B.K. BIRLA CENTRE FOR EDUCATION

SARALA BIRLA GROUP OF SCHOOLS
A CBSE DAY-CUM-BOYS' RESIDENTIAL SCHOOL

TERM-1 EXAMINATION 2025-26

PHYSICS (SET-1)

MARKING SCHEME

Class: XII **Time: 3hr**
Date: 31.08.26 **Max Marks: 70**

Section A (16 x 1M)

1. (b) V/m
2. (a) Distance
3. (a) Temperature remains constant
4. (d) Circular
5. (d) 6A in the clockwise direction.
6. (b) Closed curves
7. (a) Conservation of energy
8. (b) Zero
9. (b) Lags the voltage by 90°
10. (b) Transverse
11. (d) Wavelength changes but the frequency remains unchanged
12. (c) 1.25
13. (a)
14. (c)
15. (a)
16. (d)

Section B (5 X 2M)

17.

$$F = \frac{1}{4\pi\varepsilon_0} . \frac{q_1 q_2}{r^2}$$

Where, ε_0 = Permittivity of free space and $\frac{1}{4\pi\varepsilon_0} = 9 \times 10^9 \text{ Nm}^2\text{C}^{-2}$

Therefore, force

$$\text{F} = \frac{9 \times 10^9 \times 2 \times 10^{-7}}{(0.3)^2} = 6 \times 10^{-3}\text{N}$$

18.

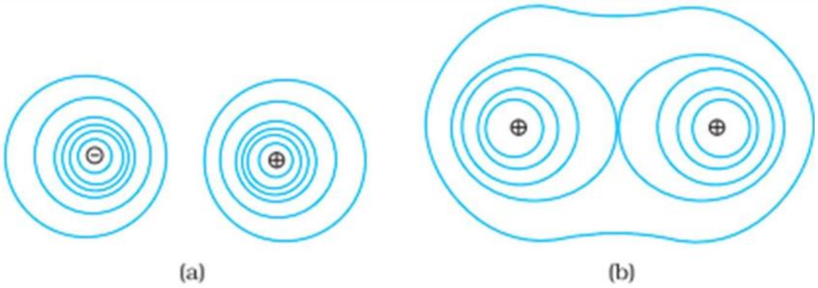
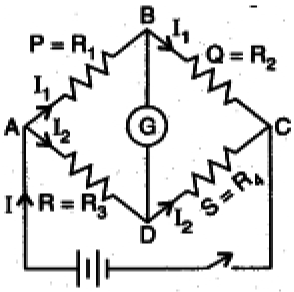


FIGURE 2.11 Some equipotential surfaces for (a) a dipole, (b) two identical positive charges.

19.



½

Applying kirchhoff's loop rule to closed loop ADBA

$-I_1R_1 + 0 + I_2R_2 = 0 \; (I_g = 0)$ ...(i) ½

For loop CBDC,

$-I_2R_4 + 0 + I_1R_3 = 0$ ...(ii)

⇒ from equation (i)

$$\frac{I_1}{I_2} = \frac{R_1}{R_2}$$

From equation (ii)

$$\frac{I_1}{I_2} = \frac{R_4}{R_3}$$ ½

$$\therefore \quad \frac{R_1}{R_2} = \frac{R_4}{R_3}$$ ½

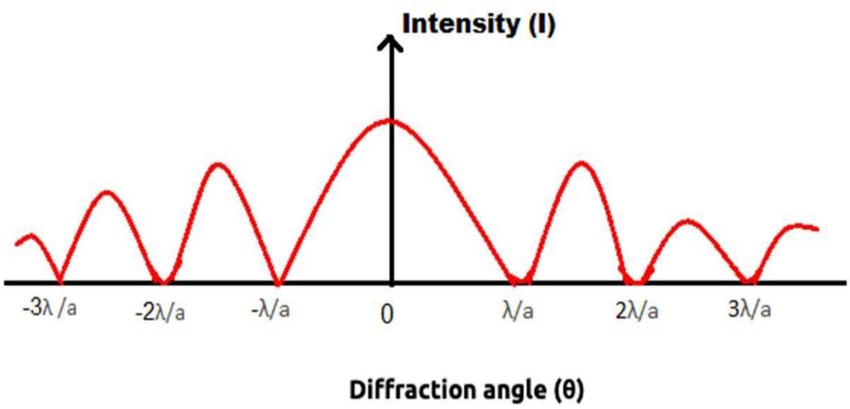
20. λ_1 -Microwave ½

λ_2 - ultraviolet ½

λ_3- infrared ½

Ascending order - $\lambda_2 < \lambda_3 < \lambda_1$ ½

21.



