

Ap Physics 1 Response Practice Exam Answer Key

Ap Physics 1 Response Practice Exam Answer Key AP Physics 1 Response Practice Exam Answer Key A Comprehensive Guide to Success The AP Physics 1 exam is a challenging yet rewarding test that assesses your understanding of fundamental physics principles Mastering the content is crucial but equally important is the ability to apply those principles to solve complex problems and communicate your reasoning effectively This article provides a comprehensive answer key to a practice exam specifically designed to help you hone your response writing skills and excel on the actual exam

Practice Exam Structure This practice exam is structured to mirror the format of the real AP Physics 1 exam consisting of two sections

Multiple Choice This section tests your understanding of key concepts and your ability to apply them to various scenarios It includes 50 questions with a time limit of 90 minutes

Free Response This section challenges you to demonstrate your problemsolving abilities explain your reasoning and communicate your solutions effectively It includes 5 questions with a time limit of 90 minutes

Free Response Question Breakdown and Answer Key The following section provides a detailed breakdown of each free response question and its corresponding answer key Each answer will include

Question Statement The original question prompt

Key Concepts Relevant physics principles and equations

Solution Steps A stepbystep guide to solving the problem

Explanation Detailed reasoning for each step and justification of the answer

Tips for Success Strategies to improve your response writing and avoid common pitfalls

Question 1 Kinematics

Question Statement A car accelerates uniformly from rest to a speed of 20 ms in 5 seconds

a What is the cars acceleration

2 b How far does the car travel during this time

Key Concepts Uniform acceleration Constant rate of change in velocity Kinematic equations Equations relating displacement velocity acceleration and time

Solution Steps

a Using the equation $v = u + at$ where v is final velocity u is initial velocity a is acceleration and t is time $v = 20 \text{ ms}$ $u = 0 \text{ ms}$ $t = 5 \text{ s}$ Therefore $a = \frac{v - u}{t} = \frac{20 - 0}{5} = 4 \text{ ms}$

b Using the equation $s = ut + \frac{1}{2}at^2$ where s is displacement $u = 0 \text{ ms}$ $a = 4 \text{ ms}$ $t = 5 \text{ s}$ Therefore $s = 0 + \frac{1}{2}(4)(5)^2 = 50 \text{ m}$

Explanation

a The car starts from rest meaning its initial velocity is zero Acceleration is the rate of change of velocity which is calculated by dividing the change in velocity by the time taken

b The distance traveled is calculated using the displacement formula which accounts for both initial velocity and acceleration

Tips for Success Identify the relevant kinematic equations and variables Clearly label your units and use correct significant figures Show all your work in a logical and organized manner Explain your

reasoning clearly and concisely

Question 2 Forces and Newtons Laws

Question Statement A 10 kg block rests on a horizontal surface. The coefficient of static friction between the block and the surface is 0.4. A horizontal force of 30 N is applied to the block.

3 a Will the block move? Explain your answer.

b What is the magnitude of the force of static friction acting on the block?

Key Concepts Force of friction: Force that opposes motion between two surfaces in contact. Static friction: Force that prevents an object from moving when a force is applied. Maximum static friction: The maximum force that can be exerted by static friction before the object starts to move.

Newton's First Law An object at rest stays at rest and an object in motion stays in motion with the same speed and in the same direction unless acted upon by an unbalanced force.

Solution Steps

a The maximum force of static friction is calculated by $F_{\text{max}} = \mu_s N$ where μ_s is the coefficient of static friction and N is the normal force $N = mg$ where m is the mass of the block and g is the acceleration due to gravity 9.8 ms^{-2} . Therefore $F_{\text{max}} = 0.4 \times 10 \text{ kg} \times 9.8 \text{ ms}^{-2} = 39.2 \text{ N}$. Since the applied force 30 N is less than the maximum static friction force 39.2 N, the block will not move.

b The force of static friction is equal and opposite to the applied force which is 30 N.

Explanation

a The maximum static friction force represents the threshold beyond which the static friction force can no longer hold the block in place. Since the applied force is lower than this threshold, the block remains stationary due to the balance between the applied force and the static friction force.

b The force of static friction always acts opposite to the direction of the applied force, creating a balanced force that prevents motion.

Tips for Success Clearly define the forces acting on the block. Use free body diagrams to visualize the forces involved. Apply Newton's laws to analyze the forces and determine the net force. Be aware of the difference between static and kinetic friction.

Question 3 Energy and Work

Question Statement A 2 kg block is released from rest at the top of a frictionless ramp that is 4.5 meters long and inclined at 30 degrees to the horizontal.

a What is the potential energy of the block at the top of the ramp?

b What is the speed of the block at the bottom of the ramp?

Key Concepts Potential energy: Energy stored due to an object's position or configuration. Kinetic energy: Energy possessed by an object due to its motion. Conservation of energy: In a closed system, the total energy remains constant though it may be transformed from one form to another.

Solution Steps

a The potential energy of the block is calculated by $PE = mgh$ where m is the mass, g is the acceleration due to gravity, and h is the height of the block above the ground. $h = 4.5 \text{ m} \sin 30^\circ = 2.25 \text{ m}$. Therefore $PE = 2 \text{ kg} \times 9.8 \text{ ms}^{-2} \times 2.25 \text{ m} = 44.1 \text{ J}$.

b Using the conservation of energy principle: $PE_{\text{top}} = KE_{\text{bottom}}$. $PE_{\text{top}} = 44.1 \text{ J}$. Since the block starts from rest, $KE_{\text{top}} = 0 \text{ J}$. At the bottom of the ramp, $PE_{\text{bottom}} = 0 \text{ J}$. Therefore $KE_{\text{bottom}} = 44.1 \text{ J}$. Using the equation $KE = \frac{1}{2}mv^2$ where v is the speed, $44.1 \text{ J} = \frac{1}{2} \times 2 \text{ kg} \times v^2$. Solving for v , we get $v = 7 \text{ ms}^{-1}$.

