Arizona State University (ASU) PHY101 Introduction to Physics Practice Exam (Sample)

Study Guide

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Questions

1. What occurs to the clay "blobs" when Dr. Hewitt turns around?
   A. They fall off completely
   B. They tend to stay where they were
   C. They move in the same direction
   D. They bounce up and down

2. Why is force considered a vector quantity?
   A. It acts only in one direction
   B. It has a magnitude and a direction
   C. It can change over time
   D. It is always positive

3. Which friction is typically greater: static friction or sliding friction?
   A. Static friction
   B. Sliding friction
   C. Both are equal
   D. Neither is relevant

4. How can you move an alphabet letter in a bowl of soup that is far away from you?
   A. By rotating the bowl clockwise
   B. By rotating the bowl counterclockwise
   C. By lifting one side of the bowl
   D. Neither rotation will work

5. What explanation did Copernicus provide for retrograde motion of the planets?
   A. Different orbital speeds of the planets
   B. Earth's rotation
   C. The influence of stars
   D. Gravity acting differently on each planet

6. What formula gives the acceleration due to gravity on Loput, given its mass and radius?

   A. g(2.1/0.80^2)

   B. g(5.6/1.7^2)

   C. g(12/2.8^2)

   D. g(8.3/4.1^2)

7. In a scenario where two ropes pull with equal tension, what is a critical factor affecting overall force?

   A. The angle of pull

   B. The weight of the object

   C. The surface friction

   D. The length of the ropes

8. How does an increase in distance from a pivot point affect rotational motion?

   A. It decreases the speed of rotation

   B. It has no effect on rotation

   C. It increases the rotational inertia

   D. It causes uniform motion

9. What happens to the upward force exerted on a man if the elevator is moving downward at a constant speed?

   A. The upward force is less than the man's weight

   B. The upward force is equal to the man's weight

   C. The upward force is greater than the man's weight

   D. The upward force can vary

10. What happens to your motion due to inertia when you leave the ground while jumping?

   A. You will come to a stop immediately

   B. Your body will fall back to the ground

   C. You continue moving at your previous speed

   D. You will move backward

Answers

1. B
2. B
3. A
4. D
5. A
6. B
7. A
8. C
9. B
10. C

Explanations

1. What occurs to the clay "blobs" when Dr. Hewitt turns around?

A. They fall off completely

B. They tend to stay where they were

C. They move in the same direction

D. They bounce up and down

When Dr. Hewitt turns around, the clay "blobs" tend to stay where they were due to inertia, which is a fundamental concept in physics. Inertia is the property of matter that causes it to resist changes to its state of motion. According to Newton's First Law of Motion, an object at rest will stay at rest unless acted upon by a net external force. In this scenario, when Dr. Hewitt turns, his motion does not exert a force on the clay blobs that would cause them to move immediately with him. Instead, the blobs remain in their original position, illustrating the principle of inertia. They experience a delay in movement compared to Dr. Hewitt's action, which effectively demonstrates that objects in motion do not automatically follow another object simply because it is moving nearby.

2. Why is force considered a vector quantity?

A. It acts only in one direction

B. It has a magnitude and a direction

C. It can change over time

D. It is always positive

Force is classified as a vector quantity because it possesses both magnitude and direction. This dual characteristic is essential for fully describing the nature of forces in physical interactions. The magnitude indicates how strong the force is, while the direction informs us where the force is applied. For instance, when you push a box, the amount you push represents the magnitude, while the direction in which you push (e.g., to the right or upward) tells us how the box will move as a result of that force. Since different forces can have the same magnitude but act in different directions, simply knowing the strength of the force (magnitude) is insufficient to understand the total effect of the force applied. This combination of magnitude and direction is what differentiates vector quantities like force from scalar quantities, which only have magnitude.

3. Which friction is typically greater: static friction or sliding friction?

A. Static friction

B. Sliding friction

C. Both are equal

D. Neither is relevant

Static friction is typically greater than sliding friction due to the nature of the forces involved when an object is at rest versus when it is in motion. When an object is stationary, static friction works to prevent it from starting to move. This type of friction arises from the interactions at the microscopic level between the surfaces in contact, which can form interlocking asperities or adhesion points. Once the object begins to slide, it enters the realm of sliding friction, which is generally lower because the surfaces have already overcome the initial barriers to motion. In sliding friction, the contact points have less time to interlock compared to when the surfaces are stationary. This transition from static to sliding means that the force needed to maintain motion is less than that needed to initiate it. This difference is why static friction is often characterized as being greater than sliding friction, as it requires more force to overcome the initial resistance of the object being at rest.

4. How can you move an alphabet letter in a bowl of soup that is far away from you?

A. By rotating the bowl clockwise

B. By rotating the bowl counterclockwise

C. By lifting one side of the bowl

D. Neither rotation will work

In the scenario of moving an alphabet letter in a bowl of soup that is far away from you, simply rotating the bowl clockwise or counterclockwise will not effectively move the letter closer to you. When you rotate the bowl, the contents, including the letter, merely follow the movement of the bowl's surface but do not experience any translational shift towards the observer. Additionally, lifting one side of the bowl might cause the contents to shift due to gravity, but it will not guarantee that the letter moves closer to you. The letter could slide in various directions, potentially moving away rather than towards you. The correct understanding here is that without physical interaction, such as reaching into the soup to directly manipulate the letter, neither rotation nor tilting the bowl will accomplish the goal of moving the letter closer. Therefore, the conclusion that neither rotation will work aligns with the mechanics of motion and the limitations of the actions described.

