

**CAMBRIDGE INTERNATIONAL EXAMINATIONS**

Cambridge International General Certificate of Secondary Education

## **MARK SCHEME for the October/November 2014 series**

### **0620 CHEMISTRY**

**0620/32**

Paper 3 (Extended Theory), maximum raw mark 80

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.

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

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- 1 (a) foodstuffs or drugs [1]
- (b) (i) simple distillation  
fractional distillation **or** diffusion  
fractional distillation  
filtration **or** evaporation  
chromatography [5]
- (ii) M1 dissolving  
M2 filtration  
M3 evaporation or heat (to crystallisation point)  
M4 crystallisation or allow leave to cool [4]  
**or**  
M3 crystallisation  
M4 filtration
- OR:** Adding to H<sub>2</sub>SO<sub>4</sub> method
- M1 Add excess mixture to acid (or until no more dissolves)  
M2 Filtration  
**or**  
M1 Add excess acid to mixture  
M2 With heat
- M3 evaporation or heat (to crystallisation point) Stop marking if heated to dryness.  
M4 crystallisation or allow leave to cool  
**or**  
M3 crystallisation  
M4 filtration
- [Total: 10]**
- 2 (a)  $Al^{3+} + 3e^{-} \rightarrow Al$  [2]  
species (1) balancing (1)
- (b) (i)  $AlCl_3 + 3Na \rightarrow 3NaCl + Al$  [2]  
species (1) balancing (1)
- (ii) M1 electrolysis [1]  
  
M2 molten sodium chloride [1]  
**or**  
M1 Add named more reactive metal (e.g. K)  
M2 Molten sodium chloride
- (c) (i) bauxite [1]
- (ii) M1 aluminium oxide / amphoteric oxide dissolves **OR** iron(III) oxide / basic oxide does not [1]  
  
M2 Filter **COND** on M1 [1]

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(iii) Any **two** from:  
 Lowers (working) temperature or lowers mpt (of mixture)  
 increases conductivity  
 reduces cost OR energy need [2]

(iv) M1 = Any one correct equation.

M2 Oxygen mark  
 Oxygen comes from oxide ions  
**or**  $2\text{O}^{2-} \rightarrow \text{O}_2 + 4\text{e}^-$

M3 Carbon dioxide mark  
 Anode reacts with oxygen / burns to form  $\text{CO}_2$   
**or**  $\text{C} + \text{O}_2 \rightarrow \text{CO}_2$

M4 Carbon monoxide mark  
 Anode reacts with limited oxygen / incompletely burns to form carbon monoxide  
**or**  $2\text{C} + \text{O}_2 \rightarrow 2\text{CO}$   
**or**  $\text{CO}_2$  reacts with the anode to form carbon monoxide  
**or**  $\text{CO}_2 + \text{C} \rightarrow 2\text{CO}$

M5 Fluorine mark  
 Fluorine comes from cryolite or fluoride ions  
**or**  $2\text{F}^- \rightarrow \text{F}_2 + 2\text{e}^-$  [5]

(d) (i) Has an impervious **or** non-porous **or** passive **or** unreactive **or** protective oxide layer [1]

(ii) Any **two** from:  
 good conductor of heat  
 high melting point  
 Unreactive towards foods [2]

3 (a) (i)  $\text{C}_4\text{H}_8$  only  
 $\text{CH}_2$  (Allow  $\text{C}_1\text{H}_2$ ) [2]

(ii) Any unambiguous structural formula of methyl cyclopropane or but-1-ene or but-2-ene or methyl propene [1]

(iii) M1 same molecular formula [1]

M2 different structural formulae or different structures  
**or** different arrangement of atoms [1]

(iv) If 'No':  
 one an alkane, the other an alkene  
**or**  
 one is saturated / has single bonds, the other is unsaturated / has a double bond  
 ignore: references to the 'functional group'

If 'yes'  
 both alkanes **or** both saturated  
 ignore: references to the 'functional group' [1]

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(b) (i) M1 Action of heat or catalyst or thermal decomposition (on an alkane) [1]  
Ignore steam. Ignore pressure.

