CLASS XII
GUESS PAPER
PHYSICS (Theory)

Time allowed: 3 hours Maximum marks: 70

General Instructions:
1. All questions are compulsory. There are 26 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 five questions of one mark each, Section B contains five questions of two marks each, Section C contains twelve questions of three marks each, Section D contains one value based question of four marks and Section E contains three questions of five marks each.

Q.1 A light metal disc on the top of an electromagnet is thrown up as the current is switched on. Why? Give reason.

Q.2 Name the physical quantity which has unit F/m. Is it a scalar or vector?

Q.3 How is the force between two charges affected when dielectric constant of the medium in which they are held increases?

Q.4 Why are microwaves considered suitable for radar systems used in aircraft navigation

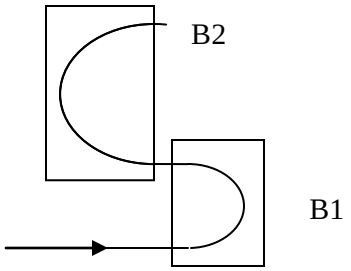
Q.5 The relative permittivity of a medium is 9 and the relative permeability is unity. What is the speed of e.m waves in the medium?

Q.6 Two amplifiers are connected one after the other in series. The first amplifier has a voltage gain of 10 and second has a voltage gain of 20. If the input signal is 0.01 V, calculate the output ac signal.

Q.7 A charged particle enters an environment of strong and non uniform magnetic field varying from point to point both in magnitude and direction and comes out of it following a complicated trajectory. Would the final speed be equal to the initial speed if it suffered no collision with the environment? Justify.

Q.8 Define electric volt. Write its relation with joule.

Q.9 Figure shows the path of an electron that passes through two region containing uniform magnetic fields of magnitudes B_1 and B_2.
Its path in each region is half circle.



a) Which field is stronger?
b) What are the directions of two fields?
c) Is the time spent by electron in, the B_1 region greater than, less than, or the same as time spent in B_2 region?

Q.10 The opposite corners of a square carry Q charge each and the other two opposite corners of the same carry q charge each. If the resultant force on q is zero. How are Q and q related?

Q.11 Is it necessary for the transmitting antenna and receiving antenna to be of the same height for the line of sight communication? Find the expression for maximum LOS distance d_m between these two antennas of height h_t and h_r?

Q.12 An inductor 200 mH, capacitor 500μF, resistor 10Ω are connected in series with a 100V, variable frequency ac source. Calculate the

(i) Frequency at which the power factor of the circuit is unity. (ii) Current amplitude at this frequency.
(iii) Q - factor.

Q.13 Draw the CE circuit of an npn transistor for measurement of input and output characteristics. Also draw the typical shape of these characteristics.

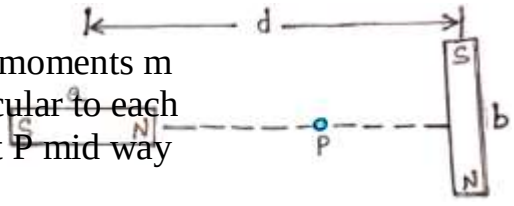
Q.14 State the principle of a capacitor.
(b) An electrical technician requires a capacitance of 2 μF in a circuit across a pd of 1 kilovolt. A large number of
1 μF capacitors are available to him each of which can withstand a pd of not more than 400 volt. Suggest a possible arrangement that requires the minimum capacitors.

Q.15 The sequence of the stepwise decays of radioactive nucleus is $D \xrightarrow{\alpha} D_1 \xrightarrow{\beta} D_2 \xrightarrow{\gamma} D_3$
The mass number and atomic number of D are 180 and 85 respectively. What are the corresponding values for D_1, D_2 and D_3 Nuclei?

Q.16 Write Einstein's photoelectric equation. State clearly the three salient features observed in photoelectric effect which can be explained on the basis of this equation.
The maximum kinetic energy of the photoelectrons gets doubled when the wavelength of light incident on the surface changes from λ_1 to λ_2. Drive the expressions for the threshold wavelength λ_0 and work function for the metal surface.

