

**VISHWACHETHANA PU COLLEGE, ANEKAL**  
**IV PREPARATORY JANUARY 2025**

**PHYSICS (33)**

**II PUC**

**TOTAL MARKS: 70**

**Time: 3 HOURS**

**General Instructions**

1. All parts A to D are compulsory. Part-E is only for visually challenged students.
2. For Part – A questions, first written-answer will be considered for awarding marks.
3. Answers without relevant diagram / figure / circuit wherever necessary will not carry any marks.
4. Direct answers to numerical problems without relevant formula and detailed solutions will not carry any marks.

**PART– A**

**I. Pick the correct option among the four given options for ALL of the following questions: 15×1=15**

1. The S.I. unit of electric charge is

- (A) coulomb metre      (B) coulomb per metre      (C) coulomb      (D) per coulomb

2. The angle between equipotential surface and electric field is

- (A) 90°      (B) 0°      (C) 180°      (D) 45°

3. Statement-I: The resistivity of metals increases with increase in temperature.

Statement-II: Increasing the temperature of metals causes more frequent collisions of electrons.

- (A) both I and II are true and II is the correct explanation of I.  
(B) both I and II are true but II is not the correct explanation of I.  
(C) I is true but II is false.  
(D) both I and II are false.

4. A moving coil galvanometer can be converted into a voltmeter by connecting

- (A) a low resistance in parallel with galvanometer.  
(B) a low resistance in series with galvanometer.  
(C) a high resistance in parallel with galvanometer.  
(D) a high resistance in series with galvanometer.

5. When a bar magnet is suspended freely, it points in the direction of

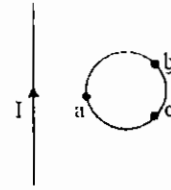
- (A) east-west      (B) north-south  
(C) northeast-southeast      (D) northwest-southwest

6. The energy stored in an inductor of inductance L in establishing the current I in it is

- (A)  $\frac{1}{2} LI$       (B)  $LI^2$       (C)  $LI$       (D)  $\frac{1}{2} LI^2$

7. The direction of current induced in the loop 'abc' shown in the figure is

- (A) along 'abc' if I is increasing
- (B) along 'abc' if I is decreasing
- (C) along 'acb' if I is increasing
- (D) along 'acb' if I is constant



8. An ideal step-up transformer decreases \_\_\_\_\_.

- (A) current
- (B) voltage
- (C) power
- (D) frequency

9. The displacement current is due to

- (A) flow of electrons
- (B) flow of protons
- (C) changing electric field
- (D) changing magnetic field

10. An object of finite height is placed in front of a concave mirror within its focus. It forms

- (A) a real enlarged image
- (B) a real diminished image
- (C) a virtual enlarged image
- (D) a virtual diminished image

11. A beam of unpolarised light of intensity  $I_0$  is passed through a pair of polaroids with their pass-axes inclined at an angle of  $\theta$ . The intensity of emergent light is equal to

- (A)  $I_0 \cos^2 \theta$
- (B)  $I_0 \cos \theta$
- (C)  $\frac{I_0 \cos \theta}{2}$
- (D)  $\frac{I_0 \cos^2 \theta}{2}$

12. Emission of electrons from a metal surface by heating it is called

- (A) photoelectric emission
- (B) thermionic emission
- (C) field emission
- (D) secondary emission

13. When alpha particles are passed through a thin gold foil, most of them go undeviated because

- (A) most of the region in an atom is empty space
- (B) alpha particles are positively charged particles
- (C) alpha particles are heavier particles
- (D) Alpha particles move with high energy

14. Nuclei with same atomic number are called

- (A) isotopes
- (B) isobars
- (C) isomers
- (D) isotones

15. The column-I is the list of materials and the column-II, the list of energy band gaps  $E_g$ .

Identify the correct match.

Column-I	Column-II
(i) conductors	(a) $E_g < 3 \text{ eV}$
(ii) insulators	(b) $E_g = 0 \text{ eV}$
(iii) semiconductors	(c) $E_g > 3 \text{ eV}$

(A) (i)- (a), (ii)-(b), (iii)-(c)

(B) (i)- (b), (ii) - (a), (iii)- (c)

(C) (i)- (c), (ii)-(a), (iii) -(b)

(D) (i)- (b), (ii)- (c), (iii)-(a)

**II. Fill in the blanks by choosing appropriate answer given in the bracket for ALL**

**the following questions:**

**5 × 1 = 5**

**(photon, polar, zero, infinite, phase, phasor)**

16. A molecule possessing permanent dipole moment is called \_\_\_\_ molecule.
17. The net magnetic flux through any closed surface is \_\_\_\_\_.
18. A rotating vector used to represent alternating quantities is called \_\_\_\_\_.
19. A wave front is a surface of constant \_\_\_\_\_.
20. In interaction with matter, light behaves as if it is made up of packet of energy called \_\_\_\_\_.

