

## **MARK SCHEME for the May/June 2013 series**

### **0620 CHEMISTRY**

**0620/33**

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 should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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- 1 (a) (i) *element*  
cannot be broken into anything simpler by chemical means [1]  
**OR** made up of one type of atom only [2]
- (ii) *compound*  
two **or** more different elements [1]  
chemically bonded together [1]
- (iii) *mixture*  
two **or** more substances not chemically joined together [1]
- (b) (i) mixture [1]
- (ii) compound [1]
- (iii) element [1]
- (c) conductivity (of heat or electricity) [1]
- [Total: 9]

- 2 (a) (i) large / high surface area [1]
- high collision rate / collide more / many collisions [1]  
(between oxygen molecules and aluminium atoms)  
**NOT** faster collisions
- (ii) concentration [1]  
of reactants decreases [1]
- allow one mark **ONLY** for:*  
for reactants used up **or** amount of reactant decreases
- (iii) *any three of four from one strand:*

<b>M1</b>	increase in temperature	
<b>M2</b>	molecules move faster <b>or</b>	particles have more energy
<b>M3</b>	higher collision rate	
<b>M4</b>	more successful collisions <b>or</b>	more particles have enough energy to react/ $E_a$

[3]

- (b) (i) flour **or** wood dust **or** coal dust or carbon or sugar [1]

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- (ii) any three from:  
 powder and larger pieces / different sized particles use  
 suitable named solid, e.g. magnesium  
 suitable named solution, e.g. named acid **or** copper sulfate(aq)  
 result – powder reacts faster than larger pieces [3]  
**NOT** Cu (with acid); K / Na with anything
- 3 (a) (i) cars, ships, bridges, construction, white goods, screws, nails, roofing, fencing, etc. [1]
- (ii) e.g. stainless steel [1]  
 cooking utensils, surgical equipment, sinks or main use [1]
- (b) blow in oxygen **NOT** air [1]  
 carbon dioxide and sulfur dioxide (escape as gases) [1]  
**COND** on reaction with air / oxygen  
 add calcium oxide / quicklime [1]  
**ALLOW** calcium carbonate, limestone  
 phosphorus oxide **or** silicon oxide (are acidic)  
 reacts (with calcium oxide / CaCO<sub>3</sub>) [1]  
 to form slag / calcium silicate [1]
- 4 (a) (i) any ambiguous formula, e.g. GeH<sub>3</sub>-GeH<sub>2</sub>-GeH<sub>3</sub> [1]
- (ii) Ge<sub>n</sub>H<sub>2n+2</sub> [1]  
**NOT** C instead of Ge
- (b) correct formula  
**COND** 4bps around germanium atom [1]  
**COND** 3nbps and 1bp around each chlorine atom [1]
- (c) four oxygen atoms around each germanium atom [1]  
 two germanium atoms around each oxygen atom [1]  
 tetrahedral [1]
- (d) oxidation [1]  
**COND** increase in oxidation number [1]  
**ACCEPT:** electron loss

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- 5 (a) (i) any Group 1 metal [1]  
**ACCEPT:** lithium
- (ii)  $2\text{Pb}(\text{NO}_3)_2 \rightarrow 2\text{PbO} + 4\text{NO}_2 + \text{O}_2$  [2]  
PbO [1]  
**COND** balancing [1]
- (iii) the metal in a (i) is **more reactive** than lead [1]  
more reactive metals have **more stable** compounds  
**OR** has stronger (ionic) bonding [1]
- (b) (i) speed / rate of forward reaction = speed / rate of back reaction [1]  
**OR** macroscopic properties do not change / constant (with time)
- (ii) goes darker **OR** goes brown [1]  
**COND** lower pressure favours side with more moles [1]  
**COND** this is  $\text{NO}_2$  side **OR** reactant side **OR** goes left [1]
- (iii) exothermic [1]  
low temperatures favour the exothermic reaction **or**  
low temperatures moves equilibrium to right / product side / towards  $\text{N}_2\text{O}_4$  [1]
- (iv) forward reaction is bond forming [1]
- 6 (a) (i) measure melting point **NOT** just heating [1]  
pure sample would melt at  $135^\circ\text{C}$  [1]  
**OR** impure would melt lower than  $135^\circ\text{C}$
- (ii)  $\text{C}_3\text{H}_4\text{O}_4$  [1]
- (iii)  $\text{C}_2\text{H}_4\text{O}_2$  **OR**  $\text{CH}_3\text{COOH}$  [1]  
ethanoic **OR** acetic acid [1]  
both marks are independent of each other
- (iv) ester **NOT** organic, covalent [1]
- (b) (i) malonic is a weaker acid/less dissociated  
**OR** sulfuric acid is a stronger acid/more dissociated [1]  
**NOT** sulfuric acid is a strong acid

