Website: contoureducation.com.au | **Phone:** 1800 888 300
Email: hello@contoureducation.com.au

VCE Chemistry ¾
Rates of Reaction [2.6]
Homework

Admin Info & Homework Outline:

Student Name	
Questions You Need Help For	
Compulsory Questions	Pg 2 - Pg 11
Supplementary Questions	Pg 12 - Pg 21

Section A: Compulsory Questions (36.5 Marks)

Sub-Section [2.6.1]: Explain How Factors Increase Frequency of Collisions

Question 1 (1.5 marks)

State what happens to the rate of reaction for each of the following scenarios for the following reaction:

$$Ca(s) + H_2SO_4(aq) \rightarrow CaSO_4(s) + H_2(g)$$

Change	Effect on Rate of Reaction
a. More water is added to sulphuric acid.	rate [increases] / [decreases] / [stays same]
b. Calcium solid is ground into powder.	rate [increases] / [decreases] / [stays same]
c. Concentration of sulphuric acid is increased to 2.0 *M*.	rate [increases] / [decreases] / [stays same]

Question 2 (2 marks)

Explain how decreasing the volume of the aqueous mixture of the reaction between potassium hydroxide and phosphoric acid will affect the rate of reaction.

Space for Personal Notes

Question 3 (2 marks)

Finely grounded powder of potassium solid reacts with hydrochloric acid according to the following equation:

$$2K(s) + 2HCl(aq) \rightarrow 2KCl(aq) + H_2(g)$$

Explain what would happen to the rate of reaction if lumps of potassium solid were to be used instead.

Space for Personal Notes

Sub-Section [2.6.2]: Explain How Temperature & Catalyst Affect the Proportion of Successful Collisions

Question 4 (1 mark)

Sue is investigating a reaction between two gas reagents in a reaction vessel. She heats the beaker up to 60°C. Predict which of the following will have the greatest impact on the rate of reaction when temperature is increased.

A. The increase in the total number of collisions.

B. The increase in the mean energy per collision between reactant particles.

C. The gas particles will increase in size due to a temperature increase, causing a pressure increase in the vessel.

D. The reaction vessel shrinking in size due to the exposure to higher temperatures.

Question 5 (3 marks)

Adeeb sets up a reaction between potassium iodide (KI) and hydrochloric acid (HCl) in a reaction vessel. Given that Adeeb increases the temperature of the reaction vessel, predict the effect on the reaction rate.

Space for Personal Notes

Question 6 (1 mark)

Nitric monoxide is added to oxygen gas in a reaction vessel.

Justin decreases the temperature in the reaction vessel from 35°C to 10°C.

a. State and justify what happens to the rate of reaction.

_____

_____

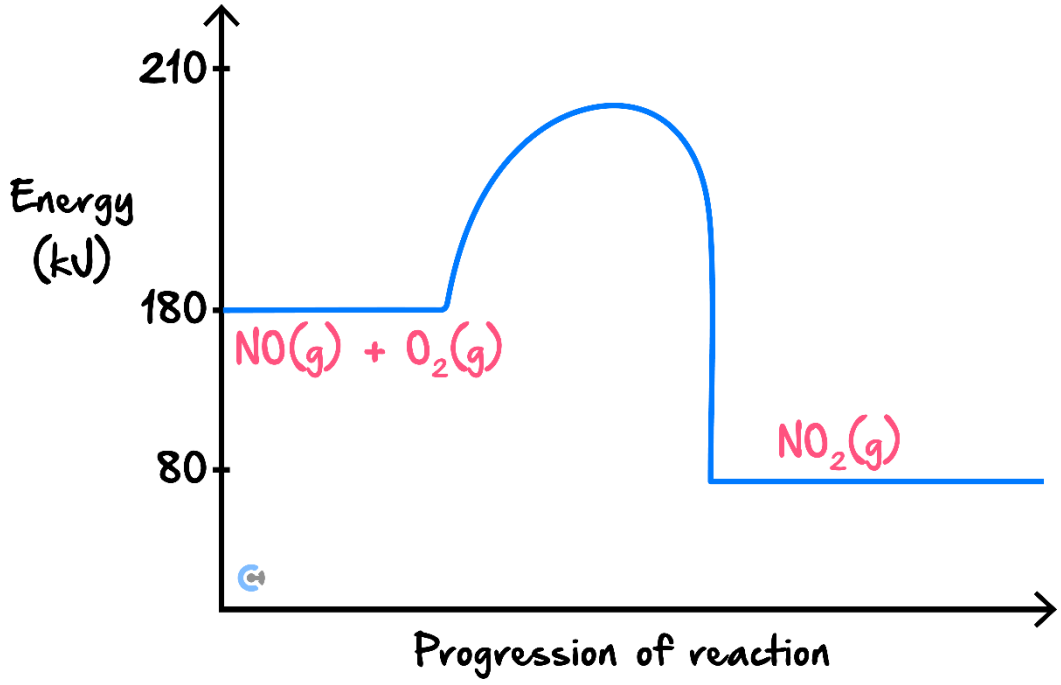
_____

_____

_____

_____

b. The energy profile for the original equation is provided before. Draw the new energy profile for the reaction occurring at a lower temperature on the same graph. (1 mark)



