**UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS**

General Certificate of Education O Level

# MARK SCHEME for the June 2005 question paper

## 5070 CHEMISTRY

**5070/02** **Paper 2 (Theory 1), maximum mark 75**

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UNIVERSITY of CAMBRIDGE
International Examinations

**JUNE 2005**

GCE O Level

# MARK SCHEME

## MAXIMUM MARK: 75

**SYLLABUS/COMPONENT: 5070/02**

**CHEMISTRY**
**Paper 2 (Theory 1)**

UNIVERSITY *of* CAMBRIDGE
International Examinations

## Section A

**Maximum 45 marks**

**A1** four names at **(1)** each: penalise correct formulae once only

**(a)** nitrogen dioxide

**(b)** silicon dioxide

**(c)** aluminium oxide

**(d)** lead(II) iodide **[Total: 4]**

**A2** **(a)** iron has positive ions and delocalised electrons **(1)**
the electrons are free to move **(1)**
moving electrons is an electric current **(1)** **[3]**

**(b)** high carbon steels are strong or are brittle (allow harder) **(1)**
low carbon steels are soft or are more easily shaped
(allow more malleable) **(1)** **[2]**

**(c) (i)** conditions are air (oxygen) and water or moist air **(1)**

**(ii)** magnesium is above iron in the reactivity series
(or is more reactive) **(1)**
hence it corrodes before the iron **(1)** **[3]**

**(d)** any two from:
coloured compounds/variable oxidation states/can act as
catalysts/valency/form complex ions **[2]**

**(e)** calculation
for idea of dividing by correct $A_r$ **(1)**
dividing by the smallest **(1)**
for final formula only if first 2 fully correct **(1)**

| K | Fe | C | N |
|---|---|---|---|
| 0.547/39 | 0.195/56 | 0.252/12 | 0.294/14 |
| 0.0140 | 0.00348 | 0.0210 | 0.0210 |
| 4 | 1 | 6 | 6 |

i.e. $K_4FeC_6N_6$ or $K_4Fe(CN)_6$ **[3]**

**[Total: 13]**

**A3** **(a)** Group 0 or the noble gas group or Group 8 **[1]**

**(b)** Any two sensible suggestions at **(1)** each
e.g: Mendeleev's table has:
Groups and periods reversed (only allow once)
no $A_r$
no atomic numbers
no transition metals
periods 4 and/or 5 and all or a specific group has two elements
group numbers Arabic rather than Roman **[2]**

**(c)** any two observations at **(1)** each
fizzes/runs on the surface/flame/dissolves/explodes/melts
equation **(1)**
$2\ Rb + 2\ H_2O \rightarrow 2\ RbOH + H_2$ **[3]**

**[Total:6]**

**A4** **(a)** boiling point **[1]**

**(b) (i)** making chemicals or feedstock or make petrol
not make plastics **(1)**

**(ii)** for road surfaces **(1)** **[2]**

**(c) (i)** saturated is single bonds or no double/triple bonds
or maximum number of hydrogen atoms **(1)**
hydrocarbon is carbon and hydrogen only **(1)**

**(ii)** correct methane structure (all dots = 1) **(2)** **[4]**

**(d)** any two ideas at **(1)** each:
enables supply to match demand (allow more useful)
make more petrol
make hydrogen
make alkenes e.g. ethene **[2]**

**[Total: 9]**

**A5** **(a) (i)** hydrogen is below sodium in the reactivity series **(1)**

**(ii)** chloride ions are removed (leaving hydroxide ions) **(1)**
**[2]**

**(b) (i)** chlorine bleaches litmus or turns starch/iodide paper blue **(1)**

**(ii)** hydrogen pops with a burning splint **(1)** **[2]**

**(c)** chlorine kills bacteria
(not just sterilises the water) **[1]**

**(d)** burning hydrogen does not produce pollutants or only forms
water or hydrogen is not a finite resource, is renewable **[1]**

**(e)** **(i)** no products or no reaction **(1)**

**(ii)** sodium chloride and bromine, both needed for **(1)**
(allow NaC*l* and $Br_2$) **[2]**

**[Total: 8]**

**A6** **(a)** sodium ion shown as 2.8 **(1)**
chloride ion shown as 2.8.8 **(1)**
(charges not needed. Outer shell only = 0) **[2]**