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(ii) add piece of suitable metal, e.g. Mg **ALLOW** Al, Ca **NOT** K, Na, Cu [1]

sulfuric acid reacts faster **OR** malonic reacts slower [1]

**OR**

as above add a piece of CaCO<sub>3</sub>, if soluble carbonate then [1] only

**OR** measure electrical conductivity [1]

sulfuric acid is the **better** conductor

**OR** malonic acid **poorer** conductor [1]

**NOT** sulfuric acid is a good conductor

(c) (i) sodium malonate **and** water [1]

(ii) CuSO<sub>4</sub>  
H<sub>2</sub>O [2]

(iii) CH<sub>2</sub>(COO)<sub>2</sub> Mg  
H<sub>2</sub> [2]

(iv) K<sub>2</sub>SO<sub>4</sub>  
CO<sub>2</sub> **and** H<sub>2</sub>O **NOT** H<sub>2</sub>CO<sub>3</sub> [2]

[Total: 16]

7 (a) (i) a compound which contains carbon and hydrogen **only** [1]

(ii) alkanes contain **only** C-C single bonds  
**or** they are saturated (hydrocarbons)  
**or** have the general formula C<sub>n</sub>H<sub>2n+2</sub> [1]

alkenes contain at least one C=C double bond  
**or** they are unsaturated (hydrocarbons)  
**or** have the general formula C<sub>n</sub>H<sub>2n</sub> [1]

(b) C<sub>20</sub>H<sub>42</sub> → 2C<sub>4</sub>H<sub>8</sub> + 2C<sub>2</sub>H<sub>4</sub> + C<sub>8</sub>H<sub>18</sub> [1]

(c) (i) any unambiguous structure of BrCH<sub>2</sub>CH<sub>2</sub>Br [1]  
**NOT** just C<sub>2</sub>H<sub>4</sub>Br<sub>2</sub>

(ii) CH<sub>3</sub>-CH=CH-CH<sub>3</sub> [2]  
For any butene [1] only

(iii) (CH<sub>3</sub>-CH<sub>2</sub>-CH=CH<sub>2</sub>) + H<sub>2</sub>O [1] → CH<sub>3</sub>-CH<sub>2</sub>-CH<sub>2</sub>-CH<sub>2</sub>OH [1]  
**ALLOW** CH<sub>3</sub>-CHOH-CH<sub>2</sub>-CH<sub>3</sub>  
butene reacts with **water/steam** (to form butanol) **ONLY** [1]

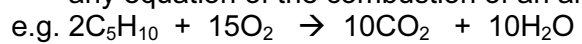
(iv) C<sub>6</sub>H<sub>12</sub> + H<sub>2</sub> → C<sub>6</sub>H<sub>14</sub> [2]  
alkenes react with **hydrogen** [1] **ONLY**

(d) volume of oxygen used = 150 cm<sup>3</sup> [1]

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volume of carbon dioxide formed = 100 cm<sup>3</sup> [1]

any equation of the combustion of an alkene



formulae [1]

**COND** balancing [1]