1. NATURE OF PHYSICAL WORLD AND MEASUREMENT

CLASS: XI

IV Numerical problems

(1) time (t) = 80 sec

speed of sound (v) = 1460 ms^{-1}

distance of enemy submarine (d) = ?

Solu

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

$$d = \frac{vxt}{2} = \frac{1460 \times 80^{40}}{2_1} = 1460 \times 40 \text{ m}$$

$$d = 58400 \text{ m}$$

$$\boxed{d = 58.40 \text{ km}}$$

(2) Radius of the circle is (r) = 3.12 m

Area of the circle A = ?

Solu

Area of the circle $A = \pi r^2$

$$A = 3.14 \times 3.12 \times 3.12$$

$$A = 30.566 \text{ m}^2$$

$$\boxed{A = 30.6 \text{ m}^2}$$

[$\because \pi = \frac{22}{7}$ (or) 3.14]

(3) Given:: The frequency γ depend upon $F, \ell, \frac{m}{\ell}$

∴ prove that $\gamma \propto \frac{1}{\ell}\sqrt{\frac{F}{m}}$ using dimentional Analysis

Sol:

$$\gamma \propto F \ell \frac{m}{\ell}$$

According to dimentional Analysis

$$\gamma \propto F^a \ell^b \left(\frac{m}{\ell}\right)^c$$

$$\gamma \propto F^a \ell^b \frac{m^c}{\ell^c}$$

$$\gamma \propto F^a \ell^b m^c \ell^{-c}$$

$$\gamma \propto F^a \ell^{b-c} m^c \quad \text{---- (1)}$$

$$F^a \ell^{b-c} m^c = F^{1/2} \ell^{-1} m^{-1/2}$$

Equating a b c values

$a = 1/2$ $\quad b-c = -1$ $\quad c = -1/2$

$b - (-1/2) = -1$

$b + 1/2 = -1$

$b = -1 - 1/2$

$a = 1/2$ $\quad b = -3/2$ $\quad c = -1/2$

Substitute a, b, c values in Eq (1), we get

$$\gamma \propto F^{1/2} \ell^{-3/2-(-1/2)} m^{-1/2}$$

$$\gamma \propto F^{1/2} \quad l^{-3/2+1/2} \quad m^{-1/2}$$

$$\gamma \propto F^{1/2} \quad l^{-\frac{2}{2}} \quad m^{-1/2}$$

$$\gamma \propto \sqrt{F} \quad l^{-1} \quad \frac{1}{\sqrt{m}}$$

$$\gamma \propto \frac{1}{l} \frac{\sqrt{F}}{\sqrt{m}}$$

$$\boxed{\gamma \propto \frac{1}{l}\sqrt{\frac{F}{m}}}$$ Hence proved.

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(4) Distance (x) = 824.7 million km.

$\theta = 35.72''$

(b) $b = ?$

Solu

using parallax method

$$\theta = \frac{b}{x}$$

$$\boxed{b = x\theta}$$

$\theta = 35.72''$

$\theta = 35.72 \times 4.874 \times 10^{-6}$ rad

$b = 824.7 \times 35.72 \times 4.874 \times 10^{-6} \times 10^{6}$ km

$b = 142872.6$ km

$\boxed{b = 1.428 \times 10^{5}}$ km

(5) Given

$l = 20$ cm
$\Delta l = 2$ mm
(or)
$\Delta l = 0.2$ cm

$T = 40$ s
$\Delta T = 1$ s

Solu

$$T = 2\pi\sqrt{l/g}$$

$$T^2 = \frac{l}{g}$$

$$g = \frac{l}{T^2}$$

$$\frac{\Delta g}{g} = \frac{\Delta l}{l} \times 100 + 2 \times \frac{\Delta T}{T} \times 100$$

$$= \frac{0.2}{20} \times 100 + 2 \times \frac{1}{40} \times 100$$

$$= \frac{2}{2} + 2 \times \frac{10}{4}$$

$$= 1 + 2 \times 2.5$$

$$= 1 + 5 = 6$$

$$\frac{\Delta g}{g} = 6\ \%$$

E. ASMATH M,sc, M.phil, B.Ed,
P.G. ASSIST IN PHYSICS
asmathmscphd@gmail.com