

CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

MARK SCHEME for the May/June 2014 series

0439 CHEMISTRY (US)

0439/33

Paper 3 (Extended Theory), maximum raw mark 80

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- 1 (a) carbon dioxide (1)
- (b) propene (1)
- (c) krypton (1) [1]
- (d) nitrogen (1) [1]
- (e) fluorine (1) [1]
- (f) sulfur dioxide (1) [1]
- (g) hydrogen (1) [1]
- [Total: 7]
- 2 (a) any **three** from:
 particles have more energy (1)
 move faster (1)
 collide more frequently (1)
 more particles have energy greater than E_a [3]
guidance: more colliding molecules have enough energy to react is worth (2)
- (b) particles move in all directions/randomly in both liquids and gases (1)
 no bonds/very weak forces between particles in gases (1)
 molecules can move apart/separate (to fill entire volume) (1)
OR
 bonds/forces/IMF between particles in liquids (1)
 molecules cannot move apart/separate (so fixed volume in liquids) (1) [3]
- [Total: 6]
- 3 (a) (i) enzymes (1) [1]
- (ii) reduces growth of microbes/rate of reproduction of microbes is lower/
 microbes are dormant (1)
 fewer (enzymes) to decay food (1)
OR
 enzymes less efficient at lower temperatures (1)
 slower reaction rate (1) [2]
- (b) correct linkage (1)
 rest of molecule correct **and** continuation shown (1)
 (other product is) water (1) [3]

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- (c) any **three** from:
 photosynthesis (1)
 light/photochemical (1)
 chlorophyll/chloroplasts (1)
 carbon dioxide and water needed (1)
 (glucose and) oxygen (1) [3]

[Total: 9]

- 4 (a) (i) heat limestone/calcium carbonate (1)
 fractional distillation (1)
 liquid air (1) [3]

- (ii) any **two** of the oxides, C, S, P and Si, mentioned (1)
 carbon dioxide and sulfur dioxide escape/are gases (1)
 phosphorus oxide **or** silicon(IV) oxide react with calcium oxide/
 phosphorus oxide **or** silicon(IV) oxide are acidic and calcium oxide is basic (1)
 to form a slag **or** calcium silicate **or** calcium phosphate (1)
 must have correct equation for one of the above reactions (1) [5]

- (b) (i) lattice/rows/regular arrangement of cations/positive ions/ Fe^{2+} (1)
 mobile/free/delocalised/sea of electrons (1) [2]

- (ii) the rows of ions/ions can move past each other (1)
 without the metal breaking/bonds are not directional/not rigid (1) [2]

- (iii) carbon particles/atoms different size (1)
 prevents movement of rows, etc. (1) [2]

[Total: 14]

- 5 (a) faster reaction rate (1)
 higher collision rate (1)
 greater yield **or** favour RHS (1)
 pressure favours products because it has lower volume/fewer product molecules (1) [4]

- (b) higher temperature favour endothermic reaction (1)
 this is the back reaction/left hand side/reactants (1)
 reduce yield (1) [3]

- (c) (i) greater surface area (1) [1]

- (ii) increase reaction rate (1)
 can use a lower temperature to have an economic rate (1)
 and not decrease yield (by increasing temperature). [2]

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- (d) lower the temperature (1)
only ammonia will liquefy (1)
OR
add water (1)
only ammonia will dissolve (1)
OR
increase pressure (1)
only ammonia will liquefy (1) [2]

- (e) second line $+3 \times 155 = +465$
third line $-3 \times 280 = (-)840$
fourth line $-3 \times 565 = (-)1695$
all **three** correct (2)
two correct (1)
- $1170 + 465 = 1635$
 $840 + 1695 = 2535$
both numerically correct (1)
exothermic reaction with some reasoning (1) [4]

[Total: 16]

- 6 (a) (i) C and H only (1) [1]
(ii) only single bonds (1) [1]
- (b) (i) C_nH_{2n+2} (1) [1]
(ii) $C_{14}H_{30}$ (1)
 $(14 \times 12) + 30 = 198$ (g) (1) [2]
- (c) (i) $C_9H_{20} + 14 O_2 \rightarrow 9CO_2 + 10H_2O$ (2) [2]
(ii) Volume ratio

$C_xH_y(g)$	$+ O_2(g)$	\rightarrow	$CO_2(g)$	$+$	$H_2O(l)$	
20	160		100			all in cm^3 mole ratio
1	8		5			
C_5H_{12}	$+ 8O_2$	\rightarrow	$5CO_2$	$+$	$6H_2O$	

For evidence of method (1)
for equation as above (2) [3]
- (d) (i) alkanes in petrol/fuel/solvent (1)
alkenes to make alcohols/plastics/polymers/solvents (1)
hydrogen to make ammonia/fuel/fuel cells, etc. (1) [3]
(ii) a correct equation for example:
 $C_{10}H_{22} \rightarrow C_8H_{16} + C_2H_4 + H_2$ (1) [1]

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(e) (i) light or lead tetraethyl/catalyst/high temperature (1)

(ii) $\text{CH}_3\text{-CHCl-CH}_3$ (1)

[Total: 16]

7 (a) bauxite (1)

[1]

(b) electrolyte alumina/aluminium oxide dissolved in molten cryolite (1)

use cryolite to reduce mp/comparable idea/temperature of electrolyte 900 to 1000°C (1)

electrodes carbon (1)

aluminium formed at cathode/ $\text{Al}^{3+} + 3\text{e} \rightarrow \text{Al}$ (1)

oxygen formed at anode/ $2\text{O}^{2-} \rightarrow \text{O}_2 + 4\text{e}$ (1)

anode burns/reacts to carbon dioxide/ $\text{C} + \text{O}_2 \rightarrow \text{CO}_2$ (1)

[6]

(c) (i) food containers/window frames/cooking foil/cars/bikes/drink cans (1)

[1]

(ii) $4\text{OH}^- \rightarrow \text{O}_2 + 2\text{H}_2\text{O} + 4\text{e}$ (2)

[2]

$4\text{Al} + 3\text{O}_2 \rightarrow 2\text{Al}_2\text{O}_3$ (2)

[2]

[Total: 12]