

Important Short Questions

Q2. Give short Answers.

1. What is nuclear Physics?

Answer

The branch of Physics, which deals with the study of the properties of isolated nuclei of atoms.

2. What is the size of an atom and nucleus?

Answer

- The size of an atom is the order of 10^{-10} m.
- The size of a nucleus is of the order of 10^{-14} m.

3. How much mass may be concentrated in the nucleus of an atom?

Answer

99.9% of the total mass of an atom is concentrated in the nucleus of an atom.

4. What are isotopes?

Answer

Isotopes are those elements whose atomic numbers are the same but their atomic mass numbers are different.

5. Define atomic mass number and atomic number.

Answer

Atomic mass number

The total number of protons and neutrons in the nucleus of an atom is called atomic mass number. It is denoted by A.

Atomic number

The number of protons present in the nucleus of an atom is called atomic number. It is denoted by Z.

It is also called charge number.

6. Who discovered natural radioactivity?

Answer

Henri Becquerel discovered natural radioactivity in 1896.

7. Define radioactivity.

Answer

Radioactivity is such a process in which the elements with the charge number greater than 82, naturally keep on radiating.

8. What are the radioactive elements?

Answer

There are certain elements in nature with powerful radiations continuously. These elements are called radioactive elements.

Example: Plutonium, Radium, Uranium.

9. What is a-rays?**Answer**

The spot on the left is due to the arc of a large circle indicating a group of positively charged particles, called a-rays.

10. Define artificial radioactivity.**Answer**

The emission of radiations from the nuclei of light elements due to bombardment by some fast-moving particles is known as artificial radioactivity.

11. What are radioactive isotopes?**Answer**

The radioactive elements whose atomic numbers are same but have different atomic mass numbers are called radiative elements.

12. Give two uses of radio isotopes.

Answer

Radio isotopes are used in agriculture.

Radio isotopes are used in medicines.

13. Why the nucleus of an atom becomes stable?**Answer**

The nuclear forces between different nucleons are strong enough and attractive so as to overcome the repulsive electrostatic forces. This is why the nucleus remains stable.

14. What is meant by half-life of an element?**Answer**

The half-life of an element is that time during which the number of atoms of that element are reduced to one half.

15. What are β -rays?**Answer**

The spot situated on the arc of a small circle on the right, indicated the presence of negatively charged particles, which are known as β -rays.

16. Give an example of half-life of an element?

Answer

If the half-life time of a radioactive element is T , then at the end of this time the number of atoms in this element remains one half, after a time $2T$, the number of atoms remains 25 % and after time $3T$, the number of atoms is reduced to 12.5 % of the initial number.

17. Differentiate between parent element and- daughter element?**Answer**

During radiation emission reaction, the original element is called the parent element and the newly formed element is called the daughter element.

18. Give some characteristics of unstable, nuclides.**Answer**

- These elements have atomic number greater than 82.
- These elements are unstable in nature.
- They emit radiations all the time.
- They emit different types of strong radiations.
- They continuously change from one type of element to another.

19. How stable elements can be changed into unstable elements?**Answer**

The stable elements can be changed into unstable form by bombarding them with neutrons. Such elements are called radioactive isotopes.

20. How radioactive isotopes help in the treatment of cancer?**Answer**

The parts suffering from cancer absorb more quantity of isotopes, and thus indicate the correct position of the diseased part, which help in the treatment. Radioactive isotopes also cure some types of cancers.

Example: Radioactive cobalt 60 is used for curing cancerous tumors and cells.

21. What are γ -rays?**Answer**

The spot in the middle indicates the particles, which do not carry any charge and are known as γ -rays.

22. Distinguish between stable and unstable nuclides.**Answer**

Stable nuclide: The nuclei, which do not emit radiations naturally are called stable nuclide.

Example: Usually most of the nuclei whose atomic number are from 1 to 82 are stable nuclei.

Unstable nuclei: The elements, whose atomic number is more than 82 are naturally unstable. These elements emit all the time different type of radiations and continuously change from one type of element to another.

