CKS CODE: 2104

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MODEL EXAMINATION 2023-24

PHYSICS (042)

CLASS XII **TOTAL MARKS:70**

TIME: 3 Hours

ANSWER KEY

(Questions 1 – 16 – one mark each)

1. (c) Microwaves

2. (d) 1.5 X 10^8 m/sec

3. (a) spherical wavefront and plane wavefront

4. (d) 16 a_0

5. (d) $\frac{R_2^2}{R_1}$

6. (d) 5/2

7. (b) 283V

8. (c) They are always attractive

9. (b) 10^{-10} s

10. (d)restoring couple per unit twist of suspension.

11. (a) 6 fermi

12. (c) β/μ

13. a) If both Assertion and Reason are true and Reason is correct explanation of Assertion.

14. a) If both Assertion and Reason are true and Reason is correct explanation of Assertion.

15. c) If Assertion is true but Reason is false.

16. d) If both Assertion and Reason are false.

SECTION B

17. $B_1 = \frac{\mu_0 I_1}{2\pi_r} =$ 1.2×10^{-4} T into the page

$B_2 = \frac{\mu_0 I_2}{2\pi r} = 0.4 \times 10^{-4}$ into the page

B_1 and B_2 are in same direction.

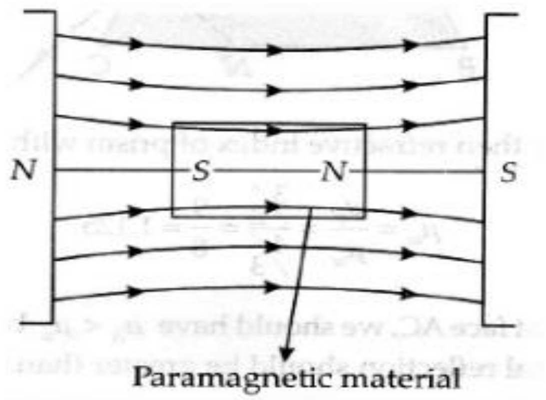
$B_{net} = B_1 + B_2 = 1.6 \times 10^{-4}$ T into the page 1

(b) Magnitude of magnetic force per unit length

$F/l = \frac{\mu_0 I_1 I_2}{2\pi r} = 1.2 \times 10^{-4}$ N/m 1

OR

Susceptibility is +ve and less than unity. Magnetic material is paramagnetic material. 1



1

18. Work done to dissociate the system of three charges,

$W = \frac{1}{4\pi\varepsilon 0}\frac{qAqB}{AB} + \frac{1}{4\pi\varepsilon 0}\frac{qBqC}{BC} + \frac{1}{4\pi\varepsilon 0}\frac{qCqA}{CA}$ 1

$W = -2.304 \times 10^{-8}$ J 1

19. Force on wire AB ,

$F = IlB \sin 90^0 = IlB$ ½

The vertical component of this force is $F \cos 30^0 = IlB \frac{\sqrt{3}}{2}$ ½

If 'm' is the mass per unit length of wire ,then weight = mlg

This weight is balance by the vertical component of force

$mlg = IlB (\sqrt{3})/2$ ½

$m = 0.2872$ Kgm^{-1} ½

20. No.of atoms in 1g of uranium = 2.563 ½

Energy released by 1g of uranium = no.of atoms × energy released per Fission. ½

Energy = 8.202×10^{10} J 1

21. Flux through S_1 = $\frac{Q}{\varepsilon 0}$ ½

Flux through S_2 = $\frac{Q+2Q}{\varepsilon 0}$ = $\frac{3Q}{\varepsilon 0}$ ½

Ratio of flux = 1: 3 ½

No change in the flux through S_1 with dielectric medium inside the sphere S_2 ½

SECTION C

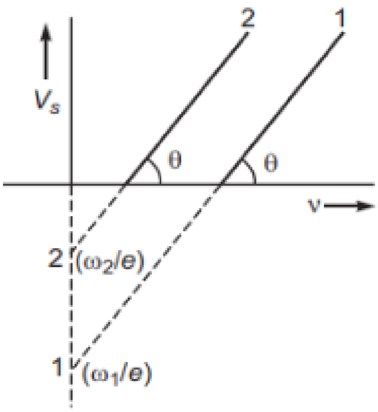
22. (a) X Rays 1

Medical use to see bone fractures. ½

(b) Microwaves 1

Used to cook food in microwave ovens. ½

23.



