Physics 101
First Major Exam 991

Q1 The position (x) of a particle moving along the x-axis depends on time (t) according to the equation:

x = a*t**2 - b*t**3

where: x is in meters and t is in seconds. What would be the dimensions of b?

(A) L/T**3
(B) L*T**3
(C) L/T**2
(D) 1
(E) 1/T**3

Q2 ch 1. How many molecules of water are there in a cup containing 250 cm**3 of water?

Molecular mass of H2O = 18 g/mole
Density of water = 1.0 g/cm**3
Avogadro s number = 6.02 * 10**23 molecules/mole

(A) 8.4 * 10**24
(B) 6.0 * 10**23
(C) 1.9 * 10**26
(D) 3.7 * 10**28
(E) 2.5 * 10**3

Q3 ch 1. Using the fact that the speed of light in space is about 3.00 * 10**8 m/s, determine how many miles light will travel in one hour.
(1 mile = 1.61 km)

(A) 6.71*10**8 miles
(B) 2.50*10**6 miles
(C) 5.40*10**9 miles
(D) 8.32*10**3 miles
(E) 4.83*10**2 miles

Q4 ch 2. A particle moves with a constant speed along the circumference of a circle of radius 5 m. It completes one revolution every 20 s. What is the magnitude of its average velocity during the first 5 s? Assume that at t = 0, the particle is on +x-ais (see figure 1).

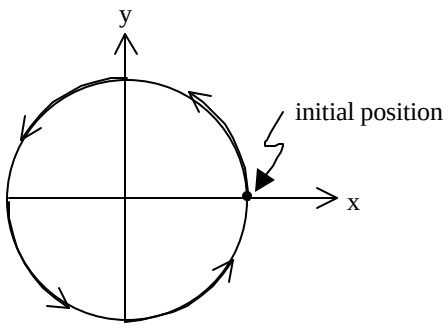

Figure 1

(A) sqrt(2) m/s
(B) 1/sqrt(2) m/s
(C) 1.57 m/s
(D) zero m/s
(E) 2.54 m/s

Q5 ch 2. A particle moves along the x-axis according to the equation:

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x = 50*t + 10*t**2
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where x is in m and t is in s. Calculate the instantaneous velocity of the particle at t = 3s.

(A) 110 m/s
(B) 50 m/s
(C) 20 m/s
(D) 240 m/s
(E) 90 m/s

Q6 ch 2. A baloon carrying a package is ascending (going vertically upward) at the rate of 12 m/s. When it is 80 m above the ground the package is released. How long does it take the package to reach the ground?

(A) 5.4 s
(B) 4.0 s
(C) 8.9 s
(D) 3.1 s
(E) 1.5 s

Q7 ch 3. If vector A = 28 i + 11 j and vector B (magnitude of B = 25) as shown in figure 2, what is the magnitude of the sum of these two vectors?

(A) 32
(B) 35
(C) 39
(D) 45
(E) 23

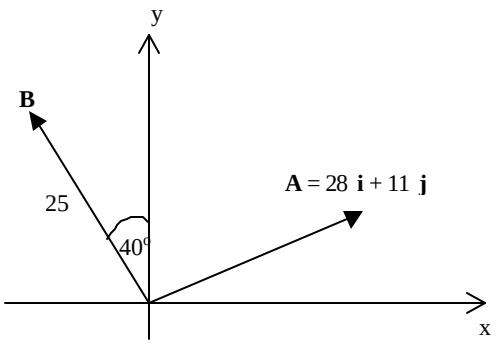


Figure 2

Q8 ch 3. Vector A = -6 i + 14 j. Find vector B whose magnitude is twice that of A and is opposite in direction to A.

(A) 12 i - 28 j
(B) -6 i + 14 j
(C) 3 i - 7 j
(D) - i + j
(E) 18 i - 12 j

Q9 ch 3. If vector A = 6 i - 7 j and vector B = -12 i + 10 j, what angle does vector C = 2*A - B make with +x-axis measured counterclockwise.

(A) 315 deg
(B) 45 deg
(C) 135 deg
(D) 90 deg
(E) 225 deg

Q10 ch 4. A particle moves in the x-y plane with a constant acceleration given by a = (-4 j) m/s**2. At t=0 its position is (10 i) m and its velocity is (-2 i + 8 j) m/s. What is the distance from the origin to the particle at t=2 s?

(A) 10 m
(B) 14 m
(C) 6.4 m
(D) 2.7 m
(E) 8.9 m

Q11 ch 4. A ball is thrown horizontally from the top of a building 100 m high. The ball strikes the ground at a point 65 m from the base of the building (see figure 3). What is the speed of the ball just before it strikes the ground?

(A) 47 m/s
(B) 33 m/s
(C) 29 m/s
(D) 56 m/s
(E) 73 m/s

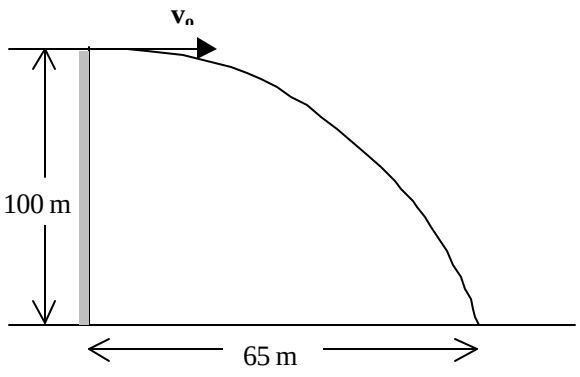


Figure 3

Q12 ch 4. A rock is projected from ground level as shown in figure 4. Four seconds later the rock is observed to srtike the top of a 10-m tall fence that is a horizontal distance of 75 m from the point of projection. Determine the speed (v0) with which the rock was projected.

