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SEPTEMBER 2019

SCIENCE P2

PRELIM

MEMO:

1.1 B //

1.2 D //

1.3 C //

1.4 D //

1.5 A //

1.6 A //

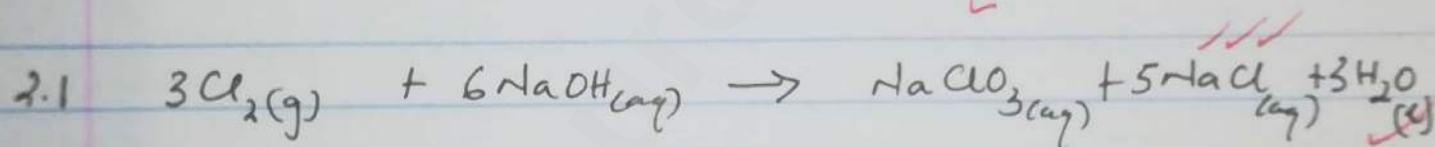
1.7 D //

1.8 C //

1.9 C //

1.10 D //

[20]

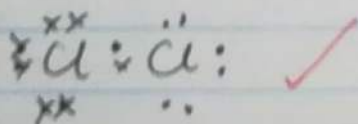


2.2.1 a bond which occurs between atoms within molecules.

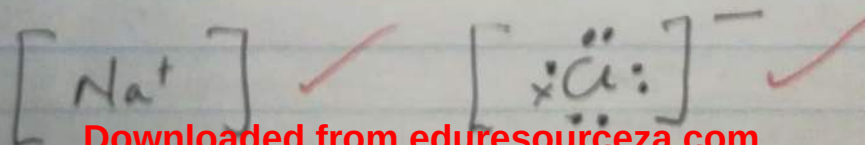
2.

2.2.2 a measure of the tendency of an atom to attract a bonding pair of electrons

2.3.1 $\Delta_{\text{en}} = 0 \therefore$ pure covalent.

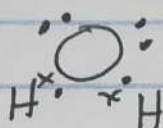


2.3.2 $\Delta_{\text{en}} = 3.0 - 0.9 = 2.1 \therefore$ ionic bond



2.3.3

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 $\therefore$ polar covalent.

2.4.1

a (weak) force of attraction between molecules, ions, or atoms of noble gas

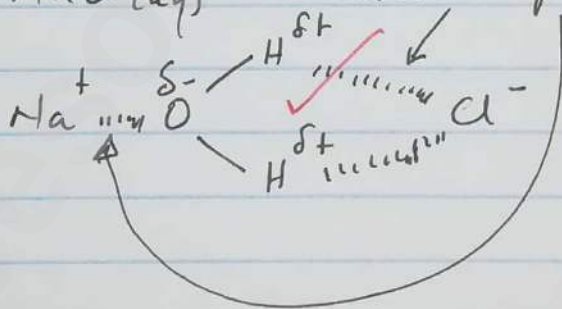
2.4.2

NaCl - ionic - very strong electrostatic forces

 Cl_2 - induced dipole-dipole (London force) H_2O - Hydrogen bonds

NaCl has strongest inf followed by H_2O
 $\therefore$ more energy needed to break forces
 in NaCl $\therefore$ high mp and b.p

2.4.3

NaCl - ionic, H_2O - H-bonds (dipoles) $\therefore$ NaCl(aq) - ion-dipole interaction

2.4.4

In solid NaCl ions held tightly by strong electrostatic forces $\therefore$ cannot move, but in solution there are weaker ion-dipole interactions therefore ions can move, thus allow for conduction of electricity.

