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: f

Q5: Location 6: g

Q6: Location 10: e



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. I selected vectors that pointed in the direction the ball was travelling at each specific point in time. In the case of location 6, the ball was stopped at the top of the ramp, so it was not accelerating in any direction.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? decreases

Q9: Explain. As the ball moves uphill, it gains speed at a slower rate, resulting in a decrease in acceleration.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? increases

Q11: Explain. As the ball moves downhill, it gains speed at a faster rate, resulting in an increase in acceleration.

END OF RESPONSE

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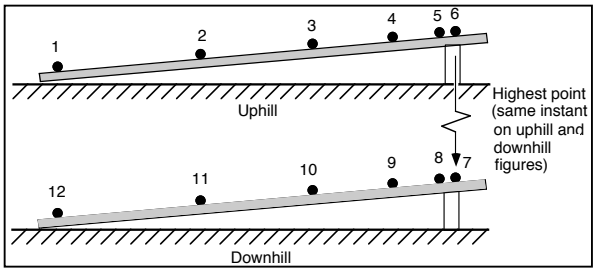
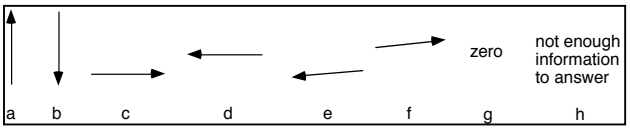


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: e

Q5: Location 6: g

Q6: Location 10: e



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. For location 3, i chose 'E' because although it is moving up the track, it is also slowing down, therefore i conculed the the acceration must be '-' in other words the opposite direction.For location 6: i believe the acceleration must be '0' because it has stopped at its maximum height.For location 10, i chose the acceleration to be 'E' because both gravity and the slant of track is pulling the ball in that direction.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? decreases

Q9: Explain. since the speed is decreasing as the ball travels up the track, its acceleration must also be decreasing.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? increases

Q11: Explain. since both forces it pulling it in the same direction as it is traveling, the acceleration must increase

END OF RESPONSE

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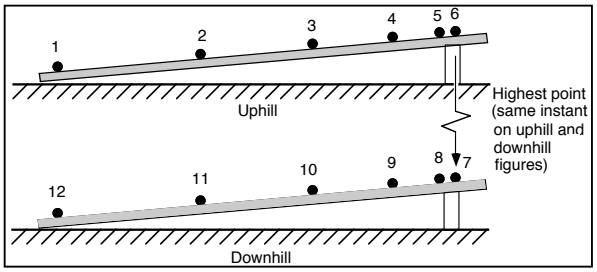
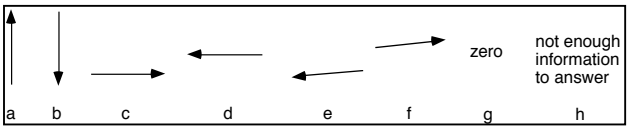


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.



Q4: Location 3: e

Q5: Location 6: e

Q6: Location 10: e

Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. the direction of the acceleration of the ball will be the same at all points. It does not matter which way the ball is travelling, up or down the ramp. It will always be either accelerating faster down the ramp in the direction of the ramp or accelerating(slowing down) when it is traveling up the ramp, but always in the direction that the ramp points downward.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? remains the same

Q9: Explain. The velocity of the ball always decreases at the same rate. This decrease in velocity is the accleration, which remains constant. This is because the angle of the ramp is always the same. Whether the ball is moving fast or slow does not mean that the acceleration is any different.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? remains the same

Q11: Explain. The velocity of the ball always increases at the same rate. This increase in velocity is the accleration, which remains constant. This is because the angle of the ramp is always the same. Whether the ball is moving fast or slow does not mean that the acceleration is any different.

END OF RESPONSE

Student#: **NAME: ,**

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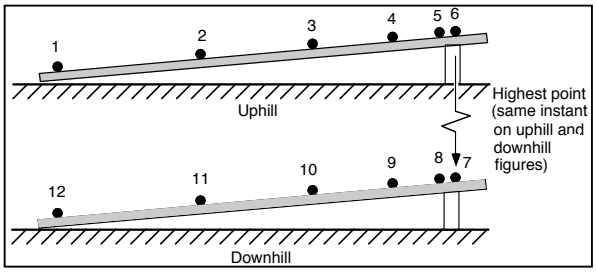
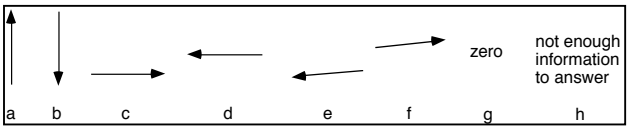


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: *e*

Q5: Location 6: *g*

Q6: Location 10: *e*



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. When the ball is going up the slope, it is slowing down, so the acceleration should be the opposite direction it is moving.When the ball is at the top of its path, it is not moving, so therefore there is no acceleration.When the ball is at position 10, it is moving down the slope, meaning the ball is accelerating because it is traveling downward.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? remains the same

Q9: Explain.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? increases

Q11: Explain.

END OF RESPONSE

Student#: **NAME: ,**

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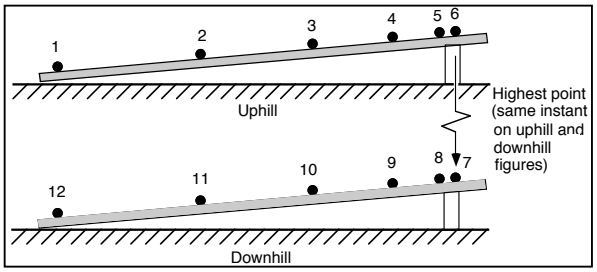
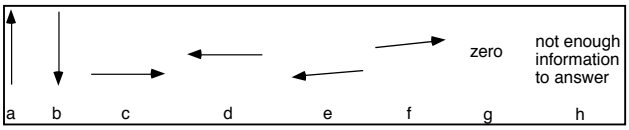


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: b

Q5: Location 6: b

Q6: Location 10: b



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. The only force acting on the ball after the initial push is gravity. The force of gravity always acts toward the center of mass of the gravitating object, in this case Earth. This direction is straight down.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? remains the same

Q9: Explain. The force of gravity is constant.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? remains the same

Q11: Explain. The force of gravity is constant.

END OF RESPONSE

Student#: **NAME: ,**

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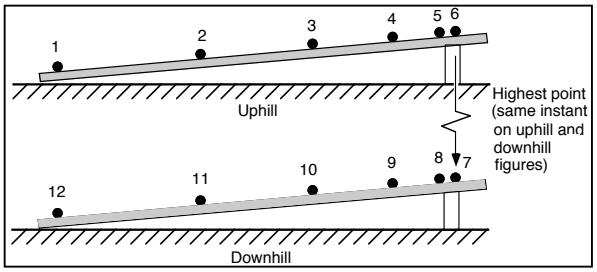
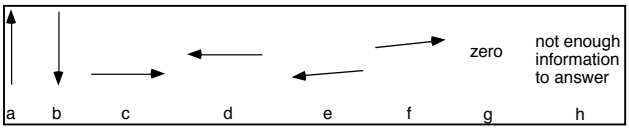


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: b

Q5: Location 6: b

Q6: Location 10: b



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. The only force acting on the ball is gravity, the vector of which points downward. F=ma.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? remains the same

Q9: Explain. Gravity is constant (relatively).

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? remains the same

Q11: Explain. See Question 10.

END OF RESPONSE

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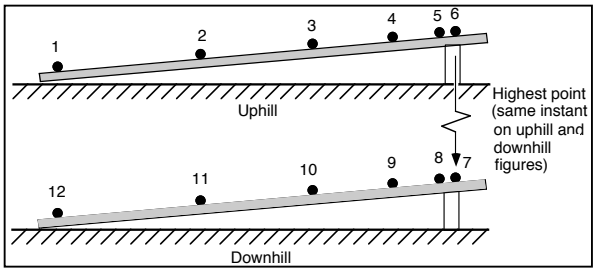
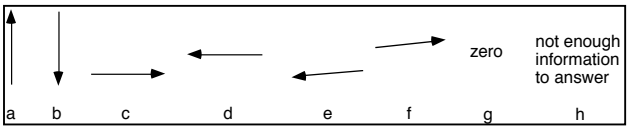


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: b

Q5: Location 6: b

Q6: Location 10: b



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. The ball is constantly being accelerated down by the force of gravity.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? remains the same

Q9: Explain. The ball is accelerated down by the force of gravity throughout the event which remains the same.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? remains the same

Q11: Explain. The force of gravity which accelerates the ball down the ramp remains at a constant magnitude of 9.8 m/s^2.

END OF RESPONSE

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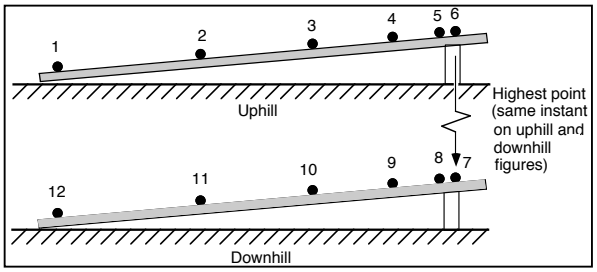
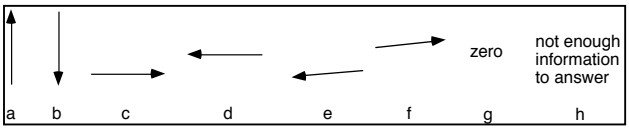


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: e

Q5: Location 6: g

Q6: Location 10: e



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. The ball is losing velocity at point 3 as it rolls up the hill, and thus is accelerating down the ramp due to gravity.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? remains the same

Q9: Explain. There are no other forces acting on the ball so it will accelerate at the same rate as gravity is a constant.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? remains the same

Q11: Explain. The magnitude of acceleration remains the same is it is only being acted on by gravity.

END OF RESPONSE

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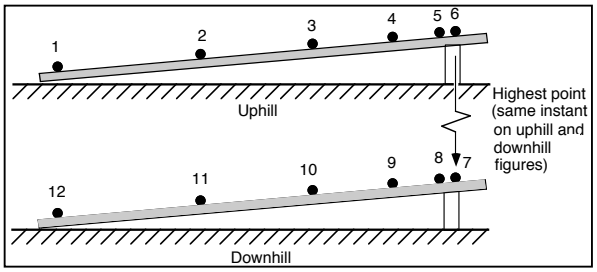
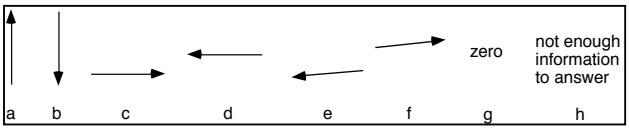


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: f

Q5: Location 6: g

Q6: Location 10: e



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. At location 3, the ball is moving up the ramp, so the arrow should point up along the slope of the ramp (f). At location 6, the ball is standing still for an instant before rolling down hill again, so it has no velocity and no acceleration (g). AT location 10, the ball is beginning to accelerate downward with the slope of the ramp due to gravity (e).

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? decreases

Q9: Explain. The ball is decclerating as it moves up the plane, so the acceleration is decreasing along withe the magnitude.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? increases

Q11: Explain. The ball will accelerating due to the fact that it is moving downward and gravity is pulling on it, so the acceleration magnitude will increase.

END OF RESPONSE

Student#: **NAME: ,**

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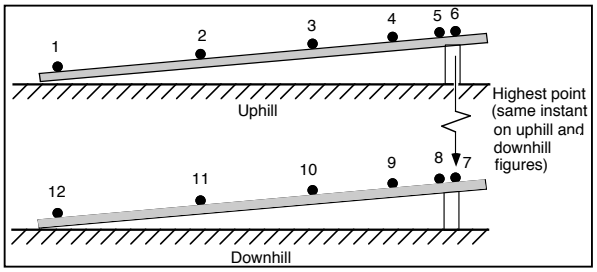
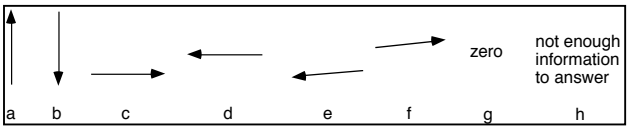


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: e

Q5: Location 6: e

Q6: Location 10: e



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. At every location acceleration will remain constant because of gravity and the slope.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? remains the same

Q9: Explain. It will lose speed as it goes up but acceleration will remain the same.

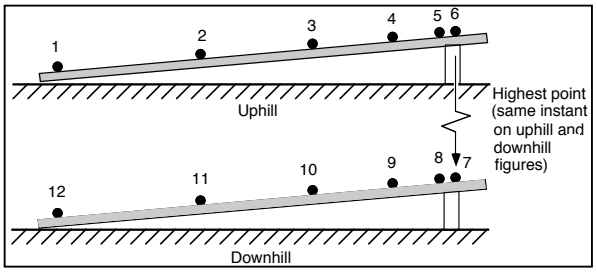
Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? remains the same

Q11: Explain. It will speed up as it travels downhill but acceleration will not change.

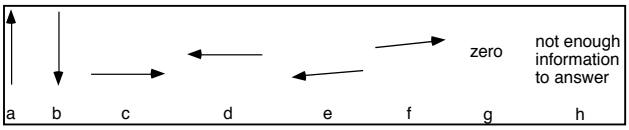
END OF RESPONSE

Student#: **NAME: ,**

The strobe diagram at right represents the motion of the ball as it rolls up and then down the track. (In a strobe diagram, the position of an object is shown at instants separated by equal time intervals.)



Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.



Q4: Location 3: b

Q5: Location 6: b

Q6: Location 10: b

Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. The acceleration is always in the same direction (down) due to gravity at all locations. At the top the velocity is zero but the acceleration is still pulling it down the slope further.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? remains the same

Q9: Explain. Because even though the ball slows down and speeds up at various times along its given path, the acceleration due to gravity is always constant.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? remains the same

Q11: Explain. As mentioned above, acceleration is always due to gravity and therefore constant. Acceleration is independent of the speed of the ball at any given location along the path downward, so despite the speed changing, acceleration remains constant.

