OCR GCSE GATEWAY PHYSICS A · J249

PHYSICS



EXAM QUESTION PACK

P6.2 USES AND HAZARDS

SCORE	PERCENTAGE
/95	%

STEMUP

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Gateway Physics A (9-1)

Uses and hazards

Please note that you may see slight differences between this paper and the original.

Candidates answer on the Question paper.

OCR supplied materials:
Additional resources may be supplied with this paper.

Other materials required:
- Pencil
- Ruler (cm/mm)

Duration: Not set

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions, unless your teacher tells you otherwise.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Where space is provided below the question, please write your answer there.
- You may use additional paper, or a specific Answer sheet if one is provided, but you must clearly show your candidate number, centre number and question number(s).

INFORMATION FOR CANDIDATES

- The quality of written communication is assessed in questions marked with either a pencil or an asterisk. In History and Geography a *Quality of extended response* question is marked with an asterisk, while a pencil is used for questions in which *Spelling, punctuation and grammar and the use of specialist terminology* is assessed.
- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **95**.
- The total number of marks may take into account some 'either/or' question choices.

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1 Nuclear radiation can be beneficial or harmful.

Write about one beneficial use of nuclear radiation and also how nuclear radiation can harm people.

---

[2]

2(a) Nuclear power stations are used to generate electricity.

The statements in the table describe the different stages of the nuclear reaction that takes place in a nuclear reactor.

They are **not** shown in the correct order.

Statement	Statement letter
Energy and neutrons released	A
Nuclei are hit by neutrons	B
This process is called fission	C
Uranium-235 nuclei are in the fuel rods	D
Excited uranium-236 nuclei exist briefly	E
Uranium nuclei split	F

Use the letters **A**, **B**, **C**, **D**, **E** and **F** to put the statements in the correct order.

The first and last letters have been done for you.

D → ..... → ..... → ..... → ..... → **C**

[2]

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(b) Nuclear scientists must make sure that nuclear reactions do not go out of control.

They can place control rods in the reactor.

Explain what the control rods do and why they cannot remain in the reactor all the time.

---

[2]

3 Nuclear radiation is used in hospitals.

Nuclear radiation from radioactive sources is used as a medical tracer.

Alpha emitters **cannot** be used as medical tracers.
Explain why.

---

[1]

4(a) Nuclear radiation is used in hospitals.

Medical tracers must **not** remain active in the body for long periods of time.

(i) Why is it dangerous for a tracer to remain active in the body for long periods of time?

---

[1]

(ii) What property of the tracer affects the time it remains active in the body?

---

[1]

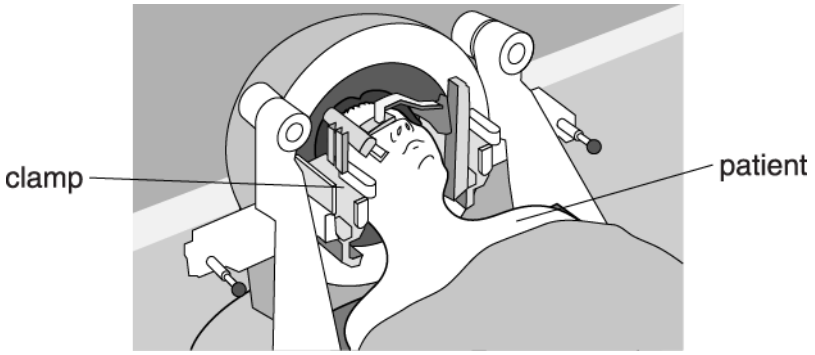
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(b) Gamma knife treatment is used to treat brain cancer.

A gamma knife uses many gamma beams that can be accurately focused on one place.



The patient's head is clamped to keep their head fixed in one position.

Explain why this is important.

---

[2]

5 Complete the sentences.

Choose the best words from the list.

fission

fusion

joining

splitting

waste

The process that gives out energy in a nuclear power station is called nuclear _____ .

This involves the _____ of nuclei.

[2]

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6(a) Nuclear radiation is used in hospitals.

Radioactive sources emit nuclear radiation.

They are used as tracers in the body.

