

As part of CIE’s continual commitment to maintaining best practice in assessment, CIE has begun to use different variants of some question papers for our most popular assessments with extremely large and widespread candidature, The question papers are closely related and the relationships between them have been thoroughly established using our assessment expertise. All versions of the paper give assessment of equal standard.

The content assessed by the examination papers and the type of questions are unchanged.

This change means that for this component there are now two variant Question Papers, Mark Schemes and Principal Examiner’s Reports where previously there was only one. For any individual country, it is intended that only one variant is used. This document contains both variants which will give all Centres access to even more past examination material than is usually the case.

The diagram shows the relationship between the Question Papers, Mark Schemes and Principal Examiner’s Reports.

<b>Question Paper</b>	<b>Mark Scheme</b>	<b>Principal Examiner’s Report</b>
Introduction	Introduction	Introduction
First variant Question Paper	First variant Mark Scheme	First variant Principal Examiner’s Report
Second variant Question Paper	Second variant Mark Scheme	Second variant Principal Examiner’s Report

**Who can I contact for further information on these changes?**

Please direct any questions about this to CIE’s Customer Services team at: [international@cie.org.uk](mailto:international@cie.org.uk)

**UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS**

International General Certificate of Secondary Education

**MARK SCHEME for the October/November 2008 question paper**

**0620 CHEMISTRY**

**0620/31**

Paper 31 (Extended Theory), maximum raw mark 80

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began.

All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes must be read in conjunction with the question papers and the report on the examination.

- CIE will not enter into discussions or correspondence in connection with these mark schemes.

CIE is publishing the mark schemes for the October/November 2008 question papers for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level syllabuses and some Ordinary Level syllabuses.



Page 2	Mark Scheme	Syllabus	Paper
	IGCSE – October/November 2008	0620	31

- 1 red litmus paper blue [1]  
 OR white fumes/smoke with HCl (g) **or** (aq)
- chlorine [1]
- “pop” with a lighted splint **or** burn with a pop **or** goes pop and extinguishes flame [1]  
**NOT** glowing splint
- oxygen [1]
- carbon dioxide [1]  
**ACCEPT** correct formulae
- [Total: 5]**
- 2 (a) 3Na : 1N correct ratio [1]  
 correct charges [1]  
 8e around N [1]
- if no symbols then must have correct key  
 if covalent only mark 1  
 ignore electrons around sodium  
 if the response includes both a correct and an incorrect answer  
 do not select correct one, mark = [0]
- (b) (i) positive ions **or** cations [1]  
**NOT** atoms **or** cores **or** nuclei  
 layers **or** lattice **or** regular pattern [1]  
 delocalised **or** free **or** mobile electrons **or** sea [1]
- OR** positive ions **or** cations [1]  
**NOT** atoms **or** cores **or** nuclei  
 attraction between ions and electrons [1]  
 delocalised **or** free **or** mobile electrons **or** sea [1]  
 the attraction/electrostatic bonding must be between ions and  
 delocalised electrons, between cations and anions does not score  
**ACCEPT** bond if qualified - electrostatic bond, etc.  
 if molecular **or** molecules then cannot score cation mark
- (ii) delocalised/free/mobile electrons [1]  
**or** electrons can move [1]
- layers **or** ions **or** atoms **or** particles [1]  
**NB** more flexible than 2(b)(i)  
 can slip **or** move past each other **or** bonding non-directional [1]

Page 3	Mark Scheme	Syllabus	Paper
	IGCSE – October/November 2008	0620	31

- (c) (i) tetrahedral [1]  
 1Si : 4O bonded/surrounded, etc. [1]  
 1O : 2 Si [1]

**NOT** molecules of oxygen, etc.

**NOT** intermolecular forces

**ONLY** tetrahedral can score for either of the above

Despite what the question states, **ACCEPT** a clear accurate diagram which shows the above three points.

