

TERM -1 EXAMINATION – 2019-2020

SUB: - PHYSICS

CLASS-XII

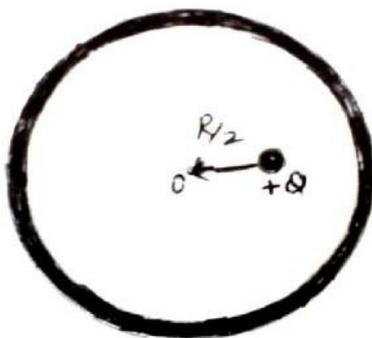
Time Allowed: 3 Hr 15 Min

MODEL TEST PAPER

M.M.:70

1. Figure shows a point charge $+Q$, located at a distance $R/2$ from the centre of a spherical metal shell. Draw the electric field lines for the given system. 1

(1)



2. Can there be a potential difference between two adjacent conductors carrying the same charge? 1
3. An electron is projected with uniform velocity along the axis of a current carrying long solenoid. Which of the following is true? 1
- (a) The electron will be accelerated along the axis.
- (b) The electron path will be circular about the axis.
- (c) The electron will experience a force at 45° to the axis and hence execute a helical path.
- (d) The electron will continue to move with uniform velocity along the axis of the solenoid.
4. Two different wires X and Y of same diameter but of different materials are joined in series and connected across a battery. If the number density of electrons in X is twice that of Y, find the ratio of drift velocity of electrons in the two wires. 1
5. Consider a current carrying wire (current I) in the shape of a circle. Note that as the current progresses along the wire, the direction of j (current density) changes in an exact manner, while the current I remain unaffected. The agent that is essentially responsible for is 1
- (a) source of emf.
- (b) electric field produced by charges accumulated on the surface of wire.
- (c) the charges just behind a given segment of wire which push them just the right way by repulsion.
- (d) the charges ahead.
6. Which of the following combinations should be selected for better tuning of an LCR circuit used for communication 1
- (a) $R = 20 \Omega$, $L = 1.5 \text{ H}$, $C = 35 \mu\text{F}$.
- (b) $R = 25 \Omega$, $L = 2.5 \text{ H}$, $C = 45 \mu\text{F}$.
- (c) $R = 15 \Omega$, $L = 3.5 \text{ H}$, $C = 30 \mu\text{F}$.
- (d) $R = 25 \Omega$, $L = 1.5 \text{ H}$, $C = 45 \mu\text{F}$.
7. Can the average power output be negative? 1
8. If E and B represent electric and magnetic field vectors of the electromagnetic wave, the direction of 1

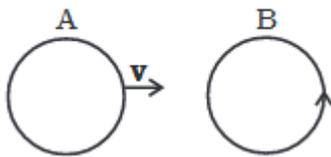
propagation of electromagnetic wave is along

- (a) E.
- (b) B.
- (c) $B \times E$.
- (d) $E \times B$.

9. Two particles A₁ and A₂ of masses $m_1, m_2 (m_1 > m_2)$ have the same de Broglie wavelength. Then 1
- (a) their momenta are the same.
 - (b) their energies are the same.
 - (c) energy of A₁ is Zero.
 - (d) energy of A₁ is more than the energy of A₂.

- 10 The electric field inside a spherical shell of uniform surface charge density is 1
- a) Zero
 - b) constant, less than zero
 - c) directly proportional to the distance from the centre.
 - d) None of the above.

- 11 There are two coils A and B as shown in Fig. A current starts flowing in B as shown, when A is moved towards B and stops when A stops moving. The current in A is counterclockwise. B is kept stationary when A moves. We can infer that 1
- (a) there is a constant current in the clockwise direction in A.
 - (b) there is a varying current in A.
 - (c) there is no current in A.
 - (d) there is a constant current in the counterclockwise direction in A.