Width of central maximum is twice that of any secondary maximum

Or

	Interference	Diffraction
1.	Interference is the result of superposition of secondary waves starting from two different wavefronts originating from two coherent sources.	Diffraction is the result of superposition of secondary waves starting from different parts of the same wavefront.
2.	All bright and dark fringes are of equal width.	The width of central bright fringe is twice the width of any secondary maximum.
3.	All bright fringes are of same intensity.	Intensity of bright fringes decreases as we move away from central bright fringe on either side.
4.	Regions of dark fringes are perfectly dark. So there is a good contrast between bright and dark fringes.	Regions of dark fringes are not perfectly dark. So there is a poor contrast between bright and dark fringes.
5.	At an angle of λ / d, we get a bright fringe in the interference pattern of two narrow slits separated by a distance d.	At an angle of λ / a, we get the first dark fringe in the diffraction pattern of a single slit of width a.

SECTION-C (7 X 3M)

22. Electric field intensity due to point charge at any point is defined as the force experienced by a unit positive charge at that point due to the point charge

    Let a point charge +q is at origin ‘O’.

    To find electric field intensity at a point P at distance ‘r’ from the ‘O’, consider a + ve charge q_0 is kept at ‘P’.

    Force experience by the charge q_0 is $F= kqq_0/r^2$

    $E=F/q_0$

    $E= (kqq_0/r^2)/ q_0$

    $E= kq/r^2$

23. (a)The electric field should be directed downwards, perpendicular to the magnetic field and the direction of motion.

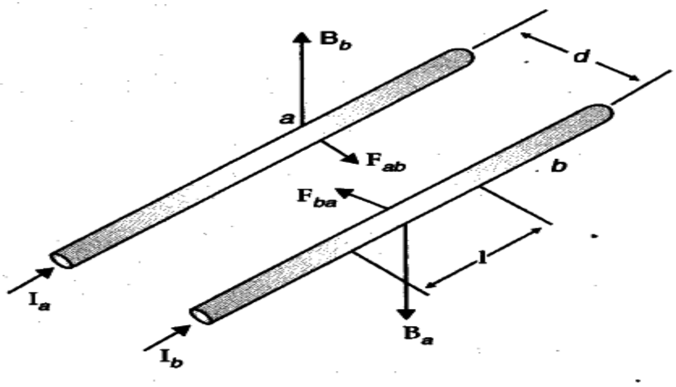
    (b) (i) Electric and magnetic forces will act in the opposite directions. No deflection of proton.

    (ii) Both Electric and magnetic forces will act in the same direction (downwards), causing the electron to be deflected strongly.

    Or

Similarly,

$$F_{ab} = I_1 l \frac{\mu_0 I_2}{2\pi d}$$



$$B_a = \frac{\mu_0 I_a}{2\pi d}$$

since $$\vec{F} = i(\vec{l} \times \vec{B})$$

$$F_{ba} = I_1 . l \frac{\mu_0 I_2}{2\pi d}$$

Similarly,

$$F_{ab} = I_1 . l \frac{\mu_0 I_2}{2\pi d}$$

1 ½

The ampere is the value of that steady current which, when maintained in each of the two very long, straight, parallel conductors of negligible cross-section, and placed one metre apart in vacuum, would exert on each of these conductors a force equal to 2×10^{-7}newtons per metre of length. 1

24. **Given**

$m = 0.32 JT^{-1}$

$B = 0.15$ T

Stable Orientation: $\theta = 0°$.

$U = -0.32 \times 0.15 \times \cos 0°$

$U = -0.048$ J

Unstable Orientation: $\theta = 180°$.

$U = -0.32 \times 0.15 \times \cos 180°$

$U = +0.048$ J

Area of the circular loop = πr^2

$$= 3.14 \times (0.12)^2 \text{ m}^2 = 4.5 \times 10^{-2} \text{ m}^2$$

$$E = -\frac{d\varphi}{dt} = -\frac{d}{dt}(\text{BA}) = -\text{A}\frac{dB}{dt} = -\text{A}\,.\,\frac{B_2 - B_1}{t_2 - t_1}$$

For $0 < t < 2$s

$$E_1 = -4.5 \times 10^{-2} \times \left\{\frac{1-0}{2-0}\right\} = -2.25 \times 10^{-2} \text{ V}$$

$$\therefore \quad I_1 = \frac{E_1}{R} = \frac{-2.25 \times 10^{-2}}{8.5} \text{ A} = -2.6 \times 10^{-3} \text{ A} = -2.6 \text{ mA}$$

