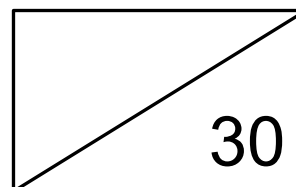


Seb Academy
Topic: Rate of Reaction
Time allowed: 40 min

Date: _____

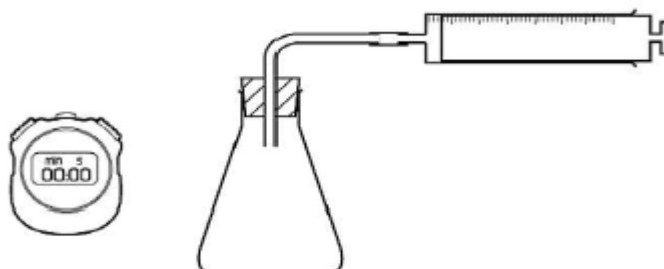
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Homework 1

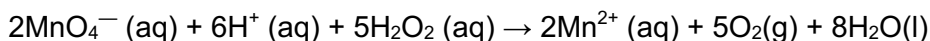
Skill 1 Measuring Rate of Reaction

1. (2018/ACS/P1/21) The apparatus shown below can be used to investigate the rate of a reaction.



In which reaction could the rate of reaction be followed using these apparatus?

- A $\text{AgNO}_3 + \text{HCl}$
 - B $\text{Mg} + \text{HCl}$
 - C $\text{NaOH} + \text{HCl}$
 - D $\text{NH}_4\text{NO}_3 + \text{HCl}$
2. (2017/StG/P1/18) The reaction of manganate(VII) ions with hydrogen peroxide in acid solution may be represented by the following equation.



The rate of reaction can be determined by measuring changes in different variables of the reaction.

Which of the following methods of monitoring the rate of reaction are suitable?

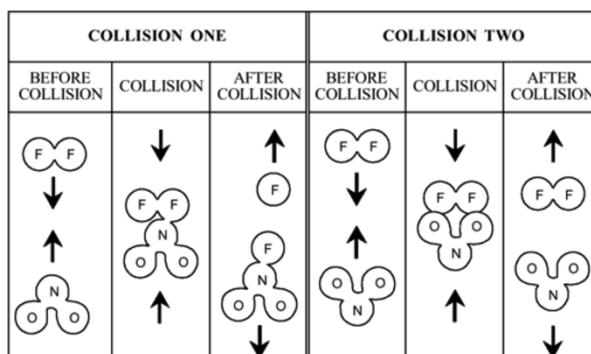
- I. volume of gas produced
- II. pH of the reaction mixture
- III. mass of the reaction mixture
- IV. amount of precipitate obtained
- V. intensity of the purple colour of the reaction mixture

- A I, II and III
- B I, II and IV
- C I, II, IV and V
- D I, II, III and V

[Total: 2 marks]

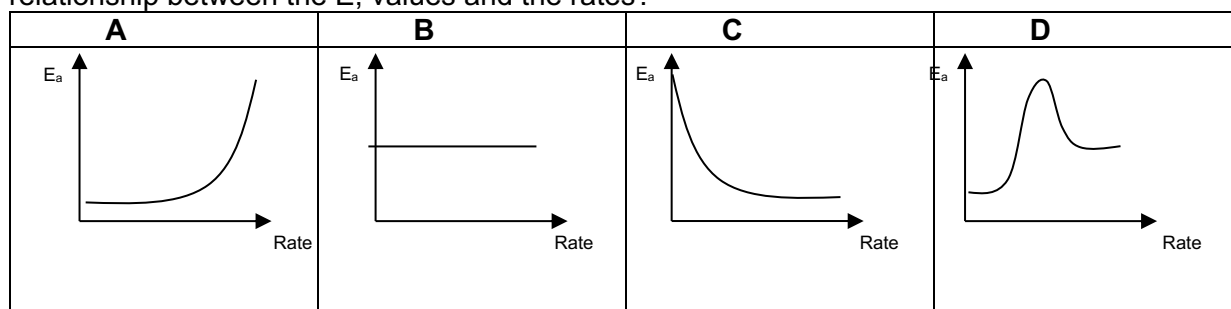
Skill 2 Collision Theory

3. Consider the following collisions, each occurring at the same temperature. Which one of the following factors explains why collision one is successful while collision two is not successful?

