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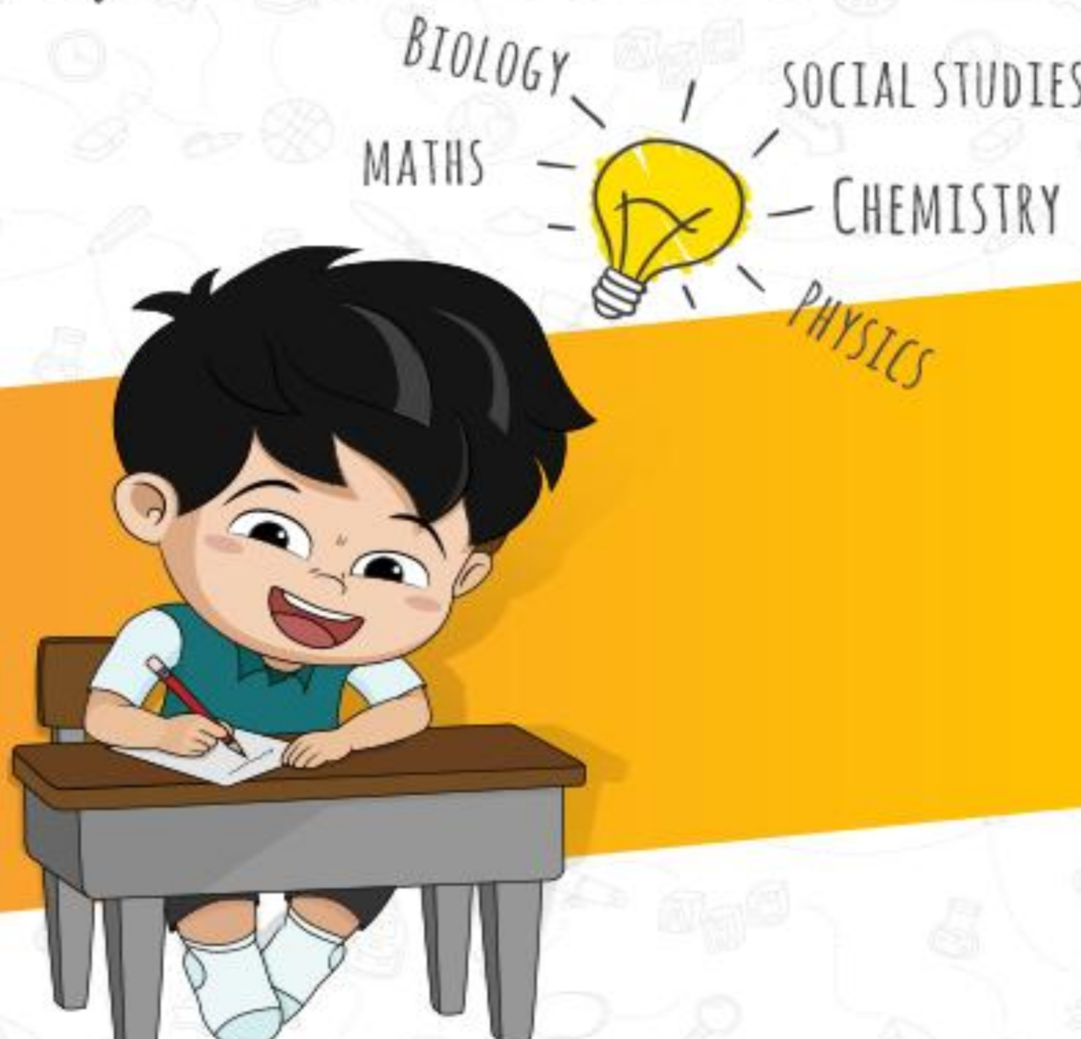


CBSE
Class XII Physics
Most Important Questions

Chapter 1: Electric Charges and Field

1. In which orientation, a dipole placed in a uniform electric field is in (i) stable, (ii) unstable equilibrium? [1]
2. Define the term 'dielectric constant' of a medium in terms of capacitance of a capacitor. [1]
3. Define electric flux. Write its S.I. Units. A spherical rubber balloon carries a charge that is uniformity 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. [2]
4. Find the electric field intensity due to a uniformly charged spherical shell at a point (i) outside the shell and (ii) inside the shell. Plot the graph of electric field with distance from the centre of the shell. [3]
5. (a) Using Gauss' law, derive an expression for the electric field intensity at any point outside a uniformly charged thin spherical shell of radius R and charge density σ C/m^2. Draw the field lines when the charge density of the sphere is (i) positive, (ii) negative.

