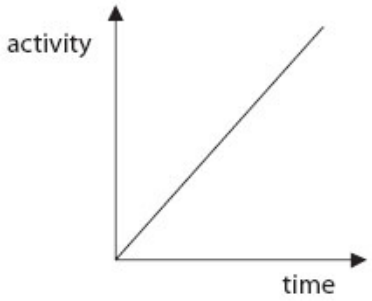
Questions

Q1.

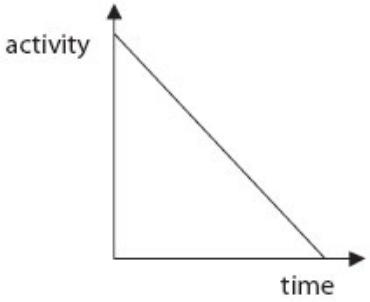
Which graph best shows how the activity of a radioactive isotope changes with time?

Put a cross (☒) in the box next to your answer.

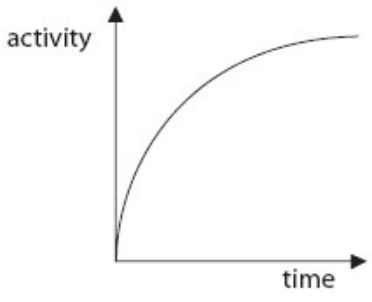
(1)



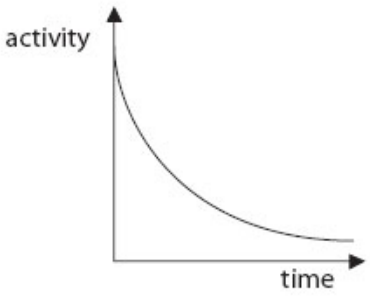
☐ **A**



☐ **B**



☐ **C**



☐ **D**

Q2.

Complete the sentence by putting a cross (☒) in the box next to your answer.

The unit of activity of a radioactive isotope is the

(1)

☒ **A** americium

☒ **B** becquerel

☒ **C** einstein

☒ **D** radium

Q3.

Ionising radiations are emitted by unstable nuclei.

Complete the sentence by putting a cross (☒) in the box next to your answer.

Following the radioactive decay of a nucleus, the nucleus might undergo some rearrangement, losing energy as

(1)

☒ **A** gamma radiation

☒ **B** a proton

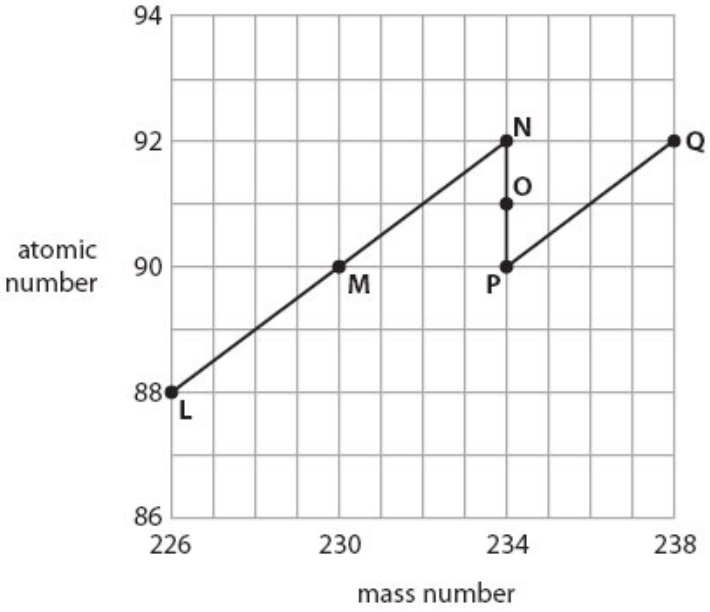
☒ **C** a neutron

☒ **D** an X-ray

Q4.

Uranium-238 is an isotope of uranium. It may undergo either radioactive decay or nuclear fission.

A nucleus of uranium-238 is shown as **Q** in the chart.



State **two** letters from the chart which show isotopes of the same element.

(1)

.....and ..... .

Q5.

Alpha, beta and gamma are types of ionising radiation.

State **two**ways in which gamma radiation is different from alpha radiation.

(2)

.....

.....