END OF RESPONSE

Student#: **NAME: ,**

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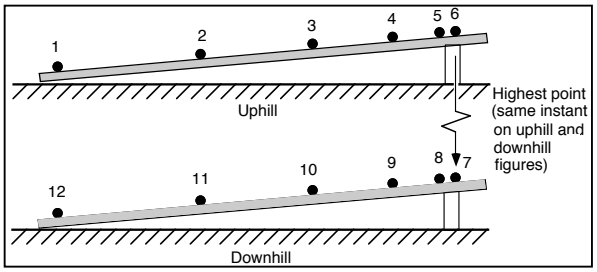
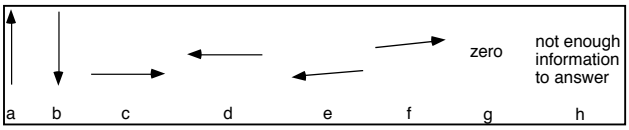


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: a

Q5: Location 6: g

Q6: Location 10: b



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. The acceleration is merely going up at any given point, not a curve.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? increases

Q9: Explain. The maximum height attained by the ball is done with increased acceleration.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? increases

Q11: Explain. As the track's height increases, more acceleration is needed.

END OF RESPONSE

Student#: **NAME: ,**

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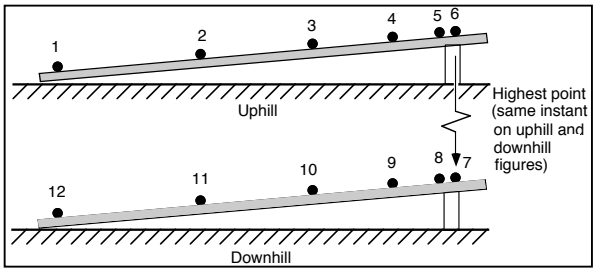
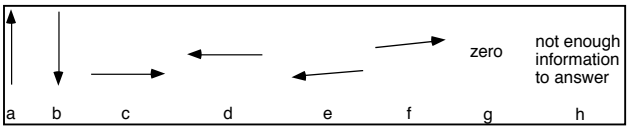


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: b

Q5: Location 6: b

Q6: Location 10: b



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. Since the only force acting on the ball is gravity, it is always accelerating downward.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? remains the same

Q9: Explain. Gravity is always -9.81 m/s no matter how high the ball is.

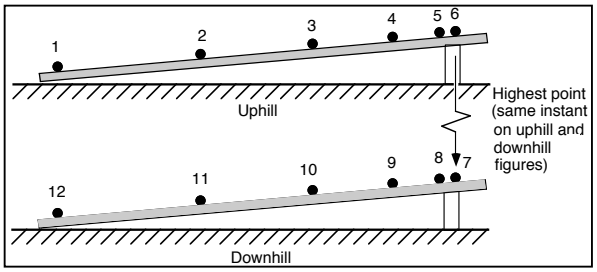
Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? remains the same

Q11: Explain. Gravity is always -9.81 m/s no matter how high the ball is.

END OF RESPONSE

Student#: **NAME: ,**

The strobe diagram at right represents the motion of the ball as it rolls up and then down the track. (In a strobe diagram, the position of an object is shown at instants separated by equal time intervals.)

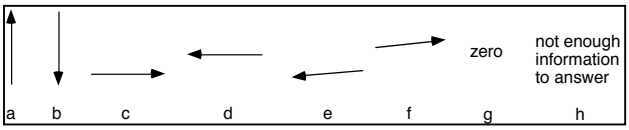


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: e

Q5: Location 6: e

Q6: Location 10: e



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. with the exception of air resistance, the forces acting on the ball are the same at each point. the sum of all forces results in a net force down and to the left.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? decreases

Q9: Explain. the only force acting on the ball that will have varrying magnitudes is the force of air. this force will be larger if the ball's velocity is larger.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? decreases

Q11: Explain. the force of air will continue to decrease in the negative direction

END OF RESPONSE

Student#: **NAME: ,**

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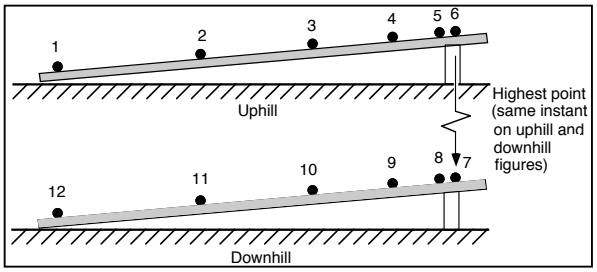
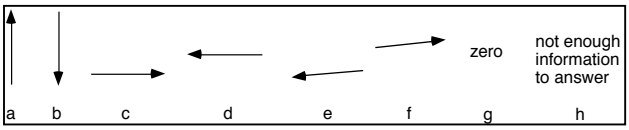


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: e

Q5: Location 6: e

Q6: Location 10: e



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. from a constant initial velocity in the direction of arrow f, the velocity always accelerates along an arrow e due to the force of gravity straight down and the ramp's angle.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? remains the same

Q9: Explain. the acceleration due to gravity is always constant, well almost always.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? remains the same

Q11: Explain. same as answer 10 above.

END OF RESPONSE

Student#: **NAME: ,**

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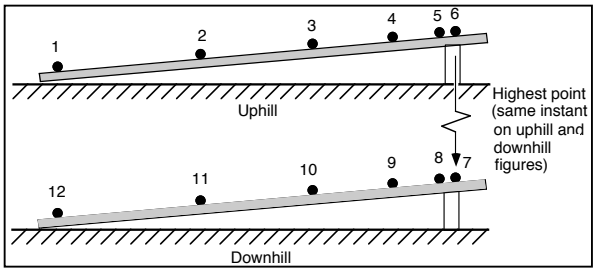
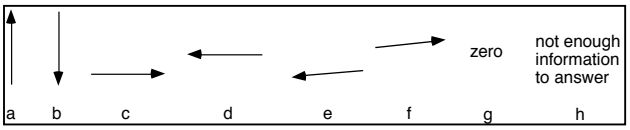


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.



Q4: Location 3: f

Q5: Location 6: g

Q6: Location 10: e

Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. To obtain the direction of the acceleration of each ball, I imagined the ball going up the first ramp at a slight angle then visualizing it going downhill. This figure is the same as the demo did in class today.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? decreases

Q9: Explain. As the ball goes uphill, gravity and fiction slows the acceleration down.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? increases

Q11: Explain. As the ball goes down the hill, the magnitude increases because of gravity. The gravity accelerates the ball in a downward motion.

END OF RESPONSE

Student#: **NAME: ,**

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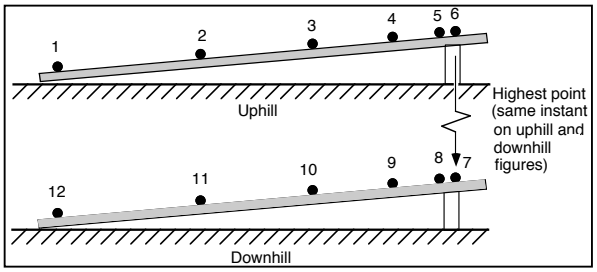
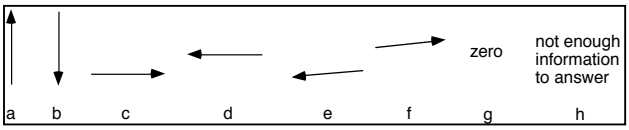


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.



Q4: Location 3: e

Q5: Location 6: f

Q6: Location 10: c

Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. When going uphill the ball is decelerating and when showing acceleration as a vector, that vector will be going in the negative direction, and also the y velocity will also be decreasing which explains the slight downward pointing of e, so e is correct. At point 6, the ball is not accelerating, so the acceleration is zero. At point 10, the ball is accelerating positivly so it is going to be a positive vector, and y velocity is also changing faster so it will point upwards, so f is correct.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? remains the same

Q9: Explain. The magnatude of the acceleration vector remains constant because the hill has constant slope and it is accelerating at a constant rate.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? remains the same

Q11: Explain. it is the same as before, because the slope is constant, so is the acceleration vectors magnitude.

END OF RESPONSE

Student#: **NAME: ,**

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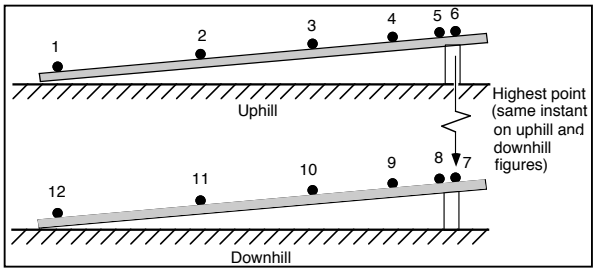
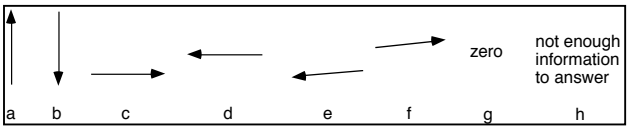


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.



Q4: Location 3: b

Q5: Location 6: b

Q6: Location 10: e

Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. Gravity is acting as a constant force upon the ball. Since no other forces (besides the normal force) are acting upon the ball, it is accelerating downward at each interval

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? remains the same

Q9: Explain. The acceleration remains the same because the acceleration due to gravity is constantly acting upon the ball.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? remains the same

Q11: Explain. The acceleration remains the same because the acceleration due to gravity is constantly acting upon the ball.

END OF RESPONSE

Student#: **NAME: ,**

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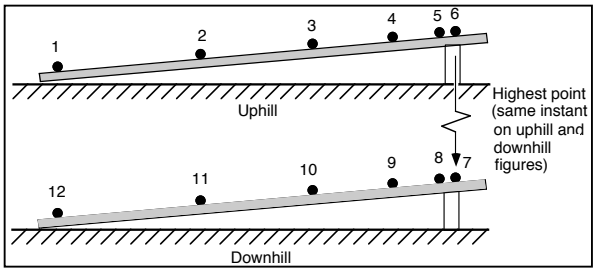
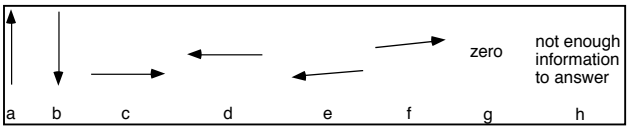


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.



Q4: Location 3: *g*

Q5: Location 6: *g*

Q6: Location 10: *e*

Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. at 3 it is going up the hill but it really isn't accelerating so I put the best answer I could think of. at six it is at it's highest point so it shouldn't be moving, and 10 it is gaining speed as it goes down the ramp.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? decreases

Q9: Explain. the ball is moving slower and slower as it goes up hill, so it is decelerating.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? increases

Q11: Explain. the ball is moving down hill, there for it will increase in acceleration.

END OF RESPONSE

Student#: **NAME: ,**

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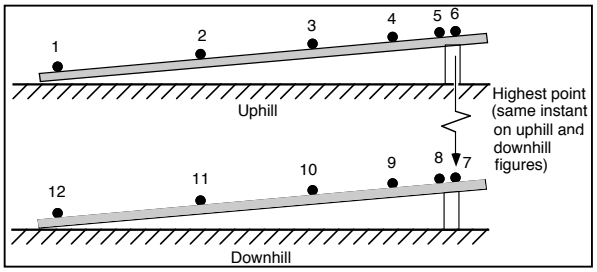
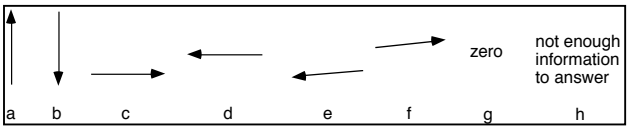


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: f

Q5: Location 6: g

Q6: Location 10: e



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. i choose the answers because the motion of the ball is either going uphill or downhill, and the acceleration goes the same direction as the hill when force is apllied to the ball.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? decreases

Q9: Explain. When the ball is traveling upward gravity is pushing against it. Gravity is trying to make the ball travel back down.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? increases

Q11: Explain. when a ball is traveling downhill it is being pushed downward and gravity is also pushing it down, so the ball has two forces pushing on it making the acceleration go faster.

END OF RESPONSE

Student#: **NAME: ,**

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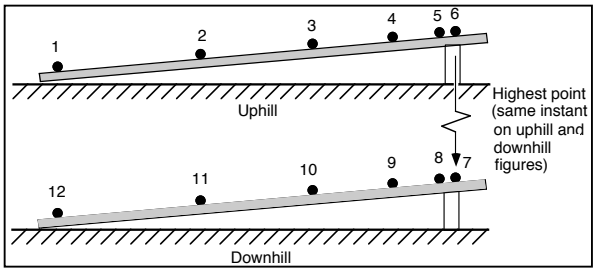
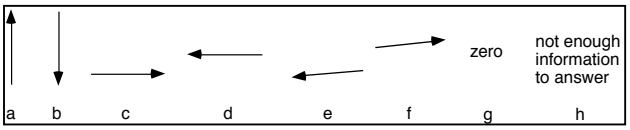


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: c

Q5: Location 6: g

Q6: Location 10: d



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. at point #3 the direction of the ball is horizontal to the right and at point #6 the ball is stationary or zero acceleration, and at point #10 the direction of the ball is horizontal to the left

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? decreases

Q9: Explain. the acceleration decreases because the direction of the acceleration is horizontal but the ball is climbing on a plane causing the ball to slow down gradually and eventually rolling back down the ramp

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? increases

Q11: Explain. the acceleration increases from points 7-12 because the ball is rolling down the ramp and gravity is causing the ball to roll faster

END OF RESPONSE

Student#: **NAME: ,**

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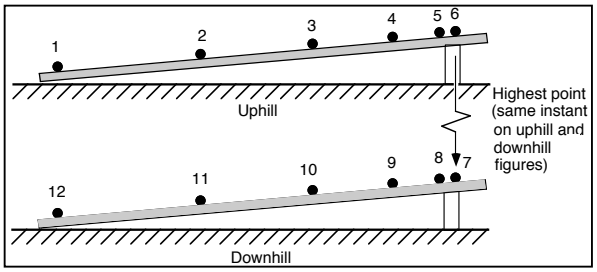
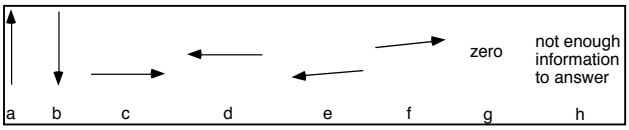


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.



