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

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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.

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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]
$KOH + HCl = KCl + H_2O$ [1]

(iii) method B [1]
potassium iodide **or** any soluble iodide [1]
$Pb^{2+} + 2I^- = PbI_2$ accept a correct equation even if soluble iodide is wrong [2]
Not balanced - $Pb^{2+} + I^- = PbI_2$ ONLY [1]

[Total: 10]

4 **(a)** **(i)** BaO [1]

(ii) B_2O_3 [1]

(b) **(i)** S^{2-} [1]

(ii) Ga^{3+} [1]

(c) NCl_3 [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^-
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]

5 (a) (i) air would react (with the magnesium **or** titanium)
OR argon would not react (with the metals) [1]
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]

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
accept strength/weight ratio **or** alloys are strong [1]
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]

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_3–CH_2–), 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
ropes, clothing, bottles, packaging, bags [1]

(c) **(i)** 8 [1]

(ii) double bond becomes single and 4 bonds per carbon atom [1]
COND a bromine atom on each carbon [1]
$C_2H_4Br_2$ 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]