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

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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]

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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

$C_xH_y(g)$	+	$O_2(g)$	→	$CO_2(g)$	+	$H_2O(l)$
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]

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(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]

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