Q4: Location 3: c

Q5: Location 6: g

Q6: Location 10: d

Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. In position 3, it is obvious that the ball is moving quickly up the ramp, so I chose the arrow that shows the acceleration force directly perpendicular to the force of gravity and traveling to the right up the ramp. Since the ball only moved a small amount between images 5 and 6, this shows that the ball's velocity has decreased to near zero. Finally, in position 10 the ball is travelling down the ramp and has an acceleration arrow pointing to the left.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? other (explain below)

Q9: Explain. The ball is decelerating as it moves up the ramp and slows down, it is not accelerating.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? increases

Q11: Explain. The force of gravity accelerates the ball as it travels down the ramp as shown by the wider and wider intervals between stroboscopic frames.

END OF RESPONSE

Student#: **NAME: ,**

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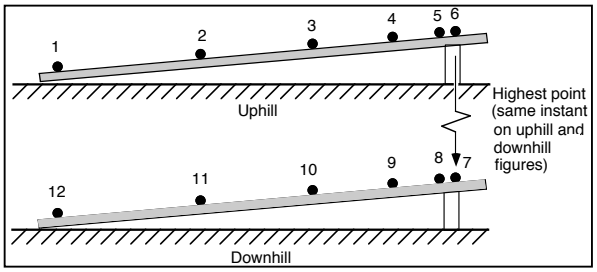
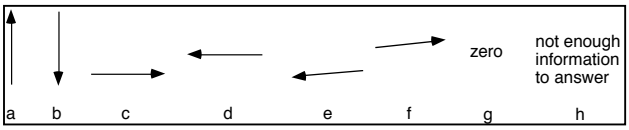


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: b

Q5: Location 6: g

Q6: Location 10: a



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. 5- at three, it is going up the ramp and so is constantly losing speed. thus, the accel decreases.6- at the top of the ramp, it is switching directions. its velocity is zero and so is its accel.7- as it goes down the ramp, it picks up speed and thus accelerates due to gravity.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? decreases

Q9: Explain. acceleration decreases due to the fact that it is going uphill against the downward pull of gravity.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? increases

Q11: Explain. acceleration increases due to the fact that the object is going downhill, picking up speed.

END OF RESPONSE

Student#: **NAME: ,**

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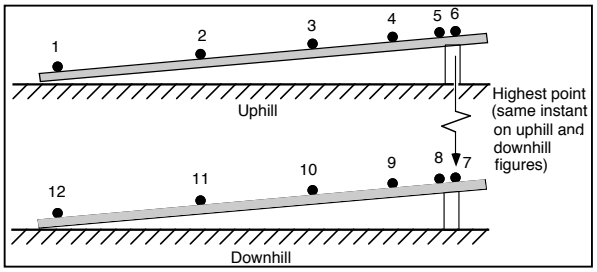
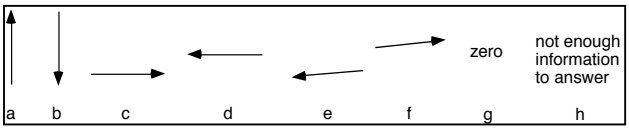


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: e

Q5: Location 6: e

Q6: Location 10: e



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. Acceleration is in a constant direction in this problem. The ball will always tend towards the starting point.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? remains the same

Q9: Explain. The abs value of accel does not change.

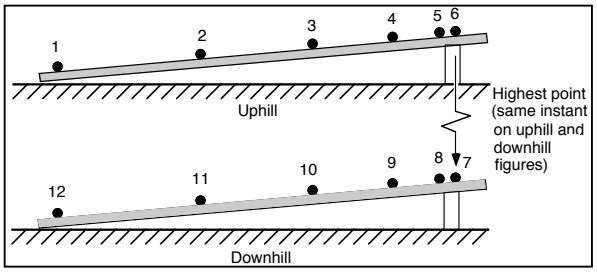
Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? remains the same

Q11: Explain. It will never change.

END OF RESPONSE

Student#: **NAME: ,**

The strobe diagram at right represents the motion of the ball as it rolls up and then down the track. (In a strobe diagram, the position of an object is shown at instants separated by equal time intervals.)

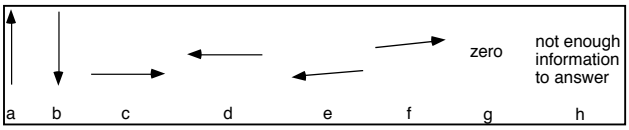


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: f

Q5: Location 6: g

Q6: Location 10: e



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. For question 5, the ball in going up the ramp, so the direction of the acceleration should point slanting up. For question 6, this is the peak point where the ball reaches, so there should be no acceleration. For question 7 the ball is going down the ramp, so the acceleration should point slanting down.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? decreases

Q9: Explain. Acceleration is the rate of change of velocity. Since the ball is slowing down when it is going up the ramp, the acceleration should decrease with velocity.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? increases

Q11: Explain. When the ball moves downhill, acceleration increases due to gravity and the slope of the ramp. The velocity of the ball is increasing, thus the ball's acceleration is increasing.

END OF RESPONSE

Student#: **NAME: ,**

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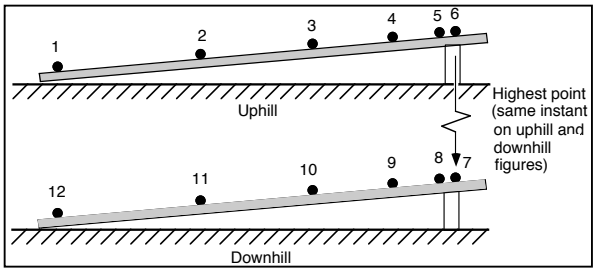
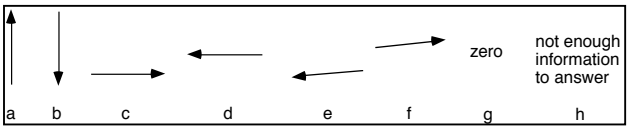


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: c

Q5: Location 6: b

Q6: Location 10: d



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. The ball is moving right at location 3. Moving up a ramp changes it's direction but not the direction of acceleration so it is just accelerating at answer C. Same would go for location 10 but in a different direction. As for location 6, velocity is 0 so the only type of acceleration would be gravity which is downwards.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? decreases

Q9: Explain. The ramp slows down the acceleration of the ball since its against gravity (up).

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? increases

Q11: Explain. The magnitutde increases because the ball is sliding downwards adding to gravity.

END OF RESPONSE

Student#: **NAME: ,**

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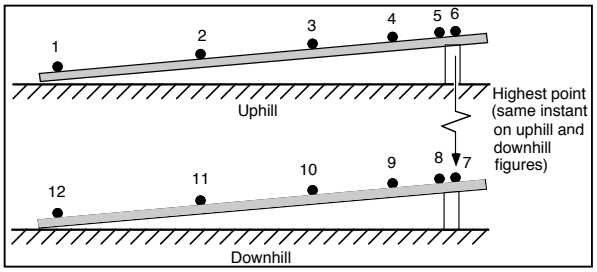
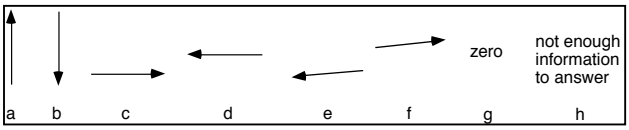


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: b

Q5: Location 6: g

Q6: Location 10: a



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. Direction C and D represent the direction. E and F represent the Velocity. A and B represent the acceleration. G represented no movement. So the location 3 was decreasing in acceleration and location 10 was increasing. location 6 stopped therefore the acceleration was 0.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? decreases

Q9: Explain. As the object was moving upwards, the acceleration was decreasing due to friction and gravity.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? increases

Q11: Explain. As the object was moving downwards, the acceleration was increasing.

END OF RESPONSE

Student#: **NAME: ,**

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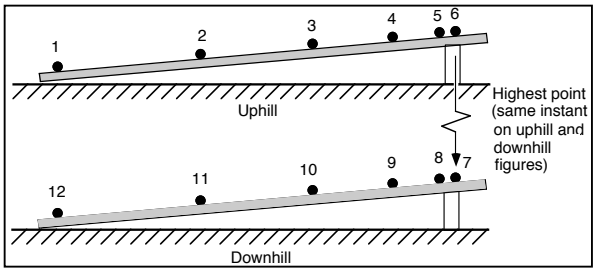
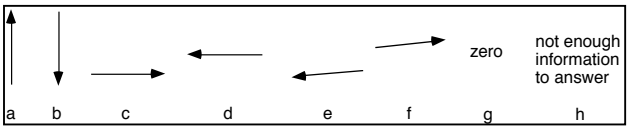


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: c

Q5: Location 6: g

Q6: Location 10: d



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. FORCE IS APPLIED FOR THE BALL TO BE PUSHED UP THEN GRAVITY PULLS IT BACK DOWN

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? decreases

Q9: Explain. GRAVITY AND FRICTION ARE SLOWING THE BALL DOWN, THUS ANIHILATING THE INITIAL 'PUSH' OR FORCE.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? increases

Q11: Explain. GRAVITY ACTS AS A 'PULLING' FORCE, THUS CONSTANTLY ACCELERATING THE BALL

END OF RESPONSE

Student#: **NAME: ,**

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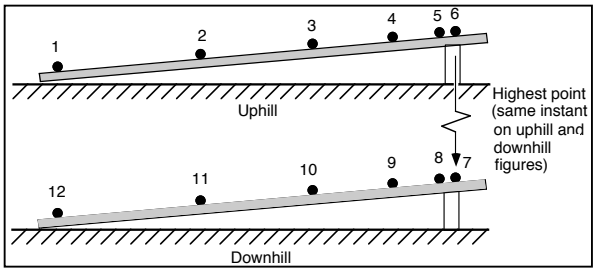
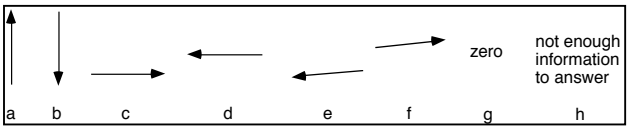


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: b

Q5: Location 6: g

Q6: Location 10: a



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. The acceleration of the ball can only move up or down.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? decreases

Q9: Explain. As the ball goes up the track it slows down because of gravity and friction.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? increases

Q11: Explain. The ball speeds up as it goes down the track because of gravity.

END OF RESPONSE

Student#: **NAME: ,**

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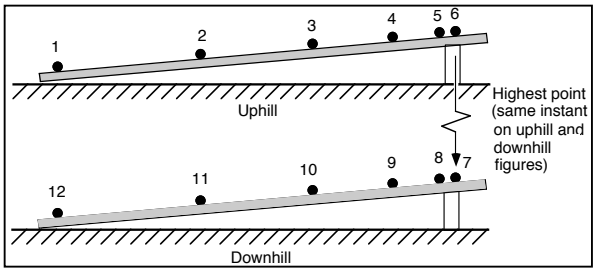
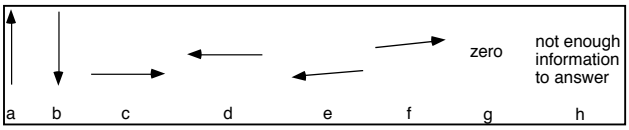


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: c

Q5: Location 6: g

Q6: Location 10: d



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. Acceleration is change in velocity over change in time. Since all time intervals are equal you can easily observe the change in velocity over a given period of time. Treating it as a particle moving in the x direction it at first moves away in a positive direction, then stops at the top of the ramp (no change in velocity at this time therefore acceleration is zero). The particle then begins to move in a reverse direction, and since velocity and acceleration consider displacement, this is negative acceleration.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? decreases

Q9: Explain. The rate at which the velocity is changing starts off greatly with the initial shove, and then the ball slows as it reaches the top of the ramp. You can determine this because the displacement is decreasing as the ball reaches the top of the ramp.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? increases

Q11: Explain. The displacement increases as the ball gains momentum, and therefore the acceleration increases slightly as the ball rolls down the ramp.

END OF RESPONSE

Student#: **NAME: ,**

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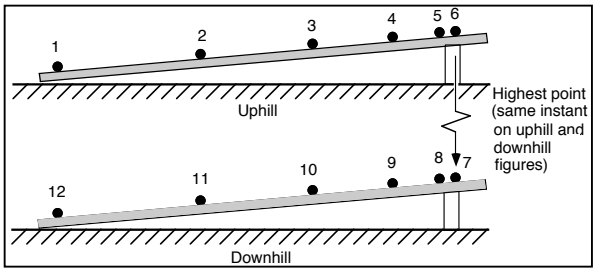
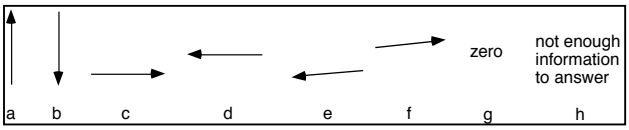


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: e

Q5: Location 6: e

Q6: Location 10: e



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. Gravity is forcing the ball to be accelerated down the hill at all times regardless of which direction it is moving.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? remains the same

Q9: Explain. Gravity causes a constant acceleration.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? remains the same

Q11: Explain. Gravity causes a constant acceleration.

