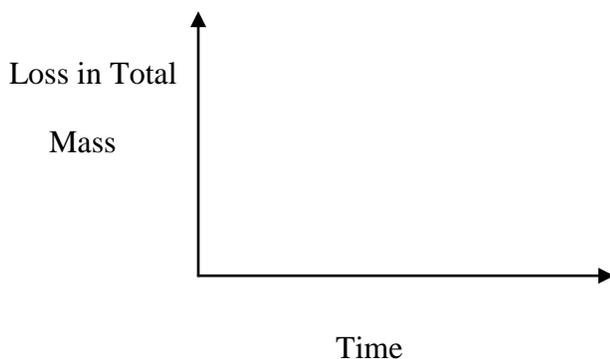


REACTION RATES AND REVERSIBLE REACTIONS

MARKING SCHEME

1. 1989 Q4 P1



2. 1989 Q23 P1

Kinetic energy of gas increase / gas molecules move faster

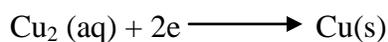
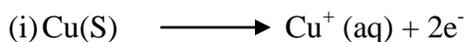
3. 1989 Q32 P1

(a) (i) X = oxygen



(iii) Relight a glowing splint

(b) Ph decreases because:- OH are being removed / H⁺ are accumulating



(ii) No observation changes because copper is being transferred from anode to cathode without interference with concentration of Cu²⁺ ions in 4. solution.

4. 1990 Q7 P1

(a) JK- Molecular receiving

Energy / increase kinetic energy / vibrate faster

(b) KL – Molecules receive energy / absorb latent heat and in the process the bonds break // molecules separate

5. 1992 Q14 P1



6. 1993 Q26 P1

Effects on rate of reaction: Reaction will be faster.

Explanation: Powdered zinc offers large surface area hence more contact or collisions or reacting particles.

Effects on rate of reaction: Reaction will be faster.

Explanation: Increase in temperature increases the kinetic energy hence more contact or collisions.

7. 1994 Q20 P1

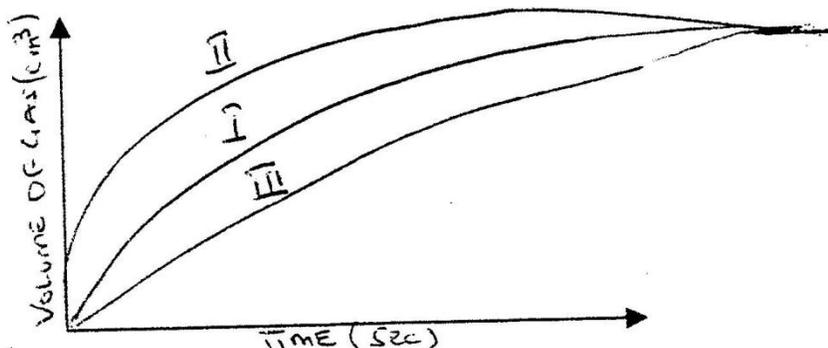
(a) In both cases the temperature remains constant because the heat energy is being used to break up forces of attraction in the solid structures / latent heat.

(b) $\text{CdCl}_{2(s)} \longrightarrow \text{Cd}^{2+} + 2\text{Cl}^{-}$ This is because CdCl_2 is an ionic compound which is held together by electrostatic forces that are stronger than the van der Waals forces and hydrogen bonds holding the H_2O molecules together in H_2O . In water there is only one change liquefaction but, in CdCl_2 there are two changes liquefaction and ionization.

