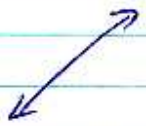
ANSWERS TO VERY IMPORTANT REVISION SHEET: These answers contain a limited amount of working and justification. They are intended for you to check the key points in your answers only. If these were the questions on the exam you should show more working than is demonstrated on these answer sheets.

(1) This diagram provides a summary or overview of the types of substances in the periodic table (top of the triangle) and the types of bonding between those substances (the bottom of the triangle).

} shows the/a transition between purely metallic elements ~~—~~ (left side) to purely non-metals (right side). It also shows the transition between elements with low electronegativity (metals) to high E'ity (Cl)

} Each cpd as you move down arrow shows increasing ionic character - from pure metal alloy (both low E'ity) $NaMg$, transition to $NaCl$ with 100% ionic character = metal + Non-metal = low electronegativity with high electronegativity



} Each cpd as you move ~~cpd~~ arrow shows ~~change~~ change from 100% ionic to covalent character. More from large diff in electronegativity (ionic) to both elements in cpd having high electronegativity.

(2) a) lowest → highest bpt : Pentane, butanol, Propanoic Acid

b) • Molecules of approx same size ∴ little diff in terms of dispersion forces. Pentane, butanol more linear so dispersion forces have greater effect as ...

However : dispersion forces v. weak intermolecular forces

• 1-Butanol also has H-forces holding molecules together

$CH_3CH_2CH_2CH_2-O-H$

↑ H bonded to O, creates H forces between molecules

H forces are the strongest intermolecular forces

- Propanoic Acid has H forces (OH group) and also has additional Dipole-Dipole forces created by dipole around C=O bond

$CH_3CH_2C(=O)OH$ – polar bond, creates polar molecule

As Pentane has only dispersion (weakest) – low B.pt
As Butanol has disp + H forces – 2nd lowest B.pt
As Propanol has disp, H forces, D-D forces – high B.pt.

(3) 1M $Fe(NO_3)_2$ solution : $Fe(NO_3)_{2\,aq} \rightarrow Fe^{+3}_{aq} + 2NO_{3\,aq}^-$

$\therefore$ Conc of Fe in solution is 1M.

Dilution : 10mL in 1L $\therefore [Fe^{+3}] = 0.01M$ $(C_S V_S = C_D V_D)$

Patient : needs 10mg

$n = \frac{m}{MM} = 0.000179$

$Vol = \frac{n}{conc} = 0.0179$

$= 17.9\,mL$

mass → $n = \frac{m}{MM}$ → moles → conc ($Conc = \frac{n}{V}$) ← need to calculate this

(4) $Cu^{+2}_{aq} + 2Cl^-_{aq} \rightarrow CuCl_{2(s)}$

$n_{CuCl_2} = \frac{m}{MM} = \frac{6.0525}{}$

$= 0.045$ moles $CuCl_2$

mass → moles → moles → conc

(i) $n_{Cu^{+2}} = 0.045$ (ii) $n_{Cl^-} = 0.09$

$Conc\,(Cu^{+2}\,used) = \frac{n}{V} = \frac{0.045}{0.4}$

$= 0.1125M$

$Conc\,(Cl^-\,used) = \frac{n}{V} = \frac{0.09}{0.4}$

$= 0.225M$

(i) Continued

As initial conc of $Cu^{+2}$ was $C_D = \frac{0.25 \times 0.2}{0.4}$

$= 0.125\ M$

$C_D - C_{used}$

$= 0.0125\ M\ Cu^{+2}$

(ii) Continued

As initial conc of $Cl^-$ was $C_D = \frac{0.15 \times 0.6}{0.4}$

$= 0.225$

$C_D - C_{used}$

$= 0$ conc of $Cl^-$

$Cl^-$ is used completely in the reaction.

(5) $2CH_3OH + 3O_2 \longrightarrow 2CO_2 + 4H_2O$

two starting pts. $n_{CH_3OH} = \frac{m}{MM} = 0.3125$

$n_{O_2} = \frac{20}{22.4} = 0.8928$

| | $CH_3OH$ | : | $O_2$ | |
|---|---|---|---|---|
| Rx Ratio | 2 | : | 3 | } $CH_3OH$ is limiting Reagent |
| Rx mixture | 0.3125 | : | 0.8928 | |

$\therefore n_{H_2O} = \frac{C_{H_2O}}{C_{CH_3OH}} \times n_{CH_3OH} = \frac{4}{2} \times 0.3125 = 0.625$