- (ii) hard  
 high mp **or** bp  
 colourless (**NOT** clear) **or** shiny **or** translucent  
 non/poor conductor (of electricity)  
 brittle  
 insoluble  
 any **TWO** [2]  
**NOT** crystalline **or** strong

[Total: 14]

- 3 (a) (i) water **or** moisture **ACCEPT** salty water [1]  
 air **or** oxygen [1]

- (ii) galvanising **or** coat with zinc  
 tin plate  
 chromium plate  
 nickel plate  
 cobalt plate  
 copper plate  
 cover with aluminium  
 anodic protection **or** sacrificial protection  
 cathodic protection  
 cover with plastic  
 alloying (ignore any named metal)  
 any **TWO** [2]  
**NOT** just plate **or** electroplate need electroplate with suitable metal  
**NOT** oil  
**ACCEPT** both galvanising and sacrificial protection

- (b) (i) hydrogen **or** carbon **or** carbon monoxide **or** methane [1]  
**or** more reactive metal **NOT** Group I

- (ii) any correct equation [2]  
 only error not balanced [1]

Page 4	Mark Scheme	Syllabus	Paper
	IGCSE – October/November 2008	0620	31

- (c) (i) 196 [1]
- (ii)  $112/196 \times 100$  [1]  
 $= 57(.1)\%$  **ACCEPT** 57 to nearest whole number [1]  
 mark **e.c.f.** to (c)(i) provided percentage not greater than 100%  
**ONLY ACCEPT**  $112/\text{answer (c)(i)} \times 100$   
 otherwise [0]

- (d) (i) forms carbon dioxide/carbon monoxide (which escapes) [1]
- (ii) forms silicon(IV) oxide **or** silicon oxide **or** silica [1]  
**OR** CaO reacts with  $\text{SiO}_2$   
 to form slag **or** calcium silicate [1]  
 ignore an incorrect formula if a correct name "slag" given  
**NOT**  $\text{Si} + \text{O}_2 + \text{CaO}$  form slag, this gains mark for slag only

[Total: 13]

- 4 (a) (i)  $\text{C}_6\text{H}_5\text{COOH}$  **or**  $\text{C}_6\text{H}_5\text{CO}_2\text{H}$  [1]  
**NOT**  $\text{C}_7\text{H}_6\text{O}_2$  /  $\text{C}_6\text{H}_6\text{COO}$
- (ii) sodium hydroxide + benzoic acid = sodium benzoate + water [1]  
 correct spelling needed **NOT** benzenoate  
**ACCEPT** correct symbol equation
- (iii) sodium carbonate **or** oxide **or** hydrogencarbonate [2]  
 any **TWO**  
**NOT** Na
- (b) (i) 7.7% [1]
- (ii) for any number: equal number ratio [2]  
 for example 1:1 **or** 6:6
- (iii) empirical formula is CH [1]  
 molecular formula is  $\text{C}_6\text{H}_6$  [1]  
 no e.c.f., award of marks not dependent on (ii)
- (c) (i)  $\text{C}_6\text{H}_8\text{O}_6$  [1]
- (ii) carbon – carbon double bond **or** alkene [1]  
 alcohol **or** hydroxyl **or** hydroxy [1]  
**NOT** hydroxide  
 hydroxide and alcohol = 0

[Total: 12]

Page 5	Mark Scheme	Syllabus	Paper
	IGCSE – October/November 2008	0620	31

- 5 (a) (i)  $2\text{H}^+ + 2\text{e} \rightarrow \text{H}_2$  [1]
- (ii)  $2\text{Cl}^- - 2\text{e} \rightarrow \text{Cl}_2$  or  $2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}$  [1]
- (iii)  $\text{Na}^+$  and  $\text{OH}^-$  are left [1]  
 OR  $\text{Cl}^-$  removed  $\text{OH}^-$  left  
**NB ions** by name or formula essential  
**NOT** any reaction of Na or  $\text{Na}^+$   
**NOT**  $\text{Na}^+$  and  $\text{OH}^-$  combine
- (b) (i) sterilise/disinfect water or kill microbes/germs bacteria, etc. [1]  
**NOT just** to make it safe to drink or purify it or clean it  
 treat above as neutral they do not negate a correct response
- (ii) ammonia or methanol or hydrogen chloride or margarine [1]  
**NOT** nylon
- (iii) fat or lipid or triester or named fat or glyceryl stearate [1]  
 or vegetable oil [1]  
 heat [1]
- [Total: 7]**

6 (a) (i)

aqueous solution	tin Sn	manganese Mn	silver Ag	zinc Zn
tin(II) nitrate		R	NR	R
manganese(II) nitrate	NR		NR	NR
silver(I) nitrate	R	R		R
zinc nitrate	NR	R	NR	

- [1] for each row [3]  
 ignore anything written in blank space
- (ii)  $\text{Sn} + 2\text{Ag}^+ \rightarrow \text{Sn}^{2+} + 2\text{Ag}$  [2]  
 all species correct [1]  
 accept equation with  $\text{Sn}^{4+}$
- (iii) Mn to  $\text{Mn}^{2+}$  need both species [1]  
 electron loss or oxidation number increases [1]
- (iv) covered with oxide layer [1]  
 makes it unreactive or protects or aluminium oxide unreactive [1]

