CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the May/June 2013 series

0439 CHEMISTRY (US)

0439/23 Paper 2 (Core 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)** **A**; **E** (1 mark each)

(ii) **C**

(iii) **C** [1]

(iv) **B** [1]

(b) $^{3}_{2}He$ [1]

ALLOW: $^{3}_{2}D$

(c) 1 mark each for: [4]
protons;
neutrons;
radioactive;
energy; **ALLOW**: neutrons

[Total: 10]

2 **(a)** **(i)** boiling point below room temperature [1]
ALLOW: it boils at –35 °C
IGNORE: boiling point is too low

(ii) melting point below room temperature and boiling point above room temperature [1]
ALLOW: it melts at –7 °C and boils at 59 °C
IGNORE: other stated figures

(b) increases (down the group) [1]

(c) **ALLOW**: 0.06 – 0.08 (actual = 0.071) [1]

(d) green / light green / yellow-green [1]
REJECT: yellow alone
REJECT: blue-green

(e) 7 electrons in outer shell; [1]

8 electrons in middle shell [1]
NOTE: electrons can be shown as dots, crosses or e^{-}

ALLOW: 2, 8, 7 in numbers for 2 marks

(f) **(i)** Br_2 on right;

2 on left (dependent on Br_2 or 2Br on right)

(ii) iodine is less reactive than bromine ORA [1]
NOTE: both iodine and bromine (or symbols or formulae) are required
ALLOW: bromine is higher in the electrochemical series than iodine
IGNORE: less reactive than brom**ide**
IGNORE: iodine is lower in the group / Periodic Table than bromine ORA

[Total: 10]

3 **(a)** Any four of: [4]
- in solid, particles are arranged regularly (or are ordered) / in a lattice
- in solid, particles are close together
- in solid, particles are not moving / only vibrate / are in fixed position
- in liquid, particles randomly arranged / disordered / have random motion
- in liquid, particles slide over each other / move slowly
- in liquid, particles are close together

IGNORE: particles are closer together

Any one of: [1]
- during melting, particles become less ordered
- during melting, particles start moving / move more / move faster

IGNORE: during melting, particles get further apart
NOTE: there must be a reference to particles to score marks

(b) Any three of: [3]
- lustrous or shiny **ALLOW**: silvery
- conduct heat / conduct electricity / conduct
- malleable or can be shaped: **ALLOW**: can be bent
- ductile / can be drawn into wires
- **ALLOW**: solid at room temperature / solid below 37 °C

IGNORE: high boiling point / comments about density / sonorous / comments about hardness

(c) Ga_2Cl_6 [1]

(d) **(i)** lower density / better electrical conductor [1]
IGNORE: low density / lighter / lightweight / good electrical conductor
NOTE: comparative needed

(ii) stronger / cheaper [1]
NOTE: comparative needed

(iii) lower density; cheaper (1 mark each) [2]
NOTE: comparative needed

(e) food containers / cooking utensils / aircraft or cars (bodywork) / rail truck (or rail (bodywork) / bicycles / (drink) cans / foil / windows / doors / roofing / walking poles / all magnets / (some types of) CD's / transistors / (high brightness) LEDs / paints / (solid) rocket fuels / coins / guitar plates (or necks) / mirrors / any other suitable use [

[Total: 14]

4 **(a)** **(i)** filtration: idea of removing larger particles or insoluble particles; [1]
ALLOW: to remove clay particles / soil particles / sticks / large impurities
IGNORE: remove large molecules / to remove impurities / to clean the water
chlorination: to kill bacteria [1]
ALLOW: to kill germs / to kill microorganisms
IGNORE: to disinfect / to remove bacteria / to get bacteria out

(ii) any suitable use for water **in the home**, e.g. for
washing / cooking / cleaning / sanitation [1]
IGNORE: for cooling **but ALLOW**: for cooling body, i.e. lowering body temperature (of fever)
IGNORE: industrial uses

(b) anhydrous / white copper sulfate; [1]
IGNORE: incorrect oxidation numbers

turns blue [1]

