

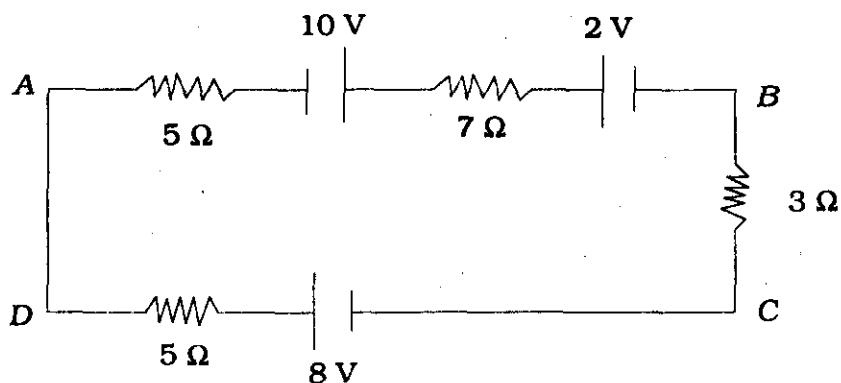
25. Unpolarised light passes through a tourmaline crystal. The emergent light is analysed by an analyser. When the analyser is rotated through 90° , the intensity of light
- remains uniformly bright
 - remains uniformly dark
 - varies between maximum and minimum
 - varies between maximum and zero.
26. If the radius of third Bohr orbit in hydrogen atom is r , then the de Broglie wavelength of electron in this orbit is
- $\frac{r}{3}$
 - $3r$
 - $\frac{2\pi r}{3}$
 - $3(2\pi r)$.
27. The nuclear force is due to the continuous exchange of particles called
- leptons
 - mesons
 - hyperons
 - photons.
28. In the following nuclear reaction
- $${}_7\text{N}^{14} + {}_0\text{n}^1 \rightarrow X + {}_1\text{H}^1$$
- the element X is
- ${}_6\text{N}^{14}$
 - ${}_6\text{C}^{14}$
 - ${}_6\text{O}^{14}$
 - ${}_7\text{C}^{13}$.
29. The time taken by the radioactive element to reduce to $\frac{1}{e}$ times is
- half-life
 - mean life
 - $\frac{\text{half-life}}{2}$
 - twice the mean life.
30. Which of the following particles is a lepton ?
- Electron
 - Proton
 - Neutron
 - π -Meson.

PART - II

N. B. : Answer any *fifteen* questions.

15 × 3 = 45

31. Define 'Coulomb' on the basis of Coulomb's law.
32. Why is it safer to be inside a car than standing under a tree during lightning ?
33. State Ohm's law.
34. In the following circuit, calculate the current through the circuit. Mention its direction.



35. State Faraday's laws of electrolysis.
36. Mention any two differences between Peltier effect and Joule's heating effect.
37. Calculate the mutual inductance between two coils when a current of 4 A changing to 8 A in 0.5 s in one coil, induces an *e.m.f.* of 50 mV in the other coil.
38. Mention the methods of producing induced *e.m.f.*
39. What are emission and absorption spectra ?
40. A 300 mm long tube containing 60 c.c. of sugar solution produces a rotation of 9° when placed in a polarimeter. If the specific rotation is 60° , calculate the quantity of sugar contained in the solution.
41. Write the conditions to achieve laser action.
42. An X-ray diffraction of a crystal gave the first line at a glancing angle of $6^\circ 27'$. If the wavelength of X-ray is 0.58 \AA , find the distance between the two cleavage planes.
43. What are the limitations of electron microscope ?
44. What is α -decay ? Give an example.
45. What is pair production and annihilation of matter ?

B

46. What is an intrinsic semiconductor ? Give two examples.
47. The gain of an amplifier without feedback is 100 and gain with positive feedback is 200. Calculate the feedback fraction.
48. Draw the circuit diagram for NPN transistor in Common Emitter (CE) mode.
49. Mention any three advantages of Integrated Circuit (IC).
50. Define modulation factor in Amplitude Modulation.

PART - III

N. B. : i) Answer the Question No. 60 compulsorily.

ii) Answer any six questions of the remaining 11 questions,

iii) Draw diagrams wherever necessary.

7 × 5 = 35

51. A parallel plate capacitor has plates of area 200 cm^2 and separation between the plates is 1 mm. Calculate (i) the potential difference between the plates if 1 nC charge is given to the capacitor. (ii) With the same charge (1 nC) if the plate separation is increased to 2 mm, what is the new potential difference and (iii) the electric field between the plates ?
52. Define mobility. Establish a relation between drift velocity and current.
53. Obtain the condition for bridge balance in Wheatstone bridge.
54. A circular coil of radius 20 cm has 100 turns of wire and it carries a current of 5 A. Find the magnetic induction at a point along its axis at a distance of 20 cm from the centre of the coil.
55. Obtain the phase relation between current and voltage in an a.c. circuit with an inductor only (graph not necessary).
56. Write a note on pile of plates.
57. Explain the spectral series of hydrogen atom without diagram.
58. Obtain Einstein's photoelectric equation.
59. Explain FitzGerald-Lorentz contraction with an example.
60. A piece of bone from an archaeological site is found to give a count rate of 15 counts per minute. A similar sample of fresh bone gives a count rate of 19 counts per minute. Calculate the age of the specimen.
(Given $T_{1/2} = 5570 \text{ Years}$).

OR

B

[Turn over

Calculate the energy released when 1 kg of ${}_{92}\text{U}^{235}$ undergoes nuclear fission. Assume, energy per fission is 200 MeV.

Avogadro number = 6.023×10^{23} . Express your answer in kilowatt hour also.

61. State and prove de Morgan's theorems.
62. What are the advantages and disadvantages of digital communication ?

PART - IV

N. B. : i) Answer any *four* questions in detail.

ii) Draw diagrams wherever necessary.

4 × 10 = 40

63. What is an electric dipole ? Derive an expression for the electric field due to an electric dipole at a point on its axial line.
64. Applying Biot-Savart law, obtain an expression for the magnetic induction at a point due to infinitely long straight conductor carrying current.
65. Explain the principle, construction and theory of a transformer. (Diagram not necessary). Define its efficiency. Mention the energy losses.
66. On the basis of wave theory, explain total internal reflection.
67. State Bohr's postulates. Obtain an expression for the radius of n^{th} orbit of hydrogen atom.
68. What is a nuclear reactor ? Explain the functions of (i) moderator, (ii) control rods and (iii) neutron reflector. Mention the uses of nuclear reactor. (Diagram not necessary).
69. What is rectification ? Explain the working of a bridge rectifier with necessary waveforms.
70. With the help of block diagram, explain the function of a monochrome TV receiver.

