Semester 1 Examination, 2003

Solutions

CHEMISTRY

PART 1

1. b	6. c	11. d	16. a
2. c	7. d	12. c	17. a
3. a	8. d	13. b	18. d
4. d	9. b	14. c	19. d
5. d	10. a	15. a	20. b

PART 2

(a)

Equation $2Cr_{(s)} + 2OH^-_{(aq)} + 6H_2O_{(\ell)} \rightarrow 2[Cr\ (OH)_4]^-_{(aq)} + 3H_{2(g)}$

Observation Metal dissolves - colourless gas is evolved – solution turns green

(b)

Equation $Cu^{+2}_{(g)} + Mg_{(s)} \rightarrow Mg^{+2}_{(aq)} + Cu_{(s)}$

Observation A black deposit forms on the magnesium strip. The solution becomes less blue

(c)

Equation $Pb^{+2}_{(aq)} + 2I^-_{(aq)} \rightarrow PbI_{2(s)}$

Observation As the colourless solutions are mixed an intense yellow precipitate is formed

2. (a) Ammonia or NH_3

(b) Fluorine or F_2

(c) Any noble gas. Eg He, Ne, Ar, Kr, Xe, Rn

(d) Sodium or Na, Potassium or K

3. (a) Heat it up, this increases the velocity of moving particles giving more collisions with greater chances of success. Also more particles have energy greater than activation energy requirements.
   (b) Increase the pressure (concentration) of O_2 and or the droplets of petrol permitting more effective collisions
   (c) Convert petrol into spray - droplets have greater surface area which leads to greater possibly of effective collisions
   (d) Find a catalyst which permits a lower energy path to products.

4. (a) TEST: Add a soluble barium salt solution to each.

   OBSERVATION: H_2SO_4 - white precipitate
   HNO_3 – No visible reaction

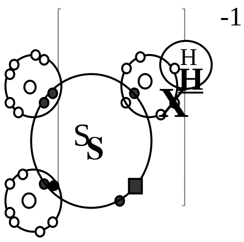
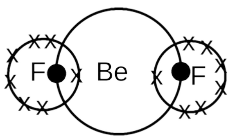
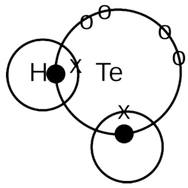
   (b) TEST: Add each to NaOH solution.
   OBSERVATION: $A\ell(OH)_3$ will dissolve
   $Mg(OH)_2$ will not

   (c) TEST: Add a soluble silver salt solution to each.
   OBSERVATION: $KC\ell \rightarrow$ white precipitate
   $KCH_3C00 \rightarrow$ nothing

5.

Solutions	**Strong Electrolyte**	**Weak Electrolyte**	**Non Electrolyte**	**Strong Conductor**	**Weak Conductor**	**Non Conductor**
Calcium Hydroxide	✓				✓	
Nitric Acid	✓			✓		
Sugar			✓			✓
Ammonia		✓			✓	

6.

Species	Electron dot diagram	Name of shape	Polar or Not?
hydrogen sulfite ion HSO_3^-		Pyramid	Polar
beryllium difluoride BeF_2		Linear	Non Polar
tellurium dihydride TeH_2		Bent	Polar

[6 marks]

PART 3

1. (a) $m(c) = \frac{12.01}{44.01} \times \frac{1.366g}{1} = \underline{\underline{0.3728g}}$

$n(OH^-) = n(H^+) = n(C\ell^-) = 30.93 \times 10^{-3} \times 2.007mol$

$\therefore$ mass $C\ell$ in sample = n $\times$ m

$= 30.93 \times 10^{-3} \times 2.007 \times 35.45$

$= \underline{\underline{2.2006}}g$

mass F = mass sample - (mass C + mass $C\ell$)

= 3.164 - 2.5734

$= \underline{\underline{0.5906}}g$

	C	$C\ell$	F
mass	0.3728	2.2006	0.5906
moL's	$\frac{0.3728}{12.01} = 0.0310$	$\frac{2.2006}{35.45} = 0.0621$	$\frac{0.5906}{19.00} = 0.031$
simplest ratio	$\frac{0.031}{0.031} = 1$	$\frac{0.0621}{0.031} = 2$	$\frac{0.031}{0.031} = 1$

$\therefore$ E.F = $\underline{\underline{CC\ell_2F}}$

(b) Molar mass $= 1.322 \times \frac{22.41}{0.1453}$

$= \underline{203}$ g moL^{-1}

E F molar mass ($CC\ell_2F$) = 12.01+ 70.90 + 19.00 = 101.91 g moL^{-1}

$\frac{\text{True molar Mass}}{\text{E.F Molar Mass}} = \frac{203}{101.9} \approx 2$

