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.

Cambridge is publishing the mark schemes for the March 2015 series for most Cambridge IGCSE® components.
1 (a) chlorine / argon [1]
(b) chlorine [1]
(c) magnesium [1]
(d) argon [1]
(e) aluminium [1]
(f) sodium [1]
[Total: 6]

2 (a) Atoms of the same element / atoms with same proton number / atoms with same atomic number
[1]
different neutron number / nucleon number / mass number [1]

(b) | particle | number of protons | number of electrons | number of neutrons | nucleon number | symbol or formula |
<table>
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</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>B</td>
<td></td>
<td></td>
<td></td>
<td>23 (1)</td>
<td>Na(1) * (1)</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
<td>10(1)</td>
<td></td>
<td></td>
<td>16(1)</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>13 (1)</td>
<td></td>
<td></td>
<td>15 (1)</td>
<td></td>
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</tbody>
</table>
[Total: 9]
3 (a) (making) fertilisers/nitric acid/nylon/explosives/urea
(for) cleaning products (allow oven cleaner)/refrigeration [1]

(b) equilibrium/reversible [1]

c (nitrogen)air/atmosphere [1]
(hydrogen) methane/water/steam/alkane/named alkane/hydrocarbon/crude oil
or petroleum/natural gas [1]

d iron [1]

e (i) rate increases/faster [1]
More (effective) collisions [1]
(ii) yield decreases [1]
(forward reaction) exothermic/reverse reaction endothermic/high temp
favours endothermic reaction [1]

(f) (i) yield increases [1]
less/fewer molecules or moles or volume on RHS ORA/high pressure
favours reaction which produces fewer molecules or moles or volume [1]
(ii) particles/molecules closer/more particles per unit area or volume/more
molecules per unit area or volume/more concentration/particles have less
space between them and more collisions [1]
(iii) safety issues/higher cost [1]

g 3 bond pairs between N & H [1]
Lone pair on N [1]

(h) (i) proton/H⁺ acceptor [1]
(ii) \[2\text{NH}_3 + \text{H}_2\text{SO}_4 \rightarrow (\text{NH}_4)_2\text{SO}_4\] [2]
Formula of (NH₄)₂SO₄ (1)
The rest (1) [Total:18]
4 (a) (i) 82.76/12 and 17.2(4)/(1)
   or evaluation: 6.89 / 6.9(0) and 17.2(4) [1]
   \( C_2H_5 \) [1]
   OR
   \( 82.76 / 100 \times 58 = 48 \) and 17.24 / 100 \( \times 58 = 10 \)
   or evaluation i.e. 48 and 10 [1]
   \( C_2H_5 \) [1]

(ii) \( (C_2H_5) = 29 \) [1]
   \( (58/29 = 2 ) \) \( C_4H_{10} \) [1]
   OR:
   \( 82.76 / 100 \times 58 = 48 \) and 17.24 / 100 \( \times 58 = 10 \)
   or evaluation i.e. 48 and 10 [1]
   \( 48/12 = 4 \) \( 10/1 = 10 \) (therefore) \( C_4H_{10} \) [1]

(b) (i) \( C_nH_{2n} \) [1]

(ii) \( CH_2 \) [1]

(c) (contains) double bond/triple bond/multiple bond(s)/not all bonds are single [1]
   (contains) carbon and hydrogen only [1]

(d) bromine/bromine water [1]
   no change/stays brown/orange/yellow/red-brown or only changes in UV [1]
   (brown/orange/yellow) to colourless/decolourised [1]

(e) (i) circle/brackets around any 2 consecutive carbon atoms in the main chain
   and all attached atoms [1]
   e.g.
   
   \[
   \begin{array}{c}
   \text{C}_2\text{H}_5 \ 	ext{H} \\
   \text{H} \ 	ext{C} \ 	ext{C} \ 	ext{C} \ 	ext{C} \\
   \text{H} \ 	ext{H} \ 	ext{H} \ 	ext{H} \\
   \end{array}
   \quad
   \begin{array}{c}
   \text{C}_2\text{H}_5 \ 	ext{H} \\
   \text{C} \ 	ext{C} \\
   \text{H} \ 	ext{H} \\
   \end{array}
   \]

