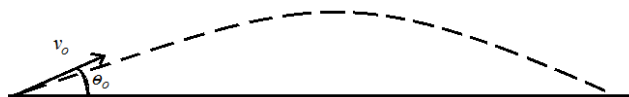
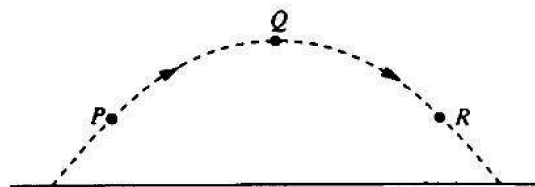


AP Physics 1: 2D Kinematics Test
Every question is worth 4 points

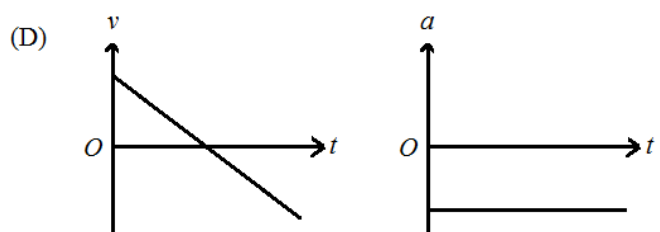
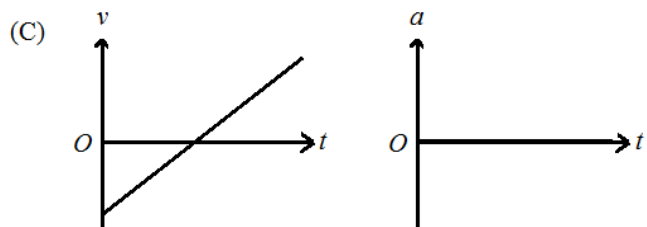
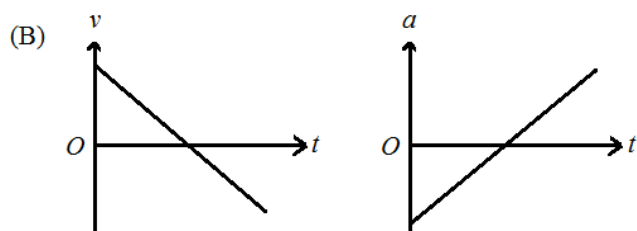
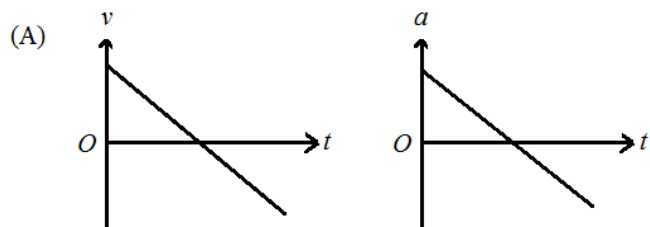


1. A projectile is fired with initial velocity v_0 and an angle θ_0 with the horizontal and follows the trajectory shown above. Which of the following pairs of graphs best represents the vertical components of the velocity and acceleration, v and a , respectively, of the projectile as functions of time t ?

Questions 2-3



A ball is thrown and follows the parabolic path shown above. Air friction is negligible. Point Q is the highest point on the path. Points P and R are the same height above the ground.



2. How do the speeds of the ball at the three points compare?

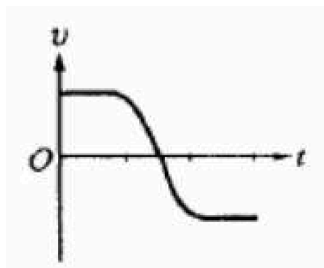
- (A) $v_P < v_Q < v_R$
- (B) $v_R < v_Q < v_P$
- (C) $v_Q < v_R < v_P$
- (D) $v_Q < v_P = v_R$

3. Which of the following diagrams best shows the direction of the acceleration of the ball at point P?

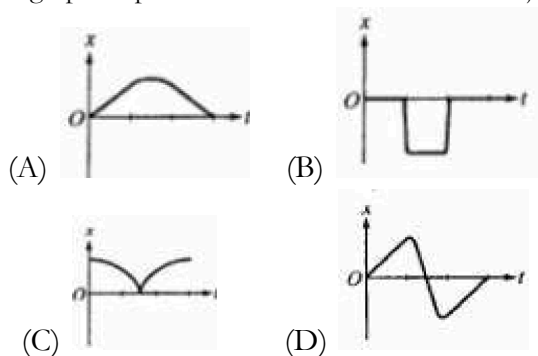
- (A)
- (B)
- (C)
- (D)

4. The velocity of a projectile at launch has a horizontal component v_h and a vertical component v_v . Air resistance is negligible. When the projectile is at the highest point of its trajectory, which of the following shows the vertical and horizontal components of its velocity and the vertical component of its acceleration?

