

EP_2A N5 Rates of Reaction

Write the date in the margin of your jotter.
Write the title of this Exercise as a heading: EP_2A N5 Rates of Reaction



SUMMARY

6. REACTION RATES

The following can affect the **speed** of a reaction:

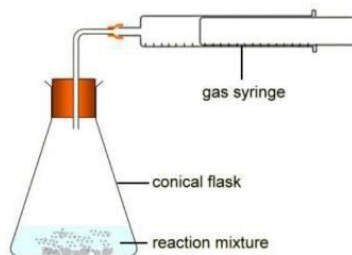
- **PARTICLE SIZE** (SMALLER PARTICLES → FASTER)
- **TEMPERATURE** (HIGHER TEMP → FASTER)
- **CONCENTRATION** (MORE CONCENTRATED → FASTER)

A **CATALYST** is a substance which **speeds up a reaction but remains unchanged at the end** (not used up!).

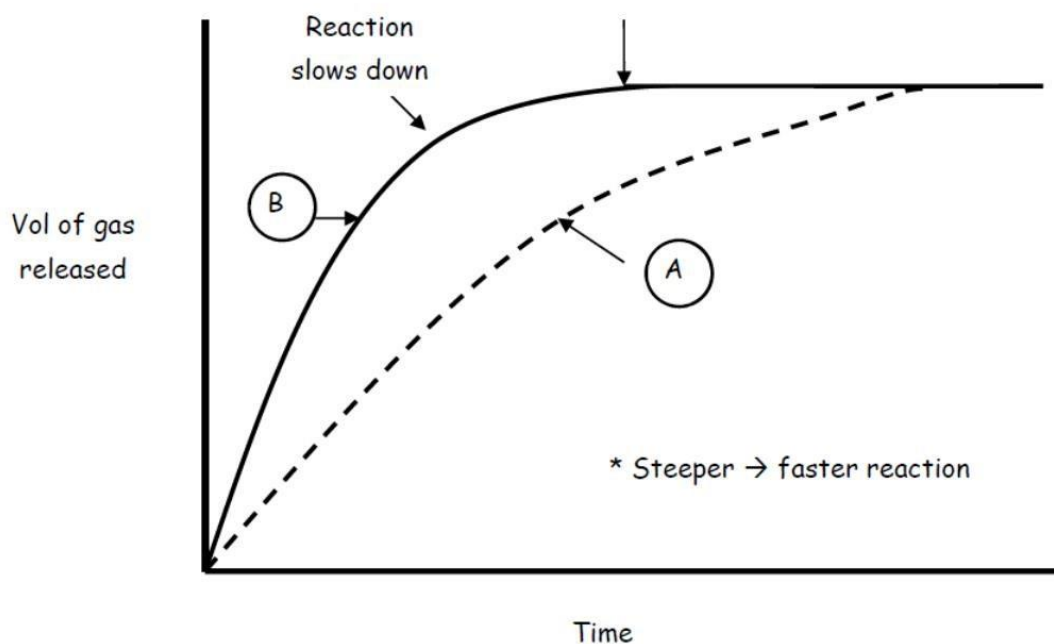
Presenting results on **RATES** of reactions:

e.g. Lump of chalk + acid A

Powdered chalk + acid B



Reaction Over



Average Rate of Reaction

CHANGE IN MASS/VOLUME/CONCENTRATION

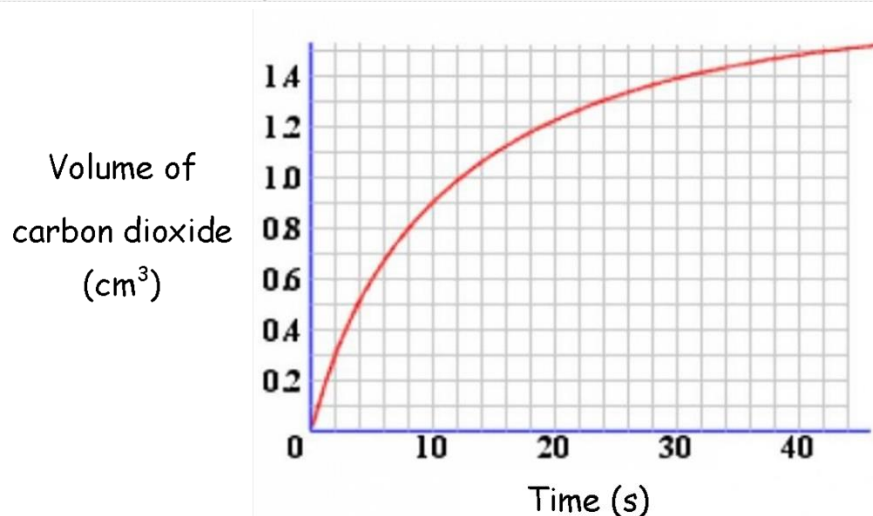
Average rate =

TIME INTERVAL

QUESTIONS

1

The graph below shows the volume of carbon dioxide released when an excess of powdered marble chips react with dilute acid.