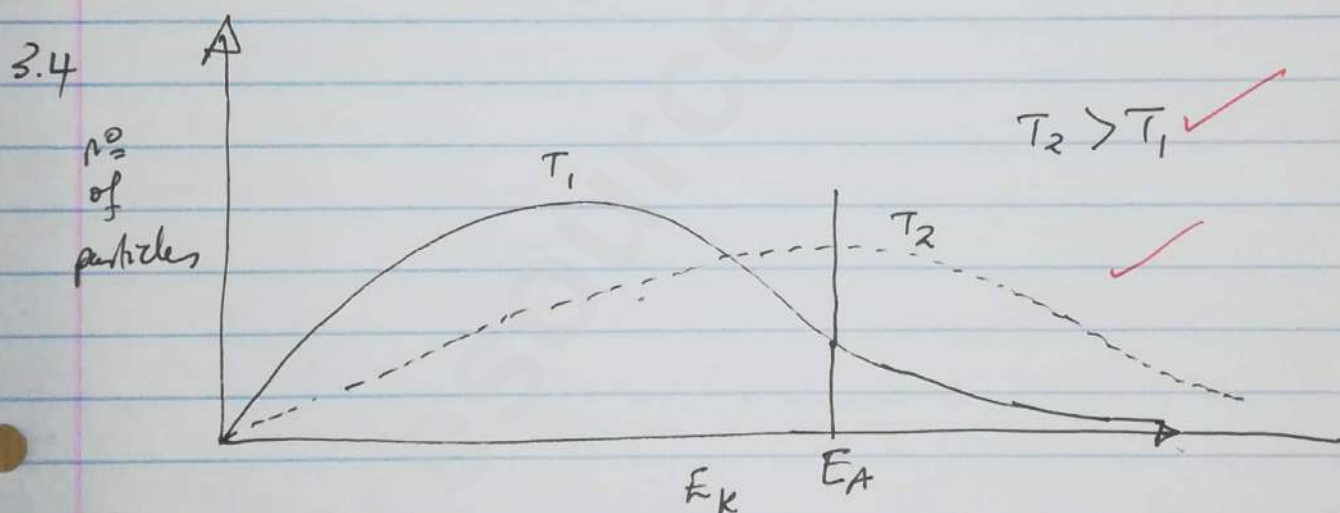
[26]

3.1 Change in concentration per unit time of either a reactant or product.

3.2 - ~~rate~~ turbidimetry - time taken for printed insert to disappear because a solid (ppt) is produced from solutions.

- ΔpH with time because an acid is being used up.

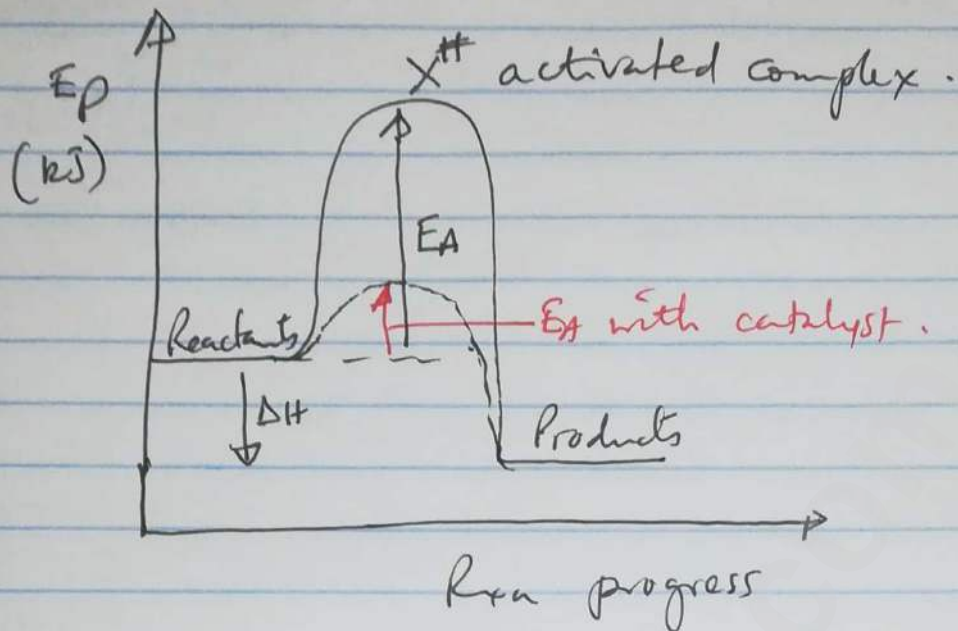
3.3 mark according to 3.2
if turbidimetry then average + correct logic
 ΔpH then instantaneous + " "



At a higher temperature T_2 more particles have sufficient energy to overcome E_A therefore higher chances of successful collisions.

