Questions

Chapter 4
Motion in Two and Three Dimensions

4-2 Average Velocity and Instantaneous Velocity
M1-061

A train traveling north at 20 m/s turns and then travels south at 20 m/s. The change in its velocity is:

A) 20 m/s south
B) 20 m/s north
C) 40 m/s south
D) 40 m/s north
E) 0 m/s

Answer C

4-2 Average Velocity and Instantaneous Velocity
M1-042

The position of a particle is initially ri = (3.0 m)i + (4.0 m)j, and 10 s later it is rf = -(3.0 m)i - (4.0 m)j (see Fig 2). What is its average velocity during this time interval ?

A) (-0.6i - 0.8j) m/s
B) (0.6i + 0.8j) m/s
C) 0 m/s
D) 10 m/s, at angle 45 degree
E) 10 m/s, at angle -45 degree

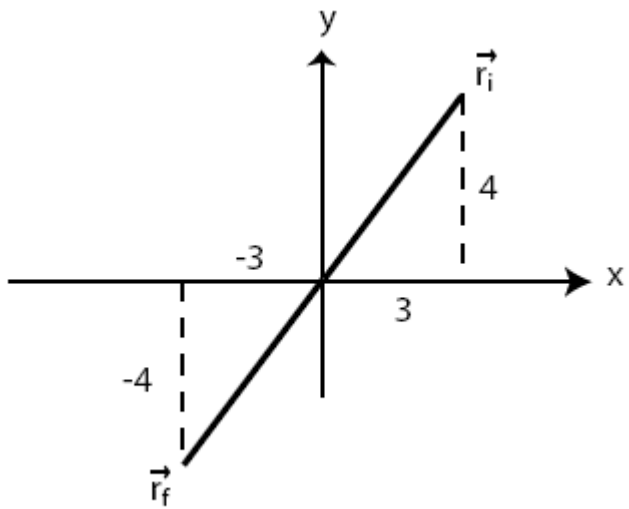

Figure 2

Answer A

4-3 Average Acceleration and Instantaneous Acceleration
M1-062

The position of a particle is given as $\vec{r} = (4.00t - t^2)\hat{i} + t^3\hat{j}$ where r is in meters and t is in seconds. The particle's acceleration at t = 0 s is:

A) $(-2.0\hat{i})\,m/s^2$
B) $(-2.0\hat{i} + 6.0\hat{j})\,m/s^2$
C) $(2.0\hat{i} + 3.0\hat{j})\,m/s^2$
D) $(6.0\hat{j})\,m/s^2$
E) zero

Answer A

4-4 Projectile Motion
M1-062

A projectile is fired horizontally at a speed of 15 m/s from the top of a tower. It lands on the ground at a horizontal distance of 45 m. The height of the tower is:

A) 22 m
B) 98 m
C) 32 m
D) 44 m
E) 88 m

Answer D

4-4 Projectile Motion
M1-061

An arrow is shot horizontally from a point P toward X as shown in Fig 2. It hits at a point Y, 0.20 s later. If the speed of the arrow at P is v_o = 11 m/s, the distance PX is:

A) 0.5 m
B) 1.0 m
C) 1.8 m
D) 0.1 m
E) 2.2 m

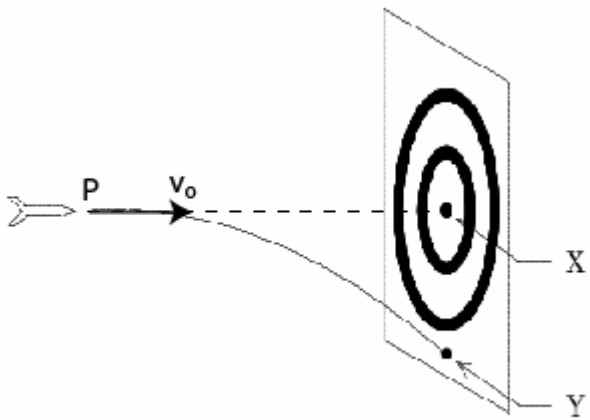

Figure 2

Answer E

4-4 Projectile Motion
M1-042

A ball is kicked from the roof of a building with an initial velocity of 25 m/s at an angle of 37 degrees to the horizontal (see Fig 3). How far from the base of the building will the ball land? (The height of the building is 40 m(