Write down **one** other use of nuclear radiation in hospitals.

---

[1]

(b) Radiographers use nuclear radiation in hospitals.

Look at the radiographer. She is preparing a patient for treatment.



Suggest **two** different ways the radiographer can remain safe when the radiation is being emitted.

---

[2]

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7 Mrs Khan is doing some experiments using **radioactive** sources.

She wants to demonstrate the **three** different types of nuclear radiation to her class.

She asks the class about some of the **safety** precautions she should follow when using the radioactive sources.

Explain the safety precautions Mrs Khan should take and name the three different types of nuclear radiation.

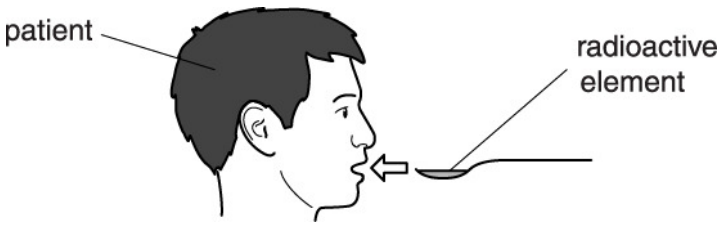
The quality of written communication will be assessed in your answer to this question.

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[6]

8 Doctor Hanif uses a radioactive element in the hospital where he works.

(i) The patient swallows a liquid containing a small amount of the radioactive element.



It is important to use a small amount of a radioactive element that decays quickly.

What is the risk of using a radioactive element with a **longer** half-life?

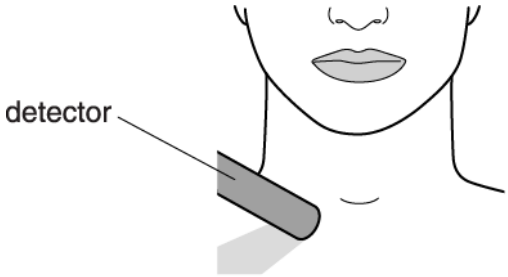
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[1]

(ii) The amount of radioactivity near the patient's throat is measured.



What type(s) of radiation can pass through the skin to the detector?

Choose from

alpha only

alpha and beta

beta only

beta and gamma

gamma only

answer _____ [1]

9 Some **artificial** background radiation comes from industry.

Write down one use of radioactive **tracers** in industry.

[1]

10(a) This question is about nuclear energy.

Complete the crossword.

One answer has been done for you.

Across

3 A fuel used in a nuclear power station is _ _ _ _ _ _.

Down

1 The process that gives out energy in a nuclear reactor is nuclear **f i s s i o n**.

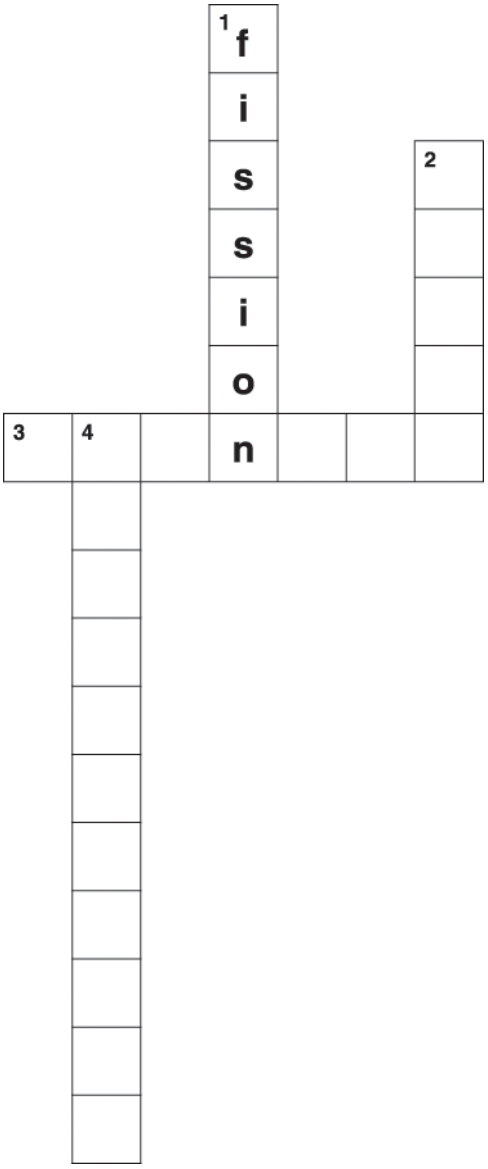
2 Energy from the reactor is used to heat water turning it into _ _ _ _ _ _.