- 12 An electric charge q is placed at the centre of a cube of side a . The electric flux on one of its faces will be 1

- a) $q/6\epsilon_0$
- b) $q/\epsilon_0 a^2$
- c) $q/4\pi\epsilon_0 a^2$
- d) q/ϵ_0

- 13 There are two sources of light, each emitting with a power of 100 W. One emits X-rays of wavelength 1 nm and the other visible light at 500 nm. Find the ratio of number of photons of X-rays to the photons of visible light of the given wavelength? 1

- 14 Describe the motion of a charged particle in a cyclotron if the frequency of the radio frequency (rf) field were doubled. 1

- 15 X-rays have wavelengths ranging from ___ m to ___ m. 1

- 16 Value of dip angle at magnetic pole is _____. 1

- 17 The mutual inductance M_{12} of coil 1 with respect to coil 2 1
- (a) increases when they are brought nearer.
 - (b) depends on the current passing through the coils.
 - (c) increases when one of them is rotated about an axis.

(d) is the difference as M_{21} of coil 2 with respect to coil 1.

- 18 Curie law $\chi T = \text{constant}$, relating magnetic susceptibility and absolute temperature of magnetic substance is obeyed by 1
- a) all magnetic substance
 - b) paramagnetic substance.
 - c) diamagnetic substance
 - d) ferromagnetic substance.
- 19 Which has greater resistance (a) millimeter or ammeter (b) millimeter or Voltmeter ? 1
- 20 Draw the graph how the resistivity of carbon varies with temperature. 1
- 21 2
- The magnetic field in a plane electromagnetic wave is given by:
 $B_y = 12 \times 10^{-8} \sin(1.20 \times 10^7 z + 3.60 \times 10^{15} t)$ T. Calculate the
- (i) Energy density associated with the Electromagnetic wave
 - (ii) Speed of the wave
- 22 Find an expression for the potential at a point due to a point charge Q. 2
- OR
- Derive an expression for the electric potential at any point along the axial line of an electric dipole?
- 23 A charged particle of mass 'm' charge 'q' moving at a uniform velocity 'v' enters a uniform magnetic field 'B' normal to the field direction. Deduce an expression for Kinetic Energy of the particle. Why does the Kinetic Energy of the charged particle not change when moving through the magnetic field? 2
- 24 A 40Ω resistor is connected in the left gap and an unknown resistance is connected in the right gap of the meter bridge. Also the null deflection point is shifted by 25 cm when the resistors are interchanged. Find the value of unknown resistance? 2
- 25 An proton and an alpha particle are released in the uniform electric field. Will they experience same force and have same acceleration? Justify? 2
- 26 A Deuteron (${}_1\text{H}^2$) and a proton are released from the centre of a cyclotron and made to accelerate. 2
- (a) Can both be accelerated at the same cyclotron frequency? Justify?
 - (b) When they are accelerated in turn, which of the two will have higher velocity at the exit slit of the dees?
- 27 The focal length of a convex lens made of glass is 20 cm. What will be its new focal length when placed in a medium of refractive index 1.25? 2

OR

The following data was recorded for values of object distance and the corresponding values of image distance in the experiment on study of real image formation by a convex lens of power + 5 D. One of these observations is incorrect. Identify this observation and give reason for your choice. (2)

Sr. No.	1	2	3	4	5	6
Object distance (cm)	25	30	35	45	50	55
Image distance (cm)	97	61	37	35	32	30