(A) 29 m/s
(B) 26 m/s
(C) 15 m/s
(D) 10 m/s
(E) 18 m/s

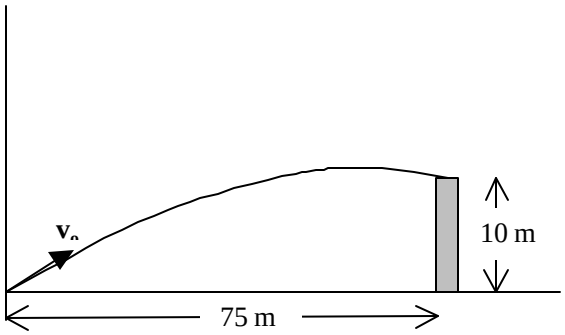


Figure 4

Q13 ch 4. A 140-m wide river flows with a uniform speed of 4.0 m/s toward the east. Starting from a point on the north bank it takes 20 s for a boat to cross the river with constant speed to a point directly across on the south bank. What is the speed of the boat relative to the water?

(A) 8.1 m/s
(B) 9.5 m/s
(C) 5.7 m/s
(D) 7.0 m/s
(E) 10. m/s

Q14 ch 5. In figure 5, if P = 6.0 N, what is the magnitude of the force exerted by block (2) on block (1)? Assume the surface is frictionless.

(A) 4.8 N
(B) 6.4 N
(C) 7.2 N
(D) 5.6 N
(E) 1.2 N

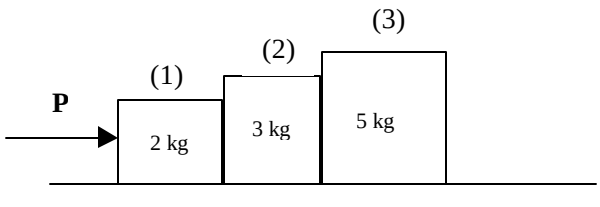


Figure 5

Q15 ch 5. A 3.0 kg block is pushed across a horizontal surface by a force F = 20 N as shown in figure 6. If the coefficient of kinetic friction between the block and the surface is 0.30, and Theta = 30 deg, what is the magnitude of the acceleration of the block?

(A) 1.8 m/s**2
(B) 2.1 m/s**2
(C) 3.3 m/s**2
(D) 1.1 m/s**2
(E) 5.8 m/s**2

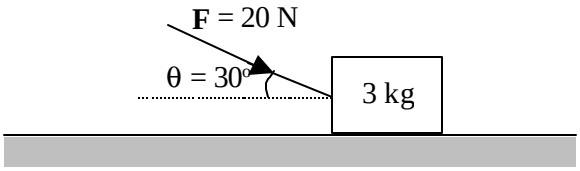


Figure 6

Q16 ch 5. A 2.0 kg object has a velocity of (4 i) m/s at t=0. A constant resultant force of (2 i + 4 j) N then acts on the object for 3.0 s. What is the magnitude of the velocity of the object at the end of the 3 s interval?

(A) 9.2 m/s
(B) 6.3 m/s
(C) 8.2 m/s
(D) 7.2 m/s
(E) 12 m/s

Q17 ch 5. Two masses M and 3M are connected by a light cord as shown in figure 7. The coefficient of kinetic friction between the surface and the 3M block is 0.20, and the coefficient of kinetic friction between the surface and the M block is 0.30. If F = 14 N and M = 1.0 kg, what is the magnitude of the acceleration of either block?

(A) 1.3 m/s**2
(B) 2.0 m/s**2
(C) 1.5 m/s**2
(D) 1.8 m/s**2
(E) 3.5 m/s**2

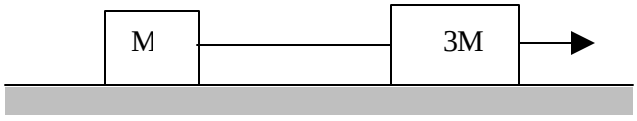
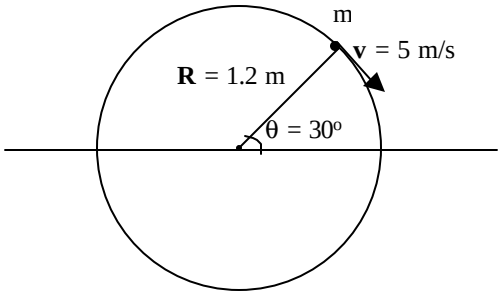


Figure 7

Q18 An object (attached to the end of a string) swings in a vertical circle of radius R = 1.2 m (see figure 8). At an instant when theta = 30 deg, the speed of the object is 5.0 m/s. Find the magnitude of the total acceleration of the object.

ch 6.

(A) 22.5 m/s2**
(B) 18.6 m/s2**
(C) 31.8 m/s2**
(D) 12.0 m/s2**
(E) 44.4 m/s2**



Q19 On a rainy day the coefficient of friction between the tires of a car and a level circular track is reduced to half its usual value. The ratio of the maximum safe speed on a rainy day for rounding the circular track to its usual value (when it is not raining) is

ch 6.

(A) 0.71
(B) 0.25
(C) 0.50
(D) 0.29
(E) 1.0

Q20 Which of the following statements is TRUE

6.

(A) Radial acceleration is due to the change in the direction of the velocity.
(B) Tangential acceleration is due to the change in the direction of the velocity.
(C) A projectile is fired at an angle 45 deg, the acceleration is zero at the maximum height.
(D) A projectile is fired at an angle 45 deg, the velocity is zero at the maximum height.
(E) The action and reaction forces always act on the same object.