Q.17 The potential difference, across a resistor 'r' carrying current 'I' is Ir.
(i) Now if the potential difference across 'r' is measured using a voltmeter of resistance 'R_V', show that the reading of voltmeter is less than the true value.
(ii) At what value of Rv, does the voltmeter measures the true potential difference?

Q.18 Two identical short magnets a and b of magnetic moments m each are placed at a distance d with their axes perpendicular to each other, as shown in fig. Find the magnetic field at a point P mid way between the two dipoles.



Q.19 A resistance R=5Ω is connected to one of the gaps in a meter bridge, which uses a wire of length 1 m. An unknown resistance X > 5Ω is connected in the other gap. The balance point is noticed at 'l' cm from the positive end of the battery. On interchanging R and X, it was found that the balance point further shifts by 20 cm away from end A. Neglecting the end correction; calculate the value of unknown resistance X used.
(b) What is the principle of the meter bridge?

Q.20 Define Power factor. In a series RC circuit, $X_C = R$ and power factor of the circuit is P_1. When an inductor with the inductance L such that $X_L=X_C$ is put in series, the power factor becomes P_2, the Find P_1/P_2.

OR

For a given ac source $I=I_m$ sin wt, show that the average power dissipated in a resistor R over a complete cycle is given by ½ I_m^2R.

Q.21 Using a ray diagram derive the magnification of a compound microscope when the final image is formed at the near point.

Q.22 Two heating elements of resistances $R_1$and R_2 when operated at a constant supply of voltage V, consume powers P_1 and P_2 respectively. Deduce the expression for the power consumed by their combination when they are connected in series across the same voltage supply.

Q.23 Gautam went for a vacation to the village where his grandmother lived. His grandmother took him to watch a street play one evening. They noticed a black box connected to the mike lying nearby. Gautam's grandmother did not know what that box was. When she asked this question to Gautam, he explained to her that it was an amplifier.
(i) Which values were displayed by the grandmother?
(ii) What is the function of an amplifier? (iii) Which basic electronic device is used in the amplifier?

Q.24 A cell of emf E and internal resistance r is connected to two resistances R1 and R2 and a perfect ammeter. The current in the circuit is measured in four different situations:
(a) Without any external resistance in the circuit
(b) With the resistance R1 only
(c) With the resistance R1 and R2 in series combination.

(d) With the resistance R1 and R2 in parallel combination.
The current measured in all the four cases are 0.42A, 1.05A, 1.4A and 4.2A, but not necessarily in that order. Identify the current corresponding to the four cases as mentioned above.

OR

Using a suitable circuit diagram, explain the experiment to determine the internal resistance of a primary cell using a potentiometer. Derive the necessary formula.
(b) Explain why a potentiometer is preferred over a voltmeter.

Q.25 Derive an expression for the radius and frequency of a charged particle moving with speed "v" into a perpendicular magnetic field.
(b) As shown in figure, a particle of mass m having positive charge q is initially traveling upward with velocity v. At the origin of coordinates it enters region of a uniform magnetic field B directed perpendicular out of the page.
(a) What is the critical value of v such that the particle just reaches y = h? Describe the path of the particle under the condition when (i) v < critical velocity (ii) v > critical velocity.

OR

State Biot-Savart law and using it derive the expression for the magnetic field on the axis of a current carrying loop.

Q.26 What is diffraction. Derive an expression for the path difference in the single slit experiment and hence write the positions of maximas and minimas.
(b) Show that the angular width of first diffraction fringe is half that of the central fringe.
(c) Explain why the maxima at $\theta = (n + \frac{1}{2})\frac{\lambda}{\alpha}$ become weaker and weaker with the increasing n.

OR

Using a suitable ray diagram derive the expression for the magnification of the compound microscope when the final image is formed at infinity
(b) An angular magnification of 30x is desired using an objective of focal length 1.25 cm and an eye piece of force length 5 cm. how will you set up the compound microscope for the final image formed at least distance of distinct vision?

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