Padasalai's Telegram Groups!

(தலைப்பிற்கு கீழே உள்ள லிங்கை கிளிக் செய்து குழுவில் இணையவும்!)

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- Padasalai's Channel - Group
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- Lesson Plan - Group
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10th Physics – Unsolved Problems:

NUMERICAL PROBLEMS:

LESSON:1(LAWS OF MOTION)

1. Two bodies have a mass ratio of 3:4 The force applied on the bigger mass produces an acceleration of 12 ms^{-2}.What could be the acceleration of the other body, if the same force acts on it.

Given:

Ratio of two masses = $m_1:m_2 = 3:4$

$a_2 = 12\ ms^{-2}$

$F_1=F_2$ (same force act on two bodies)

$a_1 = ?$

Solution:

$\therefore F_1=F_2$

$m_1a_1=m_2a_2$

$3a_1=4x12$

$a_1=\frac{48}{3}$

$a_1=16\ ms^{-2}$

2.A ball of mass 1 kg moving with a speed of 10 ms-1 rebounds after a perfect elastic collision with the floor. Calculate the change in linear momentum of the ball.

Given:

m =1 kg

u = 10 ms^{-1}

v = - 10 ms^{-1} (Rebounds)

Δp =?

Solution:

$\Delta p = mv - mu$

= (1 x -10) - (1 x 10)

= -10-10

Δp = -20 Kg ms^{-1}

3.A mechanic unscrew a nut by applying a force of 140 N with a spanner of length 40 cm. What should be the length of the spanner if a force of 40 N is applied to unscrew the same nut?

Given:

F_1=140N

L_1=40 cm

F_2=40N

L_2=?

Solution:

$$F_1 \times L_1 = F_2 \times L_2$$

$$140 \times 40 \times 10^{-2} = 40 \times L_2$$

$$L_2 = \frac{140 \times 40 \times 10^{-2}}{40}$$

$$L_2 = 140 \text{ cm or } 1.4 \text{ m}$$

4.The ratio of masses of two planets is 2:3 and the ratio of their radii is 4:7 Find the ratio of their accelerations due to gravity.

Given:

$M_1 : M_2 = 2 : 3$

$R_1 : R_2 = 4 : 7$

$g_1 : g_2 = ?$

Solution:

W.k.t, $g = \frac{GM}{R^2}$

$$\frac{g_1}{g_2} = \frac{GM_1}{R_1^2} \times \frac{R_2^2}{GM_2}$$

$$\frac{g_1}{g_2} = \frac{2 \times 7 \times 7}{4 \times 4 \times 3}$$

$$\frac{g_1}{g_2} = \frac{49}{24}$$

$$\therefore g_1 : g_2 = 49 : 24$$

LESSON:2(OPTICS)

1.An object is placed at a distance 20cm from a convex lens of focal length 10cm. Find the image distance and nature of the image.

Given:

u = -20 cm, f = 10 cm, v = ?

Solution:

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

$$\frac{1}{v} = \frac{1}{f} + \frac{1}{u}$$

$$\frac{1}{v} = \frac{1}{10} + \frac{1}{-20}$$

$$\frac{1}{v} = \frac{-20+10}{-200}$$

$$\frac{1}{v} = \frac{-10}{-200}$$

$v = \frac{-200}{-10}$

$v = 20$ cm

$m = \frac{v}{u}$

$m = \frac{20}{-20} = -1$(no unit)

Nature of the image: **Real & inverted** and image is the **same size** as that of the object.

2.An object of height 3cm is placed at 10cm from a concave lens of focal length 15cm. Find the size of the image.

Given:

u = -10 cm
f = -15 cm
h = 3 cm
h' =?

Solution:

$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

$\frac{1}{v} = \frac{1}{f} + \frac{1}{u}$

$\frac{1}{v} = \frac{1}{-15} + \frac{1}{-10}$

$\frac{1}{v} = \frac{-10-15}{150}$

$\frac{1}{v} = \frac{-25}{150}$

$v = \frac{-150}{25}$

v = -6 cm

$m = \frac{v}{u} = \frac{h'}{h}$

$\frac{-6}{-10} = \frac{h'}{3}$

h' = 0.6 x 3

h' =1.8 cm

LESSON:3 (THERMAL PHYSICS)

1.Find the final temperature of a copper rod. Whose area of cross section changes from10 m^2 to 11 m^2 due to heating. The copper rod is initially kept at 90 K. (Coefficient of superficial expansion is 0.0021 /K)

Given:

$A_0 = 10\ m^2$, $A_f = 11 m^2$, $\Delta A = (11-10)m^2 = 1\ m^2$,

$T_i = 90$ K, $\alpha_A = 0.0021/K$, T_f=?

Solution:

$$\frac{\Delta A}{A_0} = \alpha_A \Delta T$$

$$\frac{\Delta A}{A_0} = \alpha_A (T_f - T_i)$$

$$\frac{1}{10} = 0.0021(T_f - 90)$$

$$0.1 = 0.0021(T_f - 90)$$

$$T_f = \frac{0.1}{0.0021} + 90$$

$$= 47.6190 + 90$$

$$\boxed{T_f = 137.62\ K}$$

2. Calculate the coefficient of cubical expansion of a zinc bar. Whose volume is increased 0.25 m3 from 0.3 m3 due to the change in its temperature of 50 K.

