

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Ordinary Level

**MARK SCHEME for the May/June 2010 question paper  
for the guidance of teachers**

**5070 CHEMISTRY**

**5070/21**

Paper 2 (Theory), maximum raw mark 75

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

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|               |                                       |                 |              |
|---------------|---------------------------------------|-----------------|--------------|
| <b>Page 2</b> | <b>Mark Scheme: Teachers' version</b> | <b>Syllabus</b> | <b>Paper</b> |
|               | <b>GCE O LEVEL – May/June 2010</b>    | <b>5070</b>     | <b>21</b>    |

**Section A**

- A1 (a)** Nickel / Ni [1]
- (b)** Zinc / Zn [1]
- (c)** Sulfur / S [1]
- (d)** Hydrogen / H<sub>2</sub> [1]
- (e)** Chlorine / Cl<sub>2</sub> [1]
- (f)** Calcium / Ca [1]

**[Total: 6]**

- A2 (a)** 2H<sub>2</sub>O<sub>2</sub> → 2H<sub>2</sub>O + O<sub>2</sub> / ALLOW any correct multiple including fractions [1]
- (b)** More crowded particles / more particles per unit volume / particles closer together [1]  
More (effective) collisions (per second) [1]
- (c)** Particles are moving faster / particles have more energy [1]  
more energetic collisions / more effective collisions / more particles have energy  
above that of the activation energy / more successful collisions [1]
- (d)** Lowers activation energy [1]  
Reaction takes place by a different mechanism / reaction takes place by different  
pathway / more particles have energy above that of the activation energy / more  
successful collisions [1]
- (e)** 95 cm<sup>3</sup> [1]
- (i)** Way of measuring the gas collected e.g. upturned measuring cylinder / gas  
syringe [1]
- (ii)** Method works and is gas tight [1]

**[Total: 10]**

|        |                                |          |       |
|--------|--------------------------------|----------|-------|
| Page 3 | Mark Scheme: Teachers' version | Syllabus | Paper |
|        | GCE O LEVEL – May/June 2010    | 5070     | 21    |

- A3 (a)** Divide by relative atomic mass / calculated mole ratio 1.01 : 0.50 : 2.02 (K:Fe:O) (1)  
 Divide by smallest number to get ratio (1)  
**OR**  
 $M_r = 198$  (1)  
 Correct expressions to calculate the percentage by mass (1) [2]
- (b) (i)**  $M_r = 160$   
 0.0125 / ecf from wrong  $M_r$  (1) ALLOW 2 marks for 0.0125 with no working (2)
- (ii)** 0.08 (1)
- (iii)**  $\text{Fe}_2\text{O}_3$  because you need 0.125 mole of KOH /  $\text{Fe}_2\text{O}_3$  because 0.08 of KOH can only react with 0.008 mole of  $\text{Fe}_2\text{O}_3$  (1) ALLOW ecf from parts (i) and (ii) (1) [4]
- (c)** Reduction since electrons are gained / reduction since oxidation number decreases [1]
- (d)**  $\text{K}_2\text{FeO}_4$  is an oxidising agent /  $\text{K}_2\text{FeO}_4$  can be reduced [1]

[Total: 8]

**A4 (a)**

| ion              | number of |          |           | atomic number | mass number |
|------------------|-----------|----------|-----------|---------------|-------------|
|                  | protons   | neutrons | electrons |               |             |
| $\text{Mg}^{2+}$ |           |          | 10        | 12            | 24          |
| $\text{Br}^-$    | 35        | 46       | 36        |               |             |

All **six** correct (3)**Four** or **five** correct (2)**Two** or **three** correct (1)

[3]

