Midterm 1 review

Day 7:
Review

Reminders
No HW this week
Lecture notes in full on websit
Today's lecture on website after clas

Reminder- exam Thursday … 11a. Here.
Like homework … part multiple choice, part essay/long answer.
Graphs and predictions for motion
$F_{net} = ma$
x, v, a, t relations.
Springs

Bring 3 x 5 card with anything you want written on it
Bring calculator, pencil.
Can NOT use book.

Why exams? (not to inflict pain!)
1. You review material, reflect on what you do and do not understand, and why you think that.
2. Feedback to us on what you are (and are not) learning.
Is there anything we or you are missing by just looking at results on homework and in-class questions?

Mid term on Thursday

- Balcony areas will be CLOSED on Thursday
- 20 multiple choice questions, & 1 Long answer problems, total= worth 40 points.
-There will be no early or late exams given and no make-up exams.
-Accommodations please see me. Meet 11a G1b31.
- Exam will be closed book.
- ONE 3 by 5 inch formula card. You can WRITE anything on it BY HAND.
- Formula sheet / constants provided
- Calculator and pencil/eraser
  - Calculator cannot connect to outside world. No calculators on cell phones or laptops allowed.
  - No sharing of calculators.
  - No spare calculators available
- Exam grades and solutions will be posted after the exam on D2L.

Midterm preparation

- Prepare by applying the principles we have learned – practice.
- Do not seek to memorize answers to specific questions.
- Go over homeworks, class clicker questions, questions in the book.
  - Not sure how to get the answer – take it to the helproom.
- Todaywill be a review lecture

Not about memorization
Info will be on exam . . .

Each m/c question is worth 1.5 pts. The long answer 10 pts. Total points = 40.

Beware of grabbing at a numerical answer simply because you happen to see that number as you are calculating. We are sneaky and put in choices that are numbers you are likely to produce if you are not sure how to do the problem correctly. For many problems, it is good to make a simple sketch to picture the problem correctly.

For all of these problems, assume that air resistance is not important *unless* you are told otherwise.

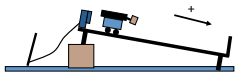
Conversions you may or may not need:
1 pound = 4.45 N 1 slug = 14.594 kg, 1 mph = 0.447 m/s.

Formulas you may or may not need.
$x = x_0 + vt$
$v = v_0 + at$
$x = x_0 + v_0 t + \frac{1}{2} at^2$
$v = (\Delta x / \Delta t) = (x_f - x_0)/(t_f - t_0)$
$a = (\Delta v / \Delta t) = (v_f - v_0)/(t_f - t_0)$
Force of Kinetic Friction = 0.3 x weight (for a moving object, like a book on a table)
$F_{net} = ma$
$F_{gravity} = mg$
$F_{spring} = -kx$

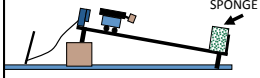
Midterm topics - Motion

- Position, velocity and acceleration
  - Definitions, Units
  - Scalars and vectors
  - Graphs of x, v, a vs time and relationships between graphs
  - Equations of motion and how to use them:
    Constant velocity: $x = x_0 + vt$
    Constant acceleration: $v = v_0 + at$
    $x = x_0 + v_0 t + \frac{1}{2} at^2$
- Forces
  - Definition, units, vector
  - $F_{gravity} = mg$ downwards
  - $F_{friction} \approx 0.3 \times$ weight in direction opposing motion
  - $F_{spring} = -kx$ in direction opposing extension/compression
  - $F_{net} = ma \Rightarrow$ If a = 0, $F_{net} = 0$
  - Free body diagrams and finding F_{net}

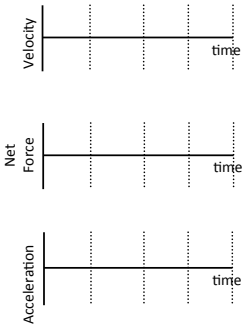
Car crashes



Case 1: hit hard end of ramp



Case 2: hit sponge at end of ramp

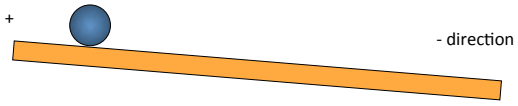


Sketch your predictions of the velocity, acceleration, net force, and measured force (by probe) vs time for this motion. Starting when we let go and ending after crash.
Plot CASE 1 AND 2 on same graph.