END OF RESPONSE

Student#: **NAME: ,**

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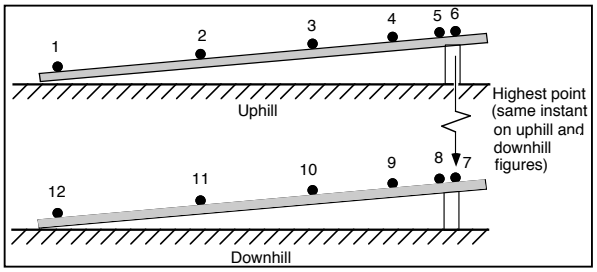
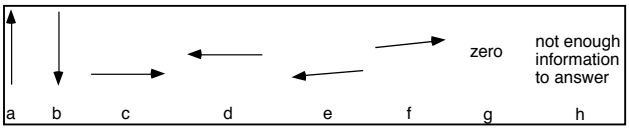


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.



Q4: Location 3: f

Q5: Location 6: g

Q6: Location 10: e

Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. The direction of the ball at each point. At point 3, the ball is moving up the ramp, at 6, down the ramp, and at 7, there is no movemement.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? decreases

Q9: Explain. As the ball travels, the acceleration decreases, as shown by the decreasing velocity.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? increases

Q11: Explain. The ball gains velocity as it moves down the ramp, therefore the acceleration is increasing.

END OF RESPONSE

Student#: **NAME: ,**

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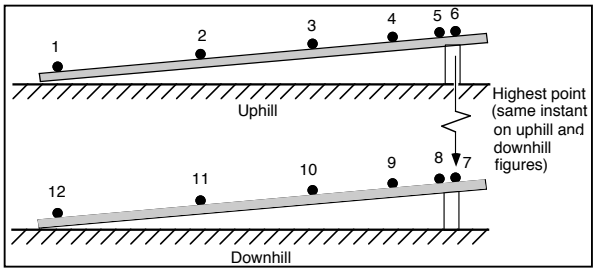
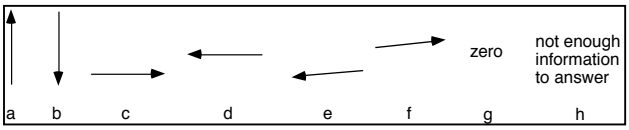


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: e

Q5: Location 6: e

Q6: Location 10: e



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. At all locations the ball is being affected by the acceleration of gravity and will accelerate down the inclined plane.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? remains the same

Q9: Explain. The acceleration of the earths gravity is not changing.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? remains the same

Q11: Explain. The acceleration of the earths gravity is not changing.

END OF RESPONSE

Student#: **NAME: ,**

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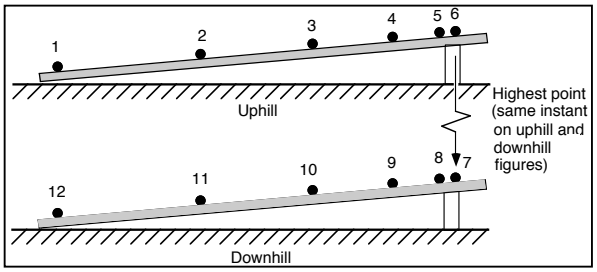
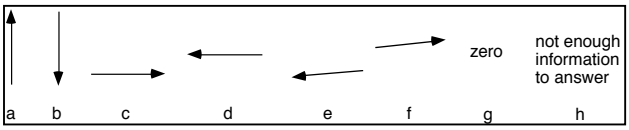


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.



Q4: Location 3: b

Q5: Location 6: g

Q6: Location 10: a

Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. At 3, the acceleration is decreasing (the ball is slowing to a stop). At 6, the acceleration has reached zero and the ball stops moving upward. At 10, the ball is rolling down the ramp, gaining momentum, and the acceleration is increasing.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? decreases

Q9: Explain. The acceleration decreases as it goes up the hill until it reaches zero and the ball begins to roll back down the hill.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? increases

Q11: Explain. The acceleration increases as it goes down the hill. The velocity starts out slow and then increases.

END OF RESPONSE

Student#: **NAME: ,**

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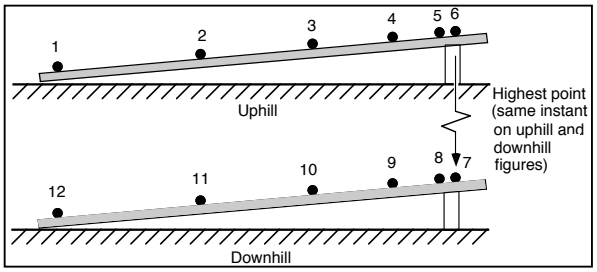
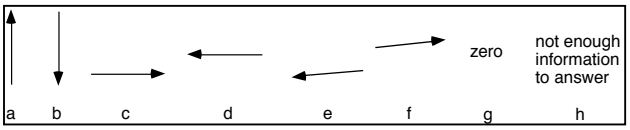


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: f

Q5: Location 6: g

Q6: Location 10: e



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. For the first few seconds, the acceleration of the ball is to the right, but the ramp directs that force upward slightly. As friction becomes more of a factor, and the initial velocity loses its impact on the situation, the ball comes to a brief stop before rolling back down. At this point, it has potential energy, but no kinetic energy, and therefore no motion, be it velocity or acceleration.On its way down (10), the ball is accelerating downward, but again is guided by the ramp. Technically, gravity is what pulls the ball back down, so [B] is a likely answer in this case, as well.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? decreases

Q9: Explain. Friction takes hold as soon as the ball is pushed, and enough of the ball's energy is expended as heat, eventually, to bring the ball to a stop. Before it can stop, though, the ball must slow down; thus the decrease in acceleration.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? remains the same

Q11: Explain. Theoretically, only gravity is acting on the ball; however, there is a potential (stored) energy inside the ball from the push up to the top of the ramp, and that MAY add more magnitude to the trip down, but gravity is a constant force, and I think all the ramp does is guide the ball on its way back to the starting point.

END OF RESPONSE

Student#: **NAME: ,**

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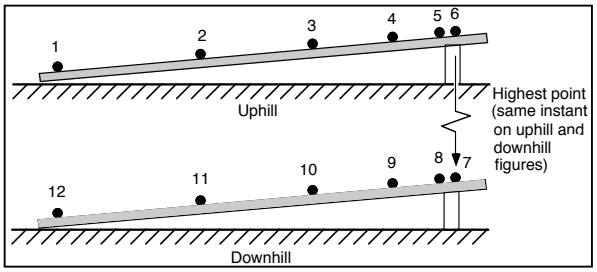
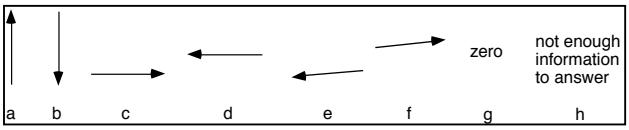


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.



Q4: Location 3: e

Q5: Location 6: g

Q6: Location 10: e

Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. At point 3 gravity is causing the ball to roll down the ramp at 9.8/sin(ramp <) and this is consistant with point 10 as well. However at point 6 the ball is completely without motion and therefore has an acceleration of zero

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? remains the same

Q9: Explain. after the initial force is imparted on the ball the only thing causing it to accelerate, or in this case decelerate is gravity, which is constant.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? remains the same

Q11: Explain. Because, again, gravity is a constant.

END OF RESPONSE

Student#: **NAME: ,**

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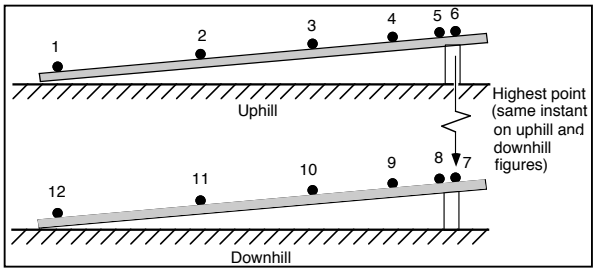
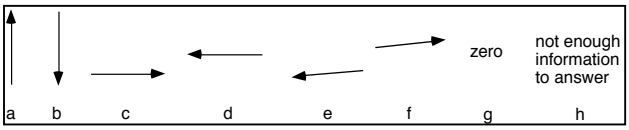


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: f

Q5: Location 6: g

Q6: Location 10: e



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. the ball is headed upward at position 3 so the accelration is upward. at position 6, the ball has come to a momentary stop where there is potential energy but the acceleration of the ball is essentially zero. for position 10, the ball is headed downward and the acceleration is therefore downward.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? decreases

Q9: Explain. because the ball is rolling uphill, it faces resistance from friction as well as positional resistance. This resistance slows down the acceleration of the ball.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? increases

Q11: Explain. because the ball is rolling downhill, it is gaining more acceleration in a position that it naturally follows.

END OF RESPONSE

Student#: **NAME: ,**

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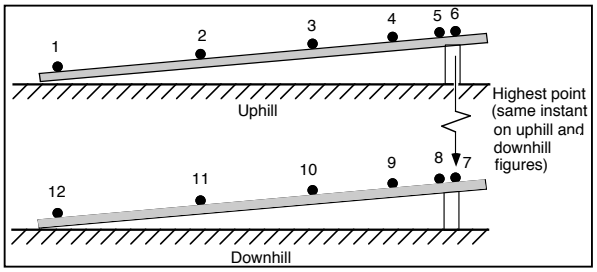
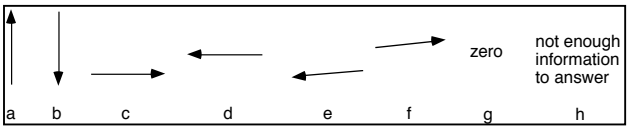


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: e

Q5: Location 6: e

Q6: Location 10: e



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. The acceleration depends on the gravity and the angle of the slope.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? remains the same

Q9: Explain. Since the gravity and the angle of the slope are constant, acceleration is constant.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? remains the same

Q11: Explain. gravity and angle of slope are constant. So acceleration is constant.

END OF RESPONSE

Student#: **NAME: ,**

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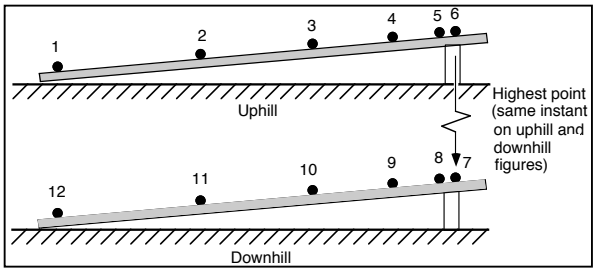
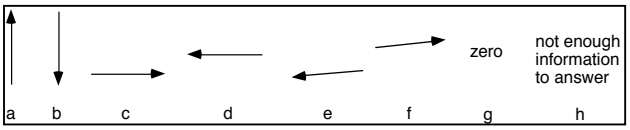


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: f

Q5: Location 6: g

Q6: Location 10: e



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. Velocity is a vector, meaning it contains both a magnitude and a direction. Since the velocity function is the derivative of the position function, and the position of the ball at different times can be clearly seen, the direction of the ball's travel can be determined. Since acceleration is the derivative of the velocity function, the direction of acceleration must be the same as the velocity. At times when the velocity of the ball is zero, the acceleration is also zero

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? decreases

Q9: Explain. the velocity is decreasing from rapid to zero at the peak(location 6). The magnitude of the acceleration is therefore decreasing since the acceleration is the change in velocity.

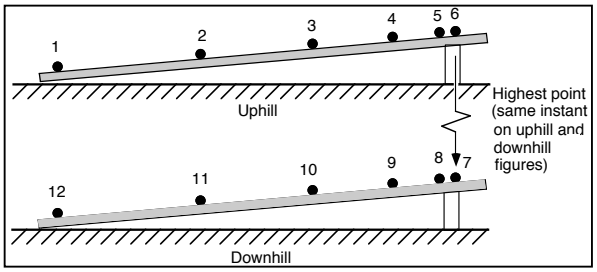
Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? increases

Q11: Explain. Opposite is true. Velocity increases, acceleration increases.

END OF RESPONSE

Student#: **NAME: ,**

The strobe diagram at right represents the motion of the ball as it rolls up and then down the track. (In a strobe diagram, the position of an object is shown at instants separated by equal time intervals.)

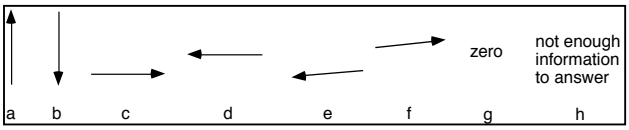


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: f

Q5: Location 6: e

Q6: Location 10: e



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. On an upwards hill, the force on the ball is exerted upwards so it will cause the ball to accelerate upwards, and also the same is true for the reverse. However, acceleration of the ball does not always cause it to go in that direction on an inclined plane, due to gravity and friction.At point 3, the force is exerted up the hill, and thus the force of acceleration is upwards (But is decreasing rapidly)At point 6, the ball stops and will begin to accelerate downards due to the incline.At point 10, the ball is continuing downwards from point 6, and which acceleration is exerted.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? decreases

Q9: Explain. As it is going upwards, it will LOSE acceleration because of friction and gravity (Both increased due to the fact the plane is inclined)

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? increases

Q11: Explain. As it is going downwards, it will GAIN acceleration because of friction and gravity. (Increase due to forces pulling down)

END OF RESPONSE

Student#: **NAME: ,**

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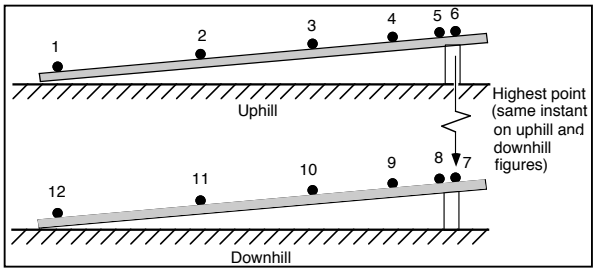
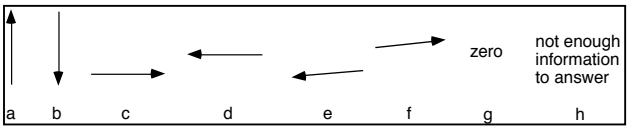


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.