8. 1995 Q19 P1

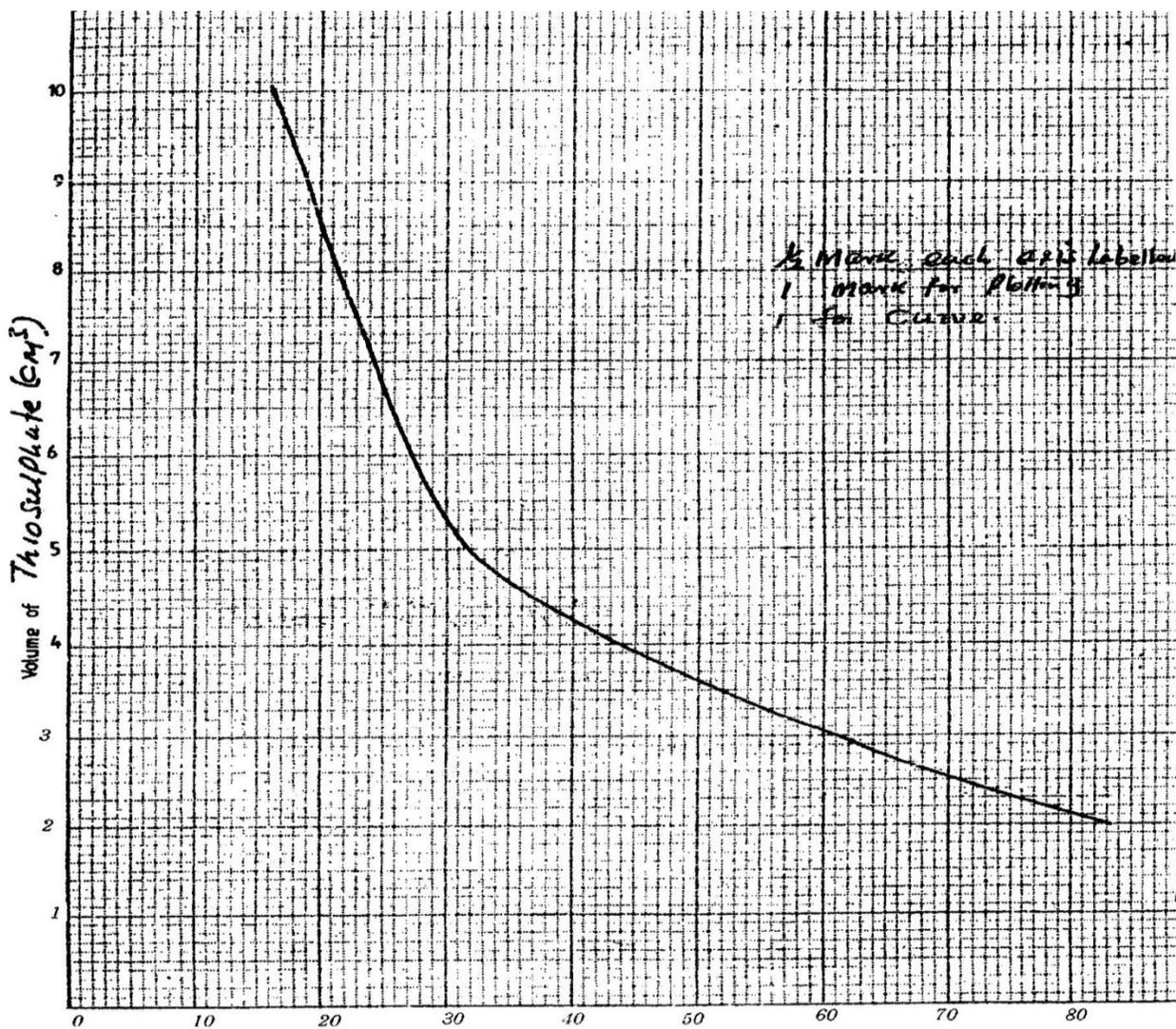
Hydrogen, because it is lighter/ less denser / diffuses faster

9. 1995 Q20 P1



10. 1996 Q1 P2

(a) i)



ii) I. 27-28 seconds (1 mark)

II 54-56 seconds (1 mark)

(Answers should also be read from the graph concentration in part II is half that of part I)

b) (i) I Moles of thiosulphate = $\frac{10}{1000} \times 0.4 = 0.004$ moles

II Moles of hydrochloric acid = $\frac{10}{1000} \times 2 = 0.02$ moles (2 marks)