3.5-1 Experiment 1 and 7, because everything else is the same except for the catalyst.

3.5.2



a catalyst provides an alternative reaction pathway of lower activation energy $\therefore$ more particles will have sufficient energy on collision per unit time to overcome E_A .

3.5.3 4.81; 6.17; 5.56; 5.20; 4.93; 4.52; 6.99; 6.54.

3.5.4 Experiments 1, 4 and 7, because $[Fe^{3+}]$ and $[Na_2S_2O_3]$ changed in those experiments.

3.5.5 Heading (1)
 Axes labelled with units (2)
 Points plotted (2)
 joined with line of best fit (1) (straight line)

3.5.6 Because $\frac{1}{t} \propto$ reaction rate.

3.5.7

Rate $\propto$ $[HCl]$

3.5.8

Increasing $[HCl]$ increases the rate of the reaction

3.5.9

Increasing $[HCl]$ increases number of particles per unit volume $\therefore$ increases probability of collision and chance of successful collisions per unit time.

3.5.10

$$\frac{1.25}{2.00} \times 45 = 28.13 \text{ cm}^3$$

(A) longer methods.

[37]

4.1 This is when both forward reaction and backward reaction continue to happen but are occurring at the same rate.

4.2 Reaction must be in a closed system.

4.3.1

$$K_c = \frac{[SO_2]^2 [O_2]}{[SO_3]^2}$$

4.3.2 When an external stress is applied to a system in dynamic equilibrium, the equilibrium point will change in such a way as to counteract the stress.

4.3.3 (a) Reducing volume increases pressure $\therefore$ side with few gaseous moles favoured to relieve pressure. Forward reaction favoured.

4.3.3 b

Increasing temperature favours the endothermic side to relieve the increase in temperature $\therefore$ Backward reaction favoured.

4.3.3 c

No effect.

4.3.4

Increasing volume decreases pressure $\therefore$ fewer particles per unit volume and chance of successful collisions decreases.

4.3.5

High temperatures favour reverse reaction but the reaction rate will be very low so a compromise temperature is used. (High pressure favours higher yield and reaction rate, but the gases will solidify.)

4.3.6 (a)

	2SO_2	$+ \text{O}_2$	$\rightleftharpoons 2\text{SO}_3$
R	2	1	2
I	1.5	0.8	0
C	-0.4	-0.2	+0.4
E	1.1	0.6	0.4
[E]	$1\frac{1}{2.5}$	$0.6\frac{1}{2.5}$	$0.4\frac{1}{2.5}$
	0.44M	0.24M	0.16M

4.3.6 (b)

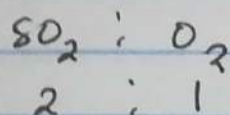
$$K_c = \frac{[\text{SO}_3]^2}{[\text{SO}_2]^2 [\text{O}_2]} = \frac{0.16^2}{0.44^2 \times 0.24} = 0.55.$$

4.3.6 (c)

No effect, favours backward reaction so $[\text{SO}_3]$ decreases while that of $[\text{SO}_2]$ and $[\text{O}_2]$ increase.

therefore no change in value of K_c .

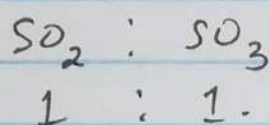
4.3.7(a)



1.5 moles : 0.75 moles (required)

but there are 0.8 moles which is more than enough $\Rightarrow \text{SO}_2$ is limiting.

4.3.7(b)



$\therefore$ 1.5 moles of SO_3 would be produced.

