

OCR



RECOGNISING ACHIEVEMENT

FOUNDATION CHEMISTRY
Mark Scheme 2811
January 2003

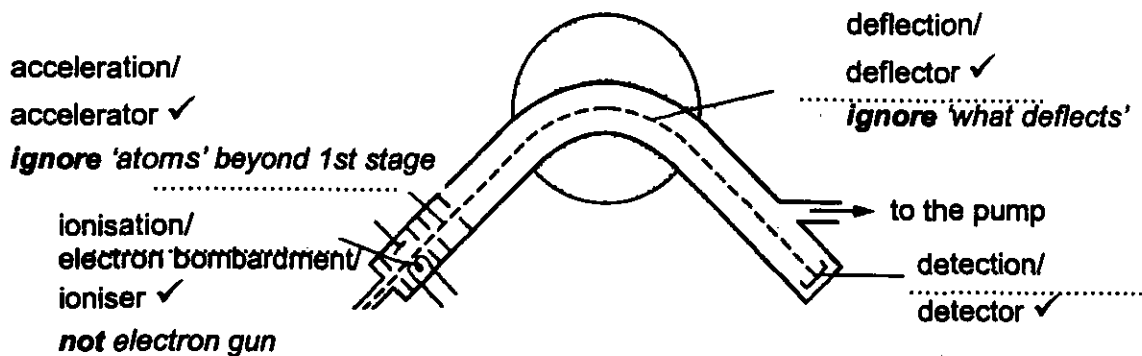
1. (a)

isotope	number of		
	protons	neutrons	electrons
⁶⁹ Ga	31	38	31
⁷¹ Ga	31	40	31

✓
✓

[2]

(b)



[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) ⁶⁹Ga: 61%; ⁷¹Ga: 39% ✓ (allow 62/38 → 69.76 below)

[1]

(iii) $A_r = 69 \times 61/100 + 71 \times 39/100 = 69.78 \checkmark = 69.8 \checkmark$

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) $3\text{Mg(s)} + \text{N}_2\text{(g)} \longrightarrow \text{Mg}_3\text{N}_2\text{(s)}$ ✓✓
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) $m(\text{MgO}) = 24.3 + 16 = 40.3 \text{ (g mol}^{-1}\text{)}$ ✓ (accept 40)
mass MgO = $0.0500 \times 40.3 = 2.015 \text{ g} / 2.02 \text{ g} / 2.01 \text{ g} / 2 \text{ g}$ ✓
g is needed here [2]
- (iii) moles $\text{HNO}_3 = 2 \times 0.0500 = 0.100 \text{ mol}$ ✓
right or wrong for 1st mark
volume $\text{HNO}_3 = 0.25 \text{ dm}^3 / 250 \text{ cm}^3$ ✓
i.e. moles $\text{HNO}_3 / 0.400 \text{ dm}^3 / 1000 \times \text{moles $\text{HNO}_3 / 0.400 \text{ cm}^3$$
0.05/0.400 \longrightarrow 0.125 dm³ / 125 cm³ would score 1 mark as molar ratio not used [2]
- (f) (i) ions move / free ions ✓ [1]
- (ii) $\text{Mg}^{2+} / \text{NO}_3^- / \text{H}^+ / \text{OH}^-$ ✓✓ 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 ✓

equation $\text{Ag}^+(\text{aq}) + \text{Cl}^-(\text{aq}) \longrightarrow \text{AgCl}(\text{s})$ /

$\text{NaCl}(\text{aq}) + \text{AgNO}_3(\text{aq}) \longrightarrow \text{AgCl}(\text{s}) + \text{NaNO}_3(\text{aq})$ ✓

(state symbols not required)

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

mark independently

[3]

- (c) (i) $\text{Cl} : \text{C} = 85.6/35.5 : 14.4/12 \checkmark = 2.4 : 1.2$
 $= 2 : 1 \checkmark$

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

molecular formula = $\text{Cl}_4\text{C}_2 \checkmark$

$\text{Cl} : \text{C} = 85.6/17 : 14.4/12 \longrightarrow \text{Cl}_4\text{C}$ scores 1 mark /

$\text{Cl} : \text{C} = 85.6/17 : 14.4/6 \longrightarrow \text{Cl}_2\text{C}$ scores 1 mark

$\text{Cl} : \text{C} = 85.6/35.5 : 14.4/6 \longrightarrow \text{ClC}$ 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) $m(\text{NaClO}_3) = 106.5 \text{ g mol}^{-1} \checkmark$

moles $\text{NaClO}_3 = 4.26/106.5 = 0.04 \text{ mol} \checkmark$

moles $\text{O}_2 = 0.06 \text{ mol} \checkmark$

volume $\text{O}_2 = 0.06 \times 24 = 1.44 \text{ (dm}^3\text{)} \checkmark$

If no molar ratio has been used, ans $\longrightarrow 0.96 \text{ dm}^3$: 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

$D(g) \longrightarrow D^+(g) + e^- \Delta H / \text{I.E.} \dots \text{kJ mol}^{-1}$ 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]