edexcel

Edexcel GCE

Chemistry (Nuffield)

6251/01

June 2006

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Results Mark Scheme

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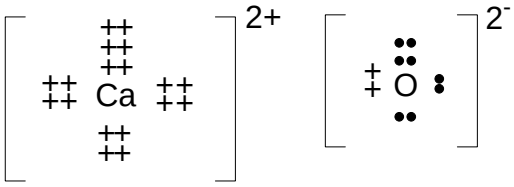
1 (a) $Ca + ½ O_2 \rightarrow CaO$

IGNORE state symbols

ALLOW multiples **(1 mark)**

(b)



(1) **(1)**

ALLOW all dots or all crosses for oxide ion

Max 1 if no/wrong charges

1 mark for two correct charges

Covalent bonding (0) **(2 marks)**

(c) (i) Calcium hydroxide

NOT limewater **(1 mark)**

(ii) 10 – 14 **(1 mark)**

2 (a) $L = \frac{79.0}{1.31 \times 10^{-22}}$ **(1)**

$= 6.03 \times 10^{23}$ **(1)**

-1 mark for SF error

Final answer must be 6.03 x 10^{23} *for 2nd mark*

Correct answer with no working **(2)**

6 x 10^{23} / *6.02* x 10^{23} quoted with no working **(0)**

Error in method, max (1) **(2 marks)**

(b) 80 is the average mass of Br atoms / isotopes

OR

There must be another/at least one Br isotope of mass **greater than** 80/with **more than** 45 neutrons

NOT naturally occurring isotope has mass 80 **(1 mark)**

3 (a) A set of properties/pattern/trend which is repeated/ recurs **(1)**
For the 1st mark there must be an idea of repetition

each period/after an interval **(1)**
ALLOW "after every eight/eighteen elements"

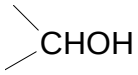
"*Repeating trends each period*" **(2)** **2 marks)**

(b) High values on left/ for metals **and** low values on right/ for non-metals
ALLOW decrease across period/increase from Group 1 to 3, then decrease
ALLOW "*high values on the left of the staircase, low on right*"
NOT just "*increases then deceases*" **(1 mark)**

(c) Melting point/ boiling point/(first) ionisation energy/ atomic volume/ ΔH_{fusion}/$\Delta H_{vaporisation}$
ALLOW density/ electronegativity/ ionic radius/ atomic radius/ thermal conductivity
NOT state/ type of bonding/ number of electrons/ mass **(1 mark)**

Total for Section A: 12 Marks

4 (a) Propan-2-ol
NOT prop-2-ol/ 2-propanol **(1 mark)**

(b) Contains  *or fully displayed*

OR carbon carrying OH/ hydroxyl/ "hydroxide" group attached to two other carbons/ two other methyl groups/ one other hydrogen
ALLOW contains CHOH/CH (OH)
NOT references to hydroxide ion/ OH^- in explanation **(1 mark)**

(c) $C_3H_8O + \frac{9}{2}O_2 \rightarrow 3CO_2 + 4H_2O$

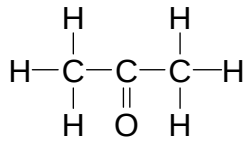
OR
$2C_3H_8O + 9O_2 \rightarrow 6CO_2 + 8H_2O$

products **(1)**
balancing of equation based on correct products **(1)**
ALLOW 4.5, 4½ for $\frac{9}{2}$
IGNORE state symbols
No penalty if structural formulae used **(2 marks)**

(d) Bubbles/ effervescence/ fizzing **(1)**
Gets hotter/ heat produced/ temperature rises **(1)**
NOT exothermic
Sodium dissolves/ disappears/ gets smaller **(1)**
White solid produced **(1)**
Hissing sound **(1)**
} *Any two*

