

# MULTIPLE CHOICE QUESTIONS

Choose the correct answer from the following choices:

1. Isotopes are atoms of same element with different:

- a) atomic mass
- b) atomic number
- c) number of protons
- d) number of electrons

2. One of the isotopes of uranium is  $^{238}_{92}\text{U}$ . The number of neutrons in this isotope is:

- a) 92
- b) 146
- c) 238
- d) 330

3. Which among the following radiations has more penetrating power?

- a) a beta particle
- b) a gamma ray
- c) an alpha particle
- d) all have the same penetrating ability

4. What happens to the atomic number of an element which emits one alpha particle and a beta particle?

- a) increases by 1
- b) stays the same
- c) decreases by 2
- d) decreases by 1



## ANSWERS

- i) a    ii) b    iii) b    iv) d    v) b    vi) d  
vii) b    viii) a    ix) b

## REVIEW QUESTIONS

**18.1 What is difference between atomic number and atomic mass number? Give a symbolical representation of a nuclide.**

**Answer**

Please see the topic.

**18.2 What do you mean by the term radioactivity? Why some elements are radioactive but some are not?**

**Answer**

Please see the topic.

**18.3 How can you make radioactive elements artificially? Describe with a suitable example.**

**Answer**

When a slow-moving neutron is bombarded to a stable nucleus to make it unstable, the decay process takes place and we get a new element called daughter element. Such radioactivity is called artificial radioactivity.

For example:  ${}_0^1n + {}_{11}^{23}\text{Na} \rightarrow {}_{11}^{24}\text{Na} + \text{gamma}(\gamma)\text{-rays}$

**18.4 What are three basic radioactive decay processes and how do they differ from each other?**

**Answer**

Please see the topic.

**18.5 Write the alpha decay process for  ${}_{91}^{234}\text{P}$ . Identify the parent and daughter nuclei in this decay.**

**Answer**



(parent nuclide) (daughter nuclide) (alpha particle)

**18.6 Explain whether the atomic number can increase during nuclear decay: Support your answer with an example.**

**Answer**

Yes, the atomic number can be increased during  $\beta^-$  decay. For example:



The above nuclear transmutation, indicates that by the emission of one  $\beta^-$  particle from carbon -14 ( ${}_{6}^{14}\text{C}$ ), its atomic number is increased by 1 and as a resultant we get a daughter element  ${}_{7}^{14}\text{N}$  (nitrogen -14) with atomic number 7.

**18.7 What do you understand by half-life of a radioactive element?**

**Answer**

Please see the topic (half-life of radioactive element)

**18.8 Is radioactivity a spontaneous process? Elaborate your answer with a simple experiment.**

**Answer**

Please see the topic (Natural radioactivity)

**18.9 What is meant by background radiations? Enlist some sources of background radiations.**

**Answer**

Please see the topic (background radiation)

**18.10 Describe two uses of radioisotopes in medicine, industry or research?**

**Answer**

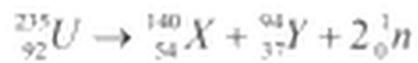
Please see the topic (Applications of radioisotopes)

**18.11 What are two common radiation hazards? Briefly describe the precautions that are taken against them.**

**Answer**

Please see the topic (radiation hazards).

**18.12 Complete this nuclear reaction:  ${}_{92}^{235}\text{U} \rightarrow {}_{54}^{140}\text{X} + ? + 2 {}_0^1\text{n}$  Does this reaction involve fusion or fission? Justify your answer.**



**Answer**

The above equation indicates the fission process.  ${}_{92}^{235}\text{U}$  is disintegrated by the bombardment of a slow-moving neutron and as a resultant we get two nuclear fragments i.e.  ${}_{54}^{140}\text{X} + {}_{37}^{94}\text{Y}$ , with the emission of one neutron.

**18.13 Nuclear fusion reaction is more reliable and sustainable source of energy than nuclear fission chain reaction. Justify this statement with plausible arguments.**

**Answer**

In fusion process a huge quantity of (heat) energy is produced as compared to fission process.

One of the best examples is that of sun, where fusion process is taking place for billions of years and we are receiving its results on the earth in the form of heat & light.