Space for Personal Notes

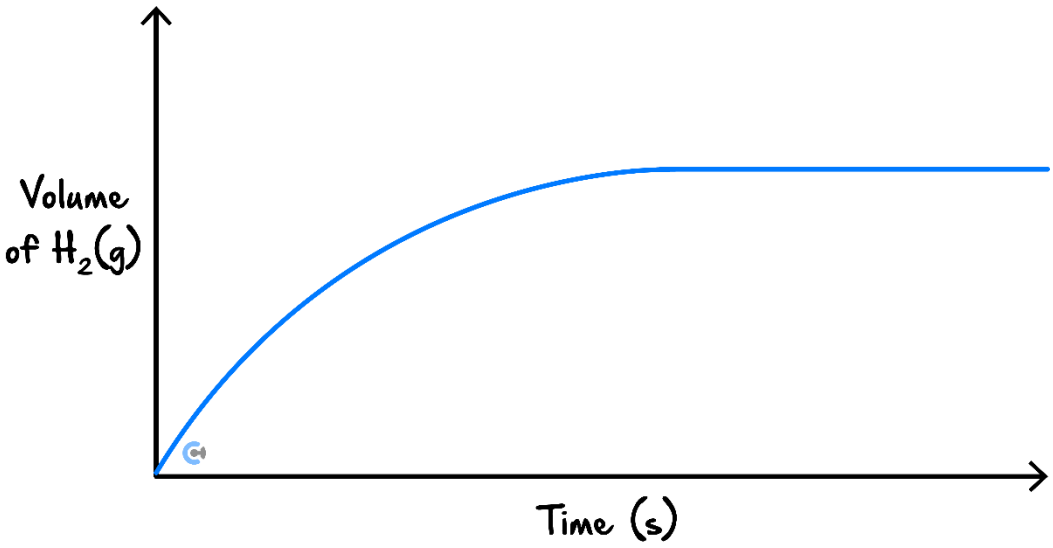
Sub-Section [2.6.3]: Graph Differences in Rate & Yield

Question 7 (3 marks)

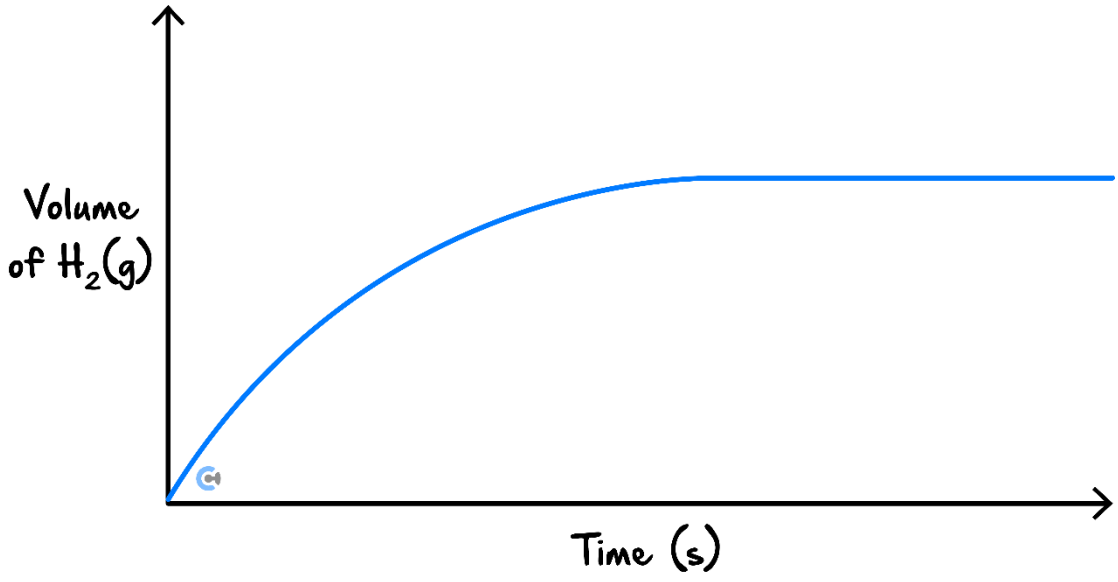
A graph has been provided below, showing how hydrogen gas is formed from a reaction between water and 2.0 g magnesium metal.

$$Mg(s) + 2HCl(aq) \rightarrow MgCl_2(aq) + H_2(g)$$

a. Draw with a dotted line, a curve which represents what happens when the temperature is increased on the graph below. (1 mark)



b. Draw with a solid line, a curve which represents what happens when the mass of magnesium is increased from 2.0 g to 4.0 g on the curve below. (2 marks)

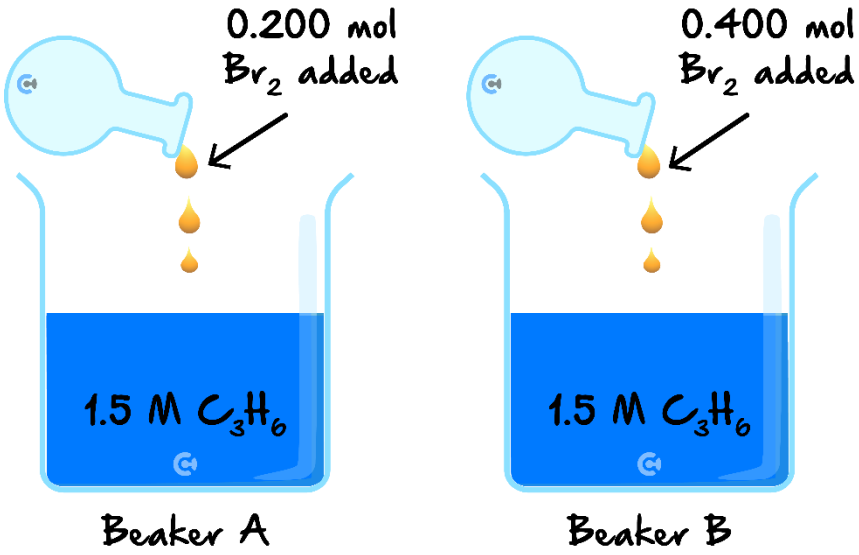


Question 8 (7 marks)

Angel adds bromine, a brown liquid, to two beakers containing the same volume of 1.5 M propene. In beaker A, Angel adds 0.200 mol of bromine liquid whereas in beaker B, 0.400 mol is added.