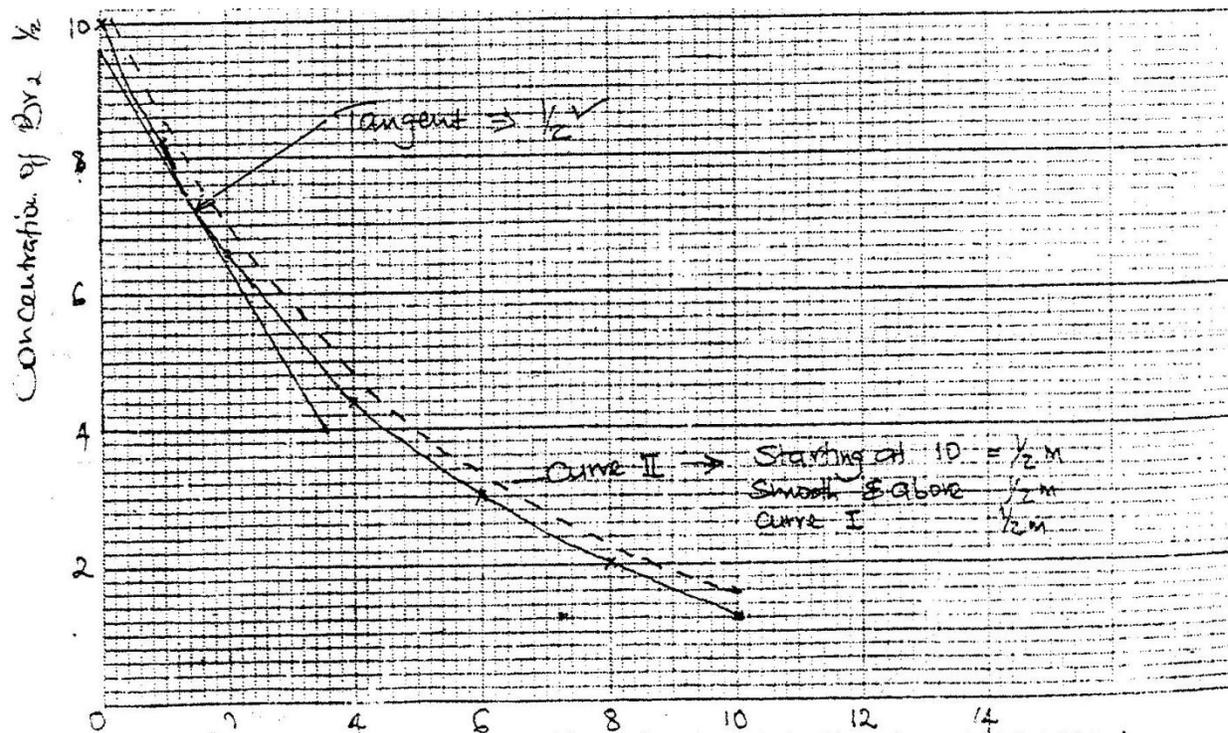
(ii) Thiosulphate – hydrochloric acid is in excess (1 mark)

c) Same cross should be used in each experiment (1 mark)

Cross should be viewed from the same position (1 mark)

12. 1997 Q5 P2

a)



(b) (i) $5.3 \times 10^3 \text{ mol dm}^{-3}$ (units not necessary/do not penalise)

$$\text{Change in conc.} = (9.6 - 4) \times 10^3 = 5.6 \times 10^3$$

$$\text{Change in time} = 3.7 - 0 = 3.7 \text{ min}$$

$$\text{Rate of reaction} = \frac{5.6}{3.7} = 1.51 \times 10^3$$

(c) At high concentration the rate of reaction is high because the more particles in solution collide at high frequency.

(d) At lower temps; the particles have less K.e / frequency of collision is reduced / few particles / less activation energy.

13. 1999 Q12 P1

(i) Curve (I)