Q4: Location 3: c

Q5: Location 6: g

Q6: Location 10: b

Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. Question 5: Since the ball is given a kick by the hand (which flashed by too fast for me to see), it accelerates straight right.Question 6: Since the ball has no velocity at it's peak, it also has no acceleration.Question 7: Likewise, when the ball rolls back, only gravity pulls it down, so the acceleration is downward.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? decreases

Q9: Explain. The ball's velocity rate of change slows, so the acceleration decreases.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? increases

Q11: Explain. The ball's velocity rate of change increases, so the accleration increases.

END OF RESPONSE

Student#: **NAME: ,**

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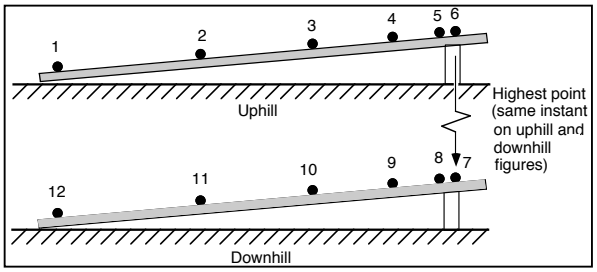
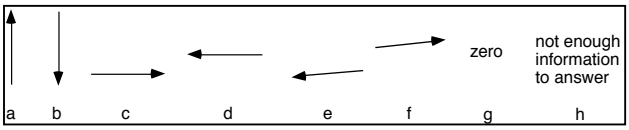


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: e

Q5: Location 6: e

Q6: Location 10: e



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. The direction of acceleration is always 'e' because two forces are acting on the ball, gravity and the force against the track. Gravity acts downward and the force caused by the track acts to the left. Hence the resultant force is in the direction left-down, which is shown by arrow 'e'.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? remains the same

Q9: Explain. Gravity remains the same in all the positions. The difference between the heights of position 1 and position 6 is so little that the change in gravity is negligible. Since gravity remains the same, the force acting on the ball caused by the track is also the same. Hence the resultant force is constant. Since mass of the ball is also constant, and F = ma, a constant force will result in a constant acceleration throughout all positions.

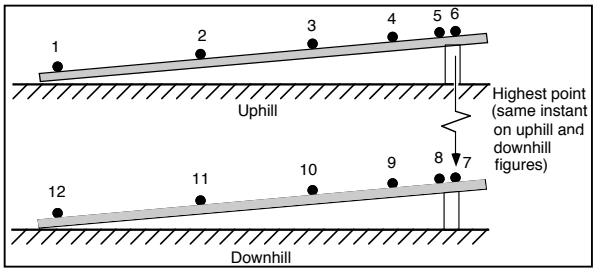
Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? remains the same

Q11: Explain. Gravity remains the same in all the positions, as the height of the track is so small. Since gravity remains the same, the force acting on the ball caused by the track is also the same. Hence the resultant force is constant, resulting in a constant acceleration throughout all positions.

END OF RESPONSE

Student#: **NAME: ,**

The strobe diagram at right represents the motion of the ball as it rolls up and then down the track. (In a strobe diagram, the position of an object is shown at instants separated by equal time intervals.)

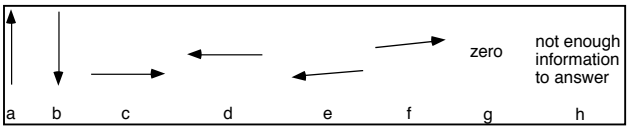


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: e

Q5: Location 6: e

Q6: Location 10: e



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. I could tell how the properities of gravity would be forcing the ball

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? remains the same

Q9: Explain. gravity, the only force causing it to accelerate is always the same.

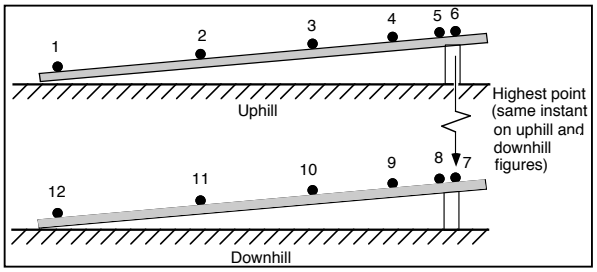
Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? remains the same

Q11: Explain. gravity, the only force causing it to accelerate is always the same.

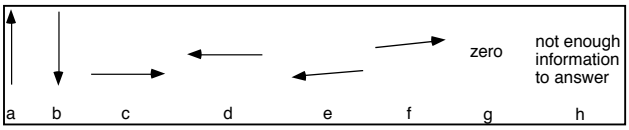
END OF RESPONSE

Student#: **NAME: ,**

The strobe diagram at right represents the motion of the ball as it rolls up and then down the track. (In a strobe diagram, the position of an object is shown at instants separated by equal time intervals.)



Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.



Q4: Location 3: e

Q5: Location 6: e

Q6: Location 10: e

Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. When the ball is at position 3 it is not longer accelerating in an upwards direction otherwise it would have rolled off the edge. And there is always a downwards acceleration on the ball due to the slope, that is how I concluded all my answers were e.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? decreases

Q9: Explain. If the magnitude of the acceleration were constant than the distance between each interval would be the same. If the magnitude increases the distance between each interval would also increase.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? increases

Q11: Explain. If the magnitude of the acceleration were constant than the distance between each interval would be the same. If the magnitude decreases the distance between each interval would also decrease.

END OF RESPONSE

Student#: **NAME: ,**

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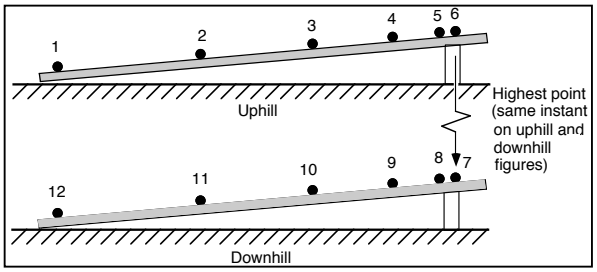
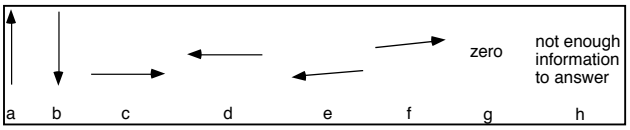


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: f

Q5: Location 6: g

Q6: Location 10: e



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. The horizontal and vertical vector quantites combine to show the direction of acceleration.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? decreases

Q9: Explain. The distance between the ball at equil time interval snapshots becomes smaller, therefore the acceleration is also becomeing smaller.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? increases

Q11: Explain. The distance between the bakk at equil time interval snapshots becomes larger, therefore the acceleration is also becomeing larger.

END OF RESPONSE

Student#: **NAME: ,**

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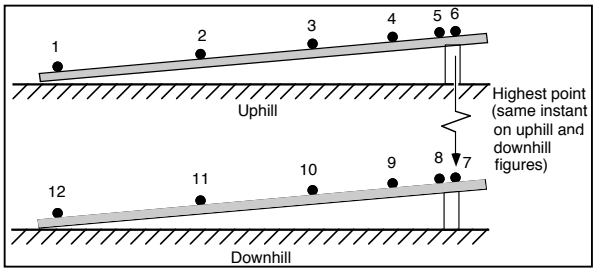
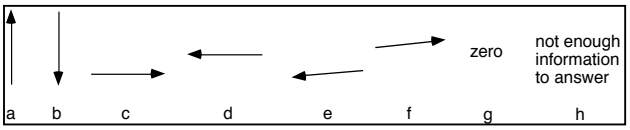


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: e

Q5: Location 6: g

Q6: Location 10: e



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. At point three, the ball is decelerating as it travels up the ramp, therefore, it is accelerating in the opposite direction. At point 6, the ball is at rest for a breif moment and therefore is not accelerating up or down the ramp. At point 10, the ball is accelarting as it travels down the ramp and therefore the acceleration is in that direction.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? remains the same

Q9: Explain. The magnitude of the acceleration will remain constant because the only forces acting on the ball are gravity and the initial push, both which will remain constant.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? remains the same

Q11: Explain. The magnitude of the acceleration remains the same because although the ball's speed increases as it travels down the ramp, the acceleration is constant because the excluding friction the only force acting on the ball's motion is gravity.

END OF RESPONSE

Student#: **NAME: ,**

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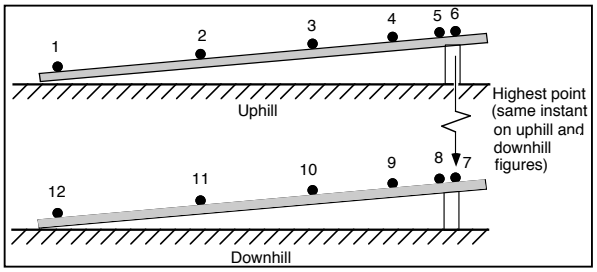
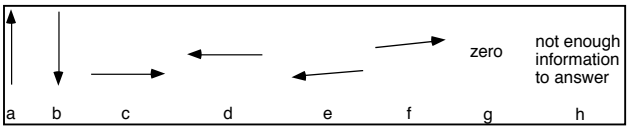


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: f

Q5: Location 6: g

Q6: Location 10: e



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. for location 3, the ball is still going up, so the direction it goes is the direction it accelerates. Same thing for location 10. At location 6, it stops, so it is not accelarating.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? decreases

Q9: Explain. The ball moves slower and slower, therefore, the accelaration decreases.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? increases

Q11: Explain. The ball moves faster and faster, therefore, the accelaration increases.

END OF RESPONSE

Student#: **NAME: ,**

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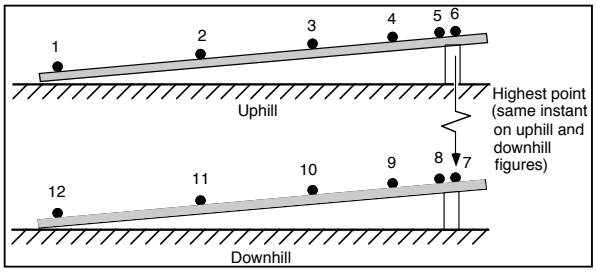
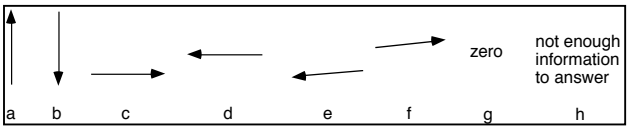


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.



Q4: Location 3: b

Q5: Location 6: g

Q6: Location 10: a

Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. At point three the acceleration is decreasing because gravity and friction are slowing the ball down. It stops at the second point at the top and is speeding up at point 10 because gravity is pulling it down the hill.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? decreases

Q9: Explain. Forces such as friction and gravity slow the acceleration of the ball down as it travels uphill.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? increases

Q11: Explain. Gravity helps the ball to move faster and faster as it moves downhill.

END OF RESPONSE

Student#: **NAME: ,**

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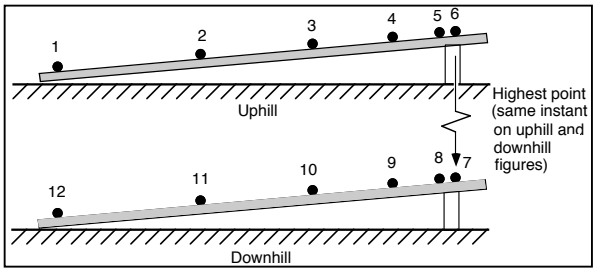
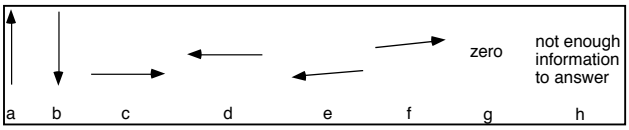


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: e

Q5: Location 6: e

Q6: Location 10: e



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. Gravity pulling the down... but since it cannot it acts using sine of the magnitude of gravity.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? remains the same

Q9: Explain. The same acceleration is acting on the ball, velocity is changing.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? remains the same

Q11: Explain. The acceleration remains constant because gravity is close to being constant as the ball descends. Velocity is changing.

END OF RESPONSE

Student#: **NAME: ,**

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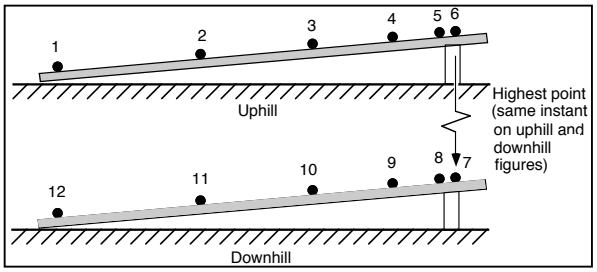
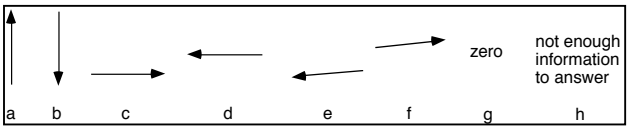


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: d

Q5: Location 6: g

Q6: Location 10: d



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. i thought about what way the ball was being pulled. In the first one it is going forward, but it is slowing down, so it is deccellerating. On the second point the ball is stopped so there is no acceleration. on the third one the ball is accelerating down the hill due to gravity.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? decreases

Q9: Explain. the graph of the velocity is a parabola and as the slope of the velocity graph is the acceleration. As you move along the parabola the slope flattens out

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? increases

Q11: Explain. as the ball moves down the ramp it moves faster and faster

END OF RESPONSE

Student#: **NAME: ,**

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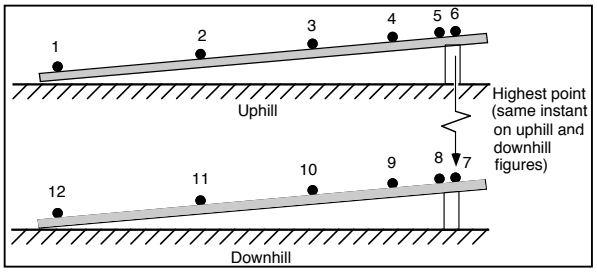
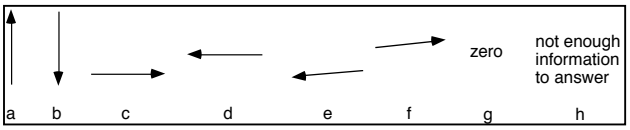


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: e

Q5: Location 6: b

Q6: Location 10: e



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. The acceleration is almost always going to be towards the left because is either slowing down going to the right, or accelerating to the left. Gravity also causes the ball to constantly accelerate downwards, so putting those two pieces together, I concluded the previous directions of the acceleration.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? remains the same

Q9: Explain. The ball is only ever under the constant force of gravity once the hand is no longer pushing the ball, so if the force and mass of the system are constant, the acceleration must also be constant.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? remains the same

Q11: Explain. Again, since the only present force is gravity, and that force and the mass of the ball will remain constant, then the acceleration must remain constant.

