

Student ID _____

STUDENT'S NAME: _____

PART I Multiple choice. (48% of the test grade). Enter all your answers in the scantron sheet.

1. Two balls are thrown from a height of 20 m. Ball one is thrown upward with a speed of 2 m/s. Ball two is thrown downward with a speed of 2 m/s. What is the ratio of the speed of ball one with the speed of ball two when each hits the ground?

- a. 1:2 b. 1:1 c. 2:1 d. 20:1 e. 1:20

2. A car is moving with a speed of 3.2 m/s when brakes are applied. If the car stops after it has moved 1.8 m, what was its average acceleration in m/s^2 ?

- a. -2.7 b. -2.8 c. -2.9 d. -3.0 e. -3.1

3. Two students A and B are pulling on the rope from opposite ends. While doing that they remain in rest. If Student A exerts the force $F=200N$, which of the following is true

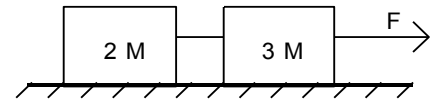
- a) Student B exerts force of magnitude 200N and the tension in the rope is 0
b) Student B exerts force of magnitude 200N and the tension in the rope is 200N
c) Student B exerts force of magnitude 200N and the tension in the rope is 400N
d) Student B exerts no force and the tension in the rope is 200N
e) None of the above

4. A particle moving in a circle is subjected to a total acceleration that has a magnitude of $8.2 m/s^2$. If its radial acceleration has a magnitude of $3.3 m/s^2$, what is the magnitude of its tangential acceleration in m/s^2 ?

- a. 8.8 b. 8.5 c. 7.7 d. 7.5 e. 7.3

5. When $M = 4 \text{ kg}$, the acceleration of the blocks is $1 m/s^2$. If the coefficient of friction between each block and the surface is 0.4, determine F in N. (Take $g=10m/s^2$)

- a. 120 b. 100 c. 80
d. 60 e. 40

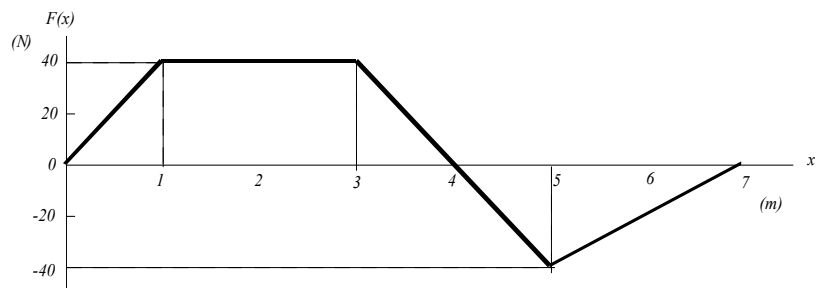


6. A body moves in a circle of radius r at constant speed v . The work done on the body by the centripetal force F in two revolutions is:

- a. $F(4\pi r)$. b. Ft c. v^2/r d. $m v^2/r$. e. zero

7. An object moves from $x = 0 \text{ m}$ to $x = 7 \text{ m}$ subject to the force shown in the diagram. How much work in J is done on the object by the force when the object moves from $x=3\text{m}$ to $x=5\text{m}$

- a. -40
b. -20
c. 0
d. 20
e. 40



Part II

In the exam booklet provide full solutions to 5 out of 6 problems .

Each problem is worth 10 points.

On the cover of your exam booklet indicate clearly which problems are to be marked.

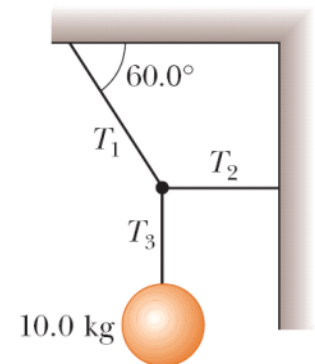
Provide full solutions with clear diagrams. Clarity of your work will affect the grade!

1. A cannon with a muzzle speed of 1 000 m/s is used to start an avalanche on a mountain slope. The target is 2 000 m from the cannon horizontally and 800 m above the cannon. At what angle, above the horizontal, should the cannon be fired?
2. The pilot of an airplane notes that the compass indicates a heading due west. The airplane's speed relative to the air is 150 km/h. The air is moving in a wind at 30.0 km/h toward the north. Find the velocity of the airplane relative to the ground.
3. A point on a rotating turntable 20.0 cm from the center accelerates from rest to a final speed of 0.700 m/s in 1.75 s. At $t = 1.25$ s, find the magnitude and direction of
 - (a) the radial acceleration(4p),
 - (b) the tangential acceleration,(4p)
 - (c) the total acceleration of the point. (2p)

4

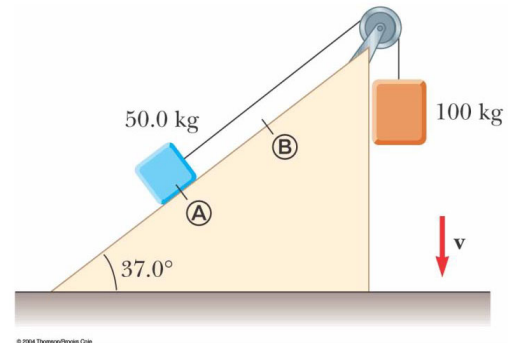
The load is hanging from the ceiling of an elevator that is moving down at constant acceleration $a=1\text{m/s}^2$

- a) Draw relevant free body diagrams (4 points)
- b) Write down the Newton's Equations (4 points)
- c) Find the tension in each of the three strands of cord supporting the load. (2 points)



5

A 50.0-kg block and 100-kg block are connected by a string as shown. The pulley is frictionless and of negligible mass. The coefficient of kinetic friction between the 50-kg block and incline is 0.250. Determine the change in the kinetic energy of the 50-kg block as it moves from A to B, a distance of 20.0 m



6

The skier of mass M slides from on an icy (frictionless) hemispherical mountain of radius R .

- a) Draw the free body diagram, and write Newton's Second Law for the block of mass M as it is at some point on the slope below the starting point.(5p)
 - b) At what angle α with vertical will she loose contact with the surface ? (5p)
- The skier is at rest on the top of the mountain.

