BVN

Name DT Class & Section Roll No.

FIRST TERM EXAMINATION—2017-18

CLASS–XII

SUBJECT–PHYSICS

Time : 3 Hours **M.M. : 70**

General Instructions :

1. *All questions are compulsory. There are 26 questions in all.*
2. *This question paper has five sections : Section A, Section B, Section C, Section D and Section E.*
3. *Section A contains five questions of one mark each. Section B contains five questions of two marks each, Section C contains twelve questions of three marks each, Section D contains one value based question of four marks and Section E contains three questions of five marks each.*
4. *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 the three questions of five marks weightage. You have to attempt only one of the choices in such questions.*
5. *You may use the following values of physical constants wherever necessary :*

$c = 3 \times 10^8\ m/s$ $h = 6.63 \times 10^{-34}\ Js$

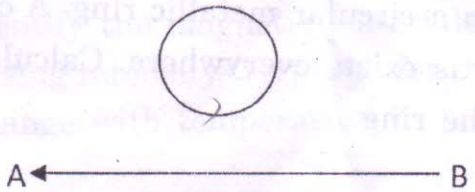
$e = 1.6 \times 10^{-19}\ C$ $\mu_0 = 4\pi \times 10^{-7}\ T\ m\ A^{-1}$

$\epsilon_0 = 8.854 \times 10^{-12}\ C^2\ N^{-1}\ m^{-2}$

Section-A

1. A beam of α particles projected along +x axis, experiences a force due to a magnetic field along +y axis. What is the direction of the magnetic field ? (1)

2. The electric current in a wire in the direction from B to A is increasing. What is the direction of induced current in the metallic loop kept above the wire as shown ? Give reason. (1)



3. The horizontal and vertical components of earth's magnetic field at a place are B and $\sqrt{3}B$ respectively. Find the angle of dip at that place. (1)

4. The electric field component of an EM wave is given by $E = 2 \times 10^7 \sin (5 \times 10^{15}t - \pi/3 \times 10^7 x)$ N/C. Find the amplitude of magnetic field. (1)

5. Why danger signals are red in colour ? (1)

Section-B

6. A point charge is placed at the centre of a spherical Gaussian surface. How will the electric flux through the surface change if–

(i) The sphere is replaced by a cube of same or different volume ?

(ii) The original charge is replaced by an electric dipole ? (2)

7. A battery of potential V is connected across a wire of length L. How does the current density of the conductor change when–

(i) Temperature is increased

(ii) Area of cross section is increased ? (2)

8. A charge particle moving in a perpendicular magnetic field penetrates a layer of lead and thereby loses half of its kinetic energy. How will the radius of curvature of its path change ? (2)

OR

A long straight conductor carries a steady current 'I'. The current is distributed uniformly across its cross section of radius 'a'. Plot a graph showing the variation of magnetic field 'B' produced by the conductor with distance 'r' from the axis of the conductor in the region (i) $r < a$ (ii) $r > a$. (2)

9. A 1 m long conducting rod rotates with angular frequency of 400 s^{-1} about an axis normal to the rod passing through its one end. The other end of the rod is in contact with a circular metallic ring. A constant magnetic field of 0.5 T parallel to the axis exists everywhere. Calculate the emf devleoped between the center and the ring. (2)

10. What do you mean by displacement current ? Mention one point of difference of displacement current with conventional current. (2)

Section-C

11. An electric dipole of length '$2l$' and dipole moment '$\vec{p}$' is kept in air. Derive an expression for electric field at any point on the equatorial line at a distance 'r', where $r >> 2l$. (3)

12. What do you mean by polar and non-polar dilelectric ? Explain the difference in their behaviour in the absence of external electric field and when they are subjected to uniform electric field. (3)

13. A capacitor of capacitance 6 μF is charged to a potential of 150 V. Its potential falls to 90 V, when another capacitor is connected to it. Find the capacitance of the second capacitor and the amount of energy lost due to the connection.(3)

14. A series battery of 6 lead accumulators of emf 2V and internal resistance 0.5 Ω is charged by a 100 V dc supply. What series resistance should be used in the charging circuit in order to limit the current to 8A ? Using the required resistor, obtain (i) the power supplied by the dc source and (ii) power dissipated as heat. (3)

