

B**7029**Register
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Part III — PHYSICS

(English Version)

Time Allowed : 3 Hours]

[Maximum Marks : 150

PART - I

Note : i) Answer all the questions.

ii) Choose and write the correct answer.

30 × 1 = 30

- In an electromagnetic wave, the phase difference between electric field \vec{E} and the magnetic field \vec{B} is
 - $\frac{\pi}{4}$
 - $\frac{\pi}{2}$
 - π
 - zero.
- A diffraction pattern is obtained using a beam of red light. What happens if the red light is replaced by blue light ?
 - Bands disappear
 - No change
 - Diffraction pattern becomes narrower and crowded together
 - Diffraction pattern becomes broader and farther apart.
- Waves from two coherent sources interfere with each other. At a point where the trough of one wave superposes with the trough of the other wave, the intensity of light is
 - maximum
 - minimum
 - zero
 - no change.

[Turn over

4. Refractive index of glass is 1.5. Time taken for light to pass through a glass plate of thickness 10 cm is
- a) 2×10^{-8} s b) 2×10^{-10} s
c) 5×10^{-8} s d) 5×10^{-10} s.
5. The wavelength of the matter wave is independent of
- a) mass b) velocity
c) momentum d) charge.
6. Avalanche breakdown is primarily dependent on the phenomenon of
- a) collision b) ionisation
c) doping d) recombination.
7. In a transistor, the value of $\left(\frac{1}{\alpha} - \frac{1}{\beta}\right)$ is equal to
- a) α b) β
c) $\frac{\beta}{\alpha}$ d) 1.
8. According to law of Boolean algebra, the expression $(A + AB)$ is equal to
- a) A b) AB
c) B d) \overline{A} .
9. Printed documents to be transmitted by fax are converted into electrical signals by the process of
- a) reflection b) scanning
c) modulation d) light variation.
10. In television, blanking pulse is applied to
- a) Cathode b) Control grid
c) Filament d) Anode.

17. Which of the following are isotones ?

- a) ${}_{92}\text{U}^{235}$ and ${}_{92}\text{U}^{238}$ b) ${}_8\text{O}^{16}$ and ${}_7\text{N}^{14}$
c) ${}_6\text{C}^{14}$ and ${}_7\text{N}^{14}$ d) ${}_7\text{N}^{14}$ and ${}_6\text{C}^{13}$.

18. Arrange α , β and γ rays in the increasing order of their ionising power :

- a) α β γ b) β α γ
c) γ β α d) γ α β .

19. The explosion of atom bomb is based on the principle of

- a) uncontrolled fission reaction b) controlled fission reaction
c) fusion reaction d) thermonuclear reaction.

20. The radioisotope used in agriculture is

- a) ${}_{15}\text{P}^{31}$ b) ${}_{15}\text{P}^{32}$
c) ${}_{11}\text{Na}^{23}$ d) ${}_{11}\text{Na}^{24}$.

21. The electric field outside the plates of two oppositely charged plane sheets of charge density σ is

- a) $\frac{+\sigma}{2\epsilon_0}$ b) $\frac{-\sigma}{2\epsilon_0}$
c) $\frac{\sigma}{\epsilon_0}$ d) zero.

22. The intensity of the electric field that produces a force of 10^{-5} N on a charge of $5 \mu\text{C}$ is

- a) $5 \times 10^{-11} \text{ NC}^{-1}$ b) 50 NC^{-1}
c) 2 NC^{-1} d) 0.5 NC^{-1} .

23. The unit of the number of electric lines of force passing through a given area is

- a) no unit b) NC^{-1}
c) $\text{Nm}^2 \text{C}^{-1}$ d) Nm.

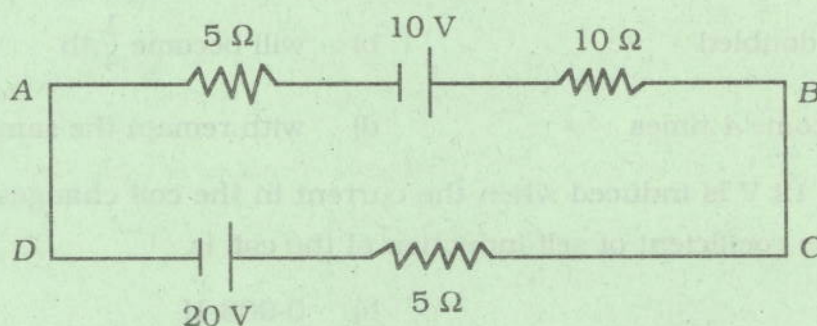
24. If a point lies at a distance x from the mid-point of the dipole, the electric potential at this point is proportional to
- a) $\frac{1}{x^2}$
 - b) $\frac{1}{x^3}$
 - c) $\frac{1}{x^4}$
 - d) $\frac{1}{x^2}$
25. If the length of the copper wire has a certain resistance R , then on doubling the length, its specific resistance
- a) will be doubled
 - b) will become $\frac{1}{4}$ th
 - c) will become 4 times
 - d) will remain the same.
26. An e.m.f. of 12 V is induced when the current in the coil changes at the rate of 40 A s^{-1} . The coefficient of self induction of the coil is
- a) 30 H
 - b) 0.003 H
 - c) 4.8 H
 - d) 0.3 H.
27. In an X-ray tube, the intensity of X-ray beam is increased by
- a) increasing the filament current
 - b) decreasing the filament current
 - c) increasing the target potential
 - d) decreasing the target potential.
28. In Sommerfeld atom model, for a given value of n , the number of values l can take is
- a) n
 - b) $n + 1$
 - c) $n - 1$
 - d) $2n + 1$.
29. The wave number of a spectral line of hydrogen atom is equal to Rydberg's constant. The line is
- a) first line of Lyman series
 - b) series limit of Lyman series
 - c) first line of Pfund series
 - d) series limit of Pfund series.
30. Cathode rays are
- a) a stream of electrons
 - b) a stream of positive ions
 - c) a stream of uncharged particles
 - d) a stream of photons.

