Name of the Student:_____

Max. Marks : 21 Marks **Time : 21 Minutes**

Q1.

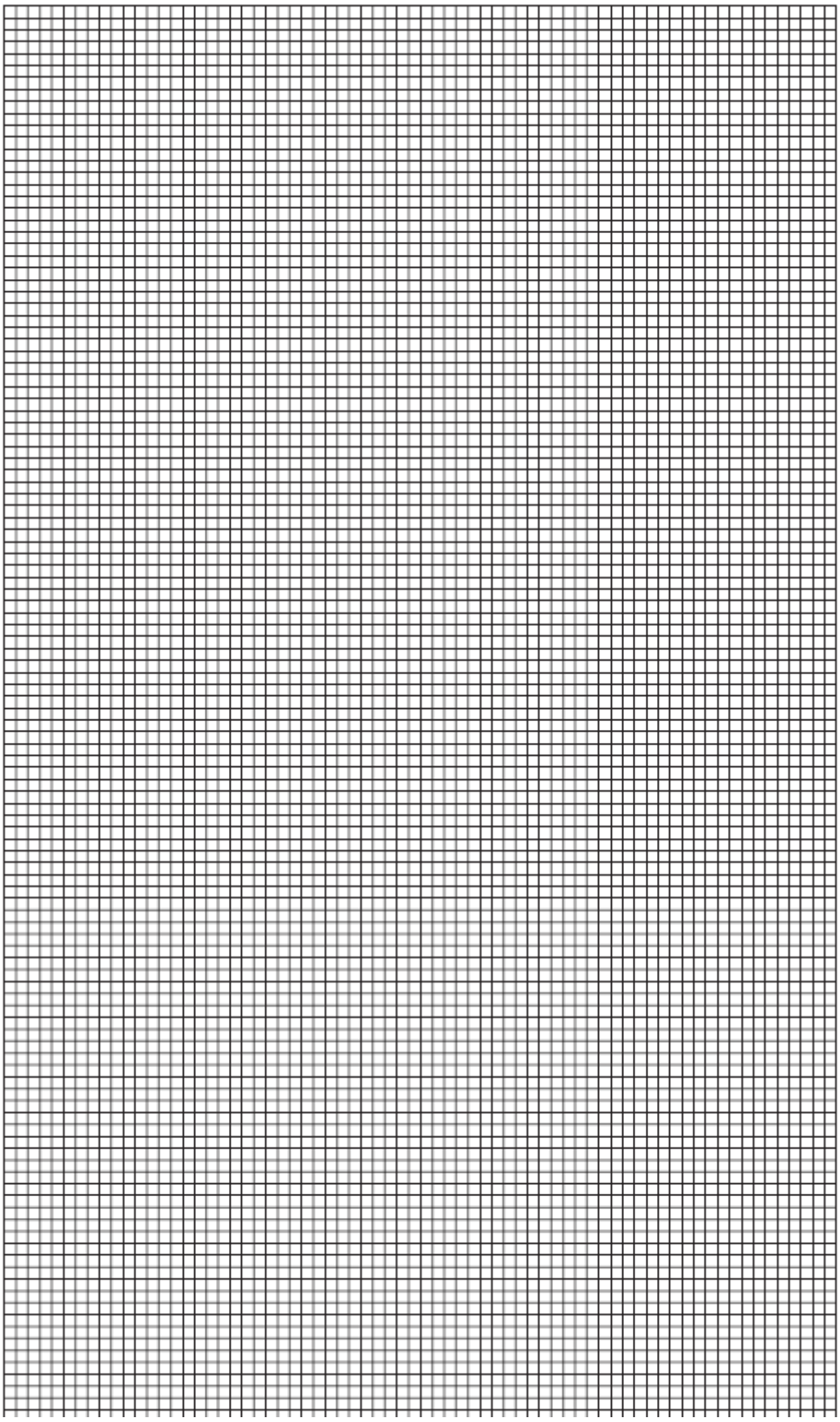
Calamine lotion can contain a mixture of zinc carbonate and zinc oxide in suspension in water. A manufacturer of calamine lotion claims that a sample contains 15.00 g of zinc carbonate and 5.00 g of zinc oxide made up to 100 cm^3 with distilled water.

(a) A chemist wanted to check the manufacturer's claim. The chemist took a 20.0 cm^3 sample of the calamine lotion and added it to an excess of sulfuric acid.
The volume of carbon dioxide evolved was measured over time. The chemist's results are shown in the table.

