UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the May/June 2009 question paper

for the guidance of teachers

0620 CHEMISTRY

0620/31 Paper 3 (Extended Theory), maximum raw mark 80

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Page 2	Mark Scheme: Teachers' version	Syllabus	Paper
	IGCSE – May/June 2009	0620	31

1 (a) (i) basic set up – container and chromatography paper [1]

sample clearly above level of solvent [1]
(original mark must be shown and not just the line)

indication that more than one "spot" either on diagram **or** as comment [1]

Allow MAX [2] for round filter paper with green spot at centre
two or more rings

(ii) run chromatogram of pure chlorophyll can be implied [1]
same position of green spot **or** same Rf [1]
NOT just a green spot

(b) catalyst
photosynthesis **or** chloroplasts
photochemical reaction **or** needs light
carbon dioxide + water form
glucose **or** starch **or** oxygen **NOT** sugar
Any **THREE** correct points ignore incorrect answers [3]

[Total: 8]

2 molten potassium iodide **NOT** aqueous [1]

hydrogen [1]
oxygen [1]
water used up **or** solution becomes more concentrated **or** sodium chloride remains
NOT no change [1]
If products are given as hydrogen, chlorine and sodium hydroxide then 2/3

copper [1]
oxygen (and water) [1]
sulfuric acid accept hydrogen sulfate [1]

aqueous **or** dilute **or** concentrated potassium bromide [1]
accept correct formulae

[Total: 8]

3 (a) (i) D [1]

(ii) E [1]

(iii) B or F [1]

(iv) B [1]

(v) A [1]

(b) (i) CF_2 **or** CaI_2 [1]
COND next two marks conditional on correct formula
C^{2+} and F^- **or** Ca^{2+} and I^- [1]
7× and 1o round F/I [1]
NOTE covalent = 0
Ignore electrons around Ca
accept arrow notation arrow from electron on calcium atom to iodine

(ii) high melting point **or** boiling point
conducts when molten **or** in solution
soluble in water
brittle
correct chemical properties
hard
Any **TWO** [2]
NOT crystalline solid **NOT** does not conduct as a solid

[Total: 10]

4 (i) Cu and Pd [2]

(ii) Ba and La [2]

(iii) +2 **or** 2+ **or** Ba^{2+} [1]

(iv) Ba **or** La [1]

(v) it is a transition metal **or** a d block element [1]

[Total: 7]

5 (a) (i) $Ca^{2+} + 2F^- \rightarrow CaF_2$ [2]
Not balanced **ONLY** [1]
Both species must be correct for first mark. Second mark is for correct balancing.

(ii) Mole ratio Ca^{2+}: F^- is 1:2 [1]
Answer must mention moles
accept argument based on charges or <u>number</u> of ions
accept 2 moles of NaF react with 1 mole of $CaCl_2$
NOT just "2" in equation
If fluorine must specify atoms or ions

(iii) to remove traces of solutions **or** to remove soluble impurities **or** to remove a named salt sodium chloride **or** sodium fluoride **or** calcium chloride [1]
To remove impurities is not enough

(iv) to dry (precipitate) **or** to remove water **or** to evaporate water [1]
NOT to evaporate some of water **NOT** to crystallise salt

(b) $T_3(PO_4)_2$ allow correct example [1]
explain why 8 cm^3 react fully [1]
comment about mole ratio [1]

[Total: 8]

6 **(a)** **(i)** air (liquid) [1]
petroleum **or** crude oil **or** alkanes **or** methane **or** water **or** steam **or** steam reforming **or** suitable aqueous solution e.g. brine or sea water [1]
NOTE: cannot crack methane

(ii) iron [1]

(iii) (as a) fertiliser **or** to make fertilisers **or** to make nitric acid [1]

(b) **(i)** concentrations/macroscopic properties do not change [1]
accept amounts stay the same
NOT no change

rate of forward and back reactions equal [1]

(ii) it decreases with increase temperature [1]
or it increases with decrease temperature

(c) **(i)** shows an increase either a line **or** curve [1]
(any decrease = 0)

(ii) increase pressure favours the side with lower volume or molecules or moles [1]
that is RHS **or** products side [1]
ignore any mention of rates

[Total: 10]

7 **(a)** (total endothermic change = 436 + 242 = +)678 kJ [1]
(total exothermic change = 2 × 431 = –)862 kJ [1]
accept correct sign/supplied/absorbed for endo etc.
accept correct sign/evolved/produced for exo etc.
change for reaction = –184 kJ [1]

not necessary to calculate –184, just show that exo change > than endo
ecf allowed provided negative
–184 kJ scores all 3 marks

(b) **(i)** because it accepts a proton [2]
accepts hydrogen ion **or** H^+ **ONLY** [1]
proton and H^+ [2]

(ii) hydrogen chloride is a strong acid [1]
hydrogen fluoride is a weak acid [1]
weaker **or** stronger correctly applied for [2]

(iii) hydrogen chloride (aqueous) would have lower pH [1]
OR hydrogen fluoride (aqueous) would have higher pH
If values suggested, not over 7

[Total: 8]

8 **(a)** biodegradable or breaks down naturally
made from a renewable source **or** does not use up petroleum

reduce visual pollution **or** reduces need for landfill sites **or** less danger to wildlife
any **TWO** [2]
ignore mention of toxic gases

(b) **(i)** ester [1]
accept polyester **or** fat **or** lipid **or** vegetable oil **or** carboxylic acid

(ii) acid **or** carboxylic acid **or** alkanoic acid [1]
alcohol **or** hydroxyl **or** alkanol [1]
NOT formulae **NOT** hydroxide

(iii) condensation [1]
COND because water is formed in reaction
or monomer does not have C=C bond [1]

(c) **(i)** lactic acid $\rightarrow$ acrylic acid + water [1]

(ii) add bromine (water) or bromine in an organic solvent [1]
remains brown/orange/yellow [1]
goes colourless **NOT** clear [1]
If mark 1 near miss e.g. bromide allow marks 2 and 3
Colour of reagent must be shown somewhere for [3] otherwise max [2]

OR acidified potassium manganate(VII)
purple/pink to colourless

OR alkaline potassium manganate(VII)
purple/pink to green
or purple/pink to brown precipitate

(iii) reagent [1]
observable result [1]

suitable named metal (**NOT** sodium, lead, any metal below magnesium etc.)
if un-named metal [0] result can score [1]
hydrogen evolved or bubbles/effervescence/fizzing

insoluble metal oxide
colour change or dissolves

any carbonate or bicarbonate
gas/carbon dioxide/bubbles/effervescence/fizzing

sodium hydroxide or alkali
temperature increase **or** accept indicator to show neutralisation
unspecified base scores [1] only
NOT alcohol

[Total: 13]

9 **(a)** 72/24 = 3 and 28/14 = 2 [1]
Mg_3N_2 [1]
accept just formula for [2] even with incorrect or no working
NOT ecf

(b) $Al_4C_3 + 12H_2O = 4Al(OH)_3 + 3CH_4$ [2]
For Al_4C_3 ONLY [1]

(c) **(i)** silicon is limiting reagent [1]
0.07 moles of Si and 25/160 = 0.156 moles of Br_2 [1]
because 0.14 (2 × 0.07) < 0.156 [1]
If 80 used to find moles of Br_2 the mark 1 and 3 still available
arguments based on masses can be used

(ii) 0.07 [1]
NOT ecf

[Total: 8]