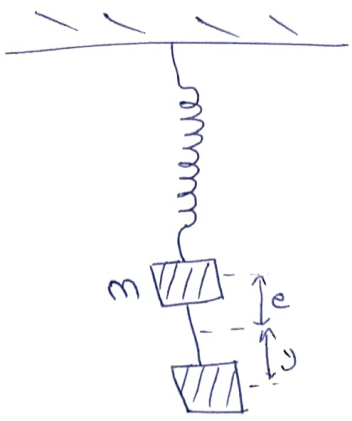
Gift

1i) Simple harmonic motion is a particular kind of periodic motion in which the acceleration of the vibrating particle at any time is directly proportional to the displacement at that time and always directed towards the equilibrium position or the mean position.

ii) Soln



Given,
mass of load = m
Spring constant = K
extension due to load = e
extension due to force = y
Time period = ?

When the string is extended by e due to load the restoring force is given by.

$$f' = -Ke$$

Since the mass is not moving

$$f' = mg$$

$$\Rightarrow mg = -Ke$$

When external force act on mass, it extend by $(e+y)$. The restoration force is given by

$$f'' = -k(e+y)$$

When it is extended by $(e+y)$ with the help of external. Two type of force are acting on mass

1) weight (mg) downward
2) Restoring force f'' upward.

Net force, $f = f'' - mg$

$$= -k(e+y) - mg$$

$$= -ke - ky - mg$$

$$= -ke - ky + ke$$

$$\therefore f = -ky$$

We know,

$$-f = ma = -ky$$

$$\Rightarrow a = -\frac{k}{m} y \quad \text{---} (1)$$

Comparing above eqn with $a = -\omega^2 y$

we get,

$$\omega^2 = +\frac{k}{m}$$

$$\Rightarrow \frac{2\pi}{T} = \sqrt{\frac{+k}{m}}$$

$$\Rightarrow \frac{T}{2\pi} = \sqrt{\frac{m}{+k}}$$

$$\therefore T = 2\pi \sqrt{\frac{m}{+k}}$$

(ii) When mass is doubled.

i.e. $m' = 2m$

$$T = 2\pi\sqrt{\frac{m}{k}}$$

$$T' = 2\pi\sqrt{\frac{2m'}{k}}$$

$$= 2\pi\sqrt{\frac{2m}{k}}$$

$$= 2\pi\sqrt{2}\sqrt{\frac{m}{k}}$$

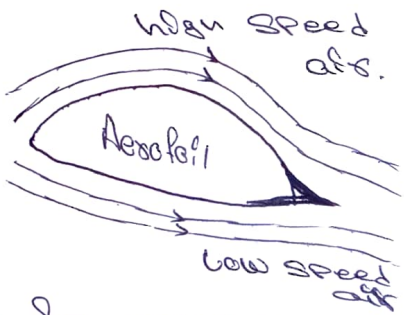
$$= \sqrt{2}\,T$$

∴ Time period (T') will be $\sqrt{2}$ times initial time period ($\sqrt{2}T$) if the mass is doubled.

---

2. (i) Bernoulli's Theorem state that the sum of Potential energy, kinetic energy and the pressure energy per unit mass for an ideal liquid in streamlined motion is constant.

$$E = \frac{P}{\rho} + \frac{v^2}{2} + gh = \text{Constant}$$



An Aeroplane uses aerofoil for lifting. upper surface of aerofoil is made more curved than the lower surface because of which air flows faster over the upper surface compared to lowersurface which creat low pressure at the upper surface and high pressure at the lower surface. which give liftup to the aeroplane.