For $2\text{s} < t < 4$s,

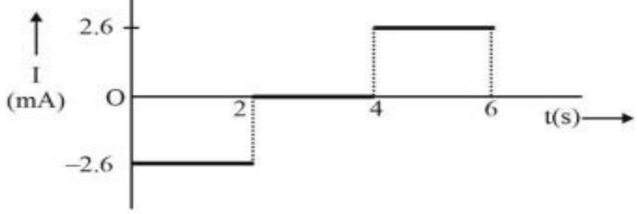
$$E_2 = -4.5 \times 10^{-2} \times \left\{\frac{1-1}{4-2}\right\} = 0$$

$$\therefore \quad I_2 = \frac{E_2}{R} = 0$$

For $4\text{s} < t < 6$s,

$$I_3 = -\frac{4.5 \times 10^{-2}}{8.5} \times \left\{\frac{0-1}{6-4}\right\}\text{A} = 2.6 \text{ mA}$$

	0<t<2s	2<t<4s	4<t<6s
E(V)	-0.023	0	+0.023
I(mA)	-2.6	0	+2.6



25.

(a) XL = 2πf L L = XL /2πf L = 20/(2 × 3.14 × 100) = 0.032 H

(b) A battery is a source of direct current and thus f = 0 Hz. As XL = 2πfL, the inductive reactance of the inductor becomes zero.

(c) Power dissipated in an LCR circuit is maximum when XL= XC f = 1/2π√(LC) f = 0.398 × 10^3 Hz f = 398 Hz Under this condition of resonance, the circuit behaves as a pure resistive circuit. Hence phase difference between current and voltage is 0°.

26. a. Microwaves are suitable for radar systems that are used in aircraft navigation.
These rays are produced by special vacuum tubes, namely Klystrons, magnetrons and Gunn diodes. 1

b. Infrared waves are used to treat muscular strain.
These rays are produced by hot bodies and molecules. 1

c. X rays are used as a diagnostic tool in medicine.
These rays are produced when high energy electrons are stopped suddenly on a metal of high atomic number. 1

27. (I) Since the light ray enters perpendicular to the face AB, the angle of incidence on face AC will be

45° ,

So, Sin C = 1/n , $Sin\ 45° = 1/n$, n = √2

(II)

In fig.2, the face AC of the prism is surrounded by a liquid so $n = \frac{n_g}{n_l} = \frac{\sqrt{2}}{\left(\frac{2}{\sqrt{3}}\right)} = \frac{\sqrt{3}}{\sqrt{2}}$

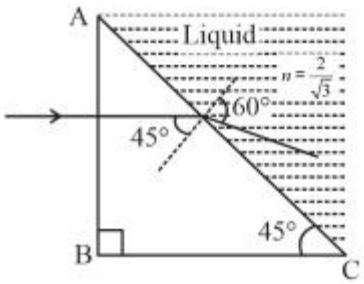
Since the angle of incidence on the surface AC is 45°, which is less than the critical angle for the pair of media (glass and the liquid), the ray neither undergoes grazing along surface AC, nor does it suffer total internal reflection **1M**

Instead it passes through the surface AC and undergoes refraction into the liquid.

For refracting interface AC, $n_1 \sin i = n_2 \sin r$

$n_1 . sin45° = \left(\frac{2}{\sqrt{3}}\right) sin\, r$

$sin\, r = \frac{\sqrt{3}}{2} \therefore\ r = 60°.$



1

28. The wavelength of the light is λ1=650nm. The wavelength of second light,λ_2=520nm.
Distance between the slit and the screen is 1.2m.
Distance between the slits is 2 mm.
The relation between the nth bright fringe and the width of fringe is:
$x = n\lambda_1 D/d$
For third bright fringe, n=3
$x = 3 \times 650 \times 10^{-9} \times 1.2/(2 \times 10^{-3}) = 1950 \times 6 \times 10^{3}$ nm

$x = 11.7 \times 10^{-3}$m =11.7mm

SECTION-D (Case Study Based Questions) (2 X 4M)

29. (i) (c) 1.6 mm/s
(ii) (d) tripled
(iii) (a) 4:1
(iv) (b) 2 mm/s Or (a) Current
30. (i) (b) Frequency of visible light is less than that for ultraviolet light I 1

(ii) (a)For non-metals the work function is high 1
(iii) (a)Photoelectric current increases 1
(iv) (b) Frequency 1

Or

(b) It decreases as the work function increases 1

SECTION-E (3 X5M)

31.

