UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the May/June 2011 question paper

for the guidance of teachers

0620 CHEMISTRY

0620/33 Paper 3 (Extended Theory), maximum raw mark 80

Mark schemes must be read in conjunction with the question papers and the report on the examination.

- Cambridge will not enter into discussions or correspondence in connection with these mark schemes.

Cambridge is publishing the mark schemes for the May/June 2011 question papers for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level syllabuses and some Ordinary Level syllabuses.

UNIVERSITY of CAMBRIDGE
International Examinations

1 **(i)** Rb / Sr [1]

(ii) I [1]

(iii) Fe [1]

(iv) P [1]

(v) Si [1]

2 **(a)** **(i)** no reaction [1]

$Fe + Sn^{2+} \rightarrow Fe^{2+} + Sn$ / $2Fe + 3Sn^{2+} \rightarrow 2Fe^{3+} + 3Sn$ [2]
for realising that there would be a reaction shown by an attempt to write an equation e.g. writing Fe_2Sn etc. allow [1]

no reaction [1]

(ii) tin oxide, nitrogen dioxide (accept nitogen(IV) oxide/dinitrogen tetroxide), oxygen
All three for two [2]
accept correct formulae

any two correct products [1]

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

(ii) $4OH^- \rightarrow O_2 + 2H_2O + 4e^-$ [2]
not balanced allow [1]

(iii) sulfuric acid [1]

(c) zinc is more reactive than iron/steel [1]
tin is less reactive than iron/steel [1]

zinc corrodes/reacts/loses electrons/is oxidised/is anodic/provides sacrificial protection/ forms positive ions (in preference to iron or steel) ORA
allow iron is cathodic for this mark. [1]

Iron/steel corrodes/reacts/rusts/loses electrons/is oxidised/is anodic/forms positive ions (in preference to tin). ORA
allow tin is cathodic for this mark [1]

3 (a) (i) concentration of thiosulfate is proportional to volume of thiosulfate solution added (when total volume is same in all experiments) / concentration of acid always the same [2]

for comments based on amount / to make experiments fair / comparable allow [1]

(ii) 240 s [1]

(iii) decreases/reaction slower [1]
because concentration of thiosulfate decreases [1]
frequency/chances/rate of collisions decreases [1]

one mark can be scored for less/smaller amount/smaller volume of thiosulfate / less collisions

(b) rate increases with temperature (or at 42 °C) ORA [1]

particles/molecules/ions move faster or gain energy / ORA [1]
(don't accept reactants or atoms)

more collisions / ORA [1]

(last mark is for qualification of the collisions) i.e.
greater frequency / more per unit time/more often /greater chance/more likely/more collision rate/more effective/more successful/more with activation energy / ORA [1]

4 **One** redox equation [1]
accept $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$
$2Fe_2O_3 + 3C \rightarrow 4Fe + 3CO_2$
$Fe_2O_3 + 3C \rightarrow 2Fe + 3CO$
$C + O_2 \rightarrow CO_2$
$CO_2 + C \rightarrow 2CO$

one acid/base equation [1]
$CaO + SiO_2 \rightarrow CaSiO_3$
or $CaCO_3 + SiO_2 \rightarrow CaSiO_3 + CO_2$

three more equations or comments [3]
carbon burns to form carbon dioxide
this reaction is exothermic or produces heat
carbon dioxide is reduced to carbon monoxide
carbon monoxide reduces hematite to iron
carbon reduces hematite to iron
limestone removes silica which is an impurity
to form slag which is a waste product
limestone decomposes or symbol/word equation

5 **(a)** $Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2$ / $Zn + 2H^+ \rightarrow Zn^{2+} + H_2$ [2]

marks are for correct reactants [1] correct products [1]
If ionic equation is given don't penalise SO_4^{2-} spectator ions on both sides

(b) (exothermic because) a cell produces (electrical) energy/electricity [1]

the next two marks score for

electrons are lost **AND** gained / oxidation no. or state/valency **both** increases and decreases / two correct half equations i.e. $Zn \rightarrow Zn^{2+} + 2e^-$ and $2H^+ + 2e^- \rightarrow H_2$ [2]