(i) Soln

Given,

$P_1 = 20\ Pa$

$V_1 = 0.38\ ms^{-1}$

$P_2 = ?$

$V_2 = 0.28\ ms^{-1}$

$S = 1000\ kg/m^3$

$\Delta h = 0$

we know,

$$\frac{P_1}{S} + \frac{V_1^2}{2} = \frac{P_2}{S} + \frac{V_2^2}{2}$$

$$2P_1 + SV_1^2 = 2P_2 + SV_2^2$$

$$P_2 = \frac{2P_1 + SV_1^2 - SV_2^2}{2}$$

$$= \frac{2 \times 20 + 1000(0.38^2 - 0.28^2)}{2}$$

$$= \frac{100}{2}$$

$$= 50\ Pa$$

OR

2a

Principle of ~~Conser~~ conservation of angular velocity

Statement: It state that if there is no external force acting on the system then total angular momentum of the system remain conserved.

i.e L = Constant

$I\omega$ = Constant

PROOF:

We know, torque (τ) is defined as rate of change of angular momentum of the system

$$\tau = \frac{dL}{dt} \quad --(1)$$

If there is no external force acting on the system

$\tau = 0$.

$$\Rightarrow \frac{dL}{dt} = 0$$

$$dL = 0$$

Integrating both side

$$\int dL = \int 0$$

L = constant

$\Rightarrow I\omega$ = constant

Proved

Given

Arms outstretched

$f_1 = 2.4$ rev/s

$I_1 = I$

Arms folded

$f_2 = ?$

$I_2 = 0.6I$

We know

$I_1\omega_1 = I_2\omega_2$

$\Rightarrow I_1 \times 2\pi f_1 = I_2 \times 2\pi f_2$

$\Rightarrow I \times 2.4 = 0.6I \times f_2$

$\Rightarrow f_2 = \frac{2.4}{0.6} = 4$ rev/sec

3V

Assumption made by Laplace for the velocity of sound in air are.

1. Propagation of sound wave is not isothermal process but it is an adiabatic process.

$$PV^{\gamma} = \text{Constant}.$$

3 ii)

Soln

Given,

$f = 512\ Hz$

$\lambda_{20} = 670\ mm = 0.67m$

$V_{20} = ?$

$\lambda_0 = ?$

We know

$V_{20} = f \lambda_{20}$

$= 512 \times 0.67$

$= 343.04\ ms^{-1}$

Also

$$\frac{V_{20}}{V_0} = \sqrt{\frac{273+20}{273}}$$

$V_0 = 343.04 \times 0.96$

$= 331.12$

$\lambda_0 = \frac{V_0}{f}$

$= \frac{331.12}{512}$

$= 0.646m$

$\therefore \lambda_0 = 646\ mm$

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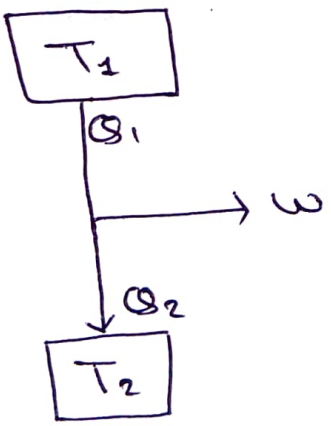
4 (i) The limitation of first law of thermodynamics are:

a) It doesn't give the direction of flow of heat

b) It doesn't explain why heat cannot be spontaneously converted into work.

ii)



(5)

4(iii) Essential part of heat engine are:

a) source of heat
b) working object
c) sink of heat at low temperature.

Soln

efficiency (η) = $\frac{\text{output work}}{\text{input work}} \times 100\%$

$= \frac{Q_1 - Q_2}{Q_1} \times 100\%$

$= \left(1 - Q_2/Q_1\right) \times 100\%$.

---

5) Biot and Savart law state that magnetic field due to tiny current element at any point is proportional to length of current element, current, sine angle between current direction and line joining the current element and inversely proportional to square of the length of distance between point and current carrying element.

$$dB = \frac{\mu_0}{4\pi} \frac{I\,dl \sin\theta}{r^2}$$

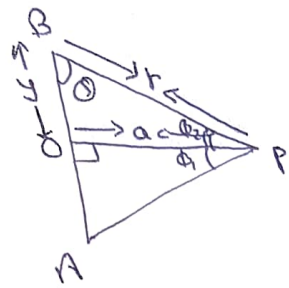
where,

dB = Small magnetic field
I = Current
dl = Small length of current carrying element
θ = angle between direction of current and line joining point and element
r = length of distance between point and element.

5.11

Let.

