



GCE MARKING SCHEME

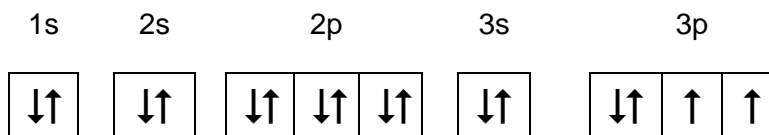
CHEMISTRY
AS/Advanced

JANUARY 2012

GCE Chemistry – CH1

SECTION A

Q.1



[1]

Q.2 B / 13

[1]

Q.3 Acid: Proton donor (1)

Dynamic equilibrium: Reversible reaction where the **rate** of forward and reverse reactions is equal (1)

[2]

Q.4 (a)

	1	2	3	4
<i>Volume used / cm³</i>	20.75	20.20	20.10	20.30

[1]

(b) 20.20 cm³

[1]

Q.5 A

[1]

Q.6 (a) Ratio of C:H is 1:1.33 (1)
Emp. Formula = C₃H₄ (1)

[2]

(b) Molecular formula = C₉H₁₂

[1]

SECTION A TOTAL [10]

SECTION B

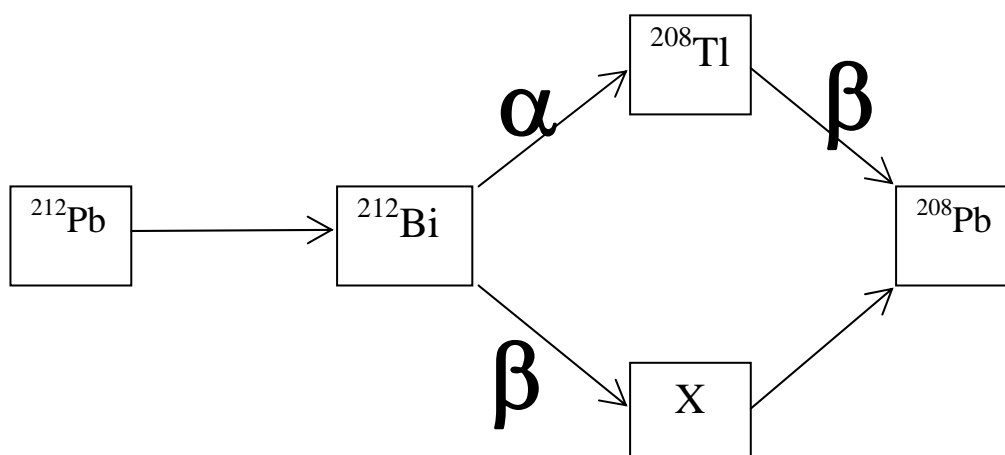
- Q.7** (a) (i) Temperature: 298K / 25°C (1) Pressure: 1 atm / 101.325 kPa or 100 kPa (1) [2]
- (ii) Hydrogen gas is an element in its standard state [1]
- (iii) $\Delta H = \Delta H_f (\text{C}_5\text{H}_{12}) + 5 \Delta H_f (\text{H}_2\text{O}) - 5 \Delta H_f (\text{CO}) - 11 \Delta H_f (\text{H}_2)$ (1)
- $\Delta H_f (\text{C}_5\text{H}_{12}) = -1049 - 5 (-286) + 5 (-111)$ (1)
- $\Delta H_f (\text{C}_5\text{H}_{12}) = -174 \text{ kJ mol}^{-1}$ (1) [3]
- (b) (i) Catalyst in different state to reactants [1]
- (ii) Catalysts provide an alternative route (1) with a lower activation energy (1) [2]
- (iii) Lower temperature or less time so less energy needed / Can make alternative production method possible with sustainable starting materials or less waste products [1]
- (iv) At higher temperatures particles have more energy (1)
- More collisions have energy above activation energy (1)
- (Can obtain these two marks from correctly labelled Boltzmann energy distribution plot with two temperature lines (1) and Activation energy (1))*
- Successful collisions occur more frequently (1) – 3 max [3]
- QWC: selection of a form and style of writing appropriate to purpose and to complexity of subject matter* [1]
- (c) (i) No effect (1)
- Same number of (gas) molecules on both sides of reaction (1) [2]
- (ii) Lower yield of hydrogen (1)
- Reaction shifts in endothermic direction to (try to counteract increase in temperature) (1) [2]
- (iii) No effect [1]

Total [19]

