

General Certificate of Secondary Education
2011

Science: Chemistry

Paper 2
Higher Tier

[G1404]

TUESDAY 7 JUNE, AFTERNOON

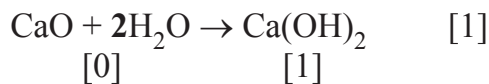
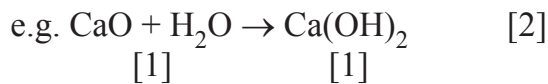
**MARK
SCHEME**

Guidelines for marking equations

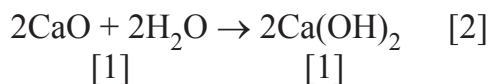
Equations where the stoichiometry is 1 gain [2] maximum

[1] for correct formula of reactant/s

[1] for correct formula of product/s



However:

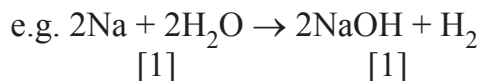


Equations where the stoichiometry is more than 1 gain [3]

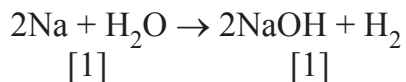
[1] for correct formula of reactant/s

[1] for correct formula of product/s

[1] for correct balancing



+ [1] for balancing = [3]



No balancing mark = [2]

1 (a)

Name	Ammonia
State at room temperature and pressure	gas [1]
Colour	colourless [1]
Odour	pungent [1]
pH of aqueous ammonia	9–11 [1]

[4]

(b) (i) white [1] smoke/fumes/solid/cloud [1] [2]

(ii) corrosive [1]

(iii) gloves/lab coat/fume cupboard [1]

(c) (i) $\text{NH}_3 + \text{HNO}_3 \rightarrow \text{NH}_4\text{NO}_3$ [2]

(ii) eutrophication [1]

(iii) some algae die [1]
 decomposing bacteria/organisms use up oxygen [1]
 less oxygen available for fish [1] [3]

(d) ammonia [1] excess [1] air [1]
 $900\text{--}1000^\circ\text{C}$ [1] } units essential and must be
 $1\text{--}10\text{ atm}$ [1] } related to this first step
 Pt/Rh [1] catalyst [1]
 $4\text{NH}_3 + 5\text{O}_2 \rightarrow 4\text{NO} + 6\text{H}_2\text{O}$ [3]
 nitrogen monoxide [1] mixed with (more) air [1]
 $2\text{NO} + \text{O}_2 \rightarrow 2\text{NO}_2$ [3]
 nitrogen dioxide [1] mixed with more air [1] and
 (passed up tower of glass beads with) water [1] running down
 $4\text{NO}_2 + \text{O}_2 + 2\text{H}_2\text{O} \rightarrow 4\text{HNO}_3$ [3] max [15]