4 The waste produced by the nuclear reaction is _ _ _ _ _ _ _ _ _ _ _.

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[2]

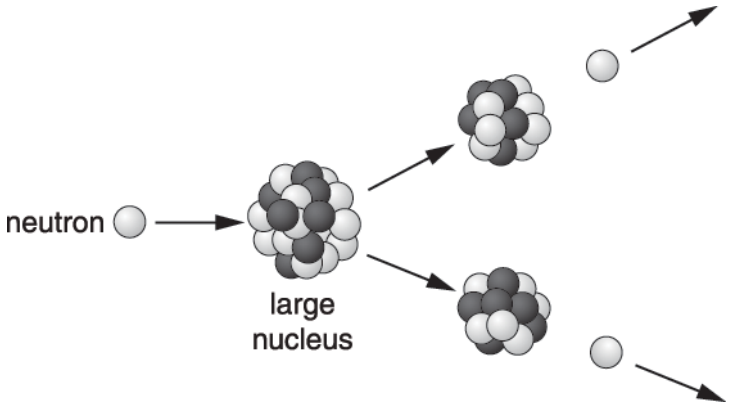
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(b) Scientific ideas can be shown by models.

Look at a simple model for **nuclear fission**.



Describe the process of nuclear fission using this simple model.

---

[2]

11(a) This question is about nuclear energy.

Complete the crossword.

Across

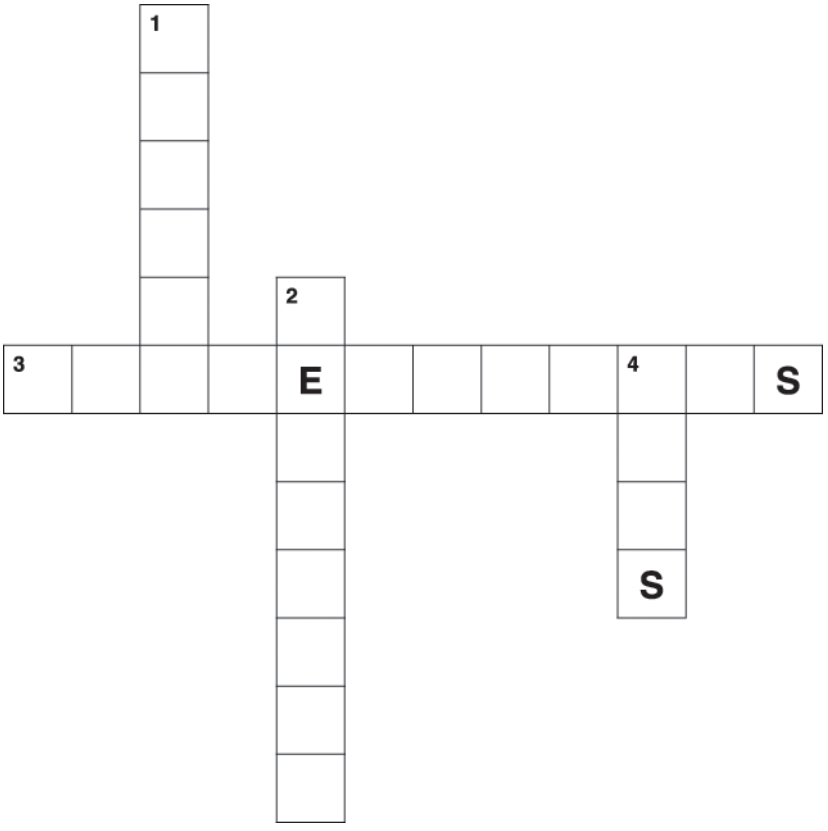
3 In stars, fusion happens at extremely high _ _ _ _ **e** _ _ _ _ _ _ **s**.

