

Question-1/conceptual multiple choice:

Choose the correct option: (1 × 10 = 10 marks)

1) Which of the following equations is dimensionally consistent?

a) $x = vt$

b) $x = \frac{1}{2}at$

c) $x = \left(\frac{2x}{a}\right)^{1/2}$

d) none of these

2) The mass of an object

a) is fixed.

b) varies from location to location.

c) has a unit Newton.

d) is vector quantity

3) When a car goes around a curve, it tends to skid outwards. The frictional force between the tires and the ground that keeps the car from skidding is

a) kinetic

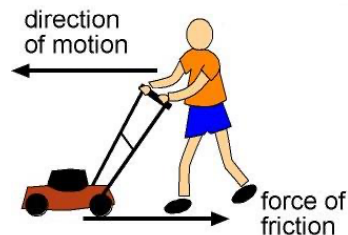
b) static

c) both of the above

d) not enough information

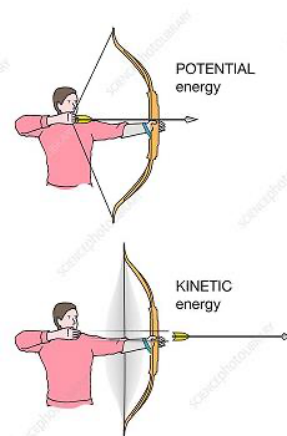
4) In the figure shown below, what will be the work done by the friction force

- a) Positive
- b) negative
- c) Zero
- d) None of the above



5) An arrow is drawn back so that 50 J of potential energy is stored in the stretched bow and string. When released, the arrow will have a kinetic energy of:

- a) 50 J
- b) More than 50 J
- c) Less than 50 J
- d) Not enough information.



6) In elastic collision, which of the following statement is correct?

- a) The Momentum is conserved.
- b) The Kinetic energy is conserved.
- c) Both momentum and kinetic energy are conserved.
- d) Neither momentum nor kinetic energy are conserved.

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- 7) If a 70 kg man and a 40 kg boy are both running at the same velocity, who has more momentum?
- a) The man
 - b) The boy
 - c) They both have the same momentum
 - d) Not enough information.
- 8) If the net force on an object is zero (N), and the net torque on the object is zero (Nm). Which of the following statements is correct?
- a) the object is in translation equilibrium
 - b) the object is in static equilibrium.
 - c) the object has a constant acceleration.
 - d) no forces acting on the object.
- 9) The heat is defined as:
- a) the highest temperature of an objects in contact.
 - b) the lowest temperature of an objects in contact.
 - c) energy that is transferred between objects that are in thermal contact because of a temperature difference
 - d) a change in temperature of objects in thermal contact
- 10) The heat exchange by the conduction mechanism occurs only in:
- a) fluids
 - b) solids
 - c) liquids
 - d) gases

Question -2 /calculated multiple choice:

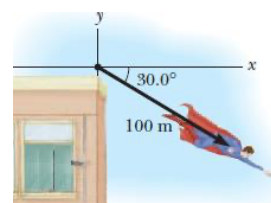
Choose the correct option: ($1 \times 10 = 10$ marks)

1) A car accelerates from 10 m/s to 30 m/s at a rate of 3 m/s^2 . What is the distance traveled by the car while accelerating?

- a) 80.0 m
- b) 133 m
- c) 399 m
- d) 226 m

2) A superhero flies down from the top of a tall building at an angle of 30° below the horizontal along the path shown in the Figure. Find the horizontal and vertical components (A_x and A_y) of the 100 m displacement of the superhero.

- a) $A_x = +86.6 \text{ m}$, $A_y = +50 \text{ m}$
- b) $A_x = +50 \text{ m}$, $A_y = -86.6 \text{ m}$
- c) $A_x = +86.6 \text{ m}$, $A_y = -50 \text{ m}$
- d) $A_x = +58 \text{ m}$, $A_y = -68 \text{ m}$



3) If your mass is 60 kg and you ride on an elevator that is moving with constant speed while standing on a scale. The reading on the scale is:

- a) depending on the value of the speed.
- b) equal to 589 N.
- c) less than 589 N.
- d) more than 589 N.



4) An object of a mass of 20 kg subjected to a force that changes its velocity from 2 m/s to 5 m/s. Find the work done on the object.

- a) 210 J
- b) 30 J
- c) 420J
- d) 600J

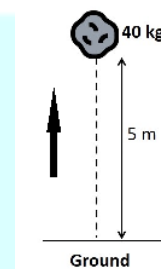
5) A car's engine generates 100,000 W of power as it exerts a force of 10,000 N. How long does it take the car to travel 100 m?