$$V = -\int_{\infty}^{R} \vec{E}\,\vec{dr}$$

But $$\vec{E} = \frac{1}{4\pi\varepsilon_0}\,\frac{q}{r^2}\,\hat{r}$$

$\therefore$ $$V = -\int_{\infty}^{R} \frac{1}{4\pi\varepsilon_0}\,\frac{q}{r^2}\,\hat{r}\,\vec{dr}$$

$$= -\int_{\infty}^{R} \frac{1}{4\pi\varepsilon_0}\,\frac{q}{r^2}\,dr$$

because $\hat{r}\,\vec{dr} = dr$

$$= -\frac{q}{4\pi\varepsilon_0}\int_{\infty}^{R} \frac{1}{r^2}\,dr$$

$$= -\frac{q}{4\pi\varepsilon_0}\left[-\frac{1}{r}\right]_{\infty}^{R} = \frac{q}{4\pi\varepsilon_0}\left[\frac{1}{R} - \frac{1}{\infty}\right]$$

or $$V = \frac{1}{4\pi\varepsilon_0}\,\frac{q}{R}$$

(i) Inside the shell potential will be constant and same as at the surface V=kq/R

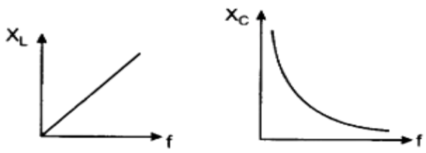
(ii) Outside the shell V= kq/r

Or

(a) C_{13}= 12μF
C_{213}= 4 μF
C_{4213}= 10 μF

(b) q_{C4} = C x V= 6 x10^{-6} X10= 6 X 10^{-5} C
q_{C1}= 4 X 10^{-5}/2= 2x 10^{-5} C

32. (a)



$\therefore$ $$X_L \propto f$$

Capacitive reactance (X_C) = $\frac{1}{2\pi f C}$

$\therefore$ $$X_C \propto \frac{1}{f}$$

(b)

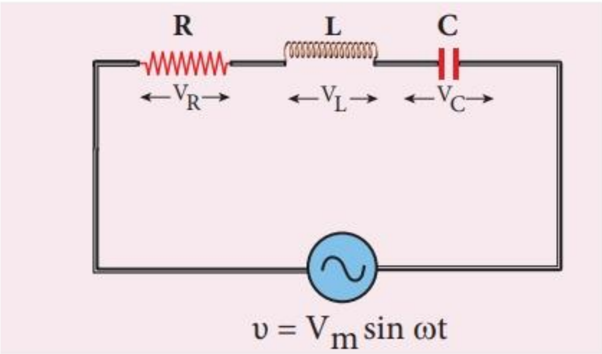


Figure AC circuit containing *R*, *L* and *C*

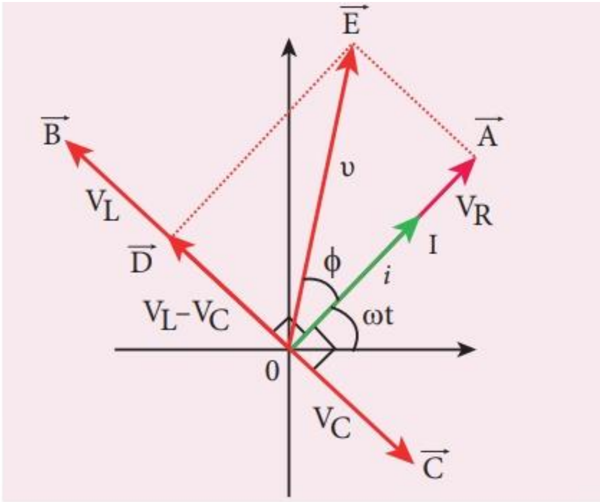
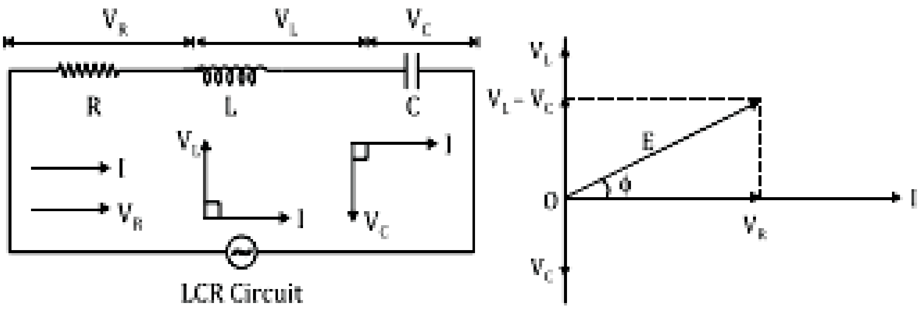