Given:

$V_0 = 0.3m^3$

$V_f = 0.55m^3$

$\Delta T = 50K$

$\Delta V = 0.25m^3$

α_v=?

V_f =(0.3+0.25)m^3

$\Delta V = (0.55 - 0.3)m^3$

Solution:

$$\frac{\Delta V}{V_0} = \alpha_V \Delta T$$

$$\frac{0.25}{0.3} = \alpha_V \times 50$$

$$\alpha_V = \frac{0.25}{0.3 \times 50}$$

$$\alpha_V = \frac{25}{1500}$$

$$\boxed{\alpha_V = 0.0166K^{-1}}$$

LESSON:4(ELECTRICITY)

1. An electric iron consumes energy at the rate of 420 W when heating is at the maximum rate and 180 W when heating is at the minimum rate. The applied voltage is220 V. What is the current in each case?

Given:

P_{max}=420 W

$P_{min} = 180\ W$

V = 220V

I_1 =?

I_2 =?

Solution:

P =VI

$P_{max} = V\ I_1$

$I_1 = \frac{P_{max}}{V}$

$I_1 = \frac{420}{220}$

$\boxed{I_1 = \mathbf{1.909}\boldsymbol{A}}$

$I_2 = \frac{P_{min}}{V}$

$I_2 = \frac{180}{220}$

$\boxed{I_2 = \mathbf{0.818}\boldsymbol{A}}$

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2. A 100 watt electric bulb is used for 5 hours daily and four 60 watt bulbs are used for5 hours daily. Calculate the energy consumed (in kWh) in the month of January.

Given:

No.of 100 W bulb = 1

No.of 60 W bulb =4

Energy consumed by 100 W bulb(E_1) =5 hr/day

Energy consumed by four 60 W bulb (E_2) = 5hr/day

No.of days in January = 31 days

E_{total} = ?

Solution:

$E_1 = 100 \times 5 \times 31$

E_1 = 1550Wh

E_1 = 15.5 KWh

$E_2 = 4 \times 60 \times 5 \times 31$

E_2 =37200 Wh

E_2 =37.2 KWh

$E_{total} = E_1 + E_2$

E_{total} = (15.5+37.2) KWh

$\boxed{E_{total} = \mathbf{52.7KWh}}$

$\therefore 52.7KWh\ energy\ is\ consumed\ inthe\ month\ of\ January.$

3.A torch bulb is rated at 3 V and 600 mA. Calculate it's a) power b) resistance c) energy consumed if it is used for 4 hour.

Given:

V=3V

I= 600 mA

I= 600 $\times 10^{-3}$ A
I= 0.6 A
t = 4hour
a)P=? b)R=? c) E=?

Solution:

a) P=VI
P=3×0.6
P=1.8W

b) R= $\frac{V}{I} = \frac{3}{0.6}$ =**5Ω**

c)E =P×t =1.8×4 =**7.2Wh**

4. A piece of wire having a resistance R is cut into five equal parts. a) How will the resistance of each part of the wire change compared with the original resistance? b) If the five parts of the wire are placed in parallel, how will the resistance of the combination change? c) What will be ratio of the effective resistance in series connection to that of the parallel connection?

Given:

R_s =RΩ
Total No.of parts =5
Each parts of Resistance = $\frac{R}{5}$

$\therefore R_1 = R_2 = R_3 = R_4 = R_5 = \frac{R}{5}$

Solution:

a) $R \propto \frac{L}{A}$

$\frac{R}{5} = \frac{\rho L}{A}$

$\boldsymbol{R = \frac{5\rho L}{A}}$

∴ The resistance of piece of wire is proportional to the length.

b) $\frac{1}{R_P} = \frac{5}{R} + \frac{5}{R} + \frac{5}{R} + \frac{5}{R} + \frac{5}{R}$

$\frac{1}{R_P} = \frac{25}{R}$

$\boldsymbol{R_P = \frac{R}{25}\Omega}$

c) $\frac{R_S}{R_P} = \frac{25R}{R}$

$\boldsymbol{R_S : R_P : 25 : 1}$

HOTS:

1.Two resistors when connected in parallel give the resultant resistance of 2 ohm; but when connected in series the effective resistance becomes 9 ohm. Calculate the value of each resistance.

Given:

R_S=9Ω ,R_P=2Ω, R_1=?, R_2=?

Solution:

$R_1+R_2 = 9$
$R_2 = 9-R_1$

$$\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2}$$

$\frac{1}{R_P} = \frac{(9-R_1)+R_1}{(9-R_1)\times R_1}$

$\frac{1}{R_P} = \frac{9}{9R_1-R_1^2}$

$\frac{1}{2} = \frac{9}{9R_1-R_1^2}$

$18 = -R_1^2 + 9R_1$

$18 + R_1^2 - 9R_1 = 0$

$(R_1-3)(R_1-6) = 0$

18
-3 -6

$R_1 = 3\Omega, 6\Omega$

$R_2 = 9-3 = 6\Omega$ | $R_2 = 9-6 = 3\Omega$

∴ R_1=**3Ω,6Ω** and R_2=**6Ω,3Ω**

2.How many electrons are passing per second in a circuit in which there is a current of 5 A?

