edexcel

GCE

Edexcel GCE

Chemistry (8080, 9080)

6241/01

Summer 2005

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Mark Scheme (Results)

Edexcel GCE
Chemistry (8080, 9080)

1 (a) $Mg + ½ O_2 \rightarrow MgO$
IGNORE state symbols
ALLOW multiples **(1 mark)**

(b) Correct number of electrons on both ions (must include inner shell) **(1)**
Drawn or "2,8"

Correct charges on each ion **(1)**
Free standing marks

ACCEPT all dots/ crosses or combination **(2 marks)**
Max 1 if elements not identified

(c) (Electrostatic) **attraction** between **positive ions** and electrons **(1)**
Symbol with correct charge can be specified
NOT nuclei/ protons for positive ions
NOT held together for attraction

Electrons delocalised / sea of electrons free moving **(1)**

are mobile / can move / flow (under a potential difference) **(1)**
NOT "free" *on its own*
NOT carry the charge **(3 marks)**

Total (6 marks)

2 (a) Gas / g green/pale green/yellow **(1)**
Liquid / l brown/red-brown / orange / red-orange *NOT* red alone **(1)**
Solid / s (dark) grey *ALLOW* black *NOT* purple **(1)**
IGNORE shiny / silver
Any combination of allowed colours **(3 marks)**

(b) (i) $KCl + H_2SO_4 \rightarrow KHSO_4 + HCl$
OR
$2KCl + H_2SO_4 \rightarrow K_2SO_4 + 2HCl$
ALLOW multiples
IGNORE state symbols **(1 mark)**

(ii) Oxidation numbers: -1 (+) 6 / (+) VI
0 (+) 4 / (+) IV
Charge can be either side of number
(1) *mark for any two correct oxidation numbers* **(2)**

Oxidising Agent: (concentrated) H_2SO_4 **(1)**
NOT dilute

Oxidation no. of **bromine** / bromide / Br changes from -1 to 0 / rises
OR
Oxidation number of **sulphur**/ S changes from +6 to +4 / falls **(1)**

ALLOW T.E. for incorrect oxidation numbers in the correct direction only **(4 marks)**
IGNORE electrons if in correct direction
4th mark not awarded if incorrect oxidising agent given EXCEPT sulphur

Total 8 marks

3 (a) (i) $(1s^2)2s^2 2p^6 3s^2 3p^6 4s^2$
OR
$(1s^2)2s^2 2p^6 3s^2 3p^6 3d^0 4s^2$
OR
$(1s^2)2s^2 2p^6 3s^2 3p^6 4s^2 3d^0$
ALLOW subscript numbers in place of superscripts

$2p^6 \equiv 2p_x^2 2p_y^2 2p_z^2$ *numbers must be superscript*
$3p^6 \equiv 3p_x^2 3p_y^2 3p_z^2$ *numbers must be superscript*

(1 mark)

IGNORE caps

(b) (i) Energy/ enthalpy / heat energy change / required per **mole** **(1)**
NOT evolved
for the **removal of 1 electron** **(1)**

from **gaseous atoms** *NOT* molecules **(1)**

OR
$X(g) \rightarrow X^+(g) + e^-$ *states required for 2nd and 3rd marks* **(2)**
Can be actual symbol of an element
ACCEPT - $e^{(-)}$ **(3 marks)**

(ii) (Even though) there is a **greater** nuclear charge / number of protons
OR nuclear charge increases down the group **(1)**

outer / **valency** electron(s) further from nucleus *NOT* "shell" *on its own* **(1)**

and **more** shielded *OR* **more** (filled) inner shells/electrons **(1)** **(3 marks)**

(c) (i) Similarity: number of protons (proton number) **(1)**
IGNORE electrons
NOT atomic number

Difference: number of neutrons
[correct numbers can be given] **(2 marks)**
NOT atomic mass or number of nucleons **(1)**

(ii) $\frac{(24 \times 78.6) + (25 \times 10.1) + (26 \times 11.3)}{100} = 24.3$

Method **(1)**
Answer must be to 3 SF **(1)**
Correct answer to 3 SF with some working **(2)**
IGNORE g or g mol^{-1} *other wrong units lose a mark* **(2 marks)**

Total 11 marks

4 (a) (i) $Na \rightarrow Na^+ + e^{(-)}$ *OR* $Na - e^{(-)} \rightarrow Na^+$ **(1)**

$\frac{1}{2} Cl_2 + e^{(-)} \rightarrow Cl^-$ **(1)**

IGNORE state symbols
ALLOW multiples
NOT Cl + $e^{(-)} \rightarrow Cl^-$
NOT $Cl \rightarrow Cl^- - e^{(-)}$
NOT $\frac{1}{2} Cl_2 \rightarrow Cl^- - e^{(-)}$ **(2 marks)**

(ii) $Na + \frac{1}{2} Cl_2 \rightarrow NaCl$ / Na^+Cl^- *NOT* $Na^+ + Cl^-$
Stand alone but not consequential on incorrect half equations
ALLOW multiples
IGNORE state symbols **(1 mark)**

(b) (i) (bonding is) ionic / electrovalent
NOT electrostatic **(1 mark)**

(ii) Diagram shows alternating cation and anion **(1)**
in a correct 3-D pattern **(1)**

Key to diagram not necessary but must be recognisable differences
If Na / Cl in diagram OK, but if <u>state</u> "atoms" **max 1** **(2 marks)**

(c) (i) **pair** of electrons **shared** (by two atoms)
OR
overlap of **partially filled** atomic orbitals **(1 mark)**
NOT diagram on its own

