Akhtar Mahmood (0333-4281759)
LGS, BLL, ALJT, ALBT, TCS-Ravi
TCS-ALCG, SALT Academy
teacher_786@hotmail.com

Q. 2) Analysis, conclusions and evaluation question:

(a) *Re-arrange the given equation as instructed to plot the graph and compare it to get an expression of gradient and y-intercept (if any).* **[1]**

Examples:

Equation	Instruction	Working	Gradient	Y-Intercept
$R = cE^{3/2}$	Plot a graph of R^2 against E^3			
$E = IK\theta$ {*June 19/51*}	A graph is plotted of $1/I$ on the *y*-axis against θ on the *x*-axis			
$y = ax^n$	plot a graph of log *y* against log *x*			
$y = ae^{kx}$	plot a graph of ln *y* against *x*			
$\eta = He^{\left(\frac{E}{kT}\right)}$ {*June 20/52*}	A graph is plotted of ln η on the *y*-axis against $1/T$ on the *x*-axis			

Akhtar Mahmood (0333-4281759)
LGS, BLL, ALJT, ALBT, TCS-Ravi
TCS-ALCG, SALT Academy
teacher_786@hotmail.com

(b)

Table of results: **[2]**

Complete the table as instructed i.e.

Column Headings:

Provide column headings that include both the quantity and the units (if any). In logarithmic quantities, units should be shown with the quantity whose logarithm is being taken, e.g. ln (d/ cm). The logarithm itself does not have a unit.

Calculation of values:

Calculate the values as instructed and the no. of s.f in calculated quantity should be equal to or one better than the least no. of s.f. of data used in calculation. The number of significant figures may, if necessary, vary down a column of values for a calculated quantity.

In logarithmic quantities, the number of decimal places should correspond to the number of significant figures. For example, if $\mathcal{L}$ / cm is 76.5 (3 sf), then lg ($\mathcal{L}$ / cm) should be either 1.884 (3 dp) or 1.8837 (4 dp).

Calculation of Uncertainties:

Absolute error can be calculated by methods read in AS level or use following relationships i.e.

Absolute error = Max value – Best value

Absolute error = Best value – Min value

$$\text{Absolute error} = \frac{\text{Max value} - \text{Min value}}{2}$$

Note: The no. of s.f. may be more than 1 s.f.

Example:

1. Calculate and record values of R^2 and E^3 in the table. Include the absolute errors in R^2.

R / cm	E / MeV		
4.00 ± 0.05	5.38		
4.35 ± 0.05	5.68		
4.80 ± 0.05	6.05		
5.05 ± 0.05	6.28		
5.70 ± 0.05	6.77		

Akhtar Mahmood (0333-4281759)
LGS, BLL, ALJT, ALBT, TCS-Ravi
TCS-ALCG, SALT Academy
teacher_786@hotmail.com

2. Calculate and record values of (1*I*/)A^{-1}. Include the absolute uncertainties in (1*II)A*$^{-1}$ *{june 19/51}*

θ/°	I/mA	$\frac{1}{I}$/A^{-1}
95	5.7 ± 0.1	
115	4.7 ± 0.1	
135	4.0 ± 0.1	
155	3.5 ± 0.1	
175	3.1 ± 0.1	
195	2.7 ± 0.1	

.

3. Calculate and record values of ln (η / 10^{-4} Pa s). Include the absolute uncertainties in ln (η / 10^{-4} Pa s).

T/K	η/10^{-4} Pa s	$\frac{1}{T}$/10^{-3} K^{-1}	ln (η/10^{-4} Pa s)
292	12.3 ± 0.2	3.42	
303	9.8 ± 0.2	3.30	
311	8.4 ± 0.2	3.22	
323	6.8 ± 0.2	3.10	
335	5.6 ± 0.2	2.99	
346	4.8 ± 0.2	2.89	

{june 2020/52}

Akhtar Mahmood (0333-4281759)
LGS, BLL, ALJT, ALBT, TCS-Ravi
TCS-ALCG, SALT Academy
teacher_786@hotmail.com

(c) Graph:

(i) Plot the plots on the scaled graph provided:

Include error bars on the marked plots: **[1]**

Error bar is the geometrical representation of uncertainty on the marked plots. Error bars are either parallel to horizontal axis or vertical axis depending upon the physical quantity taken along that axis and is marked by considering the smallest graduation/box on the grid provided.

