

Board – ICSE

Class – 10

Topic – Radioactivity

1. It is possible for a hydrogen (H) nucleus to emit an alpha particle?

Ans

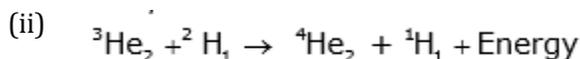
No, the hydrogen nucleus H_1^1 cannot emit alpha particles as they have insufficient amount of neutrons and protons in the nucleus.

2. (i) Why a nuclear fusion reaction is called a thermo nuclear reaction?
(ii) Complete the reaction:



Ans

(i) Nuclear fusion is not possible at normal temperature. At high temperature and due to thermal agitations, both nuclei acquire sufficient kinetic energy to overcome the force of repulsion between them when they approach each other and thus get fused. Thus, the nuclear fusion reaction is also called a thermonuclear reaction.



3. (i) What do you understand by the term nuclear fusion?
(ii) Nuclear power plants use nuclear fission reaction to produce electricity. What is the advantage of producing electricity by fusion reaction?

Ans

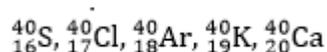
(i) Nuclear fusion is the process in which two light nuclei combine to form a heavy nucleus. In this process, a huge amount of energy is released.
(ii) For the same mass, the energy released in a fusion process is more than that released in a fission process. A fusionable substance is found in abundance. These substances are not radioactive and do not give any harmful radiation. Disposal of waste is not difficult.

4. (i) What are isobars? (ii) Give one example of isobars.

Ans

(i) Isobars are two nuclei having the same atomic number Z but different mass numbers.

(ii) Examples:



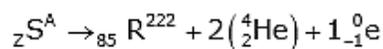
5. When does the nucleus of an atom tend to be radioactive?

Ans

A nucleus tends to be radioactive when the number of neutrons inside it is more than the number of protons.

6. An element ${}_Z\text{S}^A$ decays to ${}_{85}\text{R}^{222}$ after emitting 2 α particles and 1 β particle. Find the atomic number and atomic mass of the element S.

Ans



$$A = 222 + 2(4) + 0$$

$$\therefore A = 230$$

$$Z = 85 + 2(2) + (-1)$$

$$\therefore Z = 88$$

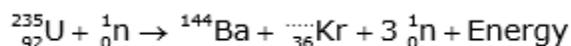
7. A radioactive substance is oxidized. Will there be any change in the nature its radioactivity? Give a reason for your answer.

Ans

There will be no change in the nature of radioactivity of the substance. This is because oxidation is a chemical process and does not involve the nucleus of the substance.

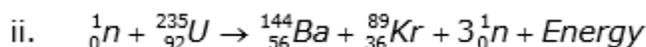
8. (i) Define nuclear fission.

(ii) Rewrite and complete the following nuclear reaction by filling in the atomic number of Ba and mass number of Kr:



Ans

i. Nuclear fission is the process in which a heavy nucleus is split into two light nuclei of nearly the same size by bombarding it with neutrons.



9. The ore of Uranium found in nature contains ${}_{92}\text{U}^{238}$ and ${}_{92}\text{U}^{235}$. Although both the isotopes are fissionable, it is found out experimentally that one of the two isotopes is more easily fissionable.

- (i) Name the isotope of Uranium which is easily fissionable.
- (ii) Give a reason for your answer.
- (iii) Write a nuclear reaction when Uranium 238 emits an alpha particle to form a Thorium (Th) nucleus.

Ans

- (i) ${}_{92}\text{U}^{235}$ is an isotope of uranium which is easily fissionable.
- (ii) ${}_{92}\text{U}^{235}$ undergoes fission with low energy neutrons or thermal neutrons. But for the fission process in ${}_{92}\text{U}^{238}$, fast neutrons of energy ~ 1 MeV is required.
- (iii) A nuclear reaction when Uranium-238 emits an alpha particle to form a Thorium (Th) nucleus is given by



10. Arrange α , β , and γ rays in ascending order with respect to their [3]
(i) Penetrating power. (ii) ionizing power. (iii) Biological effect.