PART - II

Note : Answer any fifteen questions.

$15 \times 3 = 45$

31. State Gauss' law in electrostatics.
32. Mention three applications of capacitors.
33. Define drift velocity.
34. Find the magnitude and direction of the current in the following circuit :



35. Define temperature coefficient of resistance.
36. State tangent law.
37. An aircraft having a wingspan of 20.48 m flies due north at a speed of 40 ms^{-1} . If the vertical component of earth's magnetic field at the place is $2 \times 10^{-5} \text{ T}$, calculate the e.m.f. induced between the ends of the wings.
38. What are the methods of producing induced e.m.f. ?
39. State Brewster's law.
40. In Young's experiment the width of the fringes obtained with light of wavelength 6000 \AA is 2 mm. Calculate the fringe width, if the entire apparatus is immersed in a liquid of refractive index 1.33.
41. Calculate the longest wavelength that can be analysed by a rock salt crystal of spacing $d = 2.82 \text{ \AA}$ in the first order.
42. State Moseley's law.
43. Write the two fundamental postulates of special theory of relativity.
44. Write the Proton-Proton cycle that takes place in sun and stars.
45. What percentage of a given radioactive substance will be left after 5 half-life periods ?

46. Prove the Boolean identity :

$$(A + B)(A + C) = A + BC.$$

47. What is an Extrinsic semiconductor ?

48. Draw the circuit diagram for inverting amplifier using Op-Amp.

49. Mention any three advantages of a negative feedback.

50. What is skip distance ?

PART - III

Note : i) Answer Question No. 56 compulsorily.

ii) Answer any six of the remaining 11 questions.

iii) Draw diagrams wherever necessary.

7 × 5 = 35

51. Write the properties of electric lines of force.

52. Explain the construction and working of Daniel cell with a neat diagram.

53. State and verify Faraday's second law of electrolysis.

54. What are the special features of magnetic Lorentz force ?

55. Explain the various power losses in a transformer. How are they minimised ?

56. A monochromatic light of wavelength 589 nm is incident on a water surface of refractive index 1.33. Find the velocity, frequency and wavelength of light in water.

OR

A planoconvex lens of radius 3 m is placed on an optically flat glass plate and is illuminated by monochromatic light. The radius of the 8th dark ring is 3.6 mm. Calculate the wavelength of light used.

57. Write any five properties of X-rays.

58. What is photoelectric effect ? State the laws of photoelectric emission.

59. A proton is moving at a speed of 0.900 time the velocity of light. Find its kinetic energy in joule and MeV.

60. Explain Soddy-Fajan's radioactive displacement laws.

61. Explain how multimeter is used as ohm-meter (multimeter diagram is not necessary).
62. A 10 MHz sinusoidal carrier wave of amplitude 10 mV is modulated by a 5 kHz sinusoidal audio signal wave of amplitude 6 mV. Find the frequency components of the resultant modulated wave and their amplitudes.

PART - IV

Note : i) Answer any *four* questions in detail.

ii) Draw diagrams wherever necessary. 4 × 10 = 40

63. Derive an expression for the electric field due to an electric dipole at a point on its axial line.
64. Obtain an expression for the force between two long parallel current carrying conductors. Hence define 'ampere'.
65. Describe the principle, construction and working of single phase a.c. generator.
66. Derive an expression for bandwidth of interference fringes in Young's double slit experiment.
67. With the help of energy level diagram, explain the working of He-Ne laser.
68. Explain the construction and working of a Geiger-Müller counter.
69. With a neat circuit diagram, explain the working of a single stage CE amplifier. Draw the frequency response curve and discuss the results.
70. With the help of block diagram, explain the function of superheterodyne AM receiver.