(ii) Draw the straight line of best fit: **[1]**

Draw the worst acceptable straight line: **[1]**

The worst acceptable line should be either the steepest possible line or the shallowest possible line that passes through the error bars of all the data points and is drawn by joining the opposite ends of extreme end error bars.
Worst acceptable line should be distinguished from the line of best fit either by being drawn as a broken line or by being clearly labelled.

(iii) Determination of Gradient & Y-intercept (if any): **[2+2 or 1]**

Gradient:

Determine Gradient of best fit line

Determine Gradient of worst acceptable line

Gradient = (Gradient of best fit line in same no of d.p as in uncertainty) ± (Difference of gradient of best and worst acceptable lines in 1 s.f)

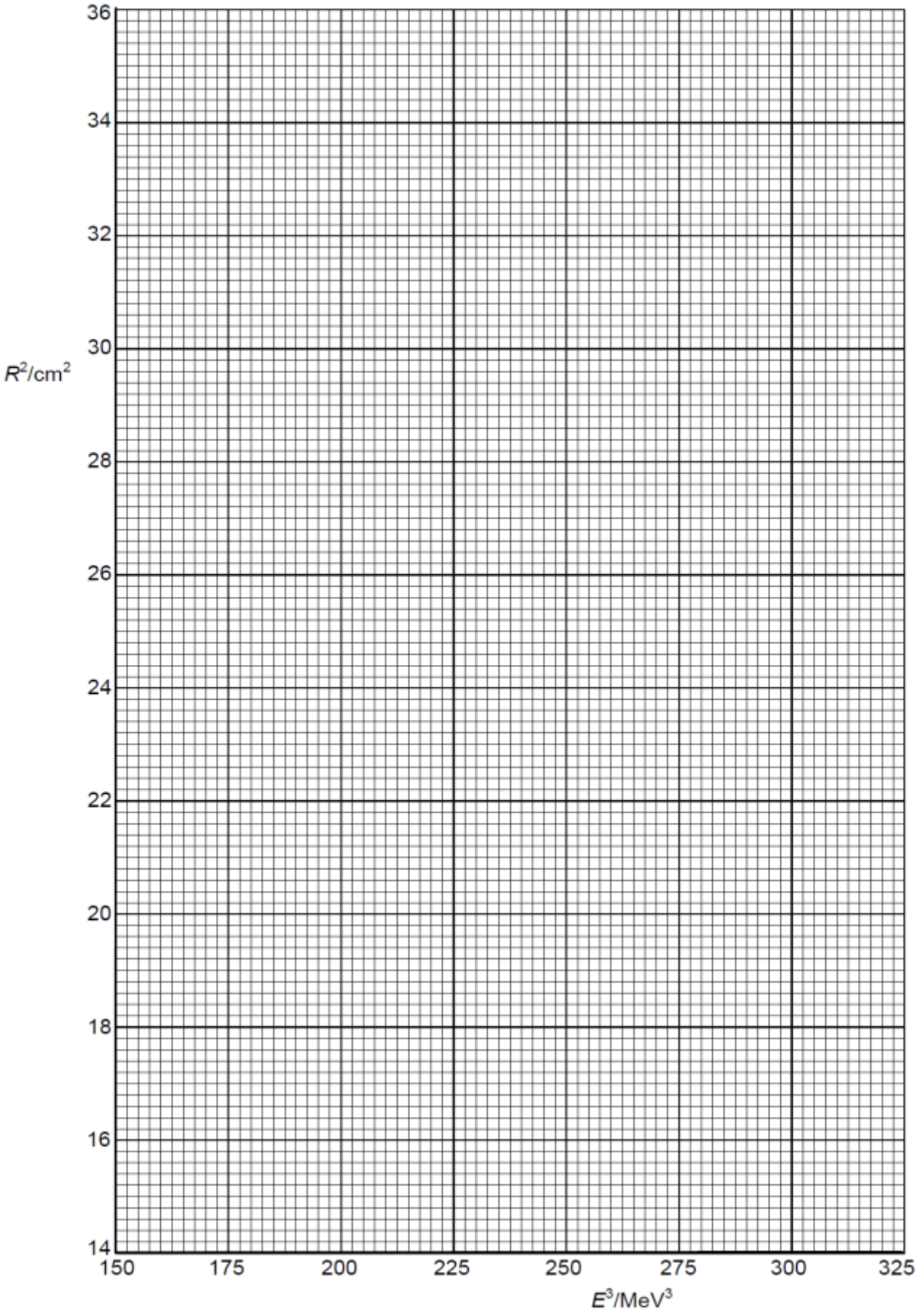
Y-Intercept:

Use $y = mx + c$ to get gradients of best and worst acceptable lines using respective gradients and coordinates values.