A) 133 m
B) 66 m
C) 34 m
D) 48 m
E) 95 m

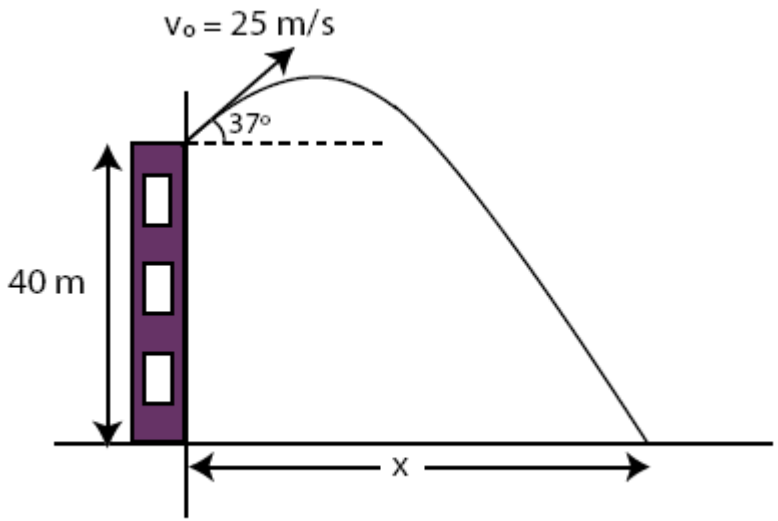

Figure 3

Answer E

4-4 Projectile Motion
M1-041

A projectile is thrown from a height H with a speed of 10.0 m/s at an angle of 30 degrees below horizontal as shown in Fig 10. Find H , if the horizontal distance x = 20.0 m .

A) 37.7 m
B) 98.0 m
C) 49.0 m
D) 20.0 m
E) 67.8 m

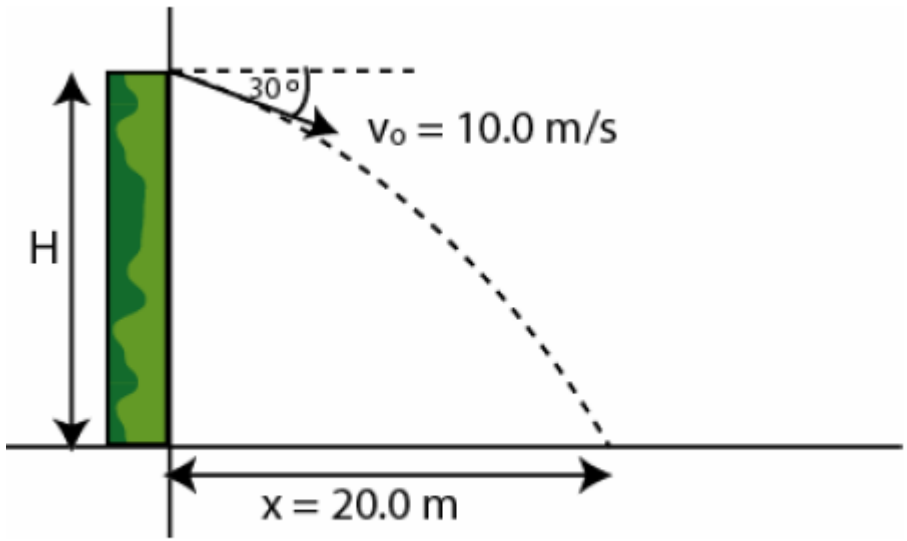

Figure 10

Answer A

4-4 Projectile Motion
M1-041

At t=0, a particle leaves the origin with a velocity of vo = (4i + 2j) m/s. After 20.0 s its velocity is v = (20i - 4j) m/s. Find its acceleration (assumed constant).

A) 0 m/s^2
B) (0.5i + 0.4j) m/s^2
C) (0.3i - 0.7j) m/s^2
D) (0.7i + 0.7j) m/s^2
E) (0.8i - 0.3j) m/s^2

Answer E

4-5 Uniform Circular Motion
M1-062

If the moon makes a complete circle around the earth in 29 *days* (= 2.5×10^6 *s*) and the distance between the center of earth and the center of the moon is 3.8×10^8 *m*, then the magnitude of centripetal acceleration on the moon is:

A) 2.4×10^{-3} m/s^2
B) 9.8 m/s^2
C) 1.6 m/s^2
D) 1.5×10^2 m/s^2
E) 6.1×10^{-4} m/s^2

Answer A

4-5 Uniform Circular Motion
M1-061

A stone is tied to a 0.50 m string and rotated at a constant speed of 2.0 m/s in a vertical circle. Its acceleration at the bottom of the circle is:

A) 32 m/s^2, up
B) 9.8m/s^2, down
C) 8.0m/s^2, down
D) 8.0 m/s^2, up
E) 9.8 m/s^2, up

Answer D

4-5 Uniform Circular Motion
M1-042

A satellite is placed in a circular orbit $8.0*10^3$ km from the center of the earth. If it takes the satellite 2.0 hours to complete one revolution, what is its centripetal acceleration?