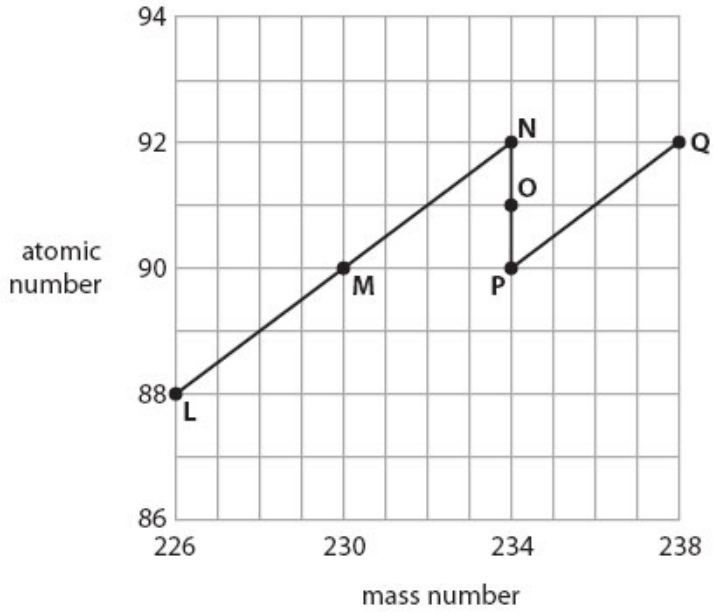
.....

.....

Q6.

Uranium-238 is an isotope of uranium. It may undergo either radioactive decay or nuclear fission.

A nucleus of uranium-238 is shown as **Q** in the chart.



Explain what happens when **Q** decays to **P.**

(2)

.....

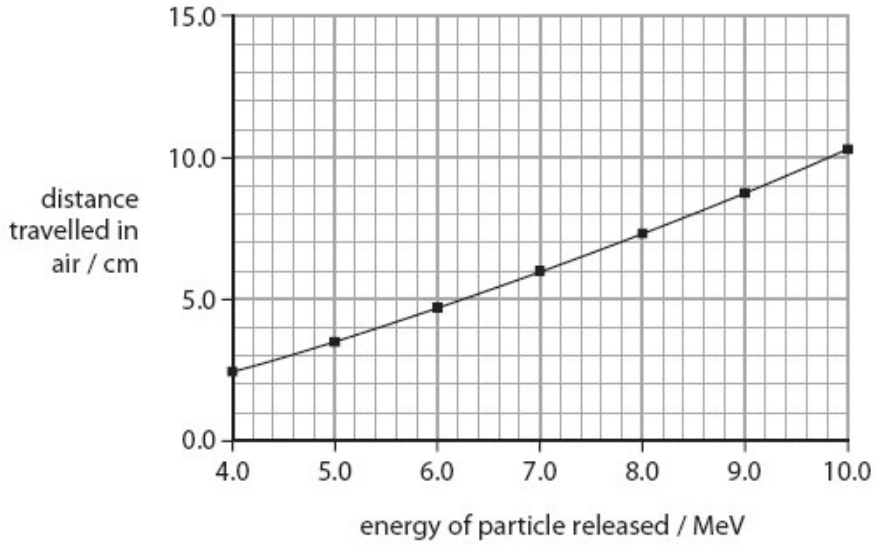
.....

.....

.....

Q7.

Particles released during radioactive decay can have different energies.
A suitable unit for these energies is MeV.
For one type of decay, the particles released have energies between 4.0 MeV and 10.0 MeV.
The graph shows how far the particles with these energies travel in air.



(i) State the name of this type of particle.

(1)

.....

(ii) Use information from the graph to describe how the distance travelled in air depends on the energy of the particle.

(2)

.....

.....

.....

.....

Q8.

Figure 17 shows a Geiger-Müller (GM) tube used for measuring radioactivity.

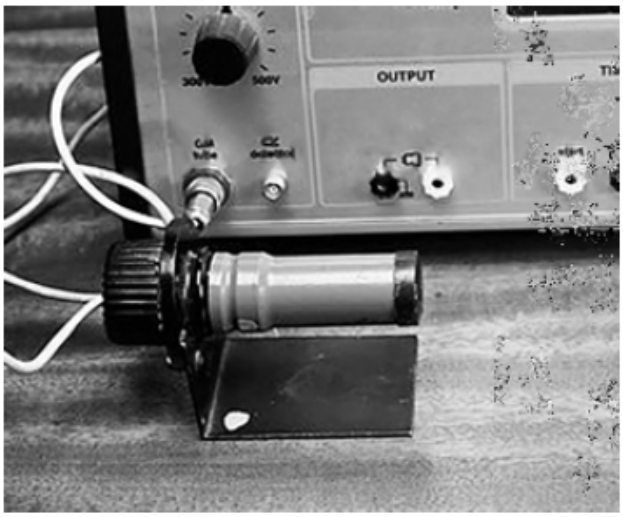


Figure 17

Describe how a teacher should use a Geiger-Müller (GM) tube to compare the count-rates from two different radioactive rocks.

