Assignment

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Course title : Applied physics
Summer Mid-Term 2020

Q1: (a) Keeping in view si units, solve the following:

(1) A body's temperature is 143.4°c. What is this temperature in kelvins?

Ans: Given Data:

Temperature 143.4°C

Required:

Temperature in kelvins?

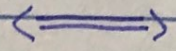
Solution:

we know temperature in kelvin an equal

$T_{k2} \; T_c + 273.15$

$\Rightarrow \quad 143.4 + 273.15$

$\Rightarrow \quad 416.55$ kelvin



(2) An item has temperature of 2596 degree K. What is its temperature in celsius:

Ans: Given Data:

Temperature 2596 degree kelvin

ID: 16216 Name: M. HAROON

Required:

Temperature in celsius

Solution:

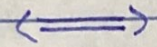
we know that

celsius = kelvin - 273

°C = 2596 - 273

°C = 2323

So 2596 kelvin = 2323 celsius.



(3) An item has a mass of 4.76 g and volume 0.54 cm^3, calculate its density?

Ans: Given Data:

Mass = 4.76 g

volume = 0.54 cm^3

Required Data:

Density: ?

Solution:

we know that

$$\text{Density} = \frac{\text{Mass}}{\text{volume}}$$

$$\text{Density} = \frac{4.76\ g}{0.54\ cm^3}$$

Density = 8.814 g/cm^3

ID: 16216
Name: M. HAROON

Q1: (b) Convert the following:

(1) 257,600 meters to Kilometers.

Ans: The length in kilometer = $\frac{\text{meter}}{1000}$

$\Rightarrow \frac{257,600}{1000} = 257.6$ kilometer.

(2) 58,300 milliliter to liters.

Ans: liter = $\frac{\text{Milliliter}}{1000} = \frac{58,300}{1000} = 58.3$ liters.

(3) 87,421 centimeters to meters.

Ans: Meter = $\frac{\text{centimeter}}{100} = \frac{87,421}{100} = 874.21$ Meters.

(4) 869 Kilogram to grams.

Ans: we know 1 kg = 1000 gram

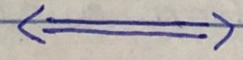
$\Rightarrow$ 869 kg = 869 x 1000 g

$\Rightarrow$ 86900 gram.

(5) 10^4 milligram to gram.

Ans: 10000 gram

gram = $\frac{\text{Milligram}}{1000} \Rightarrow \frac{10,000}{1000} = 10$ g.



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Q2:(a) Write what is the difference between the below terms:
Distance and Displacement, speed and average speed, Positive acceleration and negative acceleration give example of each case.

Ans: Distance:

1) length of actual path travelled by an object.
2) It is a scalar quantity.
3) It remains positive, can't be "0" or negative.
4) Distance can be equal to displacement or its greater than displacement.

Displacement:

1) Shortest length between initial and final position of an object.
2) It is a vector quantity.
3) It can be positive (+ve), negative (-ve) or zero.
4) Displacement can be equal to distance or its lesser than distance.

Example of Distance and Displacement:

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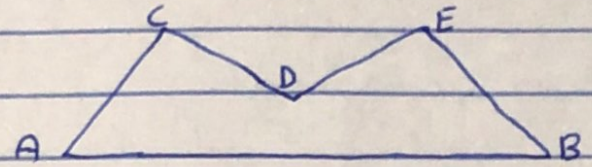


AB is Displacement.
ACDE is the Distance.

Speed:

Speed being a scalar quantity is the rate at which an object covers distance.

$$\text{Speed} = \frac{\text{distance covered}}{\text{time taken}}$$

$$v = \frac{S}{T}$$

Example of speed:

You drive a car at 20m/s your speed is 20m/s.

Average speed:

The average speed of an object is defined as the total distance traveled divided by the total time elapsed.

$$\text{Average speed} = \frac{\text{total distance}}{\text{total time}}$$

$$v = \frac{d}{T}$$

ID: 16216 Name: M. HAROON

Example of Average speed:-

If a distance of 80 kilometer cover by a car in 1 hour so the average speed is 80 kilometer per hour.

Positive Acceleration:

An Increase in the velocity of an object during a given period of time.

Example:-

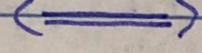
A bus or a car moving with increasing speed has positive acceleration.

Negative Acceleration:

A decrease in the velocity of an object during a given period of time.

Example:-

A car slowing down in backward direction.



ID:16216 Name: M.HAROON

Q2:(b) A car is moving with a velocity of 8m/s. The driver applies brakes and the car comes to stop after covering a distance of 19m. Calculate its acceleration?

Ans: Given Data:

$v_f = 8\ m/s$

$v_i = 0\ m/s$

$s = 19m$

$a = ?$

Solution:-

using formula

$2as = v_f^2 - v_i^2$

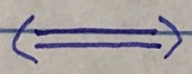
Putting values

$2a(19) = (8)^2 - 0$

$38a = 64$

$a = \frac{64}{38}$

$a = 1.68\ m/s^2$



ID: 16216 Name: M. HAROON

Q3: (a) Describe in detail and prove mathematically first law and second law of motion with giving an example for each law from our daily life.

Ans: Newton's First law of Motion:-

Inertia an object will not change its motion unless acted on by unbalanced force.

- If it is at rest, it will stay at rest.
- If it is in motion, it will remain at the same velocity.

Objects with a greater mass have more inertia, It takes more force to change their motion.

Mathematically First law:-

The first law can be stated mathematically as:-

$$\sum F = 0 \Rightarrow \frac{dv}{dT} = 0$$

Example:-

If you slide a hockey puck on ice, eventually it will stop. Because of friction on the ice,

ID: 16216 Name: M. HAROON

it will also stop if it hits something. Like a player's stick or a goalpost.

Second law of Motion:

The acceleration of an object is directly propotional to the resultant force acting on an object and inversely proportional to its mass, the object acceleration should be in the same direction as the resultant force.

Mathematically second law:-

Mathematically the relation can be expressed as:-

$$\sum \vec{F} = m\vec{a}$$

Example:-

If you use the same force to push a truck and a car, the car will have more acceleration than the truck because the car has less mass.

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Q3:(b) Explain third law of motion by deriving its equation in terms of mass and acceleration. Give three examples of this law from daily actions of life.

Ans: Newton's third law of Motion:

- According to Newton's third law, "whenever one body exerts a force on another body, the second body exerts an equal and opposite force on the first body."
- The force exerted by the first body on the second body is called action.
- The force exerted by the second body on the first body is called reaction.
- We can also say that Newton's third law states that to every action there is an equal and opposite reaction.

Derive an equation of third law of motion in term of mass and acceleration

$F_1 = -F_2$

Become

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$m_1 a_1 = -m_2 a_2$

Example:-

1) When you jump off a small rowing boat into water, you will push yourself forward towards the water. The same force you used to push forward will make the boat move backwards.
2) When air rushes out of a ballon flies up.
3) When you drive off a diving board you push down on the springboard. The board spring back and forces you into the air.