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Sample Paper 2

Class- XII Exam - 2022-23

PHYSICS

Time : 3 Hours

Maximum Marks : 70

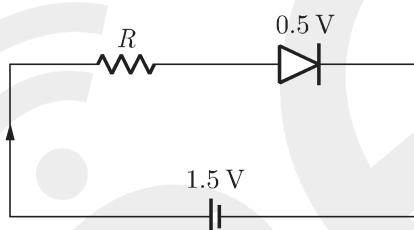
General Instructions :

- (1) There are 35 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. All the sections are compulsory.
- (3) Section A contains eighteen MCQ of 1 mark each, Section B contains seven questions of two marks each, Section C contains five questions of three marks each, section D contains three long questions of five marks each and Section E contains two case study based questions of 4 marks each.
- (4) There is no overall choice. However, an internal choice has been provided in section B, C, D and E. You have to attempt only one of the choices in such questions.
- (5) Use of calculators is not allowed.

SECTION-A

- Q1. Nickel is (1)
- | | |
|-------------------|-------------------|
| (a) diamagnetic | (b) paramagnetic |
| (c) ferromagnetic | (d) none of these |
- Q2. To convert mechanical energy into electrical energy one can use (1)
- | | |
|-----------------|-----------------|
| (a) D.C. dynamo | (b) A.C. dynamo |
| (c) Motor | (d) Transformer |
- Q3. According to the Maxwell's displacement current law, a changing electric field is source of (1)
- | | |
|-----------------------|--------------------|
| (a) an e.m.f. | (b) magnetic field |
| (c) pressure gradient | (d) all of these |
- Q4. Which of the following phenomena take place when a monochromatic light is incident on a prism? (1)
- | | |
|------------------|------------------|
| (a) Dispersion | (b) Deviation |
| (c) Interference | (d) All of these |
- Q5. When two converging lenses of same focal f are placed in contact, the focal length of the combination is. (1)
- | | |
|-------------------|----------|
| (a) f | (b) $2f$ |
| (c) $\frac{f}{2}$ | (d) $3f$ |

- Q6. The wave front due to a point source a finite distance from the source is- (1)
- (a) Spherical (b) Cylindrical
(c) Plane (d) Circular
- Q7. On disintegration of one atom of U-235, the amount of energy obtained is 200 MeV. The power obtained in a reactor is 1000 kW. How many atoms are dps ? (1)
- (a) 3.125×10^8 (b) 3.125×10^{16}
(c) 3.125×10^{24} (d) 3.125×10^{32}
- Q8. The p - n junction diode used in the circuit shown in the figure has a constant voltage drop at 0.5 V at all currents and a maximum power rating of 100 mW. What should be the value of the resistor R , connected in series and with p - n junction diode for obtaining maximum current? (1)



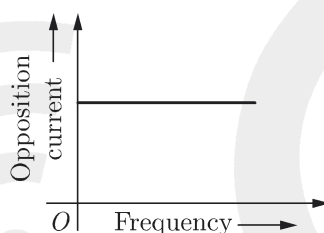
- (a) 5Ω (b) 10Ω
(c) 15Ω (d) 20Ω
- Q9. A spherical capacitor has inner sphere of radius 12 cm and an outer sphere of radius 13 cm. The outer sphere is earthed and the inner sphere has a charge of $2.5 \mu\text{C}$. If space between the concentric spheres is filled with a liquid of dielectric constant 32, then the capacitance of the capacitor is (1)
- (a) $4.5 \times 10^{-9} \text{ F}$ (b) $5.5 \times 10^{-9} \text{ F}$
(c) $6.5 \times 10^{-9} \text{ F}$ (d) $7.5 \times 10^{-9} \text{ F}$
- Q10. Light passes successively through two polarimeter tubes each of length 0.29 m. The first tube contains dextro rotatory solution of concentration $60 \text{ kg} \cdot \text{m}^{-3}$ and specific rotation $0.01 \text{ rad} \cdot \text{m}^2 \cdot \text{kg}^{-1}$. The second tube contains laevo rotatory solution of concentration $30 \text{ kg} \cdot \text{m}^{-3}$ and specific rotation $0.02 \text{ rad} \cdot \text{m}^2 \cdot \text{kg}^{-1}$. The net rotation produced is (1)
- (a) 0° (b) 10°
(c) 15° (d) 20°

DIRECTION : (Q11-Q14) Fill in the blanks with appropriate answer.

