SET-C

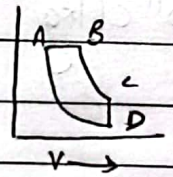
Group-'A'

1. The spikes are used in bicycle wheel to
→ c) ↑ moment of inertia of wheels.

2. Radius of Gyration of an uniform rod about an axis through its middle is
→ c) $L/(12)^{1/2}$

3. Viscosity of liquid and gases, with increase in temperature:
→ a) decrease and increase

4. In pressure-volume diagram given below, the isochoric, ~~th~~ isothermal, isobaric and isentropic path respectively are
→ ~~a)~~ d) CD, DA, AB, BC.



5. A gas is initially at 27°C. It is compressed adiabatically from 27 litres to 8 litres. The rise in temperature is ($\gamma = 1.4$)
→ b) 215°C

6. A parallel beam of light of wavelenght 450nm passes through a long slit of width 0.2mm. The angular divergence in which most of the light is diffracted is
→

7. The expression relating ~~pb~~ polarizing angle and refractive index is
→ b) $\mu \cot\theta_p = 1$

8. If a wire carrying current 'I' is bent in two arms making the right angle between them then the magnetic field intensity 'B' at the distance 'a' from both arms is: (Right be a) $\mu_0 I / 4\pi a$)

→

9. A copper ring having cut such as not to form a complete loop is held horizontally and a bar magnet is dropped through the ring with its length along the axis of ring, then acceleration of falling magnet is

→ a) g

10. Area of hysteresis curve indicates

→ c) Loss of energy per cycle

11. The value of specific charge (e/m) of electron is

→ 1.77×10^{11} C/kg

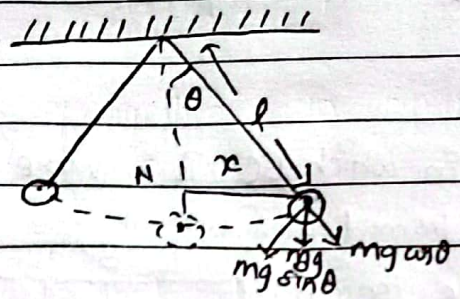
Group-'B'

Q. No. 12 (a)

→ Simple harmonic motion is the to and fro motion in which the max displacement on one side of the position is equal to max displacement of other side.

(b)

→



The given pendulumn is exerting a SHM. The bob is brought to mean position by components of mg cosθ and mg sinθ. (mg sinθ is restoring force)

$\therefore F = -mg\sin\theta$

we know,

$F = ma$

or, $-mg\sin\theta = ma$

or, $-g\sin\theta = a$

or, As θ is very small, $\sin\theta \approx \theta$.

$-g\theta = a$

Also, In a circular path,

$\theta = \frac{x}{l}$ where x is linear displacement of bob,

so,

$a = -g\,x/l$

$a \propto -x$

From above relation, we know,

$\frac{x}{a} = l/g$ [magnitude only]

$\therefore T = 2\pi\sqrt{x/g}$ $\left[f = 1/T = 1/2\pi\sqrt{g/l}\right]$ and $\left[T = 2\pi\sqrt{x/a}\right.$

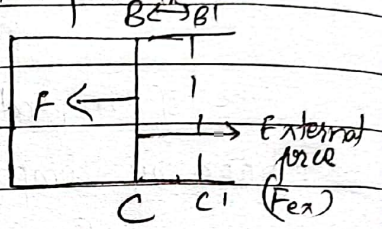
Q. No. 13(a)

→ Adhesive force is defined as the force of attraction between molecules of different substances. Eg: glass and water.

Cohesive force is defined as the force of attraction between molecules of same substance. Eg: water drop.

(b)

→ Consider a rectangular frame ABCD in which BC is movable. If we dip soap solution, a thin film is formed which pulls the BC wire towards left due to surface tension.



