Merit Minds
www.merit-minds.com
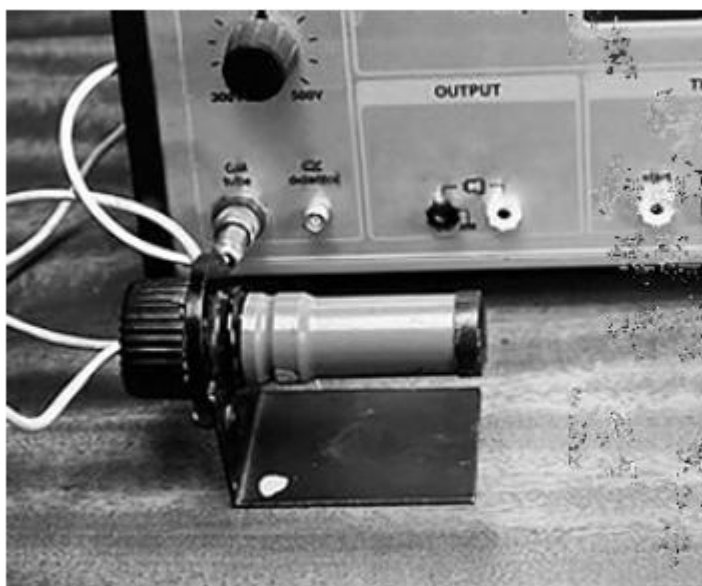Exam Preparation and Free Resources

Name of the Student:_____

Max. Marks : 21 Marks   **Time : 21 Minutes**

Q1.

Figure 17 shows a Geiger-Müller (GM) tube used for measuring radioactivity.

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Figure 17

* A radioactive rock is placed near to the front of a Geiger-Müller (GM) tube.

A radioactivity count-rate is first made in air.

The count-rate is measured again with each of three different absorbers between the rock and the GM tube.

Figure 19 shows the count-rates measured.

absorber	count-rate in counts per minute
3 cm of air	1272
thin sheet of paper	931
3 mm thick sheet of aluminium	328
2 cm thick sheet of lead	21

Figure 19

A scientist has an idea that the rock emits three different types of radiation.

Explain how the data in this table supports the scientist's idea.

(6)

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(Total for question = 6 marks)
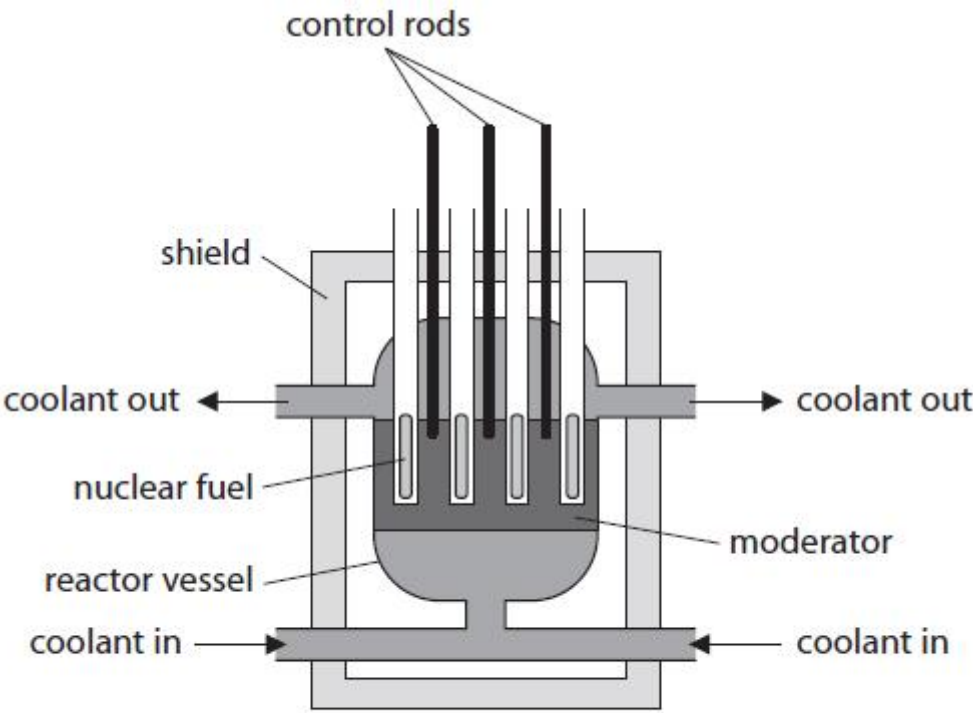
Q2.

