

# Atoms and Isotopes

## Question Paper 1

Level	GCSE (9-1)
Subject	Combined Science: Trilogy - Physics
Exam Board	AQA
Topic	6.4 Atomic Structure
Sub-Topic	Atoms and Isotopes
Difficulty Level	Bronze Level
Booklet	Question Paper 1

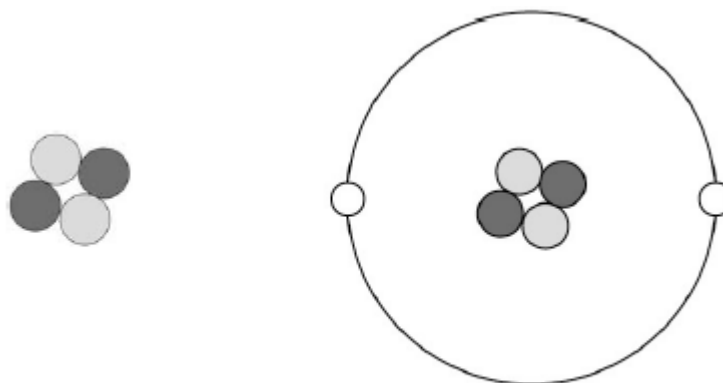
**Time Allowed:** 58 minutes

**Score:** /58

**Percentage:** /100

**Grade Boundaries:**

**Q1.** The figure below is a diagram of an alpha particle and a helium atom.



Alpha particle

Helium atom

(a) What is the approximate size of a helium atom?

Tick **one** box.

$1 \times 10^{-5}$  m

☐

$1 \times 10^{-10}$  m

☐

$1 \times 10^{-15}$  m

☐

$1 \times 10^{-20}$  m

☐

(1)

(b) A helium atom is much larger than an alpha particle.

Give **one** other difference between a helium atom and an alpha particle.

.....

.....

(1)

(c) What is the atomic number of the helium atom in the figure above?

Tick **one** box.

2

☐

4

☐

6

☐

8

☐

(1)

- (d) What is the charge on the helium atom in the figure above?

Explain your answer.

.....

.....

.....

.....

.....

(3)

- (e) Helium is a gas that occurs naturally.

There is very little helium on Earth.

Helium has important uses in medicine and is also used to inflate party balloons.

Some scientists believe that helium should **not** be used to inflate party balloons.

Why?

.....

.....

.....

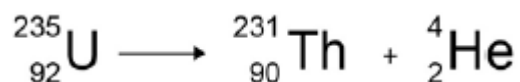
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(2)  
(Total 8 marks)

**Q2.** This question is about radioactive decay.

- (a) **Figure 1** shows a nuclear equation for the decay of an atom of uranium.

**Figure 1**



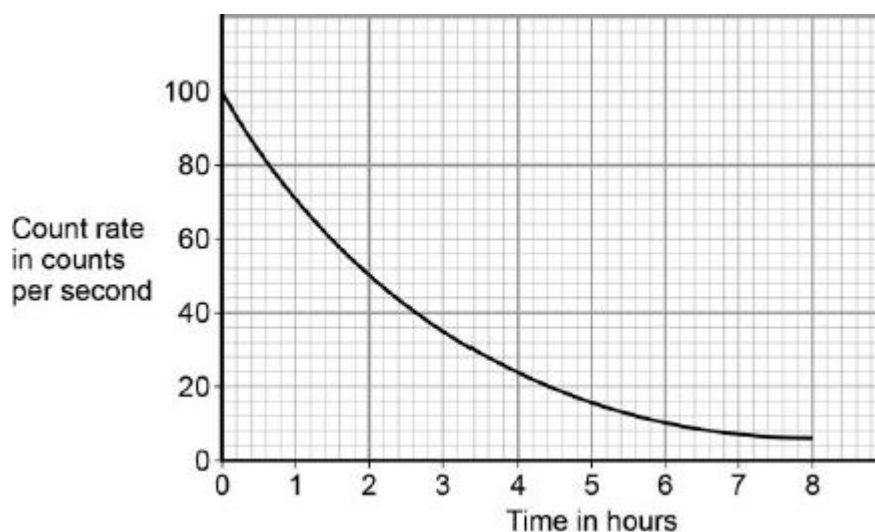
Use information from **Figure 1** to complete the table below.

	U	Th
Mass number	235	
Number of protons		90
Number of neutrons	143	

(3)

- (b) **Figure 2** shows how the count rate from a radioactive isotope changes with time.

