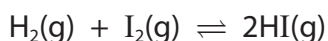


- 9 The gas phase reaction between hydrogen and iodine is reversible.



- (a) (i) Write the expression for the equilibrium constant, K_c , for this reaction. (1)

- (ii) If the starting concentration of both hydrogen and iodine was $a \text{ mol dm}^{-3}$ and it was found that $2y \text{ mol dm}^{-3}$ of hydrogen iodide had formed once equilibrium had been established, write the K_c expression in terms of a and y . (2)

- (b) The expression for the equilibrium constant in (a)(ii) can be rearranged as shown.

$$y = \frac{a\sqrt{K_c}}{2 + \sqrt{K_c}}$$

In an experiment, air was removed from a 1 dm^3 flask and amounts of hydrogen and iodine gases were mixed together such that their initial concentrations were both $a \text{ mol dm}^{-3}$. This mixture was allowed to reach equilibrium at 760 K . The equilibrium concentration of iodine was then measured.

The experiment was repeated for various initial concentrations, $a \text{ mol dm}^{-3}$, and the results recorded in the table.

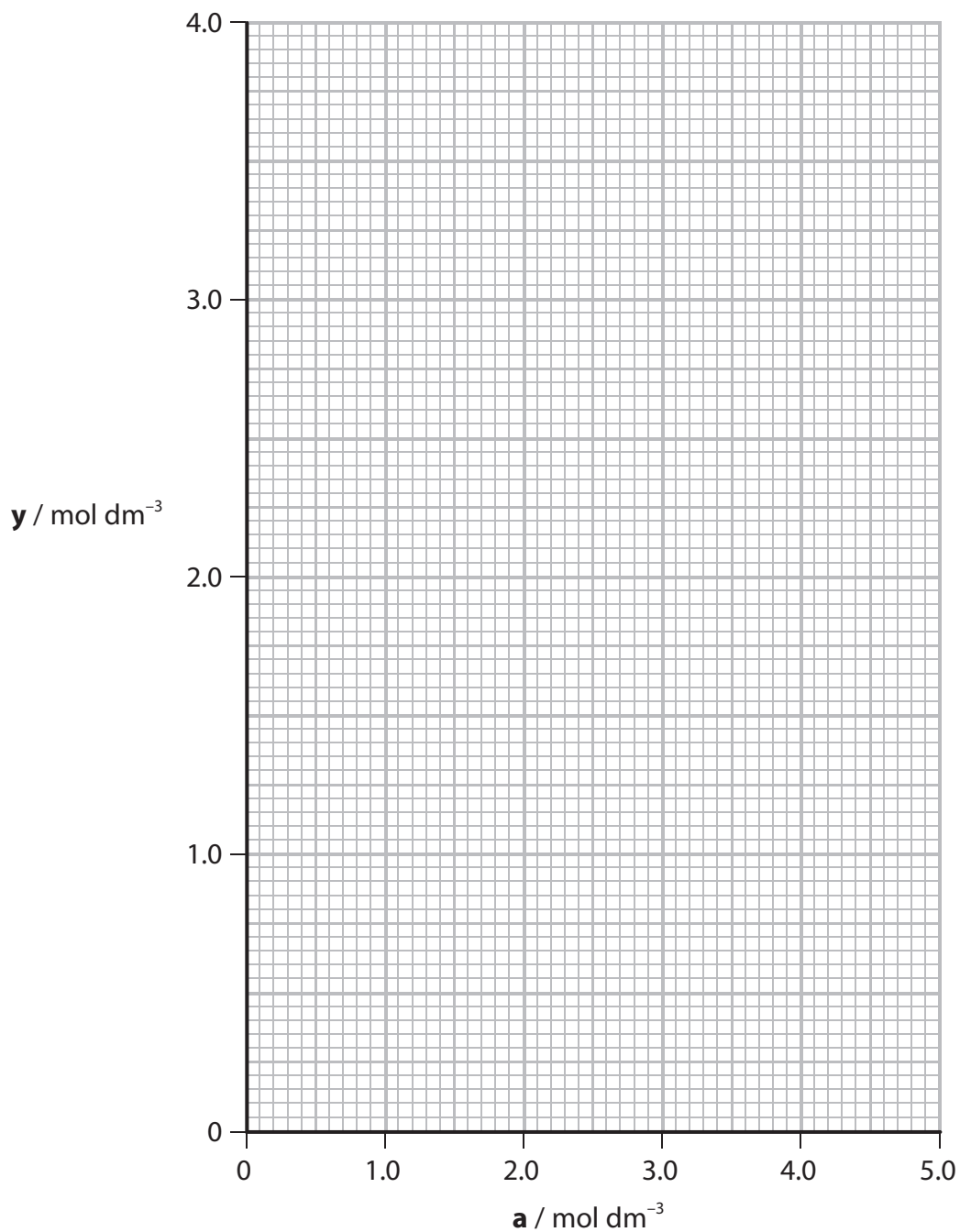
- (i) Complete the table to give the two remaining values of $y \text{ mol dm}^{-3}$, to **two** decimal places. (1)

$a / \text{mol dm}^{-3}$	$[\text{I}_2]_{\text{eq}} / \text{mol dm}^{-3}$	$y / \text{mol dm}^{-3}$
0.20	0.02	0.18
0.80	0.25	0.55
1.50	0.37	
2.10	0.57	1.53
2.80	0.65	2.15
3.80	0.87	
4.90	1.15	3.75



(ii) Plot a graph to show how $y \text{ mol dm}^{-3}$ varies with the initial concentrations of hydrogen and iodine, $a \text{ mol dm}^{-3}$.

(2)



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(iii) Determine the gradient of your graph.
Show your working on the graph.

(2)

(iv) Use your answer to (b)(iii) and the expression $y = \frac{a\sqrt{K_c}}{2 + \sqrt{K_c}}$ to calculate the value of K_c .

(2)

(c) Identify a safety issue associated with this experiment.

(1)

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(d) One of the experiments in part (b) was repeated using the same molar quantities of hydrogen and iodine but in a 500 cm³ flask instead of the 1 dm³ flask.

Deduce the effect, if any, that this would have on the rate of reaction and on the value of K_c calculated.

(2)

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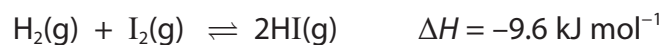
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(e) The equation for the reaction between hydrogen and iodine is



(i) Explain the effect, if any, on the value of K_c when the temperature is increased.

(2)

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(ii) On your graph in (b)(ii), draw and label the line you would expect if the experiment was carried out at 1000 K instead of 760 K.

(1)

(Total for Question 9 = 16 marks)

TOTAL FOR PAPER = 120 MARKS

