

LPS

FIRST TERM EXAMINATION 2016 – 2017
CLASS XII – PHYSICS

Time allowed: 3 hours

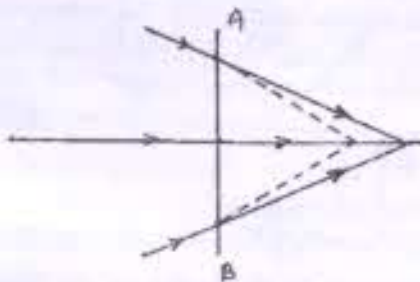
MM 70

General Instructions

All questions are compulsory. The first five questions are one mark each. Q6 to Q10 are two marks each. Q11 to Q22 are three marks each. Q23 is a value based question for 4 marks. Q24, Q25 & Q26 are for five marks each. Each five mark question has an internal choice.

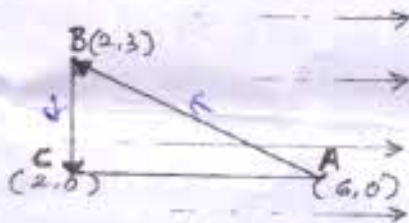
- Q1 A charge q is placed at the centre of a cube of side l . What is the electrical flux passing through two opposite faces of the cube?
- Q2 Write an expression connecting the polarisation density \vec{P} and the external electric field \vec{E} for a dielectric medium.
- Q3 In a LCR circuit, $V_L = V_C \neq V_R$. What is the value of power factor?
- Q4 Name the part of electromagnetic spectrum which is used as diagnostic tool in medicine.

Q5



The line AB in the diagram represents a lens. State whether the lens is convex or concave.

Q6



A test charge q is moved without acceleration from A to C along the path from A to B and then from B to C in electric field E as shown in the figure.

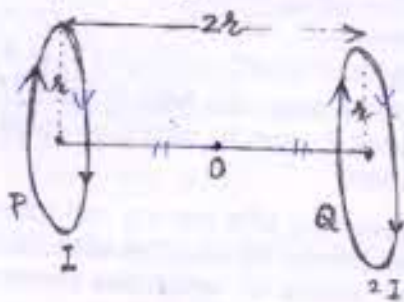
- a) Calculate the potential difference between A and C.
- b) At which point (of the two) is the electric potential more and why?

Q7

A circular coil of closely wound N -turns and radius r carries a current I . Write the expression for the following

- a) The magnetic field at its centre
- b) The magnetic moment of this coil.

Q8



Two identical circular loops P and Q each of radius r carrying currents I and $2I$ respectively are lying in parallel planes such that they have a common axis. The direction of current in both the loops is clockwise as seen from O which is equidistant from both loops. Find the magnitude of the net magnetic field at point O.

Q9

Write one difference between conduction current and displacement current. A capacitor has been charged by a d.c. source. What are the magnitudes of conduction and displacement currents, when it is fully charged?

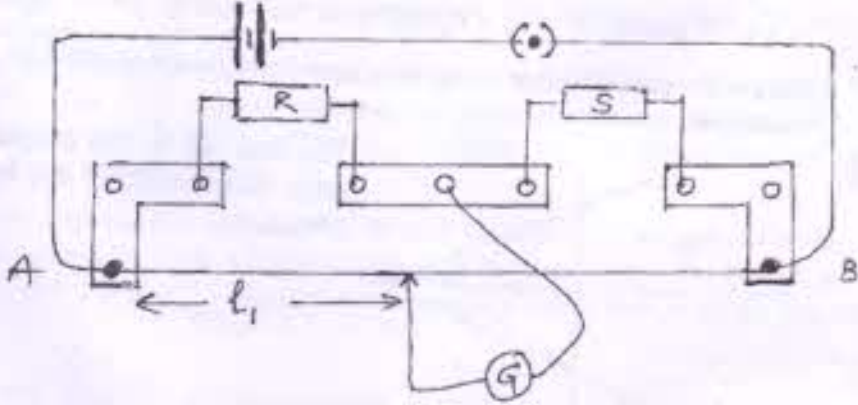
$\frac{1}{r} \propto \frac{1}{r^2}$
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Q10 Name the radiation which lies next to the infrared radiation in the electromagnetic spectrum having (a) shorter wavelength (b) longer wavelength. State the condition under which a microwave oven heats up a food item containing water molecules.

Q11 a) Depict the equipotential surfaces for a system of two identical positive point charges placed at a distance apart. = 3
 b) Deduce the expression of the potential energy of a system of two point charges q_1 and q_2 brought from infinity to the point \vec{r}_1 and \vec{r}_2 respectively in the presence of external electric field E .

Q12 ^{Derive} How much electrical energy is stored when a charge Q is transferred to a capacitor of capacitance C ?

Q13



In a meter bridge, the null point is found at a distance of l_1 cm from A. If now a resistance of X is connected in parallel with S , the null point occurs at l_2 cm.

