SET 2

CHEMISTRY EXAMINATIONS
CHEMISTRY PAPER 2
233/2

Question number		Maximum marks
1		11
2		9
3		12
4		12
5		12
6		12
7		12
TOTAL		80

Note: Throughout paper all equations 1 mark, ½ mark if missing/wrong state symbols (except in organic chemistry). Penalize fully if equation is not balanced

Q1. a) T (1 mark)   b) Halogens (1 mark)

c) (i) WQ_3 (1 mark) (Penalize fully for Q_3W) (ii) RQ_2 (1 mark) (Penalize fully for Q_2R)

d (i) (1 mark)   (ii)

(1 mark)Penalize fully if square brackets and or charge absent
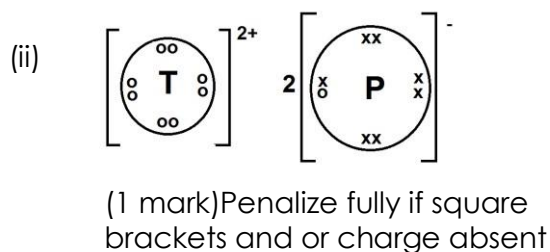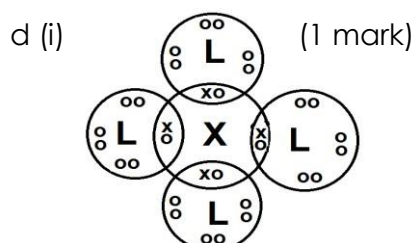
Allow if inner shells drawn, also allow if no circles drawn.

e) X has a bigger atomic radius than Y (1 mark). Atomic radius decreases across a period (½ marks) because the nuclear charge/proton attraction increases. (½ marks)

f) It has a filled electronic configuration (w.t.t.e.)

g) pH >7(½ marks). G is a metal and so would form a basic oxide (½ marks)

Q2. a) Nitrogen (½ mark) hydrogen (½ mark)

b) $4NH_{3(g)}$ + $5O_{2(g)}$ $\xrightarrow{Pt}$ $4NO_{(g)}$ + $6H_2O_{(l)}$ (1 mark)
        (Award full mark even if Pt not shown)

c) Neutralisation (1 mark)
d) Nitric acid oxidises sulphur (1 mark) to sulphur (V) oxide / sulphuric acid (Allow even if products of oxidation not given)
Nitric acid is reduced (½ marks) to nitrogen (IV) oxide (½ mark)

e) (i) Hydrogen/ammonia/carbon(II) oxide(½ **mark**)
(ii) Zinc/iron/aluminium/magnesium/. (½ **mark**) (Allow any moderately reactive metal above lead in the reactivity series excluding K, Na and Ca).

f) (i) NH_4NO_3 (1 mark) (Penalize fully if name given)

(ii) RFM NH_4NO_3 = 80 (½ mark) 28g are contained in 80g (½ mark) 140kg are contained in ⸺ (½ mark) = 400kg (½ marks) (Give full marks if worked out in terms of moles)

Q3. a) A positively charged electrode/terminal in an electrical circuit (1mark)

b) (i) A shiny grey coating forms   (1mark) (Allow silvery coating/ silver coloured deposit)

(ii) $4OH^-_{(aq)} \longrightarrow 2H_2O_{(l)} + O_{2(g)} + 4e$
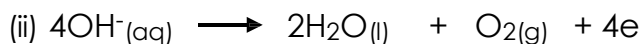
(iii) OH^-/hydroxide ions are removed (1 mark), leaving an excess of H^+/hydrogen ions (1 mark) making the solution acidic.

c) (i) Q=It   = 8X5X60($^1/_2$ mark) =2400C ($^1/_2$ mark)

(ii) 1F = 96500C forms 108g of Ag ($^1/_2$ mark) 2400C forms _____($^1/_2$ mark) = 2.686g ($^1/_2$ mark)

d) (i) $Fe_{(s)} + 2Fe^{+2}_{(aq)} \longrightarrow 3Fe^{+3}_{(aq)}$ (1mark)

 (ii) Oxidation of Fe + reduction of Fe^{3+} = 0.33v ($^1/_2$ mark)

      0.44 + reduction of Fe^{3+} = 0.33v ($^1/_2$ mark)
      Reduction of Fe^{3+} = 0.33v-0.44 ($^1/_2$ mark) = -0.11v ($^1/_2$ mark)

Q4. a). (i) propanoic acid (1 mark) (ii) pent-1ene (1 mark) (iii) but-2-yne (1 mark)

b) (i) Ethane (1 mark) (ii) 1,2 dichloro propane (1 mark) (penalize fully if positions not given)

