Essay {Paper02}

[MRSM10-07]

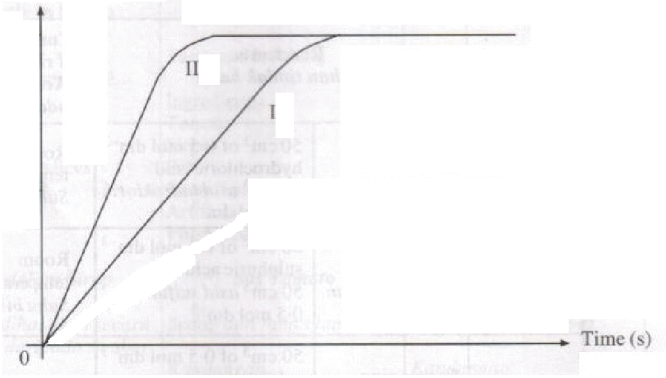
(*a*) 1. Rate of reaction at T_1 is higher than T2
2. it because the curve of graph is more stepper
3. and the frequency of affect collision at T1 is higher than T2

(*b*) 1. mol CO_2 = V/molar V at RC = 480/24000 = 0.02 mol

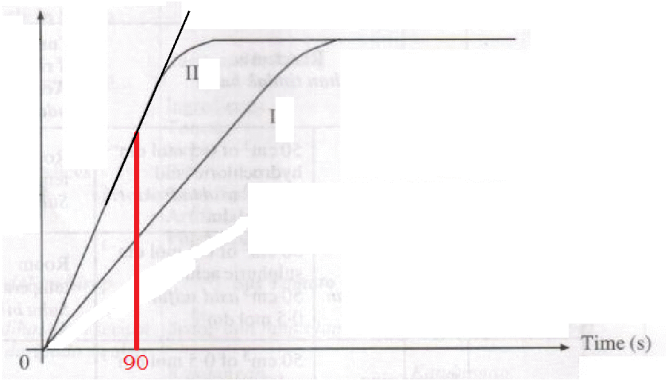
2. ratio between CO_2 to $CaCO_3$
1 mol : 1 mol
0.02 mol : 0.02 mol

3. mass = mol X molar mass = 0.02 X [40 + 12 +3(16)] = 0.02 X 100 = 2g

(*c*) (i)
Volume of gas CO_2 /cm^3



(ii) Based on the graph, determine the rate of reaction at 90 sec for Experiment I.
1. Make a tangent at 90 at the graph
2. range 0. 30 cm^3s^{-1} to 0.40 cm^3s^{-1}



(*d*) (i) $H^+ + S_2O_3^{2-} \rightarrow H_2O + S + SO_2$

(ii) 1. Rate of reaction of experiment II is higher than experiment I
2. The temperature of experiment II is higher
3. The kinetic energy of particle is higher
4. the frequency of collision between H^+ and $S_2O_7^{2-}$ increases
5. Frequency of effective collision increase

[SPM10-08]

(a)(i) [**Must refer to experiment]**
Rate of reaction in a selected quantity per unit time //
Rate of reaction = [change in selected quantity / time taken]

Selected quantity : Volume of hydrogen gas// mass of zinc // concentration of acid

2 factors :
Concentration of acid used
temperature of acid used
R : concentration [only]

(ii) $Zn + 2HCl \text{ -- > } ZnCl_2 + H_2$

(b) mol of HCl used = MV/1000 => 0.5 x 50 / 1000 = 0.025 mol [1]

Mol of hydrogen gas = 0.025/2 // 0.0125 [2]

Volume of hydrogen gas = 0.0125 x 24 // 0.3 dm3 // 300 cm^3

(c)(i) MUST compare

Aspect	Exp 1	Exp 2
1. Rate of reaction	lower	Higher
2. **Concentration of H^+ ions**// basicity	Lower // monoprotic	Higher // diprotic
3. Number of H^+ ion per **unit volume**	lower	higher
4. frequency of collision **between Zn and H+ ions**	Lower	Higher
5. **Frequency of effective collision**	Lower	Higher

