

Name:

Date:

P4 - Test 2
ATOMIC STRUCTURE
Beginner

GCSE

PHYSICS

AQA - Triple Science

Mark

Grade

Materials

For this paper you must have:

- Ruler
- Pencil and Rubber
- Scientific calculator, which you are expected to use when appropriate

Instructions

- Answer all questions
- Answer questions in the space provided
- All working must be shown

Information

- The marks for the questions are shown in brackets

1.

- (a) The names of three types of nuclear radiation are given in **List A**. Some properties of these three types of radiation are given in **List B**.

Draw a straight line to link each type of radiation in **List A** to its correct property in **List B**.
Draw only three lines.

List A Type of nuclear radiation	List B Property of radiation
alpha	not deflected by an electric field
beta	stopped by thin metal but not paper
gamma	the most strongly ionising
	will not harm living cells

(3)

- (b) Nuclear radiation is given out from the centre of some types of atom.

What name is given to the centre of an atom? _____

(1)

- (c) One of the substances in the table is used as a radioactive tracer. A hospital patient breathes in air containing the tracer. The radiation given out is measured by a doctor using a detector outside the patient's body.

Substance	Radiation given out	Solid, liquid or gas
X	alpha	gas
Y	gamma	gas
Z	gamma	solid

Which **one** of the substances, **X**, **Y** or **Z**, should be used as the tracer? _____

Give **two** reasons for your answer.

1. _____

2. _____

(3)

- (d) Radiation can also be used to kill the bacteria on fresh food.

Give **one** reason why farmers, shop owners or consumers may want food to be treated with radiation.

(1)

(Total 8 marks)

2.

- (a) The diagram shows a hazard sign.



What type of hazard does this sign warn you about?

(1)

(b) The names of three types of radiation are given in the box.

alpha (α)	beta (β)	gamma (γ)
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Complete each sentence by choosing the correct type of radiation from those given in the box. Each type of radiation should be used once or not at all.

(i) The type of radiation that travels at the speed of light is _____

(1)

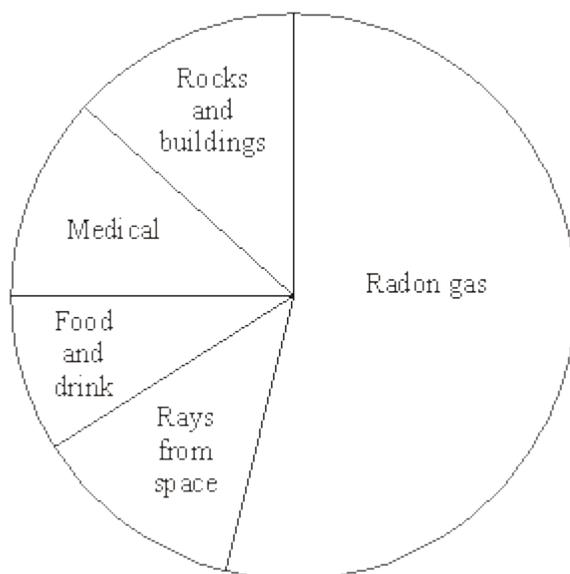
(ii) The type of radiation that is stopped by thick paper is _____

(1)

(Total 3 marks)

3.

Radiation is around us all of the time. The pie chart shows the sources of this radiation.



(i) What is the main source of this radiation?

(1)

(ii) What name is given to the radiation that is around us all of the time?

(1)

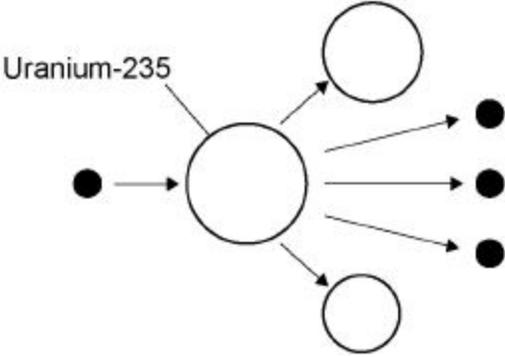
(Total 2 marks)

4.

Nuclear power can be used to generate electricity through nuclear fission.

Figure 1 shows the process of nuclear fission.

Figure 1



(a) Complete the sentences.

Choose answers from the box.

gamma rays	light rays	proton	neutron	nucleus	X-rays
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During the process of nuclear fission, a uranium _____

absorbs a _____ .

