

PHY2048 Fall 2018 Exam 2 Review Questions

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Chapter 5: Applications of Newton's Laws

- Two boxes are stacked, with box B placed on top of box A. If box A is pushed such that both boxes move at a constant velocity, is there any friction on either box?
 - Kinetic friction on box A and static friction on box B
 - Kinetic friction on box A and no friction on box B
 - Kinetic friction on box A and kinetic friction on box B
 - Static friction on box A and kinetic friction on box B
- A 3kg box is placed on top of a 10kg box. If the 10kg box is pushed with a force of 70N, what is the force of friction on the 3kg box? Assume that there is negligible friction between the 10kg box and the ground.
- A 5kg box slides down an incline of angle 40° with an unknown coefficient of kinetic friction. If the box's acceleration is measured to be 3.58 m/s^2 down the slope, what is the value of the unknown coefficient of kinetic friction?
- A 6kg box is placed on a surface with $\mu_s = 0.5$ and $\mu_k = 0.35$. If the box is pushed with a force of 20N, answer the following questions. *Note that this problem does not imply that the box is moving; you have to figure this out for yourself.*
 - What type of friction does the box feel?
 - What is the magnitude of that friction?
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Chapter 6: Work and Kinetic Energy

- A 3.7kg mass is moving at a speed of 9 m/s when an unknown force acts on it. If, after some amount of time, the mass is moving at a speed of 14 m/s, how much work did the unknown force do? If the mass gained this speed along a distance of 15cm, moving in a straight line, what was the magnitude of the unknown force?
- A 4.6kg boxes slides down a surface, inclined at 35° , with a coefficient of kinetic friction of 0.3. If the box slides a distance of 10cm down the incline's surface, how much work was done by:
 - gravity?

- (b) the normal force?
 - (c) friction?
3. A box is pushed along a path of some length, causing friction to do work on the box. If the box were pushed along a path with a greater length, then:
 - (a) Friction would do less work, because it is conservative
 - (b) Friction would do less work, because it is non-conservative
 - (c) Friction would do more work, because it is conservative
 - (d) Friction would do more work, because it is non-conservative
 4. A 5kg mass is dropped from a height of 1.2m. If it takes 0.63s to hit the ground, how much work does air resistance do on the mass during the drop? *For this problem only, treat air resistance like a constant force.*
 - 5.

Chapter 7: Conservation of Energy

1. Imagine you were loading up a moving truck with boxes, and you have two ways to put boxes in the truck: you could lift the box straight up into the truck, or you could push the boxes up a ramp into the truck. Which method would require less work? Ignore any friction and air resistance.
 - (a) Pushing the boxes up the ramp, because it requires less force
 - (b) Lifting the box straight up into the truck, because it's a shorter distance
 - (c) The work would be the same either way
 - (d) Impossible to answer without more information
2. A 65kg skateboarder rides his skateboard to a 0.7m tall ramp, starting at the bottom at 8.5 m/s. Assuming no friction or air resistance, what would the skateboarder's speed be when he reached the top of the ramp?
3. A spring is placed in front of a ramp, so that a ball can be fired from the spring and travel up the ramp to some maximum height. If a 55g ball is placed against a spring with a force constant of 150 N/m, and the spring is compressed by 15cm, how far up the ramp will the ball travel when it is released? Assume that there's no friction along the path.
4. A box is released from rest at the top of an 18cm tall ramp. If the box is moving at 1 m/s when it reaches the bottom of the ramp, how much work did friction do on the box during its descent?
5. A 1750kg car starts at the bottom of a 20m tall hill traveling at 15 m/s. During the trip up the hill, air resistance does -50 kJ of work on the car, and friction does an additional -120 kJ of work on the car. What is the minimum amount of work the engine must do in order for the car to reach the top of the hill?
- 6.

Chapter 8: Momentum

1. A 5kg mass moving at 13 m/s, to the right, collides with a 7kg mass moving at 10 m/s, to the left. If the 7kg mass recoils at 12 m/s, to the right, in what direction and at what speed does the 5kg mass move after the collision?
2. A 50g piece of clay, rolling at 25 cm/s, collides with a 75g piece of clay, initially at rest. After the collision, the two pieces of clay stick together. How fast does the new lump of clay move?
3. A 1500kg car, moving to the right at 25 m/s, collides with a 3200kg truck, moving to the left at 17 m/s. If the car fuses together with the truck during the collision, so their wreckage moves as one, how much heat is released during this collision?
4. A 15kg mass moves to the right at 10m/s, while a 12kg mass moves to the left at 15m/s. If the masses collide elastically, what is:
 - (a) The final speed, and direction, of the 15kg mass?
 - (b) The final speed, and direction, of the 12kg mass?
 - (c) The amount of heat released during the collision?
- 5.

ANSWERS:

Chapter 5

1. b
2. 16.2N
3. 0.37
4. Static, 20N
- 5.

Chapter 6

1. 212.8J, 1420N
2. 2.64J, 0J, -1.13J
3. (d)
4. -24.3J
- 5.

Chapter 7

1. (d)
2. 7.63 m/s
3. 3.1m
4. -4.55J
5. 323 kJ
- 6.

Chapter 8

1. 17.8 m/s, to the left
2. 10 cm/s
3. 900 kJ
4. 12.2 m/s to the left, 12.8 m/s to the right, 0 J
- 5.