- Q.8** (a) Be: $800 - 1000 \text{ kJ mol}^{-1}$ (1)
Ne: $1700 - 2300 \text{ cm}^{-1}$ (1) [2]
- (b) $\text{Be (g)} \rightarrow \text{Be}^+ \text{ (g)} + \text{e}$ [1]
- (c) (i) Greater nuclear charge on He (1)
No increase in shielding / Outer electrons same distance from nucleus / Outer electrons in same shell (1) [2]
- (ii) Outer electron in O is paired in orbital / Outer electron for N is unpaired (1)
Repulsion between paired electrons makes it easier to remove outer electron of oxygen (1) [2]
- (d) (i) Electrons excited to a higher energy level (1)
Energy levels are quantised (1)
Electrons drop from higher to lower energy levels (1)
Energy is emitted as light (1) – 3 max [3]
Lines represent the energy emitted (1) when an excited electron drops back (1) from one energy level to another (1)
QWC: legibility of text, accuracy of spelling, punctuation and grammar, clarity of meaning [1]
- (ii) Find frequency of convergence limit (1) for Lyman series (1)
Ionisation energy is given by $E=hf$ / Energy \propto frequency (1) [3]

Total [14]

- Q.9** (a) $M_r(\text{PbS}) = 239.1$ $M_r(\text{PbO}) = 223$ (1)
- Moles of PbS = $20,000 \div 239.1 = 83.65$ moles (1)
- Mass of PbO = $83.65 \times 223 \div 1000 = 18.7$ kg (1) [3]
- (b) (i) Sulfur dioxide: Acid rain (1)
- Carbon dioxide: Climate change / global warming / acidification of oceans (1) [2]
- (ii) I. Sum of M_r of reactants = $223 + 28 = 251$ (1)
- Atom economy = $(207 \div 251) \times 100 = 82.5\%$ (1) [2]
- (ii) II. Method 1 as higher atom economy means less waste / more useful product [1]
- (c) (i) Symbol = Po (1) Mass number = 212 (1) [2]
- (ii) All three arrows labelled correctly, as shows below, gives two marks
- Any two arrows labelled correctly gives one mark [2]



- (iii) γ -radiation is high energy / frequency electromagnetic waves (1)
- It affects neither atomic number nor mass number / it changes neither the number of protons nor neutrons (1) [2]
- (iv) 31.8 hours = 3 half lives (1)
- Mass remaining after 3 half lives = 3mg (1) [2]
- (d) $A_r = [(206.0 \times 25.48) + (207.0 \times 22.12) + (208.0 \times 52.40)] \div 100$ (1)
- $A_r = 207.3$ (1)
- 1 mark for correct significant figures (answer must be reasonable) [3]

Total [19]

- Q.10** (a) (i) $M_r(\text{CuSO}_4 \cdot 5\text{H}_2\text{O}) = 249.7$ [1]
- (ii) I. Moles of copper(II) sulfate
 $= 0.250 \times 250/1000 = 6.25 \times 10^{-2}$ moles (1)
 Mass $= 6.25 \times 10^{-2} \times 249.7 = 15.6$ g (1) [2]
- II. 1 mark each for:
- Weighing method
 - Dissolve copper sulfate in a smaller volume of distilled water
 - Transfer to 250.0 cm^3 volumetric / standard flask
 - Use of funnel
 - Wash funnel / glass rod / beaker with distilled water into volumetric flask
 - Add distilled water up to mark
 - Shake solution / mix thoroughly 5 max [5]
- QWC: organisation of information clearly and coherently; use of specialist vocabulary where appropriate* [1]
- (b) (i) Powder has a greater surface area (1) so gives a higher rate of reaction (1) [2]
- (ii) Extrapolate lines from start (level at 21.3°C) and end (through points at 180-270 seconds) (1)
 Temperature rise $= 6.0^\circ\text{C}$ (Range 5.8 - 6.2°C) (1) [2]
- (iii) I. Moles $= 0.250 \times 0.05 = 1.25 \times 10^{-2}$ moles [1]
- II. Zinc is the limiting reagent / Copper(II) sulfate is in excess [1]
- III. $\Delta H = -(50) \times 4.18 \times 6.0 \div (6.12 \times 10^{-3})$ (1)
 $\Delta H = -204902 \text{ J mol}^{-1}$
 $\Delta H = -205 \text{ kJ mol}^{-1}$ (1) [2]
- IV. Enthalpy measures chemical energy, and as heat energy increases, chemical energy must decrease [1]
- Total [18]**

SECTION B TOTAL [70]