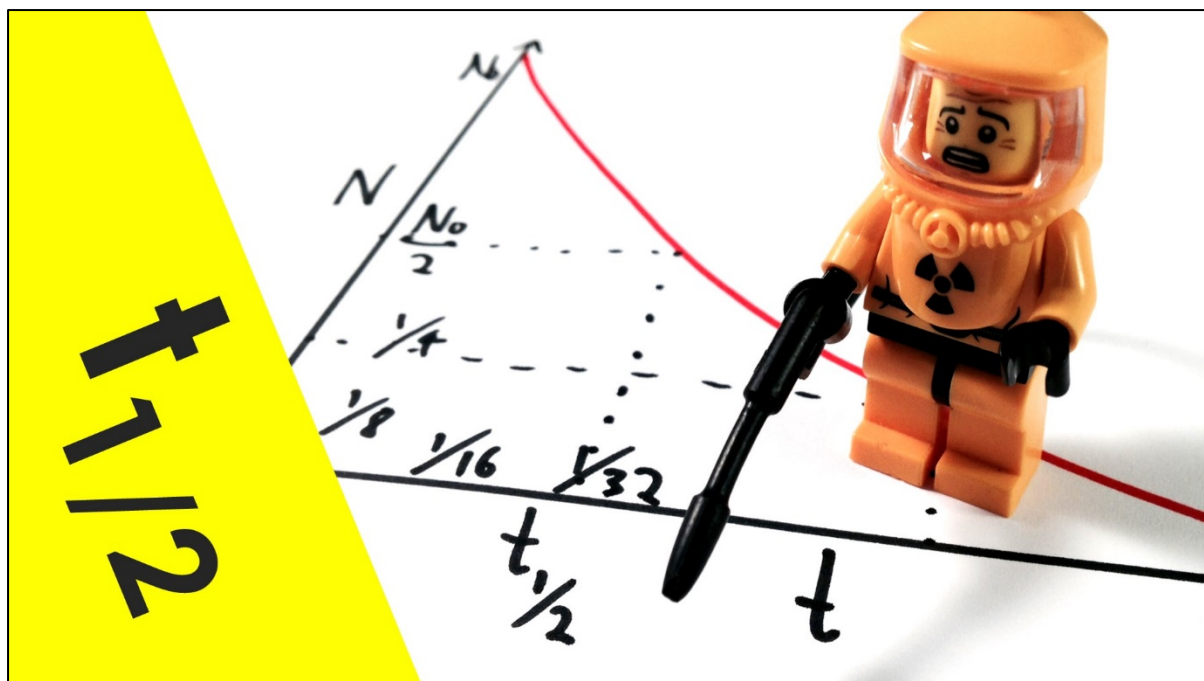


# A Level Physics

11<sup>th</sup> Jan 2021 – Radioactive Half-Life Practical

Suitable for ALL exam boards (Year 13 Topic)



This session will look at a practical to investigate half-life using a protactinium generator. This includes manipulating logarithmic equations, plotting data and using this to find the decay constant.

Don't forget to **subscribe** on **YouTube** and turn on **notification** to be reminded about the **weekly livestreams** to support you as you prepare for any exams.

Question taken from:

**Edexcel IAL Physics - June 2017 - Paper 6 (WPH06) - Question 4**

- 4 A student investigated the decay of a sample of protactinium-234 using a Geiger-Müller tube connected to a ratemeter.

The student first measured the background count rate. She recorded the count rate from the sample every 20 s and corrected each value by subtracting the background count rate. The corrected count rates are shown.

Time / s	Count rate / s <sup>-1</sup>	
0	150	
20	126	
40	98	
60	88	
80	70	
100	61	
120	46	
140	39	
160	28	

- (a) State the type of error that the student avoided by subtracting the background count rate.

(1)

- (b) Identify a variable that must be kept constant in this investigation.

(1)

- (c) The activity of the sample of protactinium is given by the formula

$$A = A_0 e^{-\lambda t}$$

where  $A$  is taken as the measured count rate at a time  $t$ .