(ii) Melting BCl_3 requires breaking van der Waals' / dispersion / London / dipole-dipole / induced dipole – induced dipole / intermolecular forces / interactions **(1)**

NOT Permanent dipole

Melting NaCl requires **breaking/overcoming** ionic bonds / (electrostatic) attractions between ions **(1)**
NOT just breaking the ionic lattice

BCl_3 forces weaker than NaCl forces **(1)**

so less **energy** required to break BCl_3 forces / intermolecular forces are weaker than ionic bonds. OR Correct argument based on high melting point of NaCl **(1)** **(4 marks)**

If in comparison :
Hydrogen bonding **max 2**
NaCl covalent **max 2**
max 2 ≡ *negate 1st correct answer, score next two*

BCl_3 covalent **max 1**
max 1 ≡ *negate two correct answers, score third*

Total 11 marks

5 (a) (i) $K(s)+H_2O(l) \rightarrow KOH\ (aq) + ½\ H_2\ (g)$ / $K^+(aq) + OH^-(aq) + ½\ H_2(g)$

Balanced equation **(1)**
State symbols on **correct** formulae only **(1)**
ALLOW multiples **(2 marks)**

(ii) bubbles / effervescence / fizzing /hissing
floats/moves (on surface)
Melts /forms a sphere
Gets smaller / disappears /dissolves
Catches fire / lilac flame / explodes
} Any two

IGNORE forms a solution
IGNORE reference to noise
NOT "see a gas" **(2 marks)**

(b) (i) % of oxygen = 45.1% **(1)**
54.9/39 = 1.41 and 45.1/16 = 2.82 **(1)**
1.41/1.41 = 1 and 2.82/1.41 = 2 (hence KO_2) / 1.41 : 2.82 ≡ 1 : 2 **(1)**

MUST have some working **(3 marks)**
Correct inductive reasoning **(3)**

(ii) -0.5 / - ½ / -.5 **(1 mark)**

(c) KNO_3 because K^+ / potassium ion has larger radius / is larger - *ion essential* **(1)**

but same charge - *stated or K^+ and Li^+ given* **(1)**
[lower charge density scores 1 out of the first two marks]
"Charge density" *on its own* **(1)** *UNLESS term is explained* **(2)**

polarises/distorts nitrate/negative ion/anion less **(1)**
OR weakens bonds in nitrate less
NOT weakens ionic bond
If $LiNO_3$ more stable (**0**) **(3 marks)**

Total 11 marks

6 (a) (i) moles silicon = 10/28 = 0.357 **(1)**

moles $SiCl_4$ = 0.357 **(1)**

mass = 0.357 x 170 = 60.7 / 60.69 (g) *ALLOW 2- 4 SF* **(1)**

OR by mass ratio

Units not required but if given must be correct.

Correct answer with some recognisable working **(3)**

Correct answer with no working **(1)** **(3 marks)**

(ii) moles chlorine = 2 x 0.357 moles Si x2 **(1)** **(1)**

$\therefore$ vol = 0.714 x 24.0 = 17.1 (dm^3) moles Cl_2 x 24 **(1)** **(1)**

ALLOW TE from (i)

ALLOW 2 – 4 SF

Units not required, but if given must be correct

Correct answer with some recognisable working (2)

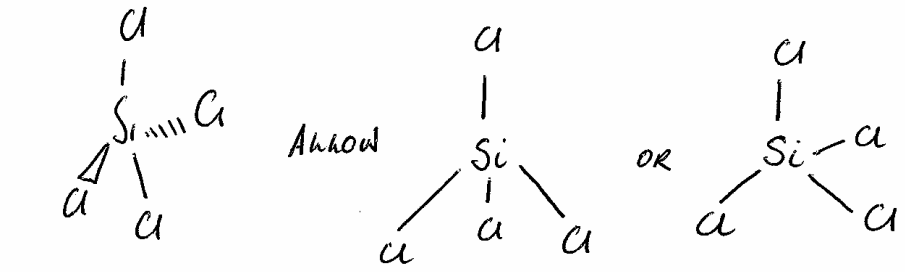
Correct answer with no working **(1)**

Penalise SF once only across (i) and (ii)

Penalise units once across (i) and (ii) **(2 marks)**

ratio	10/28	10/28 = 0.357	10/28 = 0.36	10/28 = 0.4 *loses SF mark*
mass	60.69	60.71	61.2	68
vol	17.14	17.14	17.3	19.2

(b)



(1)

Wedges not required e.g.
Atoms can be represented by circles etc provided there are 4 of one type and 1 of another

tetrahedral **(1)**

Any angle in range 109 – 109.5 ° **(1)**
degree symbol can be shown on diagram

4 (bond) pairs of electrons / 4 bonding pairs **(1)**
NOT bonds
NOT atom
NOT groups of electrons

Repel to position of **minimum** repulsion / **potential energy** *NOT* "Equal repulsion" **(1)**
OR Repel to position of **maximum** separation

4th mark cannot be awarded if atoms referred to **(5 marks)**

(c) (i) Si and Cl have different electronegativities / Cl attracts the **bonding electrons** very / more strongly / Si less electronegative than Cl / Cl **very** electronegative **(1 mark)**

(ii) symmetrical molecule / chlorines equally spaced **(1)**

bond polarities / dipoles / vectors cancel
OR
Centres of positive and negative charge coincide / vectors cancel. **(1)** **(2 marks)**

Total 13 marks

TOTAL FOR PAPER: 60 MARKS