WJEC
CBAC

GCE MARKING SCHEME

CHEMISTRY
AS/Advanced

SUMMER 2010

CH1

SECTION A

1.	(i)	C	[1]
	(ii)	0.120 g	[1]
2.	(i)	C_2N_2	[1]
	(ii)	CN	[1]
3.	(i)	79 and 81	[1]
	(ii)	142	[1]
4.	D		[1]
5.	(i)	100	[1]
	(ii)	142.5 / 143 kg	[1]
6.	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)

2×17.03 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 $= \dfrac{4 \times 10^8}{80} = 5 \times 10^6$ / 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 mm)

frequency $\propto \frac{1}{\text{wavelength}}$

shorter wavelength/shorter wavelength, higher frequency) [1]

(ii) energy = h × frequency (accept energy ∝ 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)

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

[1]

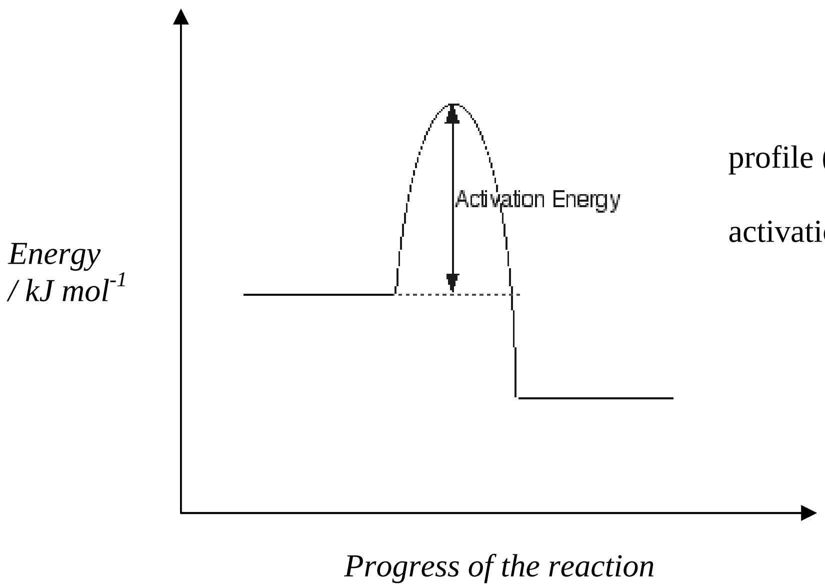
(ii) ^{24}Mg [1]

(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)

$\Delta H = \Sigma$ bonds broken $-$ Σ bonds made (1)

$= 3748 - 4824 = -1076 \text{ kJ mol}^{-1}$ (1) [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 H^+ (and more HCO_3^-) ions (1) making the water more acidic / pH decreases (1) [2]

(ii) The concentration of carbonate ions / CO_3^{2-} will decrease [1]

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

Total [15]

10. (i) $\frac{0.20}{12.5}$ = 0.016 (1) mol dm^{-3} min^{-1} (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^{-3}) [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)

$M_r = \frac{\text{mass}}{\text{number of moles}} = \frac{48.1}{0.650} = 74$ (1) [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^3 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^3) [1]

II Any 5 from
25.00 cm^3 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_r 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]