



# **GCE MARKING SCHEME**

**CHEMISTRY  
AS/Advanced**

**JANUARY 2013**

**GCE CHEMISTRY - CH2**  
**JANUARY 2013 MARK SCHEME**

**SECTION A**

- Q.1 Calcium – Bones, teeth, muscle contraction.  
Magnesium – chlorophyll, activation of ATP. (Both for 1 mark) [1]
- Q.2 4,4-dimethylpentan-1-ol (1) [1]
- Q.3 (a) Ability of atom to attract electrons in a covalent bond towards itself. [1]  
(b)  $\delta^-$  F-Cl  $\delta^+$   $\delta^+$  At-Cl  $\delta^-$  Both needed for mark [1]
- Q.4  $\text{CH}_2$  ( Accept  $\text{H}_2\text{C}$ ) [1]
- Q.5 (a) C [1]  
(b) B [1]
- Q.6 Both  $\text{O}_2$  and  $\text{O}_3$  have oxidation states of zero (1) No change in oxidation state (1) [2]
- Q.7 Reversible change in properties when conditions change. [1]

**Total Section A [10]**

**SECTION B**

- Q.8 (a) (i)  $\text{Ba}^{2+} + \text{SO}_4^{2-} \rightarrow \text{BaSO}_4$  (state symbols not required) [1]
- (ii) white precipitate [1]
- (b) (i) apple-green / yellow-green (no credit for 'green') [1]
- (ii) Reagents – silver nitrate (1)  
Observation – white precipitate (1)  
Must have correct reagent to get observation [2]
- (c) Mass produced by cooling  $1 \text{ dm}^3 = 358 - 312 = 46 \text{ g}$  (1)  
Mass produced by  $200 \text{ cm}^3 = 46 \times 200 \div 1000 = 9.2 \text{ g}$  (1) [2]
- (d)  $M_r$  of anhydrous  $\text{BaCl}_2 = 208$  (1)  
Water content = 36 so  $x = 2$  (1) [2]
- (e) (i)  $\text{BaCO}_3 + 2\text{HCl} \rightarrow \text{BaCl}_2 + \text{H}_2\text{O} + \text{CO}_2$  [1]
- (ii) I. Moles =  $50 \times 0.50 \div 1000$  (1) = 0.025 moles (1) [2]
- II. Filtration [1]
- III. Moles  $\text{BaCl}_2 = \text{moles HCl} \div 2 = 0.0125 \text{ mol}$  (1)
- Mass hydrated  $\text{BaCl}_2 = 0.0125 \times 244 = 3.05 \text{ g}$  (1) [2]

**Total [15]**

- Q.9 (a) (i) ultraviolet / sunlight [1]
- (ii) A species with an unpaired electron. [1]
- (b)  $\text{CH}_4 + \text{Cl}\cdot \rightarrow \text{CH}_3\cdot + \text{HCl}$  (1)  
 $\text{CH}_3\cdot + \text{Cl}_2 \rightarrow \text{CH}_3\text{Cl} + \text{Cl}\cdot$  (1) [2]
- (c) (i) Two  $\text{CH}_3\cdot$  radicals combine (in a termination reaction). [1]
- (ii)  $24.3 \div 12 = 2.025$  for C     $4.1 \div 1.01 = 4.059$  H     $71.6 \div 35.5 = 2.017$  Cl (1)  
 $\text{CH}_2\text{Cl}$  (1) [2]
- (d) (i) Nucleophilic substitution [1]
- (ii) Methanol has hydrogen bonding between molecules (1)  
 Chloromethane has van der Waals forces / dipole-dipole forces between molecules (1)  
 Hydrogen bonding is stronger than Van der Waals/dipole-dipole (1) [3]
- (iii) Acidified potassium dichromate / acidified potassium manganate(VII) (1)  
 Heat /warm (1) (Need correct reagent to gain heat mark) [2]
- (e) Compounds **B** and **C** are stable enough to reach the ozone layer OR Compound **D** would not reach the ozone layer as it would decompose in the lower atmosphere. (1)
- (The C-Cl forms)  $\text{Cl}\cdot$  which will decompose the ozone. (1)
- Compound **A** does not contain chlorine, (so it cannot form  $\text{Cl}\cdot$ ) / Compound **A** has a lower RODP (1) [3]

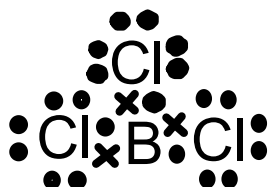
**Total [16]**

- Q.10 (a)
- $\text{BCl}_3$  is trigonal planar or clear diagram.
  - $\text{NCl}_3$  is pyramidal or clear diagram.
  - $\text{BCl}_3$  has 3 bonded pairs
  - $\text{NCl}_3$  has 3 bonded pairs
  - $\text{NCl}_3$  has a lone pair
  - $\text{BCl}_3$  has no lone pair
  - Electron pairs repel to be as far from each other as possible / position of minimum repulsion.
  - Lone pairs repel more than bonded pairs.

