GCE MARKING SCHEME

CHEMISTRY
AS/Advanced

SUMMER 2015

INTRODUCTION

The marking schemes which follow were those used by WJEC for the Summer 2015 examination in GCE CHEMISTRY. They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conferences was to ensure that the marking schemes were interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conferences, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.

CH1

SECTION A

1. Ne 10p, 10n, 10e (1)

   O^{2-} 8p, 10n, 10e (1) [2]

2. (a) ^{222}Rn [1]

   (b) Time taken for half of the atoms in a radioisotope to decay (or similar) **[1]**

   (c) Mass = 0.25 g (1)

   Moles = 1.11×10^{-3} (1) do not accept 1×10^{-3} [2]

3. (a) The mass of one mole of compound [1]

   (b) $\Delta H_f = -417$ kJ mol^{-1} [1]

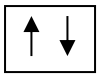
4. (a) Measure the volume of CO_2 produced / mass of CO_2 lost at constant time intervals [1]

   (b) No effect since concentration of acid has not changed [1]

Total Section A [10]

SECTION B

5. (a) **2p**  [2]

2s  (1 mark for labelling, 1 mark for arrows)

(b) (i)

N	O
25.9	74.1
14	16
1.85	4.63 (1)
1	2.5

N_2O_5 (1) [2]

(ii) $2NH_3 + 2O_2 \longrightarrow N_2O + 3H_2O$ [1]

(iii) Moles $Ca(NO_3)_2 = 5.40 \times 10^{-3}$ (1)

Moles gas = 1.35×10^{-2} (1)

Volume gas = 0.324 dm^3 (1) [3]

(c) Moles $Ca(NO_3)_2 = 0.0256$ (1)

Moles $H_2O = 0.102$ (1)

x = 4 (1) [3]

Total [11]

6. (a) (i) Energy required to remove one mole of electrons from one mole of atoms / to form one mole of positive ions from one mole of atoms (1) in the gaseous state (to form 1 mol of gaseous ions) (1)
(Accept correct equation) [2]

(ii) Cross between Na and Mg crosses [1]

(iii) P only has unpaired electrons, S has a pair of electrons in 3p orbital (1)
Repulsion between the paired electrons makes it easier to remove one of the electrons (1) [2]

(b) (i) Effective nuclear charge is greater / electron being removed from a positive ion [1]

(ii) Accept from 6000 to 9000 [1]

(c) Lines are formed from electron being excited and jumping up to a higher energy level (1)
Falling back down to the n = 2 level (1)
Emitting energy / photon of light (1)
Lines become closer since the electron energy levels of a hydrogen atom become closer (1) [4]

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

Total [12]

7. (a) (i) Sample is bombarded by high energy electrons / electron gun used on sample (1)
Electron knocked out (to form ions) (1) [2]

(ii) So no more than / only 1 electron is knocked out [1]

(iii) No difference (1)
Same number of electrons (in the outer shell) (1) [2]

(b) (i) $\frac{(7.25 \times 6) + (92.75 \times 7)}{100}$ (1)

6.928 (1) (accept 6.93) [2]

(ii) $^{6}Li^{+}$ since lower mass / lower m/z / lighter
do not accept 'smaller' [1]

(c) (i) $M_r(NH_4)_2SO_4 = 132.18$ (1)

Moles = 0.0156 (1) [2]

(ii) Moles LiOH = 0.0312 (1)

Concentration $= \frac{0.0312}{0.0298} = 1.05$ mol dm^{-3} (1) [2]

(iii) Atom economy $= \frac{34.06}{180.08} \times 100$ (1)

$= 18.9\,\%$ (1) [2]

Total [14]

8. (a) Benefits:
Stops fossil fuels from running out
Reduces CO_2 emissions / greenhouse emissions / global warming / effect of global warming
Reduces SO_2 emissions / acid rain
There will be an investment in new technology

Difficulties:
Dependence on fossil fuel/Unlikely to meet current demand
Renewable energy currently more expensive
Reliability of supply from renewables
Major development in energy efficiency technologies required
Opposition by vested interests
(Maximum 3 marks from list, but need examples of both) (3)

Consideration and discussion of benefits/difficulties (1) [4]

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

(b) (i) I As temperature increases yield decreases
As pressure increases yield decreases [1]

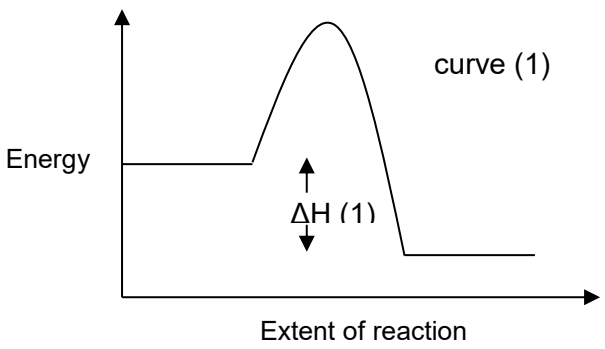
II As temperature is increased, equilibrium moves to the left (1)
Therefore forward reaction is exothermic (1)
As pressure is increased, equilibrium moves to the left (1)
Therefore more gas moles in products (1) [4]
QWC The information is organised clearly and coherently, using specialist vocabulary where appropriate [1]

(ii) If temperature is too low, then reaction is too slow (1)
If temperature is too high, yield is too low (1)
Compromise temperature – acceptable rate and yield (1)
(Accept any two points) [2]

(iii) Heterogenous catalyst [1]

(iv) Lower temperatures could be used (1)
Less energy consumption / increased yield (1)
Equilibrium could be reached more quickly (1)
(Accept any two points) [2]

(v)



[2]

(vi) $\Delta H = E_f - E_b$ [1]

Total [19]

9. (a) Otherwise a temperature change would occur on adding the acid which had nothing to do with the reaction [1]

(b) (i) Best fit lines (1)

Temperature rise = 6.4 °C (1)
(Take value from candidate's best fit lines) [2]

(ii) Volume of acid = 26.0 cm^3 [1]

[If no best fit lines award 0 in (i) and accept 25 cm^3 in (ii)]

(c) Moles acid = 0.02425 (1)

Conc acid = $\frac{0.02425}{0.026}$ = 0.933 mol dm^{-3} (1) [2]

(d) Heat = 51 × 4.18 x 6.4

= 1364 J [1]

(e) $\Delta H = -\frac{1364}{0.02425}$ (1)

= – 56.2 kJ mol^{-1} (1) [2]

(f) Pipette / burette [1]

(g) No further reaction occurs (1)

The excess acid cools the solution (1) [2]

(h) Heat / energy is lost to the environment (1)

Insulation is improved e.g. lid on the polystyrene cup (1) [2]

Total [14]

Section B Total [70]