

Class : 12

Register  
Number**COMMON HALF YEARLY EXAMINATION - 2024 - 25**

Time Allowed : 3.00 Hours]

**PHYSICS**

[Max. Marks : 70

**PART-I**

15x1=15

**I. Choose the correct answer.**

- If voltage applied on a capacitor is increased from  $V$  to  $2V$ , choose the correct conclusion.
  - $Q$  remains the same,  $C$  is doubled
  - $Q$  is doubled,  $C$  doubled
  - $C$  remains same,  $Q$  doubled
  - Both  $Q$  and  $C$  remain same
- Two identical conducting balls having positive charges  $q_1$  and  $q_2$  are separated by a centre to centre distance  $r$ . If they are made to touch each other and then separated to the same distance, the force between them will be
  - less than before
  - same as before
  - more than before
  - zero Solution
- Calculate electric energy across 10 ohm resistor flowing 5A current with 5 minutes
  - 1250J
  - 75000J
  - 75J
  - 7500J
- A toaster operating at 240 V has a resistance of 120  $\Omega$ . Its power is
  - 400 W
  - 2 W
  - 480 W
  - 240 W
- Force experienced by Current carrying conductor placed parallel to magnetic field direction is
  - maximum
  - minimum
  - zero
  - decreases
- When the current changes from +2A to -2A in 0.05 s, an emf of 8 V is induced in a coil. The co-efficient of self-induction of the coil is
  - 0.2 H
  - 0.4 H
  - 0.8 H
  - 0.1 H
- In a transformer, the number of turns in the primary and the secondary are 410 and 1230 respectively. If the current in primary is 6A, then that in the secondary coil is
  - 2 A
  - 18 A
  - 12 A
  - 1 A
- Which of the following is false for electromagnetic waves ?
  - Transverse
  - Non-mechanical waves
  - Longitudinal
  - Produced by accelerating charges
- Stars twinkle due to,
  - Reflection
  - Total internal reflection
  - Refraction
  - Polarization
- Which of the following not example for total internal reflection
  - mirage
  - glittering of diamond
  - working of optical fiber
  - The difference between the apparent and actual depth of the pool.
- A plane glass is placed over a various coloured letters (violet, green, yellow, red) The letter which appears to be raised more is,
  - red
  - yellow
  - green
  - violet
- Which of the following could not explained by electromagnetic theory?
  - photo electric effect
  - Compton effect
  - Zeeman effect
  - both (a) and (b)
- Emission of electrons by the absorption of heat energy is called ----- emission.
  - Photoelectric
  - Field
  - Thermionic
  - Secondary
- If the input to the NOT gate is  $A = 1011$ , its output is
  - 0100
  - 1000
  - 1100
  - 0011
- The materials used in Robotics are
  - Aluminum and silver
  - Silver and gold
  - Copper and gold
  - Steel and aluminum

KK/12/Phy/1

- Kallakurichi - DT

Class : 12

[ K. Sakthivel ]  
[ P.C.T. - Physics ]Register  
Number

--	--	--	--	--	--

## COMMON HALF YEARLY EXAMINATION - 2024 - 25

Time Allowed : 3.00 Hours]