- (b) (i) potassium has one valency electron [1]  
 or loses one electron  
 calcium has two valency electrons [1]  
 or loses two electrons
- (ii) potassium hydroxide  $\rightarrow$  no reaction [1]  
 calcium hydroxide  $\rightarrow$  calcium oxide and water [1]  
**ACCEPT** metal oxide

Page 6	Mark Scheme	Syllabus	Paper
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(iii)  $2\text{KNO}_3 \rightarrow 2\text{KNO}_2 + \text{O}_2$  [2]  
 [1] for **formula** of either product

$2\text{Ca}(\text{NO}_3)_2 \rightarrow 2\text{CaO} + 4\text{NO}_2 + \text{O}_2$  [2]  
 [1] for **formulae** of any **TWO** products

[Total: 17]

7 (a) (i)  $35\text{ cm}^3$  [1]  
 $40\text{ cm}^3$  [1]

(ii) forms carbon monoxide [1]

poisonous **or** toxic **or** lethal **or** prevents blood carrying oxygen  
**or** effect on haemoglobin [1]  
**NOT** just harmful

(b) (i) chlorobutane **or** butyl chloride [1]  
 number not required but if given must be 1, it must be in correct position

(ii) light **or** UV **or**  $200^\circ\text{C}$  **or** lead tetraethyl [1]

(iii) any correct equation for example 2-chlorobutane  
**or** dichlorobutane [1]

(c) (i) correct repeat unit [1]  
**COND** continuation [1]  
 $-(\text{CH}(\text{CH}_3)-\text{CH}_2)-$

(ii) butan-1-ol **or** butan-2-ol **or** butanol [1]  
 if number given then formula must correspond for second mark and number must be in correct position

structural formula of above [1]  
 $\text{CH}_3-\text{CH}_2-\text{CH}_2-\text{CH}_2\text{OH}$  **or**  $\text{CH}_3-\text{CH}(\text{OH})-\text{CH}_2-\text{CH}_3$   
**NOT**  $\text{C}_4\text{H}_9\text{OH}$   
 if first mark not awarded then either formula will gain mark [1]  
**ACCEPT** either formula for "butanol"

(iii)  $\text{CH}_3-\text{CH}(\text{Cl})-\text{CH}_3$  **or**  $\text{CH}_3-\text{CH}_2-\text{CH}_2-\text{Cl}$  [1]  
**NOT**  $\text{C}_3\text{H}_7\text{Cl}$   
 response must not include  $\text{HCl}$   
 if equation given look at RHS only

[Total: 12]

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**MARK SCHEME for the October/November 2008 question paper**

**0620 CHEMISTRY**

**0620/32**

Paper 32 (Extended Theory), maximum raw mark 80

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Page 2	Mark Scheme	Syllabus	Paper
	IGCSE – October/November 2008	0620	32

- 1 ammonia [1]  
 chlorine [1]  
 “pop” with a lighted splint **or** burn with a pop **or** goes pop and extinguishes flame [1]  
**NOT** glowing splint  
 relights a glowing splint [1]  
 turns limewater milky/cloudy/chalky/white [1]  
**ACCEPT** correct formulae

[Total: 5]

- 2 (a) 2Na : 1S correct ratio [1]  
 correct charges [1]  
 8e around S [1]

if no symbols then must have correct key  
 if covalent only mark 1  
 ignore electrons around sodium  
 if the response includes both a correct and an incorrect answer  
 do not select correct one, mark = [0]

- (b) (i) positive ions **or** cations [1]  
**NOT** atoms **or** cores **or** nuclei  
 layers **or** lattice **or** regular pattern [1]  
 delocalised **or** free **or** mobile electrons **or** sea [1]

**OR** positive ions **or** cations [1]  
**NOT** atoms **or** cores **or** nuclei  
 attraction between ions and electrons [1]  
 delocalised **or** free **or** mobile electrons **or** sea [1]  
 the attraction/electrostatic bonding must be between ions and  
 delocalised electrons, between cations and anions does not score  
**ACCEPT** bond if qualified e.g. electrostatic bond, etc.  
 if moles or molecular cannot score cation mark

- (ii) delocalised/free/mobile electrons  
**or** electrons can move [1]  
 layers **or** ions **or** atoms **or** particles [1]  
**NB** more flexible than 2(b)(i)  
 can slip **or** move past each other **or** bonding non-directional [1]

Page 3	Mark Scheme	Syllabus	Paper
	IGCSE – October/November 2008	0620	32

- (c) (i) tetrahedral [1]  
 1Si : 4O bonded/surrounded, etc. [1]  
 1O : 2 Si [1]

**NOT** molecules of oxygen, etc.

**NOT** intermolecular forces

**ONLY** tetrahedral can score for either of the above

Despite what the question states, **ACCEPT** a clear accurate diagram which shows the above three points.

