

21/9/2015  
Gurpreet - Kaur  
(11)

GURU HARKRISHAN PUBLIC SCHOOL  
FIRST TERMINAL EXAMINATION: (2015 – 2016)

SUBJECT: PHYSICS

CLASS – XII

TIME ALLOWED: 3 HOURS

MAXIMUM MARKS: 70

General Instructions:

- (i) All questions are compulsory.
- (ii) There are **26** questions in total. Question Nos. **1 to 5** are very short answer type questions and carry **one** mark each.
- (iii) Question Nos. **6 to 10** carry **two** marks each, Question Nos. **11 to 22** carry **three** marks each and Question Nos. **24 to 26** carry **five** marks each.
- (iv) 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 three questions of five marks each. You have attempt only one of the given choices in such questions.
- (v) Question No. **23** is value based question carries **four** marks.
- (vi) Use of calculators is not permitted. However, you may use log tables if necessary.

1. On increasing the current drawn from a cell, the net potential difference across its terminal is lowered, why? (1)

2. A coil is removed from a magnetic field (i) rapidly (ii) slowly. In which case more work will be done and how? (1)

3. Mention the two characteristics of the material suitable for moving core of a transformer. (1)

4. An object is placed at the principal focus of concave lens of focal length  $f$ , where will its image be formed? (1)

5. Write the relation between the refractive index and critical angle of a given pair of optical media. (1)

6. An electric dipole is held in a uniform electric field. (2)

(i) Show that net force acting on its zero.

(ii) The dipole is aligned parallel to the field. Find the work done in rotating it through the angle of  $180^\circ$ .

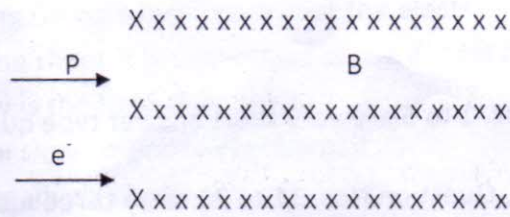
7. Two material Si and Cu are cooled from 300 K to 60 K. What will be the effect on their resistivity? (2)

8. Define power factor. State the conditions under which it is (i) maximum and (ii) minimum. (2)



9. A capacitor, made of two parallel plates of plate area  $A$  and separation  $d$  is being charged by an external ac source. Show that the displacement current inside the capacitor is the same as the current charging the capacitor.

10. An electron and a proton enter a region of uniform magnetic field  $B$  with uniform speed  $V$ , in a perpendicular direction.



(i) Show the trajectory of two particles.

(ii) What is the ratio of the radii of the circular paths of electron to proton?

OR

If  $\chi$  stand for the magnetic susceptibility of given material identify the class of material for which (i)  $-1 \geq \chi < 0$  (ii)  $0 < \chi < \epsilon$ . Write the range of relative magnetic permeability of these materials.

11. A parallel plate is charged by a battery. When the battery remains connected, a dielectric slab is inserted in the space between the plates. Explain what changes if any, occur in the values of

(i) Potential difference between the plates

(ii) Capacitance

(iii) charge on the plates.

$$Q = CV$$

(3)

12. Define the term drift velocity of the charge carries in conductor. Obtain the expression for the current density in terms of relaxation time.  $1/\rho$

(3)

13. A capacitance of unknown capacitance is connected across a battery of  $V$  volts. The charge stored in it is  $360\mu\text{C}$  when potential across the capacitance is reduced by  $120\text{V}$ , the charge stored in it becomes  $120\mu\text{C}$ . Calculate

(3)

(i) The potential  $V$  and the unknown capacitance  $C$ .

(ii) What will be the charge stored in the capacitor, if the voltage had increased by  $120\text{V}$ ?

14. Draw the circuit diagram of a metre bridge. Describe the method to determine the specific resistance of a wire.

(3)

15. With the help of a circuit, show how a moving coil galvanometer can be converted into an ammeter of a given range. Write the necessary mathematical formula.

