MARKING SCHEME
PHYSICS

Ques 1.

a. Archimedes principle states that an object immersed in a fluid experiences an upthrust force that is equal in magnitude to the force of gravity on the displaced fluid.

OR.

Archimedes principle states that "when an object is fully or partially immersed in a fluid, it experiences an upthrust, which is equal to the weight of water displaced by the immersed portion of the object. Eg: application of archimedes principle: It is used to determine relative density of an object.

b. Mass of empty bottle (M_1) ——— 25g

Mass of bottle filled with liquid (ethanol) (M_2) ——— 65g

Mass of bottled filled with water (M_3) ——— 75g

Find the relative density, hence its density.

Solution

$$R.D = \frac{\text{Mass of liquid}}{\text{Mass of equal volume of water}} = \frac{M_2 - M_1}{M_3 - M_1}$$

$$= \frac{65 - 25}{75 - 25}$$

$$= \frac{40}{50}$$

$$R.D = 0.8$$

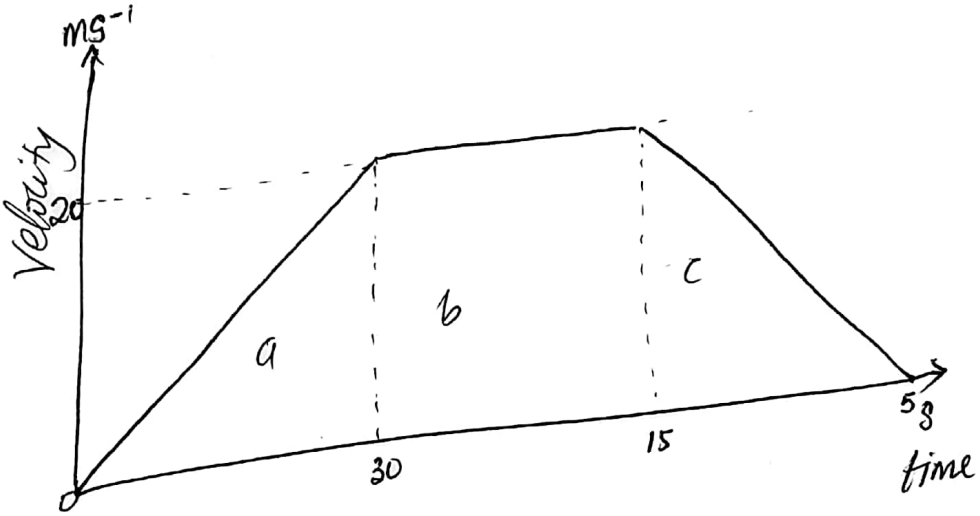
Density of Substance = R.D of the substance (ethanol) × density of water

$\rho = 0.8 \times 1000\ kgm^{-3}$

$= 800\ kgm^{-3}$

NB: $1\ gcm = 1000\ kgm^{-3}$

c. Velocity-time graph



final Velocity = $20ms^{-1}$

initial velocity = $0ms^{-1}$

time = 30s, Calculate the acceleration.

$$\text{acceleration} = \frac{\text{change in velocity}}{\text{time}}$$

$$a = \frac{v - u}{t}$$

$$a = \frac{20 - 0}{30}$$

$$a = \frac{20}{30} \Rightarrow 0.67ms^{-2}$$

$$a = 0.6667ms^{-2}$$

The total distance covered :

Area of A $= \frac{1}{2} \times b \times h$

$= \frac{1}{\cancel{2}} \times 30 \times \cancel{20}^{10}$

$= 30 \times 10$

$= 300\ m$

Area of B $= L \times B$

$= 15 \times 20$

$= 300m$

Area of C $= \frac{1}{2} \times b \times h$

$= \frac{1}{\cancel{2}_{1}} \times 5 \times \cancel{20}^{10}$

$= 5 \times 10$

$= 50m$

$\therefore$ Total distance $= (300 + 300 + 50)\ m$

$= 650\ m$

Importance of Force

i)

2. Newton's second law of motion states that the rate of change of momentum is directly proportional to the force acting on it and takes place in the direction of the force

6. Solution:

A bullet fired vertically upwards, $[a = -g]$

Take Note $[g = 10 m/s^2)$

$v^2 = u^2 + 2as$, where $v = 0$, $a = -g$

$0 = u^2 + 2as$

$0 = u^2 - 2gs$

$2gs = u^2$

Make 's' the subject of the eqn.

$\frac{2gs}{2g} = \frac{u^2}{2g}$

$s = \frac{u^2}{2g}$, [where the height 320m (S) or displacement, gravity $g = 10m/s$]

Remember the $[a = -g]$ has been used in defn the eqn above.

$320 = \frac{u^2}{2(10)}$

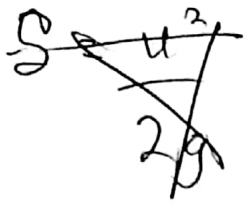
$320 \times (20) = u^2$

$\sqrt{6400} = \sqrt{u^2}$

$80 ms^{-1} = u$.

Time taken to reach the Maximum height.

Solution



$V = u + at$, where $V = 0$, $a = -g$,

where $u = 80 m/s$, $g = 10 m/s^2$

$\Rightarrow 0 = u - gt$

$\Rightarrow gt = u$

Make 't' the subject of the eqn.