(iii)   (1 mark) Allow $CH_2ClCHClCH_3$
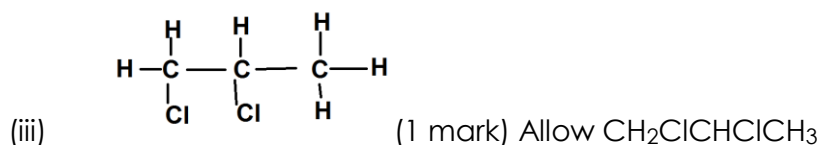
(iv) Give the reagent that can be used in:

Step I   Concentrated sulphuric acid (1 mark)

Step II   Acidified $K_2Cr_2O_7$/$KMnO_4$ (any acceptable oxidising agent). (1 mark)

(v) $CH_3CH_2CH_2OH + Na \longrightarrow CH_3CH_2CH_2ONa + \frac{1}{2} H_2$ (1 mark)

c) The molecule has a 'head' which is polar and water soluble/hydrophilic ($^1/_2$ mark) and a hydrocarbon 'tail' which is non-polar and grease soluble/hydrophobic ($^1/_2$ mark). The hydrocarbon tails dissolve in the grease while the polar heads remain in the water. When agitated, the grease is gathered up into a small globules/clusters/micelles ($^1/_2$ mark) which are then washed away by the water ($^1/_2$ mark)

Q5. a) (i) Fractional distillation (1 mark)

(ii) On diagram

(ii) Bitumen (1 mark)
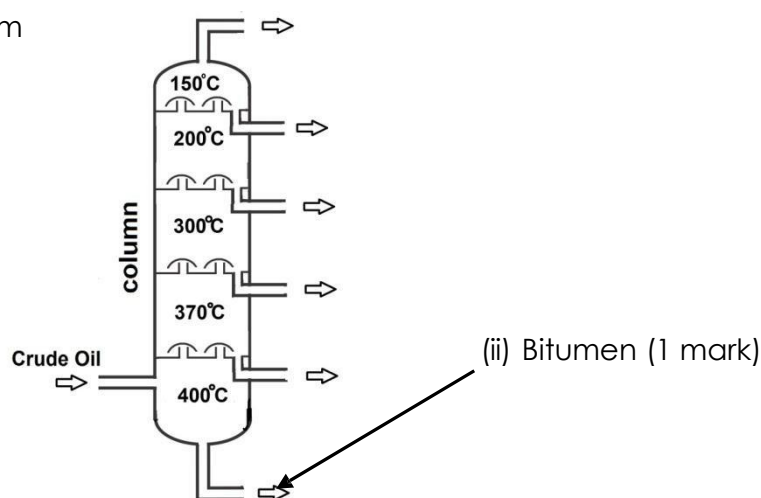
(iii) Asphalt/all weather roads/ water proofing roofs (1 mark)

(iv) The column is divided into several compartments, the crude oil vapour rises up the column with the different fractions condensing ($\frac{1}{2}$ mark) in different compartments according to their boiling point/volatility ($\frac{1}{2}$ mark)

(v) Changamwe / Mombasa (1 mark)

b) (i) To allow enough time for contact between copper and air/ to ensure all the oxygen was used up. (1 mark)

(ii) Copper metal turned black / volume of air reduced (1 mark)

(iii) No. ($\frac{1}{2}$ marks) Reaction would be violent/explosive potassium would also react with nitrogen ($\frac{1}{2}$ mark)
c) (i) Hydrated iron (III) oxide/ brown coating that forms on iron/steel /objects made from iron
(ii) $Fe_2O_3.nH_2O$ (n/1/2/3). (1 mark)

(iii) Coating iron sheets with zinc (1 mark)

Q6. a) (i) Heat/enthalpy of combustion of carbon/enthalpy of formation of carbon (IV) oxide (1mark)

(ii) Heat/enthalpy of formation of methane (1 mark)

c) By Hess's Law: $\Delta H_4 = \Delta H_1 + \Delta H_2 - \Delta H_3$ ($\frac{1}{2}$ mark) = -393-582-(-750) = -225kJ ($\frac{1}{2}$ mark)

e) (i) Breaking H-H, Cl-Cl forming 2H-Cl (1 mark)
    $\Delta H= 435+243-2(431)$ ($\frac{1}{2}$ mark) = -184kJ ($\frac{1}{2}$ mark)