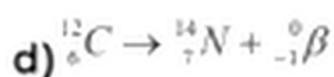
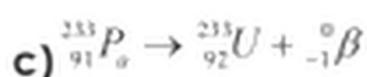
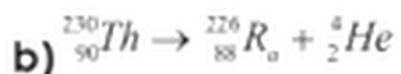
**18.14 A nitrogen nuclide  ${}_{7}^{14}\text{N}$  decays to become an oxygen nuclide by emitting an electron. Show this process with an equation.**

**Answer**

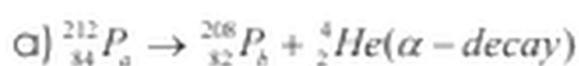


By the emission of an electron (P-particle) the atomic number of daughter element is increased by 1, this process is called  $\beta$ -decay.

**18.15 Determine which of these radioactive decay processes are possible:**



**Answer**



## CONCEPTUAL QUESTIONS

**18.1 Is it possible for an element to have different types of atoms? Explain.**

**Answer**

Yes, in case of isotope an element can have different types of atoms. For example:

Hydrogen may have three different atoms as protium( ${}^1_1\text{H}$ ), Deuterium ( ${}^2_1\text{H}$ ) and tritium ( ${}^3_1\text{H}$ ).

**18.2 What nuclear reaction would release more energy, the fission reaction or the fusion reaction? Explain.**

**Answer**

Fusion reaction would release more energy, but practically it is not possible to produce and control such fusion energy, because a large amount of energy is also required to produce fusion reaction.

**18.3 Which has more penetrating power, alpha a particle or gamma ray photon?**

**Answer**

A gamma ray photon has more penetrating power than  $\beta$ -particle. Alpha particle can be stopped by placing 'a paper in its way while gamma ray can even penetrate through a thick aluminum foil and can be stopped by a lead wall.

**18.4 What is the difference between natural and artificial radioactivity?**

**Answer**

In natural radioactivity, decay process takes place in unstable nuclei of radioactive elements, while in artificial radioactivity, a stable nuclide is made unstable for decay process by the bombardment of slow-moving neutron.

**18.5 How long would you likely have to wait to watch any sample of radioactive atoms completely decay?**

**Answer**

As the decay, process is a random process and half-lives of different radioactive elements is different so no exact time can be predicted. But statistical calculations may give us some idea of the complete decay of any element.

**18.6 Which type of natural radioactivity leaves the number' of protons and the number of neutrons in the nucleus unchanged?**

**Answer**

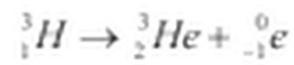
The emission of gamma rays leaves the number of protons and neutrons unchanged in the nucleus. Because, when a  $\alpha$  or  $\beta$  emission take place in the nucleus then the nucleus comes in excited state as resultant of this a gamma ray is also emitted with no change in protons or neutrons in the nucleus.

**18.7 How much of a 1g sample of pure radioactive matter would be left after four half-lives?**

**Answer**

After four half-lives, 1g of pure radioactive matter will be left as 0.0625g. Because after 1<sup>st</sup> half life it will be 0.5; after 2<sup>nd</sup> half life 0.25g; after 3<sup>rd</sup> half life 0.125g; and after 4<sup>th</sup> half life 0.0625g will be left.

**18.8 Tritium,  $^3_1\text{H}$  is radioactive isotope of hydrogen. It decays by emitting an electron. What is the daughter nucleus?**

**Answer**

${}^3_1\text{H}$  is a parent nucleus. By the emission of an electron, one of the atomic numbers is increased and we get one of the isotopes of helium ( ${}^3_2\text{H}$ ) as a daughter element.

**18.9 What information about the structure of the nitrogen atom can be obtained from its nuclide  ${}^7_{14}\text{N}$ .**

**Answer**

${}^{14}_7\text{N}$  have the atomic number 7 and atomic mass 14. It means that there are 7 protons and 7 neutrons in the nucleus of  ${}^{14}_7\text{N}$ . While in  ${}^{16}_7\text{N}$ , the atomic number is same but atomic mass is different i.e. 16 which shows that  ${}^{16}_7\text{N}$  is an isotope of nitrogen.