1

(i) Slope of the graph, tanθ = h/e depends on 'h and 'e' 1

(ii) Intersect of lines depend on the work function 1

24. (a) Coherent sources are needed to ensure that the positions of maxima and minima do not change with time. 1

(b) I = $4I_0$ $\text{Cos}^2\emptyset/2$ ½

For path difference λ, phase difference ϕ = 2π

K = $4I_0$ $\text{Cos}^2\pi$ = $4I_0$ ½

When path difference = 2 λ/3

Phase difference , $\phi = 2\pi/3$ ½

$I' = 4I_0 \, Cos^2 \, 2\pi/3 = K/4$ ½

25.

(a) According to the figure

$\Delta x = v_d \, \Delta t$

Hence, amount of charge crossing area A in time Δt

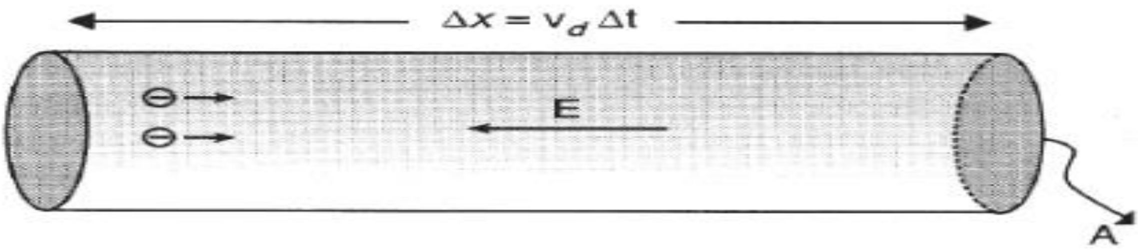


Diagram ½

Derivation for current 1

$I = nAeV_d$

(b) charge flowing = area under the curve ½

= 37.5 C 1

26. (i)Torque = MB Sinθ, ½

θ = 0

Torque = 0 ½

(ii) Force acting on the loop

Magnitude of Force = $\frac{\mu 0 I1\, I2}{2\pi} \, l \, [\frac{1}{r1} - \frac{1}{r\,2}]$ ½

$= 1.6 \times 10^{-5}$ N 1

Direction : Towards the conductor or attractive. ½

27. (a)

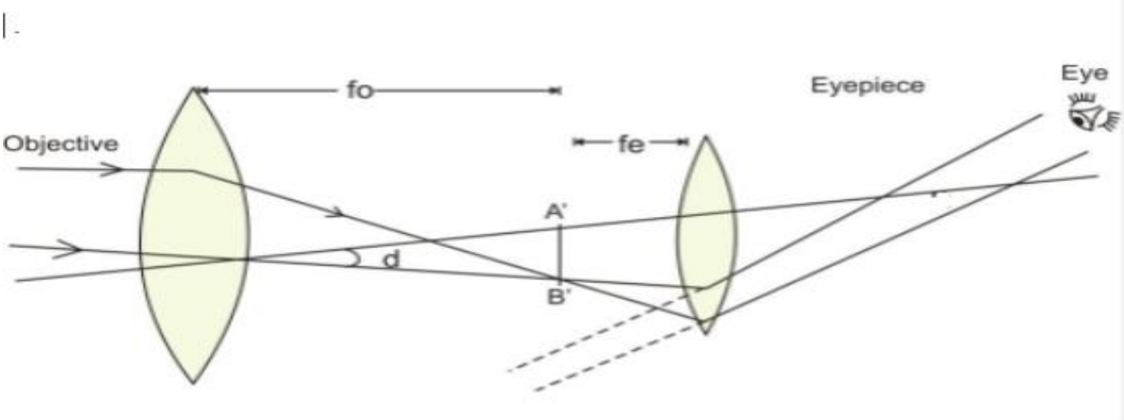


Diagram 1

(b) Astronomical telescope, the objective has a large aperture and low power and eyepiece has large power and small aperture.