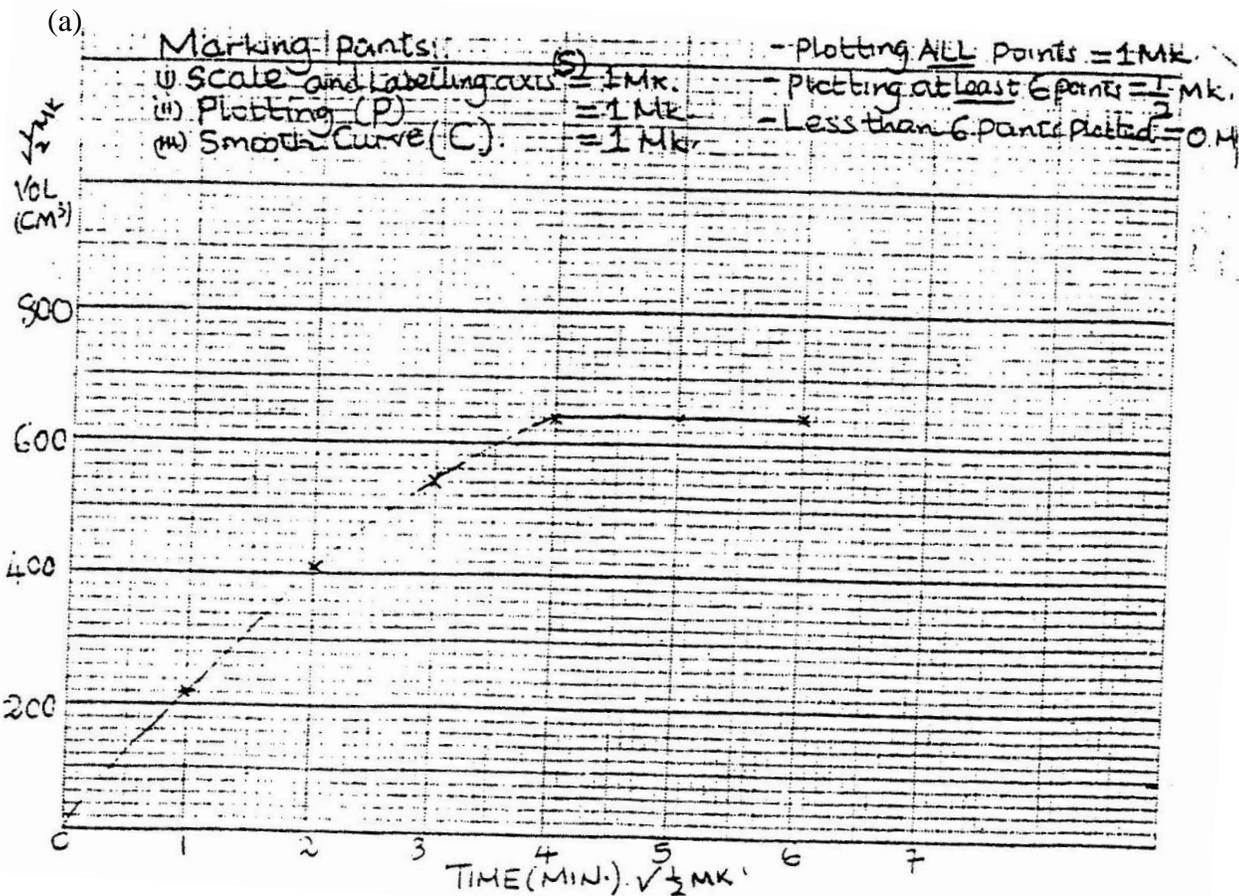
Concentration of F increases with time (1)

(ii) After time Y concentration does not change because equilibrium has been established. (1)

14. 2000 Q19 P1

I – Manganese (iv) Oxide is a catalyst and increases the rate of decomposition of the hydrogen peroxide.

15. 2001 Q1 P2



(b) $\frac{620 - 540}{1} = 80 \text{ cm}^3$

$\frac{620 - 540}{60} = 1.33 \text{ cm}^3/\text{Sec}$

(c) Solid is due to presence of copper which had NOT reacted (1 mark) as it is below hydrogen in the activity series (1 mark) Don't accept does not displace hydrogen from the acid. (Candidate should state the reason why copper does not displace hydrogen).

(d) Vol of H₂ O = $640 - 2.5 \text{ cm}^3$ - Mass of Al = $\frac{637.5 \times 2}{24000 \times 3}$

$= \frac{637.5 \text{ cm}^3}{24000} = 0.47 \text{ g}$

- Moles of H₂ = $\frac{637.5 \text{ cm}^3}{24000}$

- Mole ratio of AL: H₂ = 2:3

- % Mass of AL = $\frac{0.478 \times 100}{2}$

- Moles of AL(s) = $\frac{637.5 \times 2}{24000 \times 3}$

$\frac{0.5}{2}$
(Range 95.55 - 95.64%)

- (e)
- It is stronger than pure aluminium (1 mark)
 - It is harder than aluminium (1 mark)
 - It is not easily corroded/ rusting (1 mark)
 - It is more durable / higher ensile strength (1 mark)
- (-Any correct two = 2 marks)

16. 2002 Q7 P1

Use zinc powder (1), which has a larger surface area (1)