**PART-B**

**III. Answer any FIVE of the following questions:**

**5 × 2 = 10**

21. State and explain Gauss's law in electrostatics.
22. Define drift velocity and mobility of free electrons in conductors.
23. A long air-core solenoid of 1000 turns per unit length carries a current of 2 A. Calculate the magnetic field at the mid-point on its axis.
24. Give the principle of AC generator. Why is a current induced in an AC generator called alternating current?
25. Write any two uses of ultraviolet radiations.
26. Name the objective used in
  - a) refracting type telescope and
  - b) reflecting type telescope.
27. Write the two conditions for the total internal reflection to occur.
28. Name the majority and the minority charge carriers in n-type semiconductor.

**PART-C**

**IV. Answer any FIVE of the following questions:**

**5 × 3 = 15**

29. Write any three properties of electric field lines.
30. Obtain the expression for the effective capacitance of two capacitors connected in parallel.
31. What is Lorentz force? Write its expression and explain the terms.
32. Write any three differences between diamagnetic and paramagnetic materials.
33. Describe an experiment to demonstrate the phenomenon of electromagnetic induction using a bar magnet and a coil.
34. Give any three results of experimental study of photoelectric effect.
35. Write the three postulates of Bohr's atom model.
36. Find the energy equivalent of one atomic mass unit, first in joule and then in MeV.

Given:  $1u = 1.6605 \times 10^{-27} \text{ kg}$ ,  $e = 1.602 \times 10^{-19} \text{ C}$  and  $c = 2.9979 \times 10^8 \text{ ms}^{-1}$ .

## PART-D

V. Answer any THREE of the following questions:

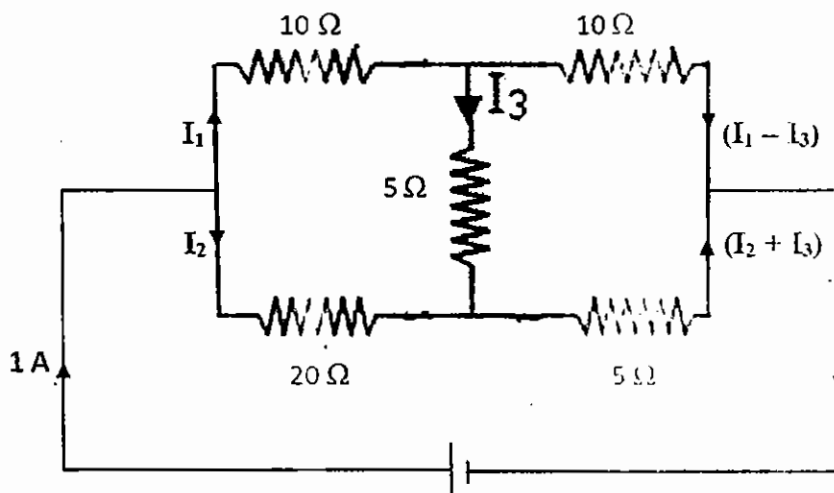
$3 \times 5 = 15$

37. Derive the expression for the electric field at a point on the axis of an electric dipole.
38. Two cells of different emfs and different internal resistances are connected in series. Derive the expression for effective emf and effective internal resistance of the combination.
39. Derive the expression for the magnetic field at a point on the axis of a circular current loop.
- 40.a) Two coherent waves of a constant phase difference undergo interference. Obtain the expression for the resultant displacement. (3)
- b) Write the conditions for constructive and destructive interference in terms of phase difference. (2)
41. What is a rectifier? Explain the working of a full-wave rectifier using a neat circuit diagram. Draw its Input-output waveforms.

VI. Answer any TWO of the following questions:

$2 \times 5 = 10$

42. a) Calculate the potential at point P due to a charge of  $400\text{nC}$  located  $9\text{cm}$  away.
- b) Obtain the work done in moving a charge of  $2\text{nC}$  from infinity to the point P. Does the answer depend on the path along which the charge is moved?
43. In the following network, find the current  $I_3$ .



44. An AC source of frequency  $50\text{Hz}$  is connected in series with an inductor of  $1\text{H}$ , a capacitor of  $90\mu\text{F}$  and a resistor of  $100\Omega$ . Does the current lead or lag the voltage? Calculate the phase difference between the current and the voltage.
45. An equilateral prism is made of glass of unknown refractive index. A parallel beam of light is incident on a face of the prism. The angle of minimum deviation is  $40^\circ$ . Find the refractive index of the material of the prism. If the prism is placed in water of refractive index  $1.33$ , find the new angle of minimum deviation of a parallel beam of light.