



ANANDALAYA  
SUMMATIVE ASSESSMENT - 1  
Class XII

Subject : PHYSICS  
Date : 23/09/2016

M.M : 70  
Time : 3 Hours

Use the constants given below wherever necessary:

Mass of electron =  $1.6 \times 10^{-19}$  C

Charge on electron =  $9.1 \times 10^{-31}$  kg

Speed of light =  $3 \times 10^8$  m/s

Acceleration due to gravity =  $10$  m/s<sup>2</sup>

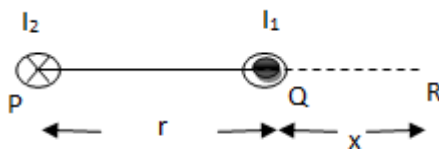
**Section A**

1. Name a physical quantity whose SI unit is  $\text{NC}^{-1}$ . (1)
2. Two copper spheres of same radii, one hollow and other solid, are charged to same potential. Which of the two will have more charge? (1)
3. Two wires of different materials, one copper and another manganin are available. Which one of the two will you choose for making a resistor and why? (1)
4. An artificial satellite with a metal surface is orbiting the earth around the equator. Will the earth's magnetism induce a current in it? (1)
5. What is displacement current? (1)

**Section B**

6. Two charges,  $q_1$  and  $q_2$ , are placed in a uniform electric field  $\vec{E}$ . Write an expression for the potential energy of the system. (2)

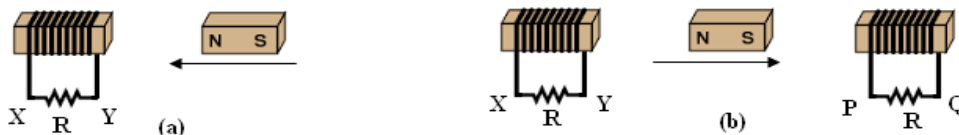
7. Two parallel wires P and Q placed 'r' distance apart. They are carrying currents  $I_1$  and  $I_2$  where  $I_1 < I_2$ , but in the opposite directions. Find the point on the line PQ where the resultant magnetic field is zero. (2)



(OR)

A circular coil of N turns and diameter d carries a current I. it is unwound and rewound to make another coil of diameter 2d, current I remaining the same. Calculate the ratio of the magnetic moments of the new coil and the original coil.

8. Predict the direction of induced current in the resistance R in figures (a) and (b). Give reason for your answer. (2)



9. A student connects a long air core coil of manganin wire to a 100 V dc source and records a current of 1.5 A. when the same coil is connected across a 100 V, 50 Hz ac source the current reduces to 1.0 A. Calculate the value of the reactance of the coil. (2)
10. A light beam is described by the electric field: (2)

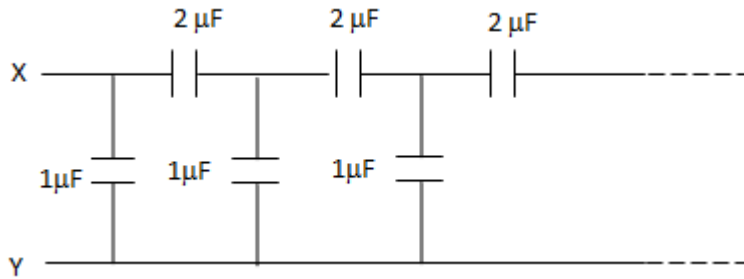
$$E_y = 0.270 \sin(4\pi \times 10^{14}t - 2\pi \times 10^6z) \text{ V/m.}$$

- a) Find the speed of the light beam.
- b) What is the direction of propagation?

**Section C**

11. State and prove Gauss law in electrostatics. (3)

12. Find the capacitance of the infinite ladder between points X and Y. (3)

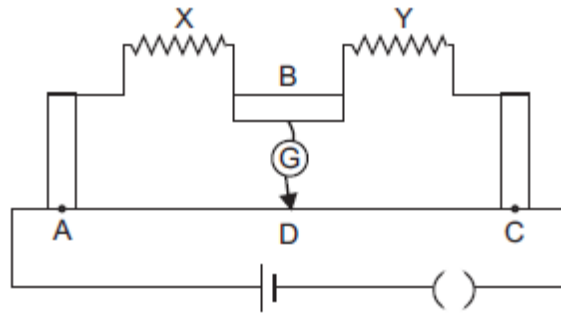


13. Which of the following is dielectric: Silicon and mica? What is the effect of temperature on dielectric constant? Can a metal sphere of radius 1 cm hold a charge of 1C, if the breakdown electric field of air is  $3 \times 10^6$  V/m? (3)
14. Show that when an electric dipole is placed in a uniform electric field  $\vec{E}$ , potential energy of the dipole is given by  $V = -\vec{p} \cdot \vec{E}$  (3)
15. What is drift velocity? A conductor has length 'l' and area of cross section 'A'. The number of free electrons per unit volume is ' $n_e$ '. Obtain an expression for the resistance of the conductor. (3)
16. Drawing necessary circuit diagram explain how the internal resistance of a cell can be found. (3)