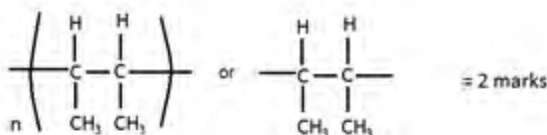
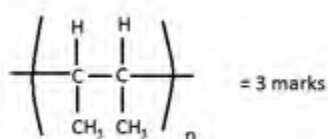
M2 Long-chained molecules or alkanes form smaller molecules (not smaller fraction) or forms smaller alkenes (or alkanes) [1]

(ii) C<sub>10</sub>H<sub>22</sub> [1]

(c) (i) M1 Correct structure of one repeat unit [1]

M2 Continuation bonds **COND** on M1 [1]

M3 use of brackets and subscript 'n' **COND** on M1 and M2 [1]



(ii) dibromoethane or 1,2-dibromoethane [1]

4 (a) M1 brass [1]

M2 copper **COND** on M1 [1]

(b) (i)  $2\text{ZnS} + 3\text{O}_2 \rightarrow 2\text{ZnO} + 2\text{SO}_2$  [2]  
species (1) balancing (1)

(ii) Manufacture of sulfuric acid [1]  
**or** bleach or making wood pulp or making paper  
**or** food or fruit juice or wine preservative  
**or** fumigant or sterilising

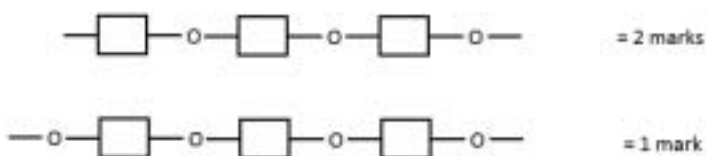
(c) (i) sulfuric acid [1]

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- 4 (c) (ii)  $Zn^{2+} + 2e \rightarrow Zn$  [1]
- oxygen or water Allow  $O_2$  and  $H_2O$  if no name seen [1]
- sulfuric acid  
Allow:  $H_2SO_4$  if no name seen [1]
- 4 (d) (i) from zinc to carbon  
(clockwise direction on or near the wire) [1]
- (ii) to allow ions to flow [1]
- (iii) oxidation  
and loss of electron(s) or increase in oxidation number/state [1]
- reduction  
and decrease in oxidation number/state or gain of electron(s) [1]

[Total: 13]

- 5 (a) (i) M1 Contain carbon, hydrogen and oxygen (only) [1]
- M2 hydrogen and oxygen is in a 2:1 ratio (or in the same ratio as water) [1]
- (ii) M1 -O- linkage [1]
- M2 3 monomer units with 3 blocks and 3 Oxygen atoms **Cond** [1]



- 5 (b) catalyst [1]
- biological or protein [1]
- 5 (c) (i) C A B [2]
- ABC = 1 ACB = 1 BCA = 1 CBA = 1 BAC = 0  
Allow 70 for C, 40 for B and 20 for A
- (ii) M1 Energy mark: at higher temperature particles/molecules more have more energy or move faster [1]
- M2 Collision frequency mark: collide more frequently/often **or** more collisions per unit time **or** higher rate of collisions. [1]  
Ignore: 'more collisions'
- M3 Collision energy mark: more molecules have enough energy to react or more collisions are above activation energy or successful [1]

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(iii) C rate zero or enzymes denatured [1]

[Total: 12]

6 (a) making fertilisers or pickling metals or making fibres or making phosphoric acid/phosphates making dyes or making paints/pigments/dyes or making paper making plastics or making detergents or tanning leather or battery acid. [1]

(b) (i) add water (to yellow solid or to (anhydrous) iron(II) sulfate or to  $\text{FeSO}_4$  or to products goes green [1]

(ii) M1 Sulfur trioxide reacts with water to make sulfuric acid or equation [1]

M2 sulfur dioxide reacts with oxygen to form sulfur trioxide or equation [1]

(iii) M1 = 2.07 Allow 2.1 or 2.0666...7

M2 = 62.8.g

M3 =( M2/152 =) 0.41(3)

M4 (=M1/M3) rounded to the nearest whole number  $\times = 5$  [4]

6 (c) (i) nitric acid or nitric(V) acid or  $\text{HNO}_3$  [1]

(ii)  $2\text{KNO}_3 = 2\text{KNO}_2 + \text{O}_2$  [2]  
Species (1)  
Balance (1)

[Total: 12]