(a) Explain why the slope of the graph is steepest at the start of the reaction.

(b) Sketch the graph in your jotter and draw and label the curves you would expect if the experiment was repeated using:

(i) a lower temperature

(ii) marble powder instead of lumps

2.

Hydrogen gas can be produced in the laboratory by adding a metal to dilute acid. Heat energy is also produced in the reaction.

A student measured the volume of hydrogen gas produced when zinc lumps were added to dilute hydrochloric acid.

Time (s)	0	10	20	30	40	50	60	70
Volume of hydrogen (cm ³)	0	12	21	29	34	36	37	37

(i) Calculate the average rate of reaction, in $\text{cm}^3 \text{s}^{-1}$, between 10 and 30 seconds.

2

(ii) Estimate the time taken, in seconds, for the reaction to finish.

1

(iii) The student repeated the experiment using the same mass of zinc. State the effect on the rate of the reaction if zinc powder was used instead of lumps.

1

3.

The table shows the times taken for 0.5 g of magnesium to react completely with acid under different conditions.

Acid concentration (mol l ⁻¹)	Temperature (°C)	Reaction time (s)
0.1	20	80
0.1	25	60
0.2	30	20
0.2	40	10

The time for 0.5 g of magnesium to react completely with 0.2 mol l⁻¹ acid at 25 °C will be

- A less than 10 s
- B between 10 s and 20 s
- C between 20 s and 60 s
- D more than 80 s.

4.

Ethyne is the first member of the alkyne family.

It can be produced by the reaction of calcium carbide with water.

The equation for this reaction is



- (a) The table shows the results obtained in an experiment carried out to measure the volume of ethyne gas produced.

Time (s)	0	30	60	90	120	150	180	210
Volume of ethyne (cm ³)	0	60	96	120	140	148	152	152

Calculate the average rate of reaction between 60 and 90 seconds.

Your answer must include the appropriate unit.

3

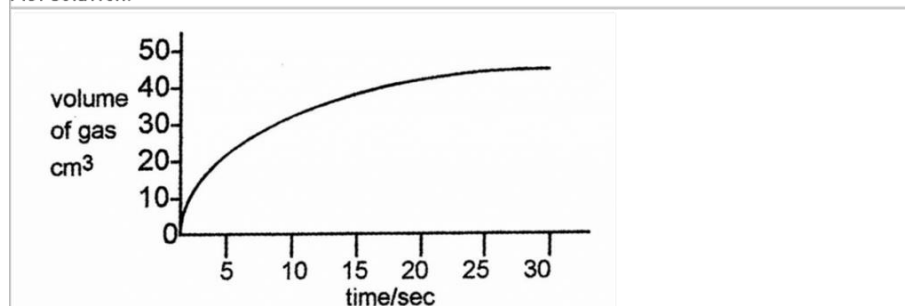
- (b) Draw a line graph of the results.

Use appropriate scales to fill most of the graph paper.

3

5.

The graph below was obtained for the reaction between excess Mg and 100cm³ of 1mol l⁻¹ HCl solution.



- (a) Use the graph to calculate the average rate in the first 20s.

- (c) Explain why the reaction rate decreases as the reaction progresses

6.

The course of a chemical reaction was followed by measuring the mass lost by the apparatus over time.

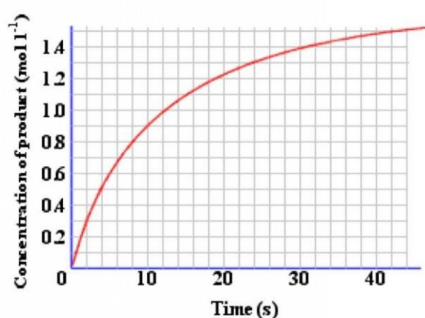
The mass decreased by 50 grams in 400 seconds.

