## **MCAT Physics Style Examination**

Topics: 1D

2D Kinematics, Newton's Laws, Friction, Circular Motion

June 2, 2025

**Instructions:** Choose the single best answer for each question. Assume the acceleration due to gravity  $g = 10 \text{ m/s}^2$  where necessary, unless otherwise stated. Neglect air resistance unless specified.

## **Physics Questions**

1. A car starts from rest and accelerates uniformly to a speed of 20 m/s in 5 seconds. What is the distance covered by the car during this time?

- (A) 20 m
- (B) 50 m
- (C) 100 m
- (D) 200 m

2. A ball is thrown vertically upward with an initial velocity of 30 m/s. What is the maximum height reached by the ball?

- (A) 15 m
- (B) 30 m
- (C) 45 m
- (D) 90 m

3. A projectile is launched at an angle of  $45^{\circ}$  to the horizontal. At the highest point of its trajectory, which of the following is true regarding its velocity  $\vec{v}$  and acceleration  $\vec{a}$ ?

- (A) Both  $\vec{v}$  and  $\vec{a}$  are zero.
- (B)  $\vec{v}$  is zero, but  $\vec{a}$  is non-zero.
- (C)  $\vec{a}$  is zero, but  $\vec{v}$  is non-zero.
- (D) Both  $\vec{v}$  and  $\vec{a}$  are non-zero.

4. A cannonball is fired with an initial horizontal velocity of 50 m/s from a cliff 80 m high. How far horizontally from the base of the cliff does the cannonball land?

- (A) 100 m
- (B) 200 m
- (C) 250 m
- (D) 400 m

5. A passenger in a car that is moving at a constant velocity is not wearing a seatbelt. If the car suddenly brakes hard, the passenger will most likely:

- (A) Be thrown backward into the seat.
- (B) Continue to move forward relative to the car.
- (C) Be thrown forward and then immediately backward.
- (D) Be pressed firmly into their seat by the deceleration.

6. A 10 kg block is on a frictionless horizontal surface. A net horizontal force of 20 N is applied to the block. What is the magnitude of the acceleration of the block?

- (A)  $0.5 \text{ m/s}^2$
- (B)  $2.0 \text{ m/s}^2$
- (C)  $10 \text{ m/s}^2$
- (D)  $200 \text{ m/s}^2$

7. A person pushes a heavy crate across a rough horizontal floor at a constant velocity. Which of the following statements is true?

- (A) The force exerted by the person on the crate is greater than the force of friction on the crate.
- (B) The magnitude of the force of friction is equal to the magnitude of the force exerted by the person.
- (C) The net force on the crate is non-zero and in the direction of motion.
- (D) The normal force exerted by the floor on the crate is less than the weight of the crate.

8. A 5 kg box rests on a horizontal surface. The coefficient of static friction between the box and the surface is  $\mu_s = 0.6$ , and the coefficient of kinetic friction is  $\mu_k = 0.4$ . What is the minimum horizontal force required to start the box moving?

- (A) 20 N
- (B) 25 N
- (C) 30 N
- (D) 50 N

9. A 2 kg block is pulled by a horizontal force of 15 N across a rough horizontal surface where the coefficient of kinetic friction is  $\mu_k = 0.2$ . What is the magnitude of the acceleration of the block?

- (A)  $2.5 \text{ m/s}^2$
- (B)  $5.5 \text{ m/s}^2$
- (C)  $7.5 \text{ m/s}^2$
- (D)  $11.0 \text{ m/s}^2$

10. A 0.5 kg ball is attached to a string of length 1.0 m and swung in a horizontal circle at a constant speed of 4.0 m/s. What is the magnitude of the centripetal force acting on the ball?

- (A) 2 N
- (B) 4 N
- (C) 8 N
- (D) 16 N