Electromagnetic radiation is released in the form of _____ .

(3)

(b) The UK needs at least 25 000 000 kW of electrical power at any time.

A nuclear power station has an electrical power output of 2 400 000 kW

Calculate how many nuclear power stations are needed to provide 25 000 000 kW of electrical power.

Number of nuclear power stations = _____

(2)

(c) State **two** environmental issues caused by generating electricity using nuclear power stations.

1. _____

2. _____

(2)

(d) The UK currently generates a lot of electricity by burning natural gas. This process releases carbon dioxide into the atmosphere.

Figure 2 shows how the concentration of carbon dioxide in the atmosphere has changed over the past 115 years.

Figure 2

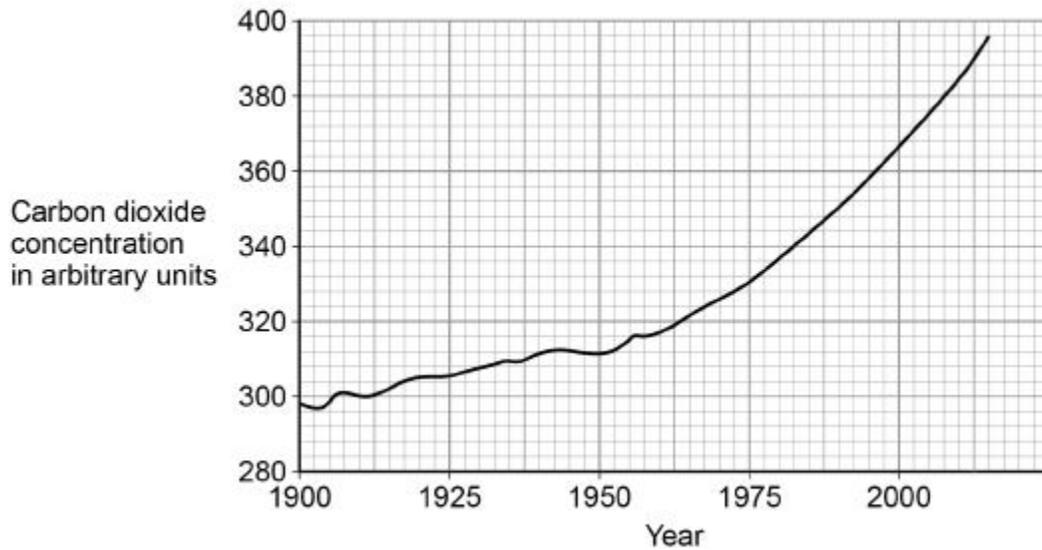
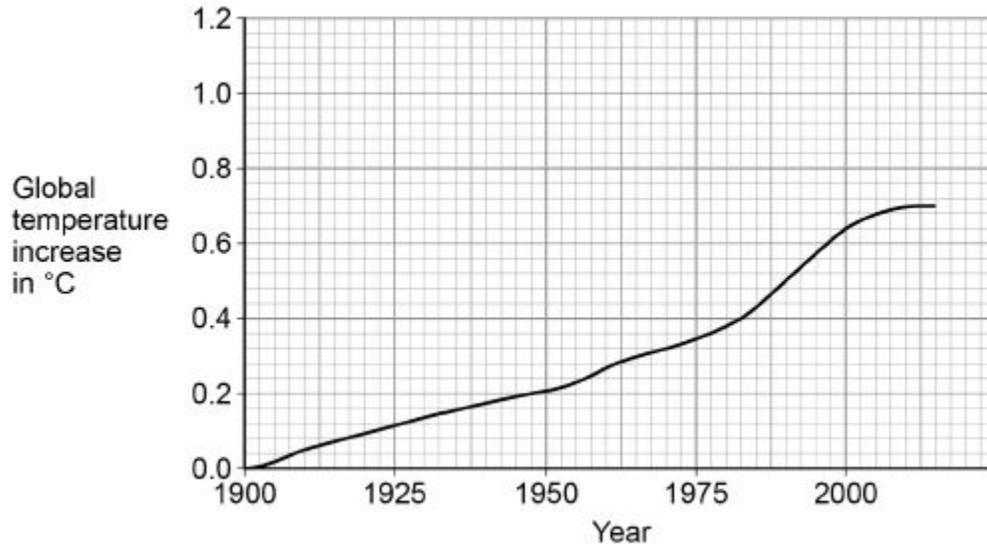


Figure 3 shows how the global temperature has changed over the past 115 years.