(3)

16. In a metre bridge, the null point is formed at a distance of  $40\text{cm}$  from  $A$ . If a resistance of  $12\Omega$  is connected in a parallel with  $S$ , the null point occurs at  $50.0\text{cm}$  from  $A$ . Determine the value of  $R$  and  $S$ .

(3)

A semi-circular arc of radius 20cm carries a current of 10A. Calculate the magnitude of magnetic field at the centre of the arc. (3)

18. What do you mean by mutual inductance of two nearby coils? Find an expression for mutual inductance of two co-axial solenoid. (3)

19. Draw a ray diagram for formation of image of a point object by a thin double convex lens having radii of curvature  $R_1$  and  $R_2$ . Hence, derive lens makers formula for double convex lens. (3)

20. (a) Derive an expression for resonant frequency. (3)

(b) Draw a plot showing the variation of the peak current ( $I_m$ ) with frequency of the a.c. source used.

(c) Define the quality factor Q of the circuit.

21. (i) Draw a schematic labeled ray diagram of reflecting type telescope. (3)

(ii) Write two important advantages, justify why reflecting type telescope are preferred over refracting telescope.

(iii) The objective of a telescope is of larger focal length and larger aperture. (Compared to the eyepiece). Why? Give reasons.

22. The current flowing in the two coils of self-inductance  $L_1 = 16\text{mH}$  and  $L_2 = 12\text{mH}$  are increasing at the same rate. if the power supplied to the two coils is equal, find the ratio of

(i) induced voltages

(ii) the current and

(iii) the energies stored in the two coils at a given instant. (3)

OR

Using Biot – Savart law derive the expression for the magnetic field at a distance x along the axis from the centre of a current carrying circular loop.

23. One day Anurag fractured his leg while playing. When his parents took him to a doctor, he told them to get the X – ray of his leg. Anurag was amazed that his bones were seen so clearly in a radiograph. From then on, whenever his leg was hurt, he asked his parents to get his X – ray done. His father explained to him that X – rays should not be done so frequently. (4)

(i) What values are exhibited by Anurag's father?

(ii) How can X – rays be harmful?

(iii) Other than diagnosis fractures, where else can X – rays be used?



24. Derive an expression for the electric potential at a point due to an electric dipole.

Mention the contrasting of electric potential of a dipole at a point as compared to that due to a single charge.

(5)

OR

(a) Define electric flux. Write its S.I. unit.

(b) using Gauss's law, prove that the electric field at a point due to a uniformly charged infinite plane sheet is independent of the distance from it.

(c) How is the field directed if

(i) the sheet is positively charged

(ii) negatively charged

25. (a) Using Ampere's circuital law, obtain the expression for the magnetic field due to a long solenoid at a point inside the solenoid on its axis.

(b) In what respect is toroid different from a solenoid. Draw and compare the pattern of the magnetic field lines in the two cases.

(c) How is the magnetic field inside a given solenoid made strong.

(5)

OR

(a) Draw a schematic sketch of a cyclotron. Explain clearly the role of crossed electric field and magnetic field in accelerating and charge. Hence derive the expression for the kinetic energy acquired by the particles.

(b) An  $\alpha$  - particle and proton are released from the centre of the cyclotron and made to accelerate. Can both be accelerated at the same cyclotron frequency. Give reason to justify your answer.

26. With the help of a ray diagram, show the formation of a point object due to refraction of a light at a spherical surface separating two media of refractive indices  $n_1$  and  $n_2$  ( $n_2 > n_1$ ) respectively. Using this diagram, derive the relation

$$\frac{n_2}{v} - \frac{n_1}{u} = \frac{n_2 - n_1}{R}$$

Write the sign conventions used. What happens to the focal length of convex lens when it is immersed in water?

OR

Draw a graph of show the angle of deviation  $\delta$  with variation of angle of incidence  $I$  for monochromatic ray of light passing through a prism of refracting angle  $A$ . Deduce the relation

$$n = \frac{\sin \frac{A + \delta_m}{2}}{\sin \frac{A}{2}}$$