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.

Cambridge will not enter into discussions about these mark schemes.

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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_2SO_4 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]

(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 $2O^{2} \rightarrow O_2 + 4e$

M3 Carbon dioxide mark
Anode reacts with oxygen / burns to form CO_2
or $C + O_2 \rightarrow CO_2$

M4 Carbon monoxide mark
Anode reacts with limited oxygen / incompletely burns to form carbon monoxide
or $2C + O_2 \rightarrow 2CO$
or CO_2 reacts with the anode to form carbon monoxide
or $CO_2 + C \rightarrow 2CO$

M5 Fluorine mark
Fluorine comes from cryolite or fluoride ions
or $2F \rightarrow F_2 + 2e$ [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) C_4H_8 only
CH_2 (Allow C_1H_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]

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

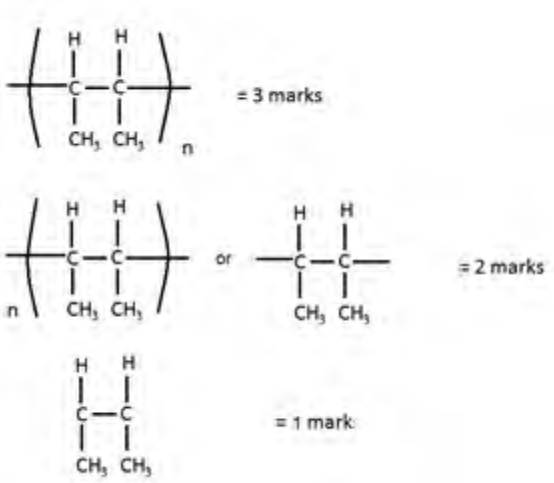
M2 Long-chained molecules or alkanes form smaller molecules (not smaller fraction) or forms smaller alkenes (or alkanes) [1]

(ii) $C_{10}H_{22}$ [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) $2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$ [2]
species (1) balancing (1)

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

(c) (i) sulfuric acid [1]

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 [1]
Allow: H_2SO_4 if no name seen

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]

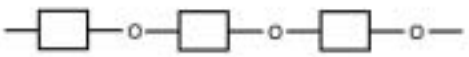
[Total: 13]

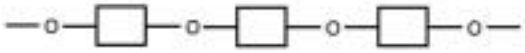
5 (a) (i) M1 Contain carbon, hydrogen and oxygen (only) [1]

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]

(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 $FeSO_4$ or to products [1]

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 × = 5 [4]

6 **(c)** **(i)** nitric acid or nitric(V) acid or HNO_3 [1]

(ii) $2KNO_3 = 2KNO_2 + O_2$ [2]
Species (1)
Balance (1)

[Total: 12]