# UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

# MARK SCHEME for the May/June 2006 question paper

## 0620 CHEMISTRY

**0620/03**        Paper 3, maximum raw mark 80

These mark schemes are published as an aid to teachers and students, to indicate the requirements of the examination. They show the basis on which Examiners were initially instructed to award marks. They do not indicate the details of the discussions that took place at an Examiners' meeting before marking began. Any substantial changes to the mark scheme that arose from these discussions will be recorded in the published *Report on the Examination*.

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*.

The minimum marks in these components needed for various grades were previously published with these mark schemes, but are now instead included in the Report on the Examination for this session.

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1   (a)  compounds are highly coloured                                           [1]
         used as catalysts                                                       [1]
         more than one oxidation state                                          [1]
         Four boxes ticked that include three correct choices [2]
         Four boxes ticked that include two correct choices [1]
         Four boxes ticked that include one correct choices [0]
         Five boxes ticked [0]

    (b)  (i)   period 4                                                          [1]

         (ii)  26$p$ and 30$n$                                                   [1]

    (c)  (i)   limestone                                                         [1]

         (ii)  slag                                                              [1]

         (iii) iron ore                                                          [1]

    (d)  to burn **or** provide heat                                            [1]
         to make carbon monoxide                                               [1]

    (e)  mild steel          cars **or** machinery **or** fridges etc.           [1]
         stainless steel     cutlery **or** chemical plants etc.               [1]

                                                                    [TOTAL = 12]

2   (a)  X
         W
         Z
         Y                                                                       [2]
         For most reactive X and least Y [1] **ONLY**
         All other responses [0]

    (b)  magnesium          W                                                    [1]
         copper             Y                                                    [1]

    (c)  (i)   goes "pop" with burning splint                                    [1]
               **or** mixed with air and ignited goes pop
               **NOT** glowing splint

         (ii)  test and observable result                                       [1]
               universal indicator goes blue
               **or** pH paper goes blue
               **or** high pH, accept 13, 14
               **or** ammonium ion gives off ammonia
               **or** with metallic cations forms a precipitate                 [1]
               **NOT** litmus
               **ONLY** accept - neutralises acids with an observable result,
               e.g. becomes warm.

         (iii) Group 1                                                          [1]

         (iv)  electrolysis                                                     [1]
               **COND** molten                                                  [1]

                                                                    [TOTAL = 10]

**3 (a)** ammonia 10
hydrochloric acid 1
sodium hydroxide 13
ethanoic acid 4
All correct                                                                                        **[2]**
Two correct [1]

**(b)** With strong acid bulb brighter                                                  **[1]**
faster rate of bubbles                                                                        **[1]**
**OR** corresponding comments for weak acid

**(c)** proton **NOT** hydrogen ion                                                      **[1]**
$H^+$ not conditional on proton                                                         **[1]**
Only way for [2] is proton and $H^+$

**(d) (i)** CaO and MgO                                                                      **[1]**

**(ii)** $CO_2$ and $SO_2$                                                                    **[1]**

**(iii)** A$l_2O_3$                                                                              **[1]**

**(iv)** CO                                                                                       **[1]**

                                                                                        **[TOTAL = 10]**

**4 (a)** 4 Ge atoms around 1 Ge                                                         **[1]**
Looks tetrahedral **or** stated to be                                                   **[1]**

**(b) (i)** Graphite has layers                                                            **[1]**
**COND** that can move/slip
**or** weak bonds between layers                                                       **[1]**

Graphite has delocalised/free/mobile electrons                                   **[1]**

**(ii)** property and use                                                                     **[1]**
soft                             lubricant **or** pencils
**OR** good conductor        electrodes **or** in electric motors

**(c) (i)** $CO_2$ and $SiO_2$ **or** $XO_2$                                                **[1]**

**(ii)** $CO_2$ molecular **or** simple molecules **or** simple covalent      **[1]**
$SiO_2$ macromolecular **or** giant covalent                                       **[1]**