OR

anhydrous / blue cobalt chloride (1 mark);
turns pink (1 mark)

NOTE: second mark dependent on first being correct
BUT: copper sulfate turns blue / cobalt chloride turns pink = 1 mark

(c) **(i)** dot and cross placed between each H atom and the O [1]
ALLOW: two dots / two crosses / two 'e' for each bond
IGNORE: electrons in inner shell of oxygen if drawn
REJECT: inner electron shells given to hydrogen / extra electrons in outer shell of hydrogen or oxygen

(ii) covalent + reasons, e.g. because electrons are shared / pair of electrons form the bond(s) [1]
IGNORE: because they are two non-metals

(d) (pH) 7 [1]

(e) sodium + water → sodium hyrdroxide + hydrogen [1]
IGNORE: symbol equations

[Total: 9]

5 **(a)** exothermic
IGNORE: combustion

(b) O_2; [1]
2 (dependent on O_2 or 2O) [1]

(c) **(i)** **B** [1]

(ii) fuel for cars / fuel for vehicles [1]
ALLOW: implication of powering cars / vehicles
IGNORE: fuel or cars without any qualification

(d) **(i)** all points plotted correctly; [2]
IF: 1 point incorrectly plotted = 1 mark
line correctly drawn through points [1]

(ii) 99 (°C) or from value correctly shown on graph with incorrect line [1]

(e) **(i)** Any two of: [2]
(group of chemicals with)
- similar chemical properties **IGNORE**: same chemical properties
- same functional group
- same general formula **IGNORE**: have a general formula
- successive members differ by CH_2 group
- general trend in physical properties

(ii) high temperature / heat; [1]
ALLOW: stated temperatures between 300 and 900 °C
IGNORE: temperature unqualified

catalyst; [1]
ALLOW: aluminium + silicon oxides / zeolites
REJECT: incorrect name alone, e.g. nickel

OR

high pressure (1 mark)
ALLOW: stated pressures between 50–100 atmospheres
IGNORE: pressure unqualified

[Total: 13]

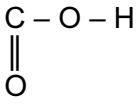
6 **(a)** Any four of:

liquid in beaker / other suitable container with chromatography paper dipping into the liquid
solvent labelled or named as word solvent or as specific named solvent (must be in correct context, e.g. in beaker)
REJECT: solution of substance to be chromatographed
spot placed on paper above solvent level
allow solvent to run up the paper / solvent carries the dyes up the paper
the spots separate / different dyes go different distances
IGNORE: the dyes separate (in stem of question)
compare distance spot moves to a standard
ALLOW: more advanced points, e.g. mark solvent front / compare R_f values
ALLOW: marks from labelled diagram

(b) **(i)** **F** [1]

(ii) **G** [1]

(iii) **G** [1]

(c)

[1]

ALLOW: COOH / CO_2H

(d) substance which dissolves another / substance which dissolves a solute [1]

(e) **(i)** 4 [1]

(ii) 10 [1]

[Total: 11]

7 **(a)** **(i)** protein / catalyst; [1]

speeds up a reaction / increases rate of reaction / makes reaction faster [1]
ALLOW: changes the rate of a reaction
IGNORE: makes a reaction slower

(ii) 2 (on left) and no other figures added; [1]

(b) **(i)** increasing the concentration increases rate ORA [1]
IGNORE: concentration increases rate

(ii) initial slope of line between that of 0.2 and 0.4 mol dm^{-3} concentrations; [1]

line levels off about half way between 18 and 22 cm^3 [1]

(iii) volume – 26 (cm^3)

time – 20 (s)

(c) (i) loss of oxygen / decrease in oxidation number / gain of electrons [1]
ALLOW: gain of hydrogen

(ii) calcium sulfate; [1]

water [1]
IGNORE: symbol equation
APPLY: listing

(iii) add (aqueous) silver nitrate; [1]

(pale) yellow precipitate [1]
(second mark dependent on first being correct)

OR
add (aqueous) lead nitrate (1 mark)
yellow precipitate (1 mark)
(second mark dependent on first being correct)

[Total: 13]