SAMPLE PAPER

2020-21

Class: XII

Subject: Physics (Theory)

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

General Instructions:

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

(2) **This question paper has five sections: Section A, Section B, Section C, Section D and Section E.**

(3) **Section A contains ten very short answer questions and four assertion reasoning MCQs of 1 mark each, Section B has two case based questions of 4 marks each, Section C contains nine short answer questions of 2 marks each, Section D contains five short answer questions of 3 marks each and Section E contains three long answer questions of 5 marks each.**

(4) **There is no overall choice. However internal choice is provided. You have to attempt only one of the choices in such questions.**

SECTION A

All questions are compulsory. In case of internal choices, attempt any one of them.

Q1: Write the dimensional formula for the permittivity of free space.

Q2: What are the limitations of Coulomb's law?

Q3: Draw the electric field lines due to a point charge (i) $Q > 0$ and (ii) $Q < 0$.

Q4: A hollow metal sphere of radius 5 cm is charged such that the potential on its surface is 10 V. What is the potential at the centre of the sphere?

OR

How will the electric potential be affected if the charge system is placed in a medium of dielectric constant K.

Q5: Name the physical quantity whose SI unit is F m^{-1} (farad/metre).

Q6: A car battery is of 12 V. Eight dry cells of 1.5 V connected in series also give 12 V, but such a combination is not used to start a car. Why?

OR

Two materials, Si and Cu, are cooled from 300 K to 60 K. What will be the effect on their resistivity?

Q7: Write two properties of a material used as a suspension wire in a moving coil galvanometer

Q8: The instantaneous current and voltage of an ac circuit are given by $I = 10 \sin 314\ t$ A and $V = 50 \sin (314\ t + \pi/2)$ V. What is the power of dissipation in the circuit?

OR

A bulb and a capacitor are connected in series to an ac source of variable frequency. How will the brightness of the bulb change on increasing the frequency of the ac source?

Q9: A proton and an electron have same kinetic energy. Which one has smaller de Broglie wavelength and why?

OR

Write the relationship of de Broglie wavelength λ associated with a particle of mass m in terms of its kinetic energy *E*.

Q10: What is the angular momentum of an electron in Bohr's hydrogen atom whose energy is –3.4 eV?

Assertions and Reasons

Directions : In the following questions (11-14), a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as :

(a) If both assertion and reason are true and reason is the 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/assertion is false and reason is true.

Q11: **Assertion.** When charges are shared between any two bodies, no charge is really lost and some loss of energy does occurs.

Reason. Some energy disappears in the form of heat, sparking etc.

Q12: **Assertion**. To observe diffraction of light, the size of obstacle/aperture should be of the order of 10^{-7} m.

Reason. 10^{-7} m is the order of wavelength of visible light.

Q13: **Assertion**. Microwaves are used in RADAR.

Reason. Microwaves are radiowaves having very small wavelengths.

Q14: **ASSERTION**: If radius of the $_{13}Al^{27}$ nucleus is estimated to be 3.6 fermi, then the radius of $_{53}Te^{125}$ nucleus is nearly 6 fermi.

Reason: radius of nuclei is directly proportional to is mass number.

SECTION B

Questions 15 and 16 are Case Study based questions and are compulsory. Attempt any 4 sub parts from each question. Each question carries 1 mark.

Case study-1

Q15: **In an experiment of potentiometer a wire of length 400 cm and resistance 250 ohms is connected with main battery E = 5V having internal resistance 5 ohms and a series resistance of 45 ohms.**

1: It is observed that the deflection on potentiometer wire is same side using an auxiliary cell of emf E1 = 4.2 V. the reason will be

(a) The potential difference of cell E1 is greater then Potential drop on the wire AB.

(b) The series resistance is low.

(c) The resistance of wire is high.

(d) The auxiliary cell has more voltage then main cell.

2: What is the potential drop on length AB

(a) 3.5 V

(b) 4.1 V

(c) 4.8 V

(d) 2.8 V

3: What will be the balancing length if auxiliary cell of 3.2 V is used

(a) 260 cm

(b) 280 cm

(c) 312 cm

(d) 356 cm

4: If any cell of emf x Volt gives a balancing length of 280 cm then x is

(a) 1.9 V

(b) 2.0 V

(c) 2.87V

(d) 3.56V

5: The value of potential difference on 45 ohms is

(a) 1.6 V

(b) 0.75 V

(c) 0.2 V

(d) 2.8 V

Case study 2

Q16: **Electric dipole is an arrangement where two equal and opposite charges of q C separated by a distance 2l. the dipole moment is p and when this dipole is placed in external Electric field E then it experience torque.**

1: The electric field on equatorial line of short dipole will be

(a) $\frac{1}{4\pi\varepsilon_0}\frac{2p}{r^3}$

(b) $\frac{1}{4\pi\varepsilon_0}\frac{p}{r^2}$

(c) $\frac{1}{4\pi\varepsilon_0}\frac{2q}{l^2}$

(d) $\frac{1}{4\pi\varepsilon_0}\frac{q}{l^2}$

2: The electric field on axial line of dipole will be ----- that of equatorial line at same distance from the centre.

(a) half

(b) Twice

(c) Thrice

(d) One third

3: The electric field at the centre of dipole will be

(a) Zero

(b) Infinite

(c) $\frac{1}{4\pi\varepsilon_0}\frac{2q}{l^2}$

(d) $\frac{1}{4\pi\varepsilon_0}\frac{q}{l^2}$

4: The torque on electric dipole when placed in external electric field will be

(a) $\tau = p.E$

(b) $\tau = p \times E$

(c) $\tau = \frac{p}{E}$

(d) Zero.

