OCR

Subject: Chemistry Foundation

Code: 2811

Session: January

Year: 2003

Final Mark Scheme

25/1/2003

| MAXIMUM MARK | **60** |

1. **(a)**

	isotope	number of		
		protons	neutrons	electrons
✓	^{69}Ga	31	38	31
✓	^{71}Ga	31	40	31

[2]

(b)

acceleration/
accelerator ✓
ignore *'atoms' beyond 1st stage*

ionisation/
electron bombardment/
ioniser ✓
not *electron gun*

deflection/
deflector ✓
ignore *'what deflects'*

to the pump

detection/
detector ✓
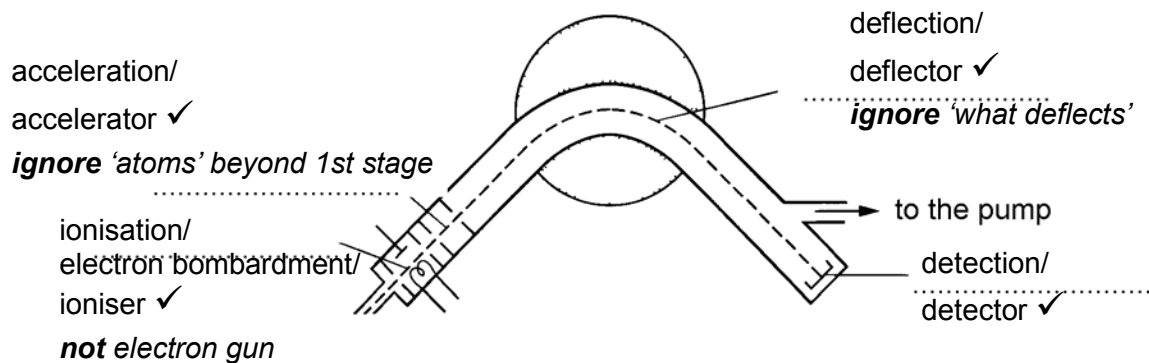
[4]

(c) **(i)** average mass/weighted mean/average mass of an **atom / the isotopes** ✓

compared with carbon-12 ✓

1/12th of mass of carbon-12/on a scale where carbon-12 is 12 ✓

not *12 g*

or... mass of 1 mole of atoms ✓
compared with carbon-12 ✓

1/12th of mass of 1 mol of carbon-12/on a scale where carbon-12 is 12 **g** ✓   [3]

(ii) ^{69}Ga: 61%; ^{71}Ga: 39% ✓ (*allow 62/38 $\longrightarrow$ 69.76 below*)

[1]

(iii) A_r = 69 x 61/100 + 71 x 39/100 = 69.78 ✓ = 69.8 ✓

ignore g / grammes   [2]

[Total: 12 marks]

2 (**a**) $1s^2 2s^2 2p^6 3s^2$ ✓

[1]

(**b**) (**i**) Mg: 0 ✓

[1]

(**ii**) MgO: +2 / 2 / II ✓

[1]

(**c**) (**i**) $3Mg(s) + N_2(g) \longrightarrow Mg_3N_2(s)$ ✓✓
    1 for correct formulae and balancing; 1 for correct state symbols

[2]

(**ii**) N_2 is less reactive than O_2 /

bond between N atoms is stronger than bond between O atoms /

nitrogen has a triple bond **and** oxygen has a double bond

activation energy of N > activation energy of O ✓

The emphasis here should be a comparison for the mark

[1]

(**d**) MgO has a giant structure ✓

MgO is ionic / charged magnesium **and** oxide ions shown ✓

strong forces ✓

[3]

(**e**) (**i**) MgO dissolves/disappears ✓

[1]

(**ii**) m(MgO) = 24.3 + 16 = 40.3 (g mol^{-1}) ✓ *(accept 40)*

mass MgO = 0.0500 x 40.3 = 2.015 **g** / 2.02 **g** / 2.01 **g** / 2 **g** ✓

g is needed here

[2]

(**iii**) moles HNO_3 = 2 x 0.0500 = 0.100 mol ✓

right or wrong for 1st mark

volume HNO_3 = 0.25 dm^3 / 250 cm^3 ✓

*i.e. moles HNO$_3$/0.400 **dm^3** / 1000 x moles HNO$_3$/0.400 **cm^3***

0.05/0.400 $\longrightarrow$ 0.125 dm^3 / 125 cm^3 would score 1 mark as molar ratio not used

[2]

(**f**) (**i**) ions move / free ions ✓

[1]