15. What is the principle of a cyclotron ? Explain in brief the working of a cyclotron. (3)

OR

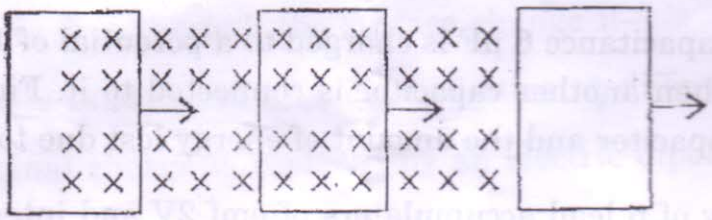
A rectangular coil of length 'L' and breadth 'b', carrying current 'I' is placed in uniform external magnetic field B. Derive an expression for torque produced on the coil. (3)

16. Two identical circular coils of radius 0.1 m, each having 20 turns are mounted co-axially 0.1 m apart. A current of 0.5 A is passed through both of them in the same direction. Find the magnitude of net magnetic field at the centre of each coil. (3)

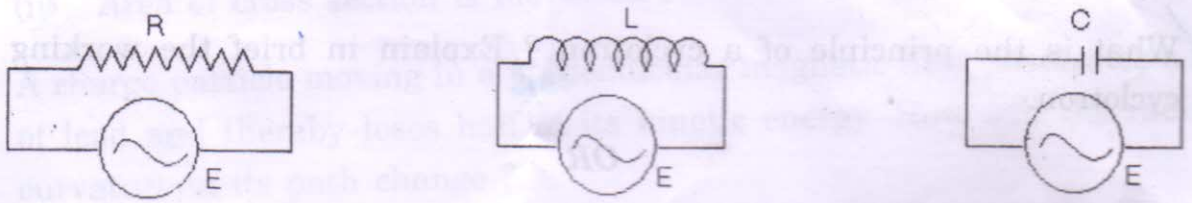
17. The magnetic permeability of two samples marked A and B are 0.9983 and 1.3418 respectively. Identify the magnetic materials. Plot magnetization (M) versus applied magnetising intensity (H) graph for the two samples. How does their magnetisation change with temperature ? (3)

18. (a) An air cored solenoid of length 'l', area of cross section 'A' and number of turns N has coefficient of self induction L. What would be its coefficient of self induction if an iron core of relative permeability μ, is introduced and number of turns becomes double ?

(b) A uniform magnetic field exists normal to the plane of paper over a small region of space. A rectangular loop of wire, initially starting completely out of magnetic field, is slowly moved with a uniform velocity across the field as shown. Draw the graph showing the variation of (i) magnetic flux linked with the loop and (ii) the induced emf in the loop with time. (3)



19. FIgures (a), (b) and (c) show three ac circuits in which equal current are flowing. If the frequency of emf be increased, how will the currents be affected in these circuits ? Give reason for your answer. (3)



20. A 60 V-100 watt electric lamp is to be run on 100V-60 Hz ac mains.

(a) Calculate inductance of the choke coil required.

(b) If resistor is to be used in place of choke coil to achieve the same result, calculate its value. (3)

21. (i) An EM wave of wavelength λ_1 is used to sterilize surgical instruments.

(ii) Another of wavelength λ_2 is used for detecting flaws in metal plate and

(iii) A third wave of wavelength λ_3 is used for physiotherapy treatment.

Identify the three radiations and write another use of each of them. (3)

22. When a lens of focal length 20 cm is placed in a liquid, it starts behaving as a lens of focal length-100 cm. Find the refractive index of the liquid. (3)

Section-D

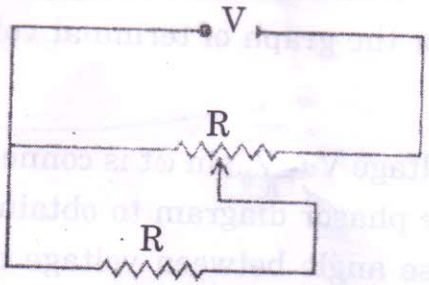
23. Some children were playing near a pond. The pond appeared shallow to them, so they decided to have fun by jumping in the pond and playing. Aayush was passing through there. He understood the intention of the children. He approached them and advised them not to indulge in such misadventure, patiently explaining to them that the pond is much deeper than it appears. He convinced them and a mishap was averted.