$A_0$  is the count rate at  $t = 0$

$\lambda$  is the decay constant of protactinium-234

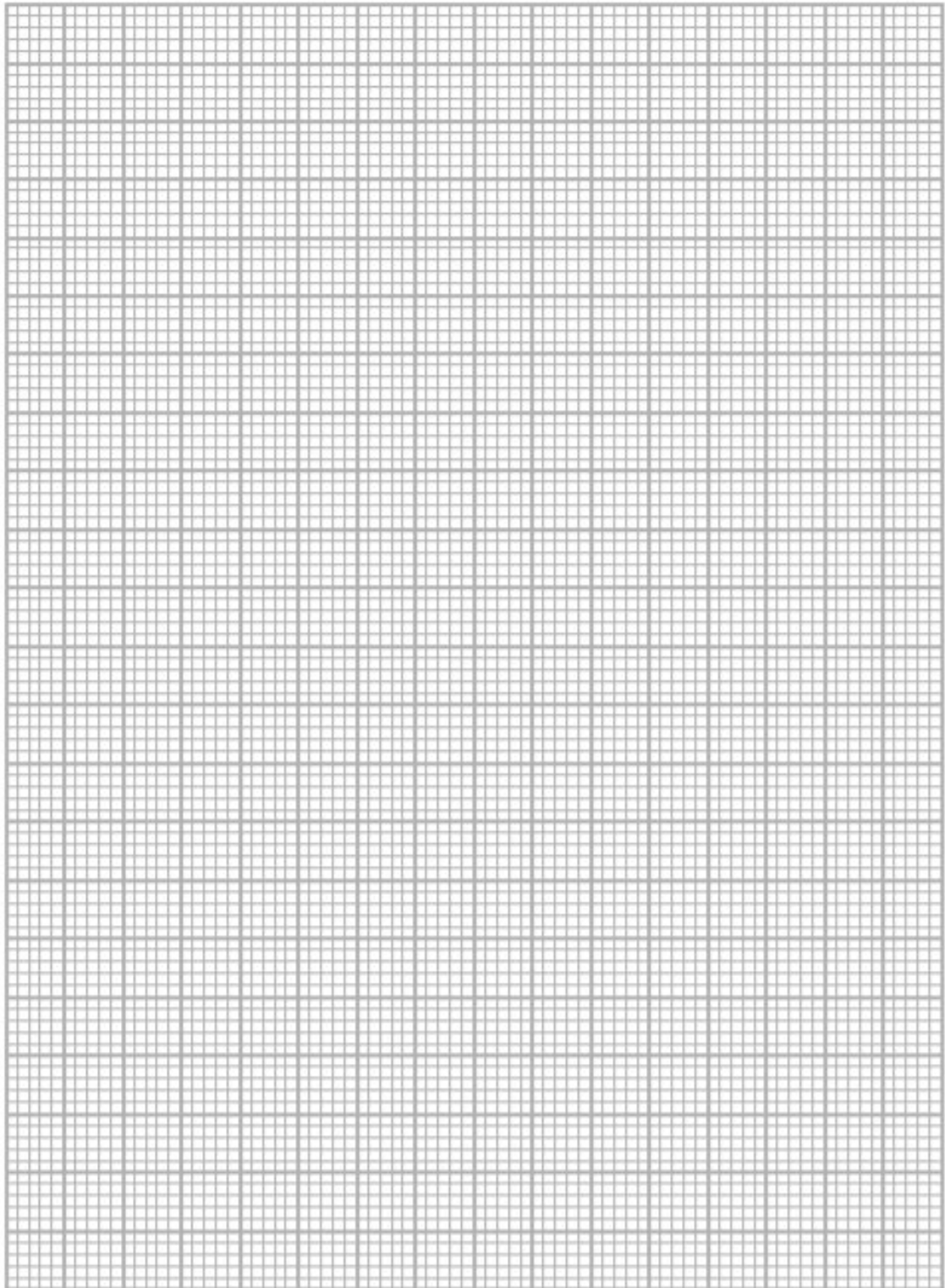
Show that a graph of  $\ln A$  against  $t$  should be a straight line.

(2)



(d) Draw a graph of  $\ln A$  against  $t$  on the grid below. Use the extra column in the table for your processed data.

(5)



(e) Use the graph to determine a value for  $\lambda$ .

(4)

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$\lambda =$  .....

(f) The half-life of a radioactive isotope is given as  $t_{1/2} = \frac{0.69}{\lambda}$ .

(i) Calculate a value for the half-life of protactinium-234.

(1)

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Half-life = .....

(ii) The half-life for this isotope is quoted as 1.2 minutes.

Comment on the accuracy of your answer.

(2)

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**(Total for Question 4 = 16 marks)**

