



# **GCE MARKING SCHEME**

**CHEMISTRY  
AS/Advanced**

**SUMMER 2010**

**CH1**  
**SECTION A**

- |           |      |                               |     |
|-----------|------|-------------------------------|-----|
| <b>1.</b> | (i)  | C                             | [1] |
|           | (ii) | 0.120 g                       | [1] |
| <b>2.</b> | (i)  | C <sub>2</sub> N <sub>2</sub> | [1] |
|           | (ii) | CN                            | [1] |
| <b>3.</b> | (i)  | 79 and 81                     | [1] |
|           | (ii) | 142                           | [1] |
| <b>4.</b> | D    |                               | [1] |
| <b>5.</b> | (i)  | 100                           | [1] |
|           | (ii) | 142.5 / 143 kg                | [1] |
| <b>6.</b> | B    |                               | [1] |

**Total [10]**

## SECTION B

7. (a) (i) A lower pressure gives a reduced equilibrium yield / less ammonia (accept – the reaction rate is slower) [1]
- (ii) The position of equilibrium will shift to the right (1) as more nitrogen and hydrogen react to restore the position of equilibrium. (1) [2]
- (iii) Unchanged [1]
- (b) (i) ammonia 17.03 (g) ammonium sulfate 132.2 (g) [1]
- (ii) molar ratio 2 : 1 (1)
- $2 \times 17.03$  tonnes ammonia give 132.2 tonnes of ammonium sulfate (1)
- 66.1 (tonnes) (1) [3]
- (c) The pH scale is a measure of acidity/alkalinity (1)
- values below 7 are acidic / above 7 are alkaline / pH 7 is neutral / pH 6 is a weak acid (1) [2]
- (d) Number of moles of ammonium nitrate =  $\frac{4 \times 10^8}{80} = 5 \times 10^6 / 5\,000\,000$  (1)
- Energy produced =  $296 \times 5 \times 10^6 = 1.48 \times 10^9$  (kJ) (1) [2]
- (e) (i) It is exothermic because the heat evolved maintains the temperature of the platinum wire, keeping it red-hot (and maintaining the reaction) [1]
- (ii) A reaction where the catalyst is in a different (physical) state to the reactants / products [1]

**Total [14]**

8. (a) (i) orange-yellow (accept sodium/590 nm)  
 frequency  $\propto \frac{1}{\text{wavelength}}$   
 shorter wavelength/shorter wavelength, higher frequency) [1]

(ii) energy =  $h \times \text{frequency}$  (accept energy  $\propto$  frequency)  
 $E = hf$  [1]

(b) (i) Lines represent the energy emitted (1) when an excited electron drops back (1) from one energy level to another (1) [3]

(ii) This represents the energy needed to remove the electron from the hydrogen atom / ionise the atom [1]

(iii) In each series the excited electron drops back to a different energy level [1]

(c) (i)

	<i>Change</i>
<i>Atomic number</i>	No change/0
<i>Mass number</i>	Increases by one/+1

[1]

(ii)  $^{24}\text{Mg}$  [1]

(d)

↑↓	↑↓	↑↓ ↑↓ ↑↓	↑↓			
1s	2s	2p	3s	3p		

[1]

(e) (i)

profile (1)  
activation energy (1)

[2]

**Total [12]**

9. (a) (i) I N (1) the yield is 75%, as for L, but only water is formed (1) [2]

II e.g. use renewable energy resources  
keep energy use to a minimum/low temperature/low pressure  
use the most effective catalyst  
use non-toxic materials wherever possible  
the co-products should be non-toxic / or capable of being converted to non-toxic materials  
use renewable feedstocks/sustainable feedstocks  
re-use / recycle waste product  
'high atom economy'

any two (1) (1) [2]

(ii)  $0.0 + \Delta H = -400 + (-858)$  (1)  
 $\Delta H = -1258 \text{ kJ mol}^{-1}$  (1) [2]

(b) Bonds broken = 3748 kJ (1) Bonds made = 4824 kJ (1)

$$\Delta H = \Sigma \text{ bonds broken} - \Sigma \text{ bonds made} \quad (1)$$
$$= 3748 - 4824 = -1076 \text{ kJ mol}^{-1} \quad (1) \quad [4]$$

(c) (i) When more carbon dioxide dissolves in sea water the position of equilibrium for the first equation is moved to the right producing more  $\text{H}^+$  (and more  $\text{HCO}_3^-$ ) ions (1) making the water more acidic / pH decreases (1) [2]

(ii) The concentration of carbonate ions /  $\text{CO}_3^{2-}$  will decrease [1]

(d) Solubility is  $1.45 \text{ g dm}^{-3}$  (1)  
Concentration of carbon dioxide =  $\frac{1.45}{M_r} = \frac{1.45}{44} = 0.033 \text{ (mol dm}^{-3}\text{)}$  (1) [2]

**Total [15]**

10. (i)  $\frac{0.20}{12.5} = 0.016$  (1) mol dm<sup>-3</sup> min<sup>-1</sup> (1) [2]

- (ii) As the reaction proceeds the rate becomes less / reaction slows down (1)  
As the concentration of the reactant becomes smaller (1)  
At the beginning of the reaction there is more chance of a successful collision  
(hence rate is faster) (1)  
The collision rate becomes slower as the reactant is used up (1)

Text is legible; spelling is accurate and its meaning is clear,  
and punctuation and grammar are correct. QWC (1)

The candidate has selected a form and style of writing that is appropriate to  
purpose and complexity of the subject matter. QWC (1)

[6]

- (iii) I Accept values between 0.30 and 0.65 (mol dm<sup>-3</sup>) [1]

II The final concentration would be the same (1) as a catalyst does not affect  
the overall yield (1) [2]

- (iv) 1 mole of the solvent gives 1 mole of the acid  
∴ Number of moles of the solvent A is also 0.650 (1)

$$M_r = \frac{\text{mass}}{\text{number of moles}} = \frac{48.1}{0.650} = 74 \quad (1) \quad [2]$$

**Total [13]**

11. (a) (i) To make sure that the potassium carbonate/soluble substances had dissolved [1]
- (ii) Filtrate added to a 250 cm<sup>3</sup> volumetric flask (1)  
 Use of a funnel (1)  
 Mention of washing out original vessel etc. (1)  
 Made up to the mark (with distilled water) (1)  
 Shaken/inverted (1)  
 Any 4 points [4]
- (iii) I 24.65 (cm<sup>3</sup>) [1]
- II Any 5 from  
 25.00 cm<sup>3</sup> of the potassium carbonate solution **pipetted** into a conical flask (1)  
 (A few drops of) indicator added (1)  
 Titrate (with the acid) until the indicator just (1) turns pink (1)  
 Shake/swirl/mix (1)  
 Reads burette before and after (1)  
 Wash sides with distilled/deionised water (1)
- Organisation of information clearly and coherently; using specialist vocabulary where appropriate QWC (1) [6]
- (b) (i) M<sub>r</sub> of potassium carbonate 138.2 (1)
- % potassium =  $\frac{78.2 \times 100}{138.2}$  (1) = 56.6 (1) [2]
- (ii) The relative (molecular) mass of the hydrate is higher (than the anhydrous salt) but a 'molecule' still only contains two potassium 'atoms' [1]
- (c) e.g. wood needs to be burnt, forming carbon dioxide (a greenhouse gas)/ deforestation [1]

**Total [16]**