

Q. 1. Define the term 'dielectric constant' of a medium in terms of capacitance of a capacitor. 1

Q. 2. Sketch a graph showing variation of resistivity of carbon with temperature. 1

Q. 3. The vertical component of Earth's magnetic field at a place is $\sqrt{3}$ times the horizontal component. What is the value of angle of dip at this place? 1

Q. 4. With that purpose was famous Davisson-Germer experiment with electrons performed? 1

Q. 5. Name the type of communication in which the signal is a discrete and binary coded version of the message or information. 1

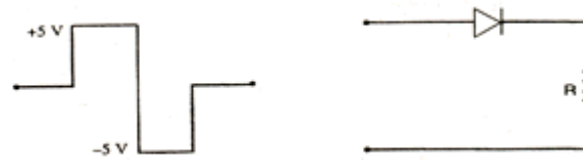
Q. 6. The electric field and electric potential at any point due to a point charge kept in air is 20 NC⁻¹ and 10 JC⁻¹ respectively. Compute the magnitude of this charge. 2

Q. 7. Write the mathematical relation between mobility and drift velocity of charge carriers in a conductor. Name the mobile charge carriers responsible for conduction of electric current in (i) an electrolyte (ii) an ionised gas. 2

Q. 8. State the principle of working of a cyclotron. Write two uses of this machine. 2

Q. 9. Draw a labelled ray diagram of a reflecting type telescope. Write its any one advantage over refracting type telescope.

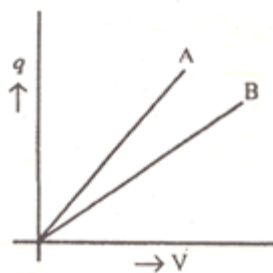
Q. 10. Draw and explain the output waveform across the load resistor R, if the input waveform is as shown in the given figure. 2



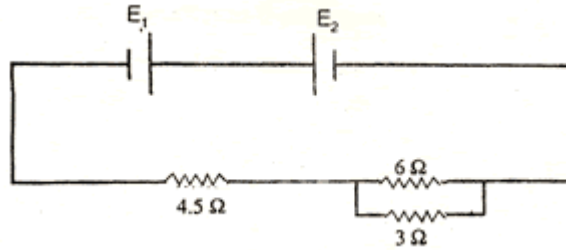
Or

Explain how the width of depletion layer in a p-n junction diode changes when the junction is (i) forward biased (ii) reverse biased.

Q. 11. The given graph shows the variation of charge q versus potential difference V for two capacitors. The two capacitors C_1 and C_2 have same plate separation but the plate area of C_2 is double than that of C_1 . Which of the lines in the graph correspond to C_1 and C_2 and why? 2



Q. 12. Two cells E_1 and E_2 in the given circuit diagram have an emf of 5 V and 9 V and internal resistance of $0.3\ \Omega$ and $1.2\ \Omega$ respectively. 2



Calculate the value of current flowing through the resistance of 3Ω .

Q. 13. How is the mutual inductance of a pair of coils affected when: **3**

- (i) separation between the coils is increased?
- (ii) the number of turns of each coil is increased ?
- (iii) a thin iron sheet is placed between the two coils, other factors remaining the same? Explain your answer in each case.

Q. 14. A convex lens made up of glass of refractive index 1.5 is dipped, in turn, in: **3**

- (i) medium A of refractive index 1.65
- (ii) medium B of refractive index 1.33

Explain, giving reasons, whether it will behave as a converging lens or a diverging lens in each of these two media.

Q. 15. Define the terms threshold frequency and stopping potential in relation to the phenomenon of photoelectric effect. How is the photoelectric current affected on increasing the (i) frequency (ii) intensity of the incident radiations and why? **3**

Q. 16. Explain, with the help of a nuclear reaction in each of the following cases, how the neutron to proton ratio changes during (i) alpha-decay (ii) beta-decay? **3**

Q. 17. What is an intrinsic semiconductor? How can this material be converted into (i) P-type (ii) N-type extrinsic semiconductor? Explain with the help of energy band diagrams. **3**

Q. 18. Why is the mass of a nucleus always less than the sum of the masses of its constituents, neutrons and protons. **3**

If the total number of neutrons and protons in a nuclear reaction is conserved, how then is the energy absorbed or evolved in the reaction? Explain.

