

PHYS2350 EV1 Fall 2017 Exam 2 Review Questions

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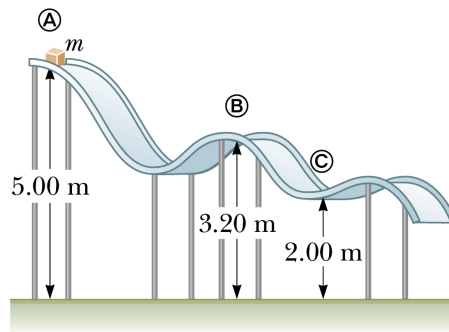
Chapter 5: Circular Motion & Gravity

1. A tetherball attached to a rope of 30cm length takes 1.5s to make one revolution. What is the linear speed of the tetherball?
2. A rollercoaster goes through a loop-the-loop, reaching a speed of 20m/s at the top of the loop. If the loop has a radius of 15m, and the rollercoaster car has a mass of 600kg including passengers, what is the magnitude of the normal force on the car at the top of the loop?
3. A satellite in orbit around the Earth feels weightless because:
 - (a) It's too far from Earth to feel gravity
 - (b) The gravitational force from Earth is balanced by the centrifugal force on the satellite
 - (c) The gravitational force from Earth is balanced by the centripetal force on the satellite
 - (d) The acceleration due to gravity matches the centripetal acceleration of the satellite
4. A 40kg child is on a swing supported by two 3m chains. At the child's lowest point in the swing, the tension in each chain is 350N. What is the speed of the child at the lowest point?
5. If the mass of Earth was doubled, what would the period of the orbit around the Sun be?
6. The weight of a 100kg man on a planet with one-half the mass and twice the radius of Earth would be what?
7. Two identical satellites, A and B, are in orbit around Earth. Satellite A is in orbit at a distance of r from the center of the Earth, while satellite B is in orbit at a distance of $2r$ from the center of the Earth. Compared to the centripetal force on satellite A, the centripetal force on satellite B is what?
8. In an x, y -coordinate system, a 2kg mass lies at the origin, a 1.2kg mass lies at (1m, 0), and a 2.5kg mass lies at (0, 0.5m). What is the magnitude and direction of the net gravitational force on the mass at the origin due to the other two masses?

Chapter 6: Work & Energy

1. A 10kg box is pushed up a 30° , frictionless incline at a constant speed. After the box is pushed 30cm, how much work has been done by the pushing force, by gravity, and by the normal force? What is the total work done?

- A box of mass m needs to be raised from the floor to a height of h . Which of the following methods requires less work to raise the box: pushing the box up an incline at a constant speed or raising the box straight up at a constant speed?
- A weightlifter lifts a 80kg barbell from the front of his hips to his collarbone, about 0.7m. During each cycle (a lift up and then a lowering down), what is the total work done on the barbell? In order to move the barbell at a constant velocity, how much work is done by the weightlifter each time he lifts the barbell?
- A block of mass m is dropped from the fourth floor of a building, and hits the ground with a speed of v . From what floor should it be dropped to double the speed with which it hits the ground?
- A 5kg box slides along a floor at a speed of 10m/s when suddenly it encounters a patch of friction that slows it to a stop **over a distance of 10m**. How much work was done on the box due to friction? What is the coefficient of kinetic friction between the box and the floor?
- A 10kg cannonball is fired at an initial speed of 50m/s at a launch angle of 30° . What is the initial kinetic energy of the cannonball? What is the kinetic energy of the cannonball at the peak of its trajectory? How much potential energy did the cannonball gain during the rise to the peak?
- If the object in the figure below is released from rest at point A, what will its speed be at point B? What will its speed be at point C? Assume there's no friction along the slide.



- Referring again to the figure above, if the object has a mass of 5kg, and is released from rest at point A, but this time there is a bit of friction doing -10J of work along the way, what will be the speed of the object at point B?
- On the moon Io of Jupiter, the acceleration due to gravity is about 1.81m/s^2 . Io is extremely volcanic, and plumes of ash can reach as high as 500km above the surface. At what speed must the ash be ejected from a volcano on Io to reach that height? What about on Earth?

Chapter 7: Momentum

- A 3kg rifle is at rest with a 100g bullet loaded. If the bullet exits the barrel at 300m/s, at what speed does the rifle recoil?
- A 10kg block slides across a frictionless floor at 25m/s when suddenly a 2kg box falls on top of it. At what speed will the boxes move after the smaller box has landed?

3. While you're fixing a roof, a shingle slides off and falls to the ground. During the fall, which of the following is true?
 - (a) Its momentum and energy are conserved
 - (b) Its momentum is conserved, but not its energy
 - (c) Its energy is conserved, but not its momentum
 - (d) Neither its energy nor its momentum are conserved
4. A 3000kg truck moving at 10m/s collides with a 2000kg car moving at 15m/s, resulting in the cars being smushed together and the wreckage sliding at 2m/s. Which vehicle experiences the greater change in momentum during the collision? Which vehicle experiences a greater change in kinetic energy?
5. A collision occurs between two objects. Object 1 has a mass m_1 and object 2 has a mass m_2 . During the collision, which of the following statements about the forces and accelerations experienced by the masses is true?
 - (a) $F_1 = F_2$ and $a_1 = \frac{m_2}{m_1}a_2$
 - (b) $F_1 = \frac{m_2}{m_1}F_2$ and $a_1 = \frac{m_2}{m_1}a_2$
 - (c) $F_1 = \frac{m_2}{m_1}F_2$ and $a_1 = a_2$
 - (d) $F_1 = F_2$ and $a_1 = a_2$
6. A 2kg ball is moving horizontally at a speed of 20m/s when it bounces off a wall. If the ball leaves the wall moving horizontally at 15m/s, what was the change in the ball's momentum?
7. A 5kg mass is moving in the $+x$ -direction at a speed of 15m/s when it collides with a 3.5kg mass moving in the $-x$ -direction at a speed of 3m/s. If the collision is elastic, what are the speeds and directions of each mass after the collision?