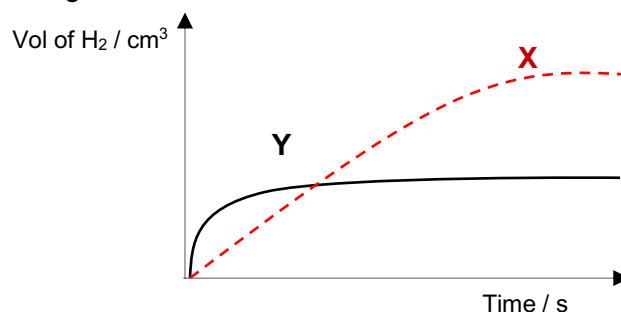


- A Catalyst present
- B Geometry of molecules colliding
- C Concentration
- D Kinetic energy

4. A certain reaction is able to proceed by various mechanisms. Each mechanism has a different E_a and results in a different overall rate. Which of the following best describes the relationship between the E_a values and the rates?



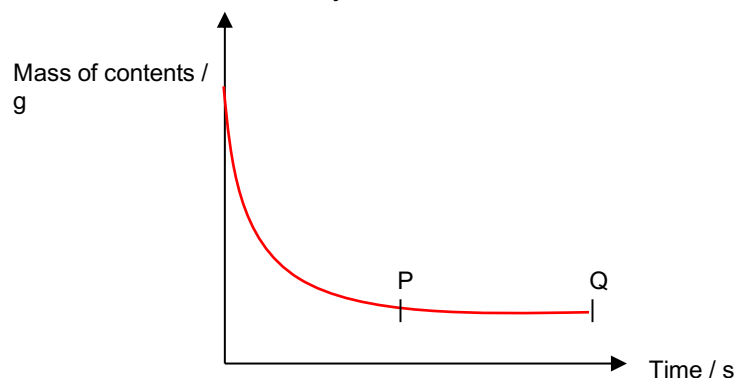
5. (2017/SJI/P1/31) In the graph shown below, curve X represents the result of the reaction between 2.5g of magnesium ribbon and 50 cm³ of 1 mol/dm³ sulfuric acid at 50°C.



Which reaction could produce curve Y?

- A 2.5g of magnesium powder at 50°C
- B 2.5g of magnesium ribbon at 60°C
- C 12.5 cm³ of 2 mol/dm³ sulfuric acid at 60°C
- D 25 cm³ of 2 mol/dm³ sulfuric acid at 50°C

6. (2015/NYGH/S3/IP/FE/P1) The graph below shows how the mass of marble chips varies with time as it reacts with excess hydrochloric acid.



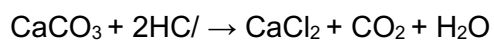
Which of the following statements about section **PQ** of the curve is correct?

- A Hydrochloric acid has fully reacted.
- B Marble chips are used up.
- C The reaction continues at a constant speed.
- D The speed of reaction is decreasing at a constant rate.

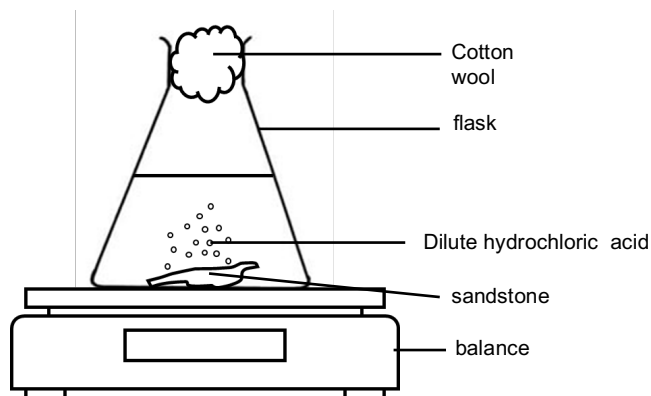
[Total: 6 marks]

