College Admission

AP-Physics
AP Physics Exam (Advanced Placement Exam)

Questions & Answers PDF

For More Information:

https://www.certswarrior.com/

Features:

- 90 Days Free Updates
- 30 Days Money Back Guarantee
- Instant Download Once Purchased
- 24/7 Online Chat Support
- Its Latest Version

Latest Version: 6.0

Question: 1

A force of 25.0 N pulls three blocks connected by a string on a frictionless surface. What is the tension in the rope between the 4.0-kg block and the 2.0-kg block?

A. 0 N
B. 11.1 N
C. 16.7 N
D. 25 N

Answer: B

Explanation:

Using Newton's second law $F = ma$, the acceleration of all three blocks, which have a combined mass of 9 kg, is $a = \frac{25\text{ N}}{9\text{ kg}} = 2.78\text{ m/s}^2$. The force pulling the rear block is $F = ma = 4\text{ kg} \times 2.78\text{ m/s}^2 = 11.1\text{ N}$. Another way of thinking of this is the tension represents $\frac{4}{9}$ of the total force, since the total mass is 9 kg and the rear block has a mass of 4 kg. This must equal the tension on the rope pulling on that block. Answer C is the tension of the string connecting the 3 kg and 2 kg masses. Answer D is the tension on the rope pulling all 3 masses.

Question: 2

A piece of art of mass 200 kg is suspended from two nails so that the angle the hanging wires make is 40˚ with the horizontal. What is the tension in the hanging wires? (Note: sin 40˚ = 0. 6428 and cos40˚ = 0. 7660).

A. 1,279 N
B. 1,525 N
C. 1,960 N
D. 3,049 N

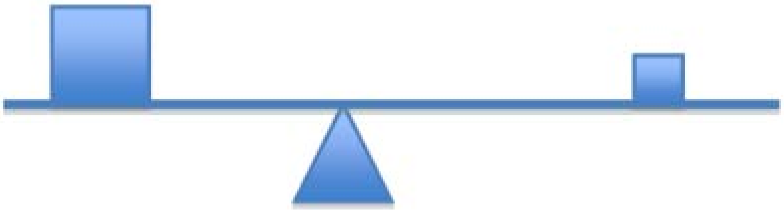
Answer: B

Explanation:

The weight of the art is 200 kg × 9.8 m/s² = 1,960 N. This is the total force pulling DOWN on the wires. However, the tension acts along a 40° angle, and the vertical force is $T \sin\theta$. However, there are two ends to the wire, which splits the tension, meaning the weight is spread across $2T \sin\theta$. So $2T \sin\theta = w$. Therefore, $T = \frac{1}{2} \times \frac{1{,}960\ \text{N}}{\sin(40°)} = 1{,}525$ N. Note: There's also a horizontal component to the tension forces, each expressed as T cos $^{\theta}$. The net force of the left and right tensions is zero. Answer A is calculated using the cos(40˚) instead of sin(40˚).

Question: 3

Two unequal masses are balanced on a fulcrum using a mass less bar, as shown below. If both masses are shifted towards the fulcrum so that their distances from the fulcrum are one-half the original distance, what happens to the masses?



A. The heavier mass will tilt downward.
B. The masses will remain balanced.
C. Cannot be determined from the information given.
D. The lighter mass will tilt downward.

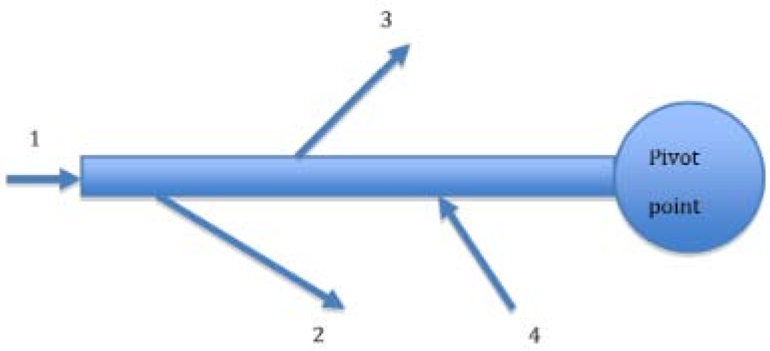
Answer: B

Explanation:

The torque acting on an object is the force acting on the object (in this case, its weight = mg) times its distance from the pivot point. Here, the masses and the bar are balanced, so the net torque is 0 N × m. This means the clockwise torque is equal and opposite to the counter clockwise torque ($m_1 g d_1 = m_2 g d_2$). Dividing the distance in half would only add a factor of $\frac{1}{2}$ to both sides of this equation. Since this affects both sides equally, the net torque is still zero when both distances are halved. C would be the correct answer if the mass of the bar was not zero.

Question: 4

Which of the forces depicted below produces a counter-clockwise torque around the pivot point?



A. 1
B. 2
C. 3
D. 4

Answer: B

Explanation:
Clockwise is the direction the hands of a clock rotate when looking at the clock, so a counterclockwise torque would require a force that pushes or pulls down on the lever. The pivot point is the axis of rotation. We don't care about the components of these forces that push either to the left or right, since these components do not produce any torque. Force I is directed into the axis, so it produces no torque. Forces 3 and 4 both push up on the lever. The only force producing a counter-clockwise rotation is Force 2.

Question: 5

You blow up a rubber balloon and hold the opening tight with your fingers. You then release your fingers, causing air to blow out of the balloon. This pushes the balloon forward, causing the balloon to shoot across the room. Which of Newton's laws best explains the cause of this motion?