   (b) A uniformly charged conducting sphere of 2.5 m in diameter has a surface charge density of 100 $\mu C/m^2$. Calculate the

   (i) Charge on the sphere

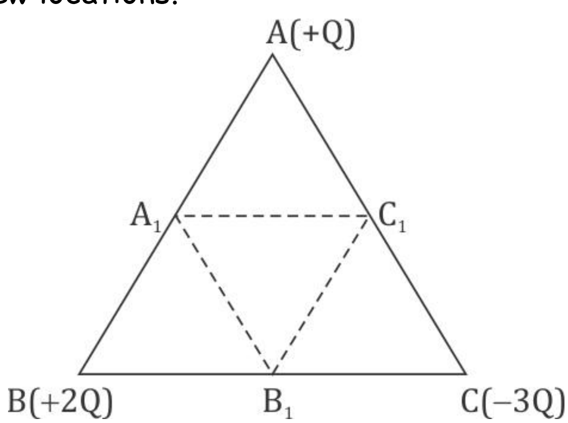
   (ii) Total electric flux passing through the sphere. [5]

Chapter 2: Electrostatic Potential and Capacitance

1. What is the geometrical shape of equipotential surfaces due to a single isolated charge? [1]
2. For any charge configuration, equipotential surface through a point is normal to the electric field. Justify. [1]

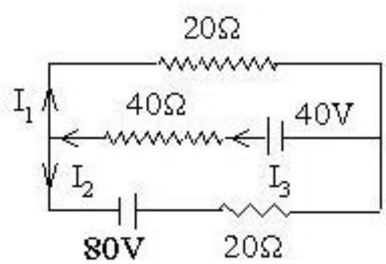
3. A parallel plate capacitor of capacitance C is charged to a potential V. It is then connected to another uncharged capacitor having the same capacitance. Find out the ratio of the energy stored in the combined system to that stored initially in the single capacitor. [2]
4. A capacitor of unknown capacitance is connected across a battery of V volts. The charge stored in it is 300 μC. When potential across the capacitor is reduced by 100 V, the charge stored in it becomes 100 μC. Calculate the potential V and the unknown capacitance. What will be the charge stored in the capacitor if the voltage applied had increased by 100 V? [3]
5. A parallel plate capacitor is charged by a battery. After sometime the battery is disconnected and a dielectric slabs its thickness equal to the plate separation is inserted between the plates. How will (i) the capacitance of the capacitor. (ii) Potential difference between the plates and (iii) the energy stored in the capacitor be affected? [3]
6. Draw a labelled diagram of Van de Graaff generator. State its working principle to show how by introducing a small charged sphere into a larger sphere, a large amount of charge can be transferred to the outer sphere. State the use of this machine and also point out its limitations. [5]
7. (a) Deduce the expression for the potential energy of a system of two charges q_1 and q_2 located $\vec{r}_1$ and $\vec{r}_2$, respectively, in an external electric field.

   (b) Three point charges, +Q, +2Q and –3Q are placed at the vertices of an equilateral triangle ABC of side 'l'. If these charges are displaced to the mid-point A_1, B_1 and C_1, respectively, find the amount of the work done in shifting the charges to the new locations. [5]



Chapter 3: Current Electricity

1. Define the term 'mobility' of charge carriers. Write its S.I. unit. [1]
2. 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 ionized gas. [1]
3. When 5 V potential difference is applied across a wire of length 0.1 m, the drift speed of electrons is 2.5×10^{-4} m/s. If the electron density in the wire is 8×10^{28} m^{-3}, calculate the resistivity of the material of the wire. [2]
4. State the two Kirchhoff's rules used in electric networks. How are there rules justified? [2]
5. State Kirchhoff's rules of current distribution in an electrical network. Using these rules determine the value of the current I_1 in the electric circuit given below. [3]



6. A number of identical cells, *n*, each of emf E, internal resistance *r* connected in series are charged by a d.c. source of emf *E'*, using a resistor *R*. Draw the circuit arrangement. Deduce the expressions for (a) the charging current and (b) the potential difference across the combination of the cells. [3]

