



Rewarding Learning

**General Certificate of Secondary Education
2012**

Science: Chemistry

Paper 2
Higher Tier

[G1404]

FRIDAY 22 JUNE, AFTERNOON

**MARK
SCHEME**

			AVAILABLE MARKS
1 (a) (i)	iron	[1]	
	(ii) oxygen	[1]	
	(iii) water	[1]	
	(iv) gain of oxygen	[1]	
	(v) red-brown [1] flaky [1] solid [1]	maximum [2]	
(b) (i)	$H_2 + Cl_2 \rightarrow 2HCl$	[3]	
	(ii) chlorine gains hydrogen [1] gain of hydrogen is reduction [1]	[2]	
	(iii) chlorine: yellow-green [1] hydrogen: colourless [1]	[2]	
	(iv) gives out heat	[1]	
(c) (i)	thermal [1] decomposition [1]	[2]	
	(ii) $CuCO_3 \rightarrow CuO + CO_2$	[2]	
	(iii) green [1] to black [1]	[2]	
(d) (i)	sulphate	[1]	
	(ii) magnesium	[1]	
	(iii) $Mg \rightarrow Mg^{2+} + 2e^-$	[3]	
	(iv) (copper ions) gain electrons [1] gain of electrons is reduction [1]	[2]	27

- 2 (a) moles of carbon = $\frac{72}{12} = 6$ [1]
 moles of hydrogen = $\frac{13.2}{1} = 13.2$ [1]
 moles of nitrogen = $\frac{16.8}{14} = 1.2$ [1]
 moles of oxygen = $\frac{38.4}{16} = 2.4$ [1]
 $C_5H_{11}NO_2$ or ratio: C:H:N:O = 5:11:1:2 [1] [5]
- (b) (i) $\frac{20 \times 0.125}{1000}$ [1] = 0.0025 [1] [2]
 (ii) $\frac{0.0025}{2}$ [1] = 0.00125 [1] [2]
 (iii) 0.00125×40 (or $\frac{0.00125 \times 1000}{25}$) [1] = 0.05 [1] [2]
 (iv) $\frac{3.7}{0.05}$ [1] = 74 [1] [2]
 (v) $74 - 60 = 14/2 = 7$ [1]
 lithium/Li₂CO₃/Li [1] [2]
- (c) mass of NH₄NO₃ = 2000 g [1]
 RFM of NH₄NO₃ = 80 [1]
 moles of NH₄NO₃ = $\frac{2000}{80} = 25$ [1]
 moles of N₂O = 25 [1]
 25×24 [1] = 600 [1] dm³ [6]
- (d) (i) equal volumes of gases [1]
 under the same conditions of temperature and pressure [1]
 contain the same number of particles [1] [3]
 (ii) 70×2 [1] = 140 [1] cm³ [2]

AVAILABLE
MARKS

26

- 3 (a) (i)
- | Substance | acid | base | alkali | salt |
|---------------------|---|-------|--------|-------|
| magnesium chloride | | | | ✓ [1] |
| magnesium hydroxide | | ✓ [1] | | |
| sodium hydroxide | | ✓ | ✓ | |
| | accept either tick for sodium hydroxide [1] | | | |
| zinc sulphate | | | | ✓ [1] |
- [4]
- (ii) $2\text{NaOH} + \text{H}_2\text{SO}_4 \rightarrow \text{Na}_2\text{SO}_4 + 2\text{H}_2\text{O}$ [3]
- (iii) magnesium nitrate [1]
- (iv) contains water [1]
contains water of crystallisation [2] [2]
- (b) (i) pipette [1]
- (ii) pink [1] to colourless [1] [2]
[1] if wrong way round
- (iii) remove the indicator [1]
- (iv) Individual marks are awarded for correctly labelled and recognisable drawings of assembled apparatus.
No labels = no marks.
- evaporating basin [1]
tripod and gauze [1]
heat/Bunsen burner [1] [3]
- (v) solubility decreases/solution becomes saturated [1]
- (vi) any **one** from:
dry between two sheets of filter paper [1]
dry in a low temperature oven [1]
dry in a desiccator [1] [1]
- (c) (i) negative ion [1]
- (ii) solid [1] appearing when two solutions are mixed [1] [2]
- (iii) barium chloride/barium nitrate [1]
- (iv) yellow [1]