**Figure 2**



What is the half-life of the radioactive isotope?

Explain why you chose that value.

Half-life = ..... hours

Explanation .....

.....

(2)

- (c) When a radioactive isotope decays it can produce beta particles.

What is a beta particle?

Tick **one** box.

A high-speed electron

☐

A neutron and an electron

☐

A neutron and a proton

☐

A helium nucleus

☐

(1)

- (d) Beta particles can cause cancer.

Complete the sentences.

Use words from the box.

<b>benign</b>	<b>controlled</b>	<b>differentiated</b>	<b>malignant</b>	<b>slow</b>	<b>uncontrolled</b>
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Tumours form when cell division is .....

Tumours that do not invade other tissues are called .....

(2)

(Total 8 marks)

**Q3.** Atoms contain three types of particle.

- (a) Draw a ring around the correct answer to complete the sentence.

The particles in the nucleus of the atom are

electrons and neutrons.
electrons and protons.
neutrons and protons.

(1)

- (b) Complete the table to show the relative charges of the atomic particles.

Particle	Relative charge
Electron	-1
Neutron	
Proton	

(2)

- (c) (i) A neutral atom has no overall charge.

Explain this in terms of its particles.

.....  
.....  
.....  
.....

(2)

- (ii) Complete the sentence.

An atom that loses an electron is called an .....  
and has an overall ..... charge.

(2)

- (d) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

Some substances are radioactive. They may emit alpha or beta particles.

Describe the characteristics of alpha particles and beta particles in terms of their:

- structure
- penetration through air and other materials
- deflection in an electric field.

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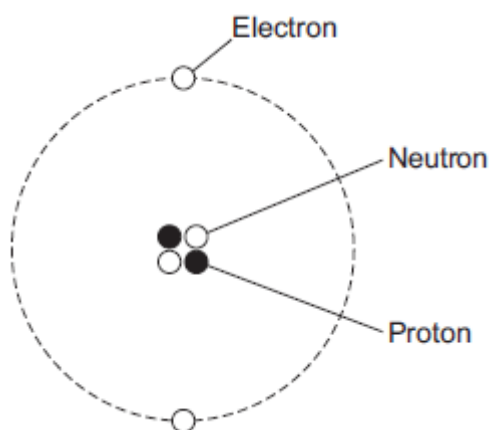
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(6)  
(Total 13 marks)

Q4.(a) The figure below shows a helium atom.



- (i) Which **one** of the particles in the atom is **not** charged?

Draw a ring around the correct answer.

**electron**

**neutron**

**proton**

(1)

- (ii) Which **two** types of particle in the atom have the same mass?

..... and .....

(1)

- (iii) What is the atomic number of a helium atom?

Draw a ring around the correct answer.

**2**

**4**

**6**

Give a reason for your answer.

.....  
.....

(2)

(b) Alpha particles are one type of nuclear radiation.



- (i) Name **one** other type of nuclear radiation.

.....

(1)

- (ii) Use the correct answer from the box to complete the sentence.

<b>electrons</b>	<b>neutrons</b>	<b>protons</b>
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The difference between an alpha particle and a helium atom is that the alpha particle does **not** have any .....

(1)

- (iii) Which **one** of the following is a property of alpha particles?

Tick (✓) **one** box.

Have a long range in air

☐

Are highly ionising

☐

Will pass through metals

☐

(1)

- (c) Doctors may use nuclear radiation to treat certain types of illness.

Treating an illness with radiation may also harm a patient.

- (i) Complete the following sentence.

The risk from treating a patient with radiation is that the radiation may ..... healthy body cells.

(1)

- (ii) Draw a ring around the correct answer to complete the sentence.

Radiation may be used to treat a patient if the risk from the

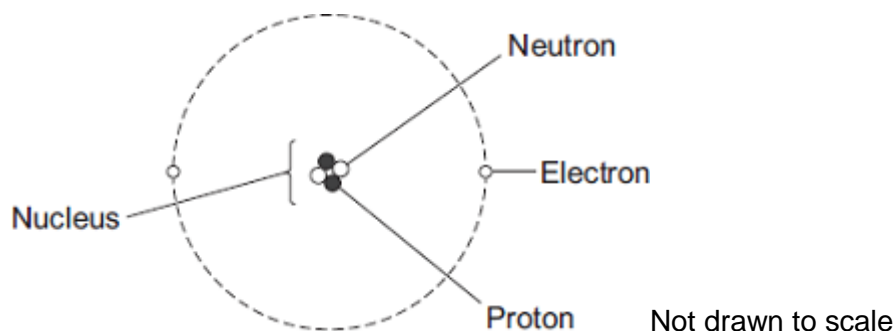
radiation is

much bigger than about the same as much smaller than
------------------------------------------------------------

the possible benefit of having the treatment.

