

Chemistry B

General Certificate of Secondary Education

Unit **B641/02**: Modules C1, C2, C3 (Higher Tier)

Mark Scheme for January 2011

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Mark schemes should be read in conjunction with the published question papers and the Report on the Examination.

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1 Abbreviations, annotations and conventions used in the detailed Mark Scheme.

| | |
|---------------|-----------------------------------------------------------------|
| / | = alternative and acceptable answers for the same marking point |
| (1) | = separates marking points |
| not | = answers which are not worthy of credit |
| reject | = answers which are not worthy of credit |
| ignore | = statements which are irrelevant |
| allow | = answers that can be accepted |
| () | = words which are not essential to gain credit |
| <u> </u> | = underlined words must be present in answer to score a mark |
| ecf | = error carried forward |
| AW | = alternative wording |
| ora | = or reverse argument |

| Question | | Expected Answers | Marks | Additional Guidance | |
|----------|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | (a) | to improve the colour or appearance of food / to stop food reacting with oxygen / to stop oil and water from separating / flavour enhancer / stabiliser (1) | 1 | allow to give it colour allow to improve texture allow to stop the food going mouldy allow to preserve food allow to stop ingredients from separating allow to add flavour or taste ignore to make it last longer to keep food fresh is not sufficient but allow so it does not go off more appetising is not sufficient | |
| | (b) | (i) | self-cooling drinks can (1) | 1 | more than one tick scores 0 |
| | | (ii) | any two from: (packaging) controls or reacts to things which are taking place inside the package (1) idea of improving the quality or safety (of the product) (1) idea of making it more difficult for bacteria or microbes or mould to grow (1) | 2 | allow (active packaging) uses a polymer and a catalyst as a packaging film (1) allow to reduce the risk of food poisoning ignore to keep it fresh for longer allow stop it going mouldy ignore stop it rotting allow kills bacteria / kills microbes ignore kills germs |
| | | Total | | 4 | |

| Question | | Expected Answers | Marks | Additional Guidance | |
|--------------|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2 | (a) | <p>any two from:</p> <p>EITHER (propane) is more convenient / portable (as it is stored in small cylinders) (1) (propane) is easy to light (1) (propane) has a high energy value (1) OR (oil) is a liquid (1) (oil) has a high energy value (1) (oil) is easy to light (1) (oil) can be stored easily (1)</p> | 2 | <p>no mark for propane / oil - marks are for explanation if coal / natural gas scores 0</p> <p>allow easy to carry</p> | |
| | (b) | (i) | <p>100 x 4.2 x 19 (1)</p> <p>but 7980 scores (2)</p> | 2 | <p>look for correct answer first, 7980 on own scores (2) despite any other working out</p> <p>allow 7.98kJ allow 119.7(J) or 1.5 x 4.2 x 19 (1)</p> |
| | | (ii) | 2800(J) (1) | 1 | <p>allow 2.8kJ unit not needed - ignore incorrect units, unless a contradiction e.g. 2800kJ</p> |
| | (c) | more energy is given out during bond making than is taken in during bond breaking (1) | 1 | <p>more than one tick scores 0 tick in second box</p> <p><input type="checkbox"/></p> <p><input checked="" type="checkbox"/></p> <p><input type="checkbox"/></p> <p><input type="checkbox"/></p> | |
| Total | | | 6 | | |

| Question | | Expected Answers | Marks | Additional Guidance | |
|----------|-----|------------------|--------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3 | (a) | solvent (1) | 1 | allow correct answer ticked, circled or underlined in list if answer line is blank | |
| | (b) | (i) | C ₄ H ₈ O ₂ (1) | 1 | allow symbols in any order allow CH ₃ CO ₂ C ₂ H ₅ / CH ₃ CO ₂ CH ₂ CH ₃ / CH ₃ COOC ₂ H ₅ / CH ₃ COOCH ₂ CH ₃ not C ₄ H ₈ O ₂ / C ⁴ H ⁸ O ² |
| | | (ii) | (hydrocarbons contain) only carbon and hydrogen / AW / contains oxygen / has an O in the formula / contains three elements / AW (1) | 1 | not references to carbon molecules / hydrogen molecules / oxygen molecules not a mixture of hydrogen and carbon ignore references to double bonds |
| | | Total | 3 | | |

| Question | | Expected Answers | Marks | Additional Guidance | |
|----------|-----|---------------------------------------------------------------------------------------------------------------------|-----------------|---------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| 4 | (a) | X = petrol Y = diesel Z = bitumen all three correct (2) one or two correct (1) | 2 | | |
| | (b) | (i) | LPG (1) | 1 | allow X / name given for fraction X in part (a) |
| | | (ii) | Z / bitumen (1) | 1 | allow ecf from fraction Z in part (a) e.g. petrol (1), if petrol is given as name of fraction Z in part (a) |
| | | Total | | 4 | |