(ii) \( \text{CH}_3\text{CH}_2\text{CH} = \text{CH}_2 \) / \( \text{C}_2\text{H}_5\text{CH} = \text{CH}_2 \) (double bond must be shown) [1]
   butene/but-1-ene [1]
(iii) \((\text{CH}_3)_2\text{C}=\text{CH}_2 / \text{CH}_3\text{CH} = \text{CHCH}_3 / (\text{CH}_2)_2\text{CHCH}_3 / (\text{CH}_2)_4\) 

[Total: 15]

5  (a) Bauxite  
(b) carbon/graphite  
(c) improves conductivity/better conductor  
   Lower (operating) temperature/save energy/saves electricity/saves heat  
(d) anode: \(2\text{O}^{2−} \rightarrow \text{O}_2 + 4\text{e}^− / 2\text{O}^{2−} − 4\text{e}^− \rightarrow \text{O}_2\)  
   cathode: \(\text{Al}^{3+} + 3\text{e}^− \rightarrow \text{Al} / \text{Al}^{3+} \rightarrow \text{Al} − 3\text{e}^−\)  
(e) (i) Iron carbon aluminium/Fe, C, Al  
   (ii) Aluminium oxide is not reduced by carbon but iron(III) oxide is  
(f) haematite/hematite  
(g) Allow: multiples in (i) to (iv)  
   (i) \(\text{C} + \text{O}_2 \rightarrow \text{CO}_2\)  
   (ii) \(\text{CO}_2 + \text{C} \rightarrow 2\text{CO}\)  
   (iii) \(\text{Fe}_2\text{O}_3 + 3\text{CO} \rightarrow 2\text{Fe} + 3\text{CO}_2 / \text{Fe}_2\text{O}_3 + 3\text{C} \rightarrow 2\text{Fe} + 3\text{CO} / \)  
   \(2\text{Fe}_2\text{O}_3 + 3\text{C} \rightarrow 4\text{Fe} + 3\text{CO}_2\)  
   (iv) \(\text{CaO} + \text{SiO}_2 \rightarrow \text{CaSiO}_3 / \text{CaCO}_3 + \text{SiO}_2 \rightarrow \text{CaSiO}_3 + \text{CO}_2\)  

[Total: 13]

6  (a) Any two from:  
   • bubbles/effervescence/fizzing  
   • (some of the) solid/copper carbonate dissolves/disappears or some (brown) solid seen (undissolved)  
   • (colourless) solution or liquid turns blue  

[Total: 2]
(b) filter/centrifuge/decant
wash with (distilled) water
(dry with) filter paper/tissues/warm windowsill/in sun/oven/fan/heat

(c) (i) Blue precipitate/ppt
(ii) \( \text{Cu}^{2+} + 2\text{OH}^- \rightarrow \text{Cu} (\text{OH})_2 \)

(d) (i) \( \text{Cu} (\text{OH})_2 (s) \rightarrow \text{CuO} (s) + \text{H}_2\text{O} (g) \)
Equation
State symbols of correct chemical equation
(ii) carbon/hydrogen

[Total:10]

7 (a) Any two from:
yeast/20–40°C/anaerobic or without oxygen or without air/(aqueous) solution or water or aqueous

(b) (i) Mr = 180 (1) \( \frac{30}{180} \) = 0.167 (1)
(ii) \( 2 \times 0.167 \) or \( 2 \times 46 \) or 0.333 or 92
\( (2 \times 0.167 \times 46) = 15.3(33) \) (g)
(iii) \( (2 \times 0.167 \times 24) = 8 \) (dm³)

(c) (i) Crude oil/petroleum
(ii) \( \text{C}_2\text{H}_4 + \text{H}_2\text{O} \rightarrow \text{C}_2\text{H}_5\text{OH} / \text{CH}_3\text{CH}_2\text{OH} \)

[Total:9]