

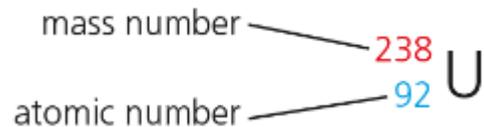
Explain the difference between irradiation and contamination.

Irradiation is where an object is exposed to nuclear radiation. The object does not become radioactive.

Contamination is the unwanted presence of materials containing radioactive atoms.

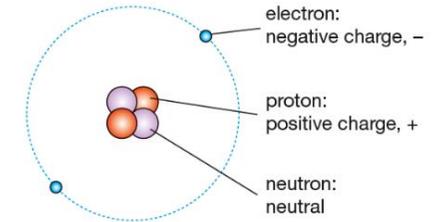
What is an isotope? Give an example.

Atoms of an element containing the same number of protons but different numbers of neutrons.



- 1 Atoms have a radius of about how many metres?
 i) 1×10^4 ii) 1×10^{10} iii) 1×10^{-10} iv) 1×10^{-4}
- 2 What is in the centre of an atom?
- 3 Which two particles make up the nucleus of an atom?
- 4 Where is most of the mass of an atom concentrated?
- 5 What charge does a proton have?
- 6 What charge does a neutron have?
- 7 What charge does an electron have and where is it found in the atom?
- 8 Electrons are found at different energy levels in the atom. How could an electron jump up to a higher energy level?
- 9 An electron might emit some infrared radiation. Would this make it jump to a higher energy level or fall down to a lower one?
- 10 What were the 'plums' in the 'plum pudding' model of the atom?
- 11 What experiment led Rutherford to come up with a model of the atom where most of the mass was in a central, positive nucleus.
- 12 Electrons were discovered which led to the plum pudding model. Protons were later identified as the source of the positive charge on the nucleus. What was the last particle to be discovered?
- 13 Is radioactive decay a random process or can it be predicted and controlled?
- 14 Why do some atomic nuclei give out radiation?
- 15 Activity is the rate at which a source of unstable nuclei decays. What is activity measured in?
- 16 What instrument is used to measure the activity of a radioactive source?
- 17 Name 4 types of nuclear radiation.
- 18 What is a beta particle?
- 19 What is an alpha particle?
- 20 What materials are used to identify whether a source is emitting alpha particles, beta particles or gamma waves?
- 21 Write down the symbols for alpha beta and gamma
- 22 In a nuclear equation, how would you represent an alpha particle?
- 23 In a nuclear equation, how would you represent a beta particle?
- 24 What happens to the mass of a radioactive source when it decays by losing an alpha particle?
- 25 What happens to the atomic number of a radioactive source if it changes into a different element by losing a beta particle?
- 26 Define 'half-life'.
- 27 If the count rate at the start of a radioactive decay experiment is 300 counts per minute and half an hour later it has fallen to 150 counts per minute, what is the half-life of the source?
- 28 Which type of radiation is the most ionising?
- 29 Which type of radiation is used in paper mills to help control thickness?
- 30 What is the difference between contamination and irradiation?

Module 4 Atomic Structure Knowledge Organiser



Name: _____

KEY WORDS/IDEAS TO REMEMBER

electron	atomic number
proton	Geiger-Muller
neutron	penetration
irradiation	ionising
contamination	decay
radioactive	exponential
isotope	random
alpha	becquerel, Bq
beta	sievert, Sv
gamma	smoke alarm
half-life	paper thickness
Plum pudding	tracer
Rutherford	gamma knife
scattering	charge
count rate	mass

What is ionisation?

Process in which electrons split away from their atoms.

Or

Process in which electrons are knocked off or added to atoms.

What are the 3 possible effects of irradiation on body cells?

1. Cell death.
2. Damaged cell that tries to repair but fails. This could lead to cancer.
3. Damaged cell that is repaired successfully.

Write at least 4 facts about an alpha particle. Do another 4 for a beta and another 4 for gamma.

Alpha

Contains 2 protons and 2 neutrons. It is a helium nucleus

Most ionising. 'Massive' compared to a beta particle.

Has a charge of +2. Stopped by a few sheets of paper

Short range (2-3cm) in air

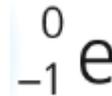


Beta

Fast moving electron. Has a charge of -1.

Can travel a few metres in air.

Stopped by Al about 3mm thick. Middle of the 3 in terms of ionisation.



Gamma

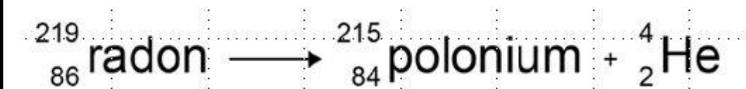
Electromagnetic wave. No charge or mass. Least ionising.

Most penetrating - several metres of concrete or several cm of lead.

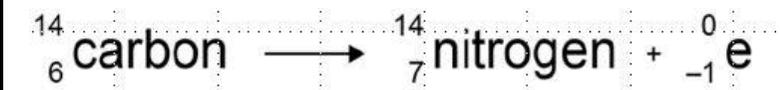
Shortest wavelength in the em spectrum

Balanced nuclear equations

Alpha decay: The mass number goes down by 4 and the atomic number goes down by 2.



Beta decay: The mass number stays the same and the atomic number goes up by 1.

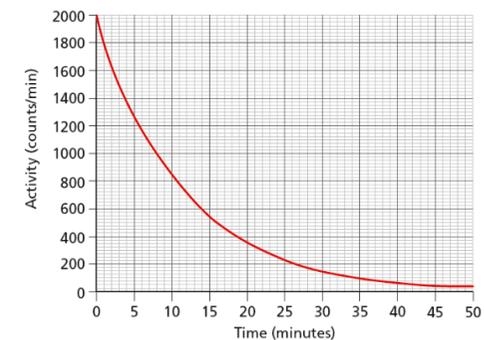


Define 'half-life'

The average time it takes for half of all nuclei present in a sample of a radioactive element to decay.

What is the difference between Carbon -14 and carbon -12?

Carbon 14 has two extra neutrons. (Both have 6 protons because they are carbon, but carbon-12 has 6 neutrons and carbon-14 has 8)



What is the half-life of the radioisotope that produced the decay curve above?

8 minutes