

CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Ordinary Level

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## MARK SCHEME for the October/November 2013 series

### 5070 CHEMISTRY

5070/22

Paper 2 (Theory), maximum raw mark 75

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Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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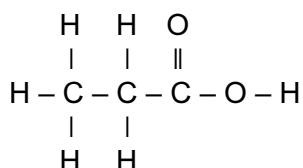
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	GCE O LEVEL – October/November 2013	5070

- A1 (a)** oxygen / O<sub>2</sub> (1)
- (b)** nickel / Ni (1)
- (c)** sulfur / S (1) [1]
- (d)** potassium / K (1) [1]
- (e)** silver / Ag (1) [1]
- (f)** zinc / Zn (1) [1]

**[Total: 6]**

- A2 (a) (i)** decreases as number of carbon atoms increases / increases as number of carbon atoms decreases (1) [1]
- (ii)** ethanoic (acid) (1) [1]
- (iii)** correct formula for propanoic acid showing all atoms and all bonds (1)



[1]

- (b) (i)** C<sub>5</sub>H<sub>10</sub>O<sub>2</sub> (1) [1]
- (ii)** any value between and including 180–195 °C (1) [1]
- (c) (i)** Hydrogen (1)  
**ALLOW:** H<sub>2</sub> [1]
- (ii)** C<sub>3</sub>H<sub>7</sub>CO<sub>2</sub>Na / C<sub>4</sub>H<sub>7</sub>O<sub>2</sub>Na / correct displayed or structural formula (1) [1]
- (d) (i)** speeds up reaction (rate) / reaction faster (1)
- lowers activation energy/makes reaction go by different route using less energy / lowers energy barrier (1) [2]
- (ii)** solvent / fragrance / perfume / food additive / flavourings / polyesters / terylene (1) [1]
- (iii)** propyl methanoate (1) [1]

**[Total: 11]**

A3 (a) 2,8,4 (1)

(b)

isotope	<sup>28</sup> Si	<sup>30</sup> Si	
number of protons	14	14	(1)
number of electrons	14	14	(1)
number of neutrons	14	16	(1)

[3]

(c)  $\text{Si} + 2\text{Cl}_2 \rightarrow \text{SiCl}_4$  (1)

[1]

(d) (i) does not conduct electricity / does not conduct heat (1)

liquid (at room temperature) / low melting point / low boiling point (1)

[2]

(ii) bonding pair between each of the 4 Si and Cl atoms (1)

rest of structure completely correct (1)

**IGNORE:** inner shell electrons

[2]

(e) many (strong) bonds / many (covalent) bonds / lattice / giant structure / lattice of covalent bonds (1)

a lot of energy needed to break the bonds / high temperature needed to break the bonds / strong bonds (1)

[2]

[Total: 11]

A4 a (i) Any **two** of:

- respiration/fermentation (1)
- decay of organic matter / decomposition of organisms (1)
- combustion of carbon (compounds)/combustion of fossil fuel / combustion of named fossil fuel (1)
- decomposition of carbonates/decomposition of limestone (1)
- from increasing temperature of the oceans / removal of (dissolved) carbon dioxide from oceans (1)
- volcanoes (1)

[2]

(ii) photosynthesis/absorbed by oceans/absorbed by seas (1)

[1]

(b) (i) gas which absorbs infra-red (radiation) / gas which absorbs infra-red (light) (1)

**ALLOW:** gas which traps heat / gas which absorbs heat

[1]

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(ii) name: methane/other named greenhouse gas (1)  
**ALLOW:** CFCs/nitrous oxide  
  
(methane) from swamps / rice paddy fields / gas from waste from animal digestion / termites / wetlands (1)  
**ALLOW:** (for methane) bacterial action (unqualified) / fracking / animal digestion (unqualified) / permafrost / glaciers / landfill  
**NOTE:** 2nd mark for source is dependent on the correct gas [2]

(c) (i) (acid which is) incompletely ionised (in water) / (acid which is) partly dissociated / (acid which is) incompletely dissociated (in water) (1) [1]

(ii) add universal / full range indicator (1)  
  
compare the colour with (colour on) indicator colour chart (1) [2]

(d)  $2\text{NaHCO}_3 \rightarrow \text{Na}_2\text{CO}_3 + \text{CO}_2 + \text{H}_2\text{O}$   
correct formulae (1)  
correct balance (1) [2]

[Total: 11]

A5 (a)  $\text{Mg} + 2\text{HCl} \rightarrow \text{MgCl}_2 + \text{H}_2$  (1) [1]

(b) (i) axes labelled correctly with appropriate units e.g. volume in  $\text{cm}^3$  on vertical axis and time in seconds/s on horizontal axis (1)  
  
graph rising steadily from near 0–0 point (although 0 does not have to be shown) then either levelling off horizontally or rising with decreasing gradient but not yet finished (1) [2]

(ii) initial gradient less steep from the start  
**AND**  
reaction finishing at same volume of gas as original or still below original level but likely to finish at the same volume as line A (1) [1]

(c) molar mass of  $\text{MgC}_2 = 48$  (1)  
 $24/48 = 50\%$  (1)  
  
1 mark for ecf from wrong molar mass of magnesium carbide [2]

[Total: 6]