Or

Draw a graph showing the variation of binding energy per nucleon with mass number for different nuclei. Explain, with the help of this graph, the release of energy by the process of nuclear fusion.

Q. 19. Define the term modulation. Name three different types of modulation used for a message signal using a sinusoidal continuous carrier wave. Explain the meaning of any one of these. **3**

Q. 20. What is electric flux? Write its S.I. units.

Using Gauss's theorem, deduce an expression for the electric field at a point due to a uniformly charged infinite plane sheet. **3**

Q. 21. A 10 m long wire of uniform cross-section and $20\ \Omega$ resistance is used in a potentiometer. The wire is connected in series with a battery of 5 V along with an external resistance of $480\ \Omega$. If an unknown emf E is balanced at 6.0 m length of the wire, calculate: **3**

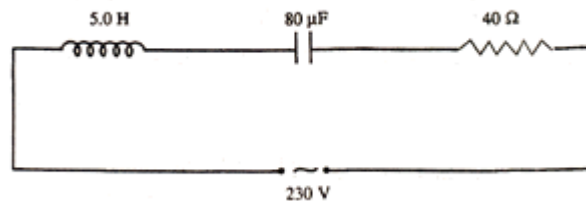
Q. 22. Draw a circuit diagram for use of NPN transistor as an amplifier in common emitter configuration. The input resistance of a transistor is $1000\ \Omega$. On changing its base current by $10\ \mu\text{A}$, the collector current increases by 2 mA. If a load resistance of $5\text{K}\ \Omega$ is used in the circuit, calculate: **1 + 2**

- (i) the current gain
- (ii) voltage gain of the amplifier

Q. 23. Define the term 'critical frequency' in relation to sky wave propagation of electromagnetic waves. On a particular day, the maximum frequency reflected from the ionosphere is 10 MHz. On another day, it was found to decrease to 8 MHz. Calculate the ratio of the maximum electron densities of the ionosphere on the two days. **3**

Q. 24. Draw a labelled diagram of Hertz's experimental set-up to produce electromagnetic waves. Explain the generation of electromagnetic waves using this set-up. **3**

Q. 25. The given circuit diagram shows a series LCR circuit connected to a variable frequency 230 V source: **5**



- (a) Determine the source frequency which drives the circuit in resonance.
- (b) Obtain the impedance of the circuit and the amplitude of current at the resonating frequency.
- (c) Determine the rms potential drops across the three elements of the circuit.
- (d) How do you explain the observation that the algebraic sum of the voltages across the three elements obtained in (c) is greater than the supplied voltage?

Or

The primary coil of an ideal step-up transformer has 100 turns and the transformation ratio is also 100. The input voltage the power are 220 V and 1100 W respectively. Calculate:

- (i) number of turns in the secondary
- (ii) the current in the primary
- (iii) voltage across the secondary
- (iv) the current in the secondary
- (v) power in the secondary

Q. 26. What is interference of light? Write two essential conditions for sustained interference pattern to be produced on the screen. **5**

Draw a graph showing the variation of intensity versus the position on the screen in Young's experiment when (a) both the slits are opened and (b) one of the slits is closed.

What is the effect on the interference pattern in Young's double slit experiment when:

- (i) screen is moved closer to the plane of slits?
- (ii) separation between two slits is increased. Explain your answer in each case.

Or

What is diffraction of light? Draw a graph showing the variation of intensity with angle in a single slit diffraction experiment. Write one feature which distinguishes the observed pattern from the double slit interference pattern.

How would the diffraction pattern of a single slit be affected when:

- (i) the width of the slit is decreased?
- (ii) the monochromatic source of light is replaced by a source of white light?

Q. 27. With the help of a neat and labelled diagram, explain the underlying principle and working of a moving coil galvanometer. What is the function of:

- (i) uniform radial field
 - (ii) soft iron core
- in such a device?

Or

Derive a mathematical expression for the force per unit length experienced by each of the two long current carrying conductors placed parallel to each other in air. Hence define one ampere of current.

Explain why two parallel straight conductors carrying current in the opposite direction kept near each other in air repel?