Location Entry Codes

UNIVERSITY of CAMBRIDGE
International Examinations

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.

- 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.

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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
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]

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

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

(c) (i) 196 [1]

(ii) 112/196 × 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/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]

5 (a) (i) $2H^+ + 2e \rightarrow H_2$ [1]

(ii) $2Cl^- - 2e \rightarrow Cl_2$ **or** $2Cl^- \rightarrow Cl_2 + 2e$ [1]

(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 → no reaction [1]
calcium hydroxide → calcium oxide and water [1]
ACCEPT metal oxide

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

$2Ca(NO_3)_2 \rightarrow 2CaO + 4NO_2 + O_2$ [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]
$CH_3-CH_2-CH_2-CH_2OH$ **or** $CH_3-CH(OH)-CH_2-CH_3$
NOT C_4H_9OH
if first mark not awarded then either formula will gain mark [1]
ACCEPT either formula for "butanol"

(iii) $CH_3-CH(Cl)-CH_3$ **or** $CH_3-CH_2-CH_2-Cl$ [1]
NOT C_3H_7Cl
response must not include HCl
if equation given look at RHS only

[Total: 12]

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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]

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

(c) (i) 196 [1]

(ii) 36/196 × 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/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]

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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]
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(iii) empirical formula is CH [1]
molecular formula is C_6H_6 [1]
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(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]

5 (a) (i) $2H^+ + 2e \rightarrow H_2$ [1]

(ii) $2Cl^- - 2e \rightarrow Cl_2$ **or** $2Cl^- \rightarrow Cl_2 + 2e$ [1]

(iii) Na^+ and OH^- are left [1]
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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]

(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 → no reaction [1]
calcium hydroxide → calcium oxide and water [1]
ACCEPT metal oxide

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

$2Ca(NO_3)_2 \rightarrow 2CaO + 4NO_2 + O_2$ [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 HC*l* [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) $CH_3–CH_2–CH_2–CH_2–C\mathit{l}$ or $CH_3–CH_2–CH(C\mathit{l})–CH_3$ [1]
NOT $C_4H_9C\mathit{l}$
if equation given look at RHS only
response must not include HC*l*

[Total: 12]