- Q11. The AC voltage across a resistance can be measured using a (1)
- Q12. In the Bohr's atomic model of hydrogen atom, the ratio of the kinetic energy to the total energy of the electron in n^{th} quantum state is (1)
- Q13. For a transistor working as common-base amplifier, the emitter current is 7.2 mA. If the current gain is 0.96, then the collector current is (1)
- Q14. n identical small spherical drops, each of radius r are charged to same potential V . They are combined to form a bigger drop. The potential of the big drop will be (1)

DIRECTION : (Q15-Q18) Answer the following:

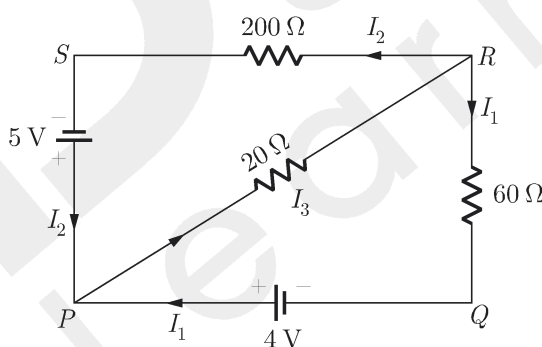
- Q15. The lab instructor told a student that in a galvanometer a coil has been wrapped on a conducting frame. Why? Which value is shown by the lab instructor? (1)
- Q16. The horizontal component of earth's magnetic field at a place is B and angle of dip is 60° . What is the value of vertical component of earth's magnetic field at this place? (1)
- Q17. The graph given below represents the variation of the opposition offered by the circuit element to the flow of alternating current with the frequency of the applied emf. Identify the circuit element. (1)



- Q18. A converging lens is kept coaxially in contact with a diverging lens both the lenses being of equal focal lengths. What is the focal length of the combination? (1)

SECTION B

- Q19. Guess a possible reason, why water has a much greater dielectric constant than mica? (2)
- Q20. Apply Kirchhoff's laws to the loops $PRSP$ and $PRQP$ to write the expressions for the currents I_1 , I_2 and I_3 in the given circuit. (2)



- Q21. Write Einstein's photoelectric equation. Plot a graph showing the variation of stopping potential versus the frequency of incident radiation. (2)
- Q22. An electron and a proton have the same kinetic energy. Which of the two has a greater wavelength? Explain. (2)
- Q23. (i) State Kirchhoff's loop rule for an electrical network.
(ii) State principle of working of a meter bridge. (1+1=2)

- Q24. Calculate the distance of an object of height (h) from a concave mirror of focal length 10 cm, so as to obtain a real image of magnification 2. (2)

OR

A screen is placed 90 cm from an object. The image is obtained on the screen by a convex lens at two different locations separated by 20 cm. Determine the focal length of lens.

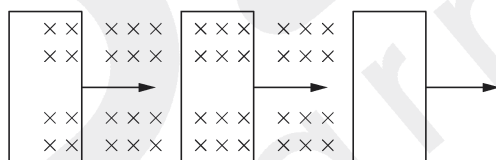
- Q25. Calculate the binding energy per nucleon of nucleus ${}_{20}\text{Ca}^{40}$. Given m_n and m_p are 1.008665 u and 1.007825 u respectively and $m({}_{20}\text{Ca}^{40}) = 39.962589$ u. (2)

OR

Using the Bohr's model, calculate the speed of the electron in a H-atom in the $n = 1$ and 2 levels. (2)

SECTION C

- Q26. In a single slit diffraction pattern, how does the angular width of central maximum changes when
1. Slit width is decreased?
 2. Distance between the slit and screen is increased?
 3. Light of smaller visible wavelength is used? Justify your answer in each case. (3)
- Q27. A circular coil of N -turns and radius R is kept normal to a magnetic field given by $B = B_0 \cos \omega t$. Deduce an expression for the emf induced in this coil. State the rule which helps to detect the direction of induced current. (3)
- Q28. (i) Steel is preferred for making permanent magnets, whereas soft iron is preferred for making electron magnets. Why?
- (ii) A uniform magnetic field exists normal to the plane of the paper over a small region of space. A rectangular loop of wire is slowly moved with a uniform velocity across the field as shown in the figure.



Draw the graph showing the variation of

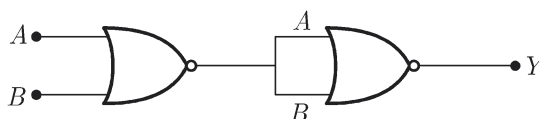
- (a) Magnetic flux linked with the loop and
- (b) The induced emf in the loop with time. (3)

OR

A small compass needle of magnetic moment m and moment of inertia I is free to oscillate in a magnetic field B . It is slightly disturbed from its equilibrium position and then released. Show that it executes simple harmonic motion. Hence, write the expression for its time period. (3)

- Q29. Find the half-life period of a radioactive material, if its activity drops to $(1/16)$ th of its initial value in 30 yr. (3)

- Q30. Write the truth table for circuit given in figure below consisting of NOR gates and identify the logic operation (OR, AND, NOT) which this circuit is performing. (3)



SECTION D

- Q31. Explain with the help of diagram, the principle and working of an AC generator. Write the expression for the emf generated in the coil in terms of its speed of rotation. (5)

OR

The primary coil of an ideal step-up transformer has 100 turns and the transformation ratio is also 100. The input voltage and the power are 220 V and 1100 W. Find:

1. Number of turns in secondary
2. The current in the primary
3. Voltage across the secondary
4. The current in the secondary
5. Power in the secondary.