Example: Plutonium, Radium, Uranium

23. Which type of radiations are emitted during the process of radioactivity?

Answer

During the process of radioactivity, three different types of radiations are emitted which are termed as Alpha Beta and Gamma radiations.

24. What part of radioactive atom disintegrates during radioactivity?

Answer

During the process of radioactivity, nucleus disintegrates into new elements by the emission of α , β , and γ -radiations.

25. What are artificial radioactive elements?

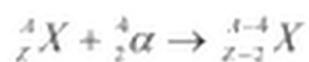
Answer

Using modern techniques, the elements, which are much lighter than the natural radioactive elements, are radioactive. Such elements are called artificial radioactive elements

26. What is effect on an element by the emission of a-particle?

Answer

If an a-particle is emitted by an element then



The new element decreases 4 its atomic mass number and 2 its atomic number after the emission of an off a-particle.

27. What is effect on an element by the emission of β -particle?

Answer

If a β -particle is emitted by all element then:



The atomic number of the newly produced element remains the same, but its charge number increases by one unit.

28. What is meant by mass energy equation?

Answer

Einstein's relation is given by:

$$E = m c^2$$

Where $m =$ mass of Matter
 $c =$ speed of light

This relation is called mass-energy equation.

29. Which is the lightest and heaviest element found in nature?

Answer

- The lightest of all elements is hydrogen.
- The heaviest element found in nature is Uranium ${}_{92}^{238}\text{U}$

30. Why alpha particles are called helium nuclei?

Answer

Alpha rays consist of positively charged particles whose mass is 4-times that of Hydrogen atom and they carry a charge twice that of a proton. Hence α -particles are called Helium nuclei.

31. Why β - particles are called fast moving electrons?

Answer

β -rays are emitted by the radioactive elements with great speed (99% of the speed of light). Their mass is small and carries negative charge. Hence β -rays are called fast moving electrons.

32. What is fission reaction?

Answer

The breaking of a nucleus into two parts with the release of large amount of energy is called fission reaction.

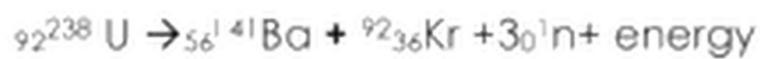
33. Why a large amount of energy is released during fission reaction?

Answer

In the fission reaction, when a nucleus breaks, the sum of the masses of the produced nuclei and the neutrons is less than the mass of the original nucleus. This difference of mass results in the release of energy according to Einstein's mass-energy equation.

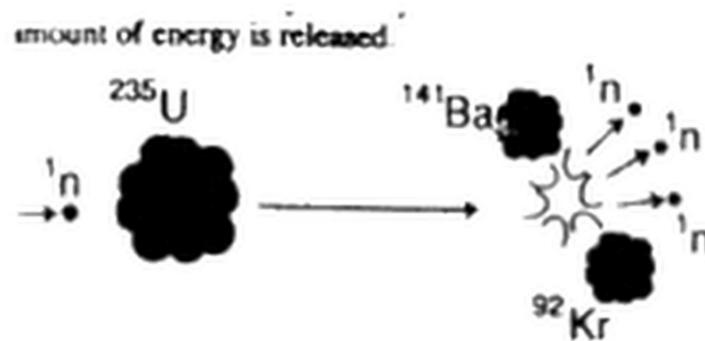
34. Give an example of nuclear fission reaction.

Answer



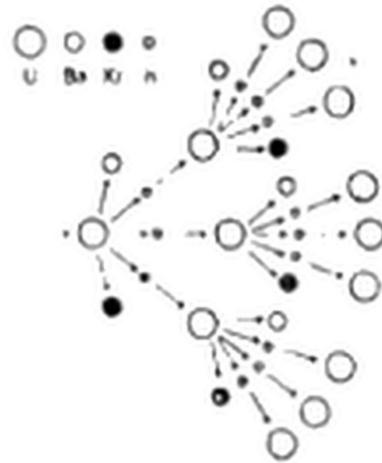
Here Ba and Kr denote Barium and Krypton respectively.

In this process of breaking a heavy element into two nuclei, a large amount of energy is released.