The chemical equation between propene and bromine liquid has been provided below:

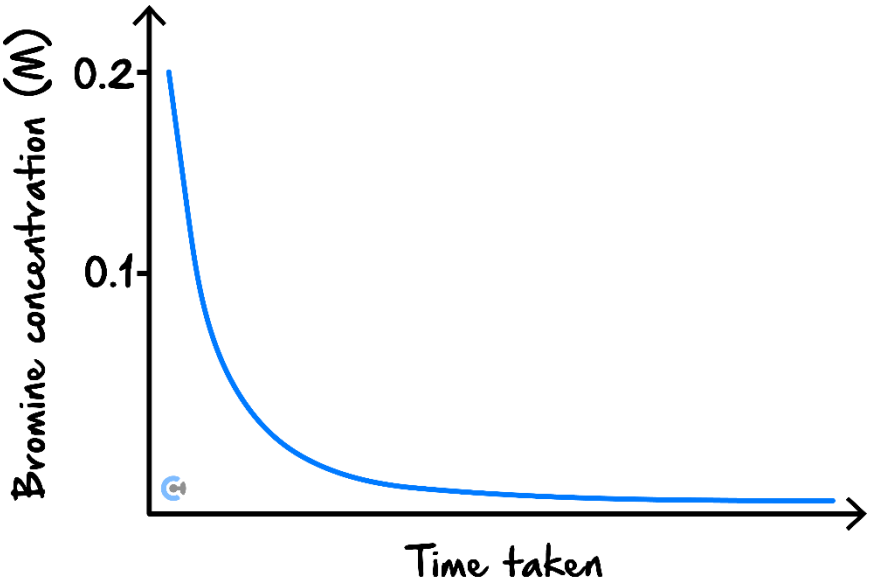
$$C_3H_6(l) + Br_2(l) \rightarrow C_3H_6Br_2(l)$$



a. Predict and justify which beaker will have the greatest rate of reaction. (3 marks)

b. Hence, explain which beaker will require the **most** amount of time for the colour to fade. (2 marks)

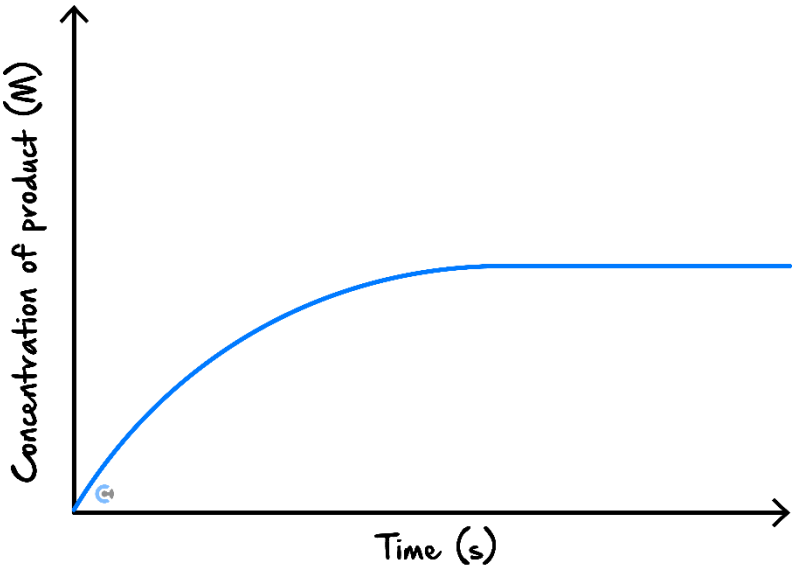
c. Angel graphs the bromine concentration vs time graph for beaker *B*. Given that beaker *A* and *B* are 2.0 *L*, on the graph below, draw the curve for beaker *A*. (2 marks)



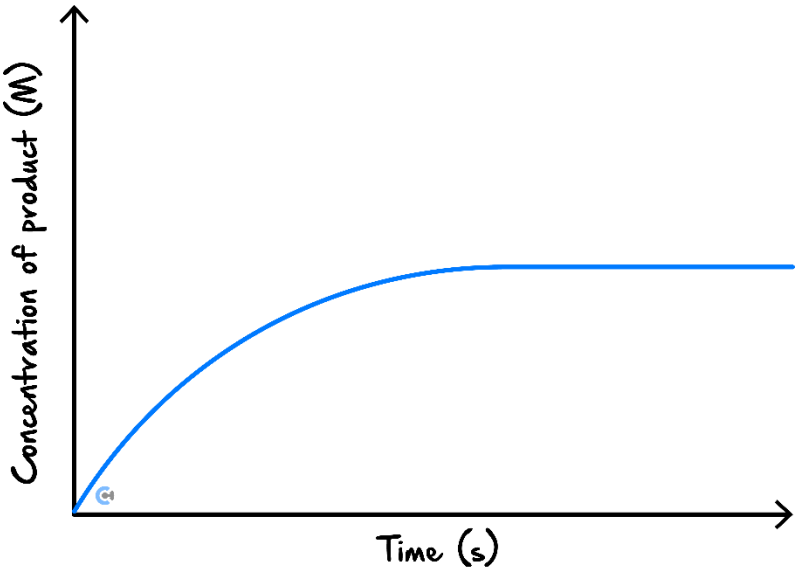
Question 9 (4 marks)

In the graphs below:

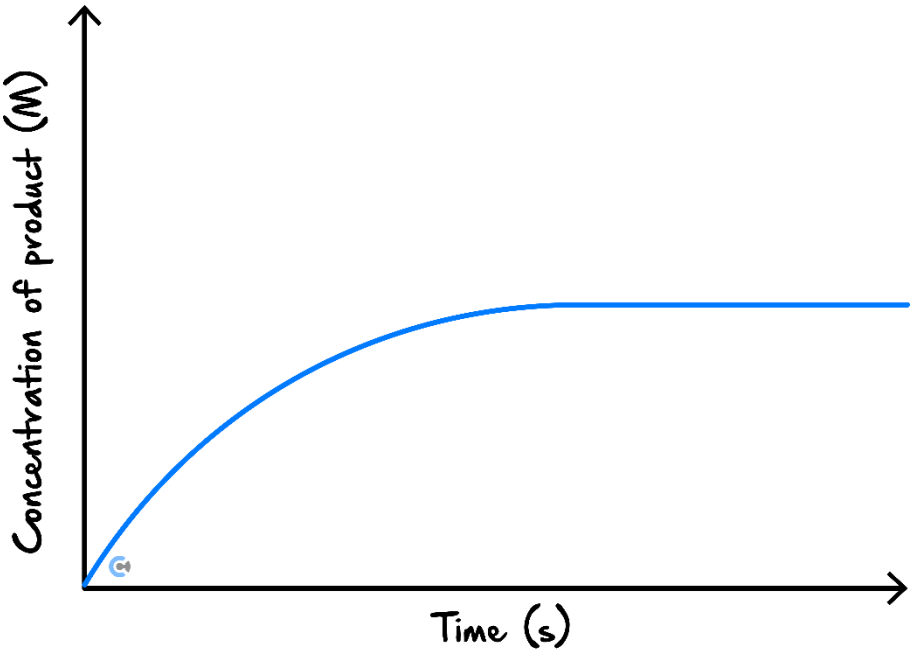
a. Draw a curve if a catalyst was added to the reaction. (1 mark)



b. If a reactant was doubled in concentration. (1 mark)



c. If a catalyst was added, but the reactant concentration was halved. (2 marks)



