

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS  
International General Certificate of Secondary Education

**MARK SCHEME for the October/November 2009 question paper  
for the guidance of teachers**

**0620 CHEMISTRY**

**0620/32**

Paper 32 (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, which would have considered the acceptability of alternative answers.

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 2009 question papers for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level syllabuses and some Ordinary Level syllabuses.



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### GENERAL INSTRUCTIONS FOR MARKING

- Error carried forward may be allowed in calculations. This will be discussed in the mark scheme. This is not applied when the candidate has inserted incorrect integers or when the answer is physically impossible.
- **COND** the award of this/these mark(s) is conditional upon a **previous** mark being awarded.  
Example – Is the reaction exothermic **or** endothermic? Give a reason for your choice.  
Mark scheme  
exothermic [1]  
**COND** a correct reason given [1]. This mark can only be awarded if the candidate has recognised that the reaction is exothermic.
- When the name of a chemical is demanded by the question, a **correct** formula is usually acceptable. When the formula is asked for, the name is not acceptable.
- When a word equation is required a **correct** symbol equation is usually acceptable. If an equation is requested then a word equation is not usually acceptable.
- An incorrectly written symbol, e.g. NA **or** CL, should be penalised once in a question.
- In the mark scheme if a word **or** phrase is underlined it (**or** an equivalent) is required for the award of the mark.  
(.....) is used to denote material that is not specifically required.
- **OR** designates alternative and independent ways of gaining the marks for the question.  
**or** indicates different ways of gaining the same mark.
- Unusual responses which include correct Chemistry which answer the question should always be rewarded – even if they are not mentioned in the marking scheme.

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- 1 (a) (i) argon **or** krypton **or** helium [1]  
**Accept** xenon and radon even though percentages are very small  
**NOT** hydrogen
- (ii) water and carbon dioxide [2]
- (b) (i) carbon monoxide **or** lead compounds **or** CFCs **or** methane **or** particulates  
**or** unburnt hydrocarbons **or** ozone [1]
- (ii) burn a fossil fuel [1]  
that contains sulfur [1]
- (iii) at high temperature **or** inside engine [1]  
nitrogen and oxygen (from the air) react [1]
- (c) liquid air [1]  
fractional distillation [1]
- [Total: 10]**
- 2 (a) pH < 7 [1]  
example [1]
- pH > 7 [1]  
example [1]  
**NOT** amphoteric oxides Be, Al, Zn, Pb, Sn etc.
- pH = 7 [1]  
example H<sub>2</sub>O, CO, NO [1]  
the two marks are not linked, mark each independently  
**NOT** amphoteric oxides Be, Al, Zn, Pb, Sn etc.
- (b) (i) shows both basic and acidic properties [1]
- (ii) acidic reacts with sodium hydroxide only [1]  
amphoteric reacts with both reagents [1]
- OR** only amphoteric oxide reacts with hydrochloric acid [2]
- [Total: 9]**
- 3 (a) (i) heat/roast/burn in air [1]  
need both points for mark
- (ii) ZnO + C → Zn + CO [2]  
**or** 2ZnO + C → 2Zn + CO<sub>2</sub>  
unbalanced **ONLY** [1]

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- (b) zinc is more reactive [1]  
it loses electrons and forms ions in preference to iron [1]  
zinc corrodes not iron [1]  
**NOT** zinc rusts
- OR** zinc loses electrons and forms ions [1]  
the electrons move on to the iron [1]  
the iron cannot be oxidised **or** it cannot rust **or** it cannot lose electrons [1]  
**CREDIT** correct Chemistry that includes the above ideas

- (c) (i) zinc atoms change into ions, (the zinc dissolves) [1]  
copper(II) ions change into atoms, (becomes plated with copper) [1]
- (ii) ions [1]  
electrons [1]

[Total: 10]