Chapter 4: Moving Charges and Magnetism

1. Using the concept of force between two infinitely long parallel current carrying conductors, define one ampere of current. [1]
2. Write the relation for the force $\vec{F}$ acting on a charge carrier q moving with a velocity $\vec{v}$ through a magnetic field $\vec{B}$ in vector notation. Using this relation, deduce the conditions under which this force will be (i) maximum (ii) minimum.[2]
3. State the principle of working of a cyclotron. Write two uses of this machine.[2]
4. State Biot – Savart law. Deduce the expression for the magnetic field at a point on the axis of a current carrying circular loop of radius 'R' distant 'x' from the centre. Hence, write the magnetic field at the centre of a loop. [3]

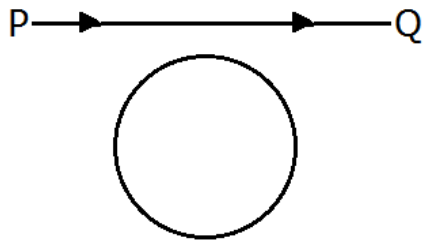
5. (a) Draw a labelled diagram of a moving coil galvanometer. Describe briefly its principle and working.
   (b) Answer the following:
      (i) Why is it necessary to introduce a cylindrical soft iron core inside the coil of a galvanometer?
      (ii) Increasing the current sensitivity of a galvanometer may not necessarily increase its voltage sensitivity. Explain, giving reason. [5]
6. With the help of a labelled diagram, state the underlying principle of a cyclotron. Explain clearly how it works to accelerate the charged particles. Show that cyclotron frequency is independent of energy of the particle. Is there an upper limit on the energy acquired by the particle? Give reason. [5]

Chapter 5: **Magnetism and Matter**

1. The horizontal component of the Earth's magnetic field at a place is B and the angle of dip is 60°. What is the value of the vertical component of Earth's magnetic field? [1]
2. Which of the following substances are paramagnetic? [1]
   Bi, Al, Cu, Ca, Pb, Ni
3. Draw magnetic field lines when a (i) diamagnetic, (ii) paramagnetic substance is placed in an external magnetic field. Which magnetic property distinguishes this behaviour of the field lines due to the two substances? [2]
4. (i) Write two characteristics of a material used for making permanent magnets.
   (ii) Why is core of an electromagnet made of ferromagnetic materials? [2]
5. (a) Draw the magnetic field lines due to a circular loop area $\vec{A}$ carrying current I. Show that it acts as a bar magnet of magnetic moment $\vec{m} = I\vec{A}$. Derive the expression for the magnetic field due to a solenoid of length '2l', radius 'a' having 'n' number of turns per unit length and carrying a steady current 'I' at a point on the axial line, distance 'r' from the centre of the solenoid. How does this expression compare with the axial magnetic field due to a bar magnet of magnetic moment 'm'? [5]

Chapter 6: Electromagnetic Induction

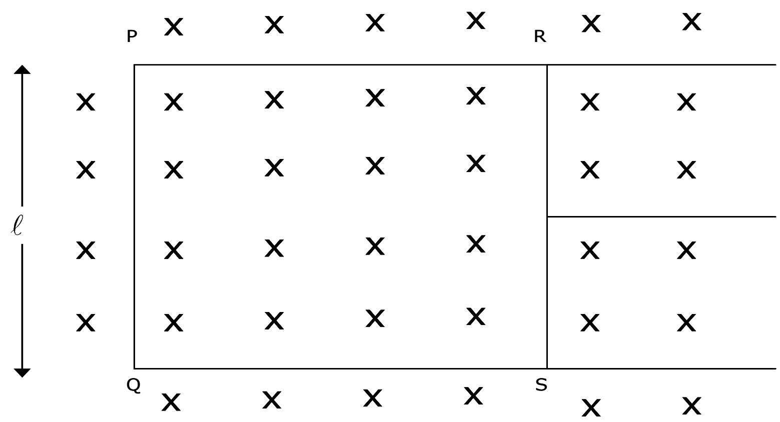
1. A conducting loop is held below a current carrying wire PQ as shown. Predict the direction of the induced current in the loop when the current in the wire is constantly increasing. [1]



2. A metallic rod of 'L' length is rotated with an angular frequency of 'w' with one end hinged at the center and the other end at the circumference of a circular metallic ring of radius L, about an axis passing through the centre and perpendicular to the plane of the ring. A constant and uniform magnetic field B parallel to the axis is present everywhere. Deduce the expression for the emf between the centre and the metallic ring. [2]
3. State Lenz's Law. A metallic rod held horizontally along east-west direction, is allowed to fall under gravity. Will there be an e.m.f. induced at its ends? Justify your answer. [2]
4. A metallic rod of length l is rotated at a constant angular speed ω, normal to a uniform magnetic field B. Derive an expression for the current induced in the rod, if the resistance of the rod is R. [3]
5. (a)A rod of length l is moved horizontally with a uniform velocity 'v' in a direction perpendicular to its length through a region in which a uniform magnetic field is acting vertically downward. Derive the expression for the emf induced across the ends of the rod.

