

Q. 1. An electron, an alpha-particle and a proton have the same kinetic energy. Which one of these particles has the largest de-Broglie wavelength ? 1

Q. 2. Why should the material used for making permanent magnets have high coercivity? 1

Q. 3. The radioactive isotope D decays according to the sequence

If the mass number and atomic number of D are 176 and 71 respectively, what is (i) the mass number (ii) atomic number of D ? 1

Q. 4. What will be the values of input A and B for the Boolean expression? 1

Q. 5. Why is frequency modulation preferred over amplitude modulation for transmission of music? 1

Q. 6. The output of an OR gate is connected to both the inputs of a NAND gate. Draw the logic circuit of this combination of gates and write its truth table. 2

Q. 7. Draw a plot of potential energy of a pair of nucleons as a function of their separation. What is the significance of negative potential energy in the graph drawn ? 2

Q. 8. A convex lens of refractive index 1.5 has a focal length of 18 cm in air. Calculate the change in its focal length when it is immersed in water of refractive index . 2

Q. 9. Distinguish between the terms 'average value' and 'rms value' of an alternating current. The instantaneous current from an a.c. source is $I = 5 \sin (314 t)$ ampere. What are the average and rms values of the current ? 2

Q. 10. Write the relation for the force acting on a charge carrier q moving with a velocity through a magnetic field in vector notation. Using this relation, deduce the conditions under which this force will be (i) maximum (ii) minimum. 2

Q. 11. A cylindrical metallic wire is stretched to increase its length by 5%. Calculate the percentage change in its resistance. 2

Q. 12. The electric field E due to a point charge at any point near it is defined as where q is the test charge and F is the force acting on it. What is the physical significance of in this expression ? Draw the electric field lines of a point charge Q when (i) $Q > 0$ and (ii) $Q < 0$. 2

Or

Define electric flux. Write its S.I. units. A spherical rubber balloon carries a charge that is uniformly distributed over its surface. As the balloon is blown up and increases in size, how does the total electric flux coming out of the surface change ? Give reason.

Q. 13. Deduce an expression for the electric potential due to an electric dipole at any point on its axis. Mention one contrasting feature of electric potential of a dipole at a point as compared to that due to a single charge. 3

Q. 14. A parallel plate capacitor, each with plate area A and separation d , is charged to a potential difference V . The battery used to charge it is then disconnected. A dielectric slab of thickness d and dielectric constant K is now placed between the plates. What change, if any, will take place in

1. charge on the plates
 2. electric field intensity between the plates
 3. capacitance of the capacitor.
- Justify your answer in each case. 3

Q. 15. State Kirchhoff's rules of current distribution in an electrical network. Using these rules determine the value of the current in the electric circuit given below. 3

Q. 16. Write the mathematical relation for the resistivity of a material in terms of relaxation time, number density and mass and charge of charge carriers in it. Explain, using this relation, why the resistivity of a metal increases and that of a semi-conductor decreases with rise in temperature. 3

Q. 17. Explain with the help of a labelled diagram the underlying principle and working of a step-up transformer. Why cannot such a device be used to step-up d.c. voltage ? 3

Or

Draw a labelled diagram of an a.c. generator. Explain briefly its principle and working. 3

Q. 18. Given below are two electric circuits A and B
Calculate the ratio of power factor of the circuit B to the power factor of circuit A. 3

Q. 19. Define the term 'resolving power' of an astronomical telescope. How does it get affected on

1. increasing the aperture of the objective lens ?
 2. increasing the wavelength of the light used ?
- Justify your answer in each case. 3

Q. 20. Write any four characteristics of electromagnetic waves. Give two uses each of

1. Radio-waves
2. Micro-waves. 3

Q. 21. In a plot of photoelectric current versus anode potential, how does

1. the saturation current vary with anode potential for incident radiations of different frequencies but same intensity ?
2. the stopping potential vary for incident radiations of different intensities but same frequency ?
3. photoelectric current vary for different intensities but same frequency of incident radiations ?

Justify your answer in each case. 3

Q. 22. Calculate the amount of energy released during the α -decay of

Given : 1. atomic mass of

2. atomic mass of

3. atomic mass of

Is this decay spontaneous ? Give reason. 3

Q. 23. What is a digital signal ? Explain the function of modem in data communication.

Write two advantages of digital communication. 3

Q. 24. Explain, with the help of a schematic diagram, the principle and working of a Light Emitting Diode. What criterion is kept in mind while choosing the semiconductor material for such a device ? Write any two advantages of Light Emitting Diode over conventional incandescent lamps. 3

Q. 25. Draw a labelled diagram of a moving coil galvanometer. State the principle on which it works. Deduce an expression for the torque acting on a rectangular current carrying loop kept in a uniform magnetic field. Write two factors on which the current sensitivity of a moving coil galvanometer depend. 5

Or

State Biot-Savart law. Use it to derive an expression for the magnetic field at the centre of a circular loop of radius R carrying a steady current I . Sketch the magnetic field lines for such a current carrying loop. 5

Q. 26. What are coherent sources ? Why are coherent sources required to produce interference of light ? Give an example of interference of light in everyday life. In Young's double slit experiment, the two slits are 0.03 cm apart and the screen is placed at a distance of 1.5 m away from the slits. The distance between the central bright fringe and fourth bright fringe is 1 cm. Calculate the wavelength of light used. 5

Or

State the condition under which the phenomenon of diffraction of light takes place. Derive an expression for the width of the central maximum due to diffraction of light at a single slit. A slit of width 'a' is illuminated by a monochromatic light of wavelength 700 nm at normal incidence. Calculate the value of 'a' for position of

1. first minimum at an angle of diffraction of 30° .
2. first maximum at an angle of diffraction of 30° . 5

Q. 27. State the principle of working of p-n diode as a rectifier. Explain, with the help of a circuit diagram, the use of p-n diode as a full wave rectifier. Draw a sketch of the input and output waveforms. 5

Or

Draw the symbolic representation of a (i) p-n-p, (ii) n-p-n transistor. Why is the base region of transistor thin and lightly doped ? With proper circuit diagram, show the biasing of a p-n-p transistor in common base configuration. Explain the movement of charge carriers through different parts of the transistor in such a configuration and show that . 5