A: greater
r : faster

C(ii)
Catalyst
1. add //use catalyst// copper(II) suphate/ $CuSO_4$ / CuO
2. Catalyst lower the activation energy
3. More colliding particles achieve the activation energy
4. Frequency of effective collision increase
5. Frequency of effective collision between **Zn and H+ ion** increase

Concentration
1. [double] the concentration of acid [half] the volume of sulphuric acid
2. the number of H+ ions per unit volume increases
3. the frequency of collision between particles increases
4,5. Frequency of effective collision between **Zn and H+ ion** increase

Use smaller size
1. use zinc powder// use smaller size of zinc
2. total surface are increase
3. the frequency of collision between particles increases
4,5. Frequency of effective collision between **Zn and H+ ion** increase

C(iii) 1. The acid used in exp II is diprotic/ dibasic but in exp I is monoprotic/ monobasic
2. the number of moles/ concentration / number of H+ ions in exp IIis doubled/ twice

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[SBPTrial2010-10]

(a) (i) 1. Experiment I, Experiment III, Experiment II
Rate of reaction increase
2. Experiment I and II: Temperature
3. Experiment II and III: Concentration
4. Correct formula of reactant and product
5. Balanced
$2\ HCl + Na_2S_2O_3 \rightarrow 2\ NaCl + SO_2 + S + H_2O$

(ii) 1. The concentration of hydrochloric acid in Exp III is higher
2. The number of particles per unit volume in Exp III is higher compare to Exp II
3. The frequency of collision between **hydrogen ions and thiosulphate ions** increases in Exp III
4. Frequency of effective collision increases
5. The rate of reaction increases in Exp III compare to Exp II

(b) Temperature Factor [Experiment II]
Procedure:
1. 50cm^3 of 0.2 $moldm^{-3}$ sodium thiosulphate **solution** is poured into conical flask
2. The initial temperature of the solution is recorded
3. The conical flask is placed on top of white paper with mark 'X' at the centre
4. 5cm^3 of 0.2 $moldm^{-3}$ hydrochloric acid is poured quickly into conical flask
5. The stopwatch is started immediately
6. The conical flask is swirled
7. The stopwatch is stopped immediately once the mark 'X' disappeared from sight and the time is recorded
8. The experiment is repeated using 50cm3 of 0.2 $moldm^{-3}$ sodium thiosulphate solution using different temperature, 35 °C, 40 °C, 45 °C and 50 °C

Observation:
9. Yellow precipitate

Ionic equation:
10. $2\ H^+ + S_2O_3^{-2} \rightarrow SO_2 + S + H_2O$

OR

Concentration Factor [Experiment III]
Procedure:
1. 50 cm^3 of 0.2 $moldm^{-3}$ sodium thiosulphate **solution** is poured into conical flask
2. The conical flask is placed on top of white paper with mark 'X' at the centre
3. 5cm3of 2.0 moldm-3 hydrochloric acid is poured quickly into conical flask
4. The stopwatch is started immediately
5. The conical flask is swirled

6. The stopwatch is stopped immediately once the mark 'X' disappeared from sight
7. The time required for mark 'X' disappeared from sight is recorded
8. The experiment is repeated using different volume of 0.2 moldm^{-3} sodium thiosulphate solution with different volume of distilled water

Observation:
9. Yellow precipitate

Ionic equation:
10. $2\ H^+ + S_2O_3^{-2} \rightarrow SO_2 + S + H_2O$

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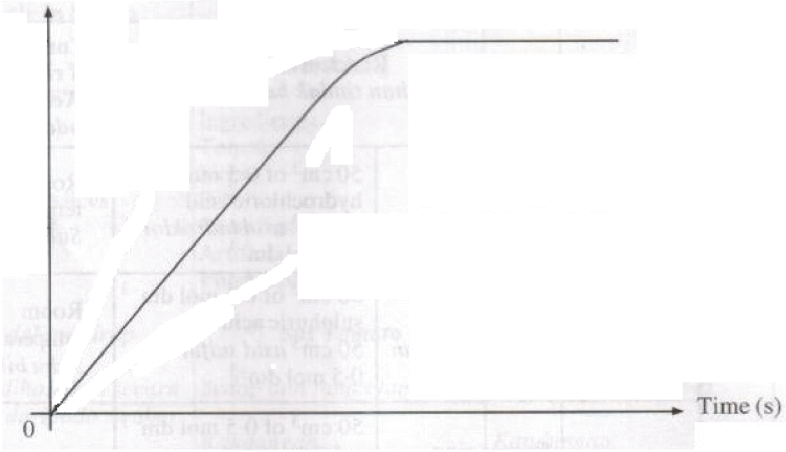
[MRSM03-08]