Down

1 Nuclei of hydrogen isotopes undergo fusion to form _ _ _ _ _ _ nuclei.

2 Scientists stop nuclear fission reactions going out of control in a reactor by absorbing some of the _ **e** _ _ _ _ _ _.

4 Scientists stop nuclear reactions going out of control by placing metal _ _ _ **s** in the reactor.



[2]

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(b) Andrea Rossi **claims** to have invented an 'energy catalyser cold fusion system'.

He demonstrated the system in January 2011 by passing hydrogen over a secret catalyst. It appeared to show that an input of a few hundred kilowatts produced an output of a few thousand kilowatts.

Some scientists believe there is a nuclear reaction taking place because of the large amounts of extra energy produced.

Suggest why other scientists might **not** accept this claim.

---[2]

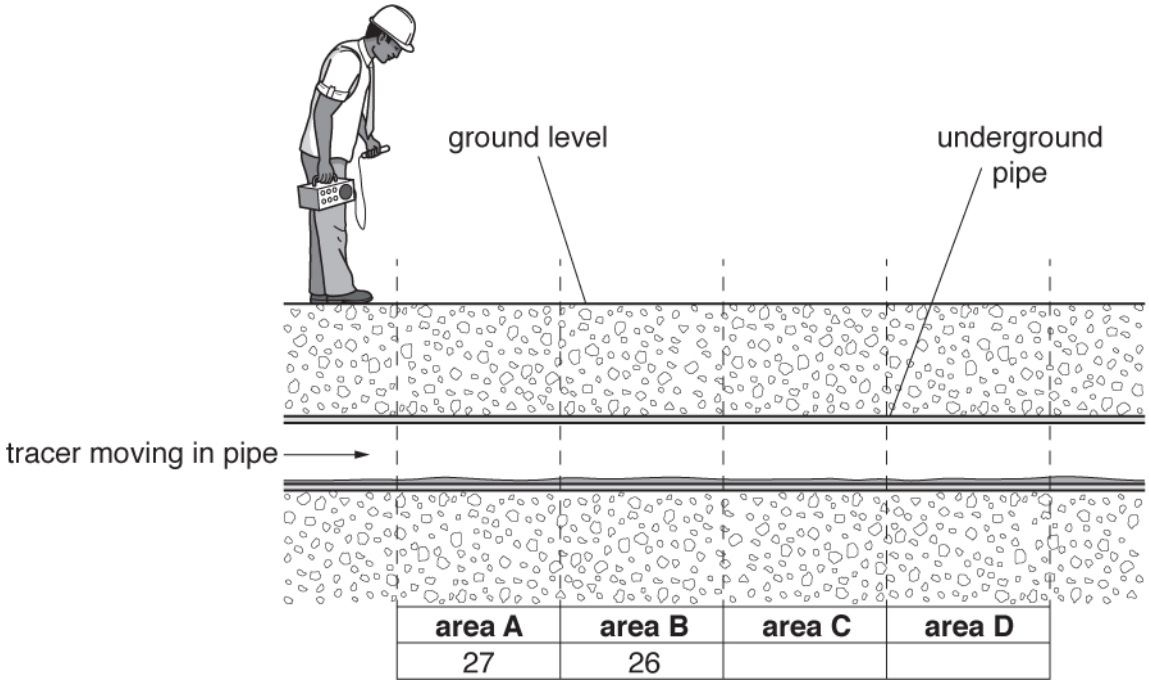
12

Radioisotopes can be used as tracers in industry.

(i) Explain why gamma sources are more useful as a tracer than alpha or beta sources.

---[1]

(ii) Tracers can be used to find a blockage in an underground pipe.



area A	area B	area C	area D
27	26		

The table shows the readings for the amount of radiation in each area.

There is a blockage between area **C** and area **D**.

Predict the readings for area **C** and area **D** and explain why you have predicted these readings.