35. Why fission reaction becomes chain reaction? Answer

When a neutron reacts with a uranium nucleus, two or three neutrons are released. Every one of these reacts with next nuclei producing two or three more neutrons and hence, the number of available neutrons and the



fission goes on increasing. Such a reaction is called the chain reaction.

36. Why chain reaction becomes uncontrollable?

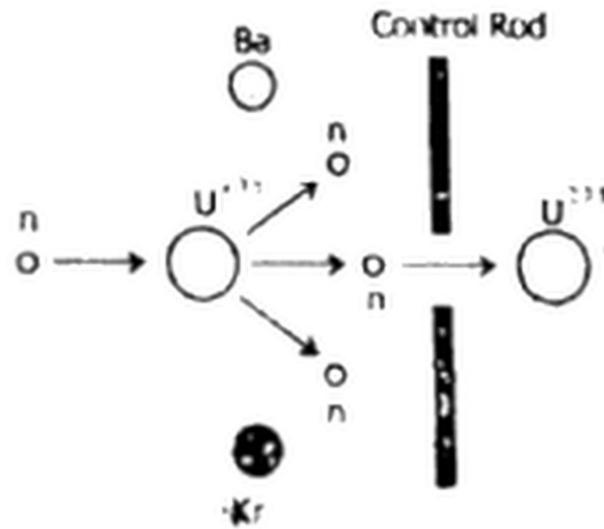
Answer

In the chain reaction, as the fission reaction builds up, the liberated energy goes on increasing. The fission reaction thus become uncontrollable and hence whole of the matter explodes which results in great destruction.

37. How fission reaction is controlled?

Answer

In the nuclear reactor, Boron or Cadmium rods absorb the surplus neutrons.



38. Whether atomic bomb is an example of fission reaction?

Answer

Yes, the fission reaction thus uncontrollable and whole of the matter explodes, which results in great destruction. Such a reaction is used in atomic bomb.

39. What is nuclear reactor? Answer

The nuclear reactor is device to produce nuclear energy in controlled manner, using fission reaction.

40. What is fusion reaction?

Answer

A process in which the light nuclei diffuse to form a heavier nucleus is called fusion reaction.

41. Write some applications of mass-energy equation. This equation shows that mass is converted into energy.

Answer

- It is helpful in determining the energy obtained from nuclear reaction.
- This equation predicts the amount of energy, which is released from the sun and the stars.

42. What is the source of solar energy?

Answer

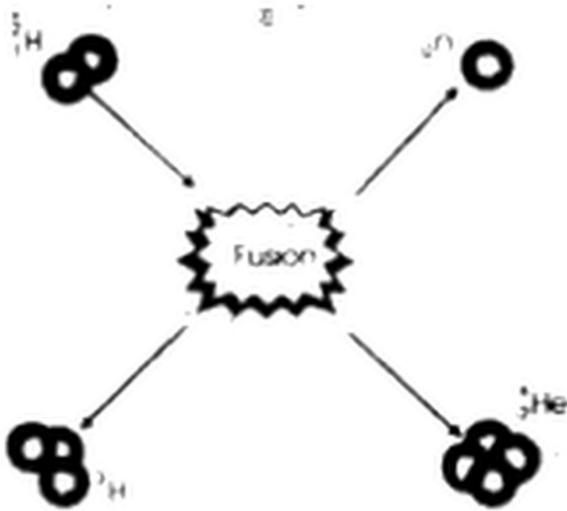
Scientists considered that the energy coming from the sun and the stars is due to the fusion nucleons. For producing α -particles hydrogen has to be converted into helium.

43. Give an example of a fusion reaction. Answer

If an atom of deuterium is fused with an atom of tritium then a helium nucleus or α -particle is formed.



In a fusion reaction if isotopes of hydrogen form a helium nucleus, nearly 17.6 MeV of energy is liberated. But it is very difficult to produce a fusion reaction.