1

So, objective lens l_1 ½

Eyepiece lens L_3 ½

28. Derivation of magnetic energy unit volume (NCERT page no.224) 2

Comparsion of energy densities 1

OR

(i) As we know, ϕ_2 = MI_1

M=$\frac{\phi_2}{I_1}$ 1

M= 10/4

M=2.5 H

½

(ii) Given emf, e_2= 100V

$|\varepsilon_2| = \frac{M\,dI_1}{dt}$ 1

$\frac{d_{I1}}{dt} = 40As^{-1}$ ½

SECTION D

29. i) (b)

ii) (c)

iii) (c)

iv) (a) OR (b) (4× 1 =4)

30. (i). b

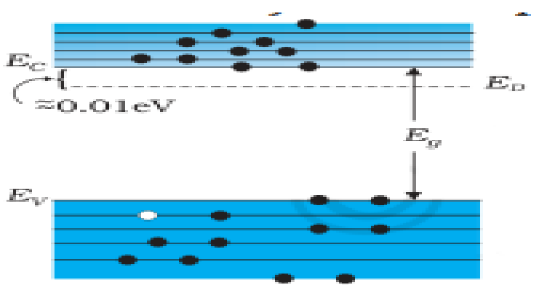
(ii) b

(iii) c

(iv) b OR a (4×1 = 4)

SECTION E

31. With proper level of doping, the number of conduction electrons can be made much larger than the number of holes.Due to this conductivity of the doped cystal increases. ½



½

(ii) Two processes (a) diffusion (b) drift 1

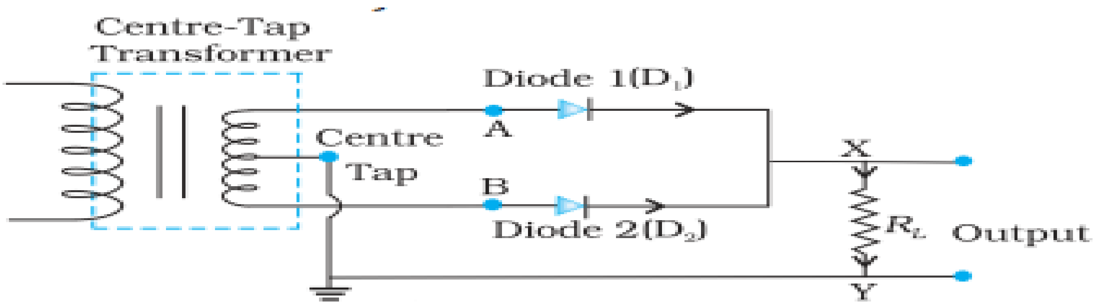
Diffusion - Due to concentration gradient majority charge carrier that is electron moves from n to p side and holes to p to n side is called diffusion. ½

Drift – the motion of charge carrier due to electric field is called drift. ½

(iii) (a) forward bias width decreases. (b) reverse bias width increases. 1+1

OR

(i)



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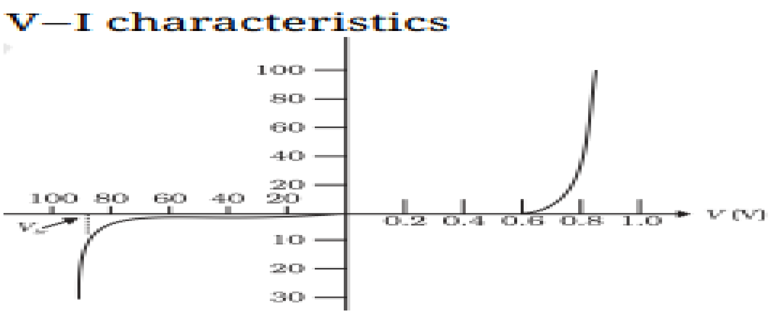
Working -NCERT page no.483 1.5

(iii)



1

Diode conducts when forward biased and does not conduct when reverse biased. This characteristic makes it suitable for use for rectification. ½

(iv) In the case of carbon energy gap is 5.4 e V but in the case of silicon energy gap is 1.1 e V . 1

32. (i) d – separation between the plates

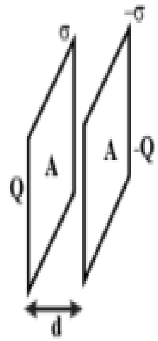
A – area of cross -section

Electric field by a single plate E = $\frac{\sigma}{2\varepsilon 0}$ ½

Electric field between the plates = $\frac{\sigma}{\varepsilon 0}$ = $\frac{Q}{A\varepsilon 0}$ ½