---

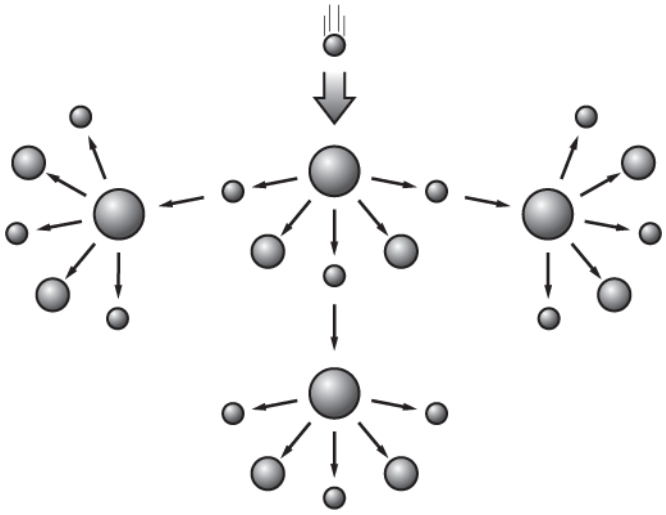
[2]

13 Carlos draws a diagram to show what happens in a chain reaction.

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Label the diagram and use it to explain what happens in a chain reaction.

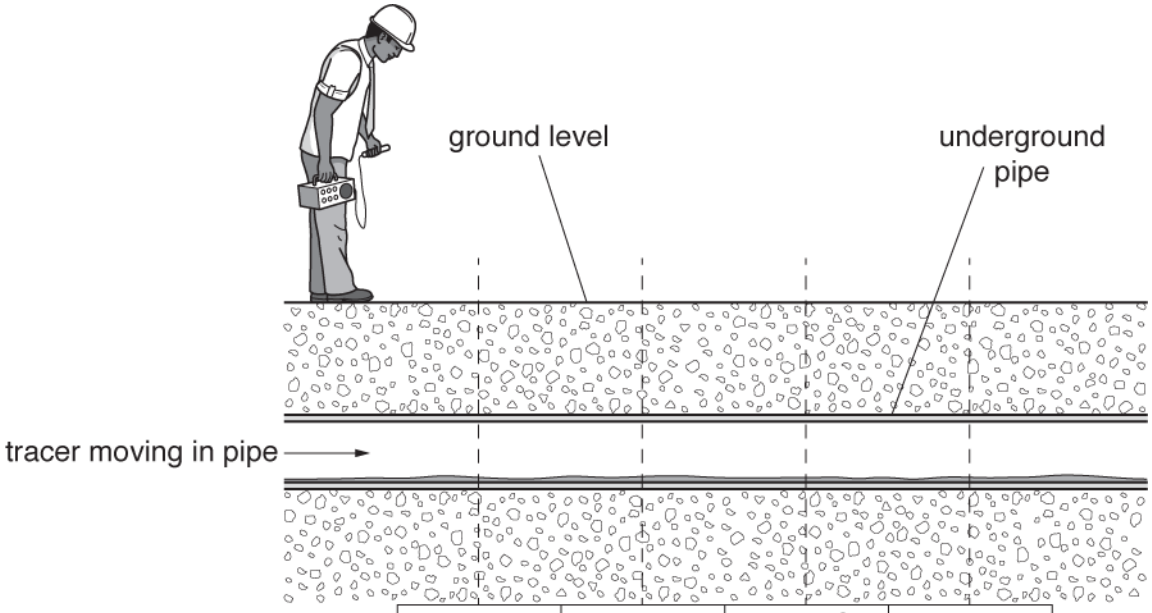
Describe the differences between a chain reaction in a nuclear reactor and in a nuclear bomb.

The quality of written communication will be assessed in your answer to this question.

[6]

14 Radioisotopes can be used as tracers in industry.

They can be used to find a blockage in an underground pipe.



	area A	area B	area C	area D
	28	31	37	4
	30	21	29	5
	23	35	36	3
mean	**27**	**29**		

The table shows the amount of radiation in each area.

There are three readings for each area.

Just before the blockage the amount of radiation from the tracer **increases**.

Calculate the mean readings in areas **C** and **D and** use this information to find the blockage.

[2]

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15(a) Nuclear radiation, such as gamma, is used to irradiate some fresh food to increase its 'shelf-life' and make it last longer.

Fresh herbs and spices are dried and irradiated with gamma rays.