5. What explanation did Copernicus provide for retrograde motion of the planets?

A. Different orbital speeds of the planets

B. Earth's rotation

C. The influence of stars

D. Gravity acting differently on each planet

Copernicus explained retrograde motion as a result of the different orbital speeds of the planets. According to his heliocentric model, planets closer to the Sun, like Earth, move faster in their orbits compared to those that are further away, such as Mars. As Earth overtakes a planet in its orbit, that planet appears to move backwards, or in retrograde motion, against the background of the stars. This explanation was revolutionary at the time, as it shifted the perspective from an Earth-centered (geocentric) view of the universe to one that recognized the Sun as the center of planetary motion. By understanding that the apparent backward motion of a planet is not an actual change in its orbit but rather a result of the relative speeds of the orbits of Earth and the other planet, Copernicus provided a clearer and more accurate model of celestial mechanics. This insight laid the groundwork for the later development of modern astronomy.

6. What formula gives the acceleration due to gravity on Loput, given its mass and radius?

A. g(2.1/0.80^2)

B. g(5.6/1.7^2)

C. g(12/2.8^2)

D. g(8.3/4.1^2)

The correct formula for calculating the acceleration due to gravity on a celestial body, such as Loput, is derived from Newton's law of universal gravitation. The formula is: \[g = \frac{G \cdot M}{r^2} \] where \(g \) is the acceleration due to gravity, \(G \) is the gravitational constant, \(M \) is the mass of the celestial body, and \(r \) is its radius. In analyzing the question choices, each option presents a version of the gravitational acceleration scaled by \(g \), where the term in the parentheses represents a ratio of mass to the square of the radius. The goal is to ensure that the ratio of mass to radius squared aligns with the specific values provided. For the chosen answer, the mass of Loput is given as 5.6 and its radius is 1.7. According to the formula, the acceleration due to gravity would be proportional to \(\frac{5.6}{1.7^2} \). This aligns correctly with the fundamental principles of gravitation, confirming that this proportionality holds for Loput. Thus, when we compare the ratio's formula with the choices and notice that choice B clearly

7. In a scenario where two ropes pull with equal tension, what is a critical factor affecting overall force?

A. The angle of pull

B. The weight of the object

C. The surface friction

D. The length of the ropes

The angle of pull is a critical factor affecting the overall force in a scenario where two ropes apply equal tension. When forces are applied at an angle, they can be resolved into their horizontal and vertical components. The resultant force that actually contributes to moving an object depends on these components. For instance, when two ropes pull at angles away from a central point, their horizontal components can either work together to produce a greater net force or oppose each other, which reduces the overall effectiveness of the pull. If the angles of pull were to change, the resultant force could significantly increase or decrease. This is crucial in determining the effectiveness of the tension in moving an object. In contrast, while the weight of the object, surface friction, and the length of the ropes matter in the context of the overall system, they do not directly influence the effective force caused by the angles at which the ropes pull. The angle of pull directly influences how effectively the tension is used to move the object.

8. How does an increase in distance from a pivot point affect rotational motion?

A. It decreases the speed of rotation

B. It has no effect on rotation

C. It increases the rotational inertia

D. It causes uniform motion

An increase in distance from a pivot point significantly affects rotational motion by increasing the rotational inertia, also known as the moment of inertia. Rotational inertia is a measure of how much an object resists changes to its rotational motion when a torque is applied. The greater the distance from the pivot point to where the mass is located, the more difficult it is to change that object's rotational speed. This concept is essential in understanding how mass distribution affects rotational dynamics. For example, consider a rotating figure skater who draws their arms in closer to their body; they spin faster because their rotational inertia decreases. Conversely, if they extend their arms, the distance from the pivot point increases, which raises their rotational inertia and consequently slows their spin. Hence, increasing the distance from the pivot point directly correlates with an increase in the rotational inertia and a subsequent impact on how easily an object can accelerate or decelerate in its rotation.

9. What happens to the upward force exerted on a man if the elevator is moving downward at a constant speed?

A. The upward force is less than the man's weight

B. The upward force is equal to the man's weight

C. The upward force is greater than the man's weight

D. The upward force can vary

When an elevator is moving downward at a constant speed, the forces acting on a man inside it can be analyzed using Newton's laws. In this scenario, the man experiences two primary forces: his weight, which acts downward due to gravity, and the upward force exerted by the elevator floor, which counteracts some of that weight. Since the elevator is moving at a constant speed, this indicates that it is in a state of dynamic equilibrium. In such a case, the acceleration of the system is zero, meaning that the total force acting on the man is also zero. According to Newton's first law, when an object is not accelerating, the forces must balance. Therefore, the upward force exerted on the man is exactly equal to his weight. This balance means he does not feel any net force acting on him, so he feels as if he is in a stationary position relative to the elevator, even as it moves downwards. Consequently, the correct understanding is that the upward force is equal to the man's weight.

10. What happens to your motion due to inertia when you leave the ground while jumping?

A. You will come to a stop immediately

B. Your body will fall back to the ground

C. You continue moving at your previous speed

D. You will move backward

When you leave the ground while jumping, your body's motion reflects the principle of inertia, which is described by Newton's first law of motion. This law states that an object in motion will remain in motion at a constant velocity unless acted upon by an external force. In the moment after your feet leave the ground, there are no forces acting on your body to change your horizontal motion—if you were moving forward before jumping, you will continue to move forward horizontally at that same speed. The upward force of your jump propels you into the air, but in the absence of additional forces, your horizontal velocity remains unchanged. Gravity will eventually act on you, pulling you back down, but during the initial phase of your jump, you maintain the speed at which you left the ground. This understanding of inertia illustrates that while gravity will pull you back down, the horizontal component of your velocity is maintained until you land. It's this concept that confirms the correctness of the selected answer, which highlights that your body will continue moving at the speed you had just before leaving the ground.