PRACTICE QUESTION PAPER-4

Class: XII SUBJECT: PHYSICS

Name of the unit	1M	2M	3M	4M	5M	TOTAL
1. Electrostatics	2		1		1	17 M
2. Current electricity	3			1		
3. Magnetic effects of current and Magnetism	1		1		1	18M
4. Electromagnetic Induction and Alternating currents	1	1	2			
5. Electromagnetic Waves	1		1			17M
6. Optics	3	1	1		1	
7. Dual nature of Radiation and matter	1	1				11M
8. Atoms & Nuclei	2	1		1		
9. Electronic devices	2	1	1			7M
TOTAL	16M	10M	21M	8M	15M	70M

PRACTICE QUESTION PAPER-4

CLASS: XII SESSION: 2023-24

SUBJECT: PHYSICS (THEORY)

Maximum Marks: 70 **Time Allowed: 3 hours.**

General Instructions:

(1) There are 33 questions in all. All questions are compulsory.

(2) This question paper has five sections: Section A, Section B, Section C, Section D and Section E.
(3) All the sections are compulsory.
(4) Section A contains sixteen questions, twelve MCQ and four Assertion- Reasoning based of 1 mark each, Section B contains five questions of two marks each, Section C contains seven questions of three marks each, Section D contains two case study based questions of four marks each and Section E contains three long answer questions of five marks each.
(5) There is no overall choice. However, an internal choice has been provided in one question in Section B, one question in Section C, one question in each CBQ in Section D and all three questions in Section E. You have to attempt only one of the choices in such questions.
(6) Use of calculators is not allowed.
(7) You may use the following values of physical constants where ever necessary.

1. C = 3 x 108 m/s ii.

2. M_e = 9.1 x10-31 kg

3. e = 1.6 x 10-19 C

4. μ_0 = 4π x 10-7 Tm/A

5. h = 6.63 x10-34 Js

6. ε_0 = 8.854 x10-12 $C^2/N\,m^2$

7. Avogadro's number = 6.023 X 1023 per gram mole

SECTION –A

1. At any point on the perpendicular bisector of the line joining two equal and opposite charges ( )

(A) the electric field is zero

(B) the electric potential is zero

(C) the electric potential and electric field, both are zero.

(D) the electric field is perpendicular to the line joining the charges

2. A metal wire of resistance 40 Ω is bent in the form of a square. The resistance between diagonally opposite corners of it is ( )

(A) 20 Ω (B) 10 Ω (C) 25 Ω (D) 5 Ω

3. A current carrying loop is placed in a uniform magnetic field. The torque acting on it does not depend upon the ( )

(A) area of loop (B) number of turns

(C) shape of loop (D) angle between normal of coil and magnetic field

4. The power factor of LCR ac circuit at resonance is ( )

(A) 0.5 (B) 1 (C) $\sqrt{2}$ (D) zero

5. Which of the following waves has the maximum wavelength? ( )

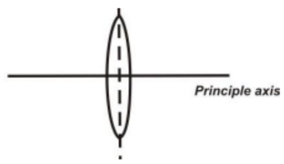
(A)X-rays (B)Infrared rays (C)Ultraviolet rays (D)Radio waves

6. Two sources of light are said to be coherent, when they give light waves of same ( )

(A) amplitude and phase (B) wavelength and constant phase difference

(C) intensity and wavelength (D) phase and speed

7. A convex lens of focal length 30com is cut in to two equal parts perpendicular to its principal axis. What is the focal length of each part of it in cm? ( )



A) 30 B) 40 C) 50 D) 60

8. The magnitude of photoelectric current depends upon ( )

(A) frequency (B) Intensity (C) Work function (D) Stopping potential

9. The density of a nucleus is of the order of ( )

(A) 10^{15} kg m^{-3} (B) 10^{18} kg m^{-3} (C) 10^{17} kg m^{-3} (D) 10^{16} kg m^{-3}

10. Which of the following statements is not true in the case of a semiconductor? ( )

(A) It is heat sensitive (B) It is a crystalline solid

(C) It has a negative temperature coefficient of resistance. (D) Its resistivity is very high

11. The refractive index of a medium is $\sqrt{2}$. Its critical angle is ( )

(A) 30^0 (B) 45^0 (C) 60^0 (D) 90^0

12. Current provided by a battery is maximum, when ( )

(A) Internal resistance equal to external resistance
(B) Internal resistance is greater than external resistance
(C) Internal resistance is less than external resistance
(D) None of these

For Questions 13 to 16, two statements are given –one labelled Assertion (A) and other labelled Reason (R). Select the correct answer to these questions from the options as given below.
A) If both Assertion and Reason are true and Reason is correct explanation of Assertion.
B) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
C) If Assertion is true but Reason is false.
D) If both Assertion and Reason are false.

13.ASSERTION: Nichrome wire is generally used as a heating element in heating appliances.
REASON: It offers large resistance and has high melting point.