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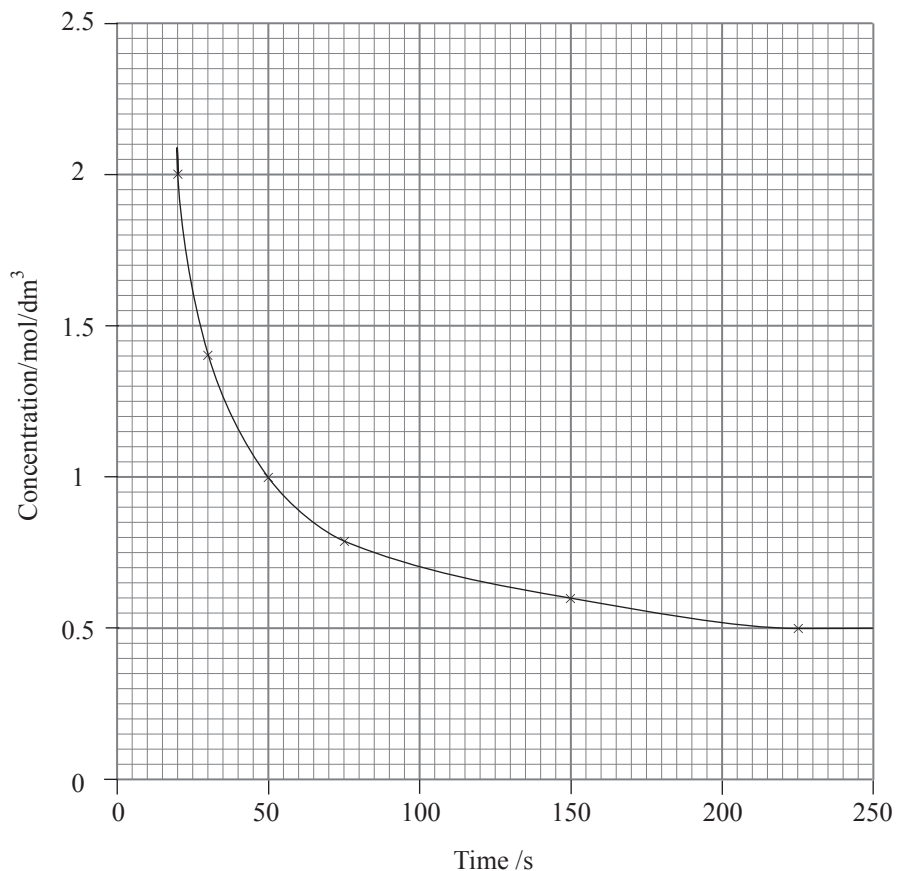
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- 2 (a) sodium chloride [1]
- (b) (i) 0.02 [1]
- (ii) Effect: increasing temperature increases rate
or decreasing temperature decreases rate [1] * essential
- Explanation: particles have more energy/move faster [1]
more collisions [1]
more successful collisions [1]
in a given period of time/idea of frequency [1] max [3]
Converse argument for decrease in temperature [4]
- (iii) only temperature has been changed/one factor changed/all other variables same [1]
- (iv) powdered Mg [1]
all other factors kept the same [1] [2]
- (c) (i) individual marks are for correctly labelled and recognisable drawings
No labels = 0 marks
- conical flask [1]
Mg ribbon + acid in contact [1]
stop clock [1] [3]
- (ii) no more bubbles/Mg disappears [1]

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- (iii) 5 or 6 points plotted correctly [2]
- 3 or 4 points plotted correctly [1]
- 0, 1, 2 points plotted correctly [0]
- curve [1]

[3]



- (iv) 27 [1] s (accept 25–30)

[1]

- (v) decreases

[1]

- (d) a substance which increases [1] rate of reaction [1]
 (or speeds up [1] a reaction [1])
 without being used up/chemically unchanged at end [1]

[3]

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- 3 (a) copper: electrons carry charge/electrons can move [1]
no effect/no decomposition [1]
- molten lead(II) bromide: ions carry charge/ions can move [1]
decomposes [1] [4]
- (b) (i) A = anode [1]
B = cathode [1]
C = evaporating basin/crucible/evaporating dish [1] [3]
- (ii) bulb/ammeter [1]
- (iii)
- | Electrode | Observations | Name of Product | Half equation |
|-----------|--|-----------------|--|
| A | red-brown [1]
pungent [1]
gas [1] max [2] | bromine | $2\text{Br}^- \rightarrow \text{Br}_2 + 2\text{e}^-$ [2] |
| B | silvery grey bead | lead [1] | $\text{Pb}^{2+} + 2\text{e}^- \rightarrow \text{Pb}$ [2] |
- [7]
- (iv) bromine/lead (fumes) are toxic/poisonous [1]
- (c) (i) D impure copper [1]
E pure copper [1] [2]
- (ii) copper sulphate/copper chloride/copper nitrate [1]
- (iii) $\text{Cu}^{2+} + 2\text{e}^- \rightarrow \text{Cu}$ [2]
- (iv) ductile [1]

- 4 (a) (i) add universal indicator/pH paper [1] compare to colour chart [1]
 or use pH meter [1] read off value [1] [2]
- (ii) weak acid lemon juice [1]
 strong alkali sodium hydroxide [1]
 neutral water [1] [3]
- (iii) H^+ [1]
- (iv) hydroxide [1]
- (v) sodium sulphate [1]
- (vi) $2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$ [3]
- (b) (i) lead nitrate [1]
 any soluble iodide, e.g. sodium iodide, potassium iodide etc. [1] [2]
- (ii) individual marks are for correctly labelled and recognisable pieces
 of assembled apparatus
 labels: filter funnel [1]
filter paper [1]
 conical flask/suitable container [1] [3]
- (iii) $Pb^{2+} + 2I^- \rightarrow PbI_2$ [3]
- (c) (i) $BaCl_2 + Na_2SO_4 \rightarrow 2NaCl + BaSO_4$ [3]
- (ii) low temperature oven/desiccator [1]