	Vertical Velocity	Horizontal Velocity	Vertical Acceleration
(A)	v_v	v_h	0
(B)	0	v_h	0
(C)	0	0	g
(D)	0	v_h	g

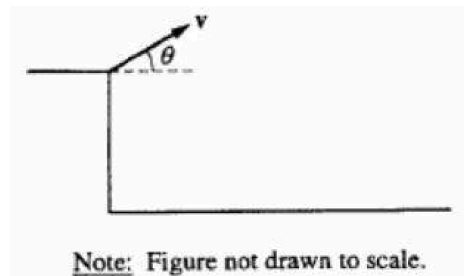


5. The graph above shows velocity v versus time t for an object in linear motion. Which of the following is a possible graph of position x versus time t for this object?



6. A student is testing the kinematic equations for uniformly accelerated motion by measuring the time it takes for light-weight plastic balls to fall to the floor from a height of 3 m in the lab. The student predicts the time to fall using g as 9.80 m/s^2 but finds the measured time to be 35% greater. Which of the following is the most likely cause of the large percent error?

- (A) The acceleration due to gravity is 70% greater than 9.80 m/s^2 at this location.
- (B) The acceleration due to gravity is 70% less than 9.80 m/s^2 at this location.
- (C) Air resistance increases the downward acceleration.
- (D) The acceleration of the plastic balls is not uniform.

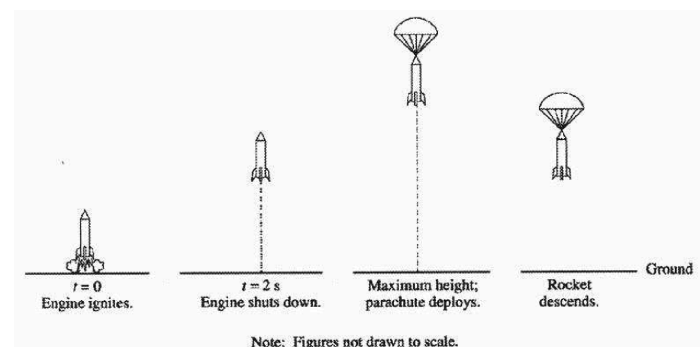


Note: Figure not drawn to scale.

7. An object is thrown with velocity v from the edge of a cliff above level ground. Neglect air resistance. In order for the object to travel a maximum horizontal distance from the cliff before hitting the ground, the throw should be at an angle θ with respect to the horizontal of

- (A) greater than 60° above the horizontal
- (B) greater than 45° but less than 60° above the horizontal
- (C) greater than zero but less than 45° above the horizontal
- (D) greater than zero but less than 45° below the horizontal

Questions 8-11



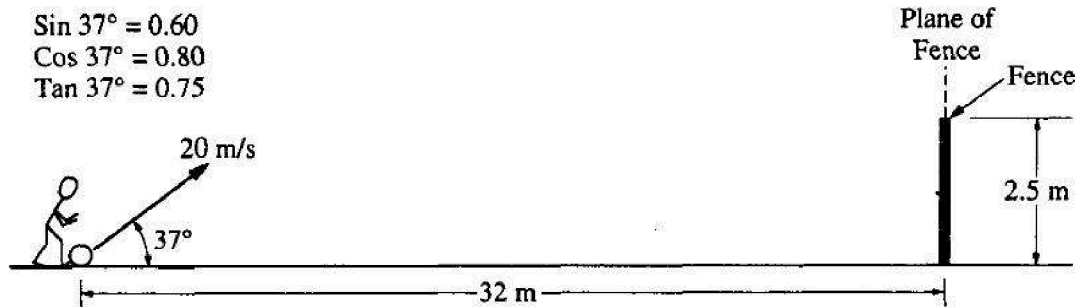
Note: Figures not drawn to scale.

A model rocket is launched vertically with an engine that is ignited at time $t = 0$, as shown above. The engine provides an upward acceleration of 30 m/s^2 for 2.0 s. Upon reaching its maximum height, the rocket deploys a parachute, and then descends vertically to the ground.

- 8. Determine the speed of the rocket after the 2 s firing of the engine.
- 9. What maximum height will the rocket reach?
- 10. At what time after $t = 0$ will the maximum height be reached?
- 11. Sketch a position time graph of the rockets motion from the time it is launched to when it reaches its maximum height.

AP Physics 1: 2D Kinematics Test
Section II: Free Response Questions
Time 15 minutes

Directions: Answer the following question, which is weighted according to the points indicated. The suggested time is about 15 minutes for answering the question. The parts within a question may not have equal weight. Show all your work in the pink booklet in the spaces provided after each part, NOT in this green insert



Note: Diagram not drawn to scale.

1. (8 points) A ball of mass 0.5 kilogram, initially at rest, is kicked directly toward a fence from a point 32 meters away, as shown above. The velocity of the ball as it leaves the kicker's foot is 20 meters per second at an angle of 37° above the horizontal. The top of the fence is 2.5 meters high. The ball hits nothing while in flight and air resistance is negligible.

- Determine the time it takes for the ball to reach the plane of the fence.
- Will the ball hit the fence? If so, how far below the top of the fence will it hit? If not, how far above the top of the fence will it pass?
- On the axes below, sketch the horizontal and vertical components of the velocity of the ball as functions of time until the ball reaches the plane of the fence.