Then force on BC due to T is,

$F = T \times 2l$

[Since film has both upper and lower surface total length is $2l$]

The wire BC moves to B'C' through 'x' distance, so the surface tension of film increases

work done in increasing surface area against the force of tension F is given by,

$W = F \times x = T \times 2l \times x$

Also, increase in surface area is,

$A = 2l \times x$

$\therefore$ surface energy $(\sigma) = \frac{W}{A} = \frac{T \times 2l \times x}{2l \times x}$

$\therefore \sigma = T$

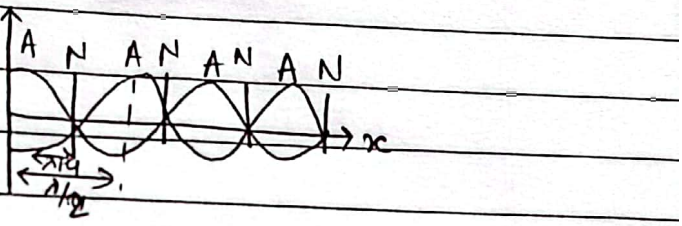
Thus surface energy is numerically equal to surface tension.

Q. No. 15(a)

(b)

For nodes,

At node amplitude of resultant wave should be 0. This is possible when $\cos kx = 0$



or, $\frac{\cos 2\pi x}{\lambda} = 0$

or, $\cos 2\pi x/\lambda = \cos(n+1/2)\pi$, where $n = 0, 1, 2, \ldots$

or, $2\pi x/\lambda = (n+1/2)\pi$

or, $x = (n+1/2)\lambda/2$, where $n = 0, 1, 2, \ldots$

Hence, $x = \lambda/4, 3\lambda/4, 5\lambda/4, \ldots$

So, distance between 2 consecutive nodes $= 3\lambda/4 - \lambda/4 = \lambda/2$ //

For antinodes: At antinodes resultant amplitude should be max.

$\cos kx = \pm 1$

or, $\cos kx = \pm 1$

or, $\cos 2\pi x/\lambda = \cos n\pi$, where $n = 0, 1, 2 \ldots$

or, $\frac{2\pi x}{\lambda} = n\pi$

or, $x = n\lambda/2$; where $n: 0, 1, 2, \cdots$

Hence, $x = 0, \lambda/2, \lambda, 3\lambda/2, \cdots$

distance between 2 consecutive antinode $= \lambda/2 - 0 = \lambda/2$

Q. No. 16(a)

Q.No.17(a)

→ Phasor diagram is a graphical way of representing the magnitude and directional relationship between 2 or more alternating quantities.

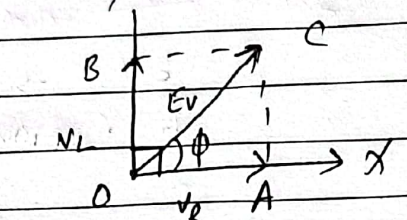


fig: Phasor diagram for L-R circuit.

(b)

→ Sol:

Given,

resistance (R) = 10Ω

Inductance (L) = 200μH = 200×10^{-6}H

supplied voltage (Ev) = 0·10V

frequency (f) = 1·0MH$_2$ = 10^6H$_2$

i) At resonance,

$$f = \frac{1}{2\pi\sqrt{LC}}$$

or, $10^6 = \frac{1}{2 \times 22/7 \times \sqrt{200 \times 10^{-6} C}}$

or, $C = \frac{1}{4\pi^2 \times 200 \times 10^6}$

$\therefore C = 126.78 \times 10^{-12}$F.

ii) Quality factor, $Q = \frac{1}{R}\sqrt{\frac{L}{C}} = \frac{1}{10}\sqrt{\frac{200 \times 10^{-6}}{126.78}} = 0.13 \times 10^6$

(The final answer may be wrong I didn't do it in calculator)

Q.No.18(a)

No, one photon can only eject one electron at a time. This is ~~bee~~ because photoelectric effect is a one to one interaction.