(c) zinc [1]
cond it is the more reactive metal / it supplies electrons / it forms ions more readily than iron [1]

(d) replace zinc with magnesium
replace iron with copper
use (more) concentrated sulfuric acid
accept use a more concentrated acid / a more concentrated solution

any **two** [2]

6 (a) (i) rate at which methanol formed by forward reaction [1]
equals rate it is reacting in back reaction [1]
rate of forward reaction equals rate of back reaction allow [1]

(ii) low/lower/decreased temperature [1]
high/higher/increased pressure [1]
Explanations not needed but if they are given they must be correct
IGNORE values of temperature and pressure

(iii) high pressure can be used / lower pressure due to expense or safety [1]
cannot use a low temperature as rate would be too slow the rate would not be economic [1]

(b) (i) ester [1]

(ii) soap/sodium stearate or any acceptable salt/glycerol [1]

(iii) burning both fuels forms carbon [1]

growing plants to make biodiesel removes carbon dioxide from atmosphere [1]

(c) (i) correct SF of an octane [1]

(ii) add bromine (water)/bromine in an organic solvent [1]
result octane remains brown/orange/yellow/red [1]
result octane goes colourless/decolourises [1]
not clear/discolours
colour of reagent must be shown somewhere for [3] otherwise max [2]
accept equivalent test using $KMnO_4$ in acid or alkali

7 **(a)** 3 bp and 1nbp around phosphorus [1]
1 bp and 3nbp around each chlorine [1]

(b) **(i)** $PCl_3 + 3H_2O \rightarrow 3HCl + H_3PO_3$ [1]

(ii) acid solutions same concentration [1]
measure pH/pH paper/Universal indicator [1]
hydrochloric acid lower pH [1]

colours of Universal indicator can be given as red<orange<yellow
ignore precise pH values as long as HCl is lower than H_3PO_3

OR Acid solutions same concentration [1]
add magnesium or any named metal above Hydrogen in reactivity series but not above magnesium
calcium carbonate or any insoluble carbonate [1]
hydrochloric acid react faster/shorter time [1]

OR acid solutions same concentration [1]
measure electrical conductivity [1]
hydrochloric acid better conductor/bulb brighter [1]

OR acid solutions same concentration [1]
add sodium thiosulphate [1]
hydrochloric acid forms precipitate faster/less time [1]

(iii) sodium hydroxide/sodium carbonate [1]
titration **cond** on correct reagent [1]
second mark scores for mention of titration /burette/pipette/indicator.
experimental detail not required

any named soluble calcium salt e.g. calcium chloride/nitrate/hydroxide [1]

precipitation/filter/decant/centrifuge [1]

8 (a) (i) (to avoid) carbon monoxide formation/so complete combustion occurs/avoid incomplete combustion So that CO_2 is produced [1]

CO does not dissolve/react with alkali [1]

(ii) CO_2 is acidic [1]

(iii) volume of gaseous hydrocarbon 20 cm^3
volume of oxygen used = 90 cm^3 [1]
volume of carbon dioxide formed = 60 cm^3 [1]

no mark for 20 cm^3 of hydrocarbon.

(iv) $2C_3H_6(g)/2CxHy(g) + 9O_2(g) \rightarrow 6CO_2(g) + 6H_2O(l)$ [1]

OR … $C_3H_6(g) + 9/2O_2(g) \rightarrow 3CO_2(g) + 3H_2O(l)$

C_3H_6 [1]

C_3H_6 can be given in the equation for the second mark

(b) (i) correct structural or displayed formula of another chlorobutane / dichlorobutane / polychlorobutane [1]

(ii) light / 200 °C / lead tetraethyl [1]

(iii) cracking is the decomposition/breaking down of an alkane/hydrocarbon/petroleum [1]
heat/high temperature / Temperature between 450 °C to 800 °C
OR catalyst / named catalyst [1]
to give a simpler alkane and alkene [1]

word equation or equation as example [1]

to make polymers / to increase petrol fraction / organic chemicals/petrochemicals / hydrogen [1]
any **four**