Name of the Student:_____
Max. Marks : 18 Marks **Time : 18 Minutes**

Q1.

Figure 4 shows a Geiger-Müller (GM) tube used for measuring radioactivity.

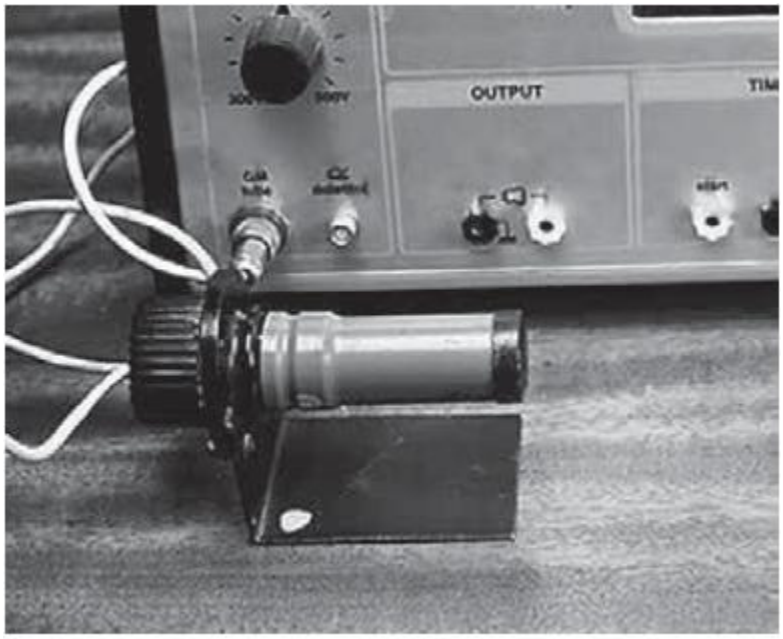

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Figure 4

One radioactive source used in hospitals is technetium (Tc).

Technetium is produced from the radioactive decay of molybdenum (Mo).

Complete the following nuclear equation.

(1)

$$^{99}_{42}\text{Mo} \rightarrow \text{\_\_\_\_} + {}^{0}_{-1}\beta$$

(Total for question = 1 mark)

Q2.

Rutherford devised an experiment to fire alpha particles at thin gold foil.

It was found that alpha particles were scattered by the gold foil.

The gold foil was about 4.0×10^{-7}m thick.

A gold atom has a diameter of about 0.15 nm.

Estimate how many gold atoms would fit across this thickness of gold foil.

(2)

number of atoms = ...

(Total for question = 2 marks)

Q3.

The half-life of cobalt-60 is 5 years.

A school cobalt source had an activity of 38.5 kBq in the year 2000.

Estimate the activity of this source in the year 2020.

(3)

activity = ... kBq

(Total for question = 3 marks)

Q4.

The apparatus that was used in the experiment is shown in Figure 10.

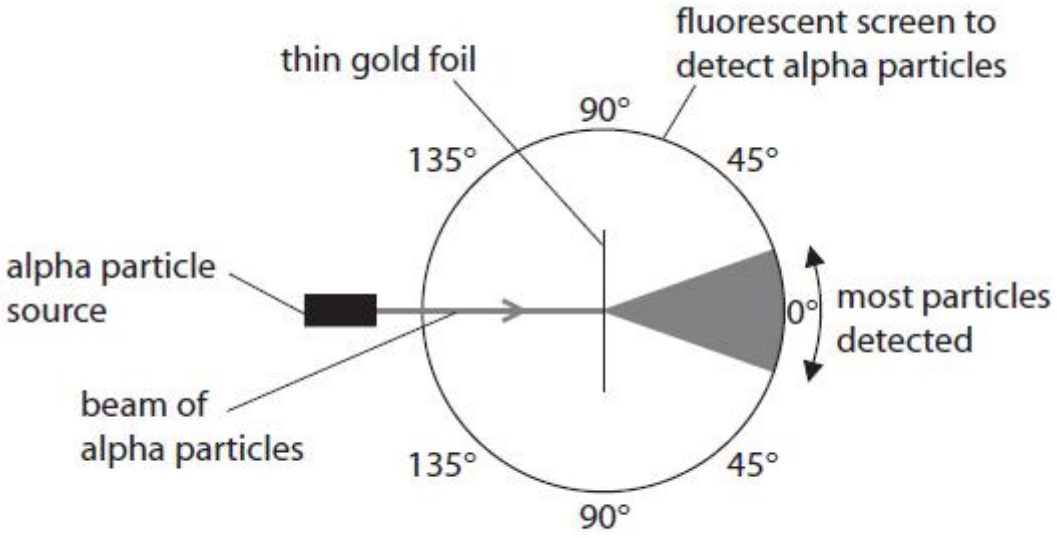

Figure 10

(i) The number of particles detected at each angle in a given time is shown on the graph in Figure 11.