(2 marks)

17. 2003 Q19a P1

- a) The high yield of ammonia decreases. At high temperatures ammonia decomposes and moves to the left OR shifts to the left. (Forward rxn is exothermic)

18. 2003 Q4a P2 (Incomplete marking scheme)

a) Carbon dioxide is lost/produced/evolved

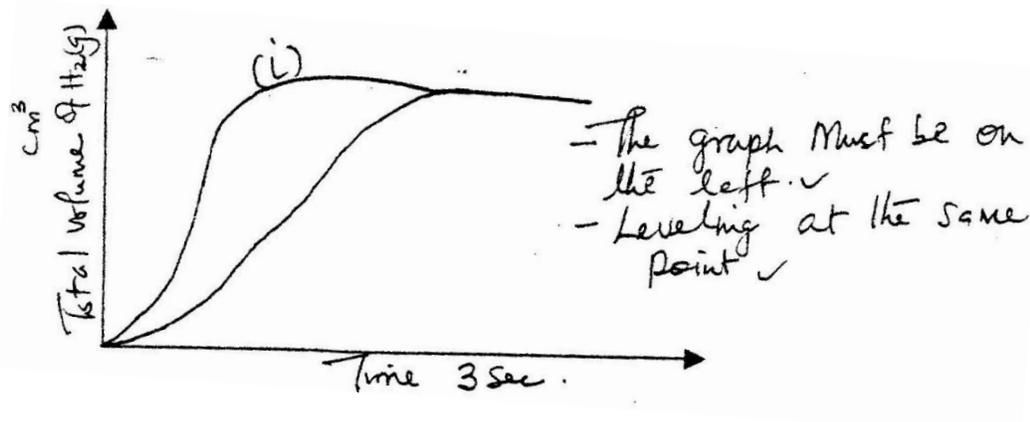
b) (i) $\frac{1.8-0}{2} = 0.9 \text{ g/min}$

(ii) $\frac{-2.95}{2} = 0.125 \text{ g/min}$

19. 2004 Q21 P1

a) Gas syringe or a measuring cylinder (i)

b)



20. 2005 Q10 P1

The reaction has stopped as substance H has all been converted to J yet the time is Continuing

21. 2005 Q17 P1

- a) When the rate of forward reaction is equal to the rate of backward reaction.
b) The equilibrium shift to the right potassium hydroxide reacts with Carbon dioxide concentration of CO_2

22. 2005 Q20 P1

M is a strong acid while L is a weak acid. M has many ions in solution that take part in a reaction forming more product than L with few ions in solution.

22. 2006 Qb,c P2

- b) Air reacts with carbon (coke) to form carbon dioxide (CO_2). Carbon dioxide reacts with coke to form carbon monoxide. The carbon monoxide reacts with Fe_2O_3 to form iron. (3 marks)
- c) To produce calcium oxide which reacts with silica to form slag. (1 mark)

23. 2007 Q4 P2

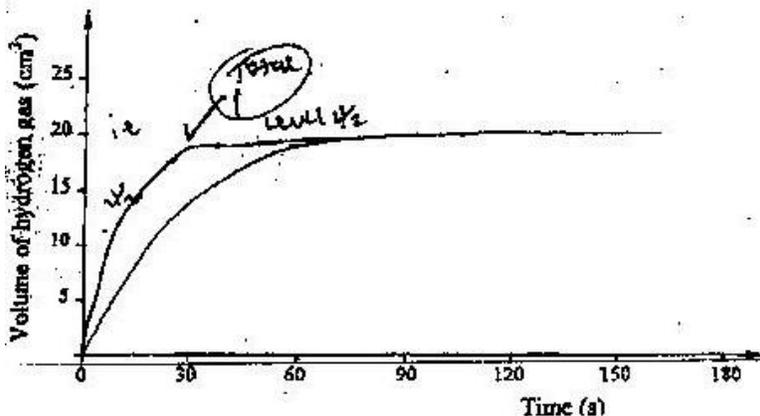
- (a) (i) Forward reaction is faster than the reverse reaction
(ii) I production will reduce since equilibrium will shift backward so as to raise the pressure.
II No change in amount of methanol since a catalyst will help reaction to come to equilibrium
(iii) I Negative: the reaction is exothermic since it requires low temperature to be fast.
II To ensure that the reacting particles possess more activation energy.
- (b)(i) no. of seconds = $2 \times 60 = 120 \text{ Sec}$
Moles of H_2O_2 decomposed
= $120 \times 6.0 \times 10^{-8} = 7.20 \times 10^{-6}$
Concentration of H_2O_2 may be higher since concentration increases the rate of reaction.