**(d)** $Ge_2H_6$                                                                               **[1]**

                                                                                        **[TOTAL = 10]**

**5** **(a)** **(i)** Burn sulphur in air (or oxygen) [1]

    **(ii)** as a <u>bleach</u> [1]

    **(iii)** kill bacteria/micro-organisms [1]
        **NOT** prevents food going bad or rotten or decaying

  **(b)** **(i)** decrease [1]

    **(ii)** exothermic [1]
        **COND** increase temperature favours back reaction so it is
        endothermic, so forward reaction must be exothermic [1]
        **OR** any similar explanation will be awarded the mark, for example
        The forward reaction is not favoured by an increase in temperature
        so it is exothermic (rather than endothermic)

    **(iii)** Low enough for good yield [1]
        High enough for (economic) rate [1]
        Any similar explanation will be awarded the mark
        **NOT** just that it is the optimum temperature

    **(iv)** bubble into (conc) sulphuric acid [1]
        add water [1]
        **NOT** consequential

                                                          **[TOTAL = 10]**

**6** **(a)** **(i)** Any bond that is broken C-H **or** O=O [1]

        Bond that is formed C=O **or** O-H [1]
        Do not insist on double bonds

    **(ii)** More energy is released forming bonds [1]
        than is used breaking bonds [1]
        For just - more energy released than used [1]
        For - energy is released forming bonds and it is used
        breaking bonds [1]

  **(b)** **(i)** U [1]
        235 [1]

    **(ii)** treatment of cancer, autoradiographs, tracer, sterilising food,
        surgical equipment, measuring thickness, checking welds [1]

  **(c)** **(i)** reductant zinc [1]
        oxidant hydrogen (ions) [1]

    **(ii)** magnesium instead of zinc **or** increase concentration of acid
        **or** copper instead of iron [1]

    **(iii)** sacrificial protection **or** stop iron/steel rusting     **[1]**
    **or** galvanising

**(d) (i)** pink **or** purple     **[1]**
    to colourless **or** decolourised     **[1]**
    **NOT** red **NOT** clear

    **(ii)** $2I^- - 2e = I_2$     **[2]**
    unbalanced **ONLY** [1]

                                     **[TOTAL = 15]**

**7 (a) (i)** any correct equation     **[1]**

    **(ii)** structural formulae from but-1-ene, but-2-ene, methylpropene
    **or** cyclobutane     Any **TWO**     **[2]**

**(b) (i)** light **or** 200°C **or** lead tetraethyl     **[1]**

    **(ii)** substitution **or** photochemical **or** chlorination **or** free radical     **[1]**
    or halogenation

    **(iii)** 1-chlorobutane, 2-chlorobutane, dichlorobutane etc.
    Any **TWO**     **[2]**

**(c) (i)** $CH_3CH_2CH_2OH$ **or** $CH_3CH(OH)CH_3$     **[1]**

    **(ii)** $CH_3CH(Br)CH_2Br$     **[1]**
    **NOT** 1,3-dibromopropane

**(d)** moles of $CH_3\text{-}CH = CH_2$ reacted = 1.4/42 = 0.033     **[1]**
**conseq**
maximum moles of $CH_3\text{-}CH(I)\text{-}CH_3$ that could be formed = 0.033     **[1]**
**conseq**
maximum mass of 2-iodopropane that could be formed = 5.61 g     **[1]**
accept 170 x 0.033 = 5.61 and 170 x 0.033333 = 5.67
**conseq unless greater than 100%**
percentage yield 4.0/5.67 x 100 = 70.5%     **[1]**
**Do not mark consequently to a series of small integers. There has to be
a serious attempt to answer the question, then consequential marking is
appropriate.**

                                     **[TOTAL = 13]**

                      **[For paper 12+10+10+10+10+15+13 = 80]**