NOT white precipitate **(2 marks)**
NOT floats/moves around and goes on fire

(e) (i) Orange to green/blue **(1 mark)**

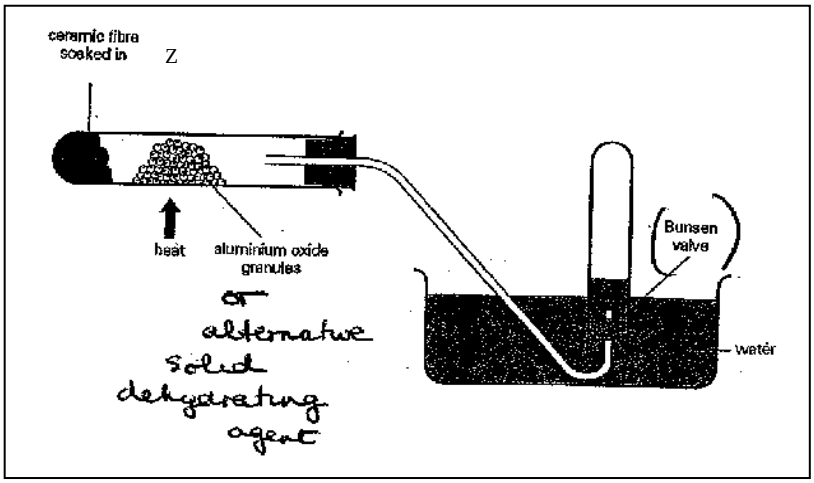
(ii)  **(1)**
MUST be fully displayed

Propanone/ propan(e)-2-one **(1)**
ALLOW acetone
No TE from incorrect formula **(2 marks)**

(iii) Blue / light blue
NOT mention of any other modified colour of blue
i.e. *NOT* blue-green **(1 mark)**

(f) (i) Aluminium oxide/ phosphorus(V) oxide/ (porous) pot/ pumice/ porcelain/ alumina/ phosphoric acid/ phosphorus pentoxide
ACCEPT formulae Al_2O_3/ P_2O_5/ P_4O_{10}/ H_3PO_4 **(1 mark)**
If formula is included, must be correct

(ii)



Tube + contents **(1)**
ALLOW glass wool/ mineral wool/ Rocksil wool
NOT wire wool/ cotton wool

Heat under some solid **(1)**

Gas collected by displacement of water – *water does not need to be labelled*
OR collect in syringe **(1)**
IGNORE open tube following Bunsen valve, providing gas can be collected

-1 for each error
e.g. single line tube; gap between bung and tube; delivery tube through side of trough, delivery tube not under collecting tube **(3 marks)**

Total for question: 14 Marks

5 (a) ($250\ cm^3$) volumetric/graduated/standard flask
NOT any mention of "conical" flask **(1 mark)**

(b) Methyl orange **(1)**
yellow to orange **(1)**
ALLOW yellow to red *OR* yellow to orange-red

OR
Screened methyl orange **(1)**
green to grey *ALLOW* green to purple **(1)**

OR
other suitable indicator in Data Book p 123, alkaline colour first

ALLOW Phenolphthalein **(1)** pink to colourless **(1)**
ALLOW bromophenol blue **(1)** blue to grey/yellow **(1)**
ALLOW recognisable spellings

NOT litmus/U.I. **(2 marks)**

(c) $\left(\frac{7.15 \times 10}{250}\right) = 0.286 \ / \ 2.86 \times 10^{-1}$ (g)

ALLOW 0.29(g)
NOT 0.28, 0.3, error in 3rd decimal place **(1 mark)**

(d) $\frac{(20.0 \times 0.100)}{(1000)} = 2 \times 10^{-3}$ *OR* 0.002 *OR* 0.0020 (mol)
(1 mark)

(e) 286 (g)
ALLOW TE from (c) and (d) **(1 mark)**

(f) 286
Same answer as in (e) for TE
NOT 286 if inconsistent with (e) unless calculation shown **(1 mark)**

(g) $106 + 18x = 286$ **(1)**
$x = 10$ **(1)**

OR
$106 + 18x = 196$ **(1)**
$x = 5$ **(1)**

ALLOW TE from (e)/(f)
ACCEPT decimals **(2 marks)**

Total for question:9 marks

6 (a) Difficult to decide when reaction complete/ reaction may be incomplete **(1)**

OR All $CaCO_3$ may not decompose **(1)**

OR Difficult to measure temperature changes in solids **(1)**

OR ΔT or $\Delta H_{reaction}$ cannot be determined because heat is supplied **(1)**

OR Necessary temperature cannot be reached **(1)**

OR No suitable thermometers (for measuring temperature change at high temperatures) **(1)**