Figure 3



Give **one** similarity and **one** difference between the data in **Figure 2** and **Figure 3**.

Similarity _____

Difference _____

(2)

(Total 9 marks)

5.

(a) Complete the **two** spaces in the sentence.

Stars form when enough _____ and gas from _____ are pulled together by gravitational attraction.

(2)

(b) How are stars able to give out energy for millions of years?

Put a tick (✓) next to the answer.

By atoms joining together

By atoms splitting apart

By burning gases

(1)

(c) There are many billions of stars in our galaxy. Our Sun is one of these stars. What is the name of our galaxy?

(1)

(d)

Why was the Universe created?

We cannot expect scientists to answer this question. What is the reason for this?

Put a tick (✓) next to the reason.

It will take too long to collect the scientific evidence.

The answer depends on beliefs and opinions, not scientific evidence.

There is not enough scientific evidence.

(1)

(Total 5 marks)

6.

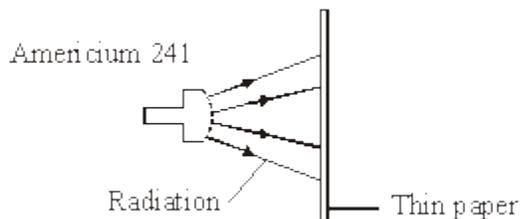
A smoke detector fitted inside a house contains a radioactive source, americium 241.

(a) Complete the following table of information for an atom of americium 241.

Number of neutrons	146
Number of protons	95
Number of electrons	

(1)

- (b) The diagram shows that the radiation given out by americium 241 does not go through paper.



Which type of radiation, alpha (α), beta (β), or gamma (γ) is given out by americium 241?

(1)

- (c) Explain why the radiation given out by the americium 241 is unlikely to do any harm to people living in the house.

(2)

- (d) Complete the sentence by choosing an answer from the box.

less than	more than	the same as
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After many years the radiation emitted by americium 241 will be _____
when the smoke detector was new.

(1)

(Total 5 marks)

7.

- (a) The names of the three types of nuclear radiation are given in **List A**.
Some properties of these types of radiation are given in **List B**.

Draw a straight line to link each type of radiation in **List A** to its correct property in **List B**.

Draw only **three** lines.

List A
Type of nuclear radiation

Alpha

Beta

Gamma

List B
Property of radiation

Has the same mass as an electron

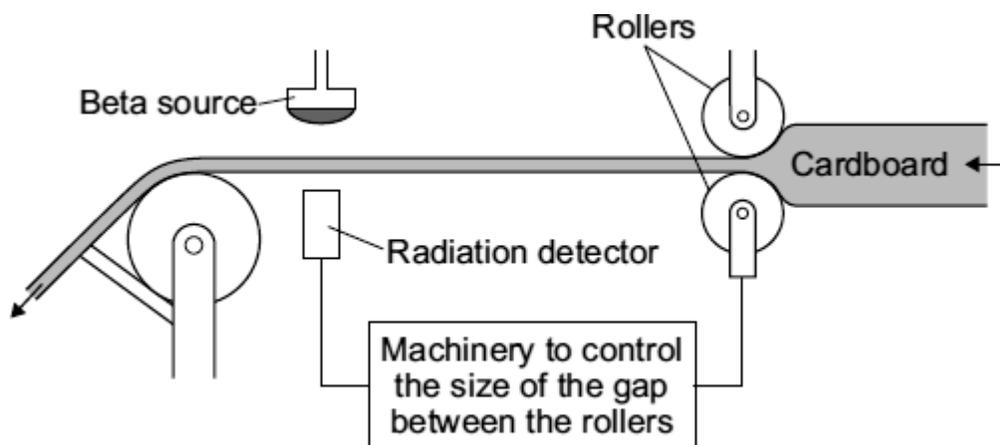
Very strongly ionising

Passes through 10 cm of aluminium

Deflected by a magnetic field but
not deflected by an electric field

(3)

(b) The diagram shows a system used to control the thickness of cardboard as it is made.



The cardboard passes through a narrow gap between a beta radiation source and a radiation detector.

The table gives the detector readings over 1 hour.