(a) volume of gas/cm^3



(b) (i) 0.083 cm^3 s^{-1}

(ii) 1. make the tangent at 210 s
2. Range 0.06 cm^3 s^{-1} – 0.07 cm^3 s^{-1}

(ii) 0.053 cm^3 s^{-1}

(c) **Temperature**
1. When temperature of experiment is higher
2. The kinetic energy of particle is higher
3. the frequency of collision between particles increases
4. Frequency of effective collision increase

Use smaller size
1. When use powder// use smaller size
2. The total surface per volume is increase
3. the frequency of collision between particles increases
4. Frequency of effective collision increase

(d) 1. Hot oil are high temperature
2. more heat was absorb by potatoes fried

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[SPM05-07]

(a)

Refrigerator	Kitchen Cabinet
Low temperature	High temperature
Low bacterial activity	High bacterial activity
Less toxin produced by bacteria	More toxin produced by bacteria
Rate of food spoilage decreases	Rate of food spoilage is high

(b) (i) Average rate of reaction for Experiment I

$= \frac{50}{55}$ $= 0.909\ cm^3s^{-1}$

(ii)
1. The **rate of reaction** for Experiment II is **higher** than Experiment I.
2. The **temperature** for Experiment II is higher than Experiment I.
3. High temperature causes the reactants **particles** to have **more kinetic energy.**
4. **Hydrogen ions, H^+ and calcium carbonate** collide with one another more rapidly.
5. The **frequency of effective collision** between hydrogen ions and calcium carbonate increases.
6. The **rate of reaction** for Experiment III is higher than Experiment II.
7. The calcium carbonate in Experiment III have a bigger **total surface area.**
8. The **frequency of collision** between hydrogen ions and calcium carbonate increases.
9. Therefore, hydrogen ions and calcium carbonate can collide with each other more rapidly.
10. The **frequency of effective collision** between hydrogen ions and calcium carbonate increases.

(iii) Number of moles HCl $= \frac{0.5 \times 30}{1000} =$ **0.015 mol**

2 moles of HCl produces 1 mole of CO_2
Therefore, the number of moles CO_2

$= \frac{0.015}{2}$ = **0.0075 mol**

Volume of $CO_2 = 0.0075 \times 24 =$ **0.18 dm³**

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[SPM03-07]

(a)
1. Small size has **bigger total surface area**
2. the rate of reaction is higher

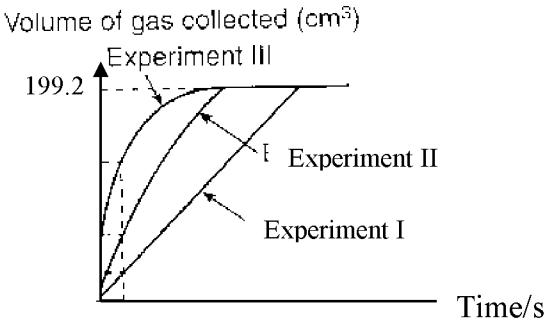
(b) (i) $Mg + 2HCl \rightarrow MgCl_2 + H_2$

Mole of Mg = $\frac{0.2}{24}$ = 0.0083 mol

1 mol Mg produce 1 mol H_2

Volume of H_2 = 0.0083 x 24000
= 199.2 cm^3

(ii)



(iii) Average rate of reaction :