(4)

.....

.....

.....

.....

.....

.....

.....

.....

(Total for question = 4 marks)

Q9.

Some radioactive isotopes emit positrons.

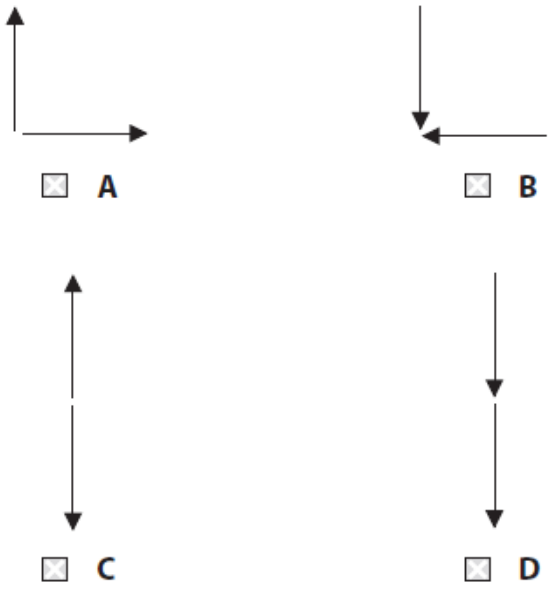
Positrons are used to make gamma rays.

When a positron annihilates an electron, two gamma rays are produced.

(i) Which diagram shows the directions of the two gamma rays produced?

Put a cross (☒) in the box next to your answer.

(1)



(ii) Explain how charge is conserved when an electron annihilates a positron.

(3)

.....

.....

.....

.....

(iii) Explain how mass and energy are conserved when an electron annihilates a positron.

(2)

.....

.....

.....

.....

Q10.

* Some scientists carry out an experiment to measure the radioactivity from a source to be

used in a factory.

They measure the background radiation before and after their experiment.

They take the background count at the same place as they do their experiment.

Explain how this procedure helps to make sure that the results of the experiment are valid.

(6)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

Q11.

Figure 17 shows a Geiger-Müller (GM) tube used for measuring radioactivity.

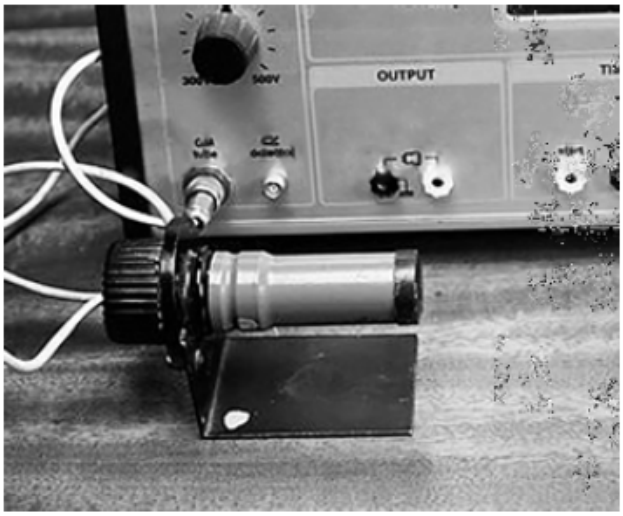


Figure 17

* A radioactive rock is placed near to the front of a Geiger-Müller (GM) tube.

A radioactivity count-rate is first made in air.

The count-rate is measured again with each of three different absorbers between the rock and the GM tube.

Figure 19 shows the count-rates measured.

absorber	count-rate in counts per minute
3 cm of air	1272
thin sheet of paper	931
3 mm thick sheet of aluminium	328
2 cm thick sheet of lead	21

Figure 19

A scientist has an idea that the rock emits three different types of radiation.

Explain how the data in this table supports the scientist's idea.

(6)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(Total for question = 6 marks)

Q12.

In 1908 a scientist called Rutherford was investigating ideas about atoms.

His students fired a beam of alpha particles at a thin piece of gold foil.

Figure 5 shows the arrangement of the experiment.

