

**UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS**  
International General Certificate of Secondary Education

## **MARK SCHEME for the May/June 2007 question paper**

### **0620 CHEMISTRY**

**0620/03**

Paper 3 (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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An incorrectly written symbol, e.g. NA **or** CL, should be penalised once in the paper.

- 1 (a) (i) coal **or** coke **or** peat [1]  
**NOT** wood **or** charcoal
- (ii) natural gas **or** methane **or** propane **or** butane **or** petroleum gases **or** calor gas **or** refinery gas [1]
- (b) (i) petrol **or** gasoline  
paraffin **or** kerosene  
diesel  
aviation fuel **or** jet fuel  
fuel oil  
heavy fuel oil  
heating oil  
Any **TWO** [2]  
**NOT** a named alkane e.g. octane
- (ii) waxes **or** grease **or** lubricants **or** polishes **or** bitumen (tar, asphalt) **or** naphtha [2]  
Any **TWO** from the primary or secondary distillation of petroleum
- (iii) (liquid) air **or** ethanol and water **or** alkenes (made by cracking) **or** Noble Gases [1]
- [Total: 7]**
- 2 good [1]  
named example e.g. sodium chloride [1]  
**ACCEPT** correct formula
- silica **or** silicon(IV) oxide **or** sand **or** silicon oxide  
named polymer only **TWO** elements [1]
- electrons [1] and positive ions [1] [2]  
good [1]
- [Total: 6]**
- 3 (i) method C [1]  
sulphuric acid (allow if given in equation) [1]  
zinc oxide + sulphuric acid = zinc sulphate + water [1]
- (ii) method A [1]  
hydrochloric acid [1]  
 $\text{KOH} + \text{HCl} = \text{KCl} + \text{H}_2\text{O}$  [1]
- (iii) method B [1]  
potassium iodide **or** any soluble iodide [1]  
 $\text{Pb}^{2+} + 2\text{I}^- = \text{PbI}_2$  accept a correct equation even if soluble iodide is wrong [2]  
Not balanced -  $\text{Pb}^{2+} + \text{I}^- = \text{PbI}_2$  ONLY [1]
- [Total: 10]**

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- 4 (a) (i) BaO [1]  
(ii) B<sub>2</sub>O<sub>3</sub> [1]
- (b) (i) S<sup>2-</sup> [1]  
(ii) Ga<sup>3+</sup> [1]
- (c) NCl<sub>3</sub> [1]  
**COND** 8e (1bp and 3nbp) around each chlorine [1]  
8e (3bp and 1nbp) around nitrogen [1]
- (d) (i) ignore a correct chemical property in (i)  
vanadium harder  
vanadium higher melting point **or** boiling point  
vanadium higher density  
**ANY TWO** [2]  
**OR** corresponding statements for potassium  
NB has to be comparison
- (ii) ignore a correct physical property in (ii)  
potassium more reactive or example of different reactivities-  
potassium reacts with cold water, vanadium does not.  
potassium one oxidation state, vanadium more than one  
vanadium coloured compounds, potassium white **or** colourless  
vanadium and its compounds catalysts, not potassium  
**ANY TWO** [2]  
NB has to be comment about both elements
- (e) (i) fluorine gas [1]  
astatine solid [1]
- (ii) both have valency of one  
both can react with other elements to form halides  
both are oxidants  
or any correct Chemistry – they both form acidic hydrides  
both have diatomic molecules  
both accept one electron **or** form ion X<sup>-</sup>  
both have seven valency electrons  
both react with non-metals to form covalent compounds  
both react with metals to form ionic compounds  
both form acidic oxides  
**NOT** have a valency of 7  
**ANY TWO** [2]

[Total: 15]

Page 4	Mark Scheme	Syllabus	Paper
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- 5 (a) (i) air would react (with the magnesium **or** titanium) [1]  
**OR** argon would not react (with the metals)  
**NOT** argon is inert
- (ii) any metal higher than magnesium in reactivity series [1]
- (iii) add water (to dissolve salt) [1]  
filter **or** centrifuge [1]
- (b) (i) electron loss [1]
- (ii) hydrogen [1]
- (iii) oxygen [1]  
chlorine [1]
- (iv) it cannot lose electrons (because) [1]  
it receives electrons (from the battery) [1]
- OR** reduction occurs at the cathode [1]  
oxidation at the anode (not cathode) [1]
- OR** electrons are “pushed” to rig [1]  
preventing it from being oxidised [1]
- for comments of the type – rusting needs oxygen, it is formed on titanium not iron **ONLY** [1]  
**NOT** the idea that titanium is more reactive etc
- (v) **SET 1**  
sacrificial protection is a cell  
does not need electricity  
cathodic protection is electrolysis  
cathodic protection needs electricity
- SET 2**  
sacrificial protection needs a more reactive metal (in contact with iron or steel)  
this metal corrodes instead of steel  
cathodic protection needs an inert electrode accept unreactive or less reactive metal as  
an electrode  
has to be **ONE** comment from each set [2]  
all comments about oxide layers and coating are neutral

[Total: 12]

Page 5	Mark Scheme	Syllabus	Paper
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- 6 (a) alumina **or** aluminium oxide [1]  
sodium aluminate [1]  
iron(III) oxide [1]  
filtration **or** centrifuge NOT conditional [1]
- (b) from left to right:  
carbon cathode **or** carbon negative electrode [1]  
900 to 1000°C [1]  
aluminium [1]  
cryolite [1]
- (c) (i)  $Al^{3+} + 3e = Al$  [2]  
not balanced [1]  
 $Al^{3+}(aq) = 0$
- (ii) oxygen is formed **NOT** oxide [1]  
reacts with carbon anode [1]
- (d) (i) low density **or** light **or** resistant to corrosion [1]  
accept strength/weight ratio **or** alloys are strong  
strong on its own is neutral
- (ii) not attacked **or** corroded **or** unreactive  
oxide layer  
easily shaped **or** malleable **or** ductile  
any **TWO** [2]
- (iii) for strength **or** so it does not break **or** does not sag **or** can have pylons further apart [1]  
**NOT** steel is a better conductor  
**NOT** aluminium protects steel from rusting

[Total: 16]

Page 6	Mark Scheme	Syllabus	Paper
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- 7 (a) butanol [1]  
no number needed but if one is given it has to be 1
- structural formula (all bonds shown) [1]  
accept –OH **NOT** –HO
- ethanoic acid [1]  
structural formula (all bonds shown) [1]  
accept –OH **NOT** –HO  
no conseq marking  
if all bonds are not shown ( CH<sub>3</sub>–CH<sub>2</sub>–), penalise once
- (b) (i) must have correct ester linkage [1]  
**COND** continuation and a group on either side of the ester group [1]  
Accept –COO–
- (ii) accept any sensible suggestion [1]  
ropes, clothing, bottles, packaging, bags
- (c) (i) 8 [1]
- (ii) double bond becomes single and 4 bonds per carbon atom [1]  
**COND** a bromine atom on each carbon [1]  
C<sub>2</sub>H<sub>4</sub>Br<sub>2</sub> ONLY [1]  
accept a structural formula with hydrogen atoms
- (iii) corn oil [1]
- (d) 100g of fat react with 86.2g of iodine  
884g of fat react with **762** g of iodine [1]  
limit 762 x 2  
one mole of fat reacts with 762/254 moles of iodine molecules  
one mole of fat reacts with **3** moles of iodine molecules [1]
- number of double bonds in one molecule of fat is **3** [1]  
limit 6  
**consequential** marking allowed provided the number of double bonds is an integer.

[Total: 14]