Explain the difference between nuclear **irradiation** and nuclear **contamination**.

---

[2]

(b) Explain how the gamma rays can increase the 'shelf-life' of herbs and spices to make them last longer.

---

[2]

(c) Some people are worried about eating irradiated food.

Write down two **concerns** they may have about irradiated food.

1. ---

---

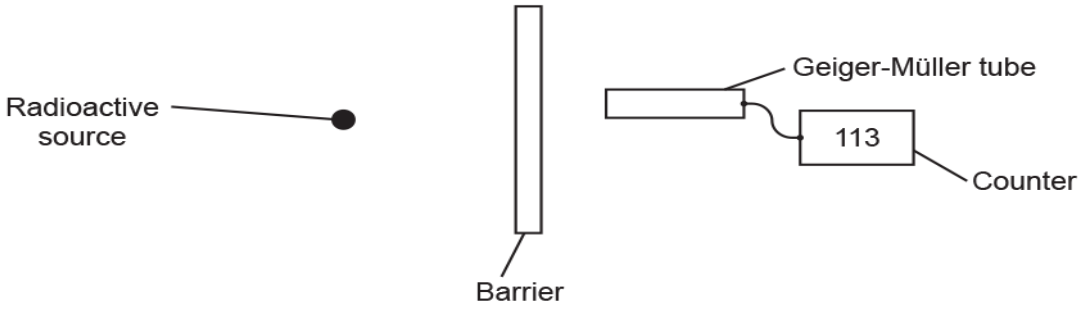
2. ---

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[2]

16 A teacher demonstrates an experiment about radioactivity. He demonstrates how different types of radiation can be absorbed.

He puts different barriers between the source and the Geiger-Müller tube. He uses four different radioactive sources **A**, **B**, **C** and **D**.



Suggest two safety **precautions** that the teacher should use when demonstrating this experiment.

1. ----------

---

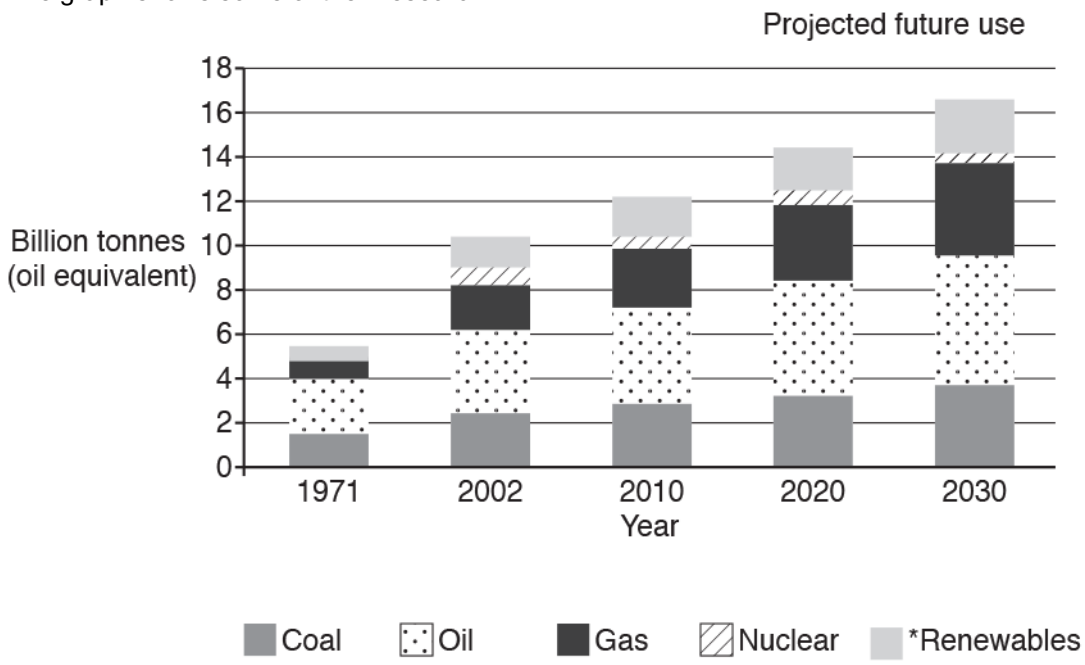
2. ----------

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[2]

17 Scientists are researching the World's energy use for the future.

The graph shows some of their research.



