CHEMISTRY

SEMESTER ONE EXAMINATION 2005

SOLUTIONS

PART 1

1.	C	5.	B	9.	A	13.	D	17.	C
2.	C	6.	C	10.	A	14.	B	18.	B
3.	B	7.	B	11.	A	15.	C	19.	C
4.	C	8.	C	12.	A	16.	A	20.	B

PART 2

1.

(a) Equation: $SO_4^{-2}{}_{(aq)} + Ba^{+2}{}_{(aq)} \rightarrow BaSO_{4(s)}$

Observation: Two colourless solutions are mixed and a white precipitate forms.

(b) Equation: $A\ell(OH)_3 + OH^- \rightarrow [A\ell(OH)_4]^-$

Observation: The white solid dissolves leaving a clear colourless solution

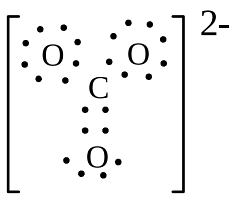
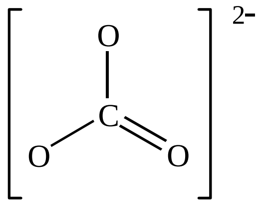
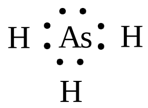
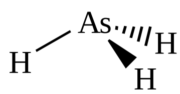
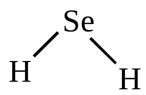
(c) Equation: $2Cs + 2H_2O \rightarrow 2Cs^+ + 2OH^- + H_2$

Observation: Explosive reaction. A colourless gas is vigorously emitted.
The solid dissolves.

(d) Equation: No reaction

Observation: No changes

2.

Molecule or ion	Structure formula (showing all valence electrons)	Sketch of shape	Name of shape
carbonate ion			PLANAR TRIANGULAR
arsenic trihydride			PYRAMIDAL
selenium dihydride			BENT

3. $[H^+] = 10^{-10.5} = 3.1623 \times 10^{-11}$ mol L^{-1}

Therefore $[OH^-] = \dfrac{10^{-14}}{3.1623 \times 10^{-11}} = 3.1623 \times 10^{-4}$

$= 3.16 \times 10^{-4}$ mol L^{-1}

4.

Explanation
The chips have less surface area in total so there are less effective collisions than with the powder giving a slower reaction.
The molecules move faster at higher temp - more collisions - faster rate. Also more molecules will possess the activation energy required - faster rate.
Catalyst provides a lower activation energy path - so more particles will possess at least this energy so they will now react - faster rate

5. (a) $[Cu(NH_3)_4]^{+2}$ or similar

(b) H_3PO_4

(c) SiO_2 or SiC

(d) Iodine (I_2)

6.

	Your chemical test. Describe fully	What you would observe in each case
solid zinc sulfate and solid zinc nitrate	Dissolve each solid in water Add to each solution a solution of Ba^{+2} , Sn^{+2}, Pb^{+2} or Hg^{+2} ions	with $ZnSO_4$ A white precipitate forms with $Zn(NO_3)_2$ No precipitate forms
solid copper (II) carbonate and solid copper (II) chloride	1. Add dilute $HC\ell$ or H_2SO_4 to each or 2. Heat strongly	with $CuCO_3$ 1. Solid dissolves to green solution - colourless gas released. 2. The green solid goes black with $CuC\ell_2$ 1. The solid dissolves to a green solution but no gas evolved. 2. Solid does not go black

END OF PART 2

PART 3

1.