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5 (a) (i) A = ethane [1]
 B = propene [1]
 C = ethene [1]
 D = butane [1] [4]

(ii) C_4H_{10} [1]

(iii) A [1]

(iv) $2C_3H_6 + 9O_2 \rightarrow 6CO_2 + 6H_2O$ [3]

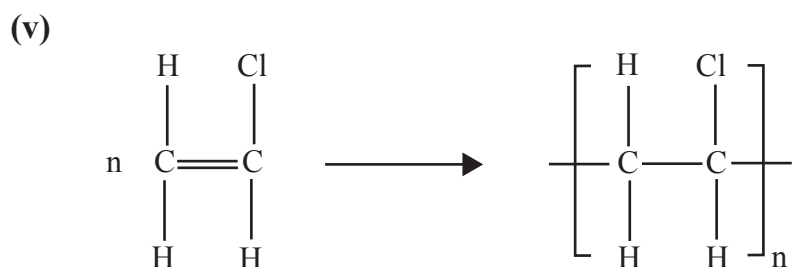
(v) same general formula [1]
 differ by CH_2 unit [1]
 similar/same chemical properties [1]
 gradation in physical properties [1] max [3]

(b) (i) substance containing only [1] carbon and hydrogen [1] [2]

(ii) addition [1]

(iii) idea of large number [1] of
 monomers/small molecules/repeating unit/alkene [1]
 (bond) to form a chain [1] max [2]

(iv) ethene [1]



[1] for correct monomer structure
 [1] for correct polymer structure in brackets
 [1] for n before ethene
 [1] for indicating repeat (repeat can be brackets and n after
 or a min of 3 repeating units) [4]

			AVAILABLE MARKS
(c)	polystyrene [1] polythene [1] PVC [1]	[3]	25
6	(a) gives out heat	[1]	
	(b) (i) A combustion	[1]	
	B neutralisation	[1]	
	(ii) $\text{NaOH} + \text{HCl} \rightarrow \text{NaCl} + \text{H}_2\text{O}$	[2]	
	(iii) $2\text{Mg} + \text{CO}_2 \rightarrow 2\text{MgO} + \text{C}$	[3]	
	(iv) magnesium continues to burn [1] white light [1] white [1] solid [1] black specks [1]	max [3]	
	(c) (i) blue [1] solution fades/changes to colourless [1] brown/black [1] solid [1] formed heat released [1]	max [3]	
	(ii) magnesium (atom) loses electrons [2] or $\text{Mg} \rightarrow \text{Mg}^{2+} + 2\text{e}^-$ [2] loss of electrons is oxidation [1] copper <u>ions</u> gain electrons [2] or $\text{Cu}^{2+} + 2\text{e}^- \rightarrow \text{Cu}$ [2] gain of electrons is reduction [1] oxidation and reduction occurring simultaneously/in same reaction [1]	[7]	
	Quality of written communication	[2]	23

- 7 (a) (i) wastes land [1]
 unpleasant smell [1]
 eyesore [1]
 loss of habitat [1]
 toxic waste leaches into land [1] max [2]
- (ii) greenhouse effect/global warming [1]
- (iii) idea of saves resources/prevents landfill or incineration [1]
- (iv) good conductors of electricity [1]
- (b) (i) advantage: heat produced can be harnessed [1]
 disadvantage: toxic fumes/greenhouse effect [1] [2]
- (ii) mixture of metals [1]
- (iii) $Al_2(SiO_3)_3$ [1]
- (c) (i)
- | Raw material | Formula | Name of chemical |
|--------------|---------------|-----------------------|
| Haematite | Fe_2O_3 [1] | iron(III) oxide |
| Limestone | $CaCO_3$ | calcium carbonate [1] |
- [2]
- (ii) coke/carbon [1]
- (iii) more employment [1]
 boosts local economy [1]
 improved road and transport infrastructure [1] max [2]
- (iv) carbon monoxide [1]
- (v) $CaO + SiO_2 \rightarrow CaSiO_3$ [2]
- Total** [17]

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