Space for Personal Notes

Sub-Section: The 'Final Boss'

Question 10 (12 marks)

A reaction occurs between a 100 mL beaker of 1.0 M iron (III) chloride and a 100 mL beaker of 1.0 M sodium hydroxide at 25℃.

a. Write the balanced overall reaction which takes place. (2 marks)

b. Devise a method to measure the rate of reaction. (2 marks)

c. The graph for the mass of oxygen gas produced is shown below.

i. The concentration of sodium hydroxide is then doubled to 2.0 *M* with the same volume.

Explain the effect this change has on the rate of formation of oxygen gas, referring to collision theory. (2 marks)

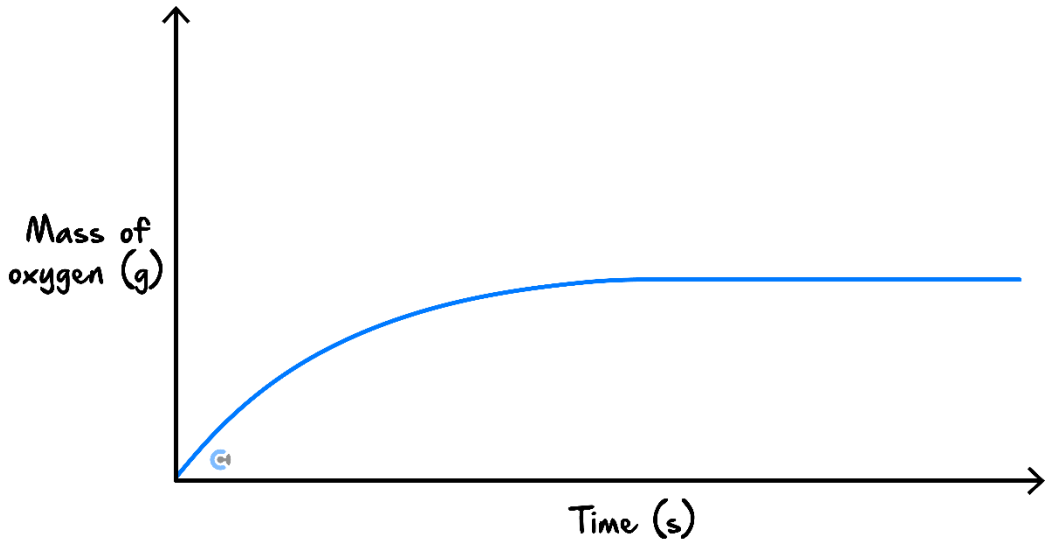
_____

_____

_____

_____

ii. On the graph provided below, show how this would change the mass of oxygen gas formed. Explain the reason for this shape. (3 marks)



d. On a separate occasion, the temperature of the whole mixture is decreased to 15°C. Explain the expected effect on the time taken for the same mass of oxygen gas to form. (3 marks)

_____

_____

_____

_____

_____

Section B: Supplementary Questions (32.5 Marks)

Sub-Section [2.6.1]: Explain How Factors Increase Frequency of Collisions

Question 11 (1.5 marks)

State what happens to the rate of reaction for each of the following scenarios for the following reaction:

$$Mg(s) + H_2SO_4(aq) \rightarrow MgSO_4(s) + H_2(g)$$

Change	Effect on Rate of Reaction
a. The mass of magnesium metal added is halved.	rate [increases] / [decreases] / [stays same]
b. Magnesium solid is added in clumps.	rate [increases] / [decreases] / [stays same]
c. Concentration of sulphuric acid is decreased to 1.5 M.	rate [increases] / [decreases] / [stays same]

Question 12 (2 marks)

Explain how increasing the volume of the aqueous mixture of the reaction between potassium hydroxide and sulphuric acid will affect the rate of reaction.

Space for Personal Notes

Question 13 (2 marks)

Lumps of sodium solid react with hydrochloric acid according to the following equation:

$$2Na(s) + 2HCl(aq) \rightarrow 2NaCl(aq) + H_2(g)$$

Explain what would happen to the rate of reaction if finely grounded powder of sodium solid were to be used instead.

Question 14 (4 marks)

Eric is preparing two solutions:

Solution 1: Adding 100 ml Silver Nitrate (1.0 M) to 200 ml Sodium Chloride (2.0 M).

Solution 2: Adding 100 ml Silver Nitrate (1.0 M) to 200 ml Sodium Chloride (3.0 M).

Assuming all other conditions are controlled, which solution will have the greater rate of reaction? Explain using Collision Theory.

Space for Personal Notes

Sub-Section [2.6.2]: Explain How Temperature & Catalyst Affect the Proportion of Successful Collisions

Question 15 (1 mark)

Predict which of the following will have the greatest impact on the rate of reaction when temperature is decreased.

A. The decrease in total number of collisions.

B. The decrease in the mean energy per collision between reactant particles.

C. The gas particles will decrease in size due to a temperature decrease, causing a pressure decrease in the vessel.

D. The reaction vessel shrinking in size due to the exposure to decreased temperatures.

Question 16 (3 marks)

Rehansa sets up a reaction between Sodium iodide (NaI) and hydrochloric acid (HCl) in a reaction vessel. Given that Rehansa decreases the temperature of the reaction vessel, predict the effect on the reaction rate.

