Iqra National University, Peshawar
Department of Electrical Engineering

Mid – Term Assignment Summer Semester-2020
Date:22/08/2020

Course Code: GSP101 **Course Title:** Applied Physics
Prerequisite: Nil **Instructor:** Dr. Shahid Latif
Module: 1 **Program:** BEE **Total Marks:** 30

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Q1	(a)	Keeping in view SI Units, solve the following: (5 Marks) 1. A body's temperature is 143.4° C. What is this temperature in kelvins? 2. An item has temperature of 2596 degree K. What is its temperature in Celsius. 3. An item has a mass of 4.76 g and volume 0.54 cm^3 , calculate its density?
	(b)	Convert the following: (5 Marks) 1. 257,600 meters to kilometers 2. 58,300 milliliter to liters 3. 87,421 centimeters to meters 4. 869 kilogram to grams 5. 10^4 milligram to Gram
Q2	(a)	Write what is the difference between the below terms: Distance & Displacement, Speed & Average speed, Positive acceleration & Negative acceleration give example of each case. (5 Marks)
	(b)	A car is moving with a velocity of 8 m/s. The driver applies brakes and the car comes to stop after covering a distance of 19 m. Calculate its acceleration? (5 Marks)
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. (5 Marks)
	(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. (5 Marks)

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Q1

(a) (1) A body's temperature is 143.4°C. what is this temperature in Kelvins?

Sol:-

Given data

Temperature in °C = 37°C

Required data

Temperature in K = ?

Formula

$K = {}^{\circ}C + 273$

Solution

$K = 143.4^{\circ}C + 273$

$= \boxed{416.4\ K}$ Ans

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

Sol:-

Given data

Temperature in K = 2596 K

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Required data

Temperature in °C = ?

Formula

°C = K - 273

Solution

°C = 2.596K - 273.15

= 2322.85 °C

Ans

(3) An item has a mass of 4.76g and volume 0.54 cm³, calculate its density?

Sol:- Given data

mass = 4.76g

Volum = 0.54 cm³

Required data

Density = ?

Formula

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

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

$$= 8.81\ g/cm^3$$ Ans

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Q1 (b) Convert the following

(1) 257,600 meters to kilometers

$257,600 \text{ meters} = 257,600 \times \frac{10^3}{10^3}$ meter

$= \frac{257,600}{10^3}$ kilometer

$= \boxed{257.600 \text{ kilometers}}$

(2) 58,300 milliliter to liters.

$58,300 \text{ milliliter} = 58,300 \times 10^{-3}$ liters

$= \boxed{58.3 \text{ liters}}$

(3) 87,421 centimeters to meters.

$87,421 \text{ centimeters} = 87,421 \times 10^{-2}$ meters

$= \boxed{874.21 \text{ meters}}$

(4) 869 kilogram to grams.

$869 \text{ kilogram} = 869 \times 10^3$ grams

$= \boxed{869,000 \text{ grams}}$

(5) 10^4 milligram to gram

$10^4 \text{ milligram} = 10^4 \times 10^{-3}$ gram

$= \boxed{10 \text{ gram}}$

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Q2

(a) (i) Distance and Displacement:-

Distance is the legth of the actual path traversed by a body in motion is called distance and denoted by (S or d). its SI unit is meter.
example: The zig-zag motion of a body which is not linear.

While Displacement is the shortest or straight directed distance covered by a moving body is called displaced and denoted by ($\vec{s}$) or ($\vec{d}$). its SI unit is also meter. example of displacement is motion in straight line.

(ii) Speed and Average Speed:

Speed:- The distance (s) covered by a moving body between two points in a unit time (t) is called speed (v) of the body.

$$v = s/t$$

example:- An example of speed is a car being driven 45 miles per hours.

Average speed:- The total distance (s) covered by a moving body divided by the total time taken (t) to cover this distance is called average speed ($\langle v \rangle$).

$$\langle v \rangle = \frac{\Delta s}{\Delta t}$$

The MRT train starts from rest at a station, moves faster until it reaches a constant speed and then slows down to a stop at station so we define the averge speed terms.

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③ positive acceleration and negative acceleration:

positive acceleration :-

If the magnitude of velocity increases with respect to time along a straight line produced is positive acceleration.

example:-

A car whose speed is increasing with the passage of time then it posses possitive acceleration. The direction of positive acceleration is parallel to the direction of velocity.

