For Examiner's Use

6 The variation with nucleon number A of the radius r of a nucleus is shown in Fig. 6.1.

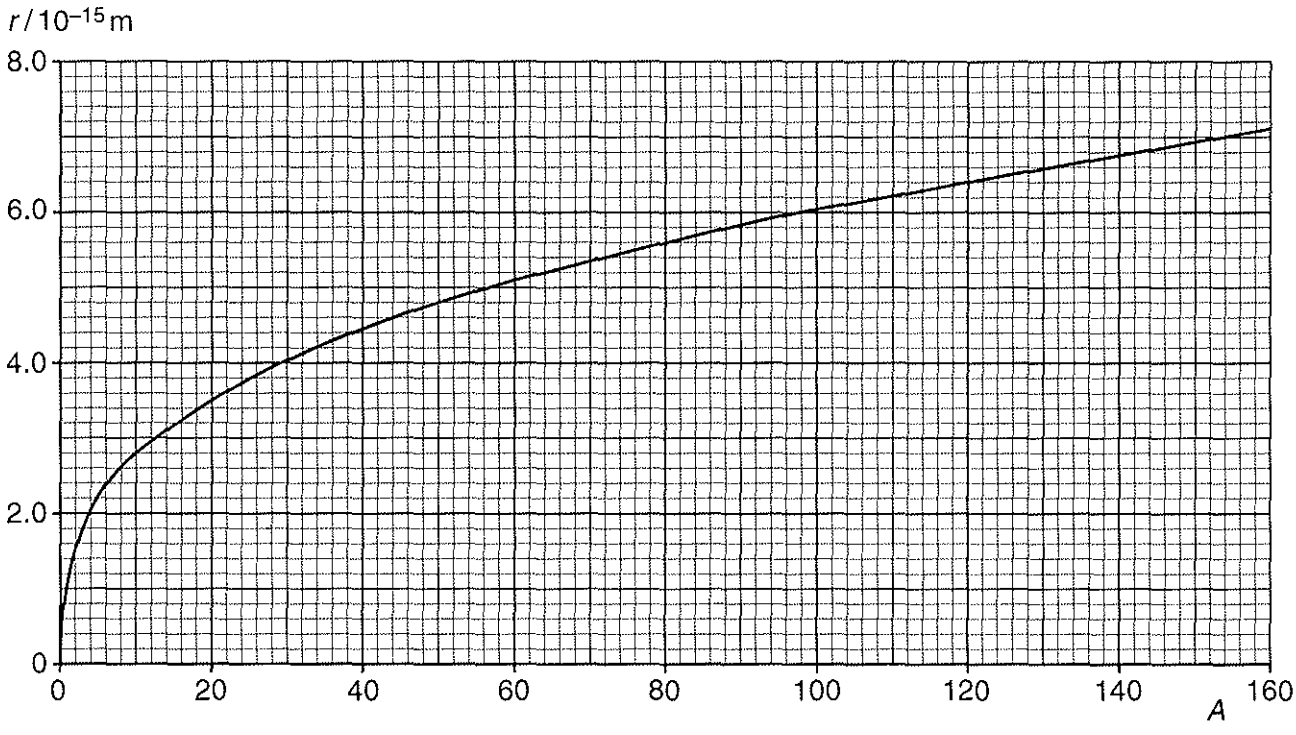

Fig. 6.1

The relation between r and A is thought to follow the expression

$$r = kA^n$$

where k and n are constants.

Data from Fig. 6.1 are used to obtain values for ln r and ln A. These are plotted on the graph of Fig. 6.2.