AVAILABLE
MARKS

24

- 4 (a) decomposition/breaking down [1]
of a substance using electricity [1] [2]
- (b) bauxite [1]
- (c) (i) A is anode [1]
B is cathode [1]
C casing [1]
D is (molten) aluminium [1] [4]
- (ii) ions are free to move [1]
idea that ions are charge carriers [1] [2]
- (iii) 900–1000 °C [1]
- (iv) lower melting point (of aluminium oxide)/increase conductivity [1]
- (v)
- | | Positive electrode | Negative electrode | |
|-----------------|---|--|-----|
| Name of product | oxygen [1] | aluminium [1] | [2] |
| Half equation | $2\text{O}^{2-} \rightarrow \text{O}_2 + 4\text{e}^-$ [3] | $\text{Al}^{3+} + 3\text{e}^- \rightarrow \text{Al}$ [3] | [6] |
- (vi) electrode: anode [1]
equation: $\text{C} + \text{O}_2 \rightarrow \text{CO}_2$ [2]
- (vii) aluminium is tapped off [1] at the bottom of the cell [1]

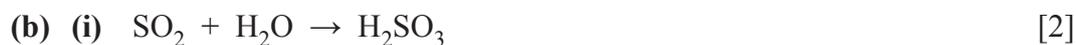
AVAILABLE
MARKS

23

			AVAILABLE MARKS	
5	(a)	anaerobic (decay) [1] of dead plants and animals [1] over millions of years [1] under the action of (heat and) pressure [1]	maximum [3]	
	(b)	(i) any two from: creates employment local/cheap fuel supply benefits local economy improved transport links	[2]	
		(ii) any two from: eyesore destroys habitats dust pollution noise pollution depletion of resources	[2]	
	(c)	(i) soluble in water	[1]	
		(ii) heating water/evaporate salt solution	[1]	
		(iii) subsidence/landslides	[1]	
	(d)	(i) electrolysis	[1]	
		(ii) NaOH	[1]	
		(iii) chlorine: bleach/PVC manufacture/water sterilisation [1] hydrogen: rocket fuel/weather balloons [1]	[2]	14

6 (a)

Gas	Test	Result of positive test	
carbon dioxide	bubble into limewater [1]	milky [1]	[2]
hydrogen	apply a lit splint [1]	pop [1]	[2]
hydrogen chloride	glass rod dipped in concentrated ammonia [1]	white [1] smoke [1]	[4]



- (ii) any **two** from:
 corrodes statues/buildings [1]
 kills fish [1]
 kills trees/ vegetation [1] [2]

- (c) (i) correct colour of sugar [1]
 crystalline [1]
 solid [1] maximum [2]

- (ii) sugar (initially) goes brown [1]
 swells/rises up beaker/pillar [1]
 reaction not immediate [1]
 heat released [1]
 caramel smell [1]
 pungent odour [1]
 gas/vapour/hisses/bubbles/porous solid/steamy fumes [1]
 black [1] solid remains maximum [3]

(d) (i)

	Result of a positive test when ammonia solution is added
iron(II) ion	green [1] ppt [1]
iron(III) ion	red-brown/brown [1] ppt [1]

[4]



AVAILABLE MARKS

24

- 7 (a) Individual marks are awarded for correctly labelled and recognisable drawings of assembled apparatus which will work.
No labels = no marks.

reaction vessel [1]

delivery tube [1]

*sealed system [1]

gas syringe [1]

stopclock [1]

* = essential mark

maximum [4]

- (b) (i) substance that speeds up [1]
a (chemical) reaction [1]
without being used up [1] [3]

- (ii) 1g [1]

(iii)

Industrial Process	Catalyst used	Balanced symbol equation for the catalysed reaction
The Haber Process	iron	$\text{N}_2 + 3\text{H}_2 \rightarrow 2\text{NH}_3$ [3]
The Contact Process	vanadium(V) oxide/ vanadium pentoxide/ V_2O_5 [1]	$2\text{SO}_2 + \text{O}_2 \rightarrow 2\text{SO}_3$
Production of Nitric acid	platinum/ rhodium	$4\text{NH}_3 + 5\text{O}_2 \rightarrow 4\text{NO} + 6\text{H}_2\text{O}$ [3]

- (c) particles gain energy/move faster [1]
more successful collisions [1]
in a given period of time/idea of frequency [1] [3]

Quality of written communication [2]

- (d) any **two** from:
vessels to contain high pressure expensive
high pressure dangerous/safety
reduce risk of explosion [2]

Total

22

160