Structured

1. (2003/O/GCSE/N) Sandstone contains sand (mainly silicon dioxide) and calcium carbonate. Excess sandstone was reacted with dilute hydrochloric acid



The rate reaction was followed by measuring the mass lost during the reaction



This is a table of the results

Time t /minutes	Total mass lost/g
0	0.00
4	0.18
8	0.30
12	0.38
16	0.4
20	0.48
24	0.51

- (a) Use information from the table to show that the rate of reaction decreases. [2]

- (b) In a second experiment, these data are recorded:

Mass of sandstone was added to excess hydrochloric acid / g	10
Mass of sandstone measured, washed, dried after bubbling stopped / g	9.12

Guiding you how to interpret data:

This is the question: **Calculate the percentage by mass of calcium carbonate in the sandstone.** [3]

1.	Find the mass lost from sandstone =
2.	This mass lost is the mass of PURE CO ₂ lost. Thus mass of CO ₂ produced is =
3.	From mass of CO ₂ , find moles of CO ₂ =
4.	Create mole ratio to find moles of pure CaCO ₃ =
5.	Find percentage purity.

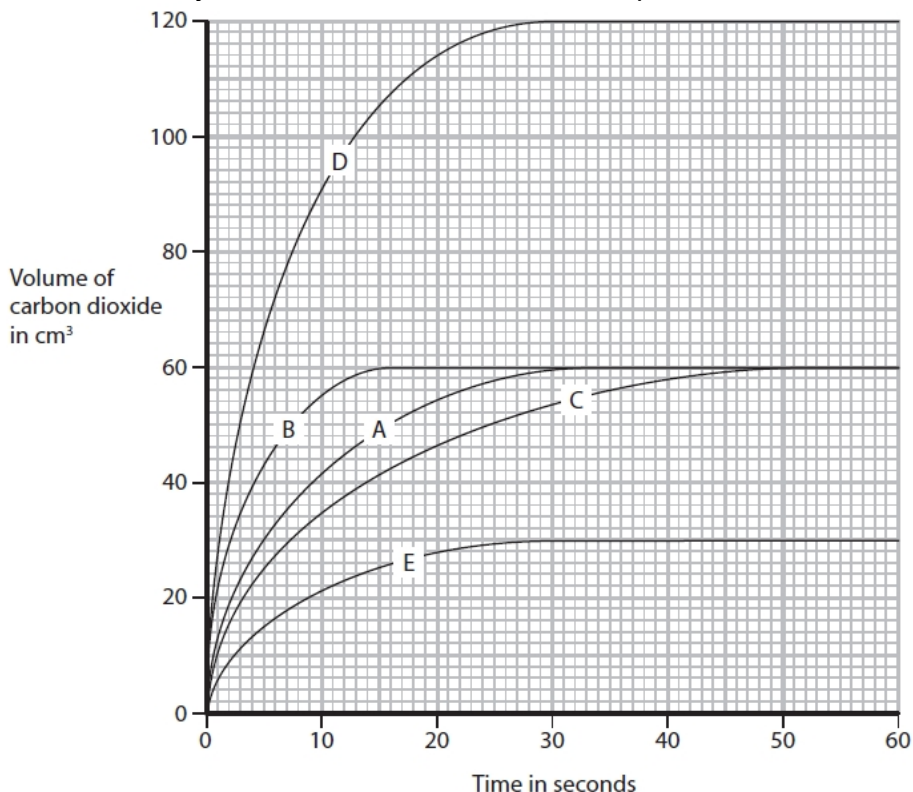
[Total: 5 marks]

2. (2002/O/GCSE/J) Antacid tablets neutralise acids. A student investigated the time taken for an antacid tablet to react completely with excess hydrochloric acid (the reaction time) under different conditions. The table shows the results.

