CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the May/June 2013 series

0620 CHEMISTRY

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

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1 (a) (i) *element*
cannot be broken into anything simpler [1]
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:*

M1	increase in temperature	
M2	molecules move faster **or**	particles have more energy
M3	higher collision rate	
M4	more successful collisions **or**	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 / $CaCO_3$) [1]
to form slag / calcium silicate [1]

4 (a) (i) any ambiguous formula, e.g. GeH_3-GeH_2-GeH_3 [1]

(ii) Ge_nH_{2n+2} [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) $2Pb(NO_3)_2 \rightarrow 2\mathbf{PbO} + 4NO_2 + O_2$ [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 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 N_2O_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 °C [1]
OR impure would melt lower than 135 °C

(ii) $C_3H_4O_4$ [1]

(iii) $C_2H_4O_2$ **OR** CH_3COOH [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** A*l*, Ca **NOT** K, Na, Cu [1]

sulfuric acid reacts fast**er OR** malonic reacts slow**er** [1]

OR
as above add a piece of $CaCO_3$, if soluble carbonate then [1] only

OR measure electrical conductivity [1]
sulfuric acid is the bett**er** conductor
OR malonic acid poor**er** conductor [1]
NOT sulfuric acid is a good conductor

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

(ii) $CuSO_4$
H_2O [2]

(iii) $CH_2(COO)_2Mg$
H_2 [2]

(iv) K_2SO_4
CO_2 **and** H_2O **NOT** H_2CO_3 [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_nH_{2n+2} [1]

alkenes contain at least one C=C double bond
or they are unsaturated (hydrocarbons)
or have the general formula C_nH_{2n} [1]

(b) $C_{20}H_{42} \rightarrow 2C_4H_8 + 2C_2H_4 + \mathbf{C_8H_{18}}$ [1]

(c) (i) any unambiguous structure of $BrCH_2CH_2Br$ [1]
NOT just $C_2H_4Br_2$

(ii) $CH_3\text{-}CH{=}CH\text{-}CH_3$ [2]
For any butene [1] only

(iii) $(CH_3\text{-}CH_2\text{-}CH{=}CH_2) + H_2O$ [1] $\rightarrow CH_3\text{-}CH_2\text{-}CH_2\text{-}CH_2OH$ [1] [2]
ALLOW $CH_3\text{-}CHOH\text{-}CH_2\text{-}CH_3$
butene reacts with **water/steam** (to form butanol) **ONLY [1]**

(iv) $C_6H_{12} + H_2 \rightarrow C_6H_{14}$ [2]
alkenes react with **hydrogen** [1] **ONLY**

(d) volume of oxygen used = 150 cm^3 [1]

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volume of carbon dioxide formed = 100 cm^3 [1]

any equation of the combustion of an alkene
e.g. $2C_5H_{10} + 15O_2 \rightarrow 10CO_2 + 10H_2O$
formulae [1]

COND balancing [1]

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