OXFORD PUBLIC SCHOOL, RANCHI

HALF YEARLY EXAMINATION

SESSION 2016-2017

Class – XII **Time : 3 Hrs**

Sub - Physics **F.M.: 70**

Name _____ Class &Sec _____ Roll No _____

General Instructions:

(i) All questions are compulsory.

(ii) There are 26 questions in total. Questions 1 to 5 carry one mark each, questions 6 to 10 carry 2 marks each, questions 11 to 22 carry 3 marks each, question 23 carries 4 marks & the questions 24 to 26 carry 5 marks each.

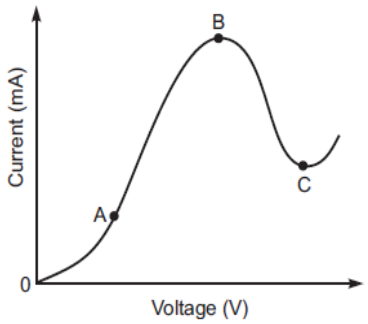
(iii) There is no overall choice, however, an internal choice has been provided in one question of two marks, one question of three marks and all questions of five marks. You have to attempt only one of the given choices in such questions.

(iv) Use of calculators is not permitted.

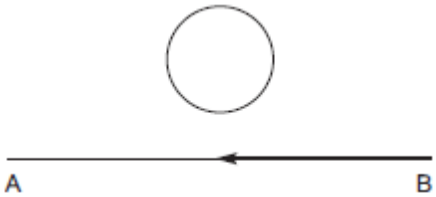
1. A charge ‘q’ is placed at the centre of a cube of side ‘l’. What is the electric flux passing through one face of the cube?

2. State the factors on which the capacitance of a parallel plate capacitor depends.

3. The graph shown in the figure represents a plot of current versus voltage for a given semiconductor. Identify the region, if any, over which the semiconductor has a negative resistance.



4. The electric current flowing in a wire in the direction from *B* to *A* is decreasing. Find out the direction of the induced current in the metallic loop kept above the wire as shown.



5. State the SI unit of self-inductance and hence define it.

6. Define electric flux. Write its SI unit. A charge q is enclosed by a spherical surface of radius R. If the radius is reduced to half, how would the electric flux through the surface change?

7. What are eddy currents? Write any two applications of eddy currents.

8. The oscillating magnetic field in a plane electromagnetic wave is given by

$$B_y = (8x\ 10^{-6}) \sin [\ 2 \times 10^{11} t + 300\pi x]\ T$$

(i) Calculate the wavelength of the electromagnetic wave. (ii) Write down the expression for the oscillating electric field.

9. (a) Draw a ray diagram for image formation of an object placed beyond centre of curvature C in front of a concave mirror.
(b) Will there be any change in the (i) position and (ii) intensity of the image if the lower half of mirror is painted black?

10. Draw a labelled ray diagram of a reflecting telescope. Mention its two advantages over the refracting telescope.

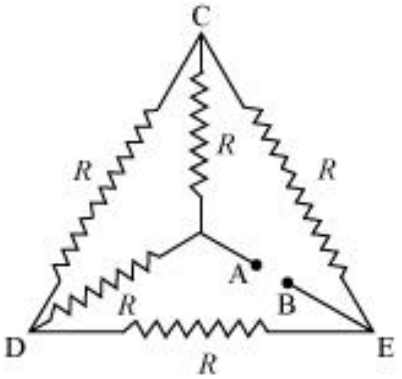
11. (a) Why don't the electric field lines intersect each other?
(b) Draw electric lines of force: (i) to represent a uniform field (ii) due to two equal and opposite charges.

12. (a) Derive an expression for the energy stored in a parallel plate capacitor C, charged to a potential difference V.
(b) How this energy stored is affected when the space between the capacitor plates is completely filled with a dielectric material of dielectric constant K, keeping the battery connected to the capacitor?

13. Define relaxation time of the free electrons drifting in a conductor. How is it related to the drift velocity of free electrons? Use this relation to deduce the expression for the electrical resistivity of the material.

14. Describe briefly, with the help of a circuit diagram, how a potentiometer is used to determine the internal resistance of a cell.

15. (i) Calculate the equivalent resistance of the given electrical network between points *A* and *B*.
(ii) Also calculate the current through *CD* and *ACB*, if a 10 V d.c source is connected between *A* and *B*, and the value of *R* is assumed as 2 Ω.



16. Explain, giving reason, the basic difference in converting a galvanometer into (i) a voltmeter and (ii) an ammeter. Give two ways in which the current sensitivity of a galvanometer can be enhanced.

17. (a) Draw magnetic field lines when a (*i*) diamagnetic, (*ii*) paramagnetic substance is placed in an external magnetic field.
(b) Name the properties of a magnetic material that make it suitable for making (i) a permanent magnet and (ii) a core of an electromagnet.