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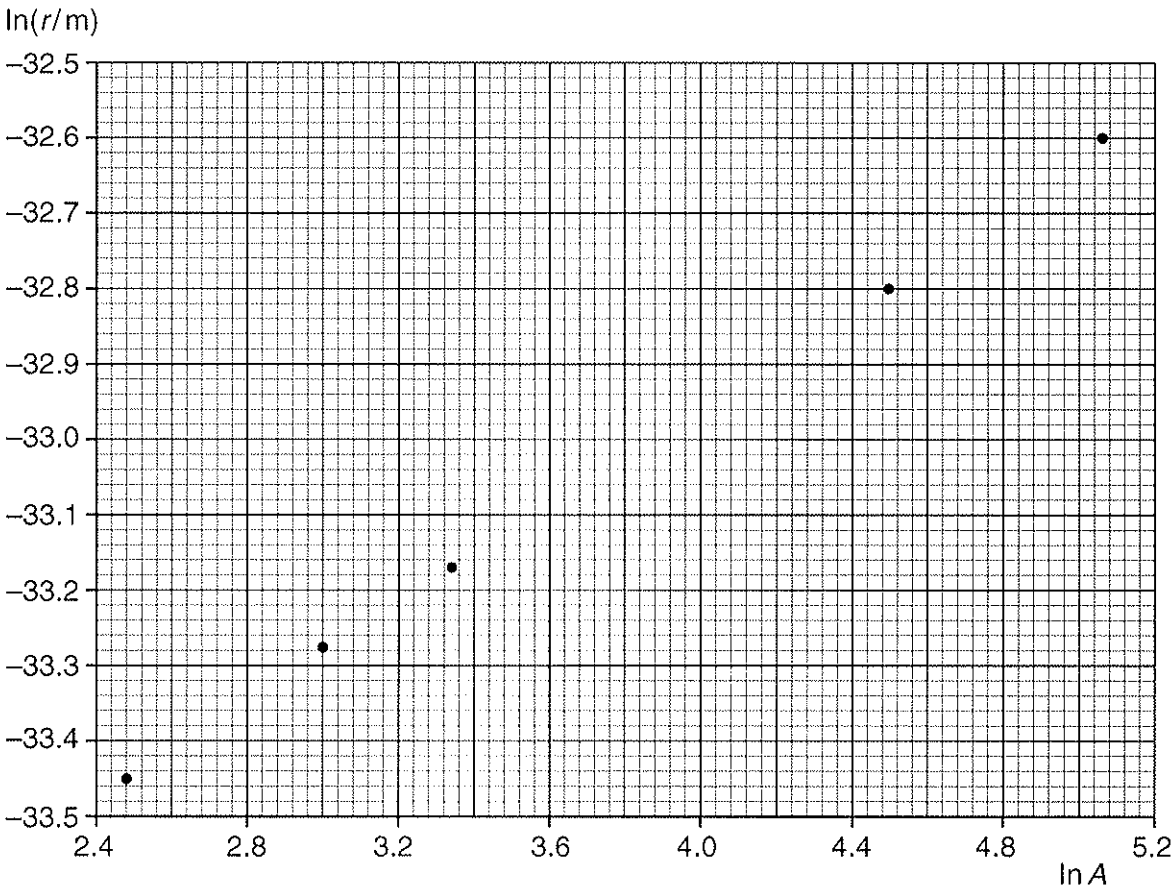

Fig. 6.2

(a) (i) Determine ln r for $A = 60$.

ln r ..... [1]

(ii) On Fig. 6.2,

1. plot the point corresponding to $A = 60$,

2. draw the line of best fit for all the points.

[2]

(iii) Use Fig. 6.2 to determine the gradient of the line drawn in **(ii)**.

gradient = ... [2]

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(iv) Show that the magnitude of k is 1.3×10^{-15} m.

[1]

(v) Suggest what the value of k represents.

.....

.....[1]

(b) Use your answers in part **(a)** to determine

(i) the radius of a uranium-235 nucleus,

radius = ... m [3]

(ii) the ratio

$$\frac{\text{density of a hydrogen-1 nucleus}}{\text{density of a uranium-235 nucleus}}.$$

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ratio = ... [3]

(c) The ratio

$$\frac{\text{density of hydrogen gas}}{\text{density of uranium metal}}$$

is 5×10^{-6}.

Give two reasons why the answer to part **(b)(ii)** is different from this ratio.

1. .....

.....

2. .....

..... [2]