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90256

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NZQA
NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

For Supervisor's use only

Level 2 Physics, 2007

90256 Demonstrate understanding of atoms and radioactivity

Credits: Two
2.00 pm Friday 30 November 2007

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

You should answer ALL the questions in this booklet.

For all numerical answers, full working must be shown. The answer should be given with an SI unit.

For all 'describe' or 'explain' questions, the answer should be in complete sentences.

If you need more space for any answer, use the page(s) provided at the back of this booklet and clearly number the question.

Check that this booklet has pages 2–7 in the correct order and that none of these pages is blank.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

For Assessor's use only	**Achievement Criteria**		
Achievement	**Achievement with Merit**	**Achievement with Excellence**
Identify or describe aspects of phenomena, concepts or principles.	Give descriptions or explanations in terms of phenomena, concepts, and / or principles.	Give concise explanations that show clear understanding, in terms of phenomena, concepts, and / or principles.
Overall Level of Performance		

You are advised to spend 20 minutes answering the questions in this booklet.

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QUESTION ONE: ATOMIC MODELS

(a) Give a concise explanation that shows clear understanding of the development of the model of the atom from **Dalton** to **Thomson** to **Rutherford**.

Dalton _____

_____

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Thomson _____

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Rutherford _____

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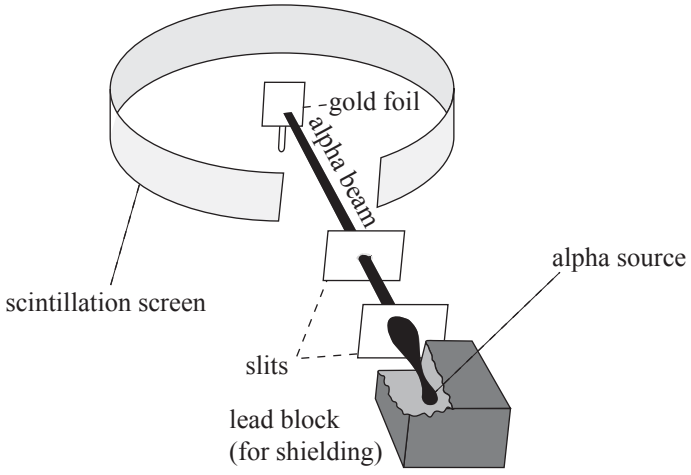
The following diagram shows Rutherford's gold foil experiment.



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(b) What would Rutherford have expected to see in his experiment if Thomson's model was correct?

(c) Write THREE observations that Rutherford made in his gold foil experiment.

(d) Rutherford's experiment was carried out in a vacuum.

If the chamber contained air, describe the effect this would have had on the **alpha particles** and on the **air**.

(e) Describe what would have been observed if Rutherford had used a beta emitter instead of an alpha emitter.

QUESTION TWO: RADIOACTIVITY

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Platinum-195 and platinum-192 are both isotopes of the same element.

(a) State the difference between the nuclei of platinum-192 and platinum-195.

(b) What do the numbers 78 and 195 represent in the symbol $^{195}_{78}\mathrm{Pt}$?

(c) Write an equation for the decay of iridium $\left(^{192}_{77}\mathrm{Ir}\right)$ to platinum $\left(^{192}_{78}\mathrm{Pt}\right)$ and **name** the particle emitted.

(d) What Physics principles did you use to write the above nuclear equation?

(e) Technetium-99 is sometimes injected into hospital patients. Technetium-99 decays by emitting gamma rays and low energy electrons. Technetium-99 has a half life of 6 hours.

Give TWO reasons why is it important for doctors to use a radioactive isotope that has a half-life of a **few hours** in patients.

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(f) Explain why it is safer to inject radioisotopes that emit gamma rays rather than those that emit alpha particles.

(g) Describe and explain the changes which occur in the nucleus of a radioactive isotope, including changes of its **atomic number** and **mass number** when it decays by emitting:

(i) **An alpha particle**

(ii) **A beta particle**

Note that this question continues on the next page.