Roll a steel ball on a clean level floor. If there is no net force on the ball it can?
a. go straight, b. turn to one side, c. slow down,
d. either a. or b., e. either a, b, or c.

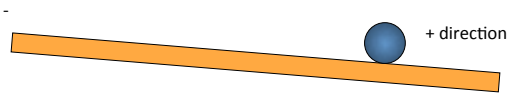
a. go straight. If nothing pushes on it, will continue in same direction and speed.

terminology questions.



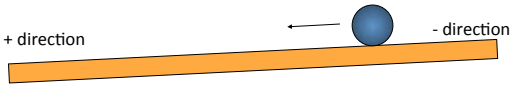
rolling ball on floor that slopes down, positive direction is to the LEFT. So ball is speeding up.
a. velocity is positive (+), accel. is pos.
b. vel. is negative (-), accel. is pos.
c. vel. is positive, accel. is negative.
d. vel. is negative, accel. is negative.,
e. none of above, it is decelerating, so has no acceleration.

Now starts out rolling to left, definition reversed so left is negative direction.



started rolling ball to left, so ball is slowing down,
a. velocity is positive (+), accel. is pos.
b. vel. is negative (-), accel. is pos.
c. vel. is positive, accel. is negative.
d. vel. is negative, accel. is negative.,
e. none of above, it is decelerating, so has no acceleration.

terminology question (if time).

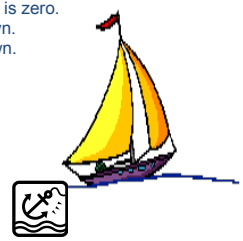


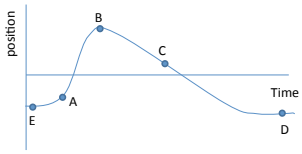
floor slopes other direction.
a. velocity is positive (+), accel. is pos.
b. vel. is negative (-), accel. is pos.
c. vel. is positive, accel. is negative.
d. vel. is negative, accel. is negative.,
e. none of above, it is decelerating, so has no acceleration.

The wind is providing a nice steady breeze, and the sail boat is sailing directly towards the shore at a constant speed of 2 knots. What do we know about the forces on the boat?
A. There must be a net force in the direction of the shore.
B. There is a force on the boat exerted by the wind.
C. The net force is zero.
D. A and B
E. B and C

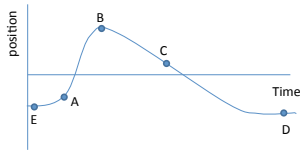
What happens right after we drop in an anchor in the water that drags along the sandy bottom?

A. The net force on the boat acts in the direction the boat is moving.
B. The net force on the boat acts in the direction opposite of the direction the boat is moving.
C. The net force on the boat is zero.
D. A and the boat slows down.
E. B and the boat slows down.



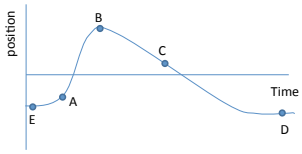


What is the person's velocity at A
a) Positive
b) Negative
c) Zero
d) Can't be determined

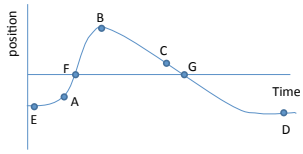


Name all points where the person is stationary

a) E, B and D
b) E and D
c) All points
d) E, C and D
e) B only



Name all the points where the person is accelerating
a) A, B and C
b) B only
c) All points
d) A and C
e) A and B

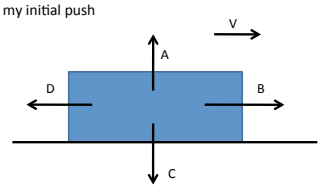


What is the person's average velocity between points F and G?

a) Something greater than zero (positive)
b) Something less than zero (Negative)
c) Zero
d) Can't determine from this graph

Motion questions

I push a shoebox of mass 2kg across a lino floor. I give it an initial velocity of +6m/s and after that it travels on its own. The next few questions relate to its motion <u>after</u> my initial push



Which of the forces above has zero magnitude in this situation?