(**ii**) Mg^{2+} /NO_3^- / H^+/OH^- ✓✓ 2 max

[2]

[Total: 17 marks]

3. (a) (i) purification/sterilisation/kills *or* removes germs/disinfects ✓

   not 'to make bleach'   **not** 'cleans the water'

[1]

(ii) turns red / yellow / orange ✓

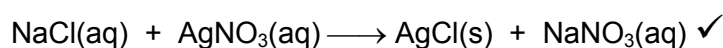   then colourless / bleaches ✓

   colourless then 'nothing' scores 1 mark

   *colourless then 'red' does **not** score because overall bleaching is not implied.*

[2]

(b) *reagent*   silver nitrate/Ag^+ ions ✓

   observation   white (precipitate) / goes white ✓   ⎫
                                                               ⎬ mark independently
   equation $Ag^+(aq) + Cl^-(aq) \longrightarrow AgCl(s)$ /

   $NaCl(aq) + AgNO_3(aq) \longrightarrow AgCl(s) + NaNO_3(aq)$ ✓

   (state symbols not required)

   Fluorine for reagent + 'correct' displacement equation scores 1 mark)

[3]

(c) (i) $Cl : C = 85.6/35.5 : 14.4/12$ ✓ $= 2.4 : 1.2$

   $= 2 : 1$ ✓

   Cl_2C has mass of 83. $166 = 2 \times 83$

   molecular formula = Cl_4C_2 ✓

   $Cl : C = 85.6/17 : 14.4/12 \longrightarrow Cl_4C$ scores 1 mark /

   $Cl : C = 85.6/17 : 14.4/6 \longrightarrow Cl_2C$ scores 1 mark

   $Cl : C = 85.6/35.5 : 14.4/6 \longrightarrow ClC$ scores 1 mark

[3]

(ii) perc is covalent / perc is **not** ionic / C–Cl bond in perc is covalent

   / no Cl^- ions / perc is molecular ✓

[1]

(d) $m(NaClO_3) = 106.5$ g mol^{-1} ✓

   moles $NaClO_3 = 4.26/106.5 = 0.04$ mol ✓

   moles $O_2 = 0.06$ mol ✓

   volume $O_2 = 0.06 \times 24 = 1.44$ (dm^3) ✓

   If no molar ratio has been used, ans $\longrightarrow 0.96$ dm^3 : worth 3 marks
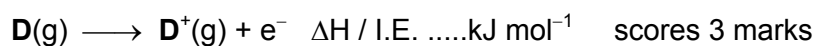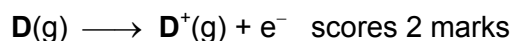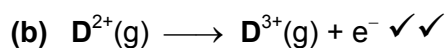
[4]

[Total:14 marks]

4. (a) Energy change when **each atom in 1 mole** ✓

of **gaseous atoms** ✓

loses an electron ✓ (to form 1 mole of gaseous 1+ ions).

1 mole of gaseous atoms loses 1 mole of electrons would score all 3 marks

D(g) $\longrightarrow$ D^+(g) + e^- scores 2 marks

D(g) $\longrightarrow$ D^+(g) + e^- ΔH / I.E. .....kJ mol^{-1} scores 3 marks

[3]

(b) D^{2+}(g) $\longrightarrow$ D^{3+}(g) + e^- ✓✓

(1st mark for equation; 2nd mark for state symbols

*'$^-$' **not** required in e^- ; ignore wrong '**D**' except if H or He used; **X** is acceptable*

[2]

(c) Group 4 ✓

Sharp rise in successive ionisation energy between 4th and 5th IE ✓

marking a change to a new shell/energy level / there are 4 electrons in the outer shell ✓

mention of '*orbital*' *or* '*sub-shell cancels the* '*shell mark*'

Each marking point in (c) is independent

[3]

[Total: 8 marks]

5. **Group 2**

atomic radii increases down group ✓

down group, electrons added to a new shell / more shells ✓

down group, **more** shielding ✓ : *'more' is essential*

increased nuclear charge outweighed / despite increased nuclear charge ✓

Period 3

atomic radii decrease across period ✓

number of protons/nuclear charge increases ✓

across period, electrons added to same shell / same or similar shielding ✓

nuclear attraction increases / shell drawn in by increased nuclear charge ✓

*watch for distinction between nuclear **attraction** and nuclear **charge** in candidates' scripts.*

[8]

Quality of Written Communication

At least **two** complete sentences that are legible and where the spelling, punctuation and grammar allow the meaning to be clear. ✓

[1]

[Total: 9 marks]