- (ii) hard  
 high melting point **or** boiling point  
 colourless (**NOT** clear) **or** shiny **or** translucent  
 non/poor conductor (of electricity)  
 brittle  
 insoluble  
 any **TWO** [2]  
**NOT** crystalline **or** strong

[Total: 14]

- 3 (a) (i) water **or** moisture **ACCEPT** salty water [1]  
 air **or** oxygen [1]

- (ii) galvanising **or** coat with zinc  
 tin plate  
 chromium plate  
 nickel plate  
 cobalt plate  
 copper plate  
 cover with aluminium  
 anodic protection **or** sacrificial protection  
 cathodic protection  
 cover with plastic  
 alloying (ignore any named metal)  
 any **TWO** [2]  
**NOT** just plate **or** electroplate need electroplate with suitable metal  
**NOT** oil  
**ACCEPT** both galvanising and sacrificial protection

- (b) (i) hydrogen **or** carbon **or** carbon monoxide **or** methane  
**or** more reactive metal **NOT** Group I [1]

- (ii) any correct equation [2]  
 only error not balanced [1]

Page 4	Mark Scheme	Syllabus	Paper
	IGCSE – October/November 2008	0620	32

- (c) (i) 196 [1]
- (ii)  $36/196 \times 100$  [1]  
 = 18(.4)% **ACCEPT** 18 to nearest whole number [1]  
 mark e.c.f. to (c)(i) provided percentage not greater than 100%  
**ONLY ACCEPT**  $36/\text{answer (c)(i)} \times 100$   
 otherwise [0]

- (d) (i) forms carbon dioxide/carbon monoxide (which escapes) [1]
- (ii) forms silicon(IV) oxide **or** silicon oxide **or** silica [1]  
**OR** CaO reacts with SiO<sub>2</sub>  
 to form slag **or** calcium silicate [1]  
 ignore an incorrect formula if a correct name given  
**NOT** Si + O<sub>2</sub> + CaO form slag

[Total: 13]

- 4 (a) (i) C<sub>6</sub>H<sub>5</sub>COOH **or** C<sub>6</sub>H<sub>5</sub>CO<sub>2</sub>H [1]  
**NOT** C<sub>7</sub>H<sub>6</sub>O<sub>2</sub> /C<sub>6</sub>H<sub>6</sub>COO
- (ii) sodium hydroxide + benzoic acid = sodium benzoate + water [1]  
 correct spelling needed **NOT** benzenoate  
**ACCEPT** correct symbol equation
- (iii) sodium carbonate **or** oxide **or** hydrogencarbonate [2]  
 any **TWO**  
**NOT** Na
- (b) (i) 7.7% [1]
- (ii) for any number: equal number ratio [2]  
 for example 1:1 or 6:6
- (iii) empirical formula is CH [1]  
 molecular formula is C<sub>6</sub>H<sub>6</sub> [1]  
 no e.c.f., award of marks not dependent on (ii)
- (c) (i) C<sub>6</sub>H<sub>8</sub>O<sub>6</sub> [1]
- (ii) carbon – carbon double bond **or** alkene [1]  
 alcohol **or** hydroxyl **or** hydroxy [1]  
**NOT** hydroxide  
 hydroxide and alcohol = 0

[Total: 12]

Page 5	Mark Scheme	Syllabus	Paper
	IGCSE – October/November 2008	0620	32

- 5 (a) (i)  $2\text{H}^+ + 2\text{e} \rightarrow \text{H}_2$  [1]
- (ii)  $2\text{Cl}^- - 2\text{e} \rightarrow \text{Cl}_2$  or  $2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}$  [1]
- (iii)  $\text{Na}^+$  and  $\text{OH}^-$  are left [1]  
**OR**  $\text{Cl}^-$  removed  $\text{OH}^-$  left  
**NB ions** by name or formula essential  
**NOT** any reaction of Na or  $\text{Na}^+$   
**NOT**  $\text{Na}^+$  and  $\text{OH}^-$  combine
- (b) (i) sterilise/disinfect water or kill microbes/germs bacteria, etc. [1]  
**NOT just** to make it safe to drink or purify it or clean it  
 treat above as neutral they do not negate a correct response
- (ii) ammonia or methanol or hydrogen chloride or margarine [1]  
**NOT** nylon
- (iii) ester or triester or lipid [1]  
 hydrolysis or saponification [1]