## PHYSICS

[Max. Marks : 70

## PART-I

15x1=15

## 1. Choose the correct answer.

- BR-1
1. If voltage applied on a capacitor is increased from V to 2V, choose the correct conclusion.  
 (a) Q remains the same, C is doubled (b) Q is doubled, C doubled  
 (c) C remains same, Q doubled (d) Both Q and C remain same
- BR-1
2. Two identical conducting balls having positive charges  $q_1$  and  $q_2$  are separated by a centre to centre distance r. If they are made to touch each other and then separated to the same distance, the force between them will be  
 (a) less than before (b) same as before  
 (c) more than before (d) zero Solution
- BR-1
3. Calculate electric energy across 10 ohm resistor flowing 5A current with 5 minutes  $H = I^2 R t$   
 (a) 1250J (b) 75000J (c) 75J (d) 7500J
- BR-2
4. A toaster operating at 240 V has a resistance of 120  $\Omega$ . Its power is  
 (a) 400 W (b) 2 W (c) 480 W (d) 240 W  $F = BIl \sin \theta$   
 $\theta = 90^\circ$
- BR-3  
(12/2/24)
5. Force experienced by Current carrying conductor placed parallel to magnetic field direction is  
 (a) maximum (b) minimum (c) zero (d) decreases
- BR-4
6. When the current changes from +2A to -2A in 0.05 s, an emf of 8 V is induced in a coil. The co-efficient of self-induction of the coil is  
 (a) 0.2 H (b) 0.4 H (c) 0.8 H (d) 0.1 H
- BR-4
7. In a transformer, the number of turns in the primary and the secondary are 410 and 1230 respectively. If the current in primary is 6A, then that in the secondary coil is  
 (a) 2 A (b) 18 A (c) 12 A (d) 1 A
- BR-5
8. Which of the following is false for electromagnetic waves ?  
 (a) Transverse (b) Non-mechanical waves  
 (c) Longitudinal (d) Produced by accelerating charges
- BR-6
9. Stars twinkle due to,  
 (a) Reflection (b) Total internal reflection  
 (c) Refraction (d) Polarization
- BR-6
10. Which of the following not example for total internal reflection  
 (a) mirage TIR (b) glittering of diamond TIR  
 (c) working of optical fiber TIR (d) The difference between the apparent and actual depth of the pool. Law of refraction
- BR-7
11. A plane glass is placed over a various coloured letters (violet, green, yellow, red) The letter which appears to be raised more is,  
 (a) red (b) yellow (c) green (d) violet
- BR-8
12. Which of the following could not explained by electromagnetic theory?  
 (a) photo electric effect (b) Compton effect  
 (c) Zeeman effect (d) both (a) and (b)
- BR-8
13. Emission of electrons by the absorption of heat energy is called ----- emission.  
 (a) Photoelectric (b) Field (c) Thermionic (d) Secondary
- BR-10
14. If the input to the NOT gate is A = 1011, its output is  
 (a) 0100 (b) 1000 (c) 1100 (d) 0011
- BR-11
15. The materials used in Robotics are  
 (a) Aluminum and silver (b) Silver and gold  
 (c) Copper and gold (d) Steel and aluminum

KK/12/Phy/1

## PART – II

II. Answer any six of the following:

6x2=12

(question no: 17 compulsory)

16. Write any four application of Polaroids.
17. A radiation of wavelength 300 nm is incident on a silver surface. Will photoelectrons be observed? [work function of silver = 4.7 eV]
18. Define: atomic mass unit
19. Define doping.
20. State Kirchoff's Second Law.
21. What is meant by action of points.
22. Electromagnetic waves are non mechanical waves why?
23. Define Q factor.
24. Compute the magnitude of the magnetic field of a long, straight wire carrying a current of 1 A at distance of 1m from it. Compare it with Earth's magnetic field.

## PART – III

III. Answer any six of the following:

6x3=18

(Question no: 26 compulsory)

25. Explain resistance in series .
26. The self-inductance of an air-core solenoid is 4.8 mH. If its core is replaced by iron core, then its self-inductance becomes 1.8 H. Find out the relative permeability of iron.
27. Derive an expression for energy stored in parallel plate capacitor.
28. How Galvanometer can be converted in to Ammeter.
29. Obtain the relation between focal length (f) and radius of curvature (R) of the spherical mirror.
30. State law of photo electric effect.
31. Derive the expression for energy of the nth orbit of hydrogen atom using Bohr atom model.
32. State and prove De Morgan's First and Second theorems.
33. Explain nicol prism.

## PART – IV

IV. Answer the following questions:

5x5=25

34. a) Explain in detail the construction and working of Van de Graff generator.  
(OR)  
b) Derive the equation for angle of deviation produced by a prism and thus obtain the equation for refractive index of material of the prism.
35. a) How the emf of two cells are compared using potentiometer?  
(OR)  
b) Derive the mirror equation and the equation for lateral magnification.
36. a) Explain the construction and working of a full wave rectifier.  
(OR)  
b) Describe the principle, construction and working of Cyclotron.
37. a) Show mathematically that the rotation of a coil in a magnetic field over one rotation induces an alternating emf of one cycle.  
(OR)  
b) Give the construction and working of photo emissive cell.
38. a) Write down Maxwell equations in integral form.  
(OR)  
b) Explain the J.J. Thomson experiment to determine the specific charge of electron.