Obtain a formula for X in terms of l_1, l_2 and S

Q14 Write any two factors on which internal resistance of a cell depends. The reading on a high resistance voltmeter, when a cell is connected across it, is 2.0 Volt when the terminals of the cell are connected to a resistance of 3Ω . The voltmeter reading drops to 1.5V. Find the internal resistance of the cell.

OR

The heating elements of resistance R_1 and R_2 when operated at a constant supply of voltage V consumes power P_1 and P_2 respectively. Deduce the expression for the power of their combination when they are, in turn, connected in (a) series) and (b) parallel across the same voltage supply.

Q15 Two particles A and B of masses m and $2m$ have charges q and $2q$ respectively. Both these particles moving with velocities v_1 and v_2 respectively in the same direction enter the same magnetic field B acting normally to their direction of motion. If the two forces F_A and F_B acting on them are in the ratio of 1:2, find the ratio of their velocities.

Q16 State the underlying principle of working of a moving coil galvanometer. Write two reasons why a galvanometer cannot be used as such to measure current in a given circuit. Name any two factors on which the current sensitivity of a galvanometer depends.

- Obtain*
- Q17 Define the term mutual inductance of a pair of long coaxial solenoids each of length l and radii r_1 and r_2 ($r_2 \gg r_1$). Total numbers of turns in the two solenoids are N_1 and N_2 respectively.
- Q18 Two identical loops, one of copper and other of aluminium are rotated with the same angular speed in the same magnetic field. Compare (a) the induced emf and (b) the current produced in the two coils. Justify your answer.
- Q19 A jet plane is travelling towards west at a speed of 1800 km/hour. What is the voltage difference developed between the ends of the wings having a span of 25m, if the earth's magnetic field at the location has a magnitude of 5×10^{-4} T and the dip angle is 30° .
- Q20 An object is placed 15cm in front of a convex lens of focal length 10cm. Find the nature and position of the image formed. Where should a convex mirror of radius of curvature 20cm be placed so that the final image is formed at the position of the object itself?
- Q21 A ray of light incident on one of the faces of a glass prism A has angle of incidence $2A$. The refracted ray in the prism strikes the opposite face which is silvered. The reflected ray from it retracing its path. Trace the ray diagram and find the relation between the refractive index of the material of the prism and the angle of prism.
- Q22 Draw a ray diagram to show the image formation by a concave mirror when the object is kept between its focus and the pole. Using the diagram derive the magnification formula for the image formed.
- Q23 Sushil is in the habit of charging his mobile and then leaving the charger connected through the mains with the switch on. When his sister (Asha) pointed this out to him, he replied there was no harm as the mobile had been disconnected. Asha then explained to him and convinced him, how the energy was still being wasted, as the charger was continuously consuming energy. Answer the following questions:
- What values did Asha display in convincing her brother?
 - What measures, in your view, should be adopted to minimise the wastage of electrical energy in your household?
 - Imagine an electric appliance of 2W left connected to the main for 20 hours, estimate the amount of energy wasted.
- Q24 Out of the two magnetic material A has (relative permeability slightly greater than unity) while B has less than unity. Identify the nature of the material A and B. Will their susceptibilities be positive or negative?
A short bar magnet of magnetic moment 0.09 J/T is placed with its axis at 30° to a uniform magnetic field. It experiences a torque of 0.063 J
- Calculate the magnitude of magnetic field
 - In which orientation will the bar magnet be in stable equilibrium in the magnetic field?
- OR
- ✓ Draw a schematic sketch of a cyclotron. Explain briefly how it works and how it is used to accelerate the charged particles.
- Show that time period of ions in a cyclotron is independent of both the speed and radius of circular path.
 - What is resonance condition? How is it used to accelerate the charged particles?

Q25

- a) Show that in an A.C. circuit containing a pure inductor, the voltage is ahead of the current by $\pi/2$ in phase
- b) A horizontal straight wire of length L extending from east to west is falling with speed v at right angles to the horizontal component of Earth's magnetic field B
 - i) Write the expression for instantaneous value of the emf induced in the wire.
 - ii) What is the direction of the emf?
 - iii) Which end of the wire is at higher potential?

OR

- a) A resistor of 400Ω , an inductor of $\frac{5}{\pi}$ H and a capacitor of $\frac{50}{\pi}$ μF are connected in series across a source of alternating voltage of $140 \sin 100\pi t$ volts. Find the voltage across the resistor when the source is delivering maximum power.
- b) A step down transformer operates on a 2.5KV line. It supplies a load with 20A. The ratio of the primary winding to secondary is 10:1. If the transformer is 90% efficient, calculate the (i) power output (ii) the current in secondary.

Q26 Derive an expression connecting object distance u , image distance v and radius of curvature R for a convex spherical surface, when the object is placed in rarer medium and its image is formed by refraction through the denser medium.

OR

Draw a ray diagram showing image formation in a compound microscope. Define the term limit of resolution and name the factor on which it depends. How is it related to resolving power of microscope?

"A telescope resolves where as a microscope magnifies." Justify the statement.