**(b)** **(i)** strong attraction between oppositely charged ions **(1)**

**(ii)** higher charges on the ions **(1)**
hence stronger attraction **(1)**
(independent marks) **[3]**

**(c)** ions cannot move in the solid but can move in the melt **[1]**

**[Total: 6]**

**[Section A: score any 45 from 46]**

## Section B

**Answer any <u>three</u> questions**

**B7** **(a)** ozone is formed by photochemical reactions
(or sparks in air, u.v on $O_2$) **[1]**

**(b)** ozone removed by reaction with chlorine (atoms) **(1)**
derived from CFC's **(1)**
ozone loss causes skin cancers <u>or</u> cataracts <u>or</u> crop damage
<u>or</u> skin diseases <u>or</u> eye damage **(1)**
(allow $O_3$ + CFC for **(1)**) **[3]**

**(c)** **(i)** bond breaking is endothermic/absorbs energy **(1)**
<u>and</u> bond forming is exothermic/releases energy
more energy released than absorbed (only if first point scored) **(1)**

**(ii)** as temperature increases molecules move faster
<u>or</u> increased k.e. **(1)**
hence more frequent collisions
<u>or</u> more molecules energy exceeds the activation energy **(1)**

**(iii)** calculation
48 g ozone releases 143 kJ **(1)**
16 g ozone releases 47.66 kJ <u>or</u> 47.7 kJ **(1)**
(answer alone **(1)**, units needed)
(if 6 x 16 = 96 g ozone used, then **(0)**)
(if 0.33 used, answer = 47.2) **[6]**

**[Total: 10]**

**B8** **(a)** calculation **(2)**
143.5 g AgC$l$ contains 108 g Ag
0.287 g AgC$l$ contains 0.216 g Ag
(answer alone **(1)**, units needed) **[2]**

**(b)** oxidation is electron loss <u>or</u> an increase in O.N. **(1)**
copper(I) is oxidised because it loses an electron
<u>or</u> its O.N. increases **(1)**
chlorine is reduced because it gains an electron
<u>or</u> its O.N. decreases **(1)** **[3]**

**(c)** equation **(1)**
$Ag + CuCl_2 \rightarrow AgCl + CuCl$ **[1]**

**(d)** **(i)** equation **(1)** state symbols **(1)**
$CuCl_2(aq) + 2\,NaOH(aq) \rightarrow Cu(OH)_2(s) + 2\,NaCl(aq)$,
(or ionic, $Cu^{2+} + 2OH^- \rightarrow Cu(OH)_2$ )
(scores **(1)** for states)

**(ii)** name is copper(II) hydroxide (allow copper hydroxide) **(1)**
colour is blue <u>or</u> blue-green **(1)**
(colour only for correct name) **[4]**

**[Total: 10]**

**B9** **(a)** **(i)** the catalyst is iron or $Fe_2O_3$ **(1)**

**(ii)** equation
$N_2 + 3H_2 \rightarrow 2NH_3$ **(1)**

**(iii)** the temperature is 280 °C **(1)**
the pressure is 400 atmos **(1)**

**(iv)** higher temperature gives faster reaction **(1)**
(higher yield = -1) **[5]**

**(b)** a catalyst increases reaction rate **(1)**
(not alters the rate)
a lower activation energy **(1)**
hence saves energy **(1)**
(third mark only if $E_a$ given) **[3]**

**(c)** equation **(1)**
$Ca(OH)_2 + 2\ NH_4NO_3 \rightarrow Ca(NO_3)_2 + 2\ H_2O + 2\ NH_3$
ammonia lost as a gas **(1)**
**[2]**

**[Total: 10]**

**B10** **(a)** name is butanoic acid (not butenoic) **(1)**

**(b)** formula is $C_5H_{11}CO_2H$ (not $C_6H_{12}O_2$) **(1)**

**(c)** structure of ethyl ethanoate **(1)**
allow full structure or condensed version, $CH_3CO_2C_2H_5$

**(d)** allow any suitable named oxidising reagent **(1)**
e.g. (acidified) potassium dichromate(VI) or air or oxygen
(allow formula) **[(a) to (d) 4]**

**(e)** equation **(1)**
$Mg + 2\ CH_3CO_2H \rightarrow Mg(CH_3CO_2)_2 + H_2$
calculation **(2)**
50 $cm^3$ acid is 0.05 mol 0.025 mol Mg needed
24 x 0.025 = 0.60 g
(answer alone **(1)**, unit needed) **[3]**

**(f)** ethanoic acid is weak and hydrochloric is strong **(1)**
lower $[H^+]$ concentration in ethanoic acid **(1)**
**[2]**

**(g)** ionic equation **(1)**
$H^+ + OH^- \rightarrow H_2O$ **[1]**

**[Total: 10]**