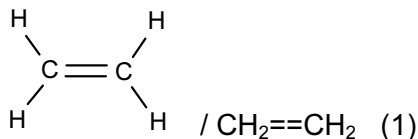
- (b)** (Two) sodium ions with  $\text{Na}^+$  and 2.8 (1) ALLOW  $[\text{Na}]^+$  IGNORE missing inner shells  
 One oxide ion with  $\text{O}^{2-}$  and 2.8 (1) IGNORE missing inner shells  
 ALLOW one mark for correct charges on both ions / one mark for both electronic configurations correct [2]
- (c)** Strong (electrostatic) attraction between ions difficult to break / strong ionic bonds difficult to overcome / large amount of energy to separate the ions / giant structure so needs lots of energy to separate the particles / giant structure so needs lots of energy to break the bonds / lots of energy to break the ionic lattice [1]
- (d)** Ions cannot move / free ions (1) IGNORE electrons cannot move [1]

[Total: 7]

|        |                                |          |       |
|--------|--------------------------------|----------|-------|
| Page 4 | Mark Scheme: Teachers' version | Syllabus | Paper |
|        | GCE O LEVEL – May/June 2010    | 5070     | 21    |

A5 (a) (i) Addition (1) ALLOW additional

(ii)



[2]

(b) (i) Any two from

- reduces litter / reduces need for land fill sites (1)
- reduces need for incineration / produce less toxic gases when burnt (1)
- saves a finite resource / metal ores are a finite resource / crude oil is a finite resource (1)
- saves energy (1)
- Less environmental damage due to mining activities / AW (1)
- NOT less pollution unless qualified / NOT costs less unless qualified (2)

(ii) Any one from

- difficult to sort substances (1)
- difficult to collect all the mobile phones (1) (1) [3]

(c) electrolyte – copper sulfate /  $\text{CuSO}_4$  (1)

anode – impure copper (1)

cathode – (pure) copper (1) [3]

ALLOW one mark if impure and pure copper are reversed

(d) (i) Close packed positive ions (attracted to) (1)  
 Positive ions are touching or almost touching each other. Can be labelled with just a positive sign  
 (Delocalised) electrons (1)

(ii) Electrons move / delocalised electrons / free electrons / sea of electrons (1) [3]

(e) (i) Alloy it to make steel / galvanised / tin plate / use of a sacrificial metal / paint (1)  
 ALLOW coat with oil

(ii) Any one from

- Sacrificial protection – Metal in sacrificial metal loses electrons more easily than iron / sacrificial metal oxidised in preference to iron / sacrificial metal more reactive than iron (1)
- Paint / oil / tin / zinc – stops oxygen and/or water reaching surface of iron (1)
- Alloy – iron surrounded by layer of chromium oxide (1)

(iii) Has a (protective) layer of (aluminium) oxide (1) [3]

[Total: 14]

|        |                                |          |       |
|--------|--------------------------------|----------|-------|
| Page 5 | Mark Scheme: Teachers' version | Syllabus | Paper |
|        | GCE O LEVEL – May/June 2010    | 5070     | 21    |

## Section B

- B6 (a)** Boiling point / boiling temperature [1]
- (b)**  $C_{12}H_{26}$  [1]
- (c)**  $N_2 + O_2 \rightarrow 2NO$  [1]  
**Any two from:**  
 28 kg of nitrogen makes 60 kg of NO [1]  
 55 kg of nitrogen makes 117.8 kg of NO [1]  
 ALLOW ecf from wrong equation.  
 If  $N_2 + O_2 \rightarrow NO$  the answer will be 58.9 kg
- (d) (i)**  $2SO_2 + O_2 \rightarrow 2SO_3$  [1]
- (ii)** NO is regenerated at the end / NO is not used up [1]  
 NO is unchanged is not sufficient
- (e)** NO reduced to  $N_2$  because it loses oxygen or gains electrons [1]  
 ALLOW reference to decrease in oxidation number  
 CO oxidised because it gains oxygen or loses electrons to form  $CO_2$  [1]  
 ALLOW reference to increase in oxidation number
- (f)**  $9.03 \times 10^{24}$  [1]

[Total: 10]