Space for Personal Notes

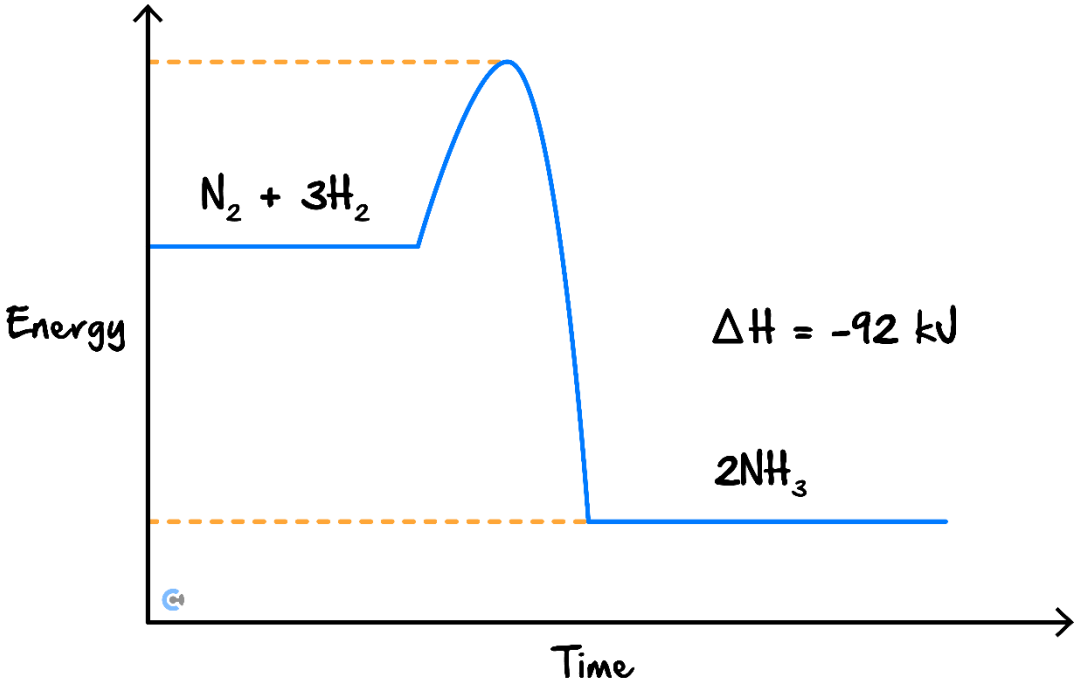
Question 17 (1 mark)

Nitrogen gas is added to a reaction vessel containing hydrogen gas, forming ammonia gas.

Aaliah decreases the temperature in the reaction vessel from 35°C to 10°C.

a. State and justify what happens to the rate of reaction.

b. The energy profile for the original equation is provided before. Draw the new energy profile for the reaction occurring at a lower temperature on the same graph. (1 mark)



Space for Personal Notes

Question 18 (3 marks)

To ensure bread dough rises, it is recommended that the dough is left at room temperature rather than in the fridge. Explain this phenomenon using the collision theory.

Space for Personal Notes

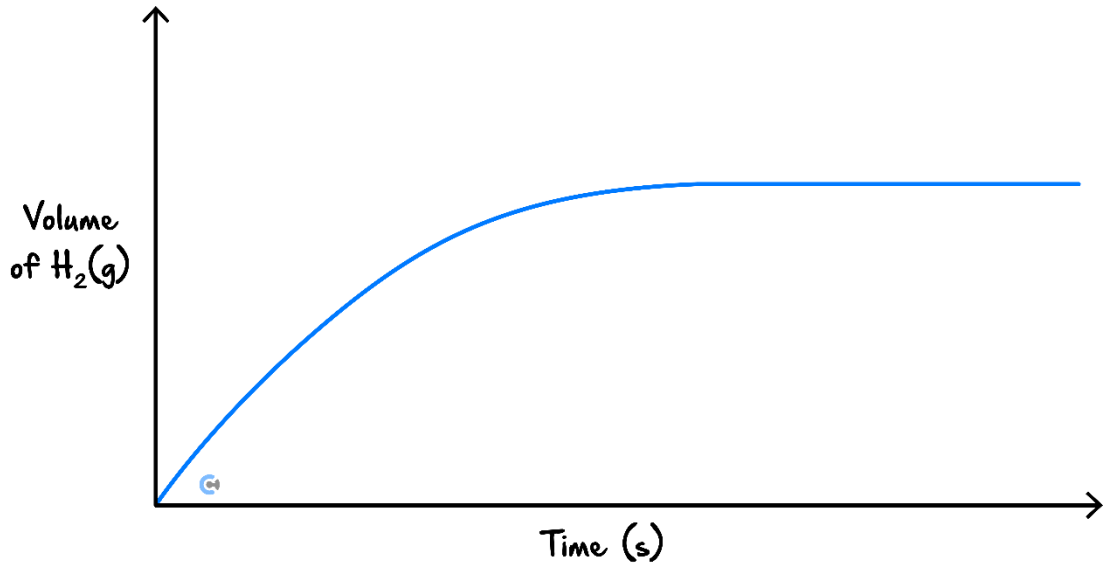
Sub-Section [2.6.3]: Graph Differences in Rate & Yield

Question 19 (3 marks)