Experiment I = $\frac{199.2}{50}$ = 3.984 or 4 $cm^3\ s^{-1}$

Experiment II = $\frac{199.2}{20}$ = 9.96 or 10 $cm^3\ s^{-1}$

Experiment III = $\frac{199.2}{15}$ = 13.28 or 13 $cm^3\ s^{-1}$

(iv)
1. rate of reaction in experiment II is higher than experiment I
2. the **temperature** of experiment II is higher than experiment I
3. the kinetic energy of **particles** increase
4. the collision between **H^+ ion and magnesium** occur
5. **frequency of effective collision** increase
6. rate of reaction in experiment III is higher than experiment II
7. **$CuSO_4$** is used as a **catalyst** in experiment III
8. The presence of catalyst **lower the activation energy**
9. **frequency of effective collision** increase

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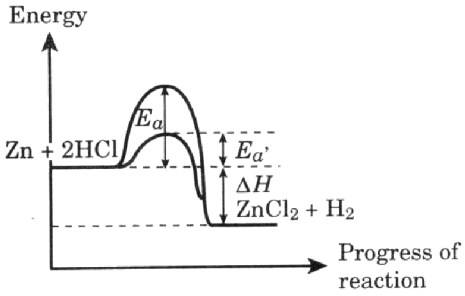
[SPM07-10]

(a) (i) Experiment I : P is **hydrochloric acid**.
$Zn + 2HCl \rightarrow ZnCl_2 + H_2$

(ii)
1. label of **energy** on vertical axis
2. the position of the energy level of the reactants is higher than the energy of the product.
3. correct position for ΔH
4. correct position for *Ea*
5. correct position for *Ea'*



1. The reaction is exothermic reaction.
2. The reactants contains more energy than the products.
3. ΔH is the energy difference in the reactants and in the products.
4. Heat given out during bond formation is greater than heat absorb during bond breaking.
5. Activation energy must be overcome in order for the reaction to take place.
6. The use of catalyst reduces the activation energy.
7. The use of a catalyst increases the frequency of effective collisions.

(b) (i) Experiment I

$$\text{Rate} = \frac{960\ cm^3}{240\ s} = 4\ cm^3\ s^{-1}$$

Experiment II

$$\text{Rate} = \frac{960\ cm^3}{160\ s} = 6\ cm^3\ s^{-1}$$

(ii) 1. The rate of reaction for experiment II is **higher** than experiment I.
2. This is because the H_2SO_4 is a **diprotic** acid whereas HCl is **monoprotic** acid.
3. Diprotic acid has **higher concentration of H^+** ion.
4. The frequency of collision between **H^+ ion and zinc** in experiment II is higher than in experiment I.
5. The **frequency of effective collisions** in experiment II is higher than in experiment I.

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[SBPmidyearF507-07]

(a)

No	Refrigerator	Kitchen cabinet
1	Low temperature	High temperature / Room temperature
2	Bacterial activity low / Bacteria inactive	Bacterial activity high / Bacteria active
3	Bacteria produces very little toxin	Bacteria produces a lot of toxin
4	Rate of decaying of food is low	Rate of decaying of food is high

(b) (i) Average rate of reaction for Experiment I = $\frac{50}{60} = 0.833\ cm^3\ s^{-1}$

(b) (ii) Between experiment I and II
1. The rate of reaction in Experiment II is higher
2. The temperature in Experiment II is higher
3. At higher temperature, the kinetic energy of the particles is higher / particles move at a greater speed.
4. Frequency of collision between hydrogen ions ions and zinc atoms increases.
5. The frequency of effective collisions increases.

Between Experiment II and III.
6. The rate of reaction in Experiment III is higher.
7. The size of solid zinc is smaller
8. The total surface area of zinc in Experiment III is larger.
9. The frequency of collision between hydrogen ions and zinc atoms increases.
10. The frequency of effective collisions increases

(b) (iii) 1. No. of moles of HCl = $\frac{0.5 \times 25}{1000} = 0.0125$
2. 2 moles of HCl produce 1 mol of H_2
3. No. of moles of H_2 = $\frac{0.0125}{2} = 0.00625$
4. Volume of H_2 = $0.00625 \times 24 = 0.15 dm^3$

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[SBPtrial05-04a,b]

