GCE MARKING SCHEME

CHEMISTRY
AS/Advanced

SUMMER 2013

GCE CHEMISTRY - CH1

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SECTION A

Q.1 number of protons 6

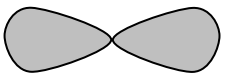
number of neutrons 8

number of electrons 6 (all correct 2 marks, 2 correct 1 mark) **[2]**

Q.2 electron (1)

β-particle (1) (max 1 if three circled, 0 if four or more) **[2]**

Q.3 Provides an alternative pathway (1)
with lower activation energy / more particles have energy above E_A (1) **[2]**

Q.4  **[1]**

Q.5 nitrogen / phosphorus (or any other Group 5 element) **[1]**

Q.6 (a) (dissociates to) release H^+ ions **[1]**

(b) 2.5-6.0 **[1]**

Total [10]

SECTION B

Q.7 (a) percentage Be by mass = 5.03% (1)

division of percentage by A_r for Be and at least one other element as shown below (1)

Al 10.04 ÷ 27 = 0.3719 → 1.00

Be 5.03 ÷ 9.01 = 0.5583 → 1.50

O 53.58 ÷ 16 = 3.3488 → 9.00

Si 31.35 ÷ 28.1 = 1.1566 → 3.10

molecular formula = $Al_2Be_3O_{18}Si_6$ or x=3 (1) **[3]**

(b) (i) Hess' Law states that where a reaction can occur by more than one route the total enthalpy **change** for each route will be the same **[1]**

(ii) $\Delta H = -393.5 - (-395.4)$ (1) $= +1.9$ kJ mol^{-1} (1) **[2]**

(iii) Kyran is **incorrect** as diamond is not the **standard state** of carbon **[1]**

(iv) I mass of diamond = 7.30 g **[1]**

II mass of graphite = 7.30 ÷ (93/100) (1) = 7.85 g (1) **[2]**

Total [10]

Q.8 (a) (i) all ionisation energies showing gradual increase and one large jump (1)

large jump after 8 electrons (1) **[2]**

(ii) eighth and ninth electrons come from different shells (1)

ninth electron is closer to nucleus / has less or no shielding / has greater effective nuclear charge (1) **[2]**

(b) the compound formation has the noble gas atom being ionised (1)

ionisation energy of argon is much higher than that of xenon (1)

because the outer electron in argon is closer to the nucleus / has greater effective nuclear charge / shielding (1) - 2 max **[2]**

(c) electrons move from lower energy levels to higher energy levels (1)

by absorbing **specific frequencies** of light (1) **[2]**

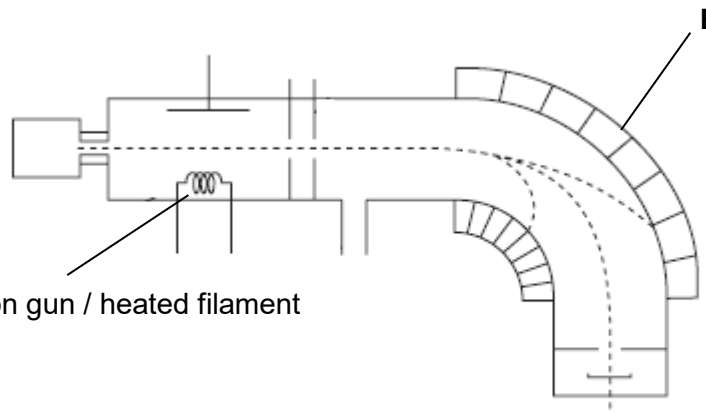
(d) 1 mol of XeO_3 released 2.5 mol gas products (1)

2.5 mol of gas occupies 24.0 x 2.5 = 60.0 dm^3 (1) – follow through error (ft)

if candidates calculate the volumes of the two gases separately, then (1) for one gas volume correct and (1) for total volume correct **[2]**

Total [10]