~~(b)~~ (c)

→ In photoelectric fire alarms, the smoke enters the chamber which reflects a light from the light source onto the sensor, triggering the alarm.

(b)

Q. No. 1 (a)

i) → The electronic circuit which makes decision is logic gate.

ii) → The Boolean expression are:

AND - ~~Y = A + B~~ $Y = A \cdot B$

OR - $Y = A + B$

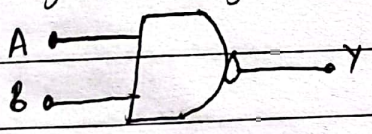
NOT - $Y = \bar{A}$

(b) (b)

→

(c)

→ Let the two inputs be denoted by A and B. First it is put through AND gate then NOT gate. Its logic symbol is:



The new logic gate formed is NAND gat

Truth table:

Inputs		Output $Y = \overline{A \cdot B}$
A	B	
0	0	1
1	0	1
0	1	1
1	1	0

Group-'C'

Q. No. 20 (a)

→ A plane transmission grating is formed by using a sharp diamond point to scratch a very large no. of equidistant parallel lines very near to each other on a surface of glass

Q (b)

→

(c)

Soln:

Given,

grating space (d) $= \frac{1}{500}$ mm

$= 2 \times 10^{-3}$ mm

$= 2 \times 10^{-6}$ m

wavelength $\lambda = 600$ nm

$= 6 \times 10^{-7}$ m

Now,

The highest order of spectra is $\theta = 90°$,

Hence, $n\lambda = d \sin 90°$

or, $n = \frac{d}{\lambda} = \frac{2 \times 10^{-6}}{6 \times 10^{-7}} = 3.33 = 3$

∴ The diffraction maxima = 3.

Q. No 22.

(a)

→ Millikan's method is based on study of motion of an oil drop under free fall due to gravity and in uniform electric field.

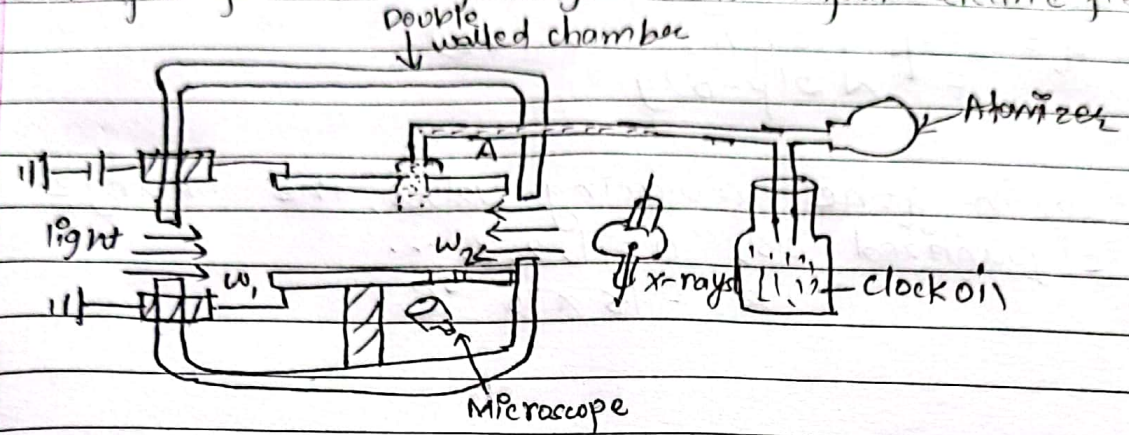


fig: Millikan's apparatus

The apparatus consists of two horizontal circular metal plates A and B about 20cm in diameter and 1.5cm apart. The upper plate is connected to high tension battery and lower plate is earthed. The p.d between 2 plates is about 10kV. Small hole is at centre of upper plat The non volatile and low vapour oil is used. Double walled chamber is used to enclose it. Oil is sprayed by atomizer. Oil drop falls between 2 plates are illuminated by arc through W_1 and ionized by x-ray through W_2. The oil drops are ionized by friction. The motion of oil drop can be measured by microscope.

