CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the May/June 2013 series

0439 CHEMISTRY (US)

0439/33 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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CAMBRIDGE
International Examinations

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]

(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

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

(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]

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]