(a) [maksud mangkin dan contoh penggunaan suatu mangkin]
1. Bahan yang mengubah kadar sesuatu tindak balas tanpa mengalami perubahan kimia
2. Larutan kuprum(II) sulfat – meninggikan kadar tindak balas antara zink dengan asid sulfurik cair./ serbuk besi dalam penghasilan ammonia/ contoh yang sesuai

(b) Kesan saiz bahan tindak balas ke atas kadar tindak balas
1. Semakin kecil saiz bahan, semakin besar jumlah luas permukaan
2. Frekuensi perlanggaran antara zarah bertambah
3. Frekuensi perlanggaran berkesan bertambah
4. kadar tindak balas bertambah/meningkat

Kesan kepekatan ke atas kadar tindak balas
5. Larutan yang pekat mengandungi lebih banyak zarah dalam satu unit isipadu larutan
6. Frekuensi perlanggaran antara zarah-zarah bahan tindak balas bertambah
7. Frekuensi perlanggaran berkesan bertambah
8. kadar tindak balas bertambah /meningkat

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[SBPtrial07-10]

(a) (i)

Catalyst is a substance that changes the rate of a chemical reaction. 1

(a) (ii)
- does not change the amount of product formed.
- unchanged chemically at the end of reaction.
- the amount of catalyst is the same before and after the reaction.
- it is specific for a reaction.
- only small amount is needed to catalyze a reaction.
- less effective when there are impurerities. 1
- most of the catalyst are transition metals or their compound. 1...2

(Any **two**)

(a) (iii)
- Haber process: iron filling
- Contact process: vanadium(V) oxide
- Ostwald process: platinum 1...1

(Any **one**)

(b) 1 Size of reactant 1
- size of reactant decrease, total surface area exsposed for collision between the particles reactants increase 1
- frequency of collision between particles increase 1
- frequency of affective collision increase 1...4
  rate of reaction increase

2 Concentration of reactant
- concentration of a solution increase, number of particles per unit volume increase 1
- frequency of collision between particles increase 1
- frequency of affective collision increase
  rate of reaction increase 1
  1...4

3 Temperature of reaction
- temperature of reactants increase, kinetic energy of particles reactants increase 1
- frequency of collision between particles increase 1
- frequency of affective collision increase
  rate of reaction increase 1
  1...4

(Any **two**)

(c) 1 Cooking of solid food 1
- solid food cut into small piece 1
- total surface area exsposed to heat increase 1
- food cook faster 1...4

2 Cooking of food in a pressure cooker 1
- high pressure raises the boiling point of water. 1
- cooking is carried out at a temperature higher than 100 ° C. 1
- food cook faster. 1...4

3 Storing of food in a refrigerator 1
- temperature in refrigerator is lower 1
- microorganisms inactive 1
- slow down rate of food decaying 1...4

(Any **two)**
(a: any suitable answer than above)