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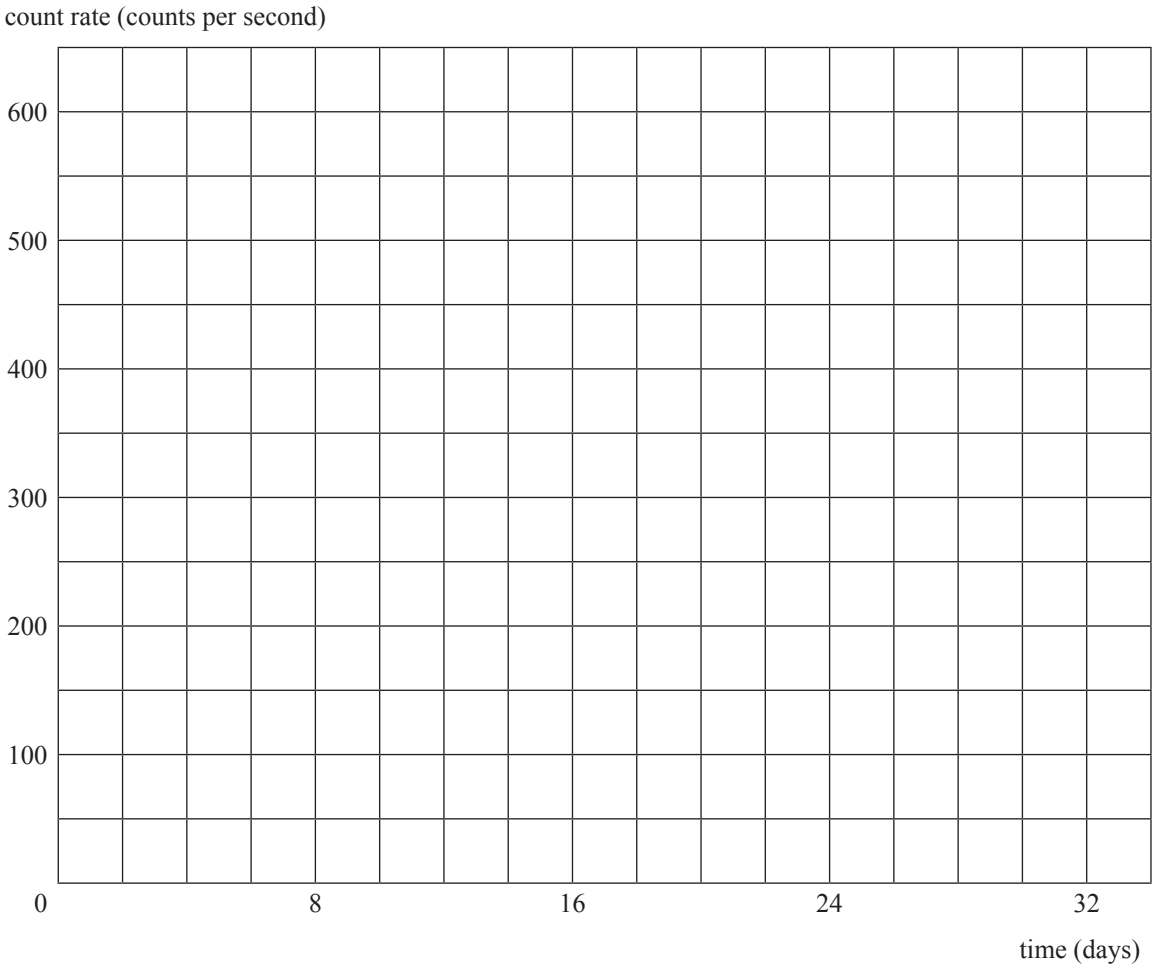
(h) A sample of pure iodine-131 has a decay rate of 600 s^{-1} (counts per second). 16 days later the decay rate has dropped to 150 s^{-1}.

Use a graph (or other method) to determine the decay rate after 28 days.
You must show your working.



Extra paper for continuation of answers if required.
Clearly number the question.

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Question number	

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