**Location Entry Codes**

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.

| **Question Paper** | **Mark Scheme** | **Principal Examiner's Report** |
|---|---|---|
| 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

**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.

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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 | |

**1**   red litmus paper blue
OR white fumes/smoke with HC$l$ (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)**   <u>positive</u> 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** <u>positive</u> 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
**or** electrons can move                                                                              [1]

layers **or** ions **or** atoms **or** particles                                                          [1]
**NB** more flexible than **2(b)(i)**
can <u>slip</u> **or** move past each other **or** bonding non-directional                                 [1]

| Page 3 | Mark Scheme | Syllabus | er |
|--------|-------------|----------|-----|
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**(c) (i)** tetrahedral
1Si : 4O bonded/surrounded, etc.
1O : 2 Si

**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
**or** more reactive metal **NOT** Group I                                      [1]

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

| Page 4 | Mark Scheme | Syllabus | |
|---|---|---|---|
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**(c) (i)** 196

   **(ii)** 112/196 × 100
   = 57(.1)%    **ACCEPT** 57 to nearest whole number
   mark **e.c.f.** to **(c)(i)** provided percentage not greater than 100%
   **ONLY ACCEPT** 112/answer **(c)(i)** × 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 $SiO_2$
   to form slag **or** calcium silicate                                                             [1]
   ignore an incorrect formula if a correct name "slag" given
   **NOT** $Si + O_2 + CaO$ form slag, this gains mark for slag only

                                                                                                **[Total: 13]**

**4 (a) (i)** $C_6H_5COOH$ **or** $C_6H_5CO_2H$                                                      [1]
   **NOT** $C_7H_6O_2$ /$C_6H_6COO$

   **(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
   any **TWO**                                                                                    [2]
   **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 $C_6H_6$                                                                     [1]
   no e.c.f., award of marks not dependent on **(ii)**

**(c) (i)** $C_6H_8O_6$                                                                                [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 | er |
|---|---|---|---|
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**5 (a) (i)** $2H^+ + 2e \rightarrow H_2$

**(ii)** $2Cl^- - 2e \rightarrow Cl_2$ **or** $2Cl^- \rightarrow Cl_2 + 2e$

**(iii)** $Na^+$ and $OH^-$ are left [1]
OR $Cl^-$ removed $OH^-$ left
**NB ions** by name **or** formula essential
**NOT** any reaction of Na **or** $Na^+$
**NOT** $Na^+$ and $OH^-$ 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
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)** $Sn + 2Ag^+ \rightarrow Sn^{2+} + 2Ag$ [2]
all species correct [1]
accept equation with $Sn^{4+}$

**(iii)** Mn to $Mn^{2+}$ 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
**or** loses two electrons [1]

**(ii)** potassium hydroxide $\rightarrow$ no reaction [1]
calcium hydroxide $\rightarrow$ calcium oxide and water [1]
**ACCEPT** metal oxide

| Page 6 | Mark Scheme | Syllabus | er |
|---|---|---|---|
| | IGCSE – October/November 2008 | 0620 | |

(iii) $2KNO_3 \rightarrow 2KNO_2 + O_2$
[1] for **formula** of either product

$2Ca(NO_3)_2 \rightarrow 2CaO + 4NO_2 + O_2$
[1] for **formulae** of any **TWO** products

**[Total: 17]**

**7 (a) (i)** 35 cm$^3$ [1]
40 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°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]
-(CH(CH$_3$)-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]
CH$_3$-CH$_2$-CH$_2$-CH$_2$OH  **or**  CH$_3$-CH(OH)-CH$_2$-CH$_3$
**NOT** C$_4$H$_9$OH
if first mark not awarded then either formula will gain mark [1]
**ACCEPT** either formula for "butanol"

**(iii)** CH$_3$-CH(C$l$)-CH$_3$  **or**  CH$_3$-CH$_2$-CH$_2$-C$l$ [1]
**NOT** C$_3$H$_7$C$l$
response must not include HC$l$
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 | er |
|---|---|---|---|
| | IGCSE – October/November 2008 | 0620 | |

