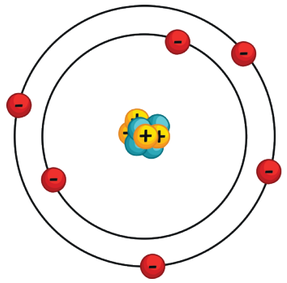
a

Complete the diagram below to show where in an atom you would find the protons, neutrons and electrons.



_____

_____

_____

Explain why atoms have no overall charge.

_____

_____

b

Complete the sentences by deleting the incorrect answers.
Most of the mass of an atom is concentrated in the nucleus/ electron shells.

The element sodium is shown below.

23
Na
11

Sodium has the following number of...

protons: _____

neutrons: _____

electrons: _____

c

Two isotopes of carbon are shown below:

$^{12}_{6}C$ $^{14}_{6}C$

Complete the sentences by choosing the correct words from the box below:

electrons, neutron, elements, beta compounds, gamma protons, radiation

Isotopes are the same element. They have the same number of _____ but a different number of _____. Most unstable elements tend to decay into other _____ and give out _____. There are 3 types of ionising radiation: alpha, _____and _____.

d

Describe the plum pudding model of the atom.

_____

_____

e

Radioactive decay is the process of the nucleus emitting ionising radiation.
The unit for radioactivity is _____

Explain the term count rate.

_____

Name the piece of equipment used to determine count rate.

_____

Name three safety precautions to be taken when handling a radioactive source.

1. _____
2. _____
3. _____

f

State the difference between irradiation and contamination.
keywords: exposed, radioactive, contaminated, harmful

_____

_____

_____

_____

_____

g

Type of Radiation	Description	Penetration	Range in Air	Ionising Power
Alpha	helium nucleus	stopped by p _____	a few c _____	s _____
B _____	high-speed electron	stopped by a _____	several metres	m _____
G _____	EM radiation	stopped by l _____	at least a k _____	w _____

h

Cobalt-60 has an activity rate of 1000Bq and a half-life of 5 years. What will be the activity after 10 years?
Hint: what would be its activity after 5 years? Repeat this for the next 5 years.

_____

_____

_____

_____

_____

i

The equation below shows the beta decay of carbon-14.

$$^{14}_{6}\text{carbon} \rightarrow {}^{14}_{7}\text{nitrogen} + {}^{0}_{-1}e$$

Complete the sentence by deleting the incorrect answers:

Beta decay does/does not cause a change in mass of the nucleus but does/does not cause the charge of the nucleus to change.

a

The equation below shows the alpha decay of radon.

$$^{219}_{86}\text{radon} \longrightarrow {}^{215}_{84}\text{polonium} + {}^{4}_{2}\text{He}$$

Complete the sentence by deleting the incorrect answers:

Alpha decay causes a increase/decrease in the mass of the nucleus.

Complete the following equation for the alpha decay of uranium-234:

$$^{234}_{92}\text{U} \longrightarrow \text{Th} + \text{He}$$

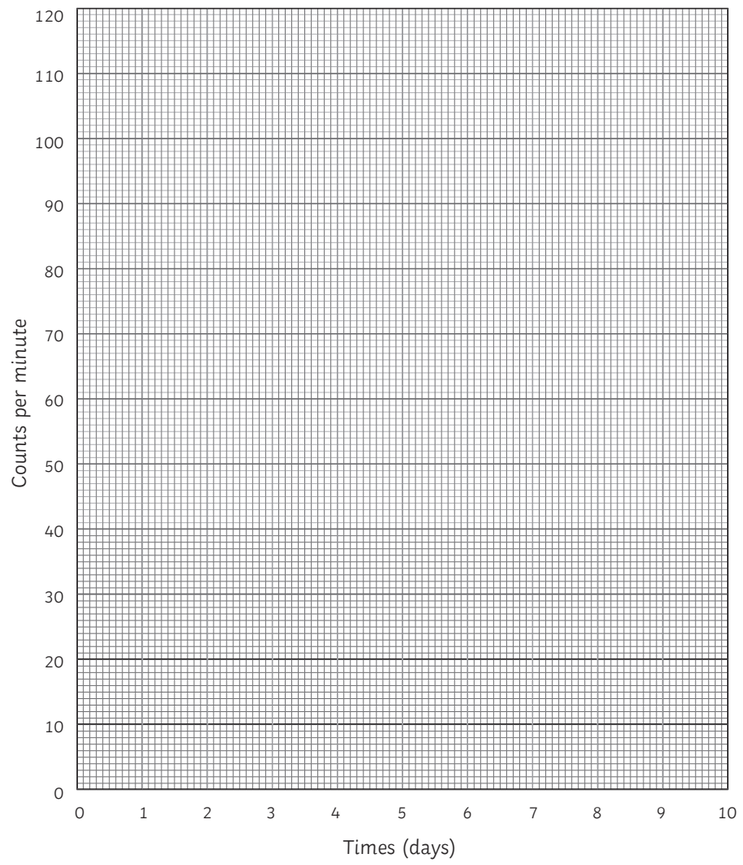
b

Define the term half-life

Substance A is a radioactive material that will change with time. The data below shows the radioactivity of substance A.

Time (days)	0	2	4	6	8	10
Count rate (counts/second)	120	60	30	15	7.5	3.75

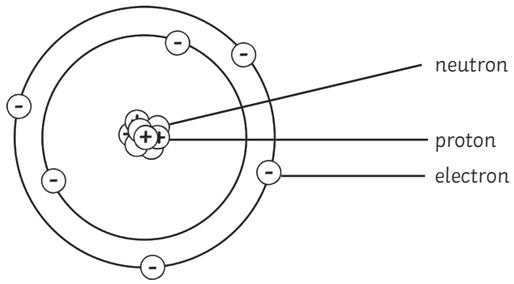
Plot a half-life graph on the graph paper below.



Use your graph to calculate the half life.

a

Complete the diagram below to show where in an atom you would find the protons, neutrons and electrons.



⊖ electrons

⊕ protons

◯ neutrons

Explain why atoms have no overall charge.
Atoms have no overall charge because the number of protons equals the number of electrons.

b

Complete the sentences by deleting the incorrect answers.
Most of the mass of an atom is concentrated in the nucleus/ ~~**electron shells.**~~

The element sodium is shown below.

$^{23}_{11}Na$

Sodium has the following number of...

protons: 11

neutrons: 12

electrons: 11

c

Two isotopes of carbon are shown below:

$^{12}_{6}C$ $^{14}_{6}C$

Complete the sentences by choosing the correct words from the box below:

electrons, neutron, elements, beta compounds, gamma protons, radiation

Isotopes are the same element. They have the same number of protons **but a different number of** neutrons**. Most unstable elements tend to decay into other** elements **and give out** radiation**. There are 3 types of ionising radiation: alpha,** beta **and** gamma**.**

d

Describe the plum pudding model of the atom.
Atoms are spheres of positive charge with electrons stuck in them.

e

Radioactive decay is the process of the nucleus emitting ionising radiation.
The unit for radioactivity is Bq (becquerels)

Explain the term count rate.
The number of radiation counts per second.

Name the piece of equipment used to determine count rate.
Geiger-Müller counter.

Name three safety precautions to be taken when handling a radioactive source.

1. Wear gloves.
2. Use tongs to hold the source.
3. Wear protective clothing.

f

State the difference between irradiation and contamination.
keywords: exposed, radioactive, contaminated, harmful
Irradiation means an object has been exposed to a radioactive source but is not radioactive.
Contamination involves radioactive particles getting onto an object. It is contaminated and is harmful.

g

Type of Radiation	Description	Penetration	Range in Air	Ionising Power
Alpha	**h**elium nucleus	**s**topped by **p**aper	**a** few **c**ms	**s**trong
Beta	**h**igh-speed electron	**s**topped by **a**luminium	**s**everal metres	**m**edium
Gamma	**E**M radiation	**s**topped by **l**ead	**a**t least a **k**m	**w**eak

h

Cobalt-60 has an activity rate of 1000Bq and a half-life of 5 years. What will be the activity after 10 years?
Hint: what would be its activity after 5 years? Repeat this for the next 5 years.