END OF RESPONSE

Student#: **NAME: ,**

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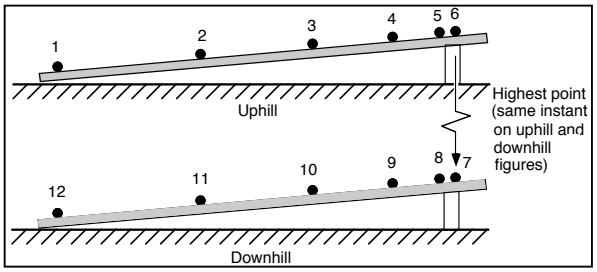
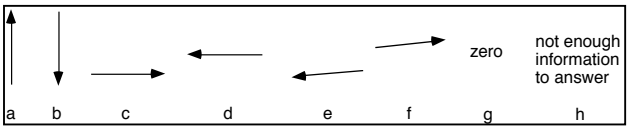


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: f

Q5: Location 6: g

Q6: Location 10: e



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. As the ball is moving up the ramp the ball is going to lose its momentum and slowly start to turn around. This is why the it is a shorter distance away from where it last was at every time interval.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? decreases

Q9: Explain. As the ball moves uphill, the ball loses its speed and acceleration making the ball slowly come to a halt and head backwards.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? other (explain below)

Q11: Explain. I think as the ball returns to its starting point it will have an equal acceleration compared to the way it went uphill only in reverse (ie. starting slow and finish fast).

END OF RESPONSE

Student#: **NAME: ,**

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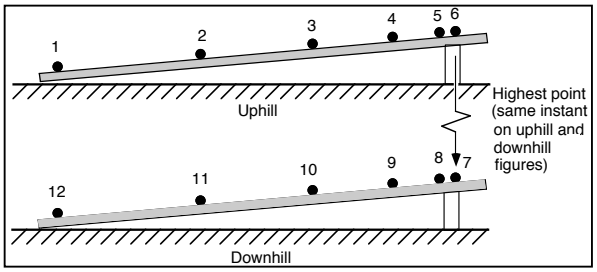
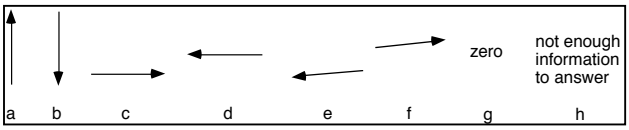


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: e

Q5: Location 6: e

Q6: Location 10: e



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. At position three, the acceleration is parallel to the direction of movement and opposite the direction of displacemant.The acceleration of the ball remains constant as it is the force of gravity which acts on the ball.For the third question, I answered the acceleration was the same as the first because it is parallel to the direction of movement and the same as the direction of travel.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? remains the same

Q9: Explain. Gravity provides a onstant acceleration, now matter where the ball is on the ramp.

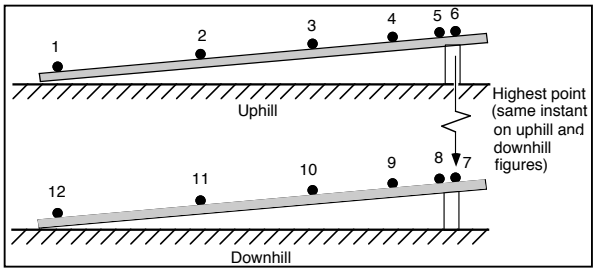
Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? remains the same

Q11: Explain. Velocity changes, but acceleration remains constant.

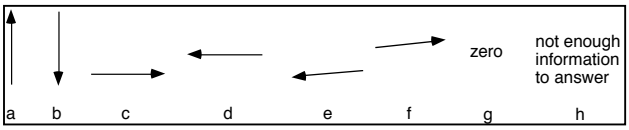
END OF RESPONSE

Student#: **NAME: ,**

The strobe diagram at right represents the motion of the ball as it rolls up and then down the track. (In a strobe diagram, the position of an object is shown at instants separated by equal time intervals.)



Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.



Q4: Location 3: e

Q5: Location 6: e

Q6: Location 10: e

Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. The only force acting on the ball is gravity, which pulls downward constantly. However, because of the track, the downwards force causes the ball to also accelerate sideways

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? remains the same

Q9: Explain. The only force acting on the ball is gravity, which remains the same.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? remains the same

Q11: Explain. The only force acting on the ball is gravity, which remains the same.

END OF RESPONSE

Student#: **NAME: ,**

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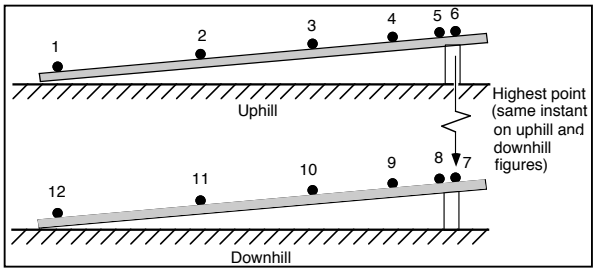
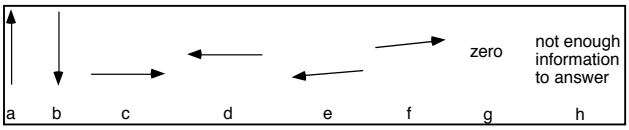


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: e

Q5: Location 6: g

Q6: Location 10: e



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. At location 3 the ball was slowing down, therefore I put a slanted backward arrow assuming negative acceleration, in the opposite direction the ball was moving.At location 6 the ball was stopped at its highest point. At that point the ball is stopped and the acceleration was zero.At location 10 the ball was speeding up and the acceleration direction was still that off the slanted backward arrow, this time the ball was moving the same direction as the acceleration.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? remains the same

Q9: Explain. Because the angle of the ramp is not changing, the acceleration due to gravity is the only force working to change the acceleration. Since gravity is constant, the acceleration is constant.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? remains the same

Q11: Explain. The acceleration is still the same due to gravity, just as it was when the ball went up the ramp, in this case, since the ball is moving in the direction of the acceleration, the ball is speeding up rather than slowing down.

END OF RESPONSE

Student#: **NAME: ,**

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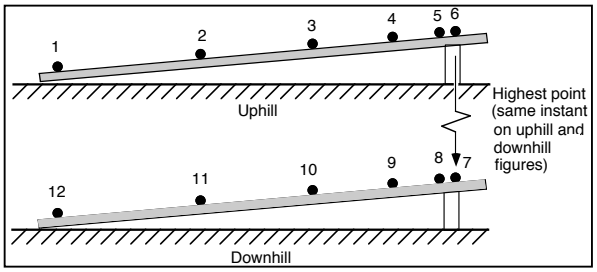
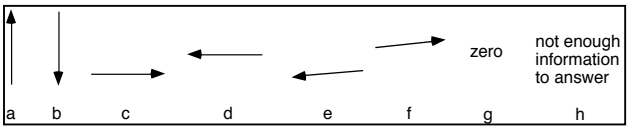


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.



Q4: Location 3: b

Q5: Location 6: b

Q6: Location 10: b

Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. Acceleration is the change in velocity. I did not want to confuse velocity with acceleration. Gravity was the only force accelerating the ball, gravity is constant, and the ramp changes the direction of the force as the ball 'pushes' on the ramp, so the acceleration has to be constant.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? remains the same

Q9: Explain. Gravity is constant.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? remains the same

Q11: Explain. Gravity is constant.

END OF RESPONSE

Student#: **NAME: ,**

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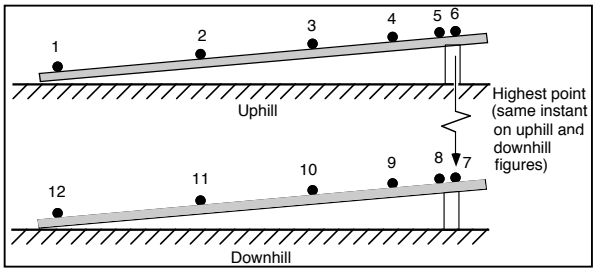
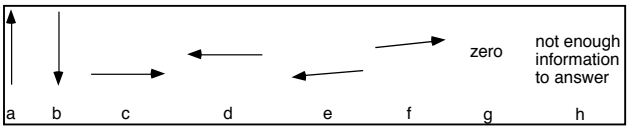


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.



Q4: Location 3: b

Q5: Location 6: b

Q6: Location 10: a

Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. The ball is negatively accelerating up the hill, so the direction is down.Right before the ball was at the top of the hill, the acceleration was negative, so the direction is down.The ball is positively accelerating, so the direction is upward.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? remains the same

Q9: Explain. Acceleration due to gravity is constant.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? remains the same

Q11: Explain. Aceeleration due to gravity is constant.

END OF RESPONSE

Student#: **NAME: ,**

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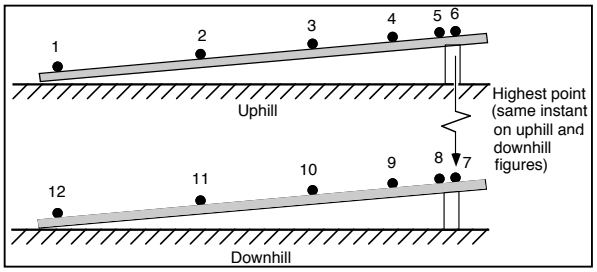
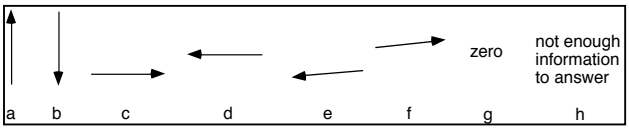


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.



Q4: Location 3: d

Q5: Location 6: g

Q6: Location 10: d

Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. As the ball rolls uphill, the acceleration is in the opposite direction. Why? Because the acceleration was provided by the hand at the very instant it hit the ball. As the ball rolls uphill, it loses speed, but there is no acceleration. There is no such thing as angled acceleration, and it asked the direction of the acceleration, not whether it is increasing or decreasing. When the ball is at its highest point, the ball is not accelerating, because it is not moving in any direction. When the ball is going downhill, it is steadily accelerating in the opposite direction.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? other (explain below)

Q9: Explain. As the ball goes uphill, there is no acceleration. The acceleration was initially provided by the hand in an instant. As the ball rolls uphill, it's speed is constantly decreasing, but it is not accelerating.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? increases

Q11: Explain. The force of gravity is acting on the ball, increasing its acceleration as it moves down the inclined plane.

END OF RESPONSE

Student#: **NAME: ,**

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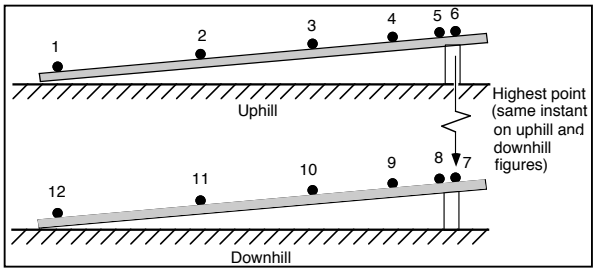
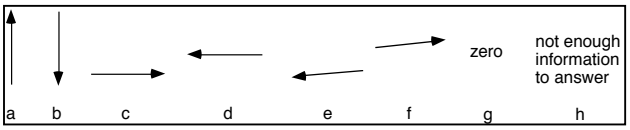


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: e

Q5: Location 6: g

Q6: Location 10: e



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. At 3, acceleration in the reverse direction that the ball is moving is causing it to slow down. At 6, the ball has stopped moving forward and is not yet moving downward. It has zero acceleration. At 10, the ball is moving downward and gaining velocity, so the acceleration is in the direction the ball is moving.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? decreases

Q9: Explain. The position of the ball is shown at equal time intervals, and the distance the ball moves is smaller than the previous distance over each interval.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? increases

Q11: Explain. The distance the ball moves over each interval in the downhill direction is greater than the previous distance, showing an increase in acceleration.

END OF RESPONSE

Student#: **NAME: ,**

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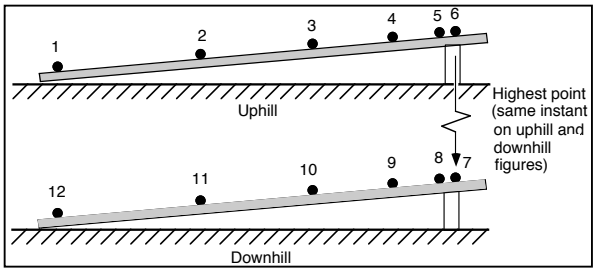
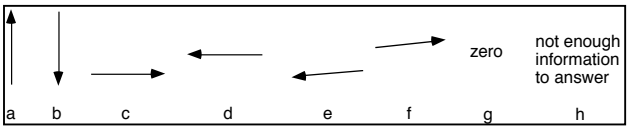


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: d

Q5: Location 6: g

Q6: Location 10: d



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. The acceleration is how the ball is changing speed.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? decreases

Q9: Explain. The ball slows down as it goies up the hill

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? increases

Q11: Explain. The ball speeds up as it ogies down hill.