A) 6.1 m/s^2 towards the center of the earth
B) 6.1 m/s^2 away from the center of the earth
C) 2.4 m/s^2 toward the center of the earth
D) 2.4 m/s^2 away from the center of the earth
E) almost zero

Answer A

4-5 Uniform Circular Motion
M1-041

A stone is tied to the end of a string and is rotated with constant speed around a horizontal circle of radius 1.0 m. If the magnitude of its acceleration is 225 m/s^2, What is the period (T) of the motion?

A) 5.0 s
B) 1.0 s
C) 0.028 s
D) 0.42 s
E) 2.0 s

Answer D

4-7 Relative Motion in Two Dimensions
M1-062

Two boats *A* and *B* leave seaport at the same time. Boat *A* travels at a speed of 10.0 *m/s* in the +*x* direction and boat *B* heads at an angle of 60.0º with the *x*-axis at a speed of 10.0 *m/s*. The velocity of *A* relative to *B* is

A) $(20.0\hat{i}-12.7\hat{j})$m/s
B) $(5.00\hat{i}-8.66\hat{j})$m/s
C) $(36.0\hat{i}-12.7\hat{j})$m/s
D) $(22.3\hat{i}-12.7\hat{j})$m/s
E) $(5.00\hat{i}-22.3\hat{j})$m/s

Answer B

4-7 Relative Motion in Two Dimensions
M1-061

A boy wishes to swim across a river from *A* to *B*. He can swim at 1.0 m/s in still water and the river is flowing at 0.50 m/s (Fig 3). At what angle θ should he be heading?

A) 45°
B) 30°
C) 60°
D) 20°
E) 70°

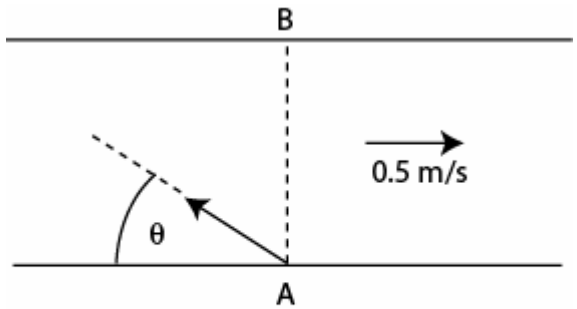

Figure 3

Answer C

4-7 Relative Motion in Two Dimensions
M1-042

A boat is sailing due North at a speed of 4.0 m/s with respect to the water of a river. If the water is moving due East at a speed of 3.0 m/s relative to the ground, what is the velocity of the boat relative to the ground?

A) 5.0 m/s making an angle 53 degrees east of north
B) 5.0 m/s making an angle 37 degrees east of north
C) 5.0 m/s east of north
D) 1.0 m/s west of south
E) 1.0 m/s west

Answer B

4-7 Relative Motion in Two Dimensions
M1-041

Car A travels with velocity (30 **j**) m/s (relative to the ground) and car B travels with speed of 50 m/s in a direction making an angle of 37 degrees with +x axis (relative to the ground) (see Fig 9). What is the velocity of car A relative to car B ?

A) (40**i**) m/s
B) (40**i**+30**j**) m/s
C) (-40**i**-60**j**) m/s
D) (-40**i**) m/s
E) (-40**i**-30**j**) m/s

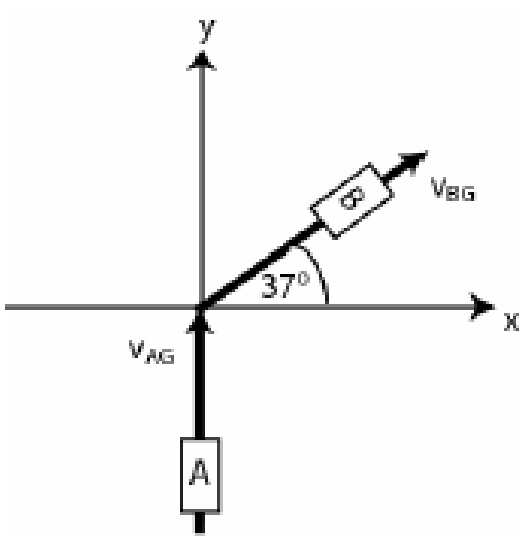

Figure 9

Answer D