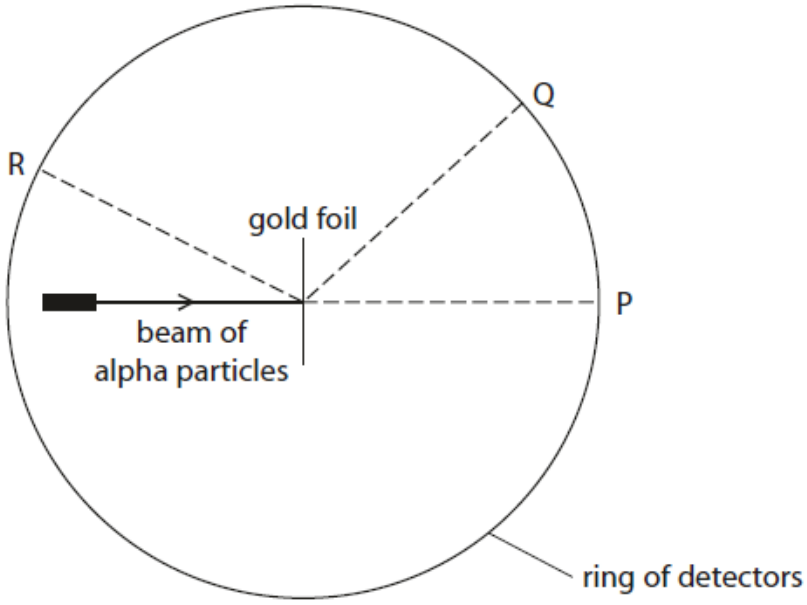


Figure 5

Some alpha particles were found at all parts of the ring of detectors.

The table in Figure 6 shows how many alpha particles were detected at P, at Q and at R, in one

experiment.

position	number of alpha particles detected
P	72340
Q	25
R	2

Figure 6

Explain what the information in Figure 5 and Figure 6 shows about the structure of an atom.

(6)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(Total for question = 6 marks)

Q13.

Carbon-14 is a radioactive isotope that occurs naturally.

Scientists use carbon-14 to help find the age of old pieces of wood.

This technique is called carbon dating.

It uses the idea of half-life.

(a) Which of these describes half-life?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** the time it takes for half of the undecayed nuclei to decay

☒ **B** the time it takes for all of the undecayed nuclei to decay

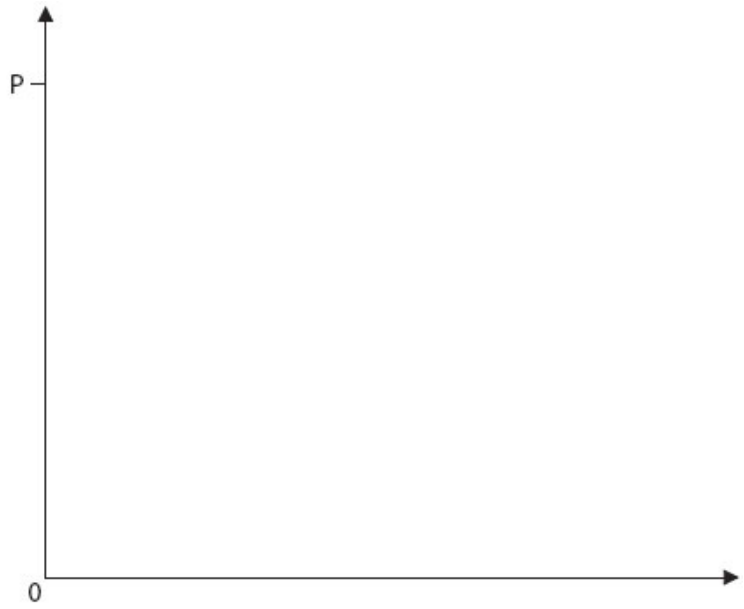
☒ **C** half the time it takes for all of the undecayed nuclei to decay

☒ **D** half the time it takes for half of the undecayed nuclei to decay

(b) Sketch a graph to show how the activity of a radioactive isotope changes with time.

Use the axes below. Start your line from point P.

(3)



(c) A scientist investigates an old wooden comb.

The activity of the carbon-14 in it is 0.55 Bq.

The estimated age of the comb is 11 400 years.

The half-life of carbon-14 is 5700 years.

(i) Calculate the activity of the carbon-14 in the comb when it was new.

(3)

activity = ...Bq

(ii) The scientist takes several readings of background radiation.

Explain why this is necessary to improve the accuracy of the investigation.

(2)

.....

.....

.....

.....

.....

(iii) Old objects like the comb emit a very small amount of radiation.

The activity from the comb is about the same as comes from background radiation.

Scientists have stopped measuring the activity of carbon-14 for carbon dating.

Instead, they can measure the mass of undecayed carbon-14 left in the sample.