Consider a straight conductor AB current be I



~~Point current is~~

Any point = P

distance OP = a

Then magnetic field B will be.

$$B = \frac{\mu_0 I}{4\pi a} [\sin\theta_1 + \sin\theta_2]$$

$$[\because \theta_1 \rightarrow 90, \theta_2 \rightarrow 90]$$

$$B = \frac{\mu_0 I}{4\pi a} [1 + 1]$$

$$B = \frac{\mu_0 I}{4\pi a}$$

III Right hand rule give the direction of magnetic field due to straight conductor.

6:

Magnetic flux is define as the total number of magnetic fields which passes through given Area. It is denoted by "Φ"

i:

ii:

Soln

Given

$\Phi = 5t^3 + 4t^2 + 3t$

$t = 2 \text{ sec}$

$\mathcal{E} = ?$

We know.

$$\mathcal{E} = \frac{d\Phi}{dt}$$

$$= \frac{d(5t^3 + 4t^2 + 3t)}{dt}$$

$$= 15t^2 + 8t + 3$$

$$= 79$$

7

i) Work function of metal is define as the energy that is needed for removing an electron from a solid to a point in the vacuum immediately outside the solide surface.

$\phi_0 = h f_0$

ii) An equation in physics giving the kinetic energy of a photoelectron emitted from a metal as a result of the absorption of a radiation quantum. $E_k = hv - w$ where E_k is the KE of photoelectron, h is plank constant, v is the freqency associated with the radiation quantum. w is the work function.

Einstein argued that light was a wave that intreact with matter in the form of a packed of energy or quantum of Energy

(iii) Soln

Given

$f_0 = 5 \times 10^{14}$

$f = 8 \times 10^{14}$

$V = 1.23$

$hf = eV + hf_0$

$h(f - f_0) = eV$

$h = \frac{eV}{f - f_0}$

$h = \frac{1.6 \times 10^{-19} \times 1.23}{8 \times 10^{14} - 5 \times 10^{14}}$

$= 6.56 \times 10^{-34}$

ii

One can estimate that the charge of electron will be 1.6×10^{-19}, $2\times1.6\times10^{-19}$, $3\times1.6\times10^{-19}$ ... $n\times1.6\times10^{-19}$ as the conclusion of millikan's oil drop experiment was the charge of electron is quantized and always found in the integral multiple of 1.6×10^{-19}

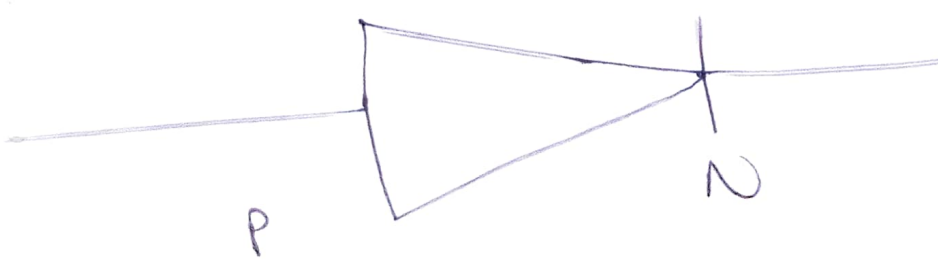
iii

The function of X-rays is to ionise the unionised particles.

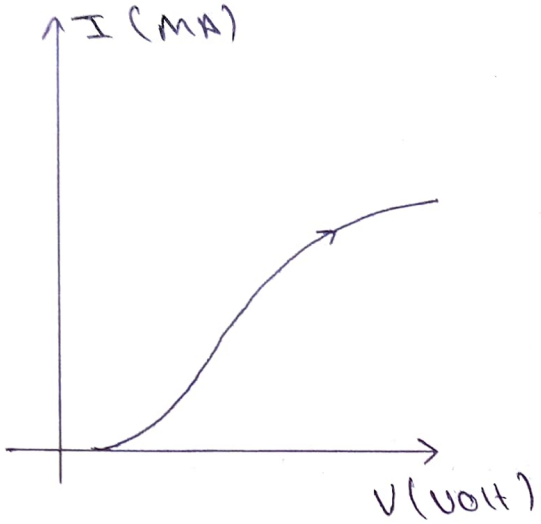
We can use X-rays because X-Rays also ionised the particle through which it pass.