Time / s	0	15	30	45	60	75	90	105	120	135
Volume / cm^3	0	135	270	380	470	530	560	570	570	570

(i) Plot a graph of the results in the table on the grid. The volume should be on the *y*-axis. Draw a best-fit curve through **all** the points.

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(3)

(ii) Estimate the time taken for the reaction to be completed.

_____

(1)

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(b) (i) The volume of carbon dioxide in part (a) was measured at 293 K and at a pressure of 100 kPa.

Use information from your graph to calculate the maximum amount, in moles, of carbon dioxide evolved from the zinc carbonate in this 20.0 cm^3 sample.

The gas constant, R = 8.31 J K^{-1} mol^{-1}

Show your working.

_____

_____

_____

_____

_____

_____

(3)

(ii) Use your answer to part (i) to calculate the mass of zinc carbonate in the 20.0 cm^3 sample of calamine lotion.

(If you were unable to complete part (i), you may assume that the amount of carbon dioxide evolved was 0.0225 mol. This is **not** the correct answer.)

_____

_____

_____

_____

_____

(2)

(iii) Calculate the difference between your answer to part (ii) and the manufacturer's claim that there are 15.00 g of zinc carbonate in 100 cm^3 of the calamine lotion.
Express this difference as a percentage of the manufacturer's claim.
(If you were unable to complete part (ii), you may assume that the mass of zinc carbonate in the 20 cm^3 sample of calamine lotion was 2.87 g. This is **not** the correct answer.)

Difference _____

Percentage _____

_____

(2)

(c) Draw a diagram of a suitable apparatus needed to perform the experiment outlined in part (a). Include in your diagram a method for collecting and measuring the carbon dioxide. The apparatus should be airtight.

(2)

(Total 13 marks)

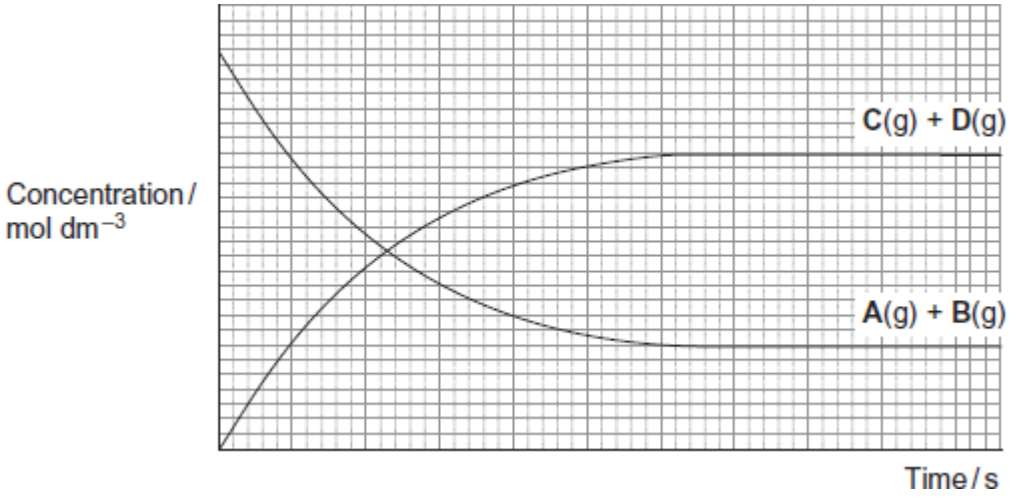
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Q2.

A dynamic equilibrium is established when gas **A** is mixed with gas **B** at a given temperature.

$$\mathbf{A}(g) + \mathbf{B}(g) \rightleftharpoons \mathbf{C}(g) + \mathbf{D}(g)$$

The figure below shows how the concentrations of reactants and products change with time.



(a) (i) On the appropriate axis of the figure, place an **X** to show the time when equilibrium is first established.

(1)

(ii) State how the rate of the forward reaction and the rate of the reverse reaction are related to each other at equilibrium.

_____

_____

(1)

(b) Give the meaning of the term **dynamic** in the context of a dynamic equilibrium.

_____

_____

_____

(1)

(c) The total pressure on the system is increased at constant temperature.

(i) State and explain the effect, if any, of this change on the position of this equilibrium.

Effect _____

Explanation _____

_____

_____

_____

(2)

(ii) State and explain the effect, if any, of this change on the time taken to reach this

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equilibrium.

Effect _____

Explanation _____

_____

_____

_____

_____

(3)

(Total 8 marks)

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