KK/12/Phy/A2

PART-II

16. Application of Polaroids:

(i). Goggles & Cameras

(ii). 3D Pictures (iii). old oil paintings

(iv). optical stress analysis. (v). Window glass.

(vi). CPs (vii). LCD.

17. Example 8.2 photo electrons be observed?

Soln:  $E = h \nu$  (Joule)  $\lambda = 300 \text{ nm}$

$$E = \frac{hc}{\lambda e} \text{ (eV)}$$

Work function = 4.7 eV  
Silver

$$E = \frac{6.626 \times 10^{-34} \times 3 \times 10^8}{300 \times 10^{-9} \times 1.6 \times 10^{-19}} = \underline{4.14 \text{ eV}}$$

$$4.14 \text{ eV} < 4.7 \text{ eV}$$

$\therefore$  "Photo electrons are not observed"

18). Atomic mass Unit.

$\left(\frac{1}{12}\right)^{\text{th}}$  of the mass of the isotope of Carbon  $^{12}\text{C}$

$$1 \text{ u} = 1.66 \times 10^{-27} \text{ kg} \approx 931 \text{ MeV}$$

19). Doping:

Process of adding impurities to intrinsic semiconductor

20). Kirchoff's Second Law:

Closed Circuit - Algebraic Sum of products of Currents & resistance of each part =  $\sum \text{emf}$

21). Action of points: (or) Corona discharge

Electric Field near sharp edge is very high.

and it ionizes the surrounding air.

sharp edge  $\rightarrow$  Positive ions repelled

Negative ions attracted.

"reduces total charge of conductor near the sharp edge"

22) Why EM wave non mechanical?

- Do not required any medium for propagation.

23) Q-Factor:-

$$Q\text{-Factor} = \frac{\text{Voltage Across L or C at resonance}}{\text{Applied Voltage}}$$

24) Example 3.15

$$B_{\text{air core}} = \frac{\mu_0 I}{2\pi r} = \frac{4\pi \times 10^{-7} \times 1}{2\pi \times 1} = 2 \times 10^{-7} \text{ T}$$

$B_{\text{earth}} \sim 10^{-5} \text{ T}$   $\longrightarrow$  100 times smaller than  $B_{\text{earth}}$

PART-III

25) Resistance - Series:

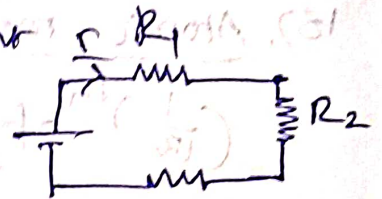
Current - same

Voltage - Different

$$V = V_1 + V_2 + V_3$$

$$R_s = R_1 + R_2 + R_3$$

$$R_s > R_1, R_2, R_3$$



26) Example 4.1

$L_{\text{air}} = 4.8 \times 10^3 \text{ H}$

$L_{\text{iron}} = 1.8 \text{ H}$

$$\mu_r = \frac{L_{\text{iron}}}{L_{\text{air}}} = \frac{1.8}{4.8 \times 10^3} = \frac{9 \times 10^3}{48} = \frac{9}{24} \times 10^3$$

$$= 0.375 \times 10^3$$

$$\boxed{\mu_r = 375}$$

27) Energy stored in parallel plate capacitor.

$$dW = V dq$$

$$V = \frac{Q}{C}$$

$$W = \int_0^Q \frac{Q}{C} dq$$

$$W = \frac{Q^2}{2C}$$

$$W = U_E = \frac{CV^2}{2}$$

$$C = \frac{\epsilon_0 A}{d}, V = Ed$$

Energy density  $u_E$

$$u_E = \frac{1}{2} \epsilon_0 E^2$$

28). Galvanometer - Ammeter

- ↳ Low Resistance
- ↳ Series in Circuit

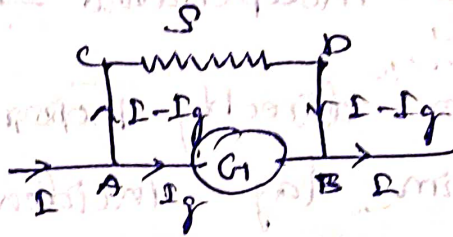
Low resistance, (S) Parallel with Galvanometer.

