CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the October/November 2012 series

0439 CHEMISTRY (US)

0439/21 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)** C / C_2H_4 / ethene;

(ii) A / CO_2 / carbon dioxide;

(iii) E / ethanol / correct formula for ethanol; [1]

(iv) D / CH_4 / methane; [1]

(v) A / CO_2 / carbon dioxide; [1]
allow: E

(vi) E / ethanol / correct formula for ethanol; [1]
allow: A

(b) C_2H_4; [1]

(c) compound: substance containing two or more different atoms joined / bonded together / substance containing 2 or more elements that can only be separated by chemical means; [1]
allow: different atoms joined / different elements joined / 2 elements react to form a molecule / molecule with 2 or more elements / substances chemically combined
ignore: two or more molecules combined / different elements react / substances made up of molecules
reject: if reference to a mixture

inert: unreactive / doesn't react; [1]

catalyst: substance which speeds up a reaction / it speeds up a reaction; [1]
allow: changes rate of reaction / changes speed of reaction

[Total: 10]

2 **(a)** structure completely correct;; [2]
allow: 1 mark for 1 pair of electrons bonded between H and C*l*;
ignore: inner shell electrons

(b) **(i)** A: burette; [1]
B: flask / erlenmeyer; [1]

(ii) pH starts above 7 / stated value above 7; [1]
allow: high pH

decreases (on addition of acid); [1]

(pH) ends at below 7 / stated value below 7; [1]
allow: low pH
note: pH decreases to pH 7 = 2 marks
note: pH goes from alkali to acid = 1 mark

(iii) ammonium chloride;
reject: ammonia chloride

NH_3; [

(c) any 4 of: [4]
blue solution at start /
precipitate formed /
(light) blue (precipitate) /
precipitate redissolves (in excess ammonia) / solution formed (in excess ammonia) /
precipitate disappears
(solution is) deep blue / dark blue
allow: goes deep blue / dark blue / goes darker blue

[Total: 13]

3 **(a)** **(i)** magnesium → zinc → iron → lead / Mg > Zn > Fe > Pb;; [2]
if: one pair reversed / complete order reversed = 1 mark

(ii) no / it will not react **and** zinc is more reactive / iron is less reactive; [1]
ignore: zinc is reactive / iron is unreactive

(b) 1st box ticked; [1]
last box ticked; [1]

(c) **(i)** arrangement: regular / fixed pattern / any indication of regularity e.g. in layers; [1]
allow: close together / packed together
ignore: stick together / all together

motion: cannot move / fixed in position/ (only) vibrate; [1]
ignore: only move a little / move

(ii) any three of: [3]
dissolve sodium chloride / add water /
filtration / use a filter paper /
sand remains on filter paper /
ignore: residue on filter paper
salt solution goes through (filter paper) / salt solution is the filtrate / salt water goes into the collecting tube
allow: decanting for 1 mark (in place of filtration)
ignore: water goes through
ignore: distillation

(d) distillation; lower; volatile; condenser; vapour; (1 mark each) [5]

[Total: 15]

4 **(a)** atoms with same number of protons but different number of neutrons;
allow: atomic number for number of protons
allow: different mass number / nucleon number for different number of neutrons
allow: same (type of) atom with different mass numbers
ignore: atoms with different numbers of neutrons
ignore: element(s) with different numbers of neutrons
ignore: atoms with different relative atomic mass

(b) any 5 of: [5]
nucleus (need not be labelled) in middle of atom and electrons round outside (electrons can be shown as dots, crosses or e) /
protons in nucleus – labelled or shown by + or p /
3 (protons) /
neutrons in nucleus – labelled or shown by n /
4 (neutrons) /
3 electrons – labelled or shown by dots, crosses or e /
2 electrons in first shell and 1 in second

(c) $4Li + O_2 \rightarrow 2Li_2O$;;; [3]
allow: two marks for $2Li + O \rightarrow Li_2O$ / $4Li + 2O \rightarrow 2Li_2O$
allow: 1 mark for O_2 if no other marks scored

(d) **(i)** electrolyte correctly labelled; [1]
anode rod correctly labelled; [1]
ignore: label on circuit / label on + sign

(ii) dissolved in <u>water</u> / solution in <u>water</u>; [1]
allow: answers implying substance is mixed with water
ignore: hydrated / hydrous

(iii) ions can move; [1]
allow: ions are free
reject: electrons can move

[Total: 13]

5 **(a)** hydrogen → a fuel with RMM of 2; [1]
methane → the main constituent of natural gas; [1]
fuel oil → fuel for ships; [1]
kerosene → fuel for aircraft; [1]

(b) **(i)** amount or mass or volume of water / distance of flame from can / height of flame / same can; [1]
ignore: the water (unqualified) / same amount of fuel / time

(ii) to make sure that the water has the same temperature (throughout) / it is at the same temperature / so it is heated evenly / so there are no hot spots / so there are no cold spots; [1]
allow: so that all the particles are heated
ignore: so that particles mix

(iii) petroleum spirit;
highest temperature rise / highest increase in temperature;
allow: calculation of all the temperature differences form the table
ignore: because it releases most heat / because it has the highest temperature
if fuel incorrect = 0 for the question

(c) A = nitrogen / N_2 / N; [1]
B = oxygen / O_2 / O; [1]

(d) **(i)** lamps / (to provide an) inert atmosphere / in welding / lasers etc [1]
allow: for lighting
ignore: for neon lights

(ii) 3 / third / III; [1]

(iii) inert / unreactive; [1]
ignore: it is stable

[Total: 13]

6 **(a)** any 4 of: [4]
crystals dissolve or go into solution /
diffusion /
random movement of ions or named particles (can be atoms or ions or particles or molecules) / particles move everywhere / particles spread out / particles mix
both ions and water in constant movement /
particles collide /
particles react / ions react / atoms react
Ag ions and iodide ions (react) /
(to make) precipitate of silver iodide /
ignore: particles move (unqualified)

(b) $2KI + Cl_2 \rightarrow 2KCl + I_2$; [2]
allow: 1 mark for $2KI + 2Cl \rightarrow 2KCl + I_2$;

[Total: 6]

7 **(a)** 24; [1]

(b) 256; [1]

(c) any 4 of:
coal / petroleum / crude oil / named fraction from crude oil
sulfur reacts with oxygen / air
(sulfur burns) to form sulfur dioxide
ignore: sulfur oxide
sulfur dioxide reacts (with gases) in the atmosphere / sulfur dioxide reacts with oxygen / nitrogen oxides
to form sulfur trioxide
sulfur dioxide / trioxide react with water / rain
allow: sulfur dioxide / trioxide dissolves in water / rain
allow: sulfur oxide(s) mix with water / rain
(to form) sulfurous/ sulfuric acid

(d) nitrogen / N_2 / N; phosphorus / P; [2]

(e) add (acidified) barium chloride / barium nitrate; [1]
white precipitate; [1]
note: second mark dependent on correct reagent

[Total: 10]