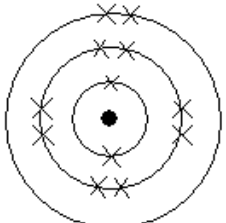
| Question | | Expected Answers | Marks | Additional Guidance |
|----------|-----|-------------------------------------------------------------------------------------|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 5 | (a) | contains only single (covalent) bonds / AW / contains no double bonds (1) | 1 | ignore contains single bonds ignore it is a hydrocarbon ending in 'ane' allow it is saturated allow follows general formula for alkanes / C_nH_{2n+2} ignore contains the maximum number of hydrogens |
| | (b) | $2CH_3OH + 3O_2 \rightarrow 2CO_2 + 4H_2O$ formulae (1) balancing (1) | 2 | allow any correct multiple, including fractions allow = instead of arrow not and or & for + balancing mark dependent on correct formulae BUT allow 1 mark for balanced equation with a minor error in subscripts / formulae e.g. $2CH_3OH + 3O_2 \rightarrow 2CO_2 + 4H_2O$ |
| | | Total | 3 | |

| Question | | Expected Answers | Marks | Additional Guidance |
|----------|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6 | (a) | low melting point / melts easily (1) | 1 | ignore references to electrical conductivity |
| | (b) | low density / AW (1) | 1 | allow lightweight allow because of its density ignore it is light but allow the aeroplane body is light |
| | (c) | <p>advantage – low density so better fuel economy / corrodes less so has longer lifetime (1)</p> <p>disadvantage – expensive compared to iron or steel (1)</p> | 2 | <p>allow one correct advantage and one correct disadvantage for 1 mark (i.e. explanation is missing) assume unqualified answer refers to aluminium allow ora if clearly stated</p> <p>allow lightweight ignore aluminium is light but allow the car is lighter so better fuel economy allow aluminium does not rust so has longer lifetime ignore references to strength</p> |
| | | Total | 4 | |

| Question | | Expected Answers | Marks | Additional Guidance |
|----------|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7 | (a) | warning of hot cup / (electric) kettles / pans / thermometer (on someone's head) / baby baths / battery testing / T-shirts that change colour / mood rings / beer cans (1) | 1 | allow temperature of babies' baths or food spoons allow (novelty) mugs / wallpaper / radiators allow to show if something is hot or cold ignore references to cooker hobs |
| | (b) | (oil is) oxidised / (oil) reacts with oxygen (1) | 1 | allow binding medium is oxidised / binding medium reacts with oxygen ignore references to binding medium hardens |
| | (c) | particles are mixed and dispersed through a liquid (1) solid particles are suspended in a liquid (1) | 2 | If more than two ticks, deduct one mark for each additional tick down to zero <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> |
| | | Total | 4 | |

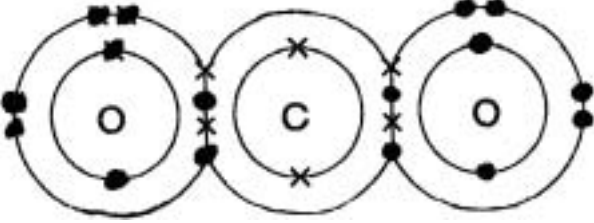
| Question | | Expected Answers | Marks | Additional Guidance |
|----------|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 8 | (a) | 18 (seconds) (1) | 1 | allow 16 to 19 |
| | (b) | more crowded particles / more particles in the same volume / more particles per cm ³ (1) more (frequent) collisions (1) | 2 | assume answer refers to concentrated acid but allow ora if dilute acid is specified ignore more particles / reaction is faster allow particles are closer together allow more chance of collisions not faster collisions / quicker collisions |
| | (c) | more (surface) area (1) more frequent collisions / more collisions per second / more chance of a collision (1) | 2 | allow more surface / more exposed particles ignore particles closer together / particles more crowded / more particles ignore particles have more energy not faster collisions / quicker collisions allow 1 mark for more (successful) collisions if no other mark awarded |
| | (d) | $\text{CaCO}_3 + 2\text{HCl} \rightarrow \text{CaCl}_2 + \text{CO}_2 + \text{H}_2\text{O}$ correct formulae of reactants and products (1) balancing (1) | 2 | allow correct multiples including fractions allow = instead of arrow not and or & for + balancing mark is dependent on correct formulae BUT allow 1 mark for balanced equation with a minor error in subscripts / formulae e.g. $\text{CA} + 2\text{HCl} \rightarrow \text{CaCl}_2 + \text{CO}_2 + \text{H}_2\text{O}$ |
| | | Total | 7 | |