- B7 (a)** Butyne / but-1-yne / but-2-yne [1]  
 Answer on the line takes precedence
- (b)** The displayed formula for  $CH_3CCH$  [1]  
 ALLOW  $CH_3CCH$  providing triple bond is clearly shown
- (c) (i)** 60 – 85 °C [1]  
 Answer on the line takes precedence
- (ii)**  $C_6H_{10}$  [1]  
 Answer on the line takes precedence
- (d) (i)** Bond breaking takes in energy and bond forming releases energy (1)  
 More energy is released than taken in (1) Second marking point is dependent on first marking point [2]
- (ii)** Moles of  $C_2H_2 = 41.7$  (1)  
**but**  
 Energy released = 58750 kJ (2) ALLOW ecf mole  $\times$  1410 [2]

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|--------|--------------------------------|----------|-------|
| Page 6 | Mark Scheme: Teachers' version | Syllabus | Paper |
|        | GCE O LEVEL – May/June 2010    | 5070     | 21    |

(e) (i)  $C_2H_2Br_2$  /  $C_2H_2Br_4$  [1]

(ii) Orange to colourless / decolourised [1]  
 ALLOW any of the following for original colour of bromine red-brown, brown, orange or yellow **but not** red.

[Total: 10]

B8 (a) (i) Position of equilibrium moves to the right [1]  
 ALLOW (percentage) yield of product increases / amount of reactant decreases  
 Because reaction is exothermic [1]

(ii) Position of equilibrium moves to the left (1) ALLOW (percentage) yield of product decreases / amount of reactant increases  
 More gas molecules on right hand side / less gas molecules on the left hand side (1) [2]

(b) Moles of ammonia =  $5.88 \times 10^6$  (1)  
 Moles of nitrogen monoxide =  $5.33 \times 10^6$  / mass of NO is 176 tonnes (1)  
 % yield =  $90.7 - 90.9$  / ALLOW 91 / ALLOW ecf (1) [3]  
 Award all three marks for correct % yield with no working out

(c) (i) Use of titration (1)  
 (careful) evaporation / leave to evaporate / put over a boiling water bath (1) [2]  
 NOT heat over a Bunsen to dryness

(ii)  $N_2O$  [1]

[Total: 10]

B9 (a) bacterial decay of organic matter / methane hydrate / from cows / pig manure / marshes / swamps, etc. [1]

(b) Any two from:  
 Sea-level rising / flooding of low lying area / water levels rising (1)  
 Polar ice melting / ice caps melting / glaciers melting (1)  
 Climate changes / (some) areas will have (severe) droughts (1) [2]  
 NOT reference to ozone layer

(c) Methane percentage is increasing (1)  
 Idea that  $30 \times$  % of methane is more than % of carbon dioxide / the overall greenhouse effect of methane is greater than that of carbon dioxide (1) [2]

(d) Structure correct [1]  
 ALLOW all dots or all crosses

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|---------------|---------------------------------------|-----------------|--------------|
| <b>Page 7</b> | <b>Mark Scheme: Teachers' version</b> | <b>Syllabus</b> | <b>Paper</b> |
|               | <b>GCE O LEVEL – May/June 2010</b>    | <b>5070</b>     | <b>21</b>    |

(e) (Weak) intermolecular force / weak forces between molecules / simple molecules / simple covalent [1]  
NOT just weak bonds

(f)  $\text{CO}_2 + 4\text{H}_2 \rightarrow \text{CH}_4 + 2\text{H}_2\text{O}$  [1]

(g) Substitution (1)

**Any two from:**

$\text{HCl}$  / hydrogen chloride (1)

$\text{CH}_3\text{Cl}$  / chloromethane (1)

$\text{CH}_2\text{Cl}_2$  / dichloromethane (1)

$\text{CHCl}_3$  / trichloromethane (1)

$\text{CCl}_4$  / tetrachloromethane (1)

ALLOW carbon tetrachloride

[2]

**[Total: 10]**