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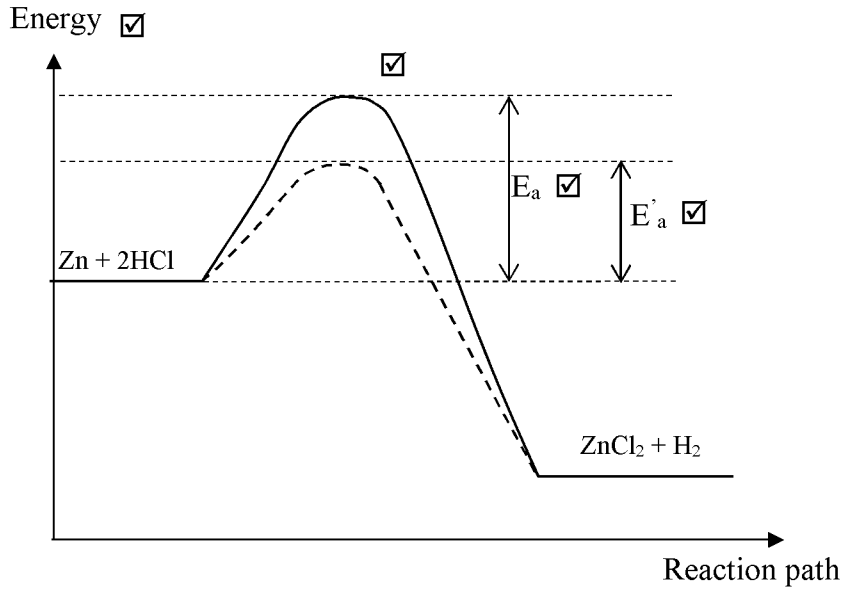
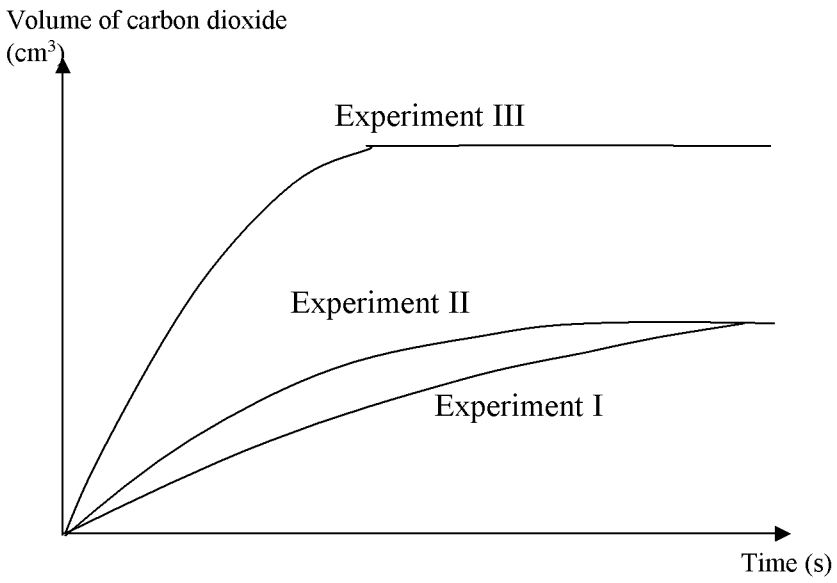
[SBPtrial09-09]

(a)		$N_2 + 3H_2 \rightarrow 2NH_3$	1
		• Use **iron** as catalyst • The reaction is carried out in high temperature /450°C to 550°C • The reaction is carried out in high pressure/200 atm	1 1 1
(b)	(i)	Experiment I Copper(II) sulphate / copper sulphate	1 1
	(ii)	 • Label of energy on vertical axis • The position of the energy level of the reactants is higher than the energy level of the product. • Correct position for E_a • Correct position for E'_a	 1 1 1 1
	(iii)	1. When a positive catalyst/copper(II) sulphate is used in experiment I, it provides an alternative path with a lower the activation energy / lower the activation energy. 2. More colliding particles /zinc atoms and hydrogen ions are able to overcome that lower activation energy. 3. This causes the frequency of effective collision increases. 4. Hence, the rate of reaction of Experiment I increases.	1 1 1 1

(c)	 • Correct position of the curve of Experiment I • Correct position of the curve of Experiment II • Correct position of the curve of Experiment III	1 1 1
	• The volume of carbon dioxide gas in Experiment I is the same as in Experiment II. • The concentration of H^+ ions in Experiment I and Experiment II is the same. • The volume of carbon dioxide gas in Experiment III is double/two times greater than in Experiment II. • The concentration of H^+ ions in Experiment III is double then in Experiment II // The concentration/number of hydrogen ions in sulphuric acid is double/two times the concentration/number of hydrogen ions in hydrochloric acid // Suphuric acid is a diprotic acid whereas hydrochloric acid is a monoprotic acid.	1 1 1 1 **Max 3**