$\Rightarrow gt + 0 = u$

$\Rightarrow \frac{gt}{g} = \frac{u}{g}$

$\therefore t = \frac{u}{g}$

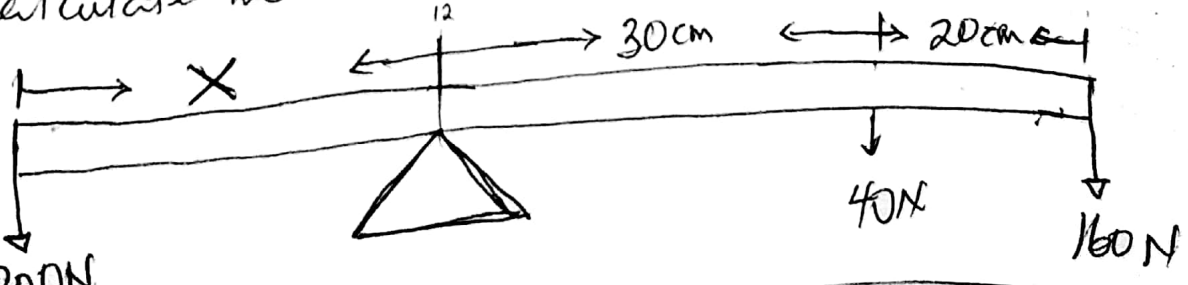
$t = \frac{80 m/s}{10 ms^{-2}}$

$t = 8s$

State the law of moments.

The law of moments states that when a body is in equilibrium the sum of clockwise moment is equal to anti-clockwise moment.

Calculate the X in the diagram below.



Solution:

Changing 'cm' to 'm'

If 100cm = 1m

The 30cm = ?

$= \frac{30 \times 1m}{100cm} = 0.3m$

If 100cm = 1m

Then 20cm = ?

$= \frac{20cm \times 1m}{100cm} = 0.2m$

Anticlockwise moment = $(200 \times X)$

Clockwise moments = $(40 \times 0.3) + (160 \times 0.2)$

Hence, from the principle of moments the sum of anti-clockwise moment is equal to the sum of clockwise moment

$\therefore$ Moment $\Rightarrow$ Sum of anticlockwise = Sum of Clockwise moment

$\Rightarrow (200 \times X) = (40 \times 0.3) + (160 \times 0.2)$

$\Rightarrow 200X = 12 + 32$

$\Rightarrow \frac{200X}{200} = \frac{44}{200}$

$X = 0.22m$

3.

Regular Reflection	Irregular Reflection
- Parallel rays are reflected in the same directions	Parallel rays are reflected in different directions.
- Occurs on highly polished surfaces	Occurs on rough, unpolished surfaces
- All rays strike at the same angle of incidence	Individual rays strikes at different angles of incidence
- Image formed here are clear and well defined	Images formed by this type of reflection are not clear and not defined.
- Obeys the laws of reflection	Does not obey the laws of reflection.

b. Concave mirror produces real image 2cm tall of a 3.4cm item tall placed 6cm from the mirror. Find the: i) Position of the image ii) focal length of the mirror.

Solution:

Magnification $\Rightarrow \frac{2}{3.4} = \frac{v}{6}$

$\Rightarrow 3.4v = 2(6)$

$\frac{3.4}{3.4}v = \frac{12}{3.4}$

$v = 3.5294$

$v = +3.5 (1dp)$

Calculate f.

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

$\frac{1}{f} = \frac{1}{6} + \frac{1}{3.5}$

$\frac{1}{f} = \frac{19}{42}$

$\frac{42}{19} = \frac{19f}{19}$

$2.2105 = f$

$2.2 (1dp) = f$

C. A coin placed in a bucket of water at a depth of 15 cm from the level of the water.

Solution:

refractive index of the water = $\frac{\text{Sine of the angle of incidence}}{\text{Sine of the angle of refraction}}$

$$\eta = \frac{\sin i}{\sin r}$$

$$d = R\left(1 - \frac{1}{\eta}\right)$$

$$d = 15\left(1 - \frac{1}{1.875}\right)$$

$$d = 7 \text{ cm}$$

⇒ Refractive index (n) = $\frac{\text{Real depth}}{\text{Apparent depth}}$

$$n = \frac{15}{8}$$

$$n = 1.875$$

or

displacement = Real D. − App. D

$$\therefore d = R.D - A$$
$$= 15 - 8$$
$$= 7 \text{ cm}$$

d. Give two real-life applications ~~of~~ each of

i) Conductors
ii) insulators.

Solution.

i) Conductors

- The plate of iron is made up of steel to absorb heat briskly.
- Conductors find their use in car radiators to eradicate heat away from the engine.
- Iron is a common material used in vehicle engine manufacturing to conduct heat
- Mercury is a common material in thermometer to check the temperature of the body.

Insulators

i) Thermal insulators disallow heat to move from one place to another. Hence, we use them in making thermoplastic bottles

ii) Sound insulators helps in controlling noise level as they are good in absorbance of sound. Thus we use them in building and conference halls to make them noise-free

iii) Electrical insulators hinder the flow of electron or passage of current through them. So, we use them extensively in ~~the~~ circuit boards and high voltage systems. They are used in coating electric wire and cables.