Time	Detector reading
08:00	150
08:15	148
08:30	151
08:45	101
09:00	149

(i) Between 08:00 and 08:30, the cardboard is produced at the usual, correct thickness.

Explain how you can tell from the detector readings that the cardboard produced at 08:45 is thicker than usual.

(2)

(ii) Which would be the most suitable half-life for the beta source?

Draw a ring around your answer.

six days

six months

six years

(1)

- (iii) This control system would **not** work if the beta radiation source was replaced by an alpha radiation source.

Why not?

(1)

(Total 7 marks)

8.

- (a) The names of three types of radiation are given in **List A**. Various properties of these three types of radiation are given in **List B**.

Draw a line to link each type of radiation in **List A** to its correct property in **List B**. Draw only **three** lines.

List A
Type of radiation

alpha (α)

beta (β)

gamma (γ)

List B
Property of radiation

not dangerous

stopped by paper

travels at 300 000 000 m/s

travels up to 1 metre in air

(3)

- (b) This sign warns people that a radioactive source is being used in a laboratory.



Why is it important to warn people that a radioactive source is being used?

(1)

- (c) To study the blood flow in a patient's lungs, a doctor injects some technetium-99 compound into the patient. The gamma radiation given out by the technetium-99 atoms is detected using a gamma camera outside the patient's body.

Which statement gives the reason why gamma radiation is used? Put a tick (✓) in the box next to your choice.

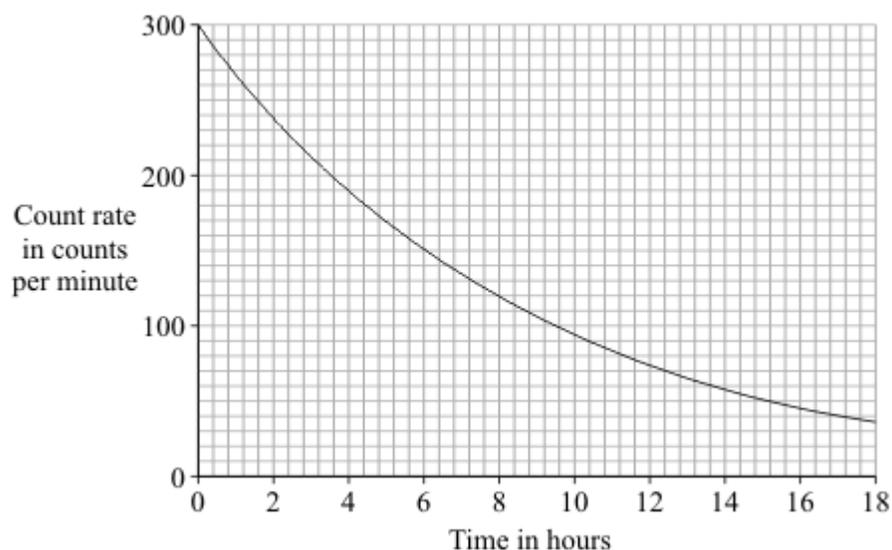
It can travel through a vacuum.

It is not affected by a magnet.

It can pass through the human body.

(1)

- (d) The graph shows how the count rate from a sample of technetium-99 changes with time.



- (i) How many hours does it take for the count rate to fall from 300 counts per minute to 150 counts per minute?

Time = _____ hours

(1)

- (ii) What is the half-life of technetium-99?

Half-life = _____ hours

(1)

(Total 7 marks)

9.

The table shows the average background radiation dose from various sources that a person living in Britain receives in one year.

Source of background radiation	Average amount each year in dose units
Buildings	50
Food and drink	300
Medical treatments (including X-rays)	300
Radon gas	1250
Rocks	360
Space (cosmic rays)	240
TOTAL	2500

(a) Only **two** of the following statements are true.

Tick (✓) the boxes next to the true statements.

Half the average background radiation dose comes from radon gas.

Everyone receives the same background radiation dose.

Cosmic rays produce less background radiation than food and drink.

(1)

(b) Most sources of background radiation are natural but some are artificial (man-made).

Which source of background radiation given in the table is artificial?

(1)

(c) Each time a dental X-ray is taken, the patient receives about 20 units of radiation.

How many dental X-rays would give the yearly average dose for medical treatments?

Number of X-rays = _____

(2)

(Total 4 marks)