Mass $H_2O = n \times MM$

$= 11.25\ g.$

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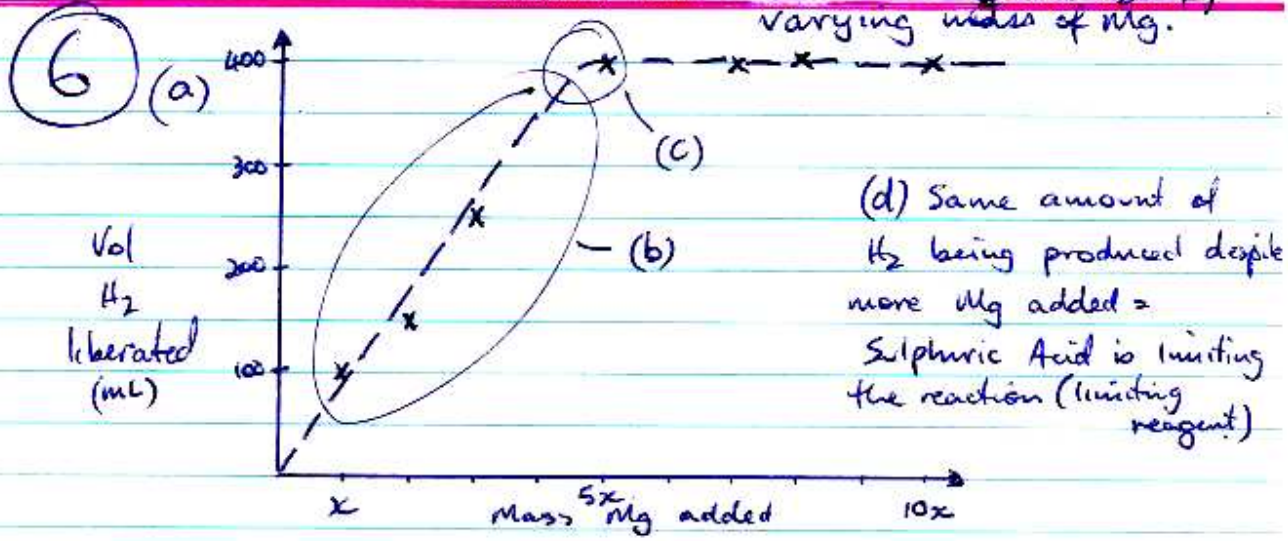
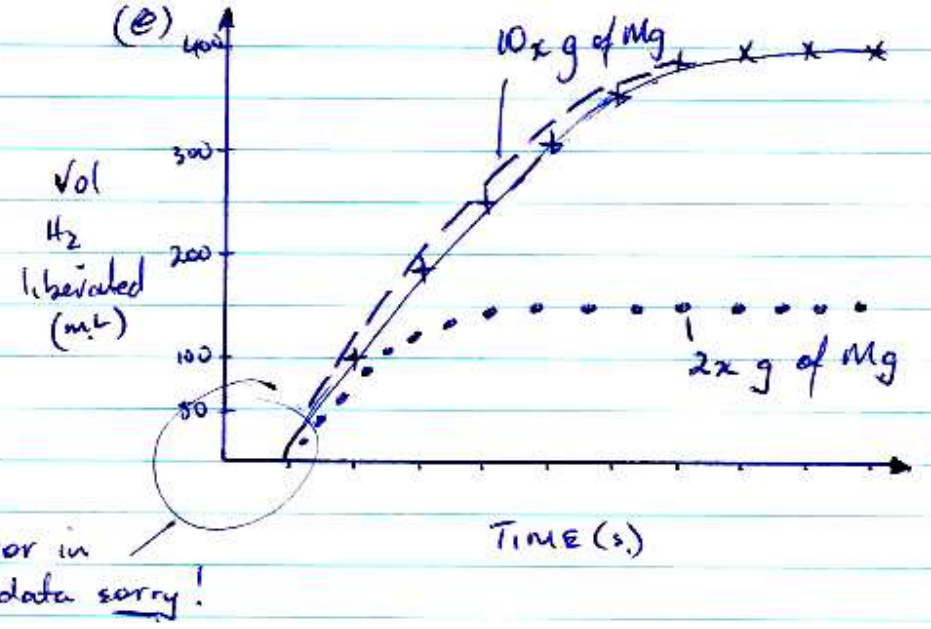
GRAPH: Reactions between Mg and $H_2SO_4$, varying mass of Mg.




(d) Same amount of $H_2$ being produced despite more Mg added = Sulphuric Acid is limiting the reaction (limiting reagent)



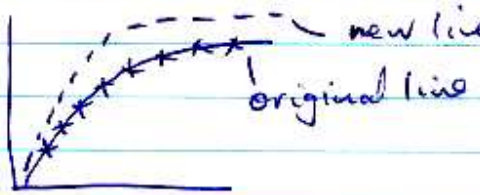

error in my data sorry!

(i) As reaction proceeds the mass of Mg and Conc of $H_2SO_4$ are reducing, this reduces the reaction rate, less $H_2$ is produced as reaction proceeds.

(ii) 10x line is essentially same as line already on graph - as the graph is for 5x g of Mg which is already in excess (Sulphuric Acid is limiting reagent) so ~~acid~~ starting with 10x g of Mg may make reaction go a little faster initially (due to greater surface Area) but the

same amount of $H_2$ product will be made - the sulphuric acid determines this as it is limiting reagent for the 2x g of Mg line, - there is less Mg so the rate may be slightly lower due to less surface area but key difference - at 2x g of Mg it will be the limiting reagent and less product will be made. From part (A) graph, the amount of $H_2$ product made was 150mL so this line reaches that max volume.

(iii) Increasing the conc of $H_2SO_4$ means it will no longer be the limiting reagent, the 5x g of Mg will be. Thus this line will reach a greater volume of $H_2$ product. It will also reach this quicker as an increase in conc will increase the rate of reaction




(7) Calculate theoretical yield.

$2S_2Cl_2 + C \rightarrow CCl_4 + 4S$

mass → moles → moles

$n_{S_2Cl_2} = \frac{m}{MM} = 0.027$

$n_{CCl_4} = \frac{C_{CCl_4}}{C_{S_2Cl_4}} \times n_{S_2Cl_2} = 0.0135$

$m_{CCl_4} = n \times MM = 2.08\,g$

$\%\ YIELD = \frac{1.51}{2.08} \times 100 = 72.5\%$

(8) mass of C = 11.5 g.