250Bq

i

The equation below shows the beta decay of carbon-14.

$$^{14}_{6}\text{carbon} \longrightarrow {}^{14}_{7}\text{nitrogen} + {}^{0}_{-1}e$$

Complete the sentence by deleting the incorrect answers:

Beta decay ~~**does**~~**/does not cause a change in mass of the nucleus but does/**~~**does not**~~ **cause the charge of the nucleus to change.**

a

The equation below shows the alpha decay of radon.

$$^{219}_{86}\text{radon} \longrightarrow {}^{215}_{84}\text{polonium} + {}^{4}_{2}\text{He}$$

Complete the sentence by deleting the incorrect answers:

Alpha decay causes a ~~increase~~/decrease in the mass of the nucleus.

Complete the following equation for the alpha decay of uranium-234:

$$^{234}_{92}\text{U} \longrightarrow {}^{230}_{90}\text{Th} + {}^{4}_{2}\text{He}$$

b

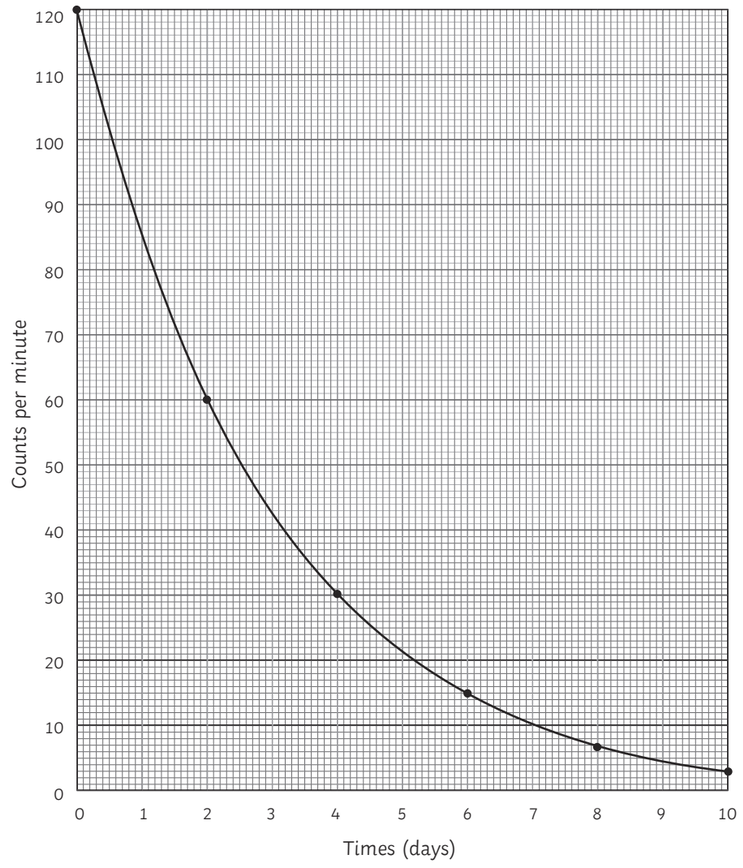
Define the term half-life

The time taken for the radioactivity of a specified isotope to fall to half its original value.

Substance A is a radioactive material that will change with time. The data below shows the radioactivity of substance A.

Time (days)	0	2	4	6	8	10
Count rate (counts/second)	120	60	30	15	7.5	3.75

Plot a half-life graph on the graph paper below.



Use your graph to calculate the half life.

2 days