END OF RESPONSE

Student#: **NAME: ,**

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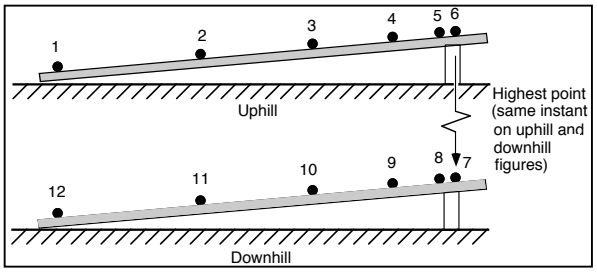
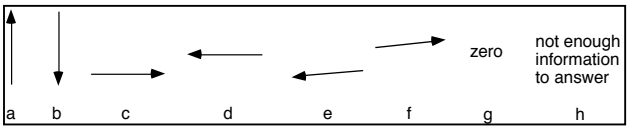


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.



Q4: Location 3: f

Q5: Location 6: g

Q6: Location 10: e

Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. Question 5-the force is clearly headed in an upwards direction, as the ball is moving uphill.Question 6-the direction of the acceleration is zero because the ball has come to it's highest point and has stopped moving at that time.Question 7-the direction of the acceleration is now heading downhill, as the ball is brough back toward the base due to gravity.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? decreases

Q9: Explain. Gravity and friction reduce the amount of acceleration as the ball moves uphill, until the ball comes to a complete stop before heading downhill.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? increases

Q11: Explain. Gravity increases the amount of acceleration as the ball moves downhill back toward earth.

END OF RESPONSE

Student#: **NAME: ,**

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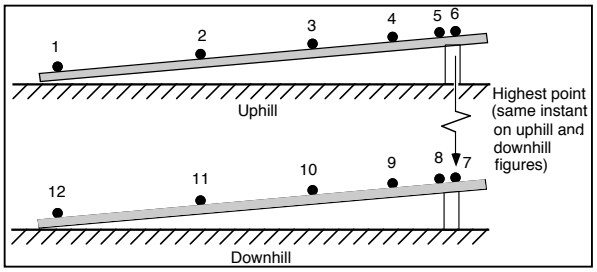
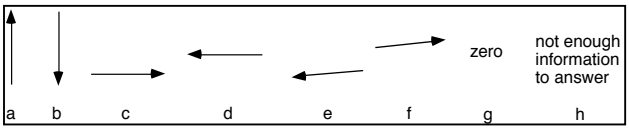


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: d

Q5: Location 6: g

Q6: Location 10: d



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. The ball is slowing down as it goes up the ramp. When it reaches the top, it is not moving, and then it accelerates toward the bottom of the ramp.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? decreases

Q9: Explain. The ball travels slower and slower as it moves up hill because of the friction resistance.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? increases

Q11: Explain. The slope and the pull of gravity work together to make the ball accelerate.

END OF RESPONSE

Student#: **NAME: ,**

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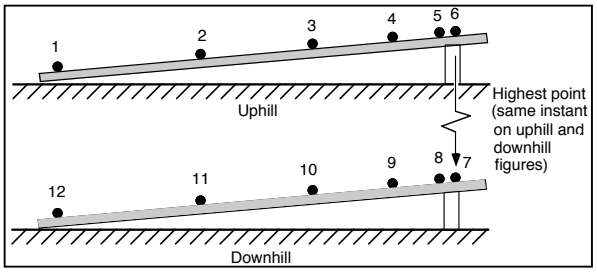
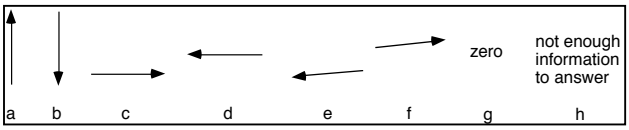


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.



Q4: Location 3: f

Q5: Location 6: h

Q6: Location 10: f

Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. I tried to imagine I was in a car that was following same path. Then I imagined which way I was being forced, and I believe, although I am not sure that that is the direction of the acceleration. Obviously, I need to know more about this.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? increases

Q9: Explain. The distance traveled during equal time periods decreases more quickly as the ball moves toward position 6.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? decreases

Q11: Explain. As the ball moves from 7 to 12, the distance traveled over equal time intervals becomes greater, but it changes more slowly.

END OF RESPONSE

Student#: **NAME: ,**

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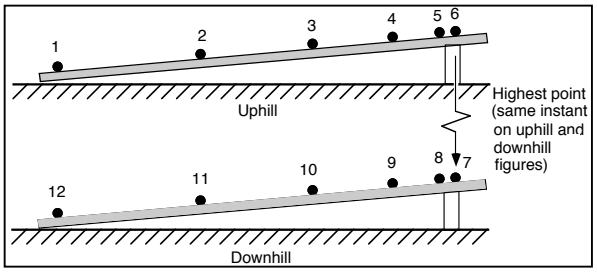
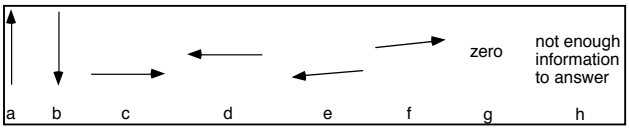


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: b

Q5: Location 6: b

Q6: Location 10: b



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. For Location 3, the ball is not accelerating but slowing down, thus, the the only acceleration comes from gravity acting on the ball in a downward motion. Gravity is the only acceleration for location 6 as well since the ball is stationary at the top but gravity still acts as a downward acceleration force. For location 10, the ball is going downhill and due to gravity, the acceleration is downward.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? remains the same

Q9: Explain. The acceleration of gravity is a constant.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? remains the same

Q11: Explain. The acceleration of gravity is constant.

END OF RESPONSE

Student#: **NAME: ,**

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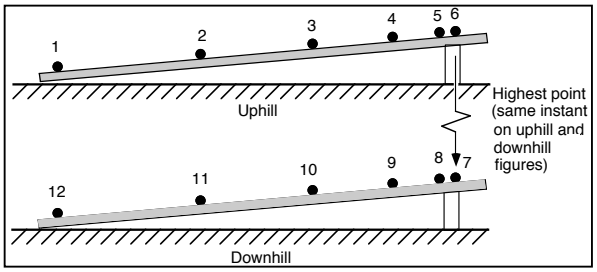
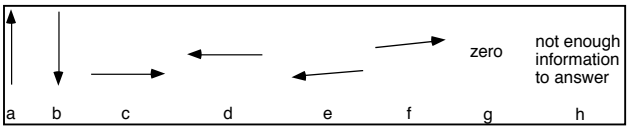


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: b

Q5: Location 6: g

Q6: Location 10: a



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. 5. At location 3, the ball is slowing down, therefore the acceleration is decreasing.6. At location 6, the ball is stopped for an instant which means that its velocity and acceleration are equal to 0.7. At location 10, the ball is speeding up which gives it a positive or increasing acceleration.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? decreases

Q9: Explain. The magnitude of the acceleration decreases as it goes up the hill because it is losing speed.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? increases

Q11: Explain. The magnitude of the acceleration increases as the ball rolls back down the hill because it is gaining speed.

END OF RESPONSE

Student#: **NAME: ,**

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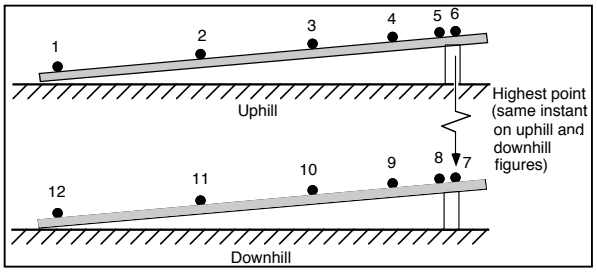

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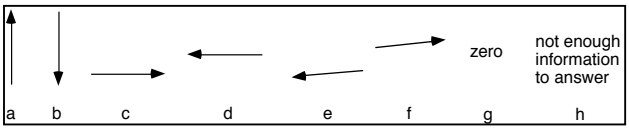

Q4: Location 3: f

Q5: Location 6: g

Q6: Location 10: e

Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. At location 3, the ball is heading up the hill, moving both forward and up. At location 6, the ball is no longer accelerating. It is going to start accelerating in the other direction. At position 10, the ball is rolling both forward and down.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? decreases

Q9: Explain. Friction and gravity are both taking their toll on the momentum of the ball as it goes up hill. The farther it has to go, the more it will slow down at the end.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? increases

Q11: Explain. This time the ball is only fighting friction. It is going in the direction that gravity wants it to, so gravity will speed the ball up as it decends.

END OF RESPONSE

Student#: **NAME: ,**

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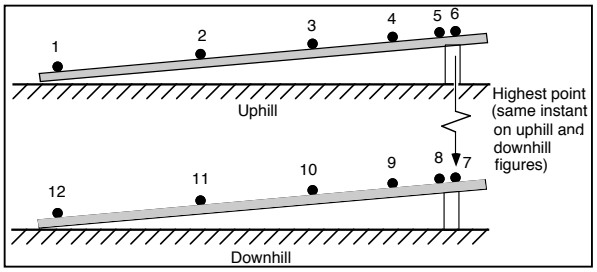
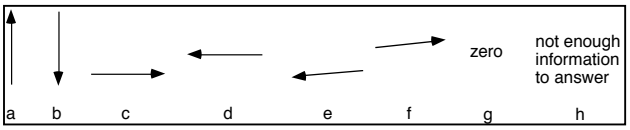


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.



Q4: Location 3: e

Q5: Location 6: e

Q6: Location 10: e

Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. For location 3, the velocity is upward, however the ball is slowing down so the acceleration is opposing it. For location 6 the acceleration is still upward. For location 10 the velocity and acceleration are in the same direction, therefore the ball will go faster.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? remains the same

Q9: Explain. Other than gravity and the normal force, there are no other forces acting upon the ball.

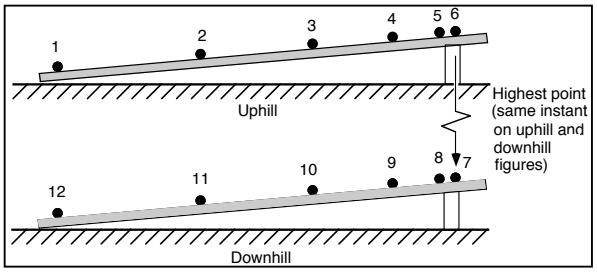
Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? remains the same

Q11: Explain. The acceleration does not change. The ball goes downhill faster because the velocity is in the same direction as the accelerationh

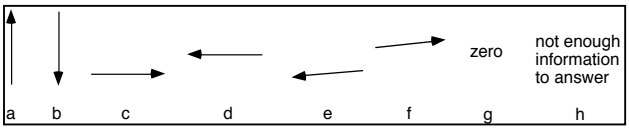
END OF RESPONSE

Student#: **NAME: ,**

The strobe diagram at right represents the motion of the ball as it rolls up and then down the track. (In a strobe diagram, the position of an object is shown at instants separated by equal time intervals.)



Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.



Q4: Location 3: e

Q5: Location 6: e

Q6: Location 10: e

Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. The acceleration due to gravity is always straight down... and since the ramp is there, it is forcing the ball in the direction of the down side of the ramp, hence, no matter where the ball is, there is always a force in the downward direction towards the bottom of the ramp.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? remains the same

Q9: Explain. The acceleration of the ball is constant because only gravity and the ramp is significantly affecting it. The gravity and the ramp don't change, so why should the acceleration?

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? remains the same

Q11: Explain. How many times do I have to say that the acceleration is always the same unless there is a force there to change it?

END OF RESPONSE

Student#: **NAME: ,**

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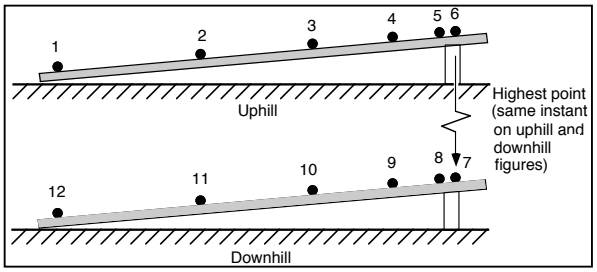
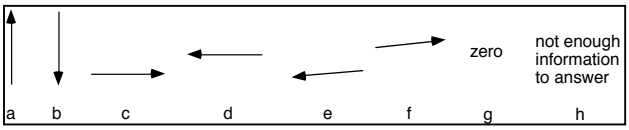


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.



Q4: Location 3: b

Q5: Location 6: g

Q6: Location 10: a

Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. for location 3, the ball is moving up a hill, therefore losing speed, therefore acceleration is going down. for location 6, the ball has reached the highest point and has momentarily stopped, acceleration is zero, for location 10 the ball is moving down hill, very little energy is used and acceleration is going up,

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? decreases

Q9: Explain. more energy needs to be used to go uphill, therefore the magnitude decreases

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? increases

Q11: Explain. less energy downhill therefore magnitude increases

END OF RESPONSE

Student#: **NAME: ,**

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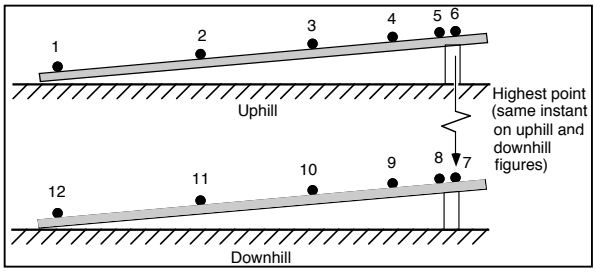
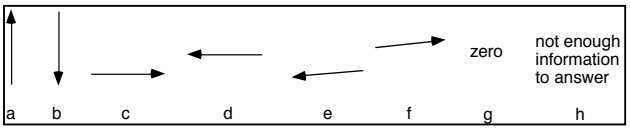


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.



Q4: Location 3: e

Q5: Location 6: f

Q6: Location 10: e

Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. The direction of the forces acting on the ball that affect the velocity of the ball. At 3, the ball is decellerating, so acceleration must be the opposite direction that the ball is traveling in, and at 10, it is speeding up, so the acceleration is the same direction as the velocity. At 6, the ball is about to change directions, so it is still acting on the ball the same as it was for 1-5, as it is for 7-12 as well. Acceleration cannot be 0 in this scenario. And gravity still acts on the ball the whole time as well, so it can't be a horizontal vector, it must be slightly downwards as well, and it needed some horizontal force to get it to go uphill in the first place.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? remains the same

Q9: Explain. Because the acceleration remains constant, changing the velocity. Gravity is assumed to be constant.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? remains the same

Q11: Explain. Because, again, the same forces are acting on it consistently.

