

**MARK SCHEME for the May/June 2011 question paper  
for the guidance of teachers**

**0620 CHEMISTRY**

**0620/31**

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, which would have considered the acceptability of alternative answers.

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

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- 1 (a) F or B diffusion / fractional distillation [1]
- (b) A simple distillation [1]
- (c) D chromatography [1]
- (d) E filtration [1]
- (e) C evaporation [1]
- (f) B fractional distillation [1]
- 2 (a) (i) photosynthesis or a photochemical reaction [1]  
**not** an example, question requires a process  
**not** devices which convert light into electricity
- (ii) cell [1]  
**accept** battery  
**not** generator
- (b) (i) correct formula [1]  
**cond** following marks conditional on correct formula  
 If covalent mark 1 only  
 correct charges [1]  
 6x and 2o around anion [1]  
 do **NOT** penalise for incorrect coding  
**ignore** electrons around potassium
- (ii) correct formula [1]  
 If ionic mark 1 only  
**cond**  
 2 bp and 2 nbp around selenium [1]  
 1 bp and 3 nbp around both chlorine atoms [1]
- (iii) the ionic compound  
 higher melting point / boiling point / less volatile  
 conducts when molten or aqueous, covalent compound does not  
 is soluble in water, covalent is not / ionic insoluble in organic solvents, covalent soluble  
 in organic solvents  
 harder  
 any **two** [2]  
**note** there has to be comparison between the ionic compound and the covalent  
 compound  
**not** density

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- (c) base [1]  
**not** alkali  
accepts a proton [2]  
accepts hydrogen ion / H<sup>+</sup> **only** [1]  
proton and H<sup>+</sup> [2]
- 3 (a) any four max 4  
carbon forms carbon dioxide / carbon monoxide [1]  
this is a gas it escapes / blown out / diffuses [1]  
silicon forms silicon(IV) oxide / silica [1]  
/ silicon(IV) oxide present in impure iron  
silicon(IV) oxide reacts with calcium oxide to form slag **or** calcium silicate [1]  
slag removed from surface [1]  
**accept** skimmed, syphoned, poured off  
**not** tapped max [4]  
**accept** correct formula or equations  
**not** calcium oxide reacts with silicon
- (b) (i) any sensible suggestion – harder/stronger/can be tailored for a specific use/more resistant to corrosion [1]  
**not** steel does not rust
- (ii) mild steel – cars or any vehicle/bicycles/white goods/screws or nails/roof/bridges/tools/buildings/ships/pipes/machinery etc. [1]  
  
stainless steel – chemical plants/cooking utensils/jewellery/cutlery/surgical equipment/kitchen sinks/pipes/etc. [1]
- (c) (i) strong attractive forces / strong bonds / bonds hard to break / requires a lot of energy to break bonds [1]  
**not** between ions, **not** between positive and negative ions,  
**not** between electrons  
  
between positive ions and (negative) electrons / opposite charges attract [1]
- (ii) because the layers, lattice or rows of ions/cations [1]  
**accept** sheets of ions  
**not** atoms / molecules / protons / nuclei  
  
can move / slip / slide past each other [1]
- 4 (a) (i)  $2\text{ZnS} + 3\text{O}_2 \rightarrow 2\text{ZnO} + 2\text{SO}_2$  [2]  
not balanced only [1]
- (ii) **two** reagents from named metal(s) more reactive than zinc/carbon monoxide [2]  
**not** hydrogen
- (iii) they have different boiling points [1]  
cadmium will distil first then zinc leaving lead/lead distilled last [1]