- a) 0.001 s
- b) 0.01 s
- c) 1000 s
- d) 10 s



6) A 40 kg object rises to a height of 5 m above the ground. What is its potential energy?

- a) 1962 J
- b) 1962 Watt
- c) 1962 J/s
- d) 1962 N



7) The fastest recorded baseball pitch was clocked at 45.0 m/s. Determine the impulse required to give a 0.145-kg baseball such a momentum?

- a) 6.53 N.s
- b) 65.3 kgm/s
- c) 0.653 kg.m/s
- d) 65.3 N.s



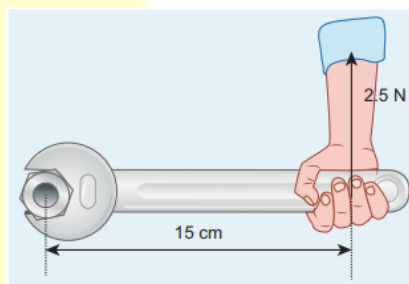
8) A compact disk rotates at 210 revolutions per minute (rpm). What is its angular speed in rad/s?

- a) 11.0 rad/s
- b) 22.0 rad/s
- c) 45.3 rad/s
- d) 69.1 rad/s



9) If a 2.5 N force is applied perpendicular to the handle of the spanner as shown in the diagram, find the torque exerted by the force situated about 15 cm from the center of the nut.

- a) 37.5 Nm
- b) 0.375 Nm
- c) 16.7 Nm
- d) 0.2 Nm



10) The temperature in a room is 77°F. What is the corresponding temperature in the Celsius scale?

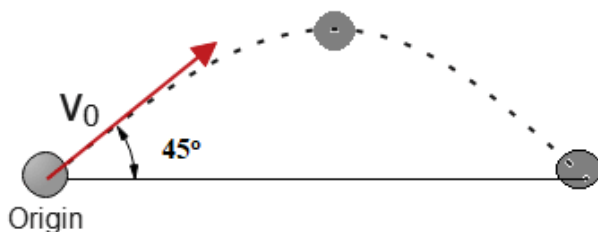
- a. 81°C
- b. 77°C
- c. 25°C
- d. 43°C

Question-3 / Problems

Solve the following problems in the space provided showing all your steps (20 marks)

Problem # 1

A ball is thrown at an angle 45° above the horizontal with an initial velocity of 20 m/s then hits the ground.



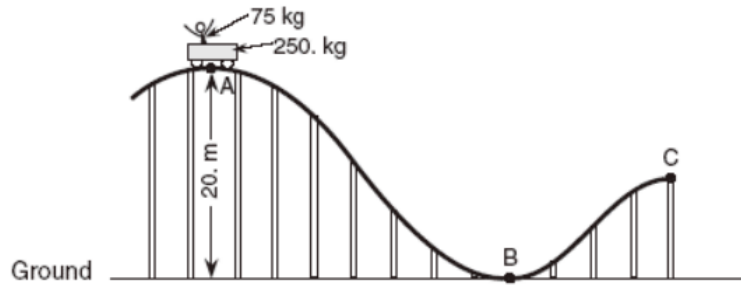
a) *What is the range of the ball?*

b) *What is the total time of flight of the ball before it hits the ground?*

c) *Find the components of velocities (V_x, V_y) at the maximum height.*

Problem # 2

A 250-kg car is initially at rest at point A on a roller coaster track. The car carries a 75-kg passenger and is 20 m above the ground at point A.



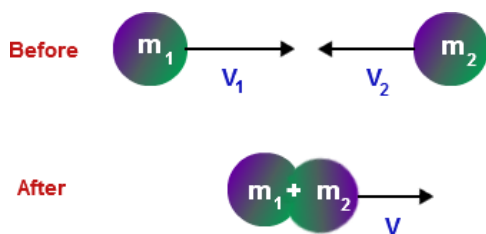
a) Calculate the mechanical energy of the roller coaster at point A? (2 marks)

b) Calculate the speed of the roller coaster at point B? (2 marks)

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Problem # 3

A 4 kg ball sliding across a frictionless surface at 12 m/s to the right collides in a head-on collision with a 2 kg ball sliding at 3m/s to the left, and the two balls stick together.



a) Find the momentum of each ball before collision?

b) Find the velocities of the balls after collision?

c) Find the total kinetic energy before and after collision?

d) What is the loss in kinetic energy due to collision?

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Problem # 4

The volume of an aluminum sphere is 30 cm^3 at 30°C . The coefficient of linear expansion of the aluminum is $24 \times 10^{-6} \text{ K}^{-1}$. If the final volume is 30.5 cm^3 , Find:

a) The change in the volume. (1mark)



b) The change in temperature of the aluminum sphere. (2marks)

c) The final temperature of the aluminum sphere. (1 mark)

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