(a) Mention two moral values displayed by Aayush which you admire.

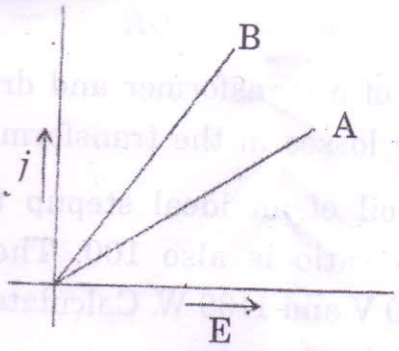
(b) Why the pond appeared shallower than it actually is ? Explain with a diagram. (2+2)

Section-E

24. (a) A resistance R draws current from a potentiometer as shown. The potentiometer has a total resistance R_0. A voltage V is supplied to the potentiometer. Derive an expression for the voltage across R when the sliding contact is in the middle of the potentiometer.

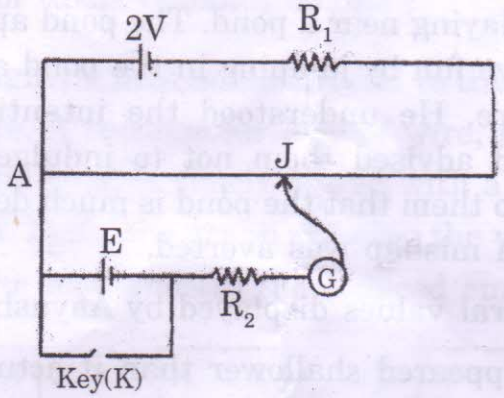


(b) The following graph shows the variation of current density of two different materials with applied electric field. Explain with reason which of the two materials should be used for making (i) standard resistance and (ii) connecting wires. (3+2=5)



OR

(a) The figure shows the circuit diagram of a potentiometer for determing the emf of a primary cell of negligible internal resistance.



(i) What is the purpose of high resistance R_2 ?

(ii) How does the position of balance point (J) change when resistance R_1 is decreased ?

(iii) Why the balance point cannot be obtained when emf ε is greater than 2 V ?

(b) A cell of emf 'e' and internal resistance 'r' is connected across a variable load resistor R. Plot the graph of terminal voltage V versus (i) R and (ii) current I. (3+2=5)

25. (a) An AC source of voltage $V = V_0 \sin \omega t$ is connected to a series combination of L, C and R. Use phasor diagram to obtain expressions for impedance of circuit and phase angle between voltage and current.

(b) In a series LR circuit $X_L = R$ and power factor of the circuit is P_1. When capacitor with capacitance C such that $X_L = X_C$ is put in series, the power factor becomes P_2. Find the ratio P_1/P_2. (3+2=5)

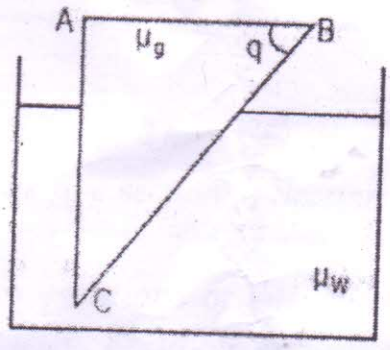
OR

(a) State principle of a transformer and draw a labelled diagram. Mention any two energy losses in the transformer.

(b) The primary coil of an ideal stepup transformer has 100 turns and transformation ratio is also 100. The input voltage and power are respectively 220 V and 1100 W. Calculate (i) number of turns in secondary and (ii) current in primary. (3+2=5)

26. (a) Derive the relation between the object distance, the image distance and the radius of curvature of a spherical surface of small aperture when refraction takes place from a rarer medium to denser medium.

(b) Calculate the value of θ, for which light incident normally on face AB grazes along the surface BC. $\mu_g = 3/2$ and $\mu_w = 4/3$. (3+2=5)



OR

Draw a ray diagram for an astronomical telescope when the image is formed at least distance of distinct vision. Derive an expression for the magnifying power in this case. Write two advantages of refracting type telescope over reflecting type telescope. (1½+2½+1=5)

□□□