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- (b) for a high yield need low temperature [1]  
then rate would be too slow or uneconomic [1]  
a discussion of optimum temperature could score mark 1 and 2
- presence of catalyst would increase rate (at same temperature) [1]  
does not alter the yield (at that temperature) [1]  
/ economic rate at lower temperature, therefore higher yield
- higher pressure which would increase yield / rate [1]  
yield high enough / high pressure expensive [1]  
**max** [4]
- accept** reverse arguments  
**note** increase yield  $\equiv$  position of equilibrium to right
- 5 (a) (i)  $2\text{Li} + 2\text{HI} \rightarrow 2\text{LiI} + \text{H}_2$  [1]
- (ii) zinc carbonate + hydriodic acid  $\rightarrow$  zinc iodide + carbon dioxide + water [1]
- (iii)  $\text{MgO} + 2\text{HI} \rightarrow \text{MgI}_2 + \text{H}_2\text{O}$  [1]
- (b) reaction 1 is redox / Li/2HI reaction [1]  
**cond** reason either oxidation number/state / electron transfer [1]
- (c) with hydriodic acid – iodine formed / goes dark brown / grey/black solid [1]  
**not** purple vapour **not** purple/black solution
- with hydrobromic acid – bromine formed / goes orange / yellow / brown / reddish brown / red / brown vapour [1]  
**note** can accept brown for iodine provided bromine is different orange/brown etc.
- (d) (i) the reaction is exothermic / reaction produces heat/energy [1]  
all the sodium hydroxide used up/neutralised / reaction has stopped [1]
- (ii) adding colder acid / no more heat produced [1]  
if not given in (d)(i) any comments such as “reaction has stopped” can gain mark
- (iii) 1.33 / 1.3 / 1.3333 ( $\text{mol}/\text{dm}^3$ ) scores both marks [2]  
**not** 1.34  
for a correct method –  $M_1 V_1$  / moles of NaOH = 0.02  
with an incorrect answer **only** [1]

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- 6 (a) (i) cracking / heat with catalyst [1]  
to make butane [1]  
butene reacts with steam/water / hydrated [1]  
**accept** heat and catalyst for cracking but if specified: 450 to 800°C zeolites /  
aluminosilicates / silica / aluminium oxide/alumina / china / broken pot / porcelain /  
chromium oxide
- (ii) glucose / sugar changed to alcohol / ethanol [2]  
**accept** an unbalanced equation  
(catalysed by) enzymes / yeast [1]
- (b) butanoic acid [1]  
 $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-COOH}$  [1]  
hydrogen atoms omitted from ends of bonds, penalise once
- (c) (i) ester [1]
- (ii)  $\text{C}_6\text{H}_{12}\text{O}_2$   
**ignore**  $\text{CH}_3\text{COOC}_4\text{H}_9$  [1]
- (iii) correct structural formula of butyl ethanoate showing all bonds [2]
- 7 (a) metal A is magnesium [1]  
**cond** most reactive or fastest reaction [1]
- metal B is aluminium [1]  
**cond** faster reaction after removal of oxide layer / it would give more hydrogen / aluminium  
more reactive than zinc [1]
- metal C is zinc [1]  
zinc least reactive [1]  
**NOTE MAX** [5]  
If you encounter different reasoning which is correct, please award the appropriate marks.
- (b) for magnesium and zinc same volume of hydrogen [1]
- because both have valency of 2 / 1 mole of metal gives 1 mole of hydrogen / 1 mole of metal  
reacts with 2 moles of acid [1]
- bigger volume for aluminium because its valency is 3 / 1 mole of metal gives 1.5 moles of  
hydrogen / 1 mole of metal reacts with 3 moles of acid [1]
- If you encounter different reasoning which is correct, please award the appropriate marks.
- accept** balanced equations  
**accept** ionic charges as alternative to valency

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- 8 (a) addition – polymer only product / only one product [1]  
**accept** monomer has C=C  
**accept** monomer and polymer have same empirical formula  
**accept** no loss of material in polymerisation  
**not** only one monomer
- condensation – polymer and water / small molecule formed [1]
- (b)  $-\text{CH}_2 - \text{CCl}_2-$   
repeat unit correct [1]  
**COND** continuation [1]
- (c)  $\text{CH}_2 = \text{CHOOCCCH}_3$  [1]
- (d)  $-\text{OC}(\text{CH}_2)_4\text{CONH}(\text{CH}_2)_6\text{NH}-$   
**COND** amide correct linkage [1]  
correct repeat units [1]  
continuation [1]  
**not**  $\text{NH}_2$  or  $\text{COOH}$  endings

[Total: 80]