(i) The future demand for fossil fuels is expected to increase.

Give two reasons why scientists are worried about this increase in demand.

1. ----------

---

2. ----------

---[2]

(ii) In the UK the government is closing coal fired power stations and planning for new nuclear power stations to be built.

Suggest why the government wants more nuclear power stations.

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[2]

18 The table gives some information about four radioactive isotopes.

Which isotope is the best to use as a medical tracer?

	Half life	Radiation emitted
A	6 hours	alpha
B	6 hours	gamma
C	6 minutes	gamma
D	6 years	beta

Your answer [ ] [1]

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19(a) Nuclear **fusion** is a reaction that happens in stars. This equation for fusion is incomplete.



(i) What else is produced in this reaction?

---

[1]

(ii) Stars are formed from dust and gas.

What causes the dust and gas to undergo fusion?

---

[1]

(b)

(i) Describe one **similarity** between nuclear fission and nuclear fusion.

---

[1]

(ii) Describe one **difference** between nuclear fission and nuclear fusion.

---

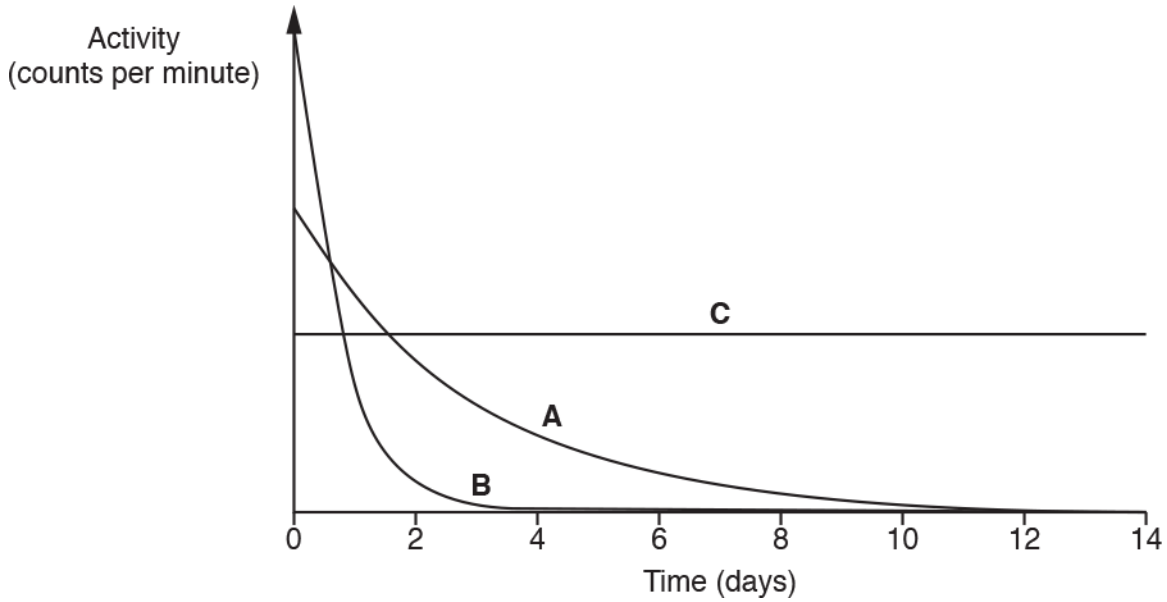
[1]

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20(a) This is a graph showing the radiation emitted from samples of three different isotopes **A**, **B** and **C**.



(i) Which isotope, **A**, **B** or **C**, takes the longest time to decay?

Tick (✓) **one** box.

A ☐

B ☐

C ☐

[1]

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Do you agree with the views of scientist 1 and scientist 2?

Use the graph and ideas about radioactivity and half-life to explain your answer.

Scientist 1 _____

_____

_____

_____

Scientist 2 _____

_____

_____

_____

[4]

(ii) Two scientists discuss the isotopes in the graph.