ALLOW "heat is required so temperature change will not be accurate"
NOT "*Heat is supplied so temperature cannot be measured/ will not be accurate*" **(1 mark)**

(b) (i) Reaction occurs quickly / incomplete reaction (in reasonable time) with lumps **(1)**

Heat losses occur if reaction is **slow (1)** **(2 marks)**

(ii) 4.2 x 20 x 2.5 = 210 (J) *OR* 0.210 kJ
IGNORE +/- signs
Incorrect units **(0)** **(1 mark)**

(iii) Number of moles of $CaCO_3$ = 0.02 **(1)**

$\frac{210}{0.02}$ = 10 500 **(1)**

ΔH_1 = -10500 J mol^{-1} *OR* -10.5 kJ mol^{-1} **(1)**

ALLOW TE from (ii)
-1 for incorrect/missing sign/units
Third mark depends on correct method for 2nd mark **(3 marks)**

(iv) $\Delta H_r = \Delta H_1 - \Delta H_2$ **(1)** = -10.5 –(-181) *ie use of Hess*

= (+) 170.5/ (+) 171 (kJ mol^{-1}) **(1)**

ALLOW T.E. from (iii)
Watch for adding J to kJ **(2 marks)**

(c) (Standard) enthalpy (change) of formation (of calcium carbonate)
ACCEPT $\Delta H_{formation}$/$\Delta H^{e}_{formation}$ */formation*
NOT ΔH_f / ΔH^{e}_{f} **(1 mark)**

Total for question: 10 marks

7 (a) Oxidised as electrons lost/ forms positive ion/ oxidation number has increased.
If oxidation numbers are quoted, must be correct ie 0 to +1 **(1 mark)**

(b) (i) **Na** yellow
ALLOW orange/yellow-orange/orange-yellow **(1)**
NOT shades of red

Mg no colour / does not change flame colour **(1)**
NOT references to white light in combination with a flame colour **(2 marks)**
NOT ultraviolet

(ii) Electrons are excited/ raised to a higher energy level/ shell with different energy **(1)**

Then return/ fall back emitting light/ a colour / a certain wavelength/ frequency **(1)** **(2 marks)**

(iii) Streetlights
OR (colour for) fireworks
OR measuring Na^+ concentration/testing for sodium
OR lamp with standard wavelength
Any one
NOT distress flares
NOT light bulbs **(1 mark)**

(c) $1s^2 2s^2 2p^6$ **(1 mark)**

(d) (i) $Mg(g) \rightarrow Mg^+(g) + e^{(-)}((g))$
OR
$Mg(g) - e^{(-)}((g)) \rightarrow Mg^+(g)$

Equation **(1)**
state symbols **(1)**

2nd mark can be given if:
- *electron is on wrong side e.g.* $Mg(g) + e^- \rightarrow Mg^+(g)$
- *2nd ionisation energy given e.g.* $Mg^+(g) \rightarrow Mg^{2+}(g) + e^-$
- *If cumulative first and second ionisation energy given e.g.* $Mg(g) \rightarrow Mg^{2+}(g) + 2e^-$

Multiples of the equation are not allowed
If equation is given correctly for wrong element eg sodium, Na, max 1
If equation is given using a letter like M or X, max 1 **(2 marks)**

(ii) Mg has more protons/ greater atomic number/ greater nuclear charge **(1)**

Shielding unchanged/ electrons removed from same sub-shell/ orbital **(1)**

IGNORE comments on Na "wanting" to lose electron **(2 marks)**

(iii) Value between 900 to 3000 inclusive (actual is 1451) (kJ mol^{-1}) **(1)**

(>738 because) e^- removed from a +ve ion / is higher than 1st ionisation energy **(1)**
ALLOW ratio of protons:electrons is higher than in atom/electron in Mg^+ closer to nucleus/ radius of Mg^+ smaller

(< 4563 because) e^- in Mg is from same shell / lower the Na as second e^- in Na is taken from shell closer to the nucleus / removing second e^- from Mg is not breaking into a new energy level **(1)** **(3 marks)**

(e) Na larger as fewer protons/ smaller nuclear force on electrons.

(1 mark)

Total for question:15 marks

Total for paper: 60 marks