Uses and Hazards

1. 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]**

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

Explain why.

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[1]

3 (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.

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[2]

(b). 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

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[2]

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

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

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[1]

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

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[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]**

4 (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]

(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]**

5(a).

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

---**[1]**

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

---**[1]**

(b). 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]**

6(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**.

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[2]

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

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[2]

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

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

1. ---

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2. ---

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[2]

END OF QUESTION PAPER