5: The dipole will be in stable equilibrium when the angle between p and E is

(a) Zero

(b) $90°$

(c) $180°$

(d) $135°$

SECTION C

All questions are compulsory. In case of internal choices, attempt anyone.

Q17: A potential difference V is applied across a conductor of length l. How is the drift velocity affected when V is doubled and l is halved?

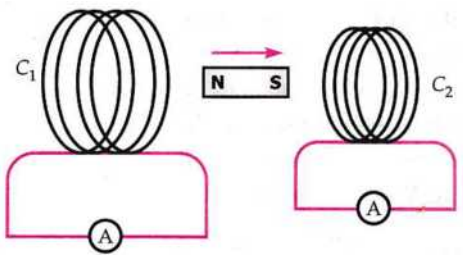
OR

Why alloys like constantan and manganin are used for making standard resistors.

Q18: Derive an expression for the self-inductance of a long solenoid.

Q19: A magnet is quickly moved in the direction indicated by an arrow between two coils

C_1



C_1 and C_2 as shown in Fig. What will be the direction of induced current in each coil as seen from the magnet ? Justify your answer.

OR

Give two difference between self-induction and mutual induction.

Q20: : Derive the expression for the reactance of a capacitor, when connected across an a.c. source.

Q21: A plane electromagnetic wave travels, in vacuum, along the y-direction. Write (i) the ratio of the magnitudes, and (ii) the directions of its electric and magnetic field vectors.

OR

Identify the part of the electromagnetic spectrum which is

(a) Suitable for radar systems used in aircraft navigation.

(b) Adjacent to the low frequency end of the electromagnetic spectrum.

(c) Produced in nuclear reactions.

(d) Produced by bombarding a metal target by high speed electrons.

Q22: Define total internal reflection. Give the conditions of TIR.

Q23: What is n-type semiconductor? Draw energy band diagram of n-type Semiconductor.

Q24: A spherical convex surface of radius of curvature 20 cm, made of glass (μ = 1.5) is placed in air. Find the position of the image formed, if a point object is placed at 30 cm in front of the convex surface on the principal axis

OR

The radii of curvature of a double convex lens are 15 cm and 30 cm and its refractive index is 1.5. Calculate its focal length.

Q25: What is the ratio of slit widths if the amplitudes of light loaves from them have a ratio of $\sqrt{2} : 1$?

SECTION D

All questions are compulsory. In case of internal choices, attempt anyone.

Q26: The kinetic energy of the electron orbiting in the first excited state of hydrogen atom is 3.4 eV. Determine the de-Broglie wavelength associated with it.

OR

Calculate the de-Broglie wavelength associated with an a-particle accelerated through a potential difference of 200 V. Given $m_p = 1.67 \times 10^{-27}$ kg.

Q27: State with reason, how would the linear width of central maximum change if (i) monochromatic yellow light is replaced with red light, and (ii) distance between the slit and the screen is increased.

OR

How will the angular separation and visibility of fringes in Young's double slit experiment change when (i) screen is moved away from the plane of the slits, and (ii) width of the source slit is increased ?

Q28: Using Bohr's postulates Derive the expression of (i) radius (ii) velocity (iii) energy of an orbiting electron in Hydrogen atom.

Q29: Discuss the path of a charged particle 'q' moving with velocity 'v' enters in magnetic field 'B' at an angle θ with it. Deduce the (i) radius of the path, (ii) pitch of the path acquired.

OR

Derive an expression for the force per unit length between two infinitely long straight parallel current carrying wires. Hence define one ampere. Also define coulomb in terms of ampere.

Q30: Define(I) atomic mass unit (ii) mass defect (iii) calculate the energy associated with one amu in electron volt.

SECTION E

All questions are compulsory. In case of internal choices, attempt anyone.

Q31: (a) Draw a circuit diagram for p-n junction diode in forward and reverse bias. Sketch the voltage-current graph for the same.

(b) What is LED. Explain its working in brief

OR

(a) With the help of a circuit diagram, explain full wave rectification using junction diodes. Draw the waveforms of input and output voltages.

(b) A semiconductor has equal electron and hole concentration of 2 x 10 m^{-3}. On doping with a certain impurity, the hole concentration increases to $4\times10^{10} m^{-3}$.

(i) What type of semiconductor is obtained on doping?

(ii) Calculate the new electron concentration of the semiconductor.

Q32: (i)with the help of well labeled diagram derive an expression of lens maker's formula

(ii) a convex lens of focal length 0.2 m made of glass of refractive index 1.5 is immersed in water of refractive index 1.33. Find the change in its focal length.

OR

(i)Draw a graph to show the variation of the angle of deviation with that of angle of incidence. For a monochromatic ray of light passing through a prism of refracting angle A. hence deduce the relation for refractive index at its minimum deviation.

(ii) A ray of light incident on an equilateral glass prism shows minimum deviation of 30°. Calculate the refractive index of the prism.

Q33: A small town with a demand of 800 Kw of electric power at 220 V is situated with 15 km away from the power plant generating power at 440 V. resistance of two wire line is 0.5 ohm per km. town gets power from the line through 4000-200 step down transformer installed at substation in the town.

(i) Estimate the line power loss in form of heat.

(ii) How much power must the plant supply. Assuming negligible power loss due to leakage.

OR

Define average value of ac. Derive an expression relating peak value of current and average value of ac.

(ii) what will be the peak value of alternating current if the rms current in a circuit is 15 A.

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