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CLASS XII CBT DECEMBER 2023 , SUBJECT- PHYSICS
TOPIC- NUCLEI AND SEMICONDUCTOR ELECTRONICS

CASE STUDY-1 : Read the following paragraph and answer the correct option of MCQ

Neutrons and protons are identical particle in the sense that their masses are nearly the same and the force, called nuclear force, binds them inside the nucleus. Nuclear force is the strongest force. Stability of nucleus is determined by the neutron proton ratio or mass defect or packing fraction. Shape of nucleus is calculated by quadruple moment and spin of nucleus depends on even and odd mass number. Volume of nucleus depends on the mass number. Whole mass of the atom (nearly 99%) is centred at the nucleus-

(1) The range of nuclear force is the order of
(a) 2 x 10^{-10} m (b) 1.5 x 10^{-20} m (c) 1.2 x 10^{-4} m (d) 1.4 x 10^{-15} m
Ans: (d)
Feedback: Nuclear force is a short range force.

(2) A force between two protons is same as the force between proton and neutron. The nature of the force is
(a) Electrical force (b) Weak nuclear force (c) Gravitational force (d) Strong nuclear force
Ans: (d)
Feedback: Nuclear force is charge independent.

(3) Two protons are kept at a separation of 10 nm. Fn is the nuclear force and Fe is the electrostatic force between them. Then
(a) Fn <<Fe (b) Fn= Fe (c) Fn >> Fe (d) Fn ≈ Fe

Ans: **(a)**

Feedback: Feedback: The distance given is 10 nm
1. We know at a distance of 10 nm the strong nuclear force is almost zero. It has its effect on two nucleons only when the distance between the two nucleons is less than equal to few Fermi (10^{-15}) (Strong Nuclear force is a short ranged force). After this there is an exponential fall in this force.
2. At the given distance the electrostatic force will be much stronger
Hence , $F_e \gg F_n$

(4) All the nucleons in an atom are held by
(a) Nuclear forces (b) Vander waal's forces (c) Tensor forces (d) Coulomb forces C
Ans: (a)
Feedback: Nuclear forces is a short range force.

CASE STUDY-2 :Read the following paragraph and answer the correct option of MCQ

A pure semiconductor germanium or silicon, free of every impurity is called intrinsic semiconductor. At room temperature, a pure semiconductor has very small number of current carriers (electrons and holes). Hence its conductivity is low. When the impurity atoms of valance five or three are doped in a pure semiconductor, we get respectively n- type or p- type extrinsic semiconductor. In case of doped semiconductor. $n_e n_p = n_i^2$ Where n_e and n_p are the number density of electron and hole charge carriers in a pure semiconductor. The conductivity of extrinsic semiconductor is much higher than that of intrinsic semiconductor

(5)Which of the following statements is not true?
a) The resistance of intrinsic semiconductor decreases with increase of temperature.
b) Doping pure Si with trivalent impurities gives p- type semiconductors.
c) The majority charges in n- type semiconductors are holes.
d) All of the above.
Ans: (c)
Feedback: The majority charges in n- type semiconductors are electrons.

(6) The impurity atoms with which pure Si should be doped to make a p- type semiconductor is
a) Phosphorus b) Boron c) Arsenic d) Antimony
Ans: (b)

Feedback: Boron is a trivalent element.

(7) Holes are majority charge carriers in

a) Intrinsic semiconductors b) n – type semiconductor c) p- type semiconductors d) Metals

Ans: (c)

Feedback: Majority charge carriers in p- type semiconductors due to trivalent impurity.

(8) At absolute zero, Si acts as

a) Non- metal b) Metal c) Insulator d) None of these

Ans: (c)

Feedback: All the electrons are bonded at absolute zero.

ASSERTION REASON TYPE QUESTION

Directions: These questions consist of two statements, Assertion and Reason. While answering these questions, you are required to choose any one of the following four responses.

(a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.

(b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.

(c) If the Assertion is correct but Reason is incorrect.

(d) If both the Assertion and Reason are incorrect

9. Assertion: Diode conducts current in forward biasing.

Reason: The junction resistance depends on thickness of depletion layer and it is thin in forward biasing

Ans: (a)

Feedback: The thickness of depletion layer decreases with increase in voltage in forward biasing so the resistance of junction decreases and the diode conducts.

10. Assertion :The binding energy per nucleon, for nuclei with atomic mass number A > 100, decrease with A.

Reason : The forces are weak for heavier nuclei.

Ans: (c)

Feedback: The nuclear force is a strong forc e and it shows saturation effect so it acts on neighbouring nucleons and so BE per nucleon decreases.