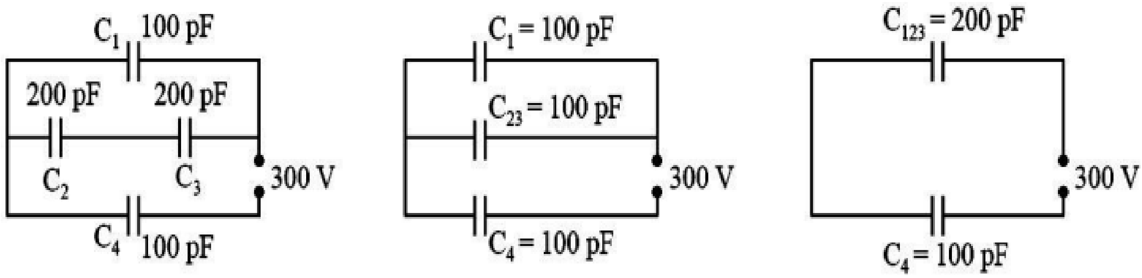
Potential difference between the plates V = Ed = $\frac{Qd}{A\varepsilon 0}$ ½

Capacitance C = $\frac{Q}{V}$ = $\frac{A\varepsilon 0}{d}$ ½



1/2

(ii)



Equivalent capacitance = 200/3 PF 1

Charge on C_4 = 2×10^{-8} C ½

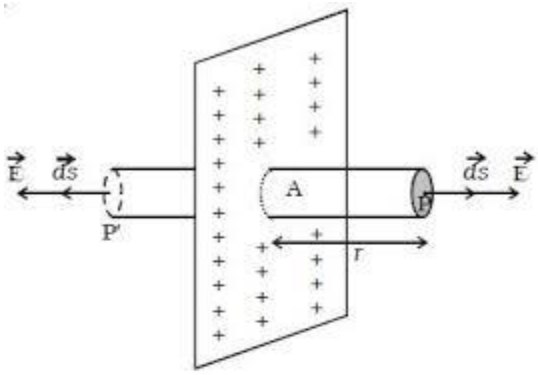
Potential difference across C_4 = 200 V

Charge on C_1 = 10^{-8} C ½

Charge on C_1 and C_3 each = 10^{-8} C ½

OR

(i) Diagram ½

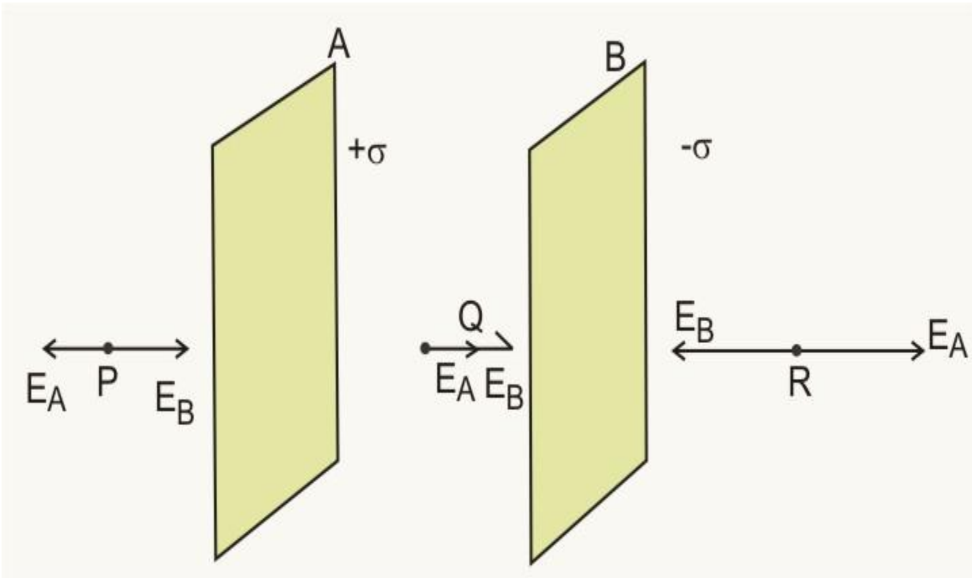


Derivation (NCERT Page no. 38) 1.5

(a) For positively charged sheet, the field is directed away from the sheet. ½

(b) For negatively charged sheet, the field is directed towards the plane sheet. ½

(ii)



½

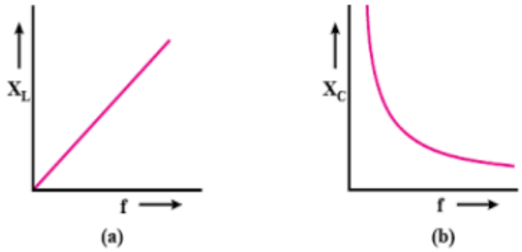
consider the two parallel sheets A and B of charges $+\sigma$ and $-\sigma$