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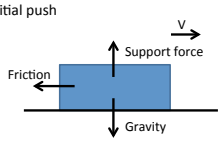

What is the approximate size of the support force?

a) 2N b) 10 N c) 20N d) 40 N e) Can't be determined

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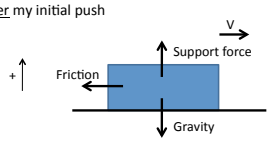

What is the approximate size of the friction force?

a) 2N b) 6 N c) 20N d) 60 N e) Can't be determined

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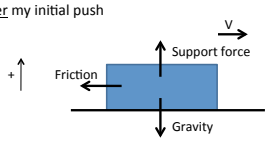

What is acceleration of the box?

a) 0 b) 6 m/s² c) -6 m/s² d) 3 m/s ² e) -3m/s²

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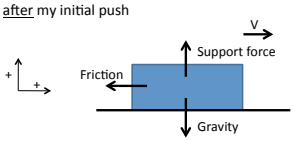

What is the velocity of the box after 1.5s?

a) 6m/s b) 4.5m/s c) 3m/s d) 1.5m/s e) 0

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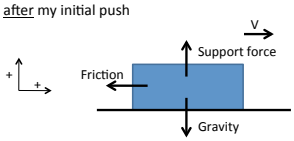

How long does box travel for before it stops?

a) 0s b) 0.5s c) 1s d) 1.5s e) 2s

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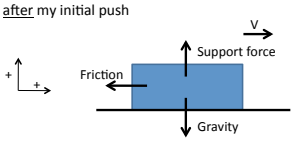
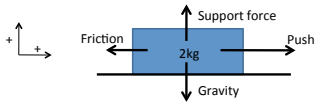


How far does box travel for before it stops?

a) 0m b) 2m c) 3m d) 6m e) 12m

The box comes to a stop. I start pushing it again, this time continuously. It accelerates at 2m/s^2. What is the size of my horizontal pushing force? (Remember from previous questions that $F_{friction}$ = 6N when box is moving)



a) 2N b) 4N c) 6N d) 10N e) 12N

Springs

I have a spring which is labeled 'Spring constant = 8 N/m'. I assume that this is correct and use it to measure the mass of an apple. I attach the apple to the bottom of the spring and it stretches 12.5cm. What is the mass of the apple? (assume g = 10m/s^2)

a) 0.1 kg b) 1kg c) 10kg d) 100kg e) Can't be determined.

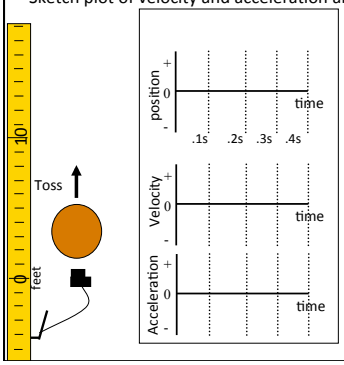
Now I hang the same apple on a different spring and it stretches much less than 12.5cm. What is the spring constant of this spring?

a) Less than 8N/m
b) 8N/m
c) More than 8N/m
d) Can't determine from information given

Which spring exerted the bigger upwards force on the apple?

a) The weak spring which had a large extension
b) The stiffer spring (smaller extension)
c) They exerted the same upwards force
d) Can't tell from this information

If we toss basketball up in air, reaches highest point in 0.2 s. Sketch plot of velocity and acceleration and position vs time.



At what time does,
pos. changes sign
vel.changes sign
accel. changes sign

a. .2 s, .2 s, .2 s
b. never, .2s, .2 s
c. .2 s, .2s, never,
d. never, .2s, never
e. never, never, never

What is the definition of acceleration?

a) slope of a position vs time graph
b) slope of a velocity vs time graph
c) Acceleration = change in position/ time taken
d) a and c
e) b and c