$$V_g = V_s$$

$$I_g R_g = (I - I_g) S$$

$$S = \frac{I_g}{(I - I_g)} R_g$$

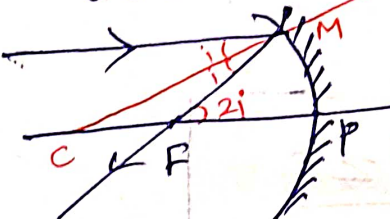
or)  $I_g = \frac{S}{S + R_g} I$



$\theta \propto I_g$        $\theta = \frac{I_g}{I} I$

$$\frac{1}{R_{eff}} = \frac{1}{R_g} + \frac{1}{S} \Rightarrow R_{eff} = \frac{R_g S}{R_g + S} = R_a$$

29). Relation between f and R



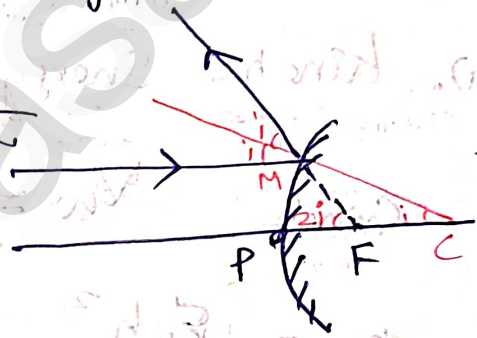
Concave mirror

$$\tan i = \frac{MP}{PC}$$

PC angle small

$$i = \frac{MP}{PC} \rightarrow \textcircled{1}$$

f and R



Convex mirror

$$\tan r = \frac{MP}{PF}$$

angle small.

$$r = \frac{MP}{PF} \rightarrow \textcircled{2}$$

Substitute  $\textcircled{1}$  in  $\textcircled{2}$ .

$$2 \left[ \frac{MP}{PC} \right] = \frac{MP}{PF}$$

$$2PF = PC$$

$$\boxed{2f = R} \quad \boxed{f = \frac{R}{2}}$$

### 30). Law of Photoelectric effect.

- (i). Minimum frequency  $\rightarrow$  Threshold frequency.
- (ii). No. of photo electrons  $\propto$  intensity of incident.
- (iii).  $K E_{\text{max}}$  independent  $\rightarrow$  incident intensity.
- (iv).  $K E_{\text{max}}$  directly proportional to incident frequency.
- (v). No time lag incident & ejection.

### 31). Energy of $n^{\text{th}}$ orbit of $H_2$ atom (Bohr atom model)

(i). Potential Energy

$$U_n = -\frac{1}{4\epsilon_0} \frac{z^2 m e^4}{h^2 n^2}$$

Since,  $r_n = \frac{\epsilon_0 h^2}{\pi m e^2} \frac{n^2}{z}$

(ii). Kinetic Energy  $K E_n = \frac{1}{2} m v_n^2$

Since  $v_n = \frac{h}{2\pi m a_0} \frac{z}{n}$

$$a_0 = \frac{\epsilon_0 h^2}{\pi m e^2}$$

$$K E_n = \frac{m e^4 z^2}{8 \epsilon_0^2 h^2 n^2}$$

$$U_n = -2 K E_n$$

(iii). Total Energy:  $E_n = K E_n + U_n$

$$E_n = -K E_n$$

$$E_n = -\frac{m e^4 z^2}{8 \epsilon_0^2 h^2 n^2}$$

For  $H_2$  atom  $z=1$

$$E_n = -\frac{m e^4}{8 \epsilon_0^2 h^2 n^2} \text{ joule}$$

$$E_n = -13.6 \frac{1}{n^2} \text{ eV}$$

(i). Ground state  $E_1 = -13.6 \text{ eV}$

(ii). 1-orbit  $E_2 = -3.4 \text{ eV}$

1 Rydberg = 13.6 eV

### 32). De Morgan's First & Second Theorem.

#### First Theorem:

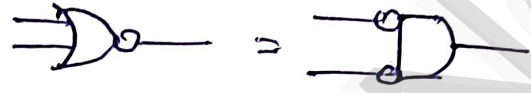
Complement of Sum = product of its Complements