14. ASSERTION: The focal length of a lens doesn't change if it is placed water.
REASON: Focal length of a lens is independent of the medium in which it is placed.

15.ASSERTION: A semiconductor at room temperature behaves as insulator.
REASON: Electrical conductivity of a semiconductor can be increased by doping.

16. ASSERTION: Heavy water is used as a moderator in nuclear reactor.
REASON: Heavy water eliminates some neutrons from the reaction.

SECTION -B

17. State Faradays laws of electromagnetic induction. (OR)

What is self-induction? Write equation for self-induction of a long solenoid.

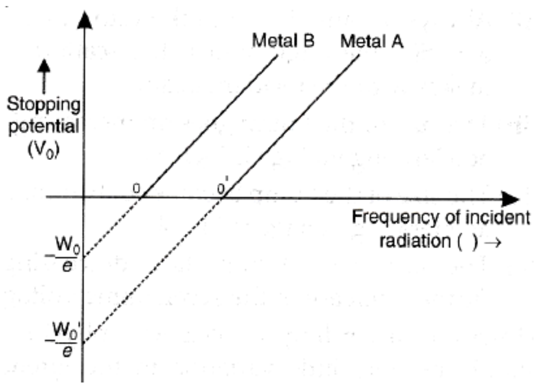
18. Draw a labelled diagram of compound microscope.

19.Mention any two differences between matter waves and EM waves.

20.In the following graph related to photoelectric effect,

i) which metal has higher work function?

ii) What is the common factor for the two graphs and what is its significance?



21. Define the terms related to the PN junction:

i) depletion layer ii) barrier potential.

SECTION - C

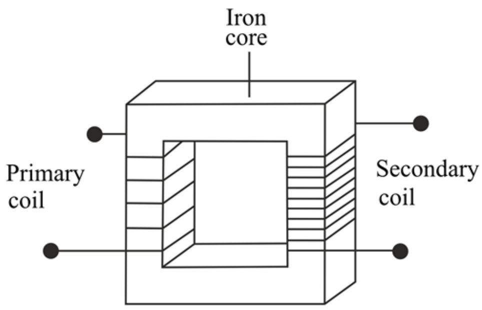
22. A point charge of 17.7μC is at the center of a hallow cube of side 10cm. Find the flux and flux density on any one surface of the cube.

23.Using Ampere's circuital law, derive the equation for magnetic field strength at a point inside a solenoid.

24. i) What is the principle of this device shown below?

ii) Mention any two energy losses in it.

iii) How is it useful in long distance power transmission?



25.In a LR ac circuit, connected to a 200V – 50Hz source, the current is 4A and the phase angle is $\pi/3$.Calculate the values of R and X_L.

26.An EM wave has a wave length of 2 X 10^{-7} m. Identify the wave and mention any two daily life uses of it.

27.Using Huygens wave theory, prove Snell's law.

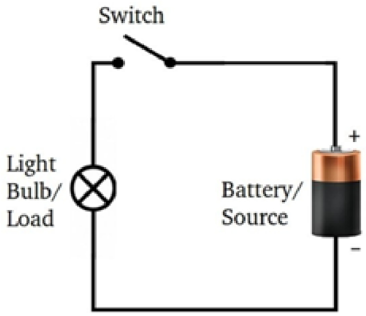
(OR)

What is the principle of working of an optical fibre? With a labelled diagram describe its construction and working.

28.With the help of a neat circuit diagram, describe the working of a full wave rectifier also draw the input and output wave forms for a full wave rectifier.

SECTION – D

29. In physics, electric power measures the rate of electrical energy transfer by an electric circuit per unit of time. Denoted by P and measured using the SI unit of power which is watt or one joule per second. Electric power is commonly supplied by electric batteries and produced by electric generators.



i.) A 25 W and 100 W are joined in series and connected to the mains. Which bulb will glow brighter?

(A) 100 W (B) 25 W

(C) Both bulbs will glow brighter (D) None will glow brighter

ii) The heat emitted by a bulb of 100 W in 1 min is

(A) 100 J (B) 1000 J (C) 600 J (D) 6000 J

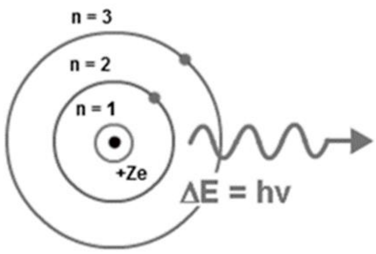
Iii)The power(P) of a device is related to its resistance (R) as

(A) P α R (B) P α 1/R (C) P α √R (D) P α R^2

iv) A heater coil is marked as 800W-200V. What is the maximum current drawn by it?