$\therefore$ True formular = 2 $\times$ E.F. = $\underline{\underline{C_2Cl_4F_2}}$

2. (a) $Ba^{+2}(aq) + SO_4^{-2}(aq) = BaSO_{4(s)}$

$n(Ba^{+2})_{\text{in 500 mL}} = \dfrac{20.82}{208.2}$ $[M(BaC\ell_2) = 208.20 \text{ g mol}^{-1}]$

$\therefore n(Ba^{+2})_{\text{in 150 mL}} = \dfrac{20.82}{208.2} \times \dfrac{150}{500} = \underline{0.03 \text{ moL}}$

$n(SO_4^{-2})_{\text{in 300 mL 0.1M } Na_2SO_4} = \underline{0.03 \text{ moL}}$

$\therefore n(Ba^{+2}) = n(SO_4^{-2}) = n(BaSO_4)$ $[M(BaSO_4) = 233.36 \text{ g mol}^{-1}]$

$\therefore m(BaSO_4) = n \times m$

$= 0.03 \times 233.36$

$= \underline{\underline{7.00}} \text{ g}$

(b) All Ba^{+2} and SO_4^{-2} is precipitated

$\therefore \left[Ba^{+2}\right] = 0 \underline{\underline{\text{moL}}} \text{ L}^{-1}$

$\left[SO_4^{-2}\right] = 0 \underline{\underline{\text{moL}}} \text{ L}^{-1}$

$n(C\ell^-) = 2 \times n(Ba^{+2})$

$= 0.06 \text{ moL}$

$\therefore \left[Cl^-\right] = \dfrac{n}{v\ (\text{total})}$

$= \dfrac{0.06}{0.45} = \underline{\underline{0.133}} \text{ moL L}^{-1}$

$n(Na^+) = 2 \times n(Na_2SO_4) = 0.06$

$\therefore \left[Na^+\right] = \dfrac{0.06}{0.48} = \underline{\underline{0.133 \text{ moL}}} \text{ L}^{-1}$

3. $CuCO_3 + H_2SO_4 \rightarrow CuSO_4 + H_2O + CO_2$ Equ 1

$H_2SO_4 + 2NaOH \rightarrow Na_2SO_4 + 2H_2O$ Equ 2

$n(NaOH)_{\text{to neutralize } \underline{\text{Excess}}\ H_2SO_4} = c \times V = 17.6 \times 10^{-3} \times 0.25 = 0.0044$ moL

From Equ 2 $n(H_2SO_4) = \frac{1}{2}\, n(NaOH) = \underline{0.0022}$ mol

$n(H_2SO_4)_{\text{original}} = c \times V = 25 \times 10^{-3} \times 0.250 = \underline{0.00625}$ moL

$\therefore n(H_2SO_4)_{\text{used}} = 0.00625 - 0.00220 = 00405$ mol

From Equ 1 $n(H_2SO_4)_{\text{used}} = n(CuCO_3) = n(Cu^{+2})$

$\therefore m(Cu)_{\text{in sample}} = n \times m = 0.00405 \times 63.55 = 0.2574$ g

$$\%Cu = \frac{m(Cu)}{m(Sample)} \times \frac{100}{} = \frac{0.2574}{5} \times \frac{100}{} = 5.15\%$$

4. (a) $(NH_4)_2CO_3 \rightarrow 2NH_3 + CO_2 + H_2O$

$n\,(NH_4)_2CO_3 = \frac{m}{M} = \frac{12.2}{96.094} = \underline{\underline{0.1270}}$ moL

From Equation total number of moles produced $= 4 \times n\big((NH_4)_2CO_3\big)$

$= 4 \text{ x } 0.1270 = \underline{0.508}$ moL

(b) $PV = nRT \qquad \therefore P = \frac{nRT}{v}$

$$= \; P = \frac{nRT}{V} = \frac{0.508 \times 8.315}{1.68} \times \frac{448.1}{} = 1126.65 = 1.13 \times 10^{3} \text{ kPa}$$

(c) $n(CO_2) = n(NH_4)_2CO_3 = 0.1270$ moL

$\therefore m(CO_2) = n \times M = 0.1270 \times 44.01 = \underline{\underline{5.59}}$ g

For answers to the Part 4 please see the section containing Extended Answer Questions