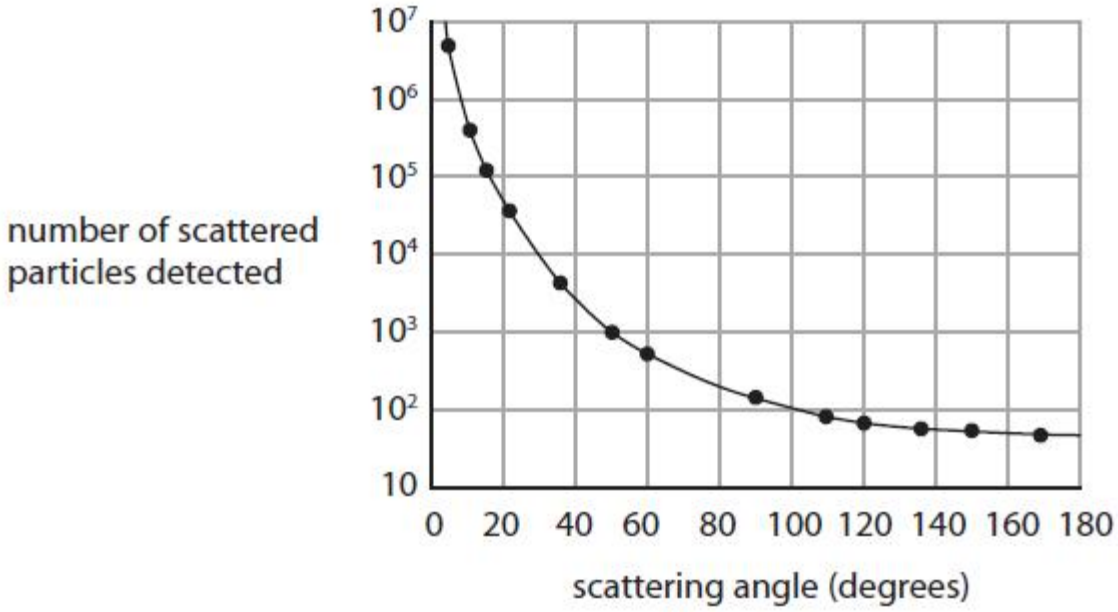

Figure 11

Use information from the graph.
Estimate the ratio of the number of particles scattered through 5° to the number of particles scattered through 100°.

(2)

ratio = ...

(ii) Explain how the difference in the number of particles scattered at different angles gives evidence for the current model of the structure of the atom.

(4)

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(Total for question = 6 marks)

Q5.

Figure 6 is a diagram of a nuclear reactor.

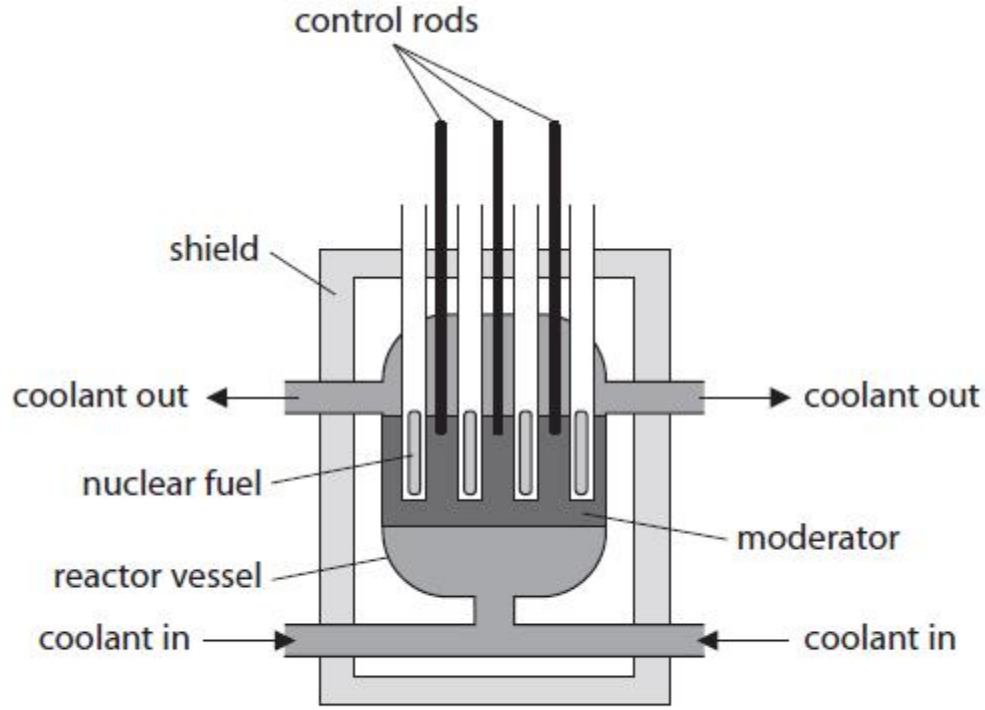

Figure 6

(i) Explain how pushing the control rods further into the reactor slows down the nuclear chain reaction.

(2)

.....

.....

.....

.....

(ii) The moderator in a nuclear reactor slows down the neutrons so that the neutrons are more likely to start other fission reactions.

In a nuclear reactor,

- the average speed of the fast neutrons is 3.0 × 107 m/s
- the average speed of the slow neutrons is 4.0 × 103 m/sCalculate the average speed of the slow neutrons as a percentage of the average speed of the fast neutrons.

(2)

..... %

(iii) The nuclear reaction is the first stage in the process of generating electricity.

Describe how energy is transferred from the nuclear reaction to the next stage in the process.

(2)

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(Total for question = 6 marks)