FORM 4 END OF TERM 2 EXAM

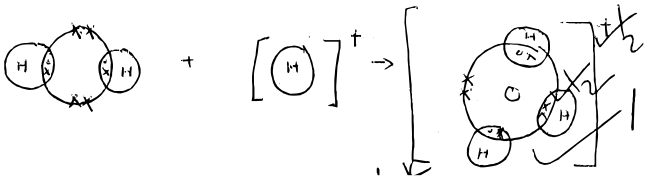
CHEMISTRY
Paper 2
July 2018
MARKING SCHEME

1. a) i) W and Y ✓1 they have energy levels ✓1
ii) Group III ✓1
iii) XW_2 ✓1

iv) Ionic / electrovalent ✓1
= transfer of electrons from X to W or X^{2-} to W^- ✓1

b) i) A type of covalent bond in which the shared pair of electrons forming the bond is contributed by only one of the combining atoms ✓1

ii)



c) i) Aluminium chloride hydrolyses ✓½ in water to form an acidic solution ✓½ while sodium chloride dissolves to form a neutral solution ✓½

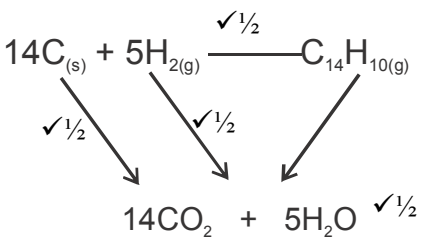
ii) Sodium chloride has ionic bonds while aluminium chloride has weak Van der waals ✓1 forces between its molecules ionic bonds require a lot of heat energy to break ✓½

2. a) This is heat energy released when one mole of water is formed from a reaction between an acid and an alkali ✓1

b) The heat change in a given reaction depends only upon the initial and final states of the system and is independent of the path followed ✓1

c) i) $14C_{(s)} + 5H_{2(s)} \rightarrow C_{14}H_{10(g)}$ ✓1

ii)



14 x 394 + 5 x -286
- 55/16 +-1430 = x + -7114
- 6946 + 7114 = x
✓½ ✓½ ✓½
$\Delta H_f ((14H_{10}) = (14 \times 394) + 5(286) = -7114$
$= -5516 + (-1430) + 7114$
$= +168 KJmol^{-1}$ ✓½

d) i) Reddish - brown solids deposit ✓1 - copper (II) ions reduced to copper metal / Fe or
- colour changes from blue to light green because Cu^{2e} ions are removed and replaced with Fe^2 ions ✓1

ii) $\Delta H = MC\Delta T$
$= 25 \times 4.2 \times 15$ ✓½
$= -157J$ ✓½

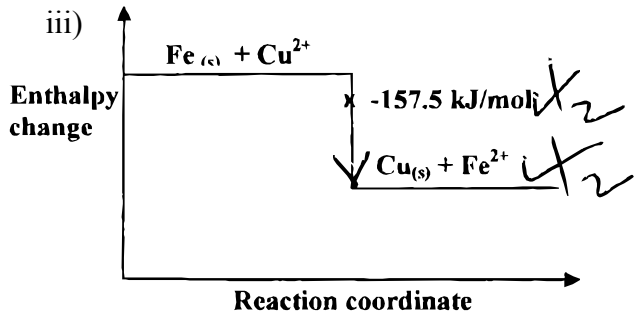
No. of moles of Cu^{2+} displaced $= \frac{0.4 \times 25}{1000}$ ✓½

$= 0.01$ moles ✓½

Molar heat $= \frac{1575}{0.01 \times 1000}$ ✓½ $= -157.5 KJ/mole$ ✓½

NB: penalise ½mk if units wrong or missing or -ve missing

iii)



3. a) $Mg_{(s)}$

b) $Mg_{(s)} + Cu^{2+}_{(aq)} \rightarrow Mg^{2+} + Cu_{(s)}$ ✓½

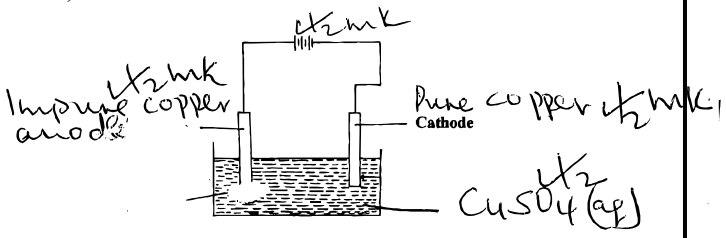
c) i) A - Mg rod ✓½
B - copper rod ✓½

ii) On the diagram ✓1 from Mg to Cu

d) Add water to copper (II) sulphate to form a solution then add excess sodium hydroxide / KOH to the solution and filter ✓½ to obtain $Cu(OH)_2$ as the residue ✓½

e) Lead (II) chloride formed is insoluble that stops exchange of ions ✓1

f)



ii) Q = It
= 3 x 3 x 60 x 60 ✓½
= 37800C ✓½

$Cu^{2+} + 2e \rightarrow Cu_{(s)}$
63.5g →193000C
x → 37800C
$\frac{63.5 \times 37800}{193000}$ ✓½ $= 12.436_{(g)}$ ✓½
Ans to 3d.p

