DAV PUBLIC SCHOOLS

Jharkhand Zone- K

HALF YEARLY EXAMINATION, SESSION-2025-26

CLASS: XII **TIME:- 3 Hrs**

SUBJECT: PHYSICS **MAXIMUM MARKS: 70**

General Instructions:-

(i) **All questions are compulsory. There are 33 questions in all.**

(ii) **This question paper contains five sections.**

(iii) **Section A contains 16 questions, twelve MCQ & four Assertion Reasoning based of 1 mark each, Section B contains 5 questions of two marks each, Section C contains 7 questions of three marks each, Section D contains 2 case study based questions of four marks each & Section E contains three long answer questions of five marks each.**

(iv) **There is no overall choice. However, internal choices has been provided in two questions of Section B , one question of Section C & all three questions of Section E .You have to attempt only one of the choices in such questions.**

(v) **You may use the following physical constants wherever necessary.**

$c = 3 \times 10^8\ ms^{-1}$

$h = 6.6 \times 10^{-34}\ Js$

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

$\mu_o = 4\pi \times 10^{-7}\ TmA^{-1}$

$1/4\pi\varepsilon_o = 9 \times 10^9\ N\ m^2C^{-2}$

Avogadro number $N_A = 6.023 \times 10^{23}\ mol^{-1}$

Mass of the neutron $= 1.675 \times 10^{-27}\ kg$

Boltzmann constant, $k = 1.38 \times 10^{23}\ J\ K^{-1}$

SECTION – A (1 X 16 = 16)

1. For charges q_1 & q_2 , if the force between them for separation r in air is , the force between them in a medium of permittivity ε will be

(a) $\frac{\varepsilon_0}{\varepsilon} F$ (b) $\frac{\varepsilon}{\varepsilon_0} F$ (c) $\varepsilon\varepsilon_0 F$ (d) $\frac{F}{\varepsilon\varepsilon_0}$

2. A proton enters a magnetic field of flux density $1.5\ wm^{-2}$ with a velocity of $2 \times 10^7 m/s$ at an angle of 30^0 with the field. The force on the proton will

(a) $2.4 \times 10^{-12} N$ (b) $0.24 \times 10^{-12} N$ (c) $24 \times 10^{-12} N$ (d) $0.024 \times 10^{-12} N$

3. If a body is charged by rubbing it, its weight

(a) always decreases slightly

(b) always increases slightly

(C) may increase slightly or may decrease slightly

(d) remains precisely the same.

4. The potential difference V & the current I flowing through an instrument in an AC circuit of frequency f are given by $V = 5cos\omega t\ volt$ & $I = 2sin\omega t\ ampere$. The power dissipated in the instrument is

a. zero (b) 10 w (c) 5w (d) 2.5 w

5. Which of the following based on the law of conservation of energy?

(a) Faraday's law (b) Lenz's law (c) Ampere's law (d) Biot – Savart's law

6. A wire of resistance 16 Ω is melted & is drawn into a wire of half of its original length. What is the resistance of the new wire?

(a) 8 Ω (b) 10 Ω (c) 6 Ω (d) 4 Ω

7. n identical resistances are first connected in series & then in parallel. What is the ratio of effective resistances in these two cases?

(a) 1: n (b) $1: n^2$ (c) $n^2: 1$ (d) none.

8. A circular coil of N turns & radius R carries a current I. It is unwound & rewound to make another coil of radius R/2 & the current I remaining the same. Calculate the ratio of the magnetic moments of the new coil to the original coil.

(a) 1 : 2 (b) 2:1 (c) 4:1 (d) 1:4

9. A galvanometer is converted into an ammeter by connecting a shunt to it in

(a) series (b) parallel (c) both (a) & (b) (d) none.

10. Volt – metre is the unit of which physical quantity ?

(a) electric field (b) magnetic flux (c) electric flux (d) none.

11. Inertia of electricity is

(a) self - induction (b) mutual induction (c) both (a) & (b) (d) none.

12. Resistivity of a material depends on

(a) length (b) area (c) both (a) & (b) (d) relaxation time.

*** For question numbers 13 to 16, two statements are given – one labelled Assertion (A) & the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b) , (c) & (d) as given below.**

(a) Both A & R are true & R is the correct explanation of A.
(b) Both A & R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false & R is also false.

13. Assertion (A): The capacitance of a parallel plate capacitor decreases by a factor, if the space between it is filled with a medium of dielectric constant K.

Reason (R): An electric field induced in the dielectric medium is in the opposite direction of the applied field.

14. Assertion (A): Ohm's law is applicable for all conducting elements.

Reason (R): Ohm's law is a fundamental law.

15. Assertion (A): Two parallel conducting wires carrying currents in the same direction, come closer to each other.

Reason (R): Parallel currents attract & anti – parallel currents repel.

16. Assertion (A): In series LCR circuit resonance can take place.

Reason (R): Resonance takes place if inductive & capacitive reactances are equal & opposite.

SECTION – B (2 X 5 = 10)

17. State Biot – Savart law & write its vector form.

18. Calculate average value of an alternating current $I = I_0 sin\omega t$ over a full cycle.

OR

What is impedance triangle? Draw it for LCR series circuit.

19. A stream of electrons travelling with speed v m/s at right angle to a uniform electric field E, is deflected in a circular path of radius r. Prove that $\frac{e}{m} = \frac{v2}{rE}$.