Experiment number	Volume of acid/cm ³	Concentrations of acid in mol/dm ³	Temperature of acid/°C	Reaction time/seconds
1	50	1.0	25	132
2	50	2.0	25	65
3	100	2.0	25	65
4	50	2.0	35	33

- (a) Which two experiments show that the volume of acid used does not affect the rate of reaction? [1]

(b) The graph shows the volumes of carbon dioxide given off when marble chips are reacted with hydrochloric acid in five different experiments.



Curve A shows the volume of carbon dioxide given off when some marble chips are reacted with an **excess** of 1.0 mol/dm^3 hydrochloric acid. [4]

i. Deduce which curve, B, C, D or E, could represent the results obtained if:

half the mass of marble chips is used with excess of the acid.	
the reaction is performed at a lower temperature, with the same mass of marble chips and excess of the acid.	
the marble chips are replaced by the same mass of powdered marble chips and excess of the acid.	
the reaction is performed with same concentration and volume of ethanoic acid at the same temperature, with the same mass of marble chips.	

[total: 5 marks]

3. Mg was added to 20 cm^3 of 0.100 mol/dm^3 of hydrochloric acid. The following results were obtained.

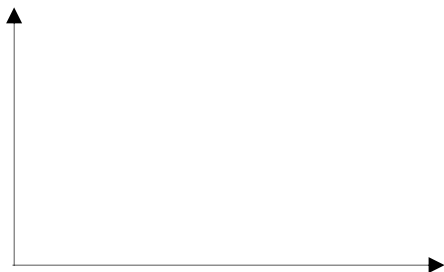
Mass of Mg before reaction / g	60
Mass of Mg after reaction / g	48

(a) Determine the limiting reactant and explain why.

[2]

(b) Calculate the volume of gas produced. [2]

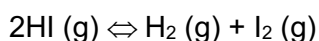
(c) Draw the graph if the reaction was completed in 50s. [1]



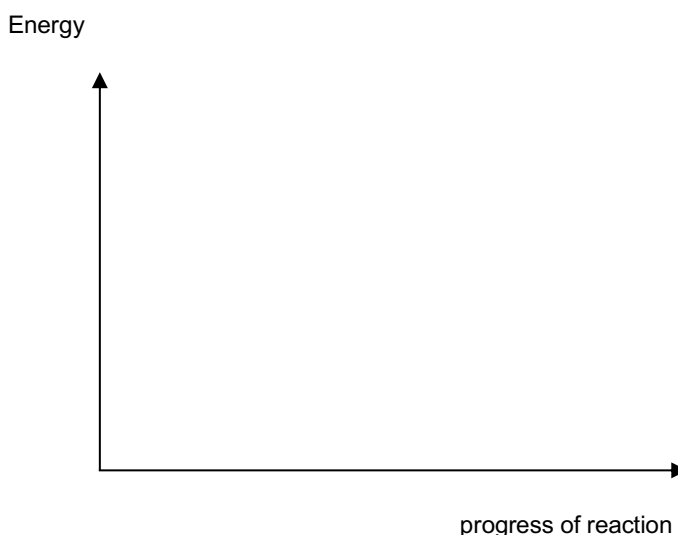
(d) Draw on the same graph, if 20 cm³ of 0.050 mol/dm³ of sulfuric acid was used. Show your workings. [3]

Review energy of Reactions

1. The equation for the decomposition of gaseous hydrogen iodide at 400°C is shown.



(a) The activation energy for the forward reaction is 184kJ/mol and that for the reverse reaction 163kJ/mol. Sketch the energy level diagram for the forward reaction, indicating the ΔH of the reaction. [2]



(b) In the presence of a gold catalyst, the activation energy for the reverse reaction is 85kJ/mol. Sketch on the same energy level in (a), using a different coloured pen, an energy profile of the catalysed reaction. Label the catalysed energy as **G** [2]

[Total: 4 marks]