| Question | | Expected Answers | Marks | Additional Guidance |
|----------|-----|----------------------------------------------------|----------|---------------------------------------------------------------------------------------------------------|
| 9 | (a) | continental (1) | 1 | |
| | (b) | tectonic plates are less dense than the mantle (1) | 1 | assume unqualified answer refers to tectonic plates allow less dense ignore lighter |
| | (c) | convection currents (in the mantle) (1) | 1 | |
| | (d) | subduction (1) | 1 | |
| | (e) | crust and outer part of the mantle (1) | 1 | both required for the mark allow crust and upper part of the mantle |
| | | Total | 5 | |

| Question | | Expected Answers | Marks | Additional Guidance |
|----------|-----|-------------------------------------------------------------|----------|---------------------------------------------------------------------------------------------------------------------|
| 10 | (a) | proton: positive / + / +ve / +1 (1) neutron: 1 / one (1) | 2 | not -1 |
| | (b) | (i) (number of) protons and neutrons (in an atom) (1) | 1 | not number of electrons and neutrons |
| | | (ii) 2.8.2 (1) | 1 | allow correct diagram  |
| | | (iii) same number of protons as electrons (1) | 1 | |
| | | Total | 5 | |

| Question | | Expected Answers | Marks | Additional Guidance |
|----------|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-----------------------------------------------------------------------------------------|
| 11 | (a) | hydrogen (1) | 1 | allow H / H ₂ not H2 / H ² |
| | (b) | sodium hydroxide (1) | 1 | allow NaOH |
| | (c) | lilac (1) | 1 | allow pink / purple / violet |
| | (d) | <p>reaction time less than 6 seconds (1)</p> <p>any two from the following for <u>one</u> mark</p> <ul style="list-style-type: none"> • explosive or indication of how it is more reactive than potassium; • skates across surface; • catches fire; • gas given off / hydrogen given off; • alkaline solution formed; • melts (1) | 2 | <p>mark independently</p> <p>allow any reaction time between 1 and 5 seconds</p> |
| | | Total | 5 | |

| Question | | Expected Answers | Marks | Additional Guidance |
|----------|-----|-------------------------------------------------------------------------------------------------------|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 12 | (a) | aluminium oxide \rightarrow aluminium + oxygen (1) | 1 | allow correct formulae or mix of correct formulae and words allow $\text{Al}_2\text{O}_3 \rightarrow \text{Al} + \text{O}_2$ allow = instead of arrow not and or & for + |
| | (b) | (graphite) anode / positive (electrode) (1) | 1 | |
| | (c) | $\text{Al}^{\beta+} + 3\text{e}^- \rightarrow \text{Al}$ correct formulae (1) balancing (1) | 2 | allow $\text{Al}^{\beta+} \rightarrow \text{Al} - 3\text{e}^-$ allow correct multiples including fractions allow = instead of arrow allow e for e^- not and or & for + balancing mark is dependent on correct formulae BUT allow 1 mark for balanced equation with a minor error in subscripts / formulae e.g. $\text{Al}\beta+ + 3\text{e}^- \rightarrow \text{Al}$ |
| | | Total | 4 | |

| Question | | Expected Answers | Marks | Additional Guidance |
|--------------|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 13 | (a) | conducts electricity when molten (1) | 1 | allow correct answer underlined, ticked or circled on list if answer line is blank |
| | (b) | electrons move / delocalised or free or sea of electrons (1) but delocalised electrons move / free electrons move / sea of electrons moves / cloud of electrons moves (2) | 2 | allow electrons free to move scores 1 but free electrons move scores 2 |
| | (c) | idea of electrons transferred between atoms (1) | 1 | not swap electrons allow idea that atoms gain or lose electrons allow electrons are passed on to another atom not metals receive electrons from non-metals |
| | (d) |  <p>one pair of electrons shared (1) rest correct (1)</p> | 2 | can be all dots or all crosses ignore inner electrons and nuclei |
| Total | | | 6 | |

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