Scientist 1	Scientist 2
'I think isotope **A** is more hazardous than **B**. **A** has a higher activity than **B**.'	'I think isotope **B** is more hazardous than **A**. **B** has a longer half-life than **A**.'

Describe how **Scientist 1** does the experiment and explain how they can work out the type of radiation emitted.

You may include a diagram in your answer.

(iii) **Scientist 1** wants to identify the type of radiation emitted by isotope **A**.

This is a list of equipment **Scientist 1** has in his laboratory:

- radiation detector
- piece of thick lead
- piece of cardboard
- piece of aluminium.

---

[4]

(b) This is a diagram to show a nuclear fusion reaction:



(i) Explain why this is nuclear fusion.

---

[1]

(ii) It is difficult for nuclear fusion reactions to occur on Earth.

Explain why nuclear fusion reactions occur in the Sun.

---

[2]

(iii) What will happen to our Sun when it runs out of hydrogen?

---

[1]

(c) Some scientists say nuclear fission is renewable. Other scientists say it is non-renewable.

Suggest why the scientists disagree.

---

[1]

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21 Which statement about nuclear **fission** is correct?

A An example is when hydrogen is converted to helium.
B It may happen when a nucleus absorbs a neutron.
C The Sun uses fission to generate its energy.
D Two nuclei join to make a heavier nucleus.

Your answer [ ] [1]

22 A radioactive isotope can be used as a tracer in a patient's body. It is monitored by a radiation detector outside the body.

Four possible radioactive isotopes are shown in **Table 18.2**.

Radioactive isotope	Type of radiation emitted	Half-life
Radon-222	Alpha	4 days
Iodine-131	Gamma	8 days
Cobalt-60	Gamma	5 years
Plutonium-238	Alpha	88 years

Table 18.2

(i) Doctors wear a lead apron when they use radioactive isotopes.

Explain why.

---

[2]

(ii) Which radioactive isotope from **Table 18.2** is best to use as a radioactive tracer in a patient's body?

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Tick (✓) **one** box.

Radon-222 ☐

Iodine-131 ☐

Cobalt-60 ☐

Plutonium-238 ☐

Explain your answer.

---

[3]

23(a) Doctors can use an ultrasound scan to measure the size of a person's kidney.



Fig. 19.2

Complete the sentences using the words below.

Each word may be used once, more than once, or not at all.

Increases **Decreases** **Stays the same**

The ultrasound scanner is made from a solid ceramic material.

As the wave enters the body, the speed ..... .

As the wave enters the body, the frequency ..... .

[2]

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(b)

(i) Explain what happens to the ultrasound wave when it reaches the kidney.

[2]

(ii) **Fig. 19.2** shows the thickness of the kidney, **w**.

Explain how ultrasound waves are used to measure **w**.

[2]

(c) A doctor uses an ultrasound scan instead of X-rays to measure the kidneys.

Explain why.

[1]

24(a) When smoke enters a detector:

- The smoke particles absorb the emitted alpha radiation.
- The alarm sounds.

Explain why beta and gamma sources are **not** suitable for use in a smoke detector.

[2]

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(b) The half-life of americium-241 is 432 years.

(i) Explain what is meant by **half-life**.

[1]

(ii) Explain why the half-life of americium-241 is suitable for a smoke detector.

[1]

(iii) The table shows some data for two radioactive sources.

Source	Half-life (years)	Radiation emitted
Americium-241 (Am-241)	432	Alpha
Thorium-228 (Th-228)	2	Alpha

Both sources start with the same number of radioactive nuclei.

Which source is a greater health risk? Explain your answer.

[2]

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(c) Read the information below about smoke detectors.

In smoke detectors, fine particles of americium-241 are rolled into a metallic foil. The americium-241 cannot be inhaled or move around.

The amount of radiation emitted is very small compared with the natural radioactivity in 1 m^3 of soil.

Americium-241 also emits a small amount of gamma rays.

A scientist says, '**There is no risk from the disposal of smoke detectors in household waste**.'

Do you agree with this statement? Give **two** reasons for your answer.

Yes ☐

No ☐

1 ---

---

2 ---

---

[2]

END OF QUESTION PAPER