- 4 (a) diffusion [1]  
different  $M_r$  **or** ozone molecules heavier than oxygen molecules  
**or** different densities or oxygen molecules move faster than ozone molecules [1]  
**NOT** oxygen is lighter **or** ozone heavier
- OR** fractional distillation [1]  
they have different boiling points [1]
- (b) (i) from colourless (solution) [1]  
to brown (solution) [1]
- (ii)  $I^-$  loses electrons (it is oxidised) [1]
- (iii) they are accepted by ozone [1]  
**or** ozone is an electron acceptor
- (c) (i) water  
carbon dioxide  
sulfur dioxide  
all **three** [2]  
any **two** [1]
- (ii) correct structural skeleton [1]  
**COND** 4bp around both carbon atoms [1]  
2bp and 2bp around sulfur atom [1]

[Total: 11]

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- 5 (a) (i) strong  
hard  
light **or** low density  
high melting point **or** high fixed points  
**Accept** high strength to weight ratio for [2]  
it includes marks 1 and 3  
any **THREE** [3]
- (ii) diagram 1 four silicons around one carbon [1]  
diagram 2 four carbons around one silicon [1]  
either diagram looks **or** stated to be tetrahedral [1]  
"tetrahedral" scores mark even if diagram does not look tetrahedral  
independent marking of three points
- (b) diagram to include  
each germanium atom bonded 4 oxygen atoms [1]  
each oxygen to 2 germanium atoms [1]
- (c) (i) structural formula of  $\text{Ge}_3\text{H}_8$  all bonds shown [1]
- (ii) germanium oxide [1]  
water [1]
- [Total: 11]**
- 6 (a) (i) USA or Texas or Louisiana, Japan  
volcanoes, natural gas, petroleum [1]
- (ii) bleach for wood pulp/cloth/straw **or** preserve food **or** sterilising  
**or** making wine **or** fumigant **or** refrigerant [1]  
**Accept** making paper
- (iii) vanadium(V) oxide or vanadium oxide or vanadium pentoxide  
or  $\text{V}_2\text{O}_5$  [1]  
NB oxidation state not essential but if given has to be (V)
- (iv) rate too slow **or** rate not economic [1]
- (v) reaction too violent **or** forms a mist [1]
- (b) (i) add water to yellow powder **or** anhydrous salt  
it would go green [1]  
[1]
- (ii) change from purple **or** pink  
to colourless **NOT** clear [1]  
[1]
- (iii) reacts with oxygen in air [1]

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- (c) number of moles of FeSO<sub>4</sub> used = 12.16/152 = 0.08\* [1]  
 number of moles of Fe<sub>2</sub>O<sub>3</sub> formed = 0.04 [1]  
 mass of one mole of Fe<sub>2</sub>O<sub>3</sub> = 160 g [1]  
 mass of iron(III) oxide formed = 0.04 × 160 = 6.4 g [1]  
 number of moles of gases formed = 0.08 [1]  
 volume of sulfur trioxide formed = 0.08 × 24 = 1.92 dm<sup>3</sup> [1]

If mass of iron(III) oxide greater than 12 g, then only marks 1 and 2 available

Apply **ecf** to number of moles of FeSO<sub>4</sub>\* when calculating volume of sulfur trioxide.  
 Do not apply **ecf** to integers

[Total: 16]

- 7 (a) (i) heat [1]  
 catalyst [1]
- (ii) equation that gives:  
 alkene + alkane **or** alkene + alkene + hydrogen [1]  
 a correct and balanced equation for the cracking of decane, C<sub>10</sub>H<sub>22</sub> but not but-1-ene [1]
- (iii) water **or** steam [1]
- (b) (i) C<sub>4</sub>H<sub>9</sub>OH + 6O<sub>2</sub> → 4CO<sub>2</sub> + 5H<sub>2</sub>O [2]  
 If only error is balancing the oxygen atoms [1]
- (ii) butanol + propanoic acid → butyl propanoate + water [2]  
 correct products **or** reactants ONLY [1]
- (c) (i) correct structural formulae [1] each [2]  
 penalise once for CH<sub>3</sub> type diagrams  
 For C<sub>3</sub>H<sub>8</sub>O [0]
- (ii) to conserve petroleum **or** reduce greenhouse effect [1]
- (d) have same boiling point [1]

[Total: 13]