4.3.7(c)

a measure of the extent of a reaction, generally measured by comparing the amount of product against the amount of product that is possible.

4.3.7(d)

$$\frac{0.4}{1.5} \times 100 = 26.67\%$$

[36]

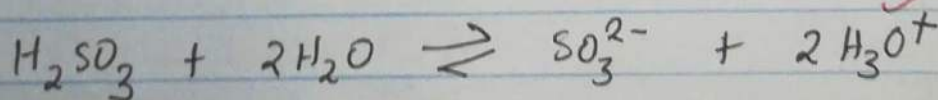
5.1.1

a proton donor that ionises partially in aqueous solution.

5.1.2

a strong acid ionises almost completely whereas a concentrated acid has a high number of moles of acid per unit volume.

5.1.3

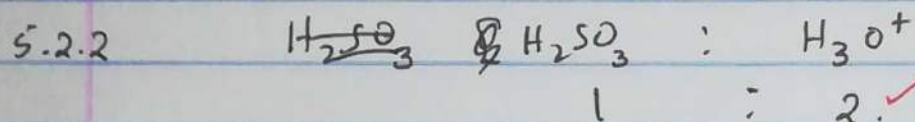


1 mole of acid gives 2 moles of H_3O^+ (diprotic)
ionisation is partial (weak)

5.2.1 $K_w = [H_3O^+][OH^-]$ ✓

$10^{-14} = (0.01)[OH^-]$ ✓

$\therefore [OH^-] = 10^{-12} M.$ ✓



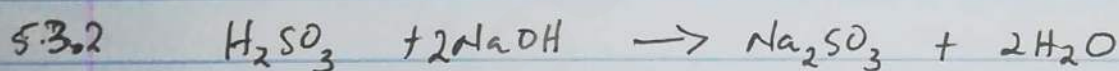
$\therefore n^{\circ}$ of moles of H_2SO_3 ionised = 0.005 mol ✓
(0.0/2)

$[H_2SO_3]_{\text{unionised}} = 0.25 - 0.005 = 0.245 M.$ ✓

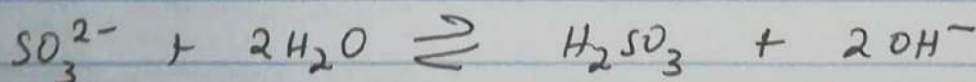
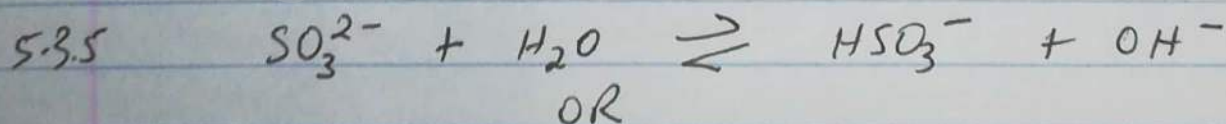
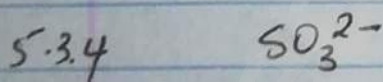
5.2.3 $K_a = \frac{[SO_3^{2-}][H_3O^+]^2}{[H_2SO_3]} = \frac{(0.005)(0.01)^2}{0.245}$ ✓

$K_a = 2.04 \times 10^{-6}.$ ✓

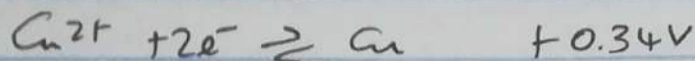
5.3.1 A substance in which the hydrogen (ion) of an acid has been replaced by a cation. ✓



5.3.3 A reaction of an ion (from a salt) with water ✓

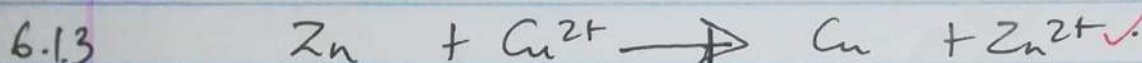


5.3.6 $7.0 < pH < 10.0$ ✓✓



Reaction is spontaneous because Zn is more reducing than Cu / Cu^{2+} is more oxidising than Zn^{2+} .