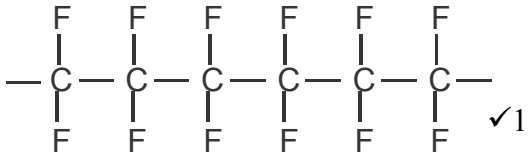
4. a) i) Pent-2-ene ✓1
ii) Butanoic acid ✓1

b) i) Substitution ✓1
ii) Addition ✓1

c) i) ethene ✓1
ii) To prevent bumping of the mixture
NaOH - to absorb CO_2 and SO_2 produced ✓1

iii) Ethanol is volatile ✓½ and can easily catch fire ✓½

d)



✓1

e) - cheaper ✓1
- more durable ✓1
- can be recycled
- not attacked by acids or bases
- can be made on demand

5. a) i) When blue anhydrous cobalt (II) chloride paper is dipped in a sample of the liquid, it turns pink ✓½
Or
White anhydrous copper (II) sulphate ✓1 turns blue ✓½ when a sample of the liquid is added

ii) - boil ✓½ the liquid, if it boils at a constant temp✓½ then it is pure (or 100°C at sea level)
- cool ✓½ the liquid if it freezes at a constant temp ✓½ then it is pure (or 0°C at sea level)
- when the density ✓½ of the liquid is determined, it is $1g/cm^3$ at 4°C ✓½

b) i) Large solid particles ✓1 like rock or sand
ii) Sedimentation ✓1

iii) I. Causes small suspended particles to settle ✓1
II. To kill germs / micro-organisms ✓1

c) i) Permanent hardness ✓1
ii) Addition of sodium carbonate ✓1 that precipitates Ca^{2+} and Mg^{2+} ions ✓1

Or
Distillation✓1 to remain with $MgSO_4$ / $CaSO_4$ ✓1 as the residue

Or
Use ion-exchange permutit ✓1 which will remove Ca^{2+} and Mg^{2+} that remains in the column ✓1

6. a) i) A - concentrated hydrochloric acid ✓½
B - water ✓½

ii) Calcium oxide / CaO ✓1

iii) To absorb unreacted / excess chlorine ✓1

iv) $2KMnO_{4(s)} + 16HCl_{aq)} \rightarrow 2KCl_{(aq)} + 2MnCl_{2(aq)} + 5Cl_{2(g)} + 8H_2O_{(l)}$ ✓1

v) Solid C sublimes ✓1 hence collects on a collects on a cooler parts of the apparatus

vi) i) $2Al_{(s)} + 3Cl_{2(g)} \rightarrow Al_2Cl_6 / 2AlCl_3$ ✓½

1 mol → 24000 $\frac{1800}{24000}$ = 0.075 moles ✓½
x 1800

0.075 x 2 = 0.05 moles ✓½
R.A.M 27 Mass = 27 x 0.05 ✓½
= 1.35g

b) i) $6NaOH_{(aq)} + 3Cl_{2(g)} \rightarrow NaClO_{3(aq)} + 5NaCl_{(aq)} + 3H_2O_{(l)}$

ii) Bleaching agent in paper pulp ✓1 used as herbicides ✓1

c) SO_2 bleaches by reduction ✓½ removal of oxygen from a dye hence temporary ✓½ while chlorine bleaches by oxidation ✓½ / addition of oxygen to a dye hence permanent ✓½

7. a) i) Calcium silicate ✓1
ii) Magnetite or siderite ✓1
iii) Carbon (IV) oxide ✓1

b) Air reacts with carbon (coke) to form carbon (IV) oxide /
$C_{(s)} + O_{2(g)} \rightarrow CO_{2(g)}$

carbon (IV) oxide reacts ✓1 with coke to form carbon (II) oxide /
$CO_{2(g)} + C_{(s)} \rightarrow 2CO_{(g)}$

The carbon (II) oxide reacts with iron (III) oxide to form iron ✓1
/ $Fe_2O_{3(s)} + 3CO_{(g)} \rightarrow 2Fe_{(l)} + 3CO_{2(g)}$

c) to produce calcium oxide ✓½ which reacts with silica to form slag

d) Cast iron is impure ✓½ hence impurities lower ✓½ its melting point

e) Manufacture of rails ✓1
- drainage pipes ✓1
- engine blocks
- any other