OR

State Ampere's circuital law & write its expression.

20. A charge of $8.85 \times 10^{-6} C$ is enclosed by a Gaussian surface of area 5 m^2. Find the electric flux passing through it.

21. A current I = 1A circulates in a round thin wire loop of radius 100 mm . Find the magnetic field induction at the centre of the loop .

SECTION – C (3 X 7 = 21)

22. A particle having a charge of $3 \times 10^{-9}\, C$ moves from a point A to B along a straight line in a uniform electric field of intensity 200 V/m. Calculate the work done by the field on it if the distance AB = 0.5 m. What is the potential difference between A &B?

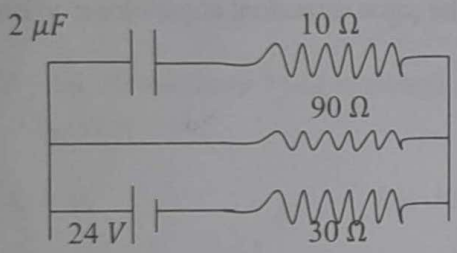
23. A photon & an alpha particle enter at right angles into a uniform magnetic field B. Calculate the ratio of radii of their paths when they enter the field with same (a) momentum & (b) kinetic energy.

24. What is galvanometer? How is it converted into an ammeter & a voltmeter ?

25. Define specific resistance & write its unit. An electron circulates in an orbit of radius R with angular velocity ω. Find the magnitude of the current.

26. Derive the expression $E = \frac{\lambda}{2\pi\epsilon_0 r}$ by using Gauss theorem, where used terms have their usual meanings.

27. Find out the charge on the capacitor.



28. What is drift velocity & write its expression? The potential difference across a given copper wire is doubled. What happens to the drift velocity of the charge carriers?

OR

Derive the relation $I = nev_dA$ where used terms have their usual meanings.

SECTION - D

29. **Read the following paragraph& answer the questions that follow. (1 X 4)**

The impedance of LCR series circuit is given as $Z = \sqrt{R^2 + \left(\omega L - \frac{1}{\omega C}\right)^2}$.

When it is minimum, the resonance is obtained. This resonating circuit is also called acceptor circuit used in receivers of radio & TV sets. In this condition the current is maximum & inductive reactance is equal to capacitive reactance.

(i) In resonance the circuit behaves as a pure

(a) Resistive circuit. (b) capacitive circuit.

(c) inductive circuit. (d) none.

(ii) In resonance the current & the voltage are in

(a) Different phase (b) same phase

(c) can't be predicted about the phase. (d) none.

(iii) The impedance of the circuit in resonating condition is

(a) $Z = \omega L$ (b) $Z = 1/\omega C$

(c) $Z = \omega L - 1/\omega C$ (d) $Z = R$

(iv) In resonance, which one is correct?

(a) $\omega L - \frac{1}{\omega C} = 0$ (b) $\omega L > \frac{1}{\omega C}$

(c) $\omega c > \frac{1}{\omega L}$ (d) none.

Read the following paragraph& answer the questions that follow.

Ramesh made a solenoid of copper wire & its two ends are connected to a battery . The magnetic field of a solenoid having n turns /length is $B = \mu_0 nI$ where I is the current flowing through it.

(i) A long solenoid has 400 turns per metre & it is used as an electromagnet. If 1.5 A current is flowing through it, what is the strength of the electromagnet? 2

(ii) State the nature of magnetic field lines passing through the current carrying solenoid. 1

(iii) Name any two factors which affects the strength of magnetic field in a solenoid. 1

SECTION – E (3 X 5 = 15)

(a) Explain different factors upon which the capacitance of a capacitor depends. 2

(b) Two capacitors are connected in parallel & in series alternately, their equivalent capacitances are $9F$ & $2F$ respectively. Find their individual value of capacitance. 3

OR

(a) Derive the expression $= \frac{C_1V_1 + C_2V_2}{C_1 + C_2}$, where used terms have their usual meanings. 2

(b) Calculate the capacitance of a parallel plate capacitor consisting of two plates of area 10 cm^2. The plate is separated by air & the distance between them is 2mm.

32. (a) State Faraday's laws of electromagnetic induction. 2

(b) State Lenz's law & explain it follows energy conservation law. 3

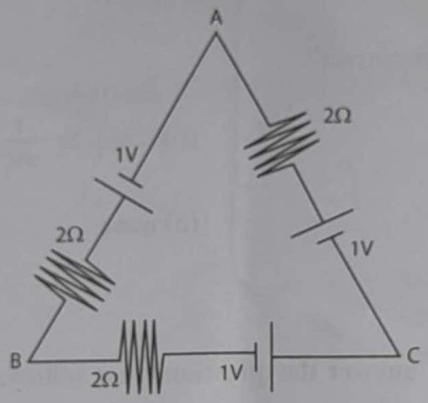
OR

(a) What is self – induction? Define self – inductance. 2

(b) Write the name of any three factors affecting the value of mutual inductance. 3

33. (a) State Ohm's law & write its vector form. 2

(b) Find the current & the potential difference in each branch of the circuit. 3



OR

(a) What is emf of a cell? State the condition for which potential difference is greater than emf. 2

(b) Draw graph between (a) current (I) versus load (R) & (b) current (I) versus potential difference (V) across the terminals of a cell. 3

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