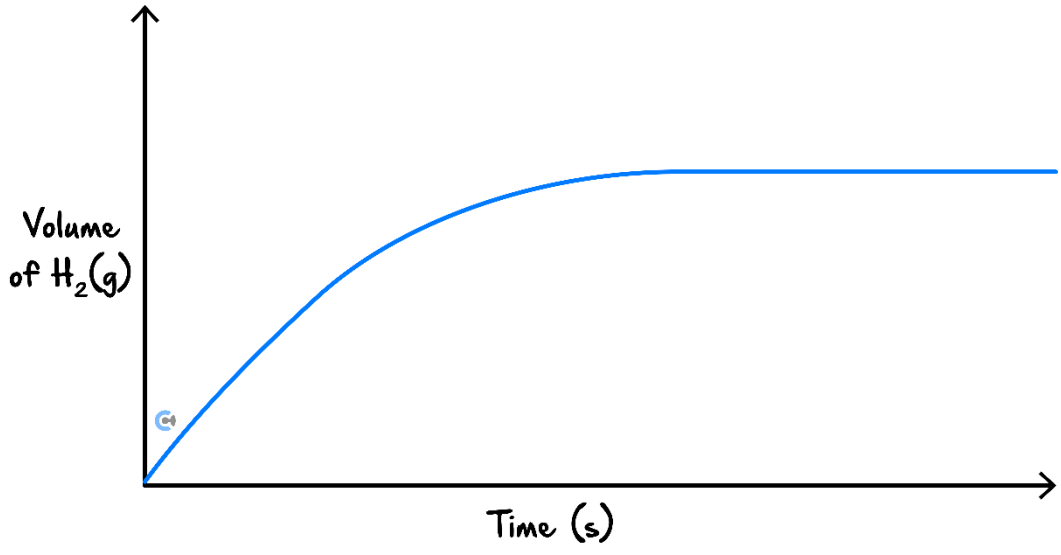
A graph has been provided below, showing how hydrogen gas is formed from a reaction between water and 2.0 g magnesium metal.

$$Mg(s) + 2HCl(aq) \rightarrow MgCl_2(aq) + H_2(g)$$

a. Draw with a dotted line, a curve which represents what happens when the temperature is decreased on the graph below. (1 mark)



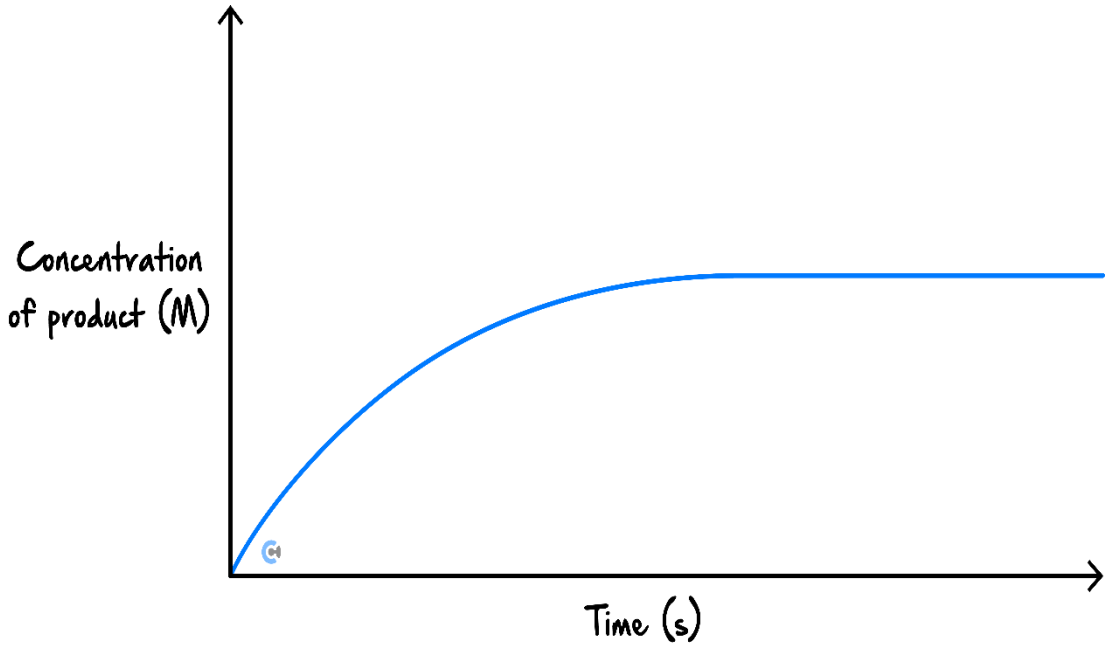
b. Draw with a solid line, a curve which represents what happens when the mass of magnesium is decreased from 2.0 g to 1.0 g, given that it is the limiting reagent, on the curve below. (2 marks)



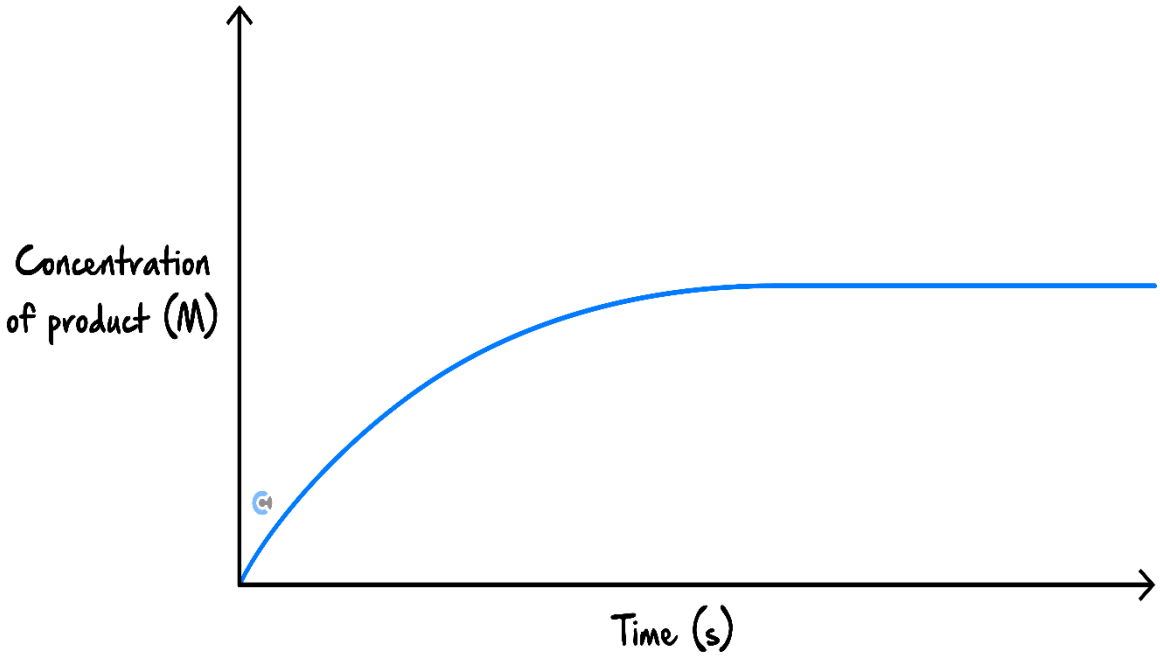
Question 20 (2 marks)