(1)  
(Total 9 marks)

Q5. The diagram shows the structure of an atom.



- (a) In 1931 scientists thought that atoms contained **only** protons and electrons.

Suggest what happened in 1932 to change the idea that atoms contained only protons and electrons.

.....  
 .....

(1)

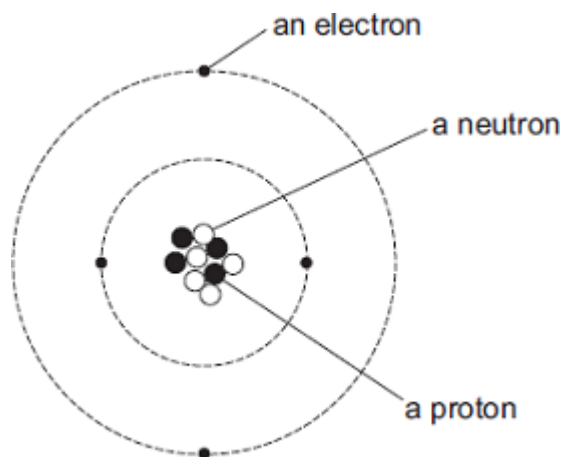
- (b) The table gives information about the particles in an atom.

Complete the table by adding the names of the particles.

Particle	Relative Mass	Relative Charge
	1	0
	very small	-1
	1	+1

(2)  
(Total 3 marks)

**Q6.** The diagram represents an atom of beryllium. The three types of particle that make up the atom have been labelled.



(a) Use the labels from the diagram to complete the following statements.

Each label should be used once.

The particle with a positive charge is .....

The particle with the smallest mass is .....

The particle with no charge is .....

(2)

(b) What is the mass number of a beryllium atom?

Draw a ring around your answer.

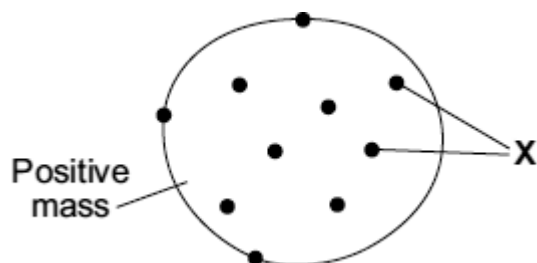
4	5	9	13
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Give a reason for your answer.

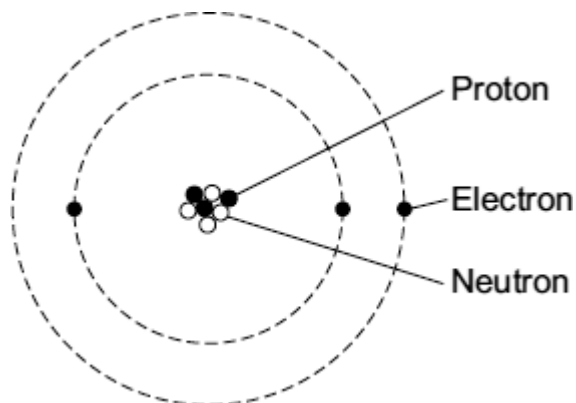
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(2)  
(Total 4 marks)

**Q7.** The diagrams show two different models of an atom.



**'Plum pudding' model**



**Model used today**

- (a) The particles labelled 'X' in the plum pudding model are also included in the model of the atom used today.

What are the particles labelled 'X' ?

.....

**(1)**

- (b) Scientists decided that the 'plum pudding' model was wrong and needed replacing.

Which **one** of the following statements gives a reason for deciding that a scientific model needs replacing?

Tick (✓) **one** box.

The model is too simple.

☐

The model has been used by scientists for a long time.

☐

The model cannot explain the results from a new experiment.

☐

**(1)**

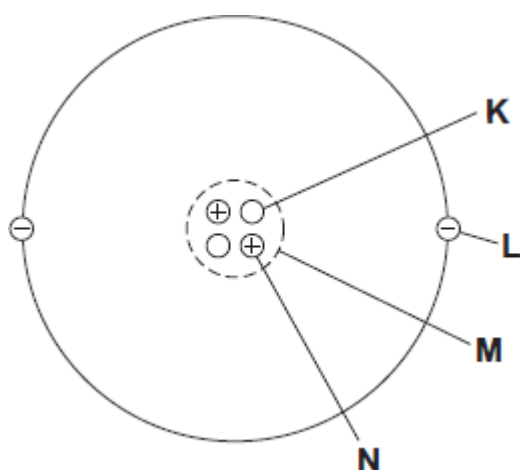
- (c) The table gives information about the three types of particle that are in the model of the atom used today.