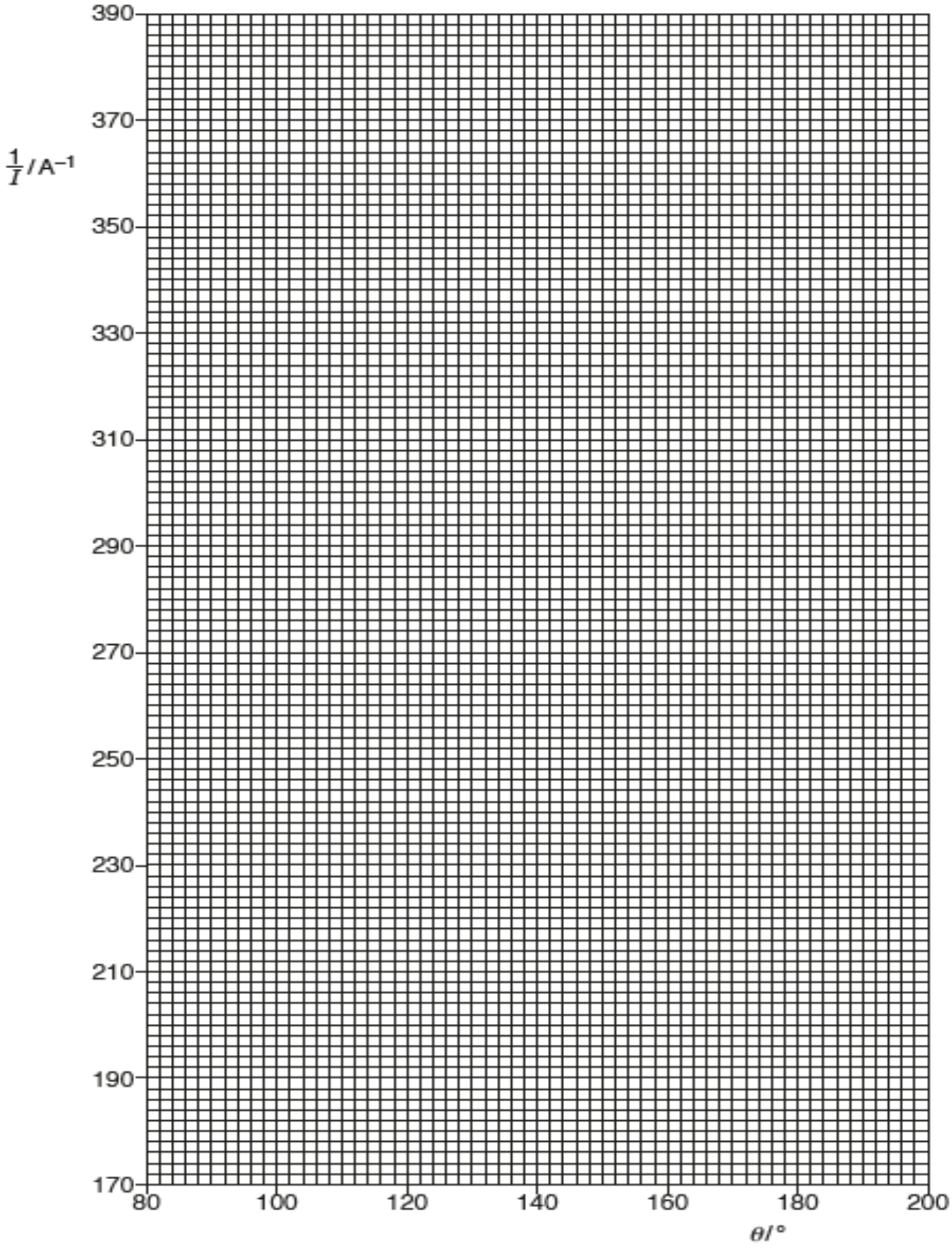
Y-intercept = (Y-intercept of best fit line in same no of d.p as in uncertainty) ± (Difference of y-intercepts of best and worst acceptable lines in 1 s.f)

Example:

