

PSU

Phys 105

Midterm Exam

Second Semester - Term 252

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خاص بالمشاركين فقط

Part 1 (10 Marks): 10 multiple choice questions, 1 mark each**Indicate the answer choice that best completes the statement or answers the question.**

Q1. Q2. Can an object have positive acceleration while its speed is decreasing?

- a) No, this is not possible.
- b) No, if acceleration is positive, the speed must increase.
- c) Yes, this is possible if the initial velocity is negative.
- d) Yes, this is possible if the initial velocity is zero.

Q2. Which of the following is a scalar quantity?

- a) Speed
- b) Velocity
- c) Displacement
- d) Acceleration

Q3. A professional golfer strikes a ball off a tee, launching it at an angle of 40° above the horizontal. Ignoring air resistance, which one of the following statements about the acceleration of the ball is correct while it is in the air?



- a) While the ball is in the air, its acceleration is zero.
- b) At the highest point of the ball's flight, its acceleration is instantaneously equal to zero.
- c) As the ball rises, its acceleration decreases from 9.81 m/s^2 to zero at the highest point.
- d) While the ball is in the air, its acceleration is 9.81 m/s^2 downward.

Q4. Under what condition(s) is an object in equilibrium?

- a) Only when it is moving with constant nonzero velocity
- b) When it is either at rest or moving with constant velocity
- c) When it is either moving with constant velocity or with constant acceleration
- d) Only when it is moving with constant acceleration

Q5. The position of an object is given as a function of time by $x = 7t - 3t^2$, where x is in meters and t is in seconds. What is the object's instantaneous velocity at $t = 3.0 \text{ s}$?

- a) -11 m/s
- b) -21 m/s
- c) -6.0 m/s
- d) 9.0 m/s

Q6. A car accelerates uniformly from an initial velocity of 7.2 km/h at a rate of 2.0 m/s^2 . How far does the car travel in 6.0 s ?

- a) 12 m
- b) 24 m
- c) 36 m
- d) 48 m

Q7. Vector $\vec{A}$ has a magnitude of 8.00 m, and vector $\vec{B}$ has a magnitude of 7.00 m. If their dot product $\vec{A} \cdot \vec{B}$ is 14.0, what is the angle between the directions of $\vec{A}$ and $\vec{B}$?

- a) 56.0°
- b) 75.5°
- c) 14.0°
- d) 15.0°

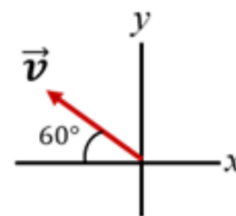
Q8. A helicopter is flying horizontally at a constant speed of 35.0 m/s at an altitude of 155 m. A wheel detaches and falls. Neglecting air resistance, with what speed does the wheel strike the ground?

- a) 65.3 m/s
- b) 56.5 m/s
- c) 45.5 m/s
- d) 70.1 m/s



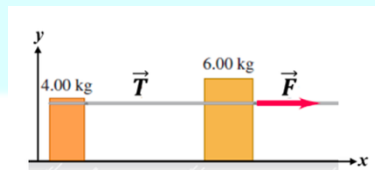
Q9. A velocity vector $\vec{v}$ has a magnitude of 20.0 m/s and makes an angle of 60° with the negative x-axis. What are the x- and y-components of the velocity?

- a) $\vec{v} = (-10.0 \text{ m/s})\hat{i} + (17.3 \text{ m/s})\hat{j}$
- b) $\vec{v} = (17.3 \text{ m/s})\hat{i} + (-10.0 \text{ m/s})\hat{j}$
- c) $\vec{v} = (-15.0 \text{ m/s})\hat{i} + (15.0 \text{ m/s})\hat{j}$
- d) $\vec{v} = (0 \text{ m/s})\hat{i} + (20.0 \text{ m/s})\hat{j}$



Q10. Two crates with masses 4.00 kg and 6.00 kg are placed on a frictionless horizontal surface and connected by a light rope. A woman applies a horizontal force F to the 6.00-kg crate, causing both crates to accelerate at 2.50 m/s^2 . Calculate the tension T in the rope connecting the two crates.

- a) 5.00 N
- b) 10.0 N
- c) 15.0 N
- d) 20.0 N

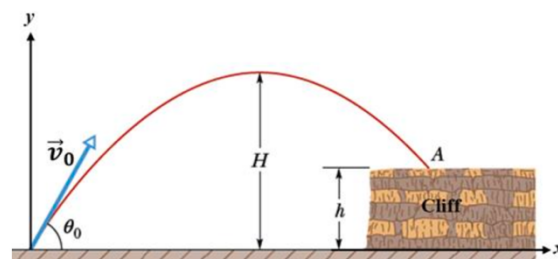


Part 2 (10 Marks):

Solve the following two problems. Show your detailed solution and include units.

Q1. (5.5 marks) A stone is thrown toward a cliff of height h with an initial speed of 51.0 m/s at angle $\theta_0 = 60.0^\circ$ above the horizontal (see figure).

The stone hits point A on the cliff 5.50 s after it is launched. Neglect air resistance.



a) (1.5 marks) Calculate the horizontal and vertical components of the projectile's initial velocity (v_{0x} and v_{0y}).

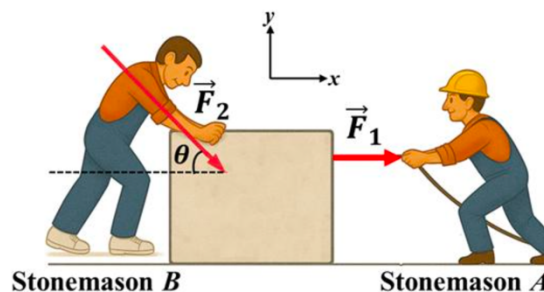
b) (1 mark) Determine the height h of the cliff.

c) (2 marks) Find the magnitude of the stone's velocity just before it strikes point A (at $t = 5.50 \text{ s}$).

d) (1 mark) Calculate the maximum height H reached above the ground.

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Q2. (4.5 marks) A marble block of $m = 11.0$ kg on a frictionless floor is acted upon by two stonemasons. The first stonemason (A), positioned on the right side, pulls horizontally on a rope attached to the block with a force (tension) of magnitude $F_1 = 12.0$ N. The second stonemason (B) pushes the block with a force of magnitude $F_2 = 40.0$ N at an angle of $\theta = 35.0^\circ$ above the horizontal.



a) (1.5 marks) Draw the free-body diagram for the block, showing all forces acting on it.

b) (1.5 marks) Calculate the acceleration of the block in the horizontal direction.

c) (1.5 marks) Determine the normal force exerted by the surface on the block.

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