Particle	Relative mass	Relative charge
	1	+1
	very small	-1
	1	0

Complete the table by adding the names of the particles.

(2)  
(Total 4 marks)

- Q8.** (a) The diagram represents a helium atom.



- (i) Which part of the atom, **K**, **L**, **M** or **N**, is an electron?

Part

(1)

- (ii) Which part of the atom, **K**, **L**, **M** or **N**, is the same as an alpha particle?

Part

(1)

- (b) A radioactive source emits alpha particles.

What might this source be used for?

Put a tick (✓) in the box next to your answer.

to monitor the thickness of aluminium foil as it is made in a factory

☐

to make a smoke detector work

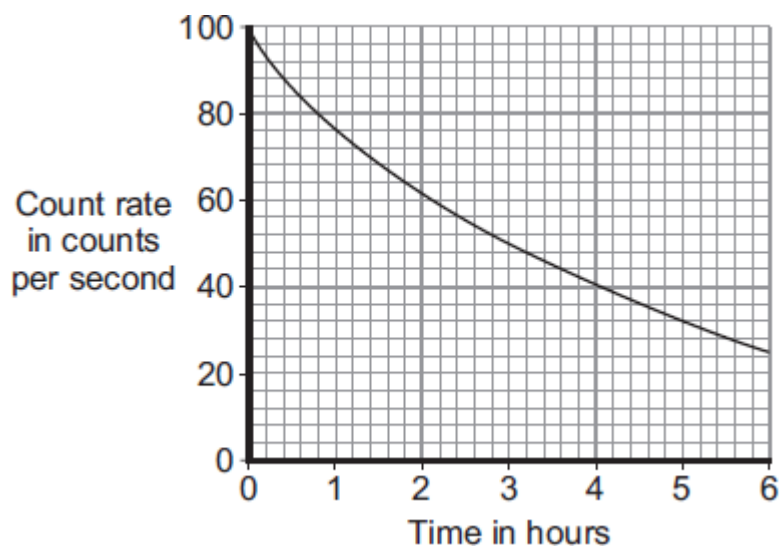
☐

to inject into a person as a medical tracer

☐

(1)

- (c) The graph shows how the count rate from a source of alpha radiation changes with time.

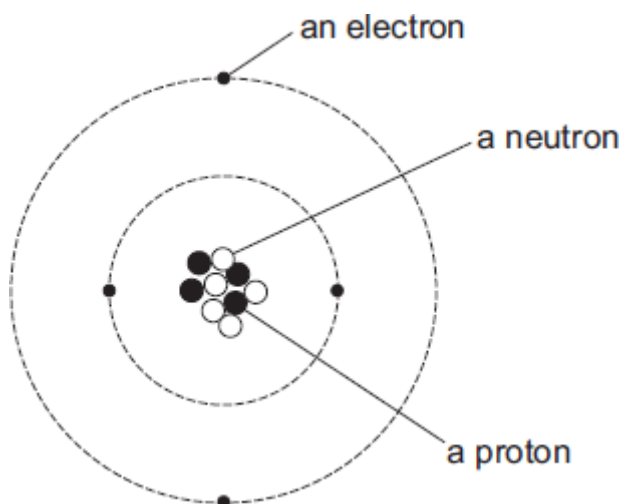


What is the count rate after 4 hours?

..... counts per second

(1)  
(Total 4 marks)

**Q9.** The diagram represents an atom of beryllium. The three types of particle that make up the atom have been labelled.



(a) Use the labels from the diagram to complete the following statements.

Each label should be used once.

The particle with a positive charge is .....

The particle with the smallest mass is .....

The particle with no charge is .....

(2)

(b) What is the atomic number of a beryllium atom?

Draw a ring around your answer.

4	5	9	13
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Give a reason for your answer.

.....

.....

(2)

- (c) Which **one** of the following statements describes what can happen to an atom to change it into an ion?

Tick (✓) **one** box.

The atom loses a neutron.

☐

The atom loses an electron.

☐

The atom loses a proton.

☐

(1)  
(Total 5 marks)