Physics 101 Fall 2004: Test 1—Multiple-Choice Questions

1. A 500 kilogram sports car accelerates uniformly from rest, reaching a speed of 30 m/s in 6 seconds. During the 6 seconds, the car has traveled a distance of

(A) 15 m
(B) 30 m
(C) 60 m
(D) 90 m
(E) 180 m

2. A spring-loaded gun can fire a projectile to a height \( h \) if it is fired straight up (vertical). If the same gun is pointed at an angle of 45° from the vertical, what maximum height can now be reached by the projectile (ignore air resistance)?

\[
\frac{h}{4} \quad \frac{2\sqrt{2}}{2} \quad \frac{h}{2} \quad \frac{h}{\sqrt{2}} \quad h
\]

(A) \( \frac{h}{4} \)  
(B) \( \frac{2\sqrt{2}}{2} \)  
(C) \( \frac{h}{2} \)  
(D) \( \frac{h}{\sqrt{2}} \)  
(E) \( h \)

3. A target \( T \) lies flat on the ground 3 m from the side of a building that is 10 m tall, as shown below. A PHYS101 student rolls a ball off the horizontal roof of the building in the direction of the target. Air resistance is negligible. The horizontal speed with which the ball must leave the roof if it is to strike the target is most nearly

(A) \( \frac{3}{10} \) m/s
(B) \( \sqrt{2} \) m/s
(C) \( \frac{3}{\sqrt{2}} \) m/s
(D) 3 m/s
(E) \( 10 \sqrt{\frac{5}{3}} \) m/s
Questions 4 - 5

Three objects can only move along a straight, level path. The graphs below show the position $d$ of each of the objects plotted as a function of time $t$.

4. The magnitude of the speed of the object is increasing in which of the cases?

(A) II only
(B) III only
(C) I and II only
(D) I and III only
(E) I, II, and III

5. The sum of the forces on the object is zero in which of the cases?

(A) II only
(B) III only
(C) I and II only
(D) I and III only
(E) I, II, and III
6. The graph above shows the velocity $v$ as a function of time $t$ for an object moving in a straight line. Which of the following graphs shows the corresponding displacement $x$ as a function of time $t$ for the same time interval?

(A) 

(B) 

(C) 

(D) 

(E) 

7. A ball is tossed straight up from the surface of a small, spherical asteroid with no atmosphere. The ball rises to a height equal to the asteroid's radius and then falls straight down toward the surface of the asteroid. The acceleration of the ball at the top of its path is

(A) at its maximum value for the ball's flight
(B) equal to the acceleration at the surface of the asteroid
(C) equal to one-half the acceleration at the surface of the asteroid
(D) equal to one-fourth the acceleration at the surface of the asteroid
(E) zero
8. A figure of a dancer on a music box moves counterclockwise at constant speed around the path shown above. The path is such that the lengths of its segments, $PQ$, $QR$, $RS$, and $SP$ are equal. Arcs $QR$ and $SP$ are semicircles. Which of the following best represents the magnitude of the dancer's acceleration as a function of time $t$ during one trip around the path, beginning at point $P$?

(A) ![Graph A]

(B) ![Graph B]

(C) ![Graph C]

(D) ![Graph D]

(E) ![Graph E]
9. A light spring balance is attached on both ends to strings; the strings hang over frictionless pulleys and are each connected to 20 N weights as shown in the figure below. The reading on the scale will be closest to

(A) 0 N
(B) 10 N
(C) 20 N
(D) 40 N

10. A descending elevator of mass 1,000 kg is uniformly decelerated to rest over a distance of 8 m by a cable in which the tension is 11,000 N as shown below. The speed \( v_i \) of the elevator at the beginning of the 8 m descent is most nearly

(A) 4 m/s
(B) 10 m/s
(C) 13 m/s
(D) 16 m/s
(E) 21 m/s
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