Figure 17 is a diagram of a nuclear reactor.

Figure 17

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

(2)

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(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/s
Calculate 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)

Q3.

An atom has a central nucleus containing neutrons and protons.

Electrons orbit the nucleus.

One isotope of carbon is carbon-14.

$$^{14}_{6}C$$

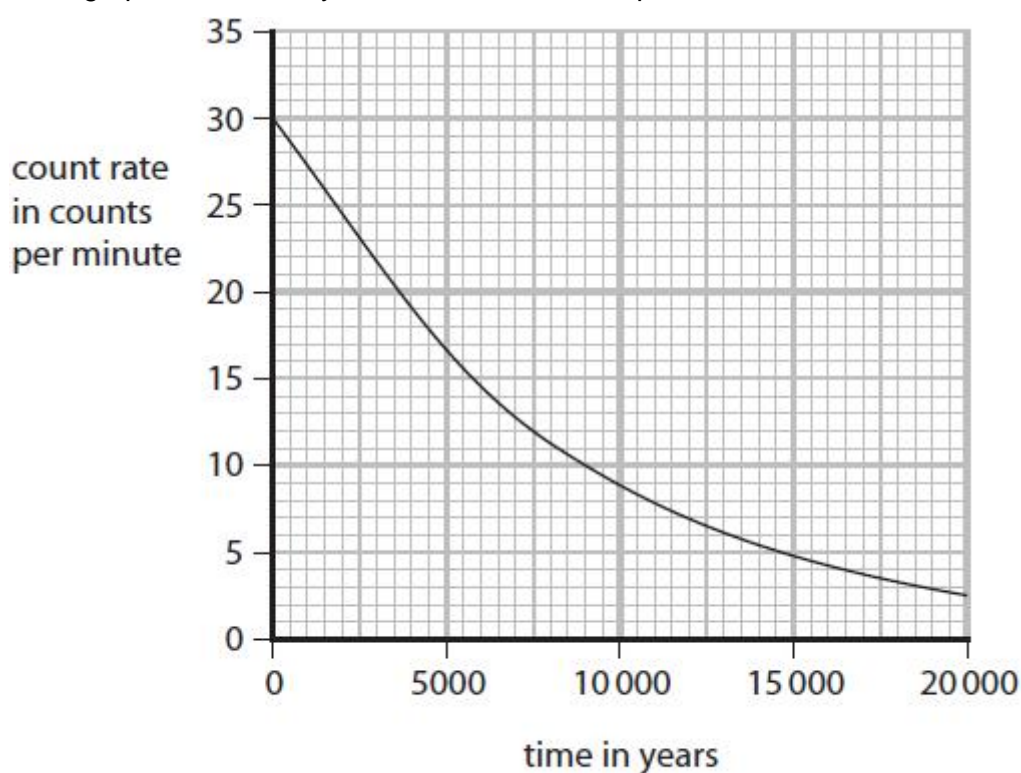(i) State the number of protons in one atom of carbon-14.

(1)

number of protons = ...

(ii) State the number of neutrons in one atom of carbon-14.

(1)

number of neutrons = ...

(iii) Figure 6 shows a graph for the decay of the radioactive isotope carbon-14.

Figure 6

Use the graph to estimate the half-life of carbon-14.

(2)

half-life = ... years

(Total for question = 4 marks)

Q4.

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 ☒.

An atom has a central nucleus containing neutrons and protons.

Electrons orbit the nucleus.

(i) Which row of the table gives the relative mass and charge of a proton?

(1)

		relative mass	charge
☒	A	0	+1
☒	B	0	−1
☒	C	1	+1
☒	D	1	−1

(ii) An atom has a radius of 1.0×10^{-10} m.

A nucleus has a radius of 1.0×10^{-15} m.
Calculate the ratio of the radius of the atom to the radius of the nucleus.

(2)

ratio of radius of atoms to radius of nucleus = ...

(iii) Explain why an atom has no charge overall.

(2)

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(Total for question = 5 marks)