25. 2008 Q23 P1

The brown colour of the mixture intensifies / increases and the green colour of the mixture fades/ decreases or the yellow deposit/ sulphur decreases Iron (II) is converted to Fe^{3+} Sulphur is converted to H_2S OR Equilibrium shift to the left.

26. 2008 Q29 P1

- (a) Gas syringe/ graduated gas cylinder/ measuring cylinder
(b) (i)



- (ii) The molecules of the reactants have higher energy marking points
The reaction is faster/ are more effective collisions

27. 2011 Q3 P2

- (a) Concentration/ volume
- (b) (i) Exothermic. Increase in temperature at constant pressure. The amount of ethanol formed at equilibrium decreases vice versa decrease in temperature at constant amount of ethanol, increase

Advantage

- (i) Amount of ethanol increases, pressure favours the side with less moles i.e. products/ equilibrium shifts to the right/ forward reaction is favoured.

Disadvantage

- It would be expensive / uneconomical. The cost of production would go up or maintaining high pressure is costly.
- Explosion can occur hence costs will go up.
- It is costly to maintain high pressure.

(c) (ii)

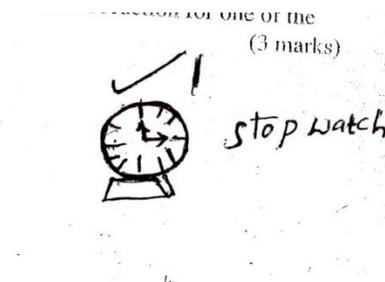
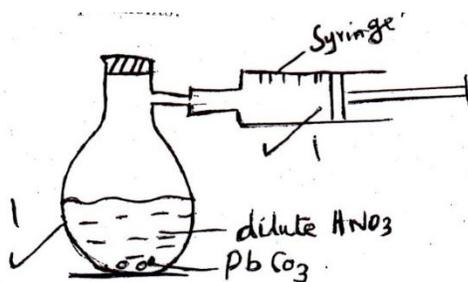
$$\text{Rate} = \frac{Y_2 - Y_1}{X_2 - X_1}$$

Ans cm^3/min

28. 2012 Q4 P2

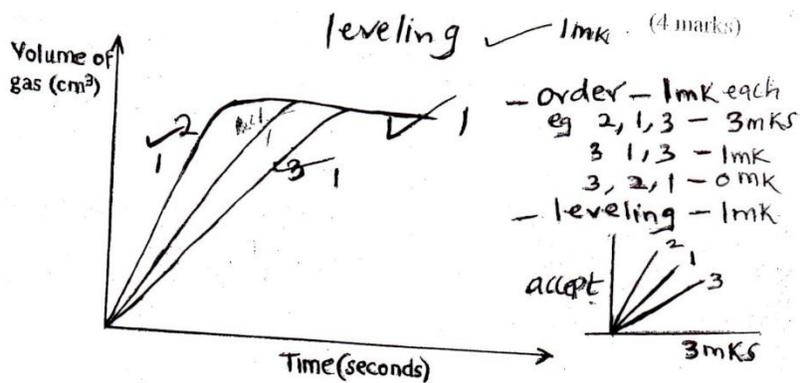
(a) Surface area / particle size / fineness of particles $\sqrt{1}$

(b) (i)



- Indication of measuring volume
- Indication of measurement of time
- Workable setup

(ii)



(c) The reaction produces insoluble lead(II) chloride which coats the carbonate preventing further action of the acid on it.

(d) – Yellow / orange colour intensifies

- Addition of HCl introduces H^+ , the backward reaction is favoured to ease their concentration or Equilibrium shifts to their left.

29. 2012 Q13 P1

Catalyst has no effect on position of equilibrium

- A catalyst increases rate of reaction or a catalyst lowers E_A
- A catalyst will increase the rate of forward and backward rxn by equal amounts
- A catalyst reduces time for establishment of equilibrium

NB marks are tied

OR equilibrium shifts to the right – because iron reacts with steam