END OF RESPONSE

Student#: **NAME: ,**

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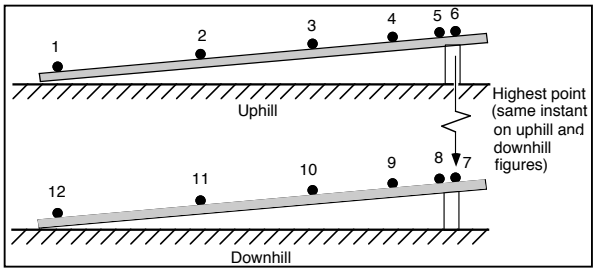
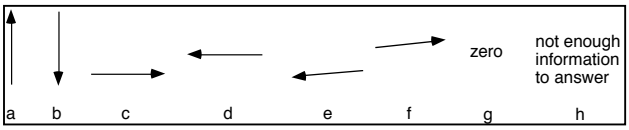


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.



Q4: Location 3: e

Q5: Location 6: e

Q6: Location 10: e

Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. The acceleration remains constant because the slope is straight and the same force is being applied to the ball at all times.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? remains the same

Q9: Explain. The acceleration remains constant because the slope is straight and the same force is being applied to the ball at all times.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? remains the same

Q11: Explain. The acceleration remains constant because the slope is straight and the same force is being applied to the ball at all times.

END OF RESPONSE

Student#: **NAME: ,**

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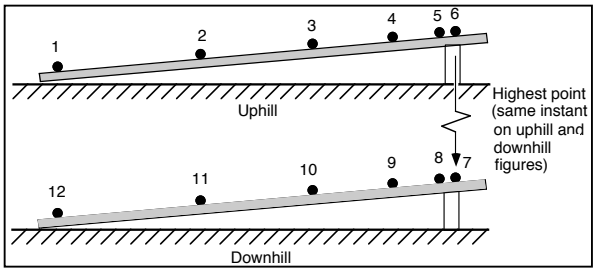
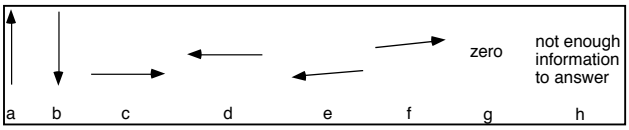


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.



Q4: Location 3: e

Q5: Location 6: e

Q6: Location 10: e

Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. At 3, it is going up but losing velocity, therefore accleration is going in opposite direction. At 6 it is at the highest point and about to come down therefore accelration is going that way. At 10 it is gaining velocity going down, therefore the acceleration is going in the same way.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? decreases

Q9: Explain. As it is going up it is losing velocity, therefore the accleration is decreasing.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? increases

Q11: Explain. As it goes down from 7 to 12 it is gaining velocity, and the accleration is increasing.

END OF RESPONSE

Student#: **NAME: ,**

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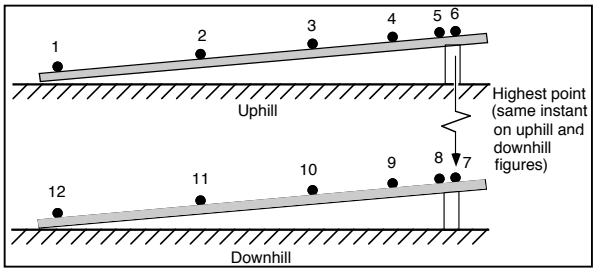
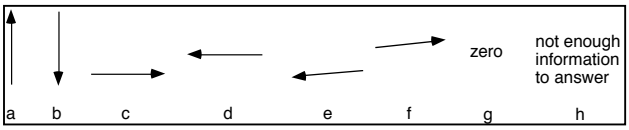


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: f

Q5: Location 6: g

Q6: Location 10: e



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. the direction of of its velocity at a fixed point is not chaning thus the direction of its acceleration is the same.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? decreases

Q9: Explain. at each time interval on the uphill diagram the ball has traveled less distance, therefore its acceleration is decreasing.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? increases

Q11: Explain. This time after each time interval distance traveled increases.

END OF RESPONSE

Student#: **NAME: ,**

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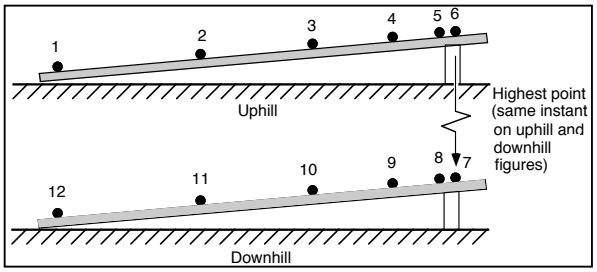
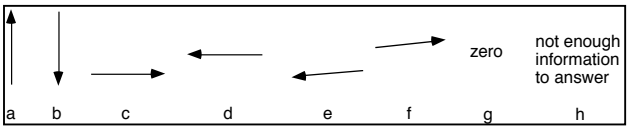


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.



Q4: Location 3: e

Q5: Location 6: e

Q6: Location 10: e

Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. Acceleration is the rate of change in velocity of the ball. though the velocity changes throughout the animation the acceleration is constant. it is a continual acceleration down the ramp.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? remains the same

Q9: Explain. There is a constant acceleration involved in the experiment.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? remains the same

Q11: Explain. The acceleration is is constant.

END OF RESPONSE

Student#: **NAME: ,**

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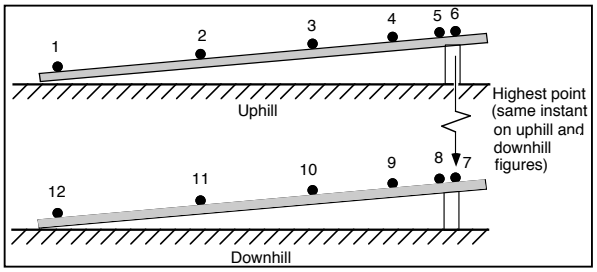
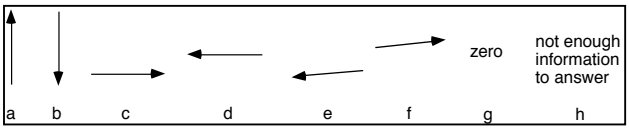


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.



Q4: Location 3: b

Q5: Location 6: b

Q6: Location 10: b

Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. Acceleration due to gravity is always going to be -9.8m/s2. So on the ramp, when it is going up it is actually accelerating down the ramp and slowing down. At the top it's not moving at all. Then it starts accelerating down again

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? remains the same

Q9: Explain. It is always downward -9.8m/s2... gravity

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? remains the same

Q11: Explain. It is always downward -9.8m/s2... gravity

END OF RESPONSE

Student#: **NAME: ,**

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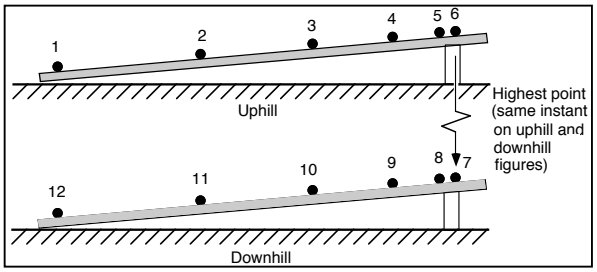
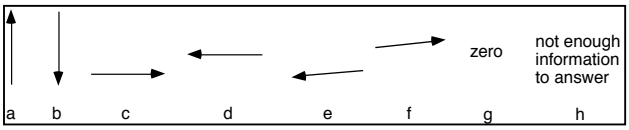
Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.





Q4: Location 3: e

Q5: Location 6: e

Q6: Location 10: e

Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. the accelleration is constant, due to the force of gravity pulling the ball down the ramp.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? remains the same

Q9: Explain. the accelleration stays the same, because there are no outside forces acting on the ball, other than gravity.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? remains the same

Q11: Explain. same idea as listed in question 10 (no outside forces are acting on the ball; only gravity)

END OF RESPONSE

Student#: **NAME: ,**

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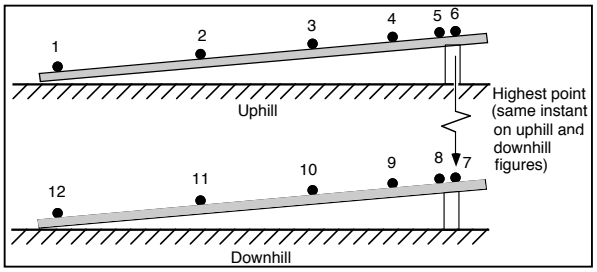
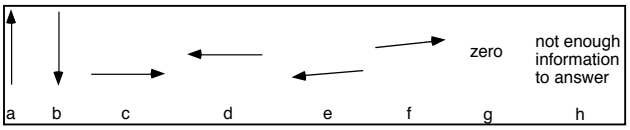


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: e

Q5: Location 6: e

Q6: Location 10: e



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. The ball is slowing when going in the f direction so it is accelerating in the e direction. The ball is speeding up as it moves down the ramp so it is accelerating in the e direction.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? decreases

Q9: Explain. The change in displacement between each strobe images are closer and closer together indicating less and less of a change in velocity which, by deffinition, is less and less acceleration.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? increases

Q11: Explain. The change in displacement between each strobe images farther and farther apart indicating more and more of a change in velocity which, by deffinition, is higher and higher acceleration.

END OF RESPONSE

Student#: **NAME: ,**

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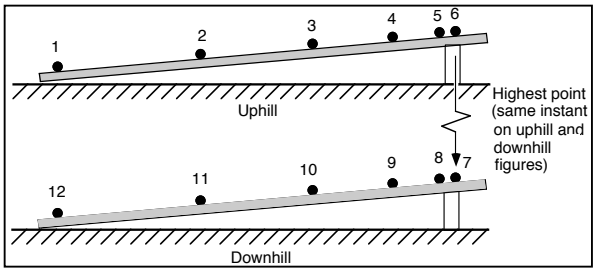
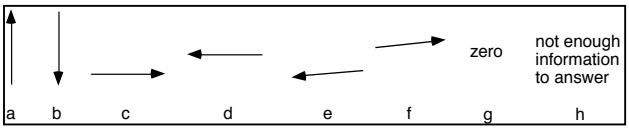


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: b

Q5: Location 6: b

Q6: Location 10: b



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. The only force acting on it to accelerate at all points was gravity.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? remains the same

Q9: Explain. There was constant acceleration on the ball at all times, since gravity stays the same.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? remains the same

Q11: Explain. Same as before, gravity remains unchanges at all times.

END OF RESPONSE

Student#: **NAME: ,**

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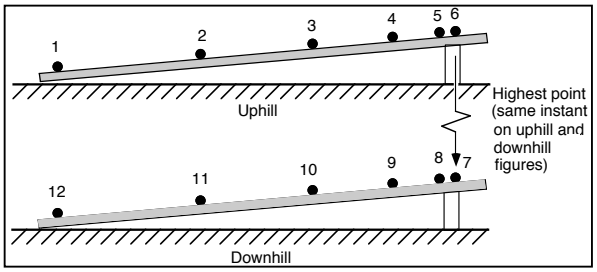
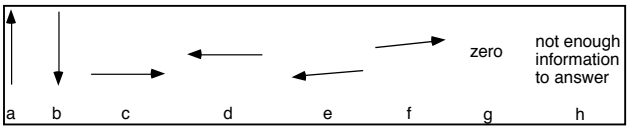


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: e

Q5: Location 6: e

Q6: Location 10: e



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. From the time the ball leaves location 1, it is slowing down (becomes more negative when going downhill), so the acceleration, which is the change in velocits, is negative. That is, the acceleration is pointing down the ramp.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? remains the same

Q9: Explain. The ball is slowing down at a constant rate; the gravity is the only acceleration force, and it is at a constant -9.80 m/s.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? remains the same

Q11: Explain. The ball is still slowing down. This is because it's velocity is increasing in the negative direction. So, since the only force acting on it (not including friction) is gravity, the acceleration is a constant -9.80 m/s.

END OF RESPONSE

Student#: **NAME: ,**

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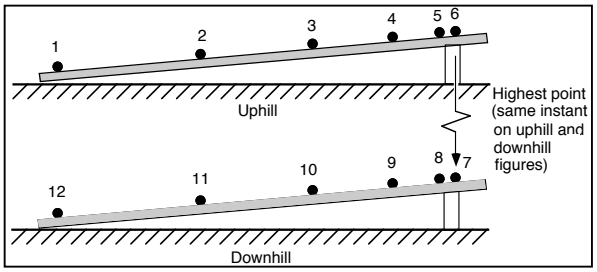
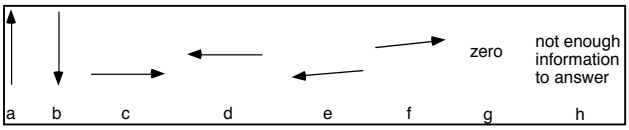


Choose the arrow from the list at right that best represents the direction of the acceleration of the ball at the following locations.

Q4: Location 3: c

Q5: Location 6: g

Q6: Location 10: d



Q7: Explain the reasoning you used to obtain the direction of the acceleration of the ball at each location. Since the ball is moving to the right at 3, the acceleration is postitive. At 6, the velocity is zero, therefore, the acceleration is also zero. At 10, the ball is moving to the left, theremore the acceleration is going to be negative.

Q8: How does the magnitude of the acceleration change as the ball moves uphill (locations 1 to 6)? decreases

Q9: Explain. As the ball moves up the hill, its potential energy is converetd to kinetic energy; therefore, there is less force to make it go faster.

Q10: How does the magnitude of the acceleration change as the ball moves downhill (locations 7 to 12)? increases

Q11: Explain. As the top of the ramp, the ball has alot of potential energy. As the ball rolls down the ramp, this enegry is convereted to kinetic energy. At the same time, the gravatational force exerted on the ball is making the ball roll down faster.

END OF RESPONSE