   (b) How does one understand this motional emf by invoking the Lorentz force acting on the free charge carriers of the conductor? Explain. [3]
6. (a) What are eddy currents? Write their two applications.

   (b) Figure shows a rectangular conducting loop PQSR in which an RS of length 'l' is movable. The loop is kept in a uniform magnetic field 'B' directed downward perpendicular to the plain of the loop. The arm RS is moved with a uniform speed 'v'. [5]



Deduce an expression for

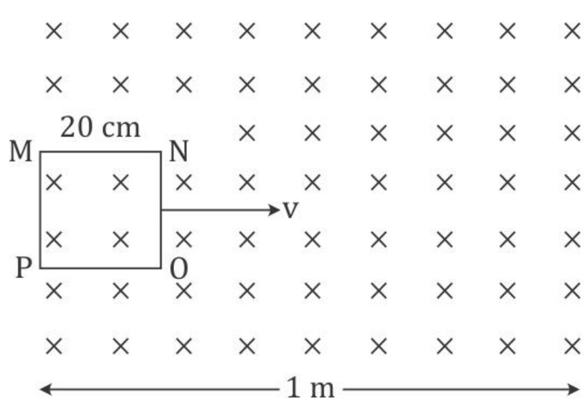
(i) The emf induced across the arm 'RS',

(ii) The external force required to move the arm, and

(iii) The power dissipated as heat.

7. (a) Define self-inductance of a coil. Obtain an expression for the energy stored in a solenoid of self-inductance 'L' when the current though it grows from zero to 'I'.

(b) A square loop MNOP of side 20 cm is placed horizontally in a uniform magnetic field acting vertically downwards as shown in the figure. The loop is pulled with a constant velocity of 20 cm s^{-1} till it goes out of the field.

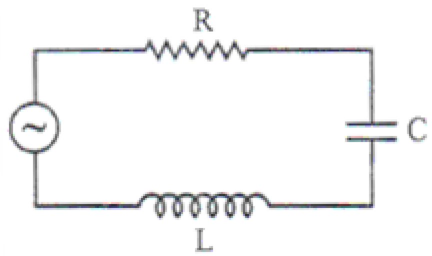


(i) Depict the direction of the induced current in the loop as it goes out of the field. For how long would the current in the loop persist?

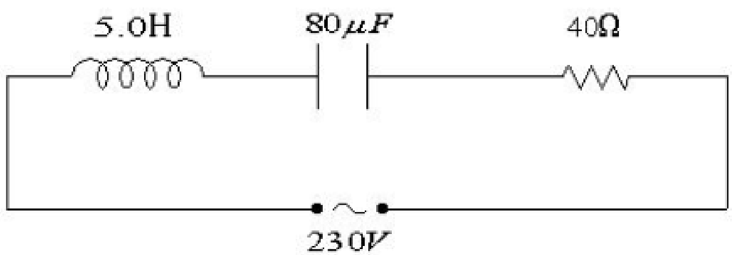
(ii) Plot a graph showing the variation of magnetic flux and induced emf as a function of time. [5]

Chapter 7: Alternating Current

1. In a series LCR circuit, $V_L = V_C \neq V_R$. What is the value of power factor? [1]
2. Why is the use of a.c. voltage preferred over d.c. voltage? Give two reasons. [1]
3. Derive an expression of the impedance of an ac circuit consisting of an inductor and a resistor. [2]
4. A voltage $V = V_0 \sin \omega t$ is applied to a series LCR circuit. Derive the expression for the average power dissipated over a cycle. Under what condition is (i) no power dissipated even though the current flows through the circuit, (ii) maximum power dissipated in the circuit? [3]
5. The figure shows a series LCR circuit with L = 5.0 H, C = 80 μF, R = 40 ohm connected to a variable frequency 240 V source. Calculate [3]



   (i) The angular frequency of the source which drives the circuit at resonance.
   (ii) The current at the resonating frequency.
   (iii) The rms potential drop across the capacitor at resonance.
6. 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 voltage of the three elements obtained in (c) is greater than the supplied voltage?