Given:

I=5A, t= 1S, n=?

Solution: | $\therefore I = \frac{Q}{T}$

Q = ne

$n = \frac{Q}{e} = \frac{I\times t}{e} = \frac{5\times 1}{1.6\times 10^{-19}} = \frac{5}{1.6} \times 10^{19} = \mathbf{3.125 \times 10^{19}}$ electrons

3.A piece of wire of resistance 10 ohm is drawn out so that its length is increased to three times its original length. Calculate the new resistance.

Given:

A piece of wire of resistance $(\frac{\rho L}{A}) = 10\Omega$

Increasing length = 3L

New area = $\frac{A}{3}$

New resistance R =?

| $(\frac{\rho L}{A}) = 10\Omega$

Solution:

New resistance $R = \frac{3\rho L}{\frac{A}{3}} = \frac{9\rho L}{A} = 9 \times 10 = \mathbf{90\Omega}$

LESSON:5(ACOUSTICS)

1.A sound wave has a frequency of 200 Hz and a speed of 400 m s^{-1} in a medium. Find the wavelength of the sound wave.

Given:

$v = n\lambda$, n =200 H_Z, v = 400 m s^{-1}, λ = ?

Solution:

$\lambda = \frac{v}{n} = \frac{400}{200} = \mathbf{2m}$

2.The thunder of cloud is heard 9.8 seconds later than the flash of lightning. If the speed of sound in air is 330 m s^{-1}, what will be the height of the cloud?

Given:

t = 9.8 s, v = 330 m s^{-1}, d = ?

Solution:

d = v×t = 330×9.8= 3234 m

∴ The height of the cloud is **3234 m**

3.A person who is sitting at a distance of 400 m from a source of sound is listening to a sound of 600 Hz. Find the time period between successive compressions from the source?

Given:

n = 600 Hz , T =?

Solution:

$n = \frac{1}{T}$

$T = \frac{1}{n} = \frac{1}{600} = \mathbf{0.0017\ s}$

4. An ultrasonic wave is sent from a ship towards the bottom of the sea. It is found that the time interval between the transmission and reception of the wave is1.6 seconds. What is the depth of the sea, if the velocity of sound in the seawater is1400 m s^{-1}?

Given:

v =1400 m s^{-1}, t=1.6 s , d(depth) =?

$\therefore v = \frac{2d}{t}$

Solution:

$d = \frac{v \times t}{2} = \frac{1400 \times 1.6}{2} = \frac{2240}{2} = \mathbf{1120\ m}$

5. A man is standing between two vertical walls 680 m apart. He claps his hands and hears two distinct echoes after 0.9 seconds and 1.1 second respectively. What is the speed of sound in the air?

Given:

d = 680 m , t_1 = 0.9 s , t_2 = 1.1 s, v = ?

$\therefore t = t_1 + t_1 = 0.9 + 1.1 = 2\ s$

Solution:

$v = \frac{2d}{t} = \frac{2 \times 680}{2} = \mathbf{680\ ms^{-1}}$

6. Two observers are stationed in two boats 4.5 km apart. A sound signal sent by one, under water, reaches the other after 3seconds. What is the speed of sound in the water?

Given:

Distance between two observers (2d) = 4.5 km , t = 3 s , v = ?

Solution:

$v = \frac{2d}{t} = \frac{4.5}{3} = \mathbf{1.5\ Kms^{-1}}$

7. A strong sound signal is sent from a ship towards the bottom of the sea. It is received back after 1s.What is the depth of sea given that the speed of sound in water1450 m s^{-1}?

Given:

v = 1450 m s^{-1} , t = 1s, depth(d) = ?

Solution:

$d = \frac{v \times t}{2} = \frac{1450 \times 1}{2} = \mathbf{725m}$

LESSON:6(NUCLEAR PHYSICS)

1. $_{88}Ra^{226}$ experiences three **α -** decay. Find the number of neutrons in the daughter element.

Given:

Radioactive element = $_{88}$ **Ra^{226}**

No.of neutrons in the daughter elements=?

Solution:

3α- decay:

$_{88-6}$ **Ra^{226-12}** $\rightarrow$ $_{82}X^{214}$ **+3 ($_2He^4$)**

No.of neutrons in the daughter elements= mass number – atomic number

= 214-82

= **132**

2.A cobalt specimen emits induced radiation of 75.6 milli curie per second. Convert this disintegration in to Becquerel (one curie =3.7×10^{10} Bq)

Given:

induced radiation =75.6 milli curie per second

Solution:

75.6 milli curie per second =$75.6\times10^{-3}\times3.7\times10^{10}$

=**279.72×10^7 Bq**

curie =3.7×10^{10} Bq

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