CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the May/June 2014 series

0620 CHEMISTRY

0620/33 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)** carbon dioxide (1) [1]

(b) propene (1) [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 <u>in both</u> 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]

(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]

(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

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

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]

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

(ii) $CH_3–CHCl–CH_3$ (1) [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 / $Al^{3+} + 3e \rightarrow Al$ (1)
oxygen formed at anode / $2O^{2-} \rightarrow O_2 + 4e$ (1)
anode burns / reacts to carbon dioxide / $C + O_2 \rightarrow CO_2$ (1) [6]

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

(ii) $4OH^- \rightarrow O_2 + 2H_2O + 4e$ (2) [2]

$4Al + 3O_2 \rightarrow 2Al_2O_3$ (2) [2]

[Total: 12]