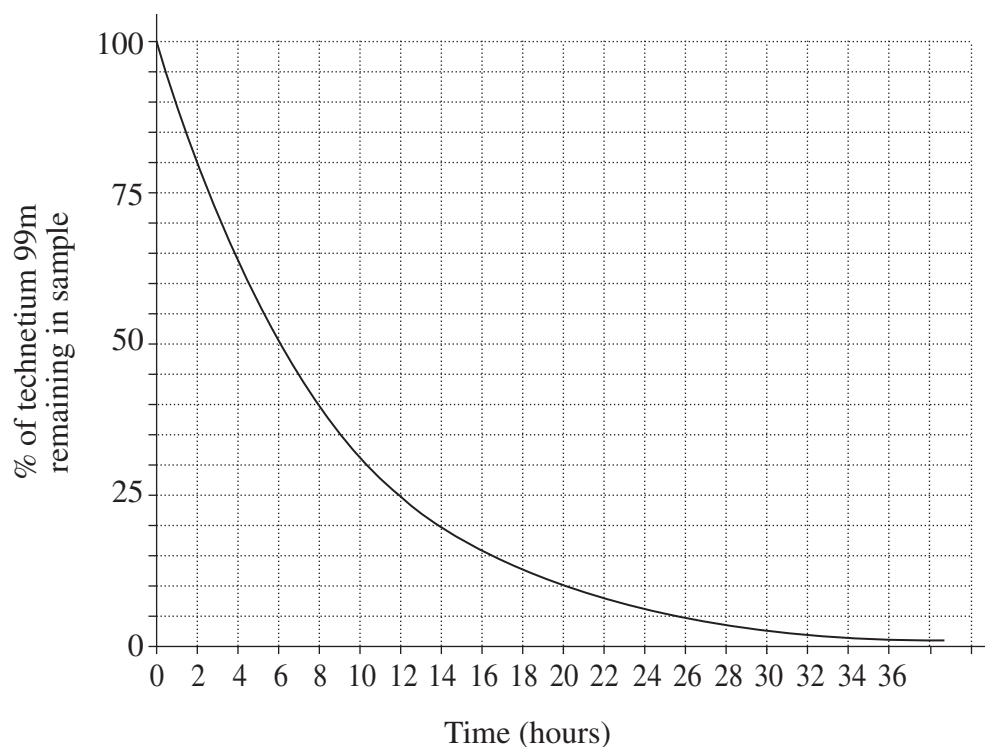


Question 29 — Medical Physics (25 marks)

- (a) (i) Briefly describe how an endoscope works. **2**
- (ii) Explain how a computed axial tomography (CAT) scan is produced. **4**
- (b) Technetium 99m is an artificial isotope which is frequently used to obtain a scan of the human body.
- (i) Using the graph, determine the half life of technetium 99m. **1**



- (ii) A patient is given an injection containing 6.0×10^{-18} kg of technetium 99m. The scan is taken four hours after the injection. **2**
- How much technetium 99m remains undecayed when the scan is taken?
(Give your answer in kilograms.)
- (iii) Propose reasons why scans are best taken between two and five hours after injection of this radioisotope. **3**

Question 29 continues on page 31

Question 29 (continued)

- (c) The diagrams shown are an MRI of the human upper arm, an X-ray of a human hand and a CAT scan of the human pelvis (hip bone) as seen in cross-section from above.



MRI of human upper arm
Procedure time:
30–60 minutes



X-ray of human hand
Procedure time:
5 minutes



CAT scan of human pelvis (hipbone)
Procedure time:
40 minutes

- (i) Identify TWO advantages of MRI scans over CAT scans. 2
- (ii) A patient is brought into a hospital out-patients ward complaining of a severe headache. He explains that he hit his head while playing football. The doctor thinks that the patient may be suffering from a fractured skull. 2
- Explain why the doctor would order an X-ray to confirm the diagnosis of a fractured skull.
- (iii) The patient, now diagnosed with a fractured skull, complains of other symptoms that may indicate that he is suffering from brain damage. 2
- Suggest ONE additional scan which may be required to confirm this diagnosis. Justify your choice.
- (d) Assess the impact of medical applications based on ultrasound and the magnetic field of particles within the body on modern society. 7

End of Question 29