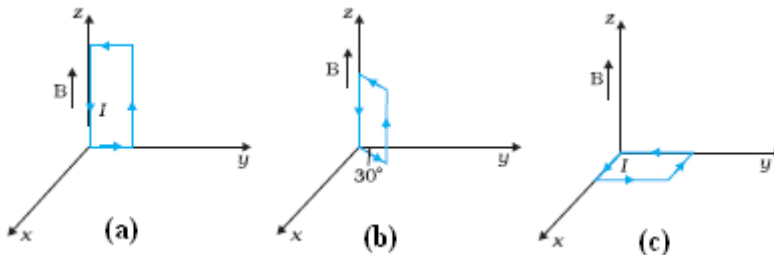
(OR)

Draw the potentiometer circuit to compare emf of two cells. Obtain the expression for comparing the emf.

17. The figure shows experimental set up of a meter bridge. When the two unknown resistances X and Y are inserted, the null point D is obtained 40 cm from the end A. When a resistance of  $10 \Omega$  is connected in series with X, the null point shifts by 10 cm. Find the position of the null point when the  $10 \Omega$  resistance is instead connected in series with resistance 'Y'. Determine the values of the resistances X and Y. (3)



18. a) Using Biot – Savart law, determine the magnetic field at the center of a circular coil of N turns carrying a current I. (3)
- b) A straight current carrying conductor is placed in North – South direction. What is the direction of magnetic field at the east side of the conductor? (3)
19. In a chamber a uniform magnetic field of 6.5 G is maintained. An electron is shot into the field with a speed of  $4.8 \times 10^6$  m/s normal to the field. (3)
- (i) Explain why the path of the electron is circle.
- (ii) Determine the radius of the circular orbit.
20. A uniform magnetic field of 3000 G is established along the positive z direction. A rectangular loop of sides 10 cm and 5 cm carries a current of 12 A. what is the torque on the loop if the loop is placed (a) parallel to Y-Z plane, (b) parallel to z axis and making  $30^\circ$  with y axis and (c) parallel to x-y plane? (3)



21. Define: Self Inductance. An inductor has self inductance  $2.0 \times 10^{-3}$  H. What will be the self inductance when the number of turns is doubled and a rod of relative permeability 5000 is inserted in the inductor? (3)
22. A series LCR circuit is connected to an ac source. Draw its phasor diagram. Obtain the expressions for the impedance of this circuit and the phase difference between current and voltage. (3)

### Section D

23. Ruchi's uncle who was a kabadiwala was getting weak day by day. His nails were getting blue, he stated losing his hair. This happened immediately after he purchased a big container of heavy mass from Delhi University Chemistry Department. Doctors advised him hospitalization and suspected he has been exposed to radiation. His uncle didn't know much about radiations but Ruchi immediately convinced her uncle to get admitted and start treatment.
- (i) What according to you are the values utilized by Ruchi to convince her uncle to get admitted in hospital?
  - (ii) Name the radioactive radiations emitted from a radioactive element. Why does this radiation have high energy compared to other radiations?

### Section E

24. a) Using Gauss law derive an expression for the electric field due to a uniformly charged infinite plane sheet. (5)
- b) Sketch a graph showing the variation of this electric field with distance from the sheet.

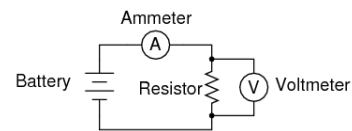
(OR)

Derive an expression for the electric field due to an electric dipole at a point on its equatorial line.

25. Two long straight wires carrying currents  $I_1$  and  $I_2$  are placed side by side separated by a distance 'd'. Obtain the force acting between the two wires. Will the force be attractive or repulsive? From the result of the derivation define 1A. (5)

(OR)

- a) How can a galvanometer of resistance G converted into a voltmeter? Derive the necessary expression for converting a galvanometer into a voltmeter.
- b) A voltmeter of resistance  $R_v$  and an ammeter of resistance  $R_A$  are connected in a circuit to measure a resistance R as shown in figure. The ratio of the meter readings gives an apparent resistance  $R'$ . Show that R and  $R'$  are related by the relation



$$\frac{1}{R} = \frac{1}{R'} - \frac{1}{R_v}$$

26. a) Mention the factors on which the resonant frequency of a series LCR circuit depends. (5)
- b) Plot a graph showing variation of impedance of a series LCR circuit with the frequency of the applied ac source.
- c) A capacitor has reactance  $2 \Omega$  when the frequency of the source is 100 Hz. An inductor L has the same reactance for the same frequency. What is the value of L? if these two are used in an LCR series circuit, what would be the resonant frequency?

(OR)

- a) What is resonance frequency of an LCR circuit?
- b) Three students X, Y and Z performed an experiment for studying the variation of ac currents with angular frequency in a series LCR circuit and obtained the graph shown below. They all used ac sources of same rms value and inductances of same value. What can we conclude (qualitatively) about the (i) Capacitance values and (ii) Resistance values used by them? In which case the quality factor will be maximum? What can we conclude about the nature of impedance of the set up at the frequency  $\omega_0$ ?