6.1.2 SO_4^{2-} , they do not change during the reaction.

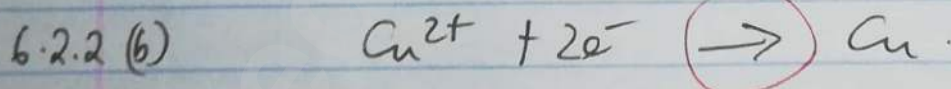
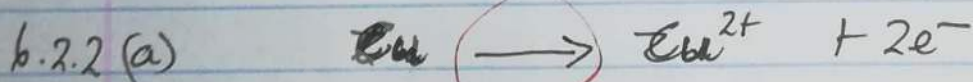


$\Delta E = 0.34 - (-0.76) = +1.10\text{V}$

6.1.4 Zn half cell because oxidation occurs in it.

6.1.5 Cu^{2+} , it accepts electrons.

6.2.1 Electrolytic, it is not spontaneous and it converts electrical energy to chemical energy



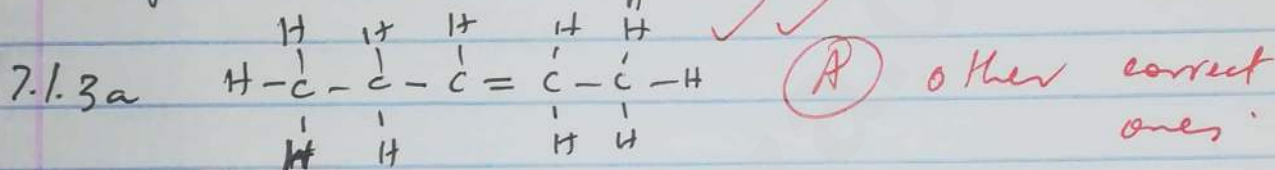
6.2.3 (a) $\text{Zn} \rightarrow \text{Zn}^{2+} + 2e^-$ because Zn is more reducing than Cu and Ag.

6.2.3 (b) Zn^{2+} is less oxidising than Cu^{2+} $\therefore \text{Cu}^{2+}$ reacts first as reduction occurs on cathode.

6.2.3 (c) Ag is added as a cathode because it is the last to be oxidised, Zn is found in solution as Zn^{2+} because it is oxidised first on anode but not reduced readily on cathode. [26]

7.1.1 A or D

7.1.2 Compounds having the same molecular formula but different structural formulae.



7.1.3b $CH_3CO_2CH_2CH_3$
Ethyl ethanoate
space! (A) other alternatives

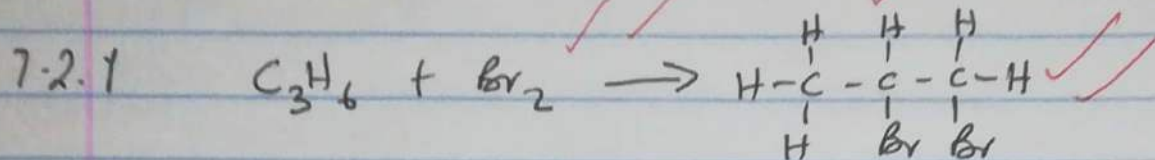
7.1.4 (a) Butane-2,3-diol. must be present.

(b) buta-1,3-diene. must be present

7.1.5 (a) It is a catalyst.

7.1.5 (b) an atom or group of atoms that form the centre of chemical activity in the molecule.

7.1.5 (c) Addition reaction, because A is unsaturated.



7.2.2 bromination / halogenation

7.2.3 Brown bromine is decolourised.

7.2.4 It is higher. $CH_3CHBrCH_2Br$ has dipole-dipole which are stronger than induced dipole-dipole in CH_3CHCH_2 OR it has a large surface area so stronger dipole-dipole force $\therefore$ more energy needed to break them.

[27]