

**Q1.**

Answer the question with a cross in the box you think is correct (☒). If you change your mind about an answer, put a line through the box (☒) and then mark your new answer with a cross (☒).

Radiation is used to treat tumours (cancer).

The source of the radiation can be inside or outside the human body.

Which of these has a radiation source that can be positioned inside the body to treat tumours?

(1)

- A** gamma rays
- B** x-rays
- C** radio waves
- D** microwaves

(Total for question = 1 mark)

**Q2.**

Some questions must be answered with a cross in a box (☒). If you change your mind about an answer, put a line through the box (☒) and then mark your new answer with a cross (☒).

Radioactive tracers can be used when scanning a person's kidneys.

A radioactive isotope is injected into a person's blood stream.

The isotope emits radiation.

As the blood flows through the kidneys, this radiation is detected outside the body by a scanner.

(i) What type of radiation travels from the kidney to the scanner?

(1)

- A** alpha
- B** beta plus
- C** beta minus
- D** gamma

(ii) During the scan, a technician needs to take readings for about 30 minutes.

The half-life of the isotope used is about 6 hours.

1. State why an isotope with a half-life of about 6 minutes is **not** suitable.

(1)

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2. State why an isotope with a half-life of about 6 days is **not** suitable.

(1)

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(Total for question = 3 marks)

**Q3.**

(a) Positrons are antiparticles of electrons.

The photograph shows a PET scanner that uses positrons to locate the site of a brain tumour.



Positrons are emitted by the radioactive isotope fluorine-18.

The fluorine-18 is attached to glucose.

The glucose is injected into the patient's blood stream and collects at the site of the tumour.

(i) Fluorine-18 has a half-life of 1.8 hours.

State one advantage and one disadvantage of using a substance with such a short half-life.

1. Advantage

(1)

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2. Disadvantage

(1)

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(ii) When a positron meets an electron they annihilate each other.

Explain how this enables the site of the tumour to be located.

(4)

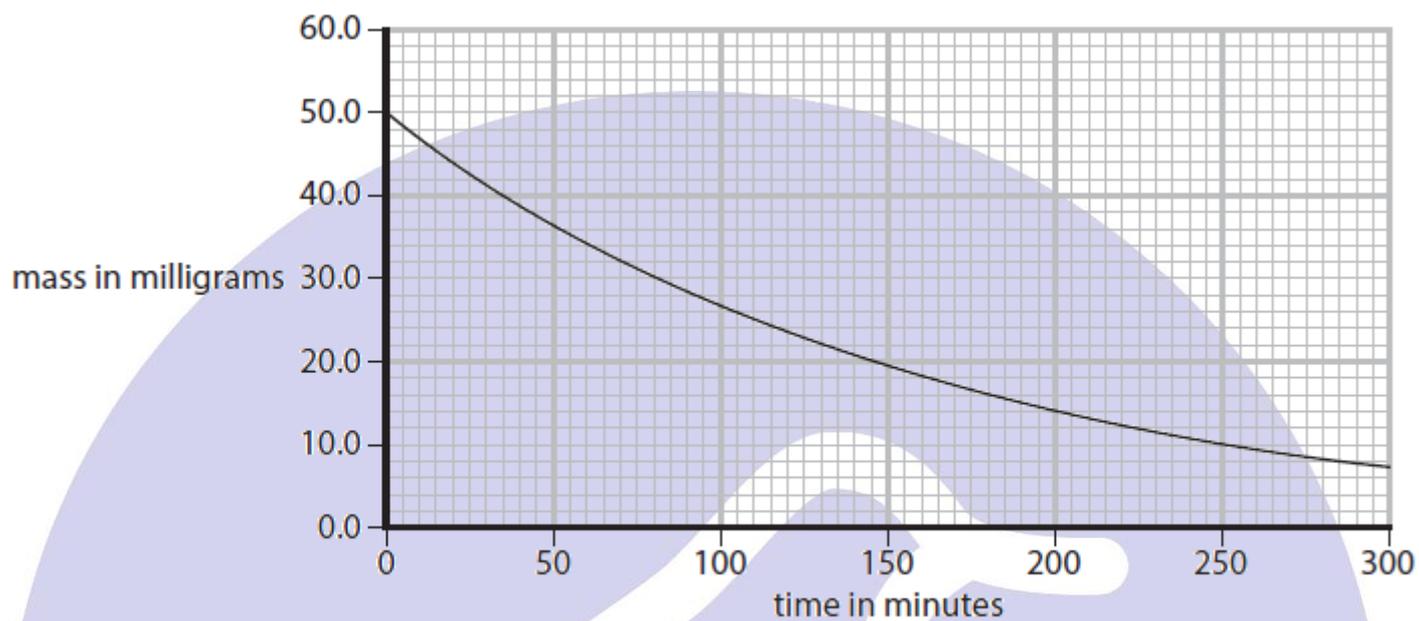
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**(Total for Question = 6 marks)**

**Q4.**

The isotope fluorine-18 is used in PET scans, which help to detect cancers.

Figure 7 shows a radioactive decay curve for a sample of fluorine-18.



