GCE MARKING SCHEME

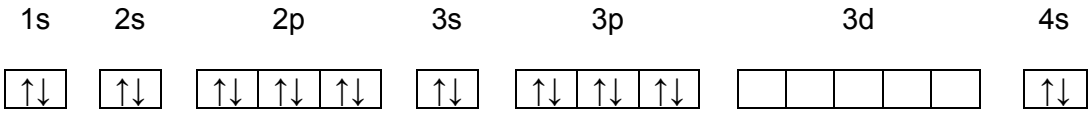
CHEMISTRY
AS/Advanced

JANUARY 2011

CH1

Section A

1.



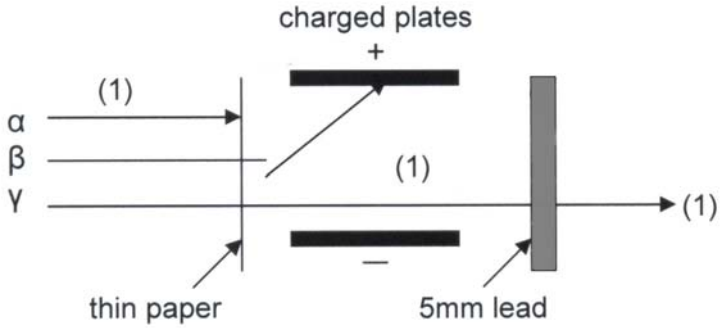
[1]

2. (a) M_r = 172.24 [1]

(b) % = 20.9 [1]

3. D [1]

4.



[3]

5. (a)

C	H	O	
40	6.7	53.3	
12	1.01	16	
3.33	6.63	3.33	(1)
1	2	1	

Empirical Formula = CH_2O (1) [2]

(b) $\frac{180}{30.02} = 6$

Molecular Formula = $C_6H_{12}O_6$ [1]

Total [10]

Section B

6. (a) (i) Average mass of one atom of the element (1) relative to 1/12th mass of one atom of carbon-12. (1) [2]

(ii) $A_r = \frac{(39 \times 93.26) + (40 \times 0.012) + (41 \times 6.73)}{100}$ (1)

$= 39.14$ (1) [2]

(b) (i) (Gaseous potassium) atoms bombarded by electrons. [1]

(ii) Deflected through a magnetic field. [1]

(c) (i) $^{40}_{19}K \longrightarrow {}^{40}_{20}Ca + {}^{0}_{-1}\beta$ (accept ${}^{0}_{-1}e$)

(1 mark for $^{40}_{20}Ca$, 1 mark for balanced equation) [2]

(ii) 3.75×10^9 years. [1]

(d) (i) Energy required to remove one mole of electrons from 1 mole of atoms / an electron from each atom in 1 mole (1) in the gaseous state. (1) [2]
(Accept equation)

(ii) I In K greater shielding of outer electron (1) outweighs larger nuclear charge (1) / Na has greater effective nuclear charge (1) / Na outer electron closer to nucleus (1).
(Maximum 2 marks) [2]

II Shielding effect on outer electron is less (1) / 2nd electron is removed from inner shell / closer to nucleus (1) / after 1st electron is removed effective nuclear charge is greater. (1) [2]

(Maximum 2 marks)

Total [15]

7. (a) Bubbles (of gas) / fizzing / $CaCO_3$ disappears / apparatus gets warmer [1]

(b) Gas syringe / burette / graduated tube/measuring cylinder [1]

(c) (Use scales to) weigh aqueous product / sampling and titration / change in pH at set times [1]

(d) (i) Moles HCl = 0.020 [1]

(ii) Moles $CaCO_3$ = 0.01 (1)
Mass = 1.00 g (1) [2]

(iii) Moles CO_2 = 0.010 (1)
Volume = 0.240 dm^3 (1) [2]

(e) (i) Smooth curve passing through 150 cm^3 ending at 200 cm^3 [1]

(ii) Curve less steep (1) ending at 100 cm^3 (1) [2]

(iii) When the acid is less concentrated it has fewer (acid) particles (1) therefore there is less chance of (successful) collisions (between the acid and carbonate) / fewer collisions per unit time. (1) [2]

(f) Diagram with two reasonable curves. (1 mark) Activation energy labelled (1) The fraction of molecules that have the required activation energy is much greater at a higher temperature. (1) [3]

QWC Selection of a form and style of writing appropriate to purpose and to complexity of subject matter. [1]

Total [17]

8. (a) (i) Between 1800 and 1900 the global temperature was fairly constant as was the concentration of CO_2 in the atmosphere. (1)
Since 1900 the global temperature has risen steadily as has the concentration of CO_2 in the atmosphere. (1)

As concentration of CO_2 increases, global temperature increases. (1 mark only). [2]

QWC Legibility of text; accuracy of spelling, punctuation and grammar, clarity of meaning [1]

(ii) There is an uncertainty in the results / temperature dropped between 1900 and 1910 / between 1940 and 1950 / at some points. [1]

(iii) Before 1900 the instruments were less accurate (1) and there were fewer records (1)
Temperatures are estimates. (1)
Any 2 from 3 [2]

(iv) More burning of fossil fuels / more industries / more transportation / deforestation. (Any two) [2]

(b) (i) Rate of forward reaction = rate of back reaction. [1]

(ii) (Molecules can escape from the bottle) so concentration amount of $CO_2(g)$ falls / pressure falls (1) and position of equilibrium moves to the left (so concentration of $CO_2(aq)$ falls) / rate of molecules entering solution is less than rate leaving solution. (1) [2]

QWC The information is organised clearly and coherently, using specialist vocabulary where appropriate [1]

Total [12]

9. (a) (i) Furthest line on left hand side. [1]

(ii) The (electron) energy levels of a hydrogen atom become closer. [1]

(b) (i) If a system at equilibrium is subject to a change the equilibrium tends to shift so as to minimize the effect of the change. [1]

(ii) I Yield increases. (1)
Forward reaction is endothermic. (1) [2]

II Yield decreases. (1)
More (gaseous) molecules on the right hand side. (1) [2]

(iii) Atom economy = $\frac{\text{mass hydrogen}}{\text{mass reactants}}$ x 100 (1)

= 17.8% (1) [2]

(c) Bonds broken = 3296 kJ Bonds formed = 3132 kJ (1)

ΔH = 3296 – 3132 = 164 kJ mol^{-1} (1) [2]

Total [11]

10. (a) To ensure that the (initial) temperature is constant / temperature difference is required between initial and maximum temperature. [1]

(b) (i) Best fit lines (1)
Temperature rise = 9.6°C (1) [2]
(Accept ±0.2°C)

(ii) Extrapolation gives the temperature that would have been reached if the reaction occurred instantly / to allow for heat loss during the experiment [1]

(c) Heat = 50 x 4.18 x 9.6
= 2006 J [1]

(d) (i) Moles Mg = 0.037 [1]

(ii) Moles $CuSO_4$ = 0.025 [1]

(e) $\Delta H = \frac{2006}{0.025}$ (1)

$= -80.2 \text{ kJ mol}^{-1}$ (1) [2]

(f) Burette / pipette [1]

(g) Magnesium was in excess. [1]

(h) Rate of reaction is quicker. Allow greater surface area if qualified. [1]

(i) $\frac{12.9}{93.1} \times 100 = 13.9\%$ [1]

(j) Energy/Heat is lost to the environment. (1)
States how insulation could be improved e.g. place a lid on the polystyrene cup (1) [2]

Total [15]

Section B Total [70]