**1**   ammonia
chlorine
"pop" with a lighted splint **or** burn with a pop **or** goes pop and extinguishes flame
**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)**   <u>positive</u> 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** <u>positive</u> 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 <u>slip</u> **or** move past each other **or** bonding non-directional      [1]

| Page 3 | Mark Scheme | Syllabus | er |
|---|---|---|---|
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**(c) (i)** tetrahedral
1Si : 4O bonded/surrounded, etc.
1O : 2 Si

**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 | er |
|---|---|---|---|
| | IGCSE – October/November 2008 | 0620 | |

**(c)** **(i)** 196

**(ii)** 36/196 × 100
= 18(.4)%   **ACCEPT** 18 to nearest whole number
mark **e.c.f.** to **(c)(i)** provided percentage not greater than 100%
**ONLY ACCEPT** 36/answer **(c)(i)** × 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 $SiO_2$
to form slag **or** calcium silicate  [1]
ignore an incorrect formula if a correct name given
**NOT** $Si + O_2 + CaO$ form slag

[Total: 13]

**4** **(a)** **(i)** $C_6H_5COOH$ **or** $C_6H_5CO_2H$  [1]
**NOT** $C_7H_6O_2$ /$C_6H_6COO$

**(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
any **TWO**  [2]
**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 $C_6H_6$  [1]
no e.c.f., award of marks not dependent on **(ii)**

**(c)** **(i)** $C_6H_8O_6$  [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 | |

**5** **(a)** **(i)** $2H^+ + 2e \rightarrow H_2$

**(ii)** $2Cl^- - 2e \rightarrow Cl_2$ **or** $2Cl^- \rightarrow Cl_2 + 2e$

**(iii)** $Na^+$ and $OH^-$ are left          [1]
**OR** $Cl^-$ removed $OH^-$ left
**NB ions** by name **or** formula essential
**NOT** any reaction of Na **or** $Na^+$
**NOT** $Na^+$ and $OH^-$ 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)** $Zn + 2AgNO_3 \rightarrow Zn(NO_3)_2 + 2Ag$      [2]
all species correct [1]
accept correct ionic equation
$Zn + 2Ag^+ \rightarrow Zn^{2+} + 2Ag$    [2]

**(iii)** $Sn^{2+}$ must be made clear that the oxidant is $Sn^{2+}$ 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 $Sn^{2+}$

**(iv)** covered with oxide layer      [1]
makes it unreactive **or** protects **or** aluminium oxide unreactive      [1]

| Page 6 | Mark Scheme | Syllabus | er |
|---|---|---|---|
| | IGCSE – October/November 2008 | 0620 | |

**(b)** **(i)** potassium has one valency electron
**or** loses one electron
calcium has two valency electrons
**or** loses two electrons

**(ii)** potassium hydroxide → no reaction [1]
calcium hydroxide → calcium oxide and water [1]
**ACCEPT** metal oxide

**(iii)** $2KNO_3 →$ $2KNO_2 + O_2$ [2]
[1] for **formula** of either product

$2Ca(NO_3)_2 → 2CaO + 4NO_2 + O_2$ [2]
[1] for **formulae** of any **TWO** products

**[Total: 17]**

**7** **(a)** **(i)** $20\,cm^3$ [1]
$80\,cm^3$ [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 °C **or** lead tetraethyl [1]

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

**(c)** **(i)** correct repeat unit [1]
**COND** continuation [1]
$–(CH(CH_3)–CH_2)–$

**(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]
$CH_3–CH_2–CH_2–OH$ **or** $CH_3–CH(OH)–CH_3$
**NOT** $C_3H_7OH$
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)** $CH_3–CH_2–CH_2–CH_2–Cl$ or $CH_3–CH_2–CH(Cl)–CH_3$ [1]
**NOT** $C_4H_9Cl$
if equation given look at RHS only
response must not include $HCl$

**[Total: 12]**