Suggest a reason for this change.

(1)

.....

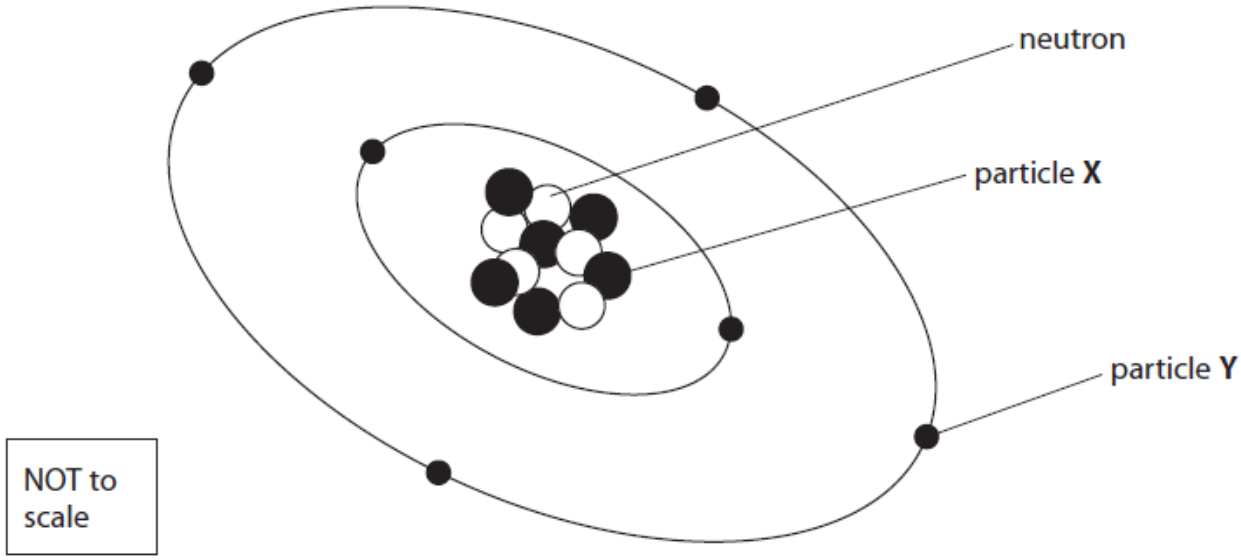
.....

.....

(Total for Question is 10 marks)

Q14.

(a) The diagram represents an atom of carbon.



(i) State the name of particle **X**.

(1)

.....

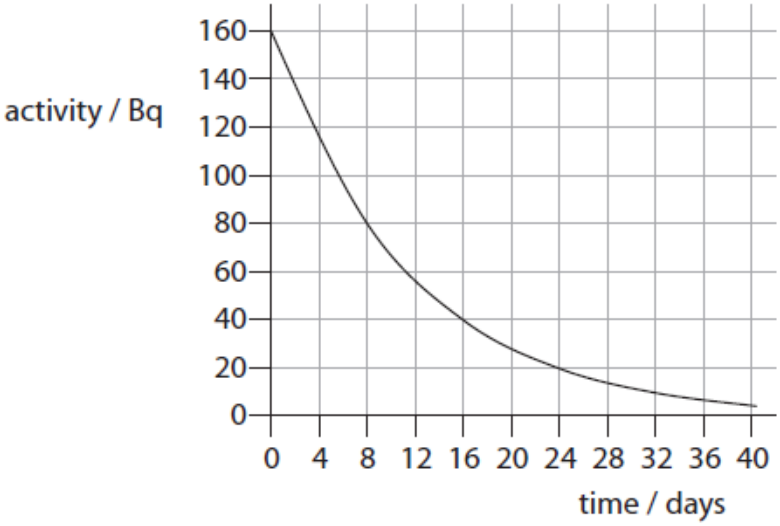
(ii) State the name of particle **Y**.

(1)

.....

(b) Iodine-131 is a radioactive isotope of iodine.

The graph shows how the activity of a sample of iodine-131 decreases with time.



(i) Use the graph to calculate the half-life of iodine-131.

(2)

half-life = ... days

(ii) Another sample of iodine-131 has an activity of 800 Bq.

Calculate how long it will take before its activity decreases to 200 Bq.

(2)

time = ... days

*(c) There are plans to build more nuclear power stations to supply electricity to the National Grid.

Discuss the advantages and disadvantages of using nuclear power to generate electricity.

(6)

.....

.....

.....

.....

.....

.....

.....

.....

(Total for Question = 12 marks)