**Figure 7**

(i) Use the graph to calculate the percentage of fluorine-18 remaining after 150 minutes.

(2)

percentage of fluorine-18 remaining after 150 minutes = ..... %

(ii) Fluorine-18 releases positrons.

Describe what happens when positrons meet electrons.

(2)

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**(Total for question = 4 marks)**

**Q5.**

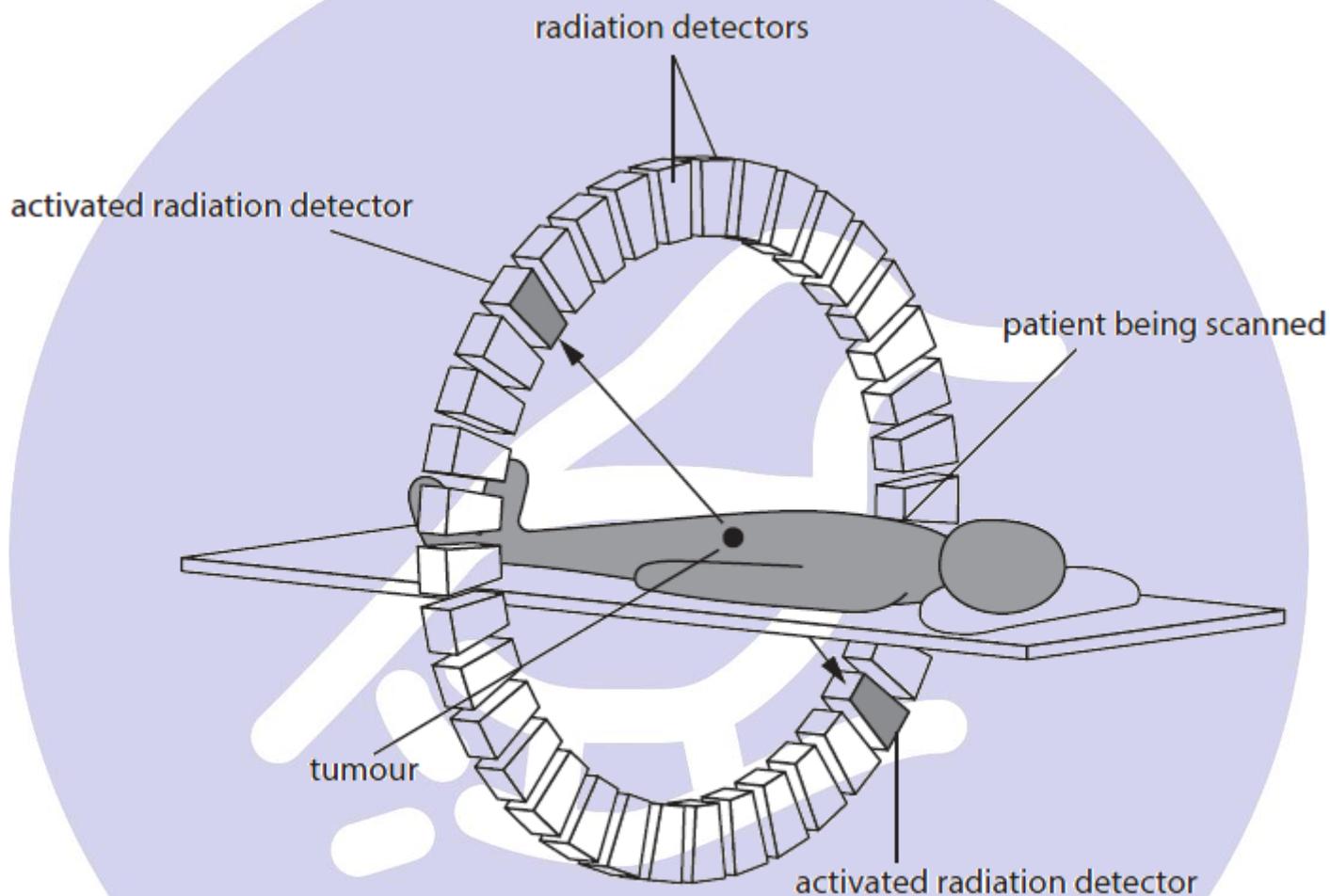
Figure 5 shows a PET scanner used to detect cancerous tumours.

A radioactive isotope is injected into a patient.

The isotope is absorbed by the tumour.

The isotope emits positrons from the location of the tumour.

The ring of radiation detectors rotates around the person.



**Figure 5**

(i) Explain how the scan can give the location of the tumour.

(3)

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(ii) Explain why the radioactive isotope injected into the patient must be produced near to the place where it is to be used.

(2)

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**(Total for question = 5 marks)**

**Q6.**

Energy from the nuclei of atoms can be used in medical diagnosis and treatment.

(i) Fluorine-18 is a radioactive isotope used in PET scanners for medical diagnosis.  
Explain why fluorine-18 must be produced close to the hospital where it is used.

(2)

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(ii) Some tumours inside the body can be treated by using either alpha radiation or gamma radiation.  
Explain why the source of alpha radiation is usually inside the body but the source of gamma radiation can be outside the body.

(4)

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**(Total for question = 6 marks)**