A. Newton's First Law
B. Newton's Second Law
C. Newton's Third Law
D. Newton's Fourth Law

Answer: C

Explanation:
All three laws of motion are operating, but the third law (forces come in equal and opposite pairs) best explains the motion. The first law (inertia) is shown from the fact that the balloon doesn't move until a force acts upon it. The second law (F = ma) is shown because you can see the force and the acceleration. The force comes from the contraction of the rubber balloon. The stretched rubber exerts a force on the air inside the balloon. This causes the air to accelerate in accordance with the second law. You can't see this acceleration because the air is invisible and

because it is all the air in the room that the balloon is exerting a force on. However, the air in the room exerts an equal and opposite force on the balloon (this is Newton's third law), which causes the balloon to accelerate in the direction it did.

Question: 6

Which has a greater moment of inertia about an axis through its center: a solid cylinder or a hollow cylinder? Both cylinders have the same mass and radius.

A. Solid cylinder
B. Hollow cylinder
C. Both have the same moment of inertia.
D. It depends on how quickly the cylinders are rolling

Answer: B

Explanation:

The moment of inertia of a point mass, m, about any axis is given by mR^2, where R is the distance from the axis. The moment of inertia of a solid object is calculated by imagining that the object is made up of point masses and adding the moments of inertia of the point masses. The average radius of the particles in a hollow cylinder will be R (all the mass is at radius R). For a solid cylinder, however, the average radius is less than R, meaning the overall moment of inertia will be smaller. The moment of inertia of a cylinder of thickness $R_2 - R_1$, where R_1 and R_2 are the inner and outer radii, respectively, is calculated by $\frac{1}{2}m({R_1}^2 + {R_2}^2)$. For a solid cylinder, $R_1 = 0$ meters. For a hollow cylinder, $R_1 = R_2$.

Question: 7

Astronauts in orbit are sometimes considered to be "weightless." Consider the three propositions about weightlessness and determine which ones are true.
I. Weightlessness occurs in outer space because the force of gravity becomes negligible.
II. Weightlessness occurs when a ski jumper makes a jump.
III. Weightlessness occurs when you roll a baseball on the ground.

A. I only.
B. II only.
C. I and II.
D. I, II and III.

Answer: B

Explanation:
The phenomenon known as weightlessness is caused by an object being in free fall. An object in space still experiences a gravitational force due to the earth, but if that object is in orbit, it's effectively free falling around the earth, which causes it to experience weightlessness. Here, proposition I is wrong because you have to be pretty far away from a star for gravity to become

negligible. In fact objects only stay in orbit because the earth's gravity pulls on them and causes them to change direction. This means the usual experience of weight is lost, as you can see by the floating objects and people inside an orbiting spaceship. The same thing happens to a ski jumper, who is in free fall after he or she jumps. If the jumper is carrying a rock, for example, that rock will feel weightless while the jumper is in the air. A rolled baseball is not in freefall and does not experience weightlessness.

Question: 8

Two cars driving in opposite directions collide. If you ignore friction and any other outside interactions, which of the following statements is always true?

A. The total momentum is conserved.
B. The sum of the potential and kinetic energy is conserved.
C. The total velocity of the cars is conserved.
D. The total impulse is conserved.

Answer: A

Explanation:
In a closed system (when you ignore outside interactions), the total momentum is constant and conserved. The total energy would also be conserved, although not the sum of the potential and kinetic energy. Some of the energy from the collision would be turned into thermal energy (heat) for example. Nor is the total velocity conserved, even though the velocity is a component of the momentum, since the momentum also depends on the mass of the cars. The impulse is a force over time that causes the momentum of a body to change. It doesn't make sense to think of impulse as conserved, since it's not necessarily constant throughout a collision.

Question: 9

Impulse is measured as the change in an object's momentum. Which statement is correct about the impulse on a ball rolling down a hill? Ignore air resistance and friction.

A. The impulse is constant.
B. The impulse only exists for a short time.
C. The units of impulse are joules per second.
D. The object's impulse increases.

Answer: D

Explanation:
Impulse is the change in an object's momentum (mv), which is in units of kg x m/s. An objeds impulse can change, depending on the forces acting upon it. For a ball rolling down a hill, gravity provides a constant force, which causes the ball to accelerate. This creates an impulse that increases as the ball gets faster and faster. This impulse does not exist for a short time, but will continue as long as the ball is accelerating.

Question: 10

Suppose a moving railroad car collides with an identical stationary car and the two cars latch together. Ignoring friction, and assuming no deformation on impact, which of the following statements is true?

A. The speed of the first car decreases by half.
B. The collision is elastic.
C. The speed of the first car is doubled.
D. There is no determining the final speed because the collision was inelastic.

Answer: A

Explanation:

A collision is considered elastic when neither object loses any kinetic energy. Since the cars latch together, this can't be the case. You could prove this by calculating the cars' kinetic energy: $KE = \frac{1}{2}mv^2$. If the railroad cars had bumpers instead of couplers, the moving car would stop and transfer all its momentum and kinetic energy to the stationary car, causing an elastic collision. In a closed system like this one, however, the conservation of momentum is an absolute law, where an object's momentum is its mass times its velocity. There are no external forces acting on the two cars. The only forces are between the two cars themselves. The momentum before the collision is the same as the momentum after the collision: $mv_{initial} + m\left(0\,\frac{\text{m}}{\text{s}}\right) = mv_{final} + mv_{final}$. So $mv_{initial} = 2mv_{final}$, and $v_{initial} = 2v_{final}$. Thus, the final velocity is half the initial velocity.