

- 3 When high energy electrons are incident on a sample of an isotope, a diffraction pattern is produced. The diffraction pattern can be used to determine the radius of a nucleus of the isotope.

The relationship between the radius  $r$  of a nucleus and the nucleon number  $A$  is

$$r = r_0 A^n$$

where  $r_0$  is the radius of a proton and  $n$  is a constant.

- (a) Explain why a graph of  $\log r$  against  $\log A$  can be used to determine a value for  $n$ . (2)

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- (b) The table shows the values of  $r$  for some different isotopes.

Isotope	$A$	$r / \text{fm}$		
H-2	2	1.54		
He-4	4	1.92		
Be-9	9	2.47		
C-12	12	2.72		
O-16	16	3.00		
Mg-24	24	3.42		

- (i) Plot a graph of  $\log r$  against  $\log A$  on the grid. Use the additional columns in the table to record your processed data. You should **not** convert the values of  $r$  to metres. (6)
- (ii) Use your graph to determine the value of  $n$ . (2)

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$n =$  .....



(iii) Determine the value of  $r_0$  and hence state the mathematical relationship between  $r$  and  $A$ .

(3)

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**(Total for Question 3 = 13 marks)**

DO NOT WRITE IN THIS AREA