Explanation

a The potential energy of the block is determined by its height above the ground. As the block is released, its potential energy is converted into kinetic energy as it moves down the ramp.

b The conservation of energy principle states that the total energy of the

system remains constant As the block descends its potential energy is converted into kinetic energy resulting in an increase in its speed

Tips for Success Clearly identify the types of energy involved in the system 5 Apply the conservation of energy principle to relate the different forms of energy Be careful with units and conversions Use appropriate equations to solve for the unknown quantities

Question 4 Momentum and Impulse

Question Statement A 0.5 kg ball moving at 10 m/s to the right collides head-on with a stationary 1 kg ball After the collision the 0.5 kg ball moves at 2 m/s to the left a What is the velocity of the 1 kg ball after the collision b What is the impulse experienced by the 0.5 kg ball during the collision

Key Concepts Momentum A measure of an object's mass in motion Impulse Change in momentum of an object Conservation of momentum In a closed system the total momentum remains constant even if collisions occur

Solution Steps a Using the conservation of momentum principle $p_{\text{initial}} = p_{\text{final}}$ $m_1 v_{1\text{initial}} + m_2 v_{2\text{initial}} = m_1 v_{1\text{final}} + m_2 v_{2\text{final}}$ $0.5 \text{ kg}(10 \text{ m/s}) + 1 \text{ kg}(0 \text{ m/s}) = 0.5 \text{ kg}(-2 \text{ m/s}) + 1 \text{ kg}v_{2\text{final}}$ Solving for $v_{2\text{final}}$ we get $v_{2\text{final}} = 6 \text{ m/s}$ to the right b The impulse experienced by the 0.5 kg ball is calculated by $\text{Impulse} = \Delta p = m \Delta v = 0.5 \text{ kg}(2 \text{ m/s} - 10 \text{ m/s}) = -4 \text{ N}\cdot\text{s}$ Therefore Impulse = 4 N·s

Explanation a The total momentum before the collision must equal the total momentum after the collision Since the 0.5 kg ball changes its velocity the 1 kg ball must gain a velocity to conserve the total momentum of the system b The impulse is the change in momentum experienced by the object The negative sign indicates that the impulse is in the opposite direction to the initial velocity of the 0.5 kg ball

Tips for Success 6 Clearly identify the system and the objects involved Use the conservation of momentum principle to analyze the collision Choose a positive direction and consistently apply it to all velocities Be aware of the relationship between momentum and impulse

Question 5 Rotational Motion and Torque

Question Statement A uniform rod of length 2 m and mass 3 kg is pivoted at one end A force of 10 N is applied perpendicularly to the rod at a distance of 1.5 m from the pivot point a Calculate the torque produced by the force b Calculate the angular acceleration of the rod

Key Concepts Torque A rotational force that tends to cause an object to rotate about an axis Moment of inertia A measure of an object's resistance to rotational motion Rotational kinematics Equations relating angular displacement angular velocity angular acceleration and time

Solution Steps a The torque produced by the force is calculated by $\tau = r F \sin \theta$ where F is the force r is the distance from the pivot point and θ is the angle between the force and the lever arm which is 90° in this case Therefore $\tau = 10 \text{ N}(1.5 \text{ m}) \sin 90^\circ = 15 \text{ N}\cdot\text{m}$ b The angular acceleration of the rod is calculated by $\tau = I \alpha$ where I is the moment of inertia and α is the angular acceleration The moment of inertia of a uniform rod about one end is $\frac{1}{3} m L^2$ where m is the mass and L is the length Therefore $I = \frac{1}{3}(3 \text{ kg})(2 \text{ m})^2 = 4 \text{ kg}\cdot\text{m}^2$ Hence $\alpha = \frac{\tau}{I} = \frac{15 \text{ N}\cdot\text{m}}{4 \text{ kg}\cdot\text{m}^2} = 3.75 \text{ rad/s}^2$

Explanation a The torque is a measure of the force's ability to cause rotation It depends on the magnitude of the force the distance from the pivot point and the angle between the force and the lever arm b The angular acceleration is the rate of change of angular velocity It is directly

proportional to the torque and inversely proportional to the moment of inertia 7 Tips for Success Clearly define the pivot point and the lever arm Understand the concept of moment of inertia and its dependence on mass distribution Use the correct equations for torque and angular acceleration Be careful with units and conversions Conclusion This practice exam and answer key provide a valuable resource for preparing for the AP Physics 1 exam By understanding the key concepts applying the correct problemsolving techniques and practicing your response writing skills you can confidently tackle the challenge of the exam and achieve success Remember to review and practice regularly focusing on the specific areas where you need improvement With dedication and effort you can master the fundamentals of physics and demonstrate your understanding on the AP Physics 1 exam

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physics is the science of how matter and energy interact and affect each other over time and space physics functions in an exciting dimension what we mean by this is that things keep changing in the

physics formula list 0 1 physical constants speed of light planck constant $3 \times 10^8 \text{ m/s}$

various branches of physics physics can be classified into various branches but classical physics is mainly concerned with energy and matter the traditional branches of classical physics are optics

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what is force push or pull of an object is considered a force push and pull come from the objects interacting with one another terms like stretch and squeeze can also be used to denote force in

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