What was the average rate of reaction in g s^{-1} ?

- A 0.25
- B 0.333
- C 1
- D 4

7.

Examine the graph below.



Which time best shows the end of the reaction ?

- A 0 - 10 seconds
- B 0 seconds
- C 40 seconds
- D later than 40 seconds (off the end of the graph)

10.

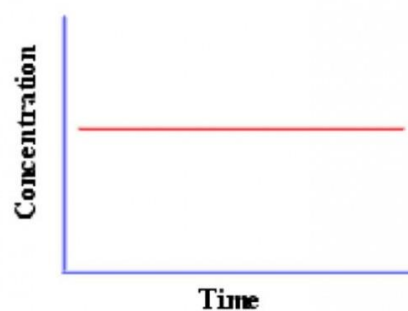
If a reaction rate was measured by a change in volume of gas produced over time, the units of the reaction rate would be :

- A g s^{-1}
- B $\text{cm}^3 \text{s}^{-1}$
- C $\text{mol l}^{-1} \text{s}^{-1}$
- D s^{-1}

11.

In a chemical reaction, compound X reacts with compound Y to form compound Z. The following graph shows the concentration of compound X over time.

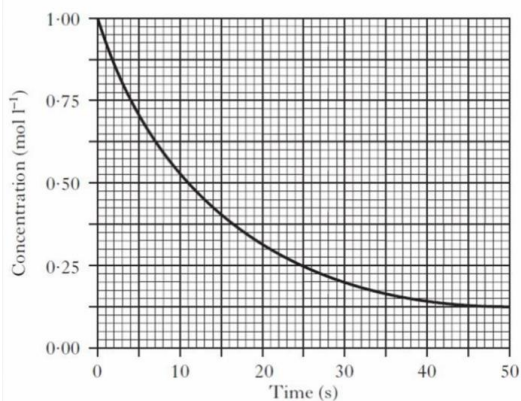
Which of the following statements best explains the graph ?



- A Compound X has been used up
- B Compound Y has been used up
- C The reaction is very slow
- D The reaction was only monitored for an extremely short time

8.

The graph below shows the variation of concentration of a reactant with time as a reaction proceeds.



During the first 25 s, the average reaction rate, in mol l⁻¹ s⁻¹, is

- A 0.01
- B 0.02
- C 0.03
- D 0.04.

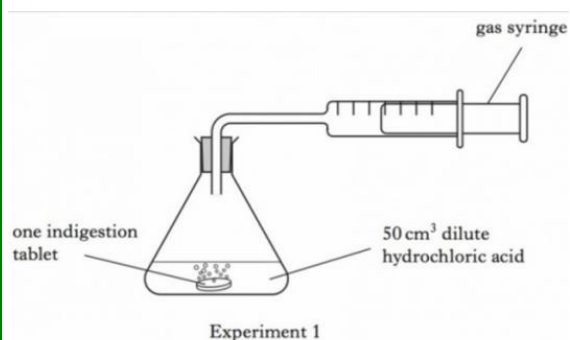
9.

Which line in the table correctly describes what happens if 1 gram of a catalyst is involved in a chemical reaction?

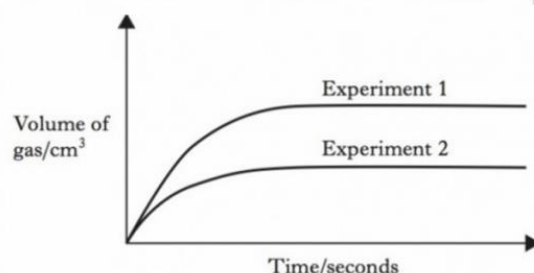
	Speed of reaction	Mass of catalyst left at end in grams
A	faster	1
B	unchanged	1
C	faster	0
D	unchanged	0

12.

A student carried out 2 experiments to investigate the rate at which gas was given off when indigestion tablets were added to dilute hydrochloric acid.



She used her results to draw curves on a graph.



Experiment 2 could have been carried out

- A at a lower temperature
- B using more concentrated hydrochloric acid
- C using half an indigestion tablet
- D using a crushed tablet

13.

In a reaction, 60 cm³ of hydrogen gas was collected in 20 s.

What is the average rate of reaction, in cm³ s⁻¹, over this time?

- A $\frac{60}{20}$
- B $\frac{20}{60}$
- C $\frac{1}{60}$
- D $\frac{1}{20}$

NOW CHECK YOUR ANSWERS