(b)

→ In Millikan's oil drop experiment, the value of charge of electron was calculated i.e. 1.6×10^{-19} C as he derived the formula,

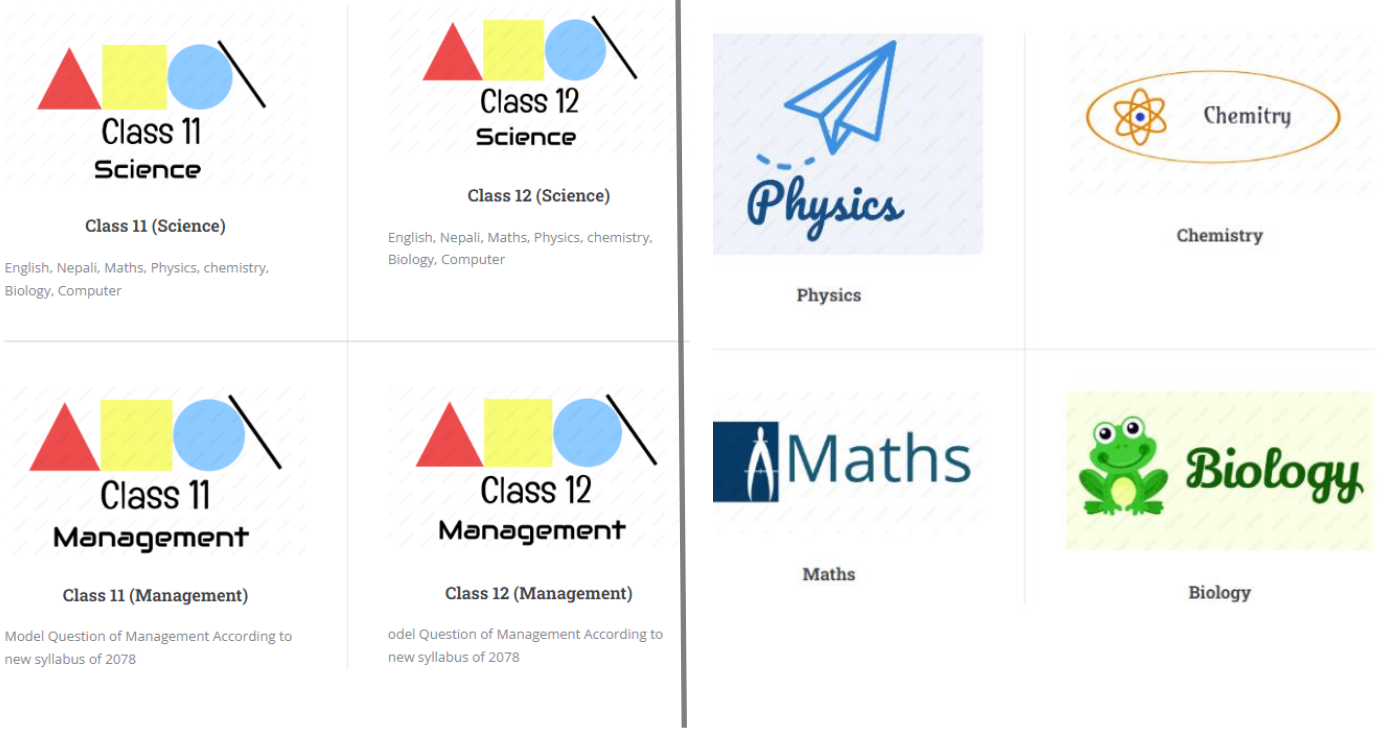
$$q = \frac{6\pi\eta}{E}\sqrt{\frac{9\eta v_1}{2(\rho-\sigma)g}}\,(v_1+v_2)$$

so, in $q = ne$ replacing values, the charge is quantized as, $n = 1, 2, 3, \ldots$

$$e = -1.6 \times 10^{-19} C$$

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