OR

i. When the P side of junction diode is with the +ve of cell then it is called forward biasing. When the N side of junction diode is connected with the +ve terminal of cell then it is called reverse biasing of junction diode



ii



iii Two applications of junction diode.

→ Can be used for making rectifier
→ Can be used ~~for~~ in LED lighting application when forward-biased.

Group C

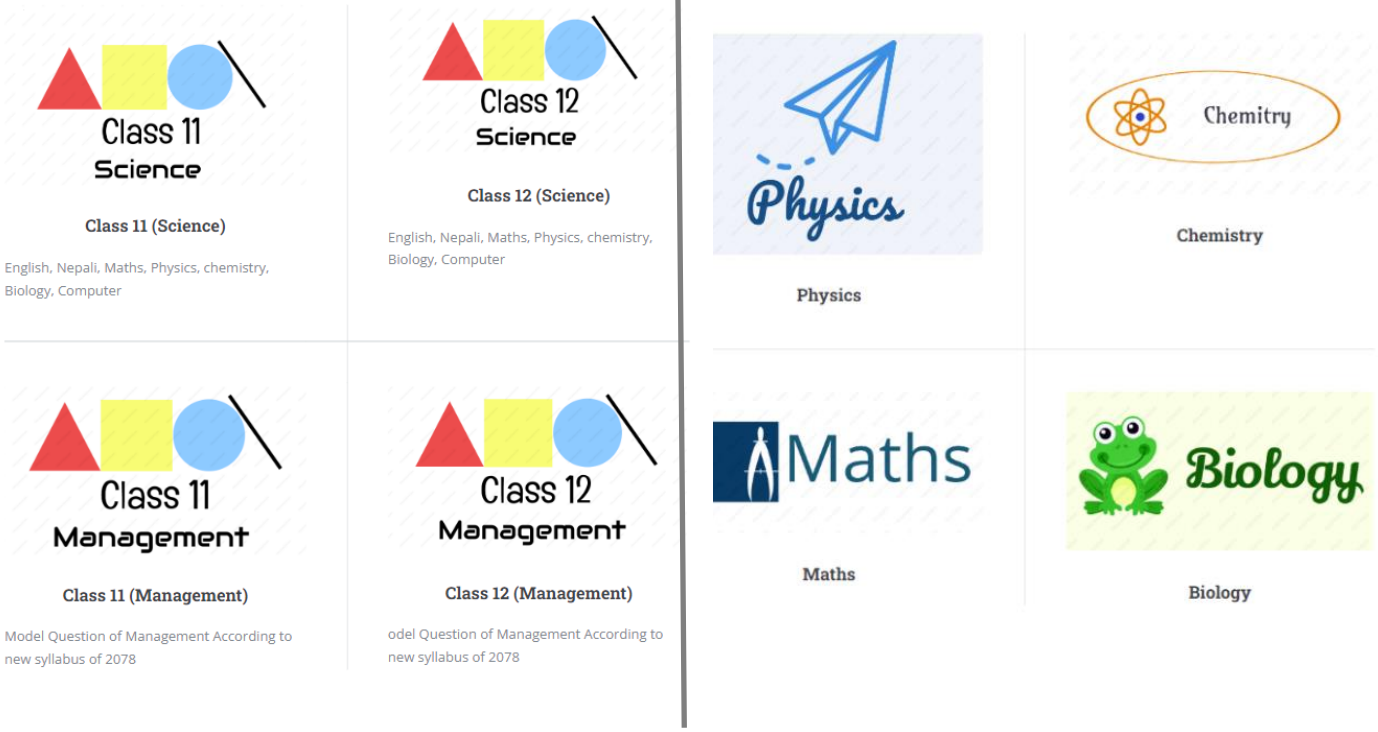
i) He cant study Interference pattern using candle because the waves emitted from candle flame are not monochromatic waves as there exist huge range of wavelength

ii) He can produce sustainable Interference pattern by:-

1) using monochromatic source of light like Sodium bulb.
11) The source must be coherent. i.e. source must have same wavelength / frequency, and in the same phase.

BIPO's notes

Class 12 complete notes and paper collection and solutions.



Feedbacks:

admin@bipinkhatri.com.np | bipinkhatri.ram@gmail.com

Contact:

@im.bipo www.bkhatri.com.np @im.bipo