18. A series LCR circuit is connected to an ac source. Using the phasor diagram, derive the expression for the impedance of the circuit. Plot a graph to show the variation of current with frequency of the source, explaining the nature of its variation.

OR

An inductor of 5 H, a capacitor of 80 μF and a resistor of 40 Ω are connected in series with a variable frequency 240 V ac source. Calculate

(a) the angular frequency of the source which drives the circuit at resonance.

(b) the current at the resonating frequency.

(c) the rms potential drop across the capacitor at resonance.

19. Derive the expression for force per unit length between two long straight parallel current carrying conductors.

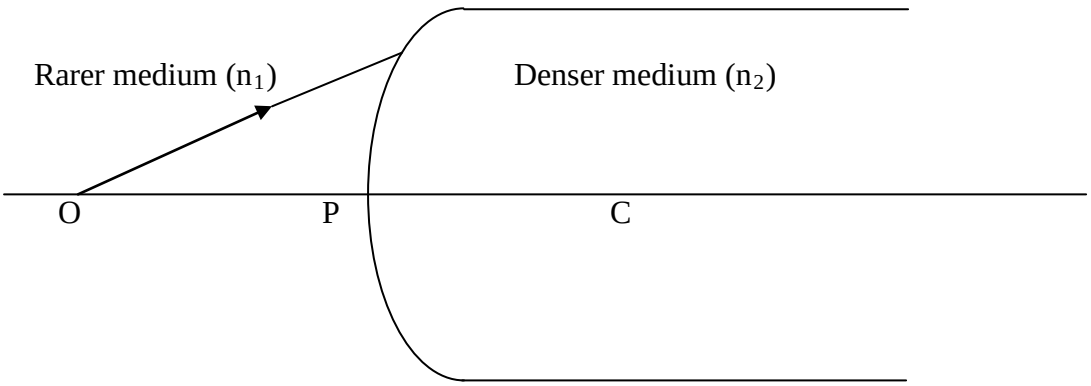
20. (*a*) Name the electromagnetic waves which are produced during radioactive decay of a nucleus. Write their frequency range.

(*b*) Welders wear special glass goggles while working. Why? Explain.

(*c*) Why are infrared waves often called as heat waves? Give their one application.

21. A 4.5 cm needle is placed 12 cm away from a convex mirror of focal length 15 cm. Give the location of the image and the magnification. Describe what happens as the needle is moved farther from the mirror.

22. A spherical surface of radius of curvature R separates a rarer medium of refractive index n_1 and a denser medium of refractive index n_2. Complete the path of the ray of light, showing the formation of a real image. Hence derive the relation connecting object distance 'u', image distance 'v', radius of curvature R and the refractive indices n_1 and n_2 of the two media.



23. Kamal's uncle was advised by his doctor to undergo an MRI scan test of his chest and gave him an estimate of the cost. Not knowing much about the significance of this test and finding it to be too expensive he first hesitated. When Kamal learnt about this, he decided to take help of his family, friends and neighbours and arranged for the cost. He convinced his uncle to undergo this test so as to enable the doctor to diagnose the disease. He got the test done and the resulting information greatly helped the doctor to give him proper treatment.

(a) What, according to you, are the values displayed by Kamal? Mention any two.

(b) Assuming that the MRI scan test involved a magnetic field of 0.1 T, find the maximum and minimum values of the force that this field could exert on a proton moving with a speed of 10^4 m/s. State the condition under which the force can be minimum.

24. (a) Define electric dipole moment. Is it a scalar or a vector quantity? Derive the expression for the electric field of a dipole at a point on the equatorial plane of the dipole.
(b) Draw the equipotential surfaces due to an electric dipole. Locate the surface where the potential due to the dipole is zero.

OR

Using Gauss' law, deduce the expression for the electric field due to a uniformly charged spherical conducting shell of radius R at a point (i) outside and (ii) inside the shell.
Plot a graph showing variation of electric field as a function of $r > R$ and $r < R$ (r being the distance from the centre of the shell).

25. (a) With the help of a labelled diagram, state the underlying principle of a cyclotron. Explain clearly how it works to accelerate the charged particles.
(b) Show that cyclotron frequency is independent of energy of the particle.

OR

(*a*) Draw a labelled diagram of a moving coil galvanometer. Describe briefly its principle and theory of working.
(b)Why is it necessary to introduce a cylindrical soft iron core inside the coil of galvanometer?

26. Describe briefly, with the help of a labelled diagram, the basic elements of an AC generator. State its underlying principle. Explain how an alternating emf is generated by a loop of wire rotating in a magnetic field. Derive the expression for the instantaneous value of the emf induced in the rotating loop.

OR

(*a*) State the principle of a step-up transformer. Explain, with the help of a labeled diagram, its theory of working.
(*b*) Describe briefly any two energy losses, giving the reasons for their occurrence in actual transformers.

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