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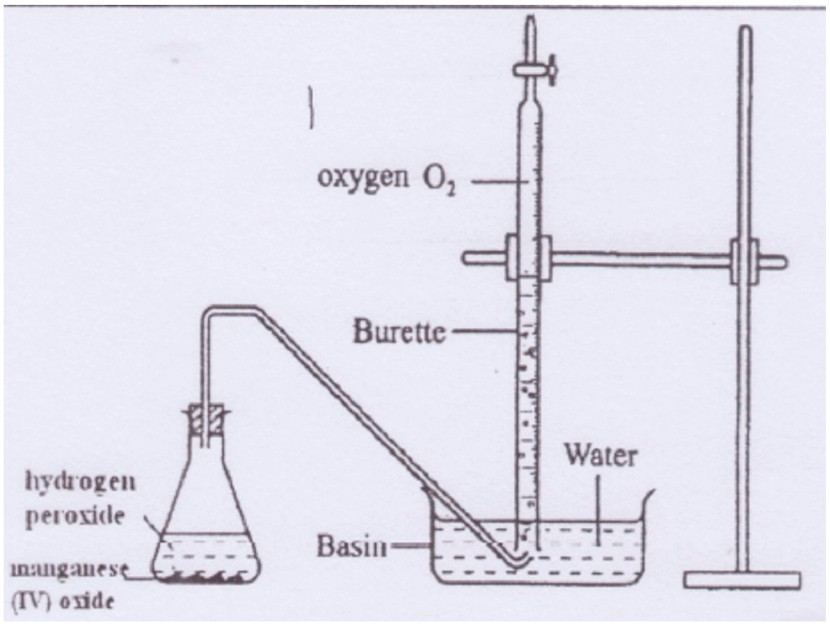
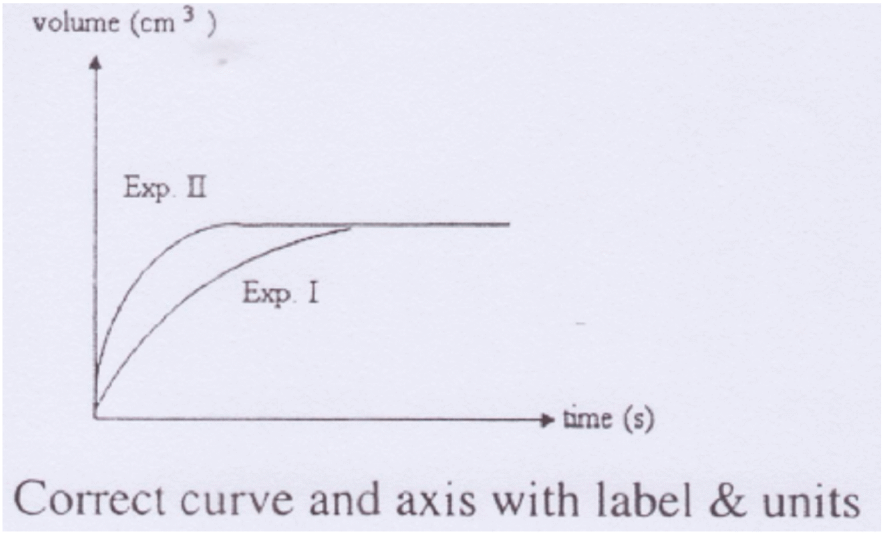
[MRSM09-08]

(*a*) 1. Manganese (IV) oxide provide an alternative route
2. which has lower activation energy
3. more collision achieved the lower activation energy with the correct orientation
4. frequency of effective collision increases
5. rate of reaction/ decomposition increases

(*b*) (i)



(ii)



(iii) experiment I = 50 cm^3/40 s = 1.25 cm^3s^{-1}

experiment II = 50 cm^3/20 s = 2.5 cm^3s^{-1}

(iv) 1. Rate of reaction in experiment II is higher than experiment I
2. concentration of H_2O_2 n experiment II is higher
3. Number of H_2O_2 molecule per unit volume is experiment II is higher
4. the frequency of collision between H_2O_2 molecule increases
5. frequency of effective collision increases

(v) 1. $2H_2O_2 \rightarrow 2H_2O + O_2$
2. moles of O_2 = 50/24000 = 0.002 mol
3. ratio
Moles H_2O_2 = 2 X mol O_2 = 2 X 0.002 = 0.004 mol

4. molarity = Mol X 1000/V = 0.004 X 1000/50 = 0.08 mol dm^{-3}

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