Negative acceleration :-

If the magnitude of velocity decreases with respect to time along a straight line then the acceleration produced is called negative acceleration.

example

when driver applies breakes to a moving car, then its speed decreases and negative acceleration is produced.

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Q2

(b)

Sol:-

Given data:

initial velocity = 8 m/s
final velocity = 0 m/s
distance = 19 mm

Required data:

$a = ?$

formula

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

solution

$$a = \frac{v_f^2 - v_i^2}{2s}$$

$$= \frac{(0)^2 - (8)^2}{2(19)}$$

$$a = \boxed{1.684 \text{ m/s}^2}$$

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Q3

(a1)

Newton's 1st law of Motion

Statement:

"Every object containues its state of rest or uniform motion in a straight line unless it is compelled to chage its state by applying an external force on it."

Explanation:

This law is also known as law of inertia. "The property of all material substance due to which it opposes any change in its state, is called inertia."

If greater is the mass of a body greater will be its inertia.

Mathematically derivation

if $\vec{F} = 0$

$F = ma$

$\boxed{a = 0}$

Then velocity is constant

$\vec{v}$ = constant

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Daily life examples:

① A Applied physics book lying on the table is at rest and will remain in its state of rest because the net force acting on the book is zero.

② A paratrooper comes down with uniform velocity because the downward force (weight) is balanced by upthrust (air friction).

③ A passenger falls jerk in the backward direction, when the bus suddenly starts and also he falls jerk in forward direction, when the fast moving bus is suddenly stopped. These all are because of the property of inertia.

Newton's 2nd law of Motion:

Statement:

"whenever a net force acts on a body then acceleration is produced in that body in the direction of applied force. The magnitude of the acceleration is directly proportional to the applied force and inversely proportional to the mass of that body."

Mathematical Derivation

From the statement of 2nd law, we can write as

$$\vec{a} \propto \vec{F} \rightarrow (1)$$

and $$\vec{a} \propto \frac{1}{m} \rightarrow (2)$$

combining (1) and (2) we have

$$\vec{a} \propto \frac{\vec{F}}{m}$$

or

$$\vec{a} = K \cdot \frac{\vec{F}}{m}$$

$$\vec{a} = (1) \frac{\vec{F}}{m}$$

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

This is the mathematical form of Newton's 2nd law.

Daily life example:

① If you push the accelerator of a vehicle hard by applying more force, it will accelerate more.

② If a car and bus have the engine of same power and their accelerators are pushed by the same force then the acceleration produced in the car will be more than the bus due to its smaller mass.

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Q3 (b)

Sol:

Newton's 3rd law of motion

Statement:-

This law states that, "to every action there is always an equal and opposite reaction".

Explanation:-

According to newton's third law of motion, whenever one 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 force and the force exerted by the second body on the first body is called reaction force. Action force and reaction force act on two different bodies, but they act simultaneously.

Mathematically Derivation:-

Consider two bodies "1" and "2" moving towards each other and collides, as shown in figure. Let "$\vec{F}_{12}$" is the force exerted by body "1" on body "2" and "$\vec{F}_{21}$" is the force exerted by body "2" on body "1".

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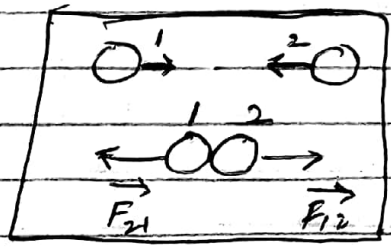
Then, According to Newton's 3rd law we, have

$$\vec{F}_{12} = -\vec{F}_{21}$$

$$m_1\vec{a} = -m_2\vec{a}$$



This is the mathematical form of newton's 3rd law. The negative sign shows that both the forces are in opposite direction.

Daily life examples :-

① When you strike a ball on the wall, then the ball exerts a force on the wall which is action, while the wall exerts the same force on the ball in opposite direction, which reaction of the wall due to which it comes back to your hand.

② When a bullet is fired from a gun it moves in forward direction due to action while in reaction the bullet pushed the gun in backward direction.

③ When we walk on the ground, we push the ground in the backward direction this is the action, while in reaction, the ground pushes us in the forward direction.

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