44. Differentiate between fission and fusion reaction.

Answer

Fission Reaction	Fusion Reaction
In this process, heavy nucleus splits up into light nuclei	In this process, light nuclei fuse together to produce heavy nucleus.
Energy is needed to start fission reaction.	A very high temperature is required to start the fusion reaction.
In fission reaction, unit mass produce small energy than fusion reaction.	In fusion reaction, unit mass produce large energy than fission reaction.
Fission reaction is controllable.	Fusion reaction is uncontrollable.

45. Why it is very difficult to produce a -fusion reaction?

Answer

It is very difficult to produce a fusion reaction because when nuclei are brought near each other for fusion, work has to be done against the electrostatic force, which requires great amount of energy or heat.

46. Give some properties of α -rays?

Answer

- α -particles are the nuclei of Helium.
- α - rays are emitted with the speed ranging between 1.4×10^7 and 1.7×10^7 ms⁻¹.
- They affect the photographic plate.
- α -particles ionizes the gas through which they pass.
- Penetration power of α -particles is very low.

47. Write some properties of β -rays?

Answer

- β -rays consists of fast-moving electrons and carry negative charge.
- They are affected by electric and magnetic fields.
- They can also affect the photographic plate.
- They move with the speed of light.
- They produce fluorescence in many substances.

48. Write some characteristics of γ -rays?

Answer

- γ - rays move with the speed of light.
- These rays are not affected by electric and magnetic fields.
- Their penetration power is very high.
- Their ionization power is very low.
- These are electromagnetic in nature.

49. Which reaction is responsible for the solar and stellar energy?

Answer

Bethe had suggested that a chain reaction taking place inside the sun. According to this reaction, when 4 Hydrogen nuclei fuse together to form a Helium nucleus, then along with two positron and three α -rays nearly 25.7 % MeV of energy is also released. This reaction is responsible for the solar and stellar energy.

50. Whether hydrogen bomb is an example of fusion reaction?

Answer

Yes, hydrogen bomb is an example of fusion reaction.

For fusion reaction the required temperature is achieved by exploding a fusion bomb.

51. How one isotope of an element differs from the other isotope of the same element?

Answer

Isotope of an element has same chemical properties due to same charge number. However, their physical properties are different for every isotope of the same element.

52. Why do α -particles have highest ionization power?

Answer

α -particles have the highest ionization power due to following reason:

- It is the heaviest particle of all the three type of radioactive radiations. It is most heavily charged.

53. What is the use-of Phosphorus-32?

Answer

Phosphorus-32 is used to detect tumors in the brain.

54. Why radiations can be very harmful for us?

Answer

Radiations can be very harmful for us because:

- It can damage our body.
- Excessive radiations may cause cancer.
- They can destroy our body cells.

55. What are the precautions to minimize radiation as danger?

Answer

The following steps should be taken to minimize the radiations danger:

- One should keep a safe distance away from the radiation emitting sources.
- Only the required portion of the body should be exposed to radiation for treatment.
- The nuclear waste must be buried in the desert.
- The radioactive material must be placed in a box of the persons working in the laboratories, where radioactive material is available must get themselves medically checked regularly.

56. What does (A-Z) value indicate?**Answer**

For finding the number of neutrons we use the relation

$$N = A - Z$$

Where-

N = number of neutrons

A = atomic mass

Z = atomic number

57. Why neutron source is used to produce isotopes?**Answer**

A neutron source from a nuclear reactor is often used to produce isotopes. Slow neutrons with low kinetic energies are used to bombard the element or a compound. Since the neutrons are electrically neutral, they are easily captured by the nuclei of the element.

58. Name some source of radiations.

Answer

All the three types of radiations come from the unstable nuclei of elements.

Examples: Uranium, Plutonium, Radium, Radon etc..

59. Why do heavy nuclei become unstable?

Answer

As the nuclear force between the nucleons is stronger than the Coulomb's repulsive force between the protons. In case of smaller nuclei, the distance between the protons is smaller and strong nuclear force is more dominant. However, with the addition of more nuclei, the distance between the protons increases and as strong nuclear force is short range, it becomes weaker and Coulomb's repulsive force become dominant and nucleus becomes unstable.

60. How radioisotopes are made?

Answer

Bombarding a radioactive element with neutrons and other particles under suitable conditions makes radioisotopes.