In the graphs below:

a. Draw a curve if the reactant was crushed into a fine powder instead of added as larger pellets. (1 mark)



b. If a reactant was halved in concentration. (1 mark)



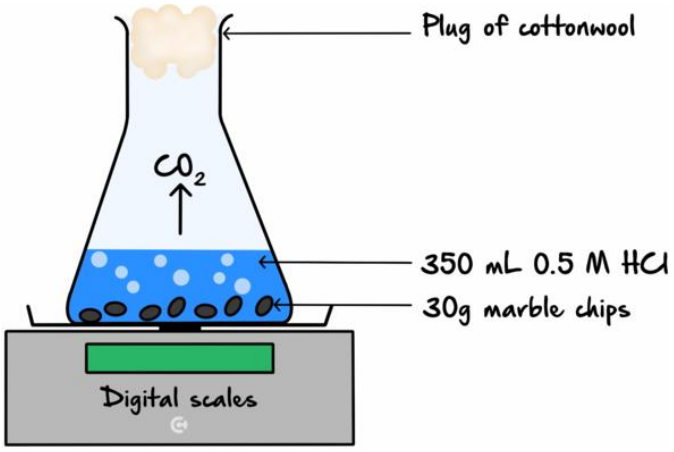
Space for Personal Notes

Question 21 (10 marks)

A student set up an experiment to test the effect of different factors on the rate and extent of the reaction between a strong acid and marble chips (Calcium Carbonate, $CaCO_3$). In each trial, the mass of the flask and its contents was measured every 30 seconds, from the instant the reactants were mixed.

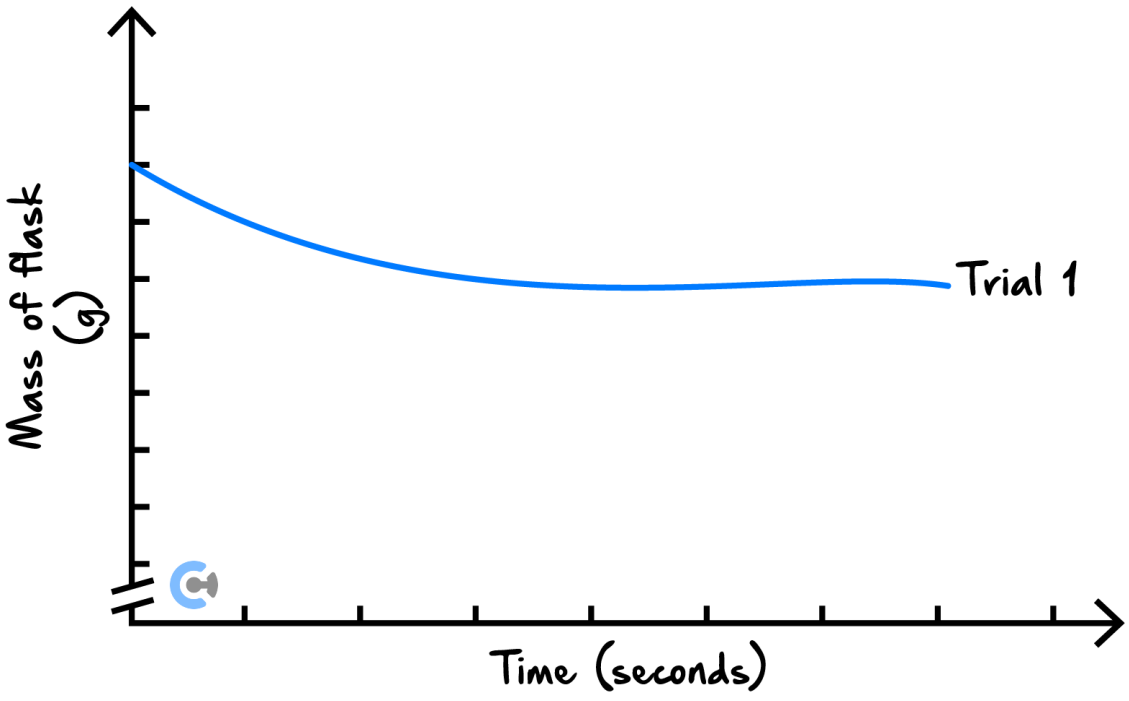
The strong acid used was Hydrochloric acid, HCI. The equation for the reaction is as follows.

