

Name: _____ Date: _____

Predicting the Unseen: Advanced Kinematics for 10th Grade

Calculate terminal velocities and relative motion vectors within non-inertial frames of reference to solve complex trajectory challenges.

1. A drone is flying due North at 15 m/s relative to the air. A crosswind is blowing due East at 8 m/s. What is the magnitude of the drone's resultant velocity relative to an observer on the ground?

- A. 17 m/s
- B. 23 m/s
- C. 7 m/s
- D. 13 m/s

2. If an object's velocity-time graph is a horizontal line above the x-axis, the object's acceleration is non-zero and constant.

- A. True
- B. False

3. An experimental maglev train starts from rest and accelerates uniformly at 4.0 m/s^2 . The distance it covers during the 5th second of its motion is _____ meters.

- A. 50.0 m
- B. 32.0 m
- C. 18.0 m
- D. 8.0 m

4. A projectile is launched at an angle across level ground. At the peak of its trajectory, which of the following statements regarding its velocity (v) and acceleration (a) is true?

- A. $v = 0$, $a = 0$
- B. v is horizontal, $a = 0$
- C. v is horizontal, a is downward
- D. v is vertical, a is downward

5. A spacecraft decelerates from 100 m/s to 40 m/s over a displacement of 420 meters. The constant acceleration of the craft during this period is _____ m/s^2 .

- A. -5.0
- B. -10.0
- C. 10.0
- D. -14.2

6. In a vacuum, a heavy lead sphere and a light feather dropped from the same height will have the same instantaneous velocity at any point during their fall.

- A. True

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B. False

7. Two cars, A and B, are moving in the same direction. Car A travels at 25 m/s and Car B travels at 15 m/s. What is the velocity of Car A relative to Car B?

- A. 40 m/s
- B. 10 m/s
- C. -10 m/s
- D. 5 m/s

8. A particle moves such that its position is defined by $x = 3t^2 + 2t + 5$. The instantaneous velocity of the particle at $t = 3$ seconds is _____ m/s.

- A. 20
- B. 38
- C. 11
- D. 29

9. An object moving with a constant speed can still be undergoing acceleration.

- A. True
- B. False

10. A ball is thrown vertically upward with an initial speed of 29.4 m/s. Taking $g = 9.8 \text{ m/s}^2$, how much time passes before it returns to the thrower's hand?

- A. 3 seconds
- B. 9 seconds
- C. 6 seconds
- D. 1.5 seconds