(5)

- Q32. (i) What do you mean by the polarisation of light? Define law of Malus and then show that the intensity of light becomes half, when ordinary light is incident on a polariser. (5)
- (ii) Two polarising sheets have their polarising direction parallel, so that the intensity of the transmitted light is maximum. Through what angle must the either sheet be turned, if the intensity is to drop by one half? (5)

OR

1. Define Brewster's law. Show that the sum of angle of polarisation and angle of refraction is 90° .
2. Discuss the intensity of transmitted light, when polaroid sheet is rotated between two crossed polaroid. (5)

- Q33. Find an expression for the capacitance of a parallel plate capacitor. An air capacitor has a capacitance of $2\mu\text{F}$, which becomes $12\mu\text{F}$, when a dielectric medium is filled in the space between the plates. Find dielectric constant of that material. (5)

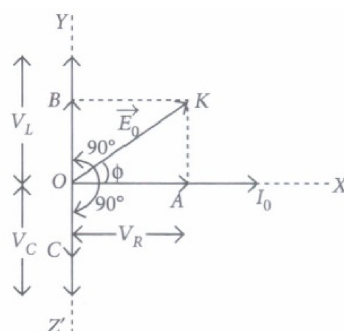
OR

Find an expression for the electric field intensity at a point on equatorial line due to an electric dipole. (5)

SECTION E

- Q34. When a pure resistance R , pure inductor L and an ideal capacitor of capacitance C is connected in series to a source of alternating e.m.f., then current at any instant through the three elements has the same amplitude and is represented as $I = I_0 \sin \omega t$. However, voltage across each element has a different phase relationship with the current as shown in graph.

The effective resistance of RLC circuit is called impedance (Z) of the circuit and the voltage leads the current by a phase angle ϕ .



A resistor of 12Ω a capacitor of reactance 14Ω and a pure inductor of inductance 0.1 H are joined in series and placed across 200 V , 50 Hz a.c. supply (4)

- (i) The value of inductive reactance is
 - (a) 15Ω
 - (b) 31.4Ω
 - (c) 20Ω
 - (d) 30Ω
- (ii) The value of impedance is
 - (a) 20Ω
 - (b) 15Ω
 - (c) 30Ω
 - (d) 21.13Ω
- (iii) What is the value of current in the circuit?
 - (a) 5 A
 - (b) 15 A
 - (c) 10 A
 - (d) 9.46 A
- (iv) What is the value of the phase angle between current and voltage?
 - (a) $53^\circ 9'$
 - (b) $63^\circ 9'$
 - (c) $55^\circ 4'$
 - (d) 50°

- Q 35. Smallest charge that can exist in nature is the charge of an electron. During friction it is only the transfer of electrons which makes the body charged. Hence net charge on any body is an integral multiple of charge of an electron.

$$\begin{array}{l} \text{(+2e)} \\ \text{(-3e)} \end{array} = -e \quad \begin{array}{l} \text{(+10e)} \\ \text{(+5e)} \end{array} = 15e$$

$$[1.6 \times 10^{-19}\text{ C}] \text{ i.e.}$$

$$q = \pm ne$$

where $n = 1, 2, 3, 4, \dots$

Hence no body can have a charge represented as $1.1e, 2.7e, \dots e$, etc.

Recently, it has been discovered that elementary particles such as protons or neutrons are composed of more elemental units called quarks. (4)

- (i) Which of the following properties is not satisfied by an electric charge?
- (a) Total charge conservation (b) Quantization of charge
- (c) Two types of charge (d) Circular line of force
- (ii) Which one of the following charges is possible?
- (a) $5.8 \times 10^{-18} \text{C}$ (b) $3.2 \times 10^{-18} \text{C}$
- (c) $4.5 \times 10^{-19} \text{C}$ (d) $8.6 \times 10^{-19} \text{C}$
- (iii) If a charge on a body is 1 nC, then how many electrons are present on the body?
- (a) 6.25×10^{27} (b) 1.6×10^{19}
- (c) 6.25×10^{28} (d) 6.25×10^9
- (iv) If a body gives out 10^9 electrons every second, how much time is required to get a total charge of 1 C from it?
- (a) 190.19 years (b) 150.12 years
- (c) 198.19 years (d) 188.21 years