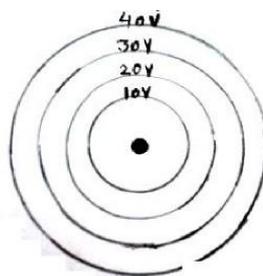
- 28 Charges of q , q and $-q$, respectively are placed at the vertices of an equilateral triangle of side l each. Find the net force experienced by each charge. 3
- 29 Derive an expression for the capacitance of the capacitor. When a metal plate is introduced in such a way that thickness of plate is less than separation of plate of capacitor. 3
- 30 Identify the following electromagnetic radiations as per the frequencies given below. Write one application of each. (a) 10^{15} Hz (b) 10^5 Hz (c) 10^{10} Hz 3
- 31 (a) Explain the working and theory of AC generator. 3
(b) How is transformer used in large scale transmission and distribution of electrical energy over long distances? 3
- 32 Derive an expression for the mutual inductance of two long co-axial solenoids of same length wound over one another. 3
- 33 Explain the cause of paramagnetic and diamagnetic substances. Give two examples of each. 3
- 34 State the principle of Wheatstone bridge. Draw the circuit diagram to find unknown resistance by meter bridge. Write the formula also. 3
- 35 a) Define electric dipole moment. Is it a scalar or a vector? Derive the expression for the electric field of a dipole at a point on the axial line of the dipole. 5
b) An electric dipole moment 4×10^{-9} Cm is aligned at 30° with the direction of uniform electric field of magnitude 5×10^4 NC⁻¹. Calculate the magnitude of the torque acting on the dipole.

OR

(a) Two isolated metal spheres A and B have radii R and $2R$ respectively, and same charge q . Find which of the two spheres have greater : (i) Capacitance and (ii) energy density just outside the surface of the spheres.

(b) (i) Show that the equipotential surfaces are closed together in the regions of strong field and far apart in the regions of weak field. Draw equipotential surfaces for an electric dipole. (1+1)

(ii) Concentric equipotential surfaces due to a charged body placed at the centre are shown. Identify the polarity of the charge and draw the electric field lines due to it. (1)



36 A device X is connected across an ac source of voltage $V = V_0 \sin \omega t$. The current through X is given 5

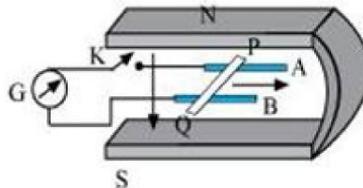
$$I = I_0 \sin \left(\omega t + \frac{\pi}{2} \right)$$

- Identify the device X and write the expression for its reactance.
- Draw graphs showing variation of voltage and current with time over one cycle of ac, for X.
- How does the reactance of the device X vary with frequency of the ac? Show this variation graphically.
- Draw the phasor diagram for the device X.

OR

Figure shows a metal rod PQ of length l , resting on the smooth horizontal rails AB positioned between the poles of a permanent magnet. The rails, rod and the magnetic field B are in three mutually perpendicular directions. A galvanometer G connects the rails through a key 'k'. Assume the magnetic field to be uniform. Given the resistance of the closed loop containing the rod is R.

- Suppose K is open and the rod is moved with a speed v in the direction shown. Find the polarity and the magnitude of induced emf.
- With K open and the rod moving uniformly, there is no net force on the electrons in the rod PQ even though they do experience magnetic force due to the motion of the rod. Explain.
- What is the induced emf in the moving rod if the magnetic field is parallel to the rails instead of being perpendicular? (3 + 2)



b) Explain wattless current and Power factor.

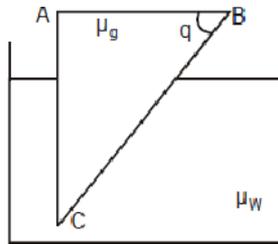
37. (a) Draw a ray diagram to show the formation of the real image of a point object due to a convex spherical refracting surface, when a ray of light is travelling from a rarer medium of refractive index μ_1 to a denser medium of refractive index μ_2 . Hence derive the relation between object distance, image distance and radius of curvature of the spherical surface. (3)

(b) An object is placed in front of right angled prism ABC in two positions as shown. The prism is made of crown glass with critical angle of 41° . Trace the path of the two rays from P & Q. (2)

OR

(a) Calculate the value of θ , for which light incident normally on face AB grazes

along the face BC. $\mu_g = 3/2$ $\mu_w = 4/3$. (2)



(b) Draw a graph showing the variation of angle of deviation ' δ ' with that of angle of incidence ' i ' for a monochromatic ray of light passing through a glass prism of refracting angle ' A '. What do you interpret from the graph? Write a relation showing the dependence of angle of deviation on angle of incidence and hence derive the expression for refractive index of the prism.

(3)