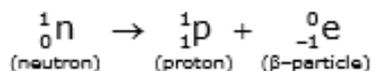
Ans

- (i) Penetrating power: α , β , γ
- (ii) Ionising power: γ , β , α
- (iii) Biological effect: α , β , γ

11. (i) Represent the change in the nucleus of a radioactive element when a β particle is emitted.
(ii) What is the name given to elements with same mass number and different atomic number
(iii) Under which conditions does the nucleus of an atom tend to radioactive? [4]

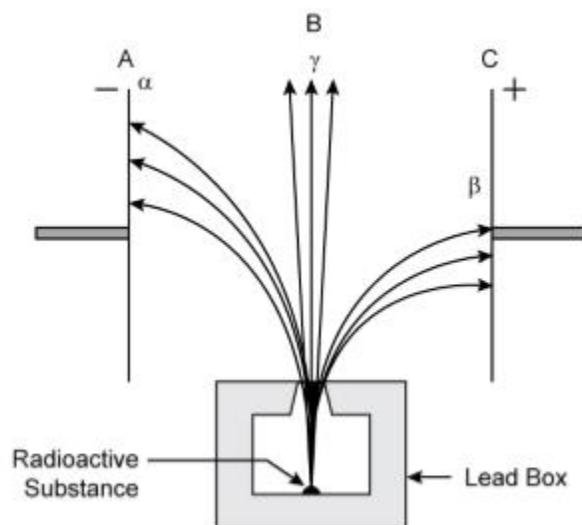
Ans

- (i) In an unstable nucleus, the neutron is changed into a proton by emitting a beta particle. This is represented as



- (ii) Elements with the same mass number but different atomic numbers are called isobars.
- (iii) The nucleus of an atom tends to be radioactive when the number of neutrons in the nucleus exceeds the number of protons inside it.

12. Radiations given out from a source when subjected to an electric field to a direction perpendicular to their path are shown below in the diagram. The arrows show the path of the radiation A, B and C. Answer the following questions in terms of A, B and C. [4]



- (i) Name the radiation B which is unaffected by the electrostatic field.
- (ii) Why does the radiation C deflect more than A?
- (iii) Which among the three causes the least biological damage externally?
- (iv) Name the radiation which is used in carbon dating.

Ans

- (i) Radiation B which is unaffected by the electrostatic field is gamma radiation.
- (ii) Radiation C is beta radiation, and it is nothing but electrons. The mass of electrons is much smaller than alpha particles (radiation A). Hence, beta radiation (radiation C) deflects more.
- (iii) Radiation A, which is alpha radiation, causes the least biological damage externally.
- (iv) Gamma radiation is used for carbon dating

13. State two differences and two similarities between X-rays and γ -rays.

Ans.

Differences :

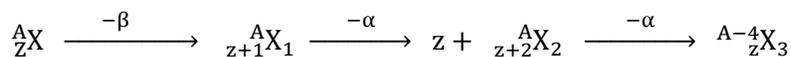
- (i) The wavelength of X-rays is of the order of 1\AA , whereas wavelength of γ -rays is of the order of 10^{-3}\AA .
- (ii) X-rays are less penetrating than γ -rays.

Similarities :

- (i) Both are electromagnetic waves.
- (ii) Both travel with the speed of $3 \times 10^8 \text{ ms}^{-1}$.

14. A radioactive element loses two successive β -particles, followed by an A_ZX α -particle, such that the resulting nuclide is Find the values of P and Q. P_QY .

Ans.



$$\therefore {}^P_QY = {}^{A-4}_zX_3$$

$$\therefore P = A - 4 ; Q = Z.$$

15. What are radio-isotopes? State one use of radio-isotopes.

Ans.

The isotopes of some elements having atomic number less than 82, such that they emit radioactive radiations are called radio-isotopes. Radio-sodium chloride is used as traces in the detection of cancer and brain tumour.