[Total: 7]

6 (a) (i)

aqueous solution	tin Sn	manganese Mn	silver Ag	zinc Zn
tin(II) nitrate		R	NR	R
manganese(II) nitrate	NR		NR	NR
silver(I) nitrate	R	R		R
zinc nitrate	NR	R	NR	

[1] for each row [3]  
 ignore anything written in blank space

- (ii)  $\text{Zn} + 2\text{AgNO}_3 \rightarrow \text{Zn}(\text{NO}_3)_2 + 2\text{Ag}$  [2]  
 all species correct [1]  
 accept correct ionic equation  
 $\text{Zn} + 2\text{Ag}^+ \rightarrow \text{Zn}^{2+} + 2\text{Ag}$  [2]
- (iii)  $\text{Sn}^{2+}$  must be made clear that the oxidant is  $\text{Sn}^{2+}$  not Sn [1]  
 it gains electrons or oxidation number decreases or it is reduced [1]  
 reason must relate to an oxidant  
**NB** not dependent on identifying  $\text{Sn}^{2+}$
- (iv) covered with oxide layer [1]  
 makes it unreactive or protects or aluminium oxide unreactive [1]

Page 6	Mark Scheme	Syllabus	Paper
	IGCSE – October/November 2008	0620	32

- (b) (i) potassium has one valency electron [1]  
 or loses one electron  
 calcium has two valency electrons [1]  
 or loses two electrons [1]
- (ii) potassium hydroxide → no reaction [1]  
 calcium hydroxide → calcium oxide and water [1]  
**ACCEPT** metal oxide
- (iii)  $2\text{KNO}_3 \rightarrow 2\text{KNO}_2 + \text{O}_2$  [2]  
 [1] for **formula** of either product
- $2\text{Ca}(\text{NO}_3)_2 \rightarrow 2\text{CaO} + 4\text{NO}_2 + \text{O}_2$  [2]  
 [1] for **formulae** of any **TWO** products
- [Total: 17]**
- 7 (a) (i)  $20\text{ cm}^3$  [1]  
 $80\text{ cm}^3$  [1]
- (ii) forms carbon monoxide [1]  
 poisonous **or** toxic **or** lethal **or** prevents blood carrying oxygen  
**or** effect on haemoglobin [1]  
**NOT** just harmful, etc.
- (b) (i) chlorobutane **or** butyl chloride [1]  
 number not required but if given must be 1, it must be in correct position
- (ii) light **or** UV **or**  $200\text{ }^\circ\text{C}$  **or** lead tetraethyl [1]
- (iii) any correct equation for example 2-chlorobutane  
**or** dichlorobutane  
 must include  $\text{HCl}$  [1]
- (c) (i) correct repeat unit [1]  
**COND** continuation [1]  
 $-(\text{CH}(\text{CH}_3)-\text{CH}_2)-$
- (ii) propan-1-ol **or** propan-2-ol **or** propanol [1]  
 if number given then formula must correspond for second mark.  
 number must be in correct position  
 structural formula of above [1]  
 $\text{CH}_3-\text{CH}_2-\text{CH}_2-\text{OH}$  **or**  $\text{CH}_3-\text{CH}(\text{OH})-\text{CH}_3$   
**NOT**  $\text{C}_3\text{H}_7\text{OH}$   
 if first mark not awarded then either formula will gain mark [1].  
**accept** either formula for "propanol" in (i)  
**NB On scoris both marks entered together not as [1] and [1] separately**
- (iii)  $\text{CH}_3-\text{CH}_2-\text{CH}_2-\text{CH}_2-\text{Cl}$  **or**  $\text{CH}_3-\text{CH}_2-\text{CH}(\text{Cl})-\text{CH}_3$  [1]  
**NOT**  $\text{C}_4\text{H}_9\text{Cl}$   
 if equation given look at RHS only  
 response must not include  $\text{HCl}$

**[Total: 12]**