$$\overline{A+B} = \overline{A} \cdot \overline{B}$$

↓                      ↓

From truth table → 1000

1000



#### Second Theorem:

Complement of product = Sum of its Complements

$$\overline{A \cdot B} = \overline{A} + \overline{B}$$

↓                      ↓

From truth table → 1110

1110

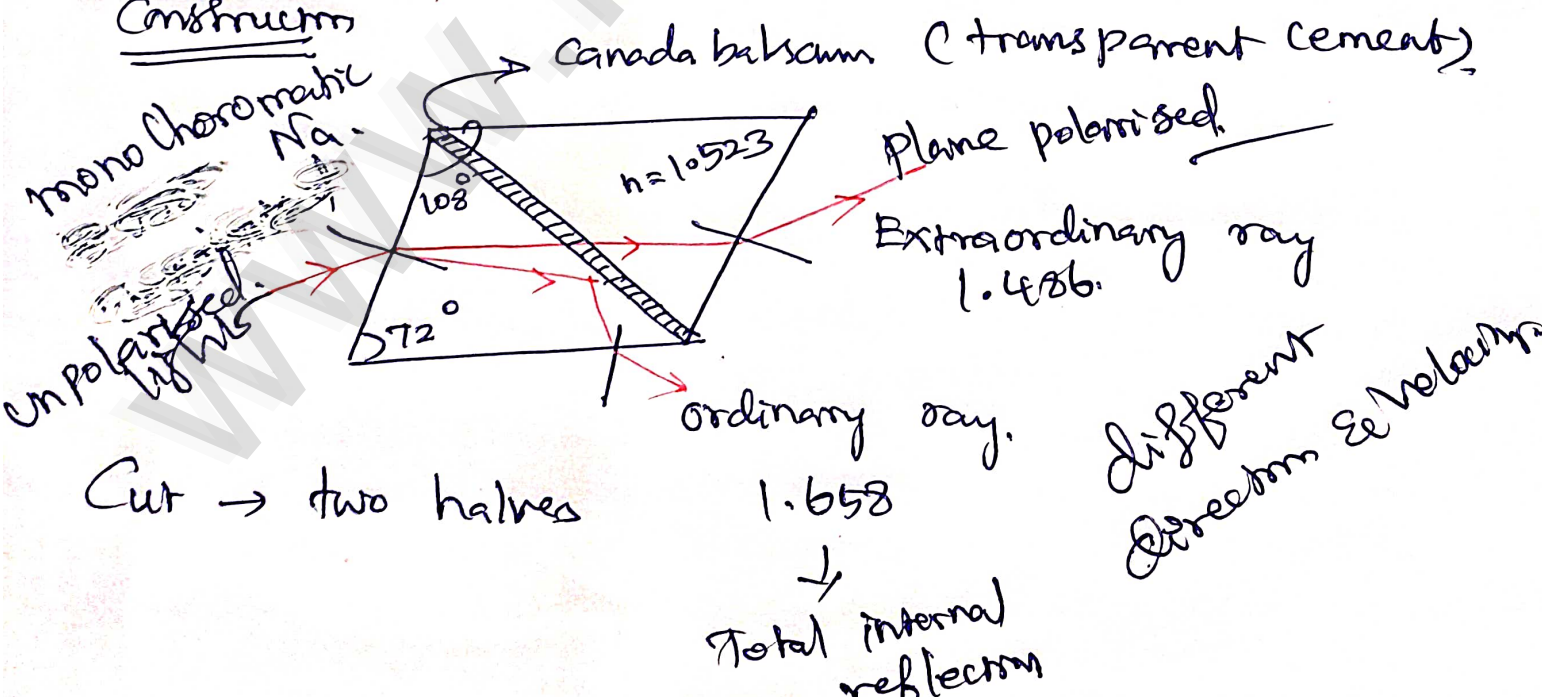


### 33). Nicol prism

Optical device → plane polarised light and also analysing.

Phenomenon → Double Refraction.

#### Construction



Cut → two halves