First two points and any other 4 for (1) each up to 6 max [6]

- *QWC: selection of a form and style of writing appropriate to purpose and to complexity of subject matter.[1]*
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- *QWC: legibility of text, accuracy of spelling, punctuation and grammar, clarity of meaning.[1]* [2]

(b)



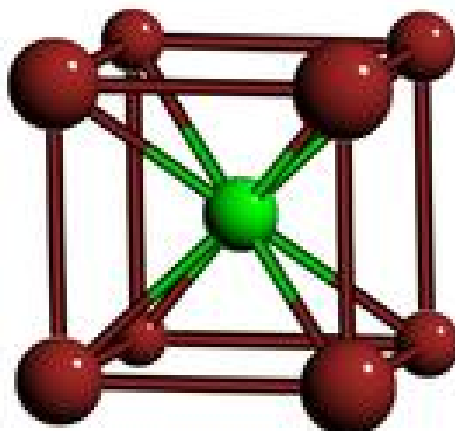
accept crosses and dots exchanged (1)

Electron deficient: outer shell of boron has less than 8 electrons / is not full.(1) [2]

- (c)  $\text{NH}_3$  can form hydrogen bonds with water molecules (so it dissolves) (1) [2]  
 $\text{NCl}_3$  cannot form hydrogen bonding. (1)
- (d)
- Covalent has a pair of shared electrons one from each atom (1)
  - Coordinate has a pair of shared electrons both electrons from same atom (1) [2]

**Total [14]**

Q.11 (a) (i)



Clear 8 coordination number (1)  
Labels of both  $\text{Cl}^-$  and  $\text{Cs}^+$  (either way round) (1) [2]

(ii)  $\text{Cs}^+$  ion larger than  $\text{Na}^+$  so can have a larger coordination number. [1]

- (b) (i) Any three from the following for (1) each up to 3 max – can gain these from labelled diagram [3]
- Layers of carbon atoms.
  - Hexagons of carbon atoms / each carbon bonded to three others.
  - Weak forces between layers.
  - Delocalised electrons above and below plane.

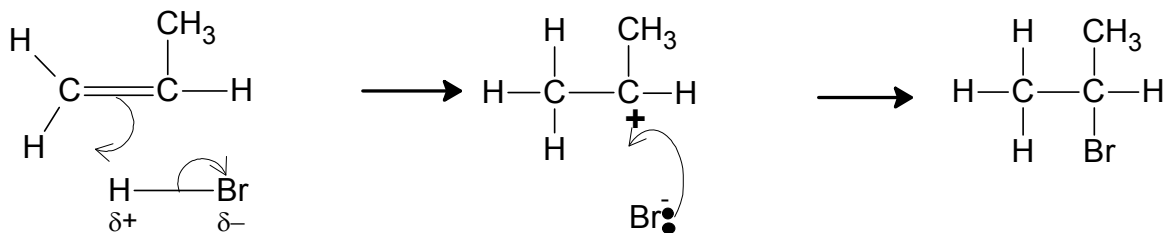
*QWC: organisation of information clearly and coherently; use of specialist vocabulary where appropriate.* [1]

(ii) Delocalised electrons in graphite can move to carry a current (1)  
Diamond has no delocalised electrons (1) [2]

(iii) Van der Waals forces between molecules need to be broken to form iodine gas (1)  
Covalent bonds need to be broken to form a gas from diamond/graphite (1)  
Van der Waals forces are much weaker than covalent bonds (1) [3]

**Total [12]**

- Q.12 (a) (i) Molecules with different numbers of carbon atoms have different boiling points. [1]
- (ii) Any suitable reaction, e.g.  $C_{10}H_{22} \rightarrow C_4H_{10} + C_6H_{14}$  [1]
- (b) (i) Turns from orange to colourless (no credit for 'red') [1]
- (ii) (1) for arrows in first diagram; (1) for arrow in second diagram; (1) for all charges.



[3]

- (iii) Ethanol OR Alcohol solution / Heat - both required [1]
- (c) (i) Restricted rotation about double bond in but-2-ene but not butane (1)
- 2 groups attached to each carbon of the double bond are different in but-2-ene but in propene one carbon has the same two groups attached (1) [2]
- (ii)



Accept any valid representation [1]

- (d) (i) Steam, phosphoric acid catalyst, (1) 300°C, 70 atm pressure (1) [2]
- (ii) Butan-2-ol will have IR absorptions at 2500-3550  $cm^{-1}$  / 1000 – 1300  $cm^{-1}$  and butene will not  
OR  
But-2-ene will have an IR absorption at 1620-1720 and butan-2-ol will not [1]

**Total [13]**

**Total Section B [70]**