$$2HCl(aq) + CaCO_3(s) \rightarrow CaCl_2(aq) + CO_2(g) + H_2O(l)$$

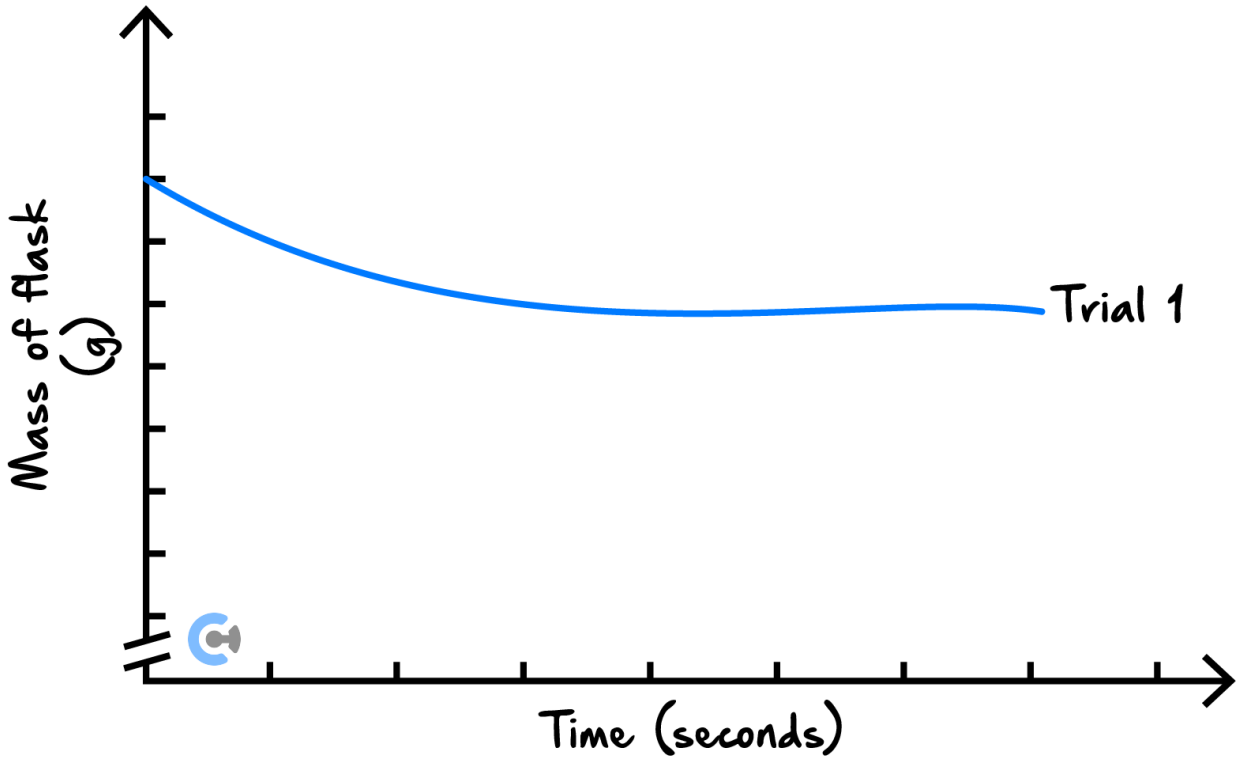


The student then goes about making several changes to the experimental design. Assume trial 1 is the condition of the experiment as shown above.

a. First, the student adds 350 ml of Nitric acid (Trial 2) instead of 350 ml of HCl (Trial 1). On the same set of axes, draw the two trials. (2 marks)

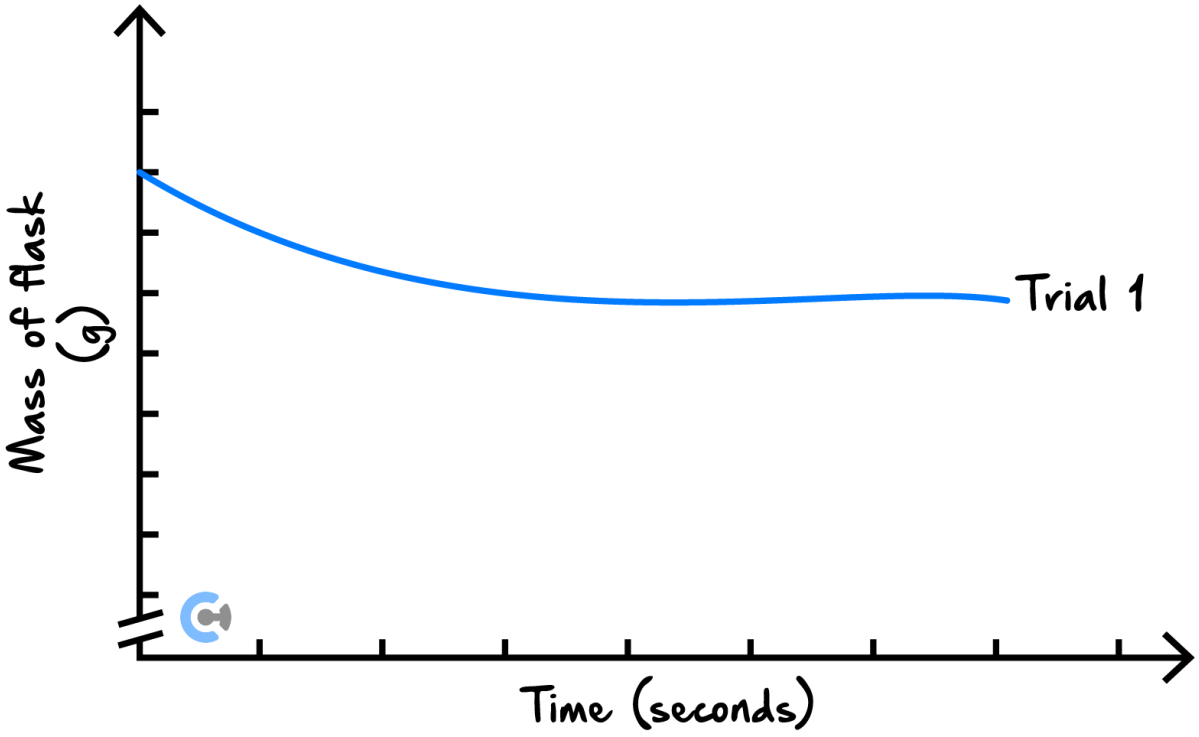


b. The student then crushes the 30 *g* of marble chips and conducts another trial. Draw what would be expected from the trial on the graph below. (2 marks)



c. The student then decides to add MnO_2 and conducts another trial.

i. Draw what would be expected from the trial below. (2 marks)



ii. Explain why this graph is observed. (4 marks)

Space for Personal Notes

CONTOUREDUCATION

Website: contoureducation.com.au | **Phone:** 1800 888 300 | **Email:** hello@contoureducation.com.au

VCE Chemistry ¾

Free 1-on-1 Support

Be Sure to Make The Most of These (Free) Services!

- Experienced Contour tutors (45+ raw scores, 99+ ATARs).
- For fully enrolled Contour students with up-to-date fees.
- After school weekdays and all-day weekends.

1-on-1 Video Consults	Text-Based Support
➢ Book via bit.ly/contour-chemistry-consult-2025 (or QR code below). ➢ One active booking at a time (must attend before booking the next).	➢ Message +61 440 137 304 with questions. ➢ Save the contact as "Contour Chemistry".

Booking Link for Consults
bit.ly/contour-chemistry-consult-2025

Number for Text-Based Support
+61 440 137 304