TEST PAPER: PHYSICS

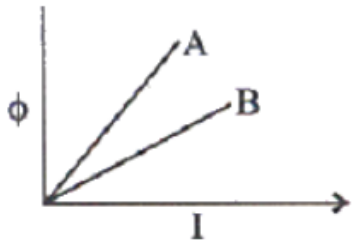
Time: 75 Minutes **Class:** ISC/CBSE 12

Max. Marks: 30 Marks **Date:** 16th January 2019

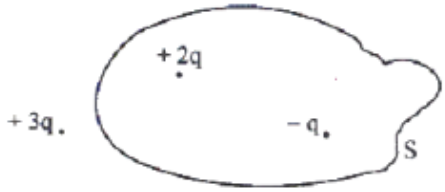
Marking Scheme: *All questions carry 10 marks each. Subparts (A) and (B) carry 3 marks each and subpart (C) carries 4 marks.*

Question 1:

A. Answer the following:
   1. In which orientation, a dipole placed in a uniform electric field is in (i) stable, (ii) unstable equilibrium?
   2. Which part of electromagnetic spectrum has largest penetrating power?
   3. A plot of magnetic flux versus current is shown in the figure for two inductors A and B. Which of the two has larger value of self-inductance?

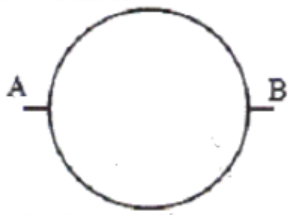


B. Answer the following:
   1. Below figure shows three points charges, +2q, -q and +3q. Two charges +2q and –q are enclosed within a surface 'S'. What is the electric flux due to this configuration through the surface 'S'?



   2. A glass lens of refractive index 1.45 disappears when immersed in a liquid. What is the value of refractive index of the liquid?
   3. What is the ratio of radii of the orbits corresponding to first excited state and ground state in a hydrogen atom?

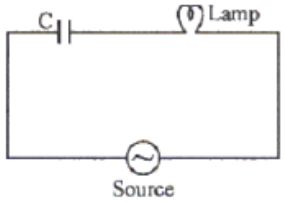
C. Answer the following:
   1. A wire of resistance 8R is bent in the form of a circle. What is the effective resistance between the ends of a diameter AB?



   2. State the conditions for the phenomenon of total internal reflection to occur.
   3. Draw magnetic field lines when a (i) diamagnetic, (ii)paramagnetic substance is placed in an external magnetic field. Which magnetic property distinguishes this behavior of the field lines due to the two substances?

Question 2:

A. Answer the following:
   1. An electric lamp having coil of negligible inductance connected in series with a capacitor and an AC source is glowing with certain brightness. How does the brightness of lamp change on reducing the (i) capacitance, and (ii) the frequency? Justify your answer. (Refer to the image)



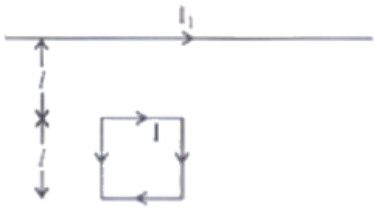
2. Arrange the following electromagnetic radiations in ascending order of their frequencies: (i) Microwave (ii) Radio wave(iii) X-rays(iv) Gamma rays. Write two uses of any one of these.

B. Answer the following:
   1. The radii of curvature of the faces of a double convex lens are 10 cm and 15 cm. If focal length of the lens is 12 cm, find the refractive index of the material of the lens.
   2. An electron is accelerated through a potential difference of 100 volts. What is the de-Broglie wavelength associated with it? To which part of the electromagnetic spectrum does this value of wavelength correspond?

C. Answer the following:
   1. A heavy nucleus X of mass number 240 and binding energy per nucleon 7.6MeV is split into two fragments Y and Z of mass numbers 110 and 130. The binding energy of nucleons in Y and Z is 8.85 MeV per nucleon. Calculate the energy Q released per fission in MeV.
   2. Plot a graph showing the variation of stopping potential with the frequency of incident radiation for two different photosensitive materials having work functions w1and w2(w1> w2). On what factors does the (i) slope and (ii) intercept of the lines depend?

Question 3:

1. A parallel plate capacitor is charged by a battery. After sometime the battery is disconnected and a dielectric slabs its thickness equal to the plate separation is inserted between the plates. How will (i) the capacitance of the capacitor. (ii) Potential difference between the plates and (iii) the energy stored in the capacitor be affected? Justify your answer in each case.
2. Write the expression for the magnetic moment due to a planer square loop of side 'l' carrying a steady current I in a vector form. In the given figure this loop is placed in a horizontal plane near a long straight conductor carrying a steady current I1 at a distance l as shown. Give reasons to explain that the loop will experience a net force but no torque. Write the expression for this force acting on the loop.



3. Describe briefly, with the help of a labelled diagram, the basic elements of an A.C. generator. State its underlying principle. Show diagrammatically how an alternating emf is generated by a loop of wire rotating in a magnetic field. Write the expression for the instantaneous value of the emf induced in the rotating loop.

You may use the following values of physical constants wherever necessary.

$c = 3 \times 10^8\ ms^{-1}$
$h = 6.626 \times 10^{-34}\ Js$
$e = 1.602 \times 10^{-19}\ C$
$\mu_0 = 4\pi \times 10^{-7}\ TmA^{-1}$
$\frac{1}{4\pi\varepsilon_0} = 9 \times 10^{-9}\ Nm^2C^{-2}$
Mass of electron $m_e = 9.1 \times 10^{-31}\ kg$
Mass of neutron $m_n \cong 1.675 \times 10^{-27}\ kg$
Boltzmann's constant $k = 1.381 \times 10^{-23}\ J\ K^{-1}$
Avogadro's number $N_A = 6.022 \times 10^{23}\ mol^{-1}$
Radius of earth = 6400 km