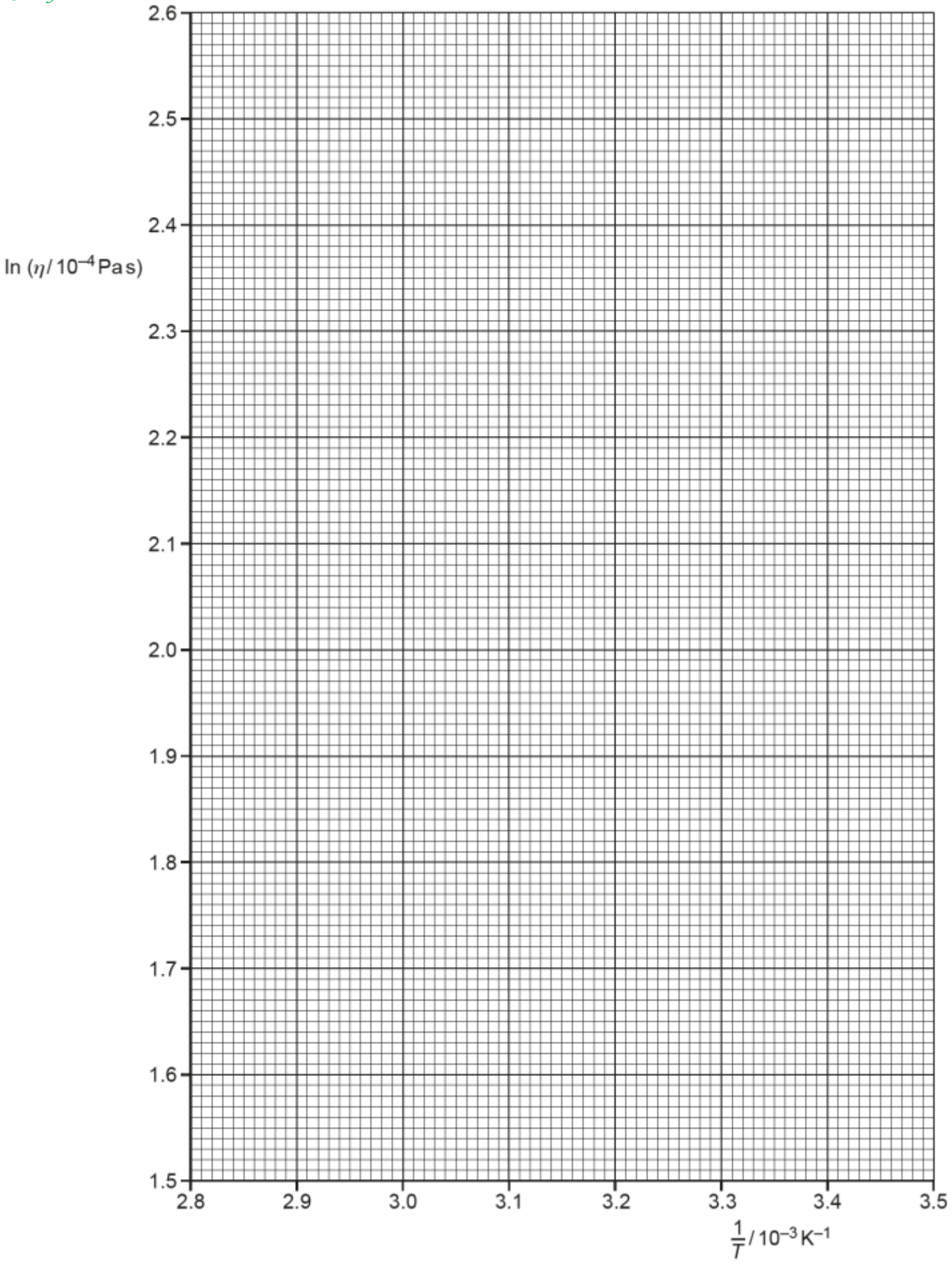
Q. 1 {*Specimen Paper June 2016*}



Q.2 {*june 19/51*}


390
370
$\frac{1}{I}$ / A^{-1}
350
330
310
290
270
250
230
210
190
170
80
100
120
140
160
180
200
θ/°

Q.3 *{june 2020/52}*



Akhtar Mahmood (0333-4281759)
LGS, BLL, ALJT, ALBT, TCS-Ravi
TCS-ALCG, SALT Academy
teacher_786@hotmail.com

(d) *Use the expression of gradient & Y-intercept (if any) from part (a) and their respective values from part (c)* *[5 or 6]*

to evaluate:

(i) Their values and uncertainties

(ii) Percentage errors

Example:
Q. {*Specimen Paper June 2016*}
(d) Determine the value of *c*. Include the error and the unit in your answer.

c = ... [5]