(A) 5A (B) 4A (C) 3A (D) 0.25 A

30. Bohr Model of the hydrogen atom first proposed the planetary model, but later an assumption concerning the electrons was made. The assumption was the quantization of the structure of atoms. Bohr's proposed that electrons orbited the nucleus in specific orbits or shells with a fixed radius. Only those shells with a radius provided by the equation below were allowed, and it was impossible for electrons to exist between these shells.



i) The radius of first Bohr's orbit is ( )

A) $0.53A^0$ B) $0.35A^0$ C)$1.2A^0$ D) $0.65A^0$

ii) The ionization energy of Hydrogen atom is ( )

A) 1.36eV B) 13.6eV C) -1.36eV D) -13.6eV

iii) According to Bohr's theory, which physical quantity of electron is quantized? ( )

A) energy B) momentum C) angular momentum D) speed

iv) Lyman series belongs to which part of EM spectrum? ( )

A) gamma rays B) visible rays C) Infrared rays D) UV rays

SECTION -E

31 .i) What is the principle of a capacitor?

ii)Derive the equation for capacitance of a parallel plate capacitor with a dielectric slab as medium.

iii)What type of energy is stored between the two plates of a charged capacitor?

(OR)

i)Derive the equation for potential at any point due to a short dipole.

Ii)Mention any two properties of equipotential surface.

32) i) Show that like currents attract each other and derive the equation for the force between them.

ii) Find the magnetic field strength at the center of a circular loop of radius 5cm , with 10 turns carrying a current of 2A.

(OR)

i)What is the principle of working a moving coil galvanometer?

ii)What is the significance of radial magnetic field in it?

iii) If only 10% of the total current can pass through a galvanometer of resistance 45Ω, what value of shunt is required?

33) i) Derive prism equation.

ii) What is the deviation produced by a prism of angle 6^0, with refractive index 1.5.

(OR)

i)Draw interference and diffraction patterns and mention any two differences between them.

ii) In YDS experiment, light of wave length $6000A^0$ is used. If the distance between the two slits is 1.5mm and the distance of the screen is 2m , find the positions of second bright and 3ed dark images from the center of the screen

CLASS: XII SESSION: 2023-24
MARKING SCHEME

Q.No	Answer	Q.NO	Answer	Q.No	Answer	Q.No	Answer
1	B	8	B	15	B	30	
2	B	9	C	16	C	i	A
3	C	10	D	29.		Ii	B
4	B	11	B	i	B	Iii	C
5	D	12	A	ii	D	iv	D
6	B	13	A	iii	B		
7	D	14	D	iv	A		

17. Faradays laws statements (2M)

(OR) Self-induction definition (1M)

Equation , $L = (\mu_0 N^2 A / l)$, (1M)

18. Ray diagram of compound microscope (2M)

19. Any two differences (1mark each)

20.i) Metal A, as it has higher threshold frequency

ii) slope is common for them, which gives Planks constant.

21.two definitions , (1M each)

22.$\varphi_E = Q / \varepsilon_0 = 2 \times 10^6$ Nm^2/C (1+1/2)

$E = (\varphi_e /6 A) = = 2 \times 10^8$ N/C (1+1/2)

23. Amperes circuital law equation (1), labelled diagram (1/2), derivation (1.5)

24.i) Mutual induction (1M)

ii) any two loses (½ mark each)

iii) electrical energy is transmitted as high voltage and low current to avoid loss of energy during transmission.

25.$\cos\theta = R/Z$, $Z= \sqrt{(R^2 + X_l^2)}\ \Omega$, $e_{rms} = i_{rms}\ Z$

$R = Z/2 = 25\Omega$, $X_L = \sqrt{1875} = 43.3\Omega$

26. UV radiation (1M), Two uses (1M each)

27.Labelled diagram (1M) , derivation (2M)

(OR) Principle- TIR (1M) , labelled diagram (1 M) , explanation (1M)

28.Labelled circuit diagram (1M), Graphs (1M) , explanation (1M)

31.i) principle, $C = Q/V$ (1/2M) , ii) Derivation (2M) , iii) electric field energy (1/2M)

(OR) i) diagram (1M) , ii) derivation (2M) , iii) two properties (1M each)

32.i) labelled diagram (1M) , derivation (2M) , ii) $B = (u_0 NI/ 2r) =$ (equation and calculation 1M each)

(OR) i) principle , equation , $T = BINA \cos\theta$ (2M) , ii) Significance of RMF (1M) ,

iii) $I_g \times R_g = I_s \times R_s$ (1M)

Let, $I = 100$, $I_g = 10$, $I_s = 90$, then , $R_s = 5\Omega$ (1 M)

33. i) labelled diagram and graph (1+1) , derivation (2M)

ii) $d = A(n - 1)$, $d = 3^0$ (1M)

(OR) i)Two graphs(½ each) , Two differences (1M each)

ii) Bright image, $x_2 = (n\lambda D/d) = 0.8mm$ (1M)

Dark image , $x_3 = (2n - 1)(\lambda D/2d) = 2mm$, (1M)