Q.9 (a) (i) both needed



[1]

(ii) electron gun bombards sample and **ionises** atoms/molecules (1)

negatively charged plates / electric field **accelerates** (positive ions in) sample (1)

electromagnet **deflects** ions according to mass and charge / m/z (1)

current in electromagnet / electromagnetic field is varied so different mass ions hit detector (1)

[4]

QWC: selection of a form and style of writing appropriate to purpose and to complexity of subject matter (1)

QWC: legibility of text, accuracy of spelling, punctuation and grammar, clarity of meaning (1)

QWC **[2]**

(b) A_r = (78 x 12.2) + (79 x 26.4) + (80 x 61.4) ÷ 100 (1) [for method] = 79.5 (1)

(1) for 3 sig figs for sensible answer (above 79.0 and below 80.0) (1) **[3]**

(c) (i) a 81

X Br /bromine both needed **[1]**

(ii) 75 minutes = 4 half-lives (1)

2.72g → 1.36g → 0.68g → 0.34g → 0.17g (1) – no ft **[2]**

Total [13]

Q.10 (a) $x = 10$ **[1]**

(b) (i) number of moles = 250 x 0.200 ÷ 1000 = 0.05 mol (1) – ft

mass of sodium carbonate = 0.05 x $M_r(Na_2CO_3)$ = 0.05 x 286.2
= 14.31g (1) **[2]**

(ii) any two points from:

weigh by difference (1)

add less water initially (1)

wash out beaker / glass rod / funnel and put water into volumetric flask (1)

add water up to mark in volumetric flask (1)
- 2 max **[2]**

(c) add few drops of indicator (1) do not accept 'universal indicator'

take initial and final reading on burette (1)

swirl the conical flask (1)

add acid until the indicator changes colour (1) **[4]**

QWC: organisation of information clearly and coherently; use of specialist vocabulary where appropriate. *QWC* **[1]**

Total [10]

Q.11 (a) (i) $\Delta H = 9 \times (-394) + 10 \times (-286) - (-275)$ (1)

$= -6131$ kJ mol^{-1} (1) for correct value and (1) for correct sign **[3]**

(ii) temperature 298K, 25°C (1) pressure 1 atm, 101 kPa (1) **[2]**

(b) (i) $M_r = (9 \times 12) + (20 \times 1.01) = 128.2$ (1)

number of moles $= 1.56 \times 10^{-3}$ mol (1) **[2]**

(ii) $\Delta H = -50 \times 4.18 \times 42 \div 1.56 \times 10^{-3}$ (1)

$= -5626698$ J mol^{-1} $= -5627$ kJ mol^{-1} (1) **[2]**

(iii) heat loss to environment / incomplete combustion / not standard conditions **[1]**

Total [10]

Q.12 (a) killing marine life / killing trees **[1]**

(b) (i) either gas syringe or inverted burette attached to sealed vessel **[1]**

(ii) different surface area would affect rate of reaction **[1]**

(iii) concentration / volume / nature of acid (1)

temperature (1) **[2]**

(c) (i) increasing pressure will shift the reaction to side with fewer gas molecules (1)

increasing yield of SO_3 (1) – reason must be given **[2]**

(ii) I increasing temperature shifts equilibrium in endothermic direction (1)

as SO_3 yield is decreased forward reaction must be exothermic (1) **[2]**

II increasing temperature increases energy of particles (1)

more collisions have energy above activation energy (1)

successful collisions occur more frequently (1)

can gain first two points from labelled Boltzmann distribution curve **[3]**

III e.g. iron in production of ammonia or any valid example **[1]**

(d) (i) atom economy = 100% **[1]**

(ii) any two points from:

lower pressure used in B (1)

methanol is a renewable starting material (1)

higher atom economy in B or less waste in B (1)

[ignore reference to cost]
2 max **[2]**

(iii) no effect on position of equilibrium **[1]**

Total [17]