Chapter 8: Electromagnetic Waves

1. To which part of the electromagnetic spectrum does a wave of frequency 5 x 10^{11} Hz belong? [1]
2. Name the EM waves used to studying crystal structure of solids. What is its frequency range? [1]
3. Considering the case of a parallel plate capacitor being charged, show how one is required to generalize Ampere's circuital law to include the term due to displacement current. [2]
4. When an ideal capacitor charged by a dc battery, no current flows. However, when an ac source is used, the current flows continuously. How does one explain this, based on the concept of displacement current? [2]
5. What is space wave propagation? State the factors which limit its range of propagation. Derive an expression for the maximum line of sight distance between two antennas for space wave propagation. [3]

Chapter 9: Ray Optics and Optical Instruments

1. A glass lens of refractive index 1.5 is placed in a trough of liquid. What must be the refractive index of the liquid in order to make the lens disappear? [1]
2. 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 $\frac{4}{3}$. [1]
3. The radii of curvature of the faces of a double convex lens are 10 cm and 15 cm. If focal length of the lens is 12 cm, find the refractive index of the material of the lens. [2]
4. A ray of light, incident on an equilateral glass prism ($\mu_g = \sqrt{3}$) moves parallel to the base line of the prism inside it. Find the angle of incidence for this ray.[2]
5. A convex lens of focal length 20 cm is placed coaxially with a convex mirror of radius of curvature 20 cm. The two are kept 15 cm apart. A point object is placed 40 cm in front of the convex lens. Find the position of the image formed by this combination. Draw the ray diagram showing the image formation. [3]
6. An object is placed 15 cm in front of a convex lens of focal length 10 cm. Find the nature and position of the image formed. Where should a concave mirror of radius of curvature 20 cm be placed so that the final image is formed at the position of the object itself? [3]

7. (a) [5]
   (i) Draw a labeled ray diagram to show the formation of image in an astronomical telescope for a distant object.
   (ii) Write three distinct advantages of a reflecting type telescope over a refracting type telescope.
   (b) A convex lens of focal length 10 cm is placed coaxially 5 cm away from a concave lens of focal length 10 cm. If an object is placed 30 cm in front of the convex lens find the position of the final image formed by the combined system.
8. Draw a ray diagram to show the working of a compound microscope. Deduce an expression for the total magnification when the final image is formed at the near point.
   In a compound microscope, an object is placed at a distance of 1.5 cm from the objective of focal length 1.25 cm. If the eye piece has a focal length of 5 cm and the final image is formed at the near point, estimate the magnifying power of the microscope. [5]

Chapter 10: Wave Optics

1. Which of the following waves can be polarized (i) Heat waves (ii) Sound waves? Give reason to support your answer. [1]
2. How the angular separation of interference fringes in Young's double slit experiment would change when the distance between the slits and screen is halved? [1]
3. Define the term 'linearly polarised light'. When does the intensity of transmitted light become maximum, when a polaroid sheet is rotated between two crossed polaroids? [2]
4. In Young's double slit experiment, monochromatic light of wavelength 600 nm illuminates the pair of slits and produces an interference pattern in which two consecutive bright fringes are separated by 100 mm. Another source of monochromatic light produces the interference pattern in which the two consecutive bright fringes are separated by 89 mm. Find the wavelength of light from the second source.
   What is the effect on the interference fringes if the monochromatic source is replaced by a source of white light? [3]

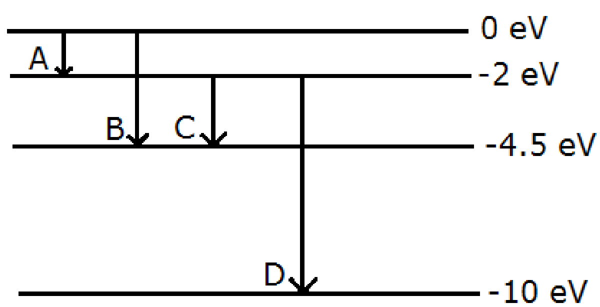
5. What is an upolarised light? Explain with the help of suitable ray diagram how an unpolarised light can be polarized by reflection from a transparent medium. Write the expression for Brewster angle in terms of the refractive index of denser medium. [3]
6. What are coherent sources? Why are coherent 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]
7. State Huygen's principle. Show, with the help of a suitable diagram, how this principle is used to obtain the diffraction pattern by a single slit.
   Draw a plot of intensity distribution and explain clearly why the secondary maxima become weaker with increasing order (n) of the secondary maxima. [5]