Electric field between the plates = $\frac{\sigma}{2\varepsilon 0}$ + $\frac{\sigma}{2\varepsilon 0}$ = $\frac{\sigma}{\varepsilon 0}$ 1

Electric field outside the sheet = $\frac{\sigma}{2\varepsilon 0}$ - $\frac{\sigma}{2\varepsilon 0}$ = 0 ½

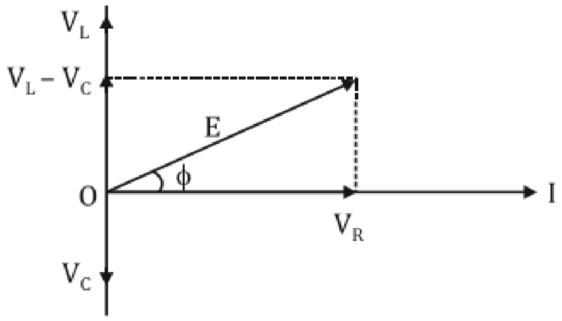
33.

(a)



½ + ½

(b)



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(c) (i) In device X, Current lags behind the voltage by π /2, X is an inductor

In device Y, Current in phase with the applied voltage, Y is resistor ½ + ½

(ii) We are given that

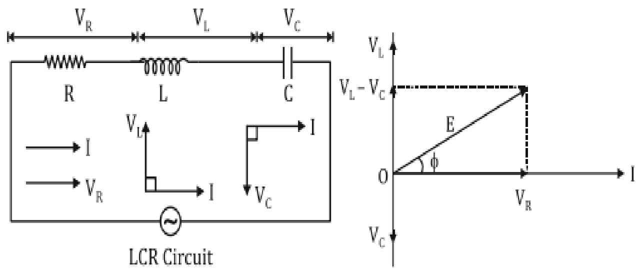
0.25=220/XL, XL =880 Ω, also 0.25=220/R, R = 880Ω 1

For the series combination of X and Y,

Equivalent impedance Z = 880 √2 Ω, I= 0.177 A 1

OR

(a)



1

E = E0 sinωt is applied to a series LCR circuit. Since all three of them are connected in series the current through them is same. But the voltage across each element has a different phase relation with current. The potential difference V_L, V_C and V_R across L, C and R at any instant is given by $V_L = IX_L$, $V_C = IX_C$ and $V_R = IR$, where I is the current at that instant. V_R is in phase with I. V_L leads I by 90° and V_C

lags behind I by 90° so the phasor diagram will be as shown Assuming $V_L > V_C$, the applied emf E which is equal to resultant of potential drop across R, L & C is given as

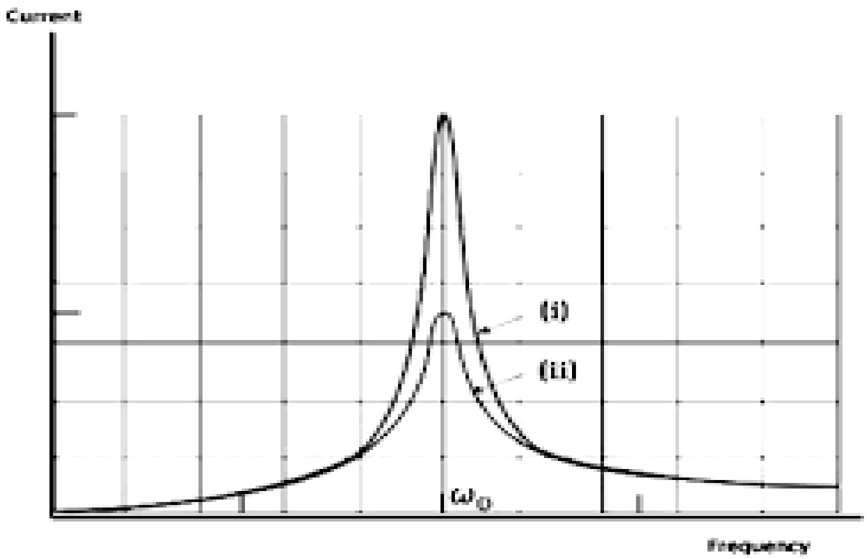
$$I = \frac{E}{\sqrt{[R^2 + (X_L - X_C)2\,]}} = \frac{E}{Z}$$

3

. Z – impedance

Emf leads current by a phase angle φ as tan φ = $V_L - V_C / R$ = $(X_L - X_C)$ /R

b. The curve (i) is for R_1 and the curve (ii) is for R_2



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