(ii) Breaking C-H, Cl-Cl forming C-Cl, H-Cl(1 mark)
    $\Delta H= 415+243-339-431$ ($\frac{1}{2}$ mark) = -112kJ ($\frac{1}{2}$ mark)

f) (i) $C_4H_{10(g)}$ + $6\frac{1}{2}O_{2(g)}$ → $4CO_{2(g)}$ + $5H_2O_{(l)}$ = ΔH_c ($\frac{1}{2}$ mark)

By Hess's Law: ΔH_c =- $\Delta H_{f(C4H10)}$ + $4\Delta H_{f(CO2)}$ + $5\Delta H_{f(H2O)}$ ($\frac{1}{2}$ mark)

= - (-275) = 4(-393) + 5(-286) ($\frac{1}{2}$ mark) = -2727kJ ($\frac{1}{2}$ mark)

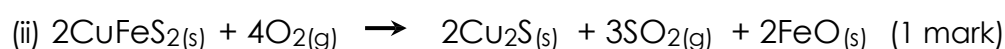
(ii) $\Delta H = mc\theta$ = 5 X 4.2 x (100-18) ($\frac{1}{2}$ mark) = 1722 kJ ($\frac{1}{2}$ mark)
     I mole butane weighs 58g and produces 2727 kJ ($\frac{1}{2}$ mark)
       1722 kJ would be produced by ⎯⎯⎯ ($\frac{1}{2}$ mark) = 36.6 g ($\frac{1}{2}$ mark)

       Mass of burner = 798 – 36.6 ($\frac{1}{2}$ mark) = 761.4g ($\frac{1}{2}$ mark)

Q7. a) (i) Sulphur (IV) oxide (1 mark) (Penalty sulphur dioxide $\frac{1}{2}$ mark)

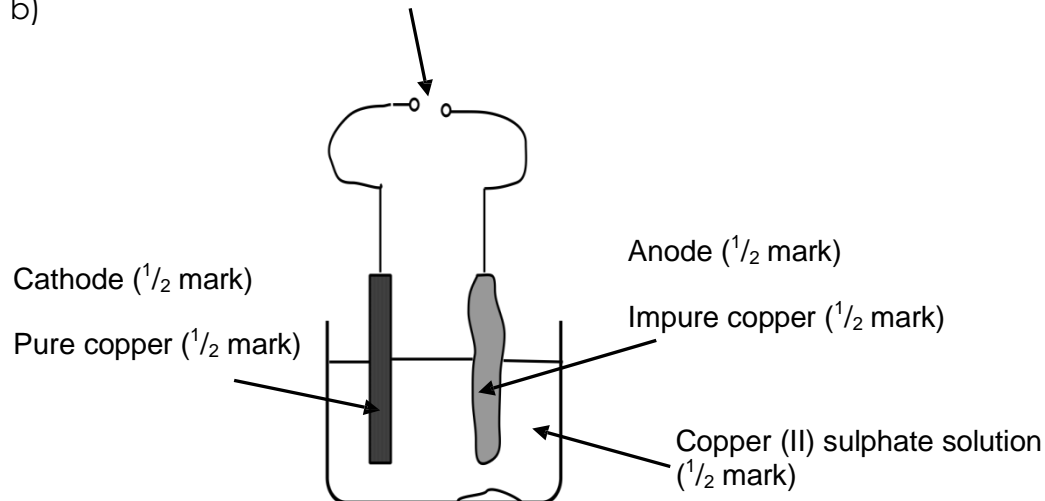(ii) $2CuFeS_{2(s)}$ + $4O_{2(g)}$ → $2Cu_2S_{(s)}$ + $3SO_{2(g)}$ + $2FeO_{(s)}$ (1 mark)

(iii) Fe^{2+} (1 mark)

(iv) Carbon (IV) oxide (1 mark) (Penalize carbon dioxide fully)

(v) Redox/Reduction (1 mark) the copper (II) oxide is reduced to copper metal by the coke (1 mark)

b)

Cell /potential difference ($\frac{1}{2}$ mark)

Anode ($\frac{1}{2}$ mark)

Impure copper ($\frac{1}{2}$ mark)

Cathode ($\frac{1}{2}$ mark)

Pure copper ($\frac{1}{2}$ mark)

Copper (II) sulphate solution ($\frac{1}{2}$ mark)

c) ⎯⎯⎯($\frac{1}{2}$ mark) =1.5 % ($\frac{1}{2}$ mark)

d)   -Sulphur (IV) oxide causes acid rain
       -Carbon (IV) oxide responsible for the greenhouse effect
       -Land dereliction / makes the land uninhabitable
       -Dust pollution.
       -Sound pollution because of explosives used in mining (any two) (2 marks)