(a) $Ba^{+2} + SO_4^{-2} \rightarrow BaSO_4$

$n(BaSO_4) = \frac{m}{M} = \frac{1.70}{233.36} = 7.285 \times 10^{-3}$ mol

$n(MgSO_4) = n(SO_4^{-2}) = n(BaSO_4) = 7.285 \times 10^{-3}$ mol

Therefore $m(MgSO_4) = n \times M = 7.285 \times 10^{-3} \times 120.37$

$= 0.8769$g (5L)

$= \underline{175 \text{ mg L}^{-1}}$

(b) $Mg^{+2} + CO_3^{-2} = MgCO_3$

$[Mg\ SO_4] = \frac{n}{V}$

$= \frac{7.285 \times 10^{-3}}{5} = 1.457 \times 10^{-3}$ mol L^{-1}

$n(MgSO_4)$ in 100 L $= c \times v$

$= 1.457 \times 10^{-3} \times 10^{2}$

$= 1.457 \times 10^{-1}$ mol

$n(Na_2CO_3 .10H_2O) = n(CO_3^{-2}) = n(Mg\ SO_4) = 1.457 \times 10^{-1}$ mol

$m(Na_2CO_3 .10H_2O) = nM$

$= 1.457 \times 10^{-1} \times 286.15$

$= \underline{41.7 \text{ g}}$

(c) $n(Na^+)$ in 100 L $= 2n(Na_2CO_3 .10H_2O)$

$= 2.9147 \times 10^{-1}$ mol

therefore $[Na^+] = \frac{n}{V} = \frac{2.9147 \times 10^{-1}}{100} = \underline{2.91 \times 10^{-3}}$ mol L^{-1}

2. (a) $m(C) = \frac{12.01}{44.01} \times \frac{0.705}{1} = 0.19238\text{ g}$ therefore % C =

$\frac{0.19348}{1.036} \times \frac{100}{1} = \underline{18.56\%}$

$m(H) = \frac{2.016}{18.016} \times \frac{0.145}{1} = 0.01622\text{ g}$ therefore %H =

$\frac{0.01622}{1.036} \times \frac{100}{1} = \underline{1.566\%}$

In second sample

$m(C\ell) = \frac{35.45}{143.35} \times \frac{2.108}{1} = 0.5213$ g therefore $\%C\ell$ =

$\frac{0.5213}{0.945} \times \frac{100}{1} = \underline{55.164\%}$

therefore % (0) = 100 - (18.569 + 1.566 + 55.164) = $\underline{24.70\%}$

	C	H	O	$C\ell$

%	18.569	1.566	24.70	55.164
n	$\frac{18.569}{12.01} = \underline{1.54}$	$\frac{1.566}{1.008} = \underline{1.5535}$	$\frac{24.7}{16} = \underline{1.543}$	$\frac{55.164}{35.45} = \underline{1.556}$
Simplest Ratio	1	1	1	1
	therefore EF = $CHOC\ell$			

(b) $n = \frac{PV}{RT}$

$= \frac{101.3 \times 0.250}{8.315 \times 473} = 6.44 \times 10^{-3}$ mol

$M = \frac{m}{n} = \frac{0.83}{6.44 \times 10^{-3}} = 128.88$

$= \underline{1.29 \times 10^{2}}$

(c) EF = $COHC\ell$

therefore EF MW = 64.47 g mol^{-1}

$\frac{\text{Molecular FW}}{\text{EF MW}} = \frac{128.88}{64.47} = 1.999 = \frac{2}{1}$

therefore Molecular Formula = 2 E.F = $C_2O_2HC\ell_2$

3. (a) $\frac{6.22 + 6.18 + 6.20}{3} = 6.20$ mL

(b) $H^+ + OH^- \rightarrow H_2O$

$n(OH^-) = c \times v = 0.1031 \times 0.0062 = 6.3922 \times 10^{-4}$ mol

therefore $n(H^+)$ in 20 mL $= 6.3922 \times 10^{-4}$ mol

therefore $n(H^+)$ in 250 mL $= 6.3922 \times 10^{-4} \times \frac{250}{20} = 7.99025 \times 10^{-3}$ mol

$n(H^+)$ in 1.0308 g sample is 7.99025×10^{-3} mols

therefore $M = \frac{\text{Mass}}{\text{MoLs}} = \frac{1.0308}{7.99025 \times 10^{-3}}$

$= 129$ g mol^{-1}

(c) Taking more care is not a modification.
Modify to give less significant error from the burette reading by

- Increasing the titration volume by reducing the NaOH concentraton
- Increasing the titration volume required by increasing the acid concentration