Figure Phasor diagram for a series *RLC* – circuit when $V_L > V_C$

(c) (i) X- Inductor, Y- Resistor
(ii) I= √2/8 A

Or

(a)



$$V^2 = V_R^2 + (V_C - V_L)^2 \Rightarrow V = \sqrt{V_R^2 + (V_C - V_L)^2} \qquad ...(i)$$

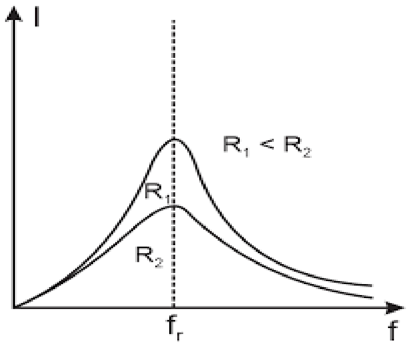
But $\quad V_R = R\,i,\ V_C = X_C\,i \quad$ and $\quad V_L = X_L\,i \qquad ...(ii)$

where $X_C = \dfrac{1}{\omega C}$ = capacitance reactance and $X_L = \omega L$ = inductive reactance

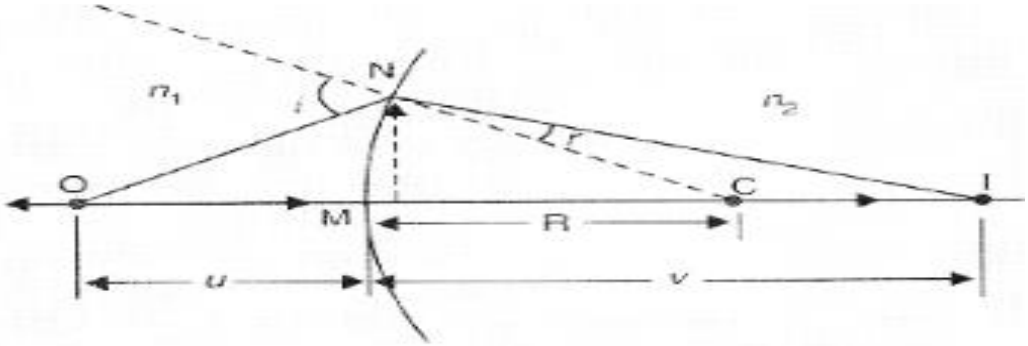
$$\therefore \qquad V = \sqrt{(R\,i)^2 + (X_C\,i - X_L\,i)^2}$$

$\therefore$ Impedance of circuit, $\quad Z = \dfrac{V}{i} = \sqrt{R^2 + (X_C - X_L)^2}$

(b)



33. (a)



From the given diagram, for small angles :

$$\tan \angle NOM = \frac{MN}{OM} = \angle NOM$$

$$\tan \angle NCM = \frac{MN}{MC} = \angle NCM$$

$$\tan \angle NIM = \frac{MN}{MI} = \angle NIM$$

For Δ NOC, $\angle i$ is the exterior angle.

$$\Rightarrow \angle i = \angle NOM + \angle NCM = \frac{MN}{OM} + \frac{MN}{MC}$$

Similarly,

$$\Rightarrow \angle r = \angle NCM + \angle NIM$$

$$r = \frac{MN}{MC} + \frac{MN}{MI}$$ 2

$$n_1 \sin i = n_2 \sin r$$

$$n_1 i = n_2 r$$

$$\Rightarrow n_1 \left(\frac{MN}{OM} + \frac{MN}{MC}\right) = n_2 \left(\frac{MN}{MC} - \frac{MN}{MI}\right)$$

1

$(n_2/v)- (n_1/v) = (n_2-n_1)/R$

(b) Lens maker's formula,

1f= $(\mu-1)\ (1/R_1-1/R_2)$ 1

Here, f = 20 cm, μ = 1.55, R1 = R, R2 = -R

120= (1.55−1) (1/R−1/(−R) or   120 = 0.55×2R

⇒R=1.1×20=22cm 1

Or

(a) Using Lens Formula

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

$\frac{1}{20}=\frac{1}{v}+\frac{1}{12}$

$\frac{1}{v}=\frac{3}{60}-\frac{5}{60}=-\frac{1}{30}$ ½

V= -30 cm 1

(b)

$m=\frac{\text{fo}}{\text{fe}}$

$=\frac{144}{6.0}$ 1

= 24 ½

Separation= f_o + f_e= 144+6= 150 cm 1

___________________________END OF MARKING KEY__________________________