Chapter 11: Dual Nature of Matter and Radiation

1. The stopping potential in an experiment on photoelectric effect is 2 V. What is the maximum kinetic energy of the photoelectrons emitted? [1]
2. Show graphically, the variation of the de-Broglie wavelength (λ) with the potential (V) through which an electron is acceleration from rest. [1]
3. A proton and an α-particle are accelerated through the same potential difference. Which one of the two has (i) greater de-Broglie wavelength, and (ii) less kinetic energy? Justify your answer. [2]
4. Plot a graph showing the variation of stopping potential with the frequency of incident radiation for two different photosensitive materials having work functions w_1 and w_2 ($w_1 > w_2$). On what factors does the (i) slope and (ii) intercept of the lines depend? [2]
5. (a) Why photoelectric effect cannot be explained on the basis of wave nature of light? Give reasons.
   (b) Write the basic features of photon picture of electromagnetic radiation on which Einstein's photoelectric equation is based. [3]
6. Write Einstein's photoelectric equation. State clearly how this equation is obtained using the photon picture of electro-magnetic radiation. Write the three salient features observed in photoelectric effect which can be explained using this equation. [3]

Chapter 12: Atoms

1. What is the ratio of radii of the orbits corresponding to first excited state and ground state in a hydrogen atom? [1]
2. Using Bohr's postulates of the atomic model derive the expression for radius of n^{th} electron orbit. Hence obtain the expression for Bohr's radius. [2]
3. Use Rydberg formula to determine the wavelength of H_α line. [Given: Rydberg constant $R = 1.03 \times 10^7\ m^{-1}$] [2]
4. (a) Using Bohr's second postulate of quantization of orbital angular momentum show that the circumference of the electron in the nth orbital state in hydrogen atom is n times the de-Broglie wavelength associated with it.
   (b) The electron in hydrogen atom is initially in the third excited state. What is the maximum number of spectral lines which can be emitted when it finally moves to the ground state? [3]
5. The energy levels of a hypothetical atom are shown below. Which of the shown transitions will result in the emission of a photon of wavelength 275 nm?
   Which of these transitions correspond to emission of radiation of (i) maximum and (ii) minimum wavelength? [3]



Chapter 13: Nuclei

1. Two nuclei have mass numbers in the ratio 27: 125. What is the ratio of their nuclear radii? [1]
2. State the reason, why heavy water is generally used as a moderator in a nuclear reactor. [1]
3. A heavy nucleus X of mass number 240 and binding energy per nucleon 7.6 MeV is split into two fragments Y and Z of mass numbers 110 and 130. The binding energy of nucleons in Y and Z is 8.85 MeV per nucleon. Calculate the energy Q released per fission in MeV. [2]
4. 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? [2]

5. (a) Derive the mathematical expression for law of radioactive decay for a sample of a radioactive nucleus.
   (b) How is the mean life of a given radioactive nucleus related to the decay constant? [3]
6. Write symbolically the nuclear β^+ decay process of ${}^{11}_{6}C$. Is the decayed product X an isotope or isobar of (${}^{11}_{6}C$)? Given the mass values m (${}^{11}_{6}C$) = 11.011434 u and m (X) = 11.009305 u. Estimate the Q-value in this process. [3]

Chapter 14: Semiconductor Electronics

1. 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. [1]
2. In a transistor, doping level in base is increased slightly. How will it affect (i) collector current and (ii) base current? [1]
3. 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. [2]
4. Draw the circuit diagram of an illuminated photodiode in reverse bias. How is photodiode used to measure light intensity? [2]
5. 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]
6. Give a circuit diagram of a common emitter amplifier using an n – p transistor. Draw the input and output waveforms of the signal. Write the expression for its voltage gain. [3]
7. 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]

Chapter 15: Communication Systems

1. Why is frequency modulation preferred over amplitude modulation for transmission of music? [1]
2. A signal of 5 kHz frequency is amplitude modulated on a carrier wave of frequency 2 MHz. What are the frequencies of the side bands produced? [1]
3. Write two factors justifying the need of modulation for transmission of a signal. [2]

4. Draw a block diagram of simple amplitude modulation. Explain briefly how amplitude modulation is achieved. [2]
5. What is space wave propagation? Give two examples of communication system which use space wave mode.
   A TV tower is 80 m tall. Calculate the maximum distance up to which the signal transmitted from the tower can be received. [3]
6. (a) State three important factors showing the need for translating a low frequency signal into a high frequency wave before transmission.
   (b) Draw a sketch of a sinusoidal carrier wave along with a modulating signal and show how these are superimposed to obtain the resultant amplitude modulated wave.