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- B6 (a)** 2 marks for the reactions at the anode and cathode:  
 anode reaction:  $2\text{O}^{2-} \rightarrow \text{O}_2 + 4\text{e}^-$  /  $2\text{O}^{2-} - 4\text{e}^- \rightarrow \text{O}_2$  (1)
- cathode reaction:  $\text{Al}^{3+} + 3\text{e}^- \rightarrow \text{Al}$  /  $\text{Al}^{3+} \rightarrow \text{Al} - 3\text{e}^-$  (1)
- 2 marks for the description:  
 mention of molten aluminium oxide + cryolite in correct context (1)
- AND**  
 Any one of:
- cryolite increases conductivity of aluminium oxide / cryolite helps in dissolving electrolyte mixture (1)
  - graphite electrode(s) / carbon electrode(s) (1)
  - any temperature between and including 900–1200 °C quoted (1)
  - at anode carbon + oxygen → carbon dioxide (in words or equation) (1) [4]
- (b) (i)** low density (1) [1]
- (ii)** (good) electrical conductor (1)  
**ACCEPT:** has mobile electrons [1]
- (c) (i)** has an oxide layer (1)
- oxide (layer) is unreactive / oxide (layer) 'sticks' strongly to the surface (of the aluminium) / oxide is non-porous (1) [2]
- (ii)** displacement / redox (1) [1]
- (iii)**  $\text{Al}_2(\text{SO}_4)_3$  (1) [1]
- [Total: 10]**
- B7 (a)** (unsaturated): has (carbon-carbon) double bond (1)
- (hydrocarbon): contains carbon and hydrogen only / has no other elements than Carbon and hydrogen (1) [2]
- (b) (i)** high temperature / values between and including 400–500 °C (1)
- catalyst/aluminium oxide / zeolites / silicon dioxide (1) [2]
- (ii)**  $\text{C}_{14}\text{H}_{30} \rightarrow \text{C}_2\text{H}_4 + \text{C}_{12}\text{H}_{26}$  (1) [1]
- (c) (i)** cling film/ bottles / bags / packaging / sandwich bags / moisture barrier / damp-proofing / toys / jugs / plates / dustbins / water pipes / screw closures / sacks / gas pipes / bubble wrap / cable coverings / pond linings / ropes / nets / greenhouses / paints / glues / waxes / (outdoor) furniture e.g. tables / chairs etc. (1) [1]
- (ii)**  $\begin{array}{l} \text{C}_2\text{H}_5 \\ | \\ \text{CH}=\text{CH}_2 \end{array}$  /  $\text{C}_2\text{H}_5\text{CH}=\text{CH}_2$  (1) [1]

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(d) 28 g ethene → 46 g ethanol (1)

0.4 tonnes gives  $0.4 \times 46/28$  OR 0.657 / 0.66 (tonnes) (1)

**ALLOW:** ecf from incorrect molar masses

$(0.657 \times 5/100) = 0.03$  / 0.033 / 0.0329 (tonnes) (1)

**ALLOW:** ecf from step 2 i.e. for x answer in step 2 by 5/100

[3]

**[Total: 10]**

**B8 (a)** Idea of reactants being converted to products at the same time as products converted to reactants / reaction is reversible (1)  
 reactants and products at constant concentrations / amounts of reactants and products are constant(1)

**OR**

rate of forward reaction = rate of backward reaction = 2 marks

[2]

(b) (i) mol HI =  $0.94 \times 50/1000$  OR 0.047 mol (1)

mass HI =  $0.047 \times 128 = 6$  / 6.0 / 6.02 / 6.016 (g) (1)

[2]

(ii) At 25 °C higher concentration of reactant / lower concentration of products / At 450 °C lower concentration of reactant / higher concentration of products / decrease in temperature shifts reaction to the left / increase in temperature shifts reaction to right / concentration of reactant increases as temperature decreases / concentration of products increases as temperature increases (1)

reaction is endothermic (1)

[2]

(c) labelled products / H<sub>2</sub> + I<sub>2</sub> on right and above the reactants (1)

enthalpy change shown as upward pointing arrow with ΔH or 'enthalpy change' (1)

[2]

(d) add (aqueous) silver nitrate / lead nitrate (1)

yellow precipitate (1)

[2]

**[Total: 10]**

**B9 (a)** to increase plant growth / to improve plant growth / to grow better / to increase the crop / to increase the yield / to make more (plant) proteins / to make more amino acids / speeds up growth (of crops) (1)

[1]

(b)  $2\text{NH}_3 + \text{H}_2\text{SO}_4 \rightarrow (\text{NH}_4)_2\text{SO}_4$  (1)

[1]

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- (c) (i)  $\text{OH}^-$  (1)
- (ii) ammonia is produced /  $\text{NH}_3$  produced (1)  
ammonia lost to the air / ammonia is a gas (1) [2]
- (d) mol  $\text{HCl} = 0.01 \times 4/1000$  **OR**  $4 \times 10^{-5}$  (1)  
mol  $\text{Ca(OH)}_2 = 2 \times 10^{-5}$  / half answer to mol  $\text{HCl}$  (1)  
concentration of  $\text{Ca(OH)}_2 = (2 \times 10^{-5} \times 1000 / 10)$   
 $= 2 \times 10^{-3} \text{ mol / dm}^3$  (1) [3]
- (e) heat solution to crystallisation point / leave in a warm place / partially evaporate solution (1)  
filter (off crystals) / pick out crystals  
**AND**  
dry crystals with filter paper (1) [2]

[Total: 10]