CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International General Certificate of Secondary Education

MARK SCHEME for the October/November 2014 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.

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1 **(a)** **(i)** E

(ii) A and D

(iii) D [1]

(iv) B [1]

(v) D [1]

(vi) A and D [1]

(b) $C_2H_4Br_2$ [1]

(c) 4 (H_2O) [1]

5 (O_2) [1]
note: mark dependent on 4 (H_2O)

[Total: 9]

2 **(a)** **(i)** sodium / Na^+ [1]

(ii) X is fluoride [1]

Y is nitrate [1]

(iii) 0.244 (mg) [1]
allow: 0.24

(iv) 4th box down ticked (weakly acidic) [1]

(b) (add nitric acid) add silver nitrate [1]

white precipitate [1]
note: mark dependent on correct reagent

(c) polymer [1]

monomer [1]

[Total: 9]

3 **(a)** ring around the OH group

(b) bromine (water)
allow: bromination

decolourised / turns colourless [1]
note: mark dependent on correct reagent
ignore: goes clear / gets discoloured

allow: potassium manganate(VII) / potassium permanganate (1)
turns colourless (1)

ignore: incorrect colour of reagent

(c) **(i)** to break up the cells / to extract the pigment / to separate the pigment from the petals / idea of getting the colour out of the petals, e.g. otherwise the colour won't come out [1]

idea that solvent dissolves the pigment / idea of making a solution [1]
ignore: find out how pure the rose petals are / reference to separating colours

(ii) pigment might be absorbed onto filter paper / pigment sticks to filter paper [1]

(d) **(i)** chromatography [1]

(ii) spot near the bottom and above the solvent level [1]

(iii) to keep atmosphere in jar saturated (with solvent vapour) [1]
allow: to reduce / prevent (solvent) evaporation

(iv) A and C [1]

(e) structure of ethanol with ALL atoms and bonds shown [2]

[Total: 12]

4 **(a)** thermometer

(b) Any **two** from: [2]

- same volume of water in can
- same height of burner (from can)
- wick same height
- same rate / amount of stirring of water
- **allow**: same temperature of water at start
- **allow**: same amount of fuels burnt / same temperature rise
- **allow**: same type of can

(c) so same temperature throughout the water / to stop differences in temperature in the different parts of the water / otherwise the temperature will be higher at the bottom (of the water) / so not hotter in one place [1]
ignore: to mix the water / so there are no convection currents

(d) decreases / goes down [1]

idea of liquid or fuel turning to vapour / gas; [1]
allow: gases formed
ignore: fuels evaporate
note: 2nd mark dependent on first

(e) F [1]

(f) **(i)** mixture of metals / mixture of metal(s) + non-metals [1]
do not allow: compound

(ii) covers surface / idea of protective layer [1]

prevents contact with air / prevents contact with water / so air (or water) does no react with steel [1]
do not allow: reference to tin being more reactive / sacrificial protection (for second marking point)

(g) 1st box down ticked (giant covalent) [1]

[Total: 11]

5 **(a)** Any **four** from:

- suitable named metal / metal oxide e.g. reactive metal such as Mg / Zn or
- their oxides
- suitable named acid
- metal + acid gives metal salt / named metal gives named metal salt
- metal + acid gives off hydrogen

note: complete word equation for metal + acid → salt + hydrogen (2)

- metal oxide + acid gives metal salt / named metal oxide gives named metal
- salt
- water also product of reaction of metal oxide + acid

note: complete word equation for metal oxide + acid → salt + water (2)

(b) exothermic [1]

(c) suitable use of radioactive isotope e.g. detecting leaks in pipes / checking thickness of paper / tracer / cancer treatment / investigating thyroid function [1]
ignore: atomic bombs / explosions

(d) protons 92 and 92 [1]

neutrons 143 and 146 [1]

electrons 92 and 92 [1]

[Total: 9]

6 **(a)** **(i)** (concentration) decreases [1]

then remains constant [1]
allow: levels out

(ii) 3.8 (hr) / 3 hr 48 min [1]

(iii) 9 (hr) [1]
allow: 8.8–9.2 (hr)

(iv) steeper graph line from same starting point [1]

levels off lower than 0.10 mol /dm^3 [1]

(v) increase the temperature / increase concentration of sodium hydroxide [1]
allow: add a catalyst

(b) Any **four** from:

- acid in burette
- use (volumetric) pipette to put sodium hydroxide into flask

allow: sodium hydroxide in burette / acid in flask

- idea of correct setup of apparatus, i.e.flask under burette
- indicator in flask
- run hydrochloric acid into sodium hydroxide
- until indicator changes colour
- any indication of good technique e.g. repeating experiment / add acid
- slowly / shaking flask after each addition of acid

note: answers must be in the correct context, e.g. do not allow indicator in burette

(c) bonding pair of electrons between H and Cl and no additional electrons on the H atom [1]

six non-bonding electrons around the chlorine atom [1]

ignore: inner shell electrons in Cl.

[Total: 13]

7 **(a)** for better crop / for better plant growth / to replace elements (or named elements or minerals) lost from soil when crops harvested / for more plant protein [1]

allow: to give more nutrients to plants

ignore: for healthy plant growth / to give plants the compounds they need to grow / to help plants grow

(b) neutralisation acid-base (reaction) [1]

(c) ammonium nitrate [1]

(d) 2 NH_4^+ to 1 SO_4^{2-} / 2 ammonium to 1 sulfate [1]

allow: 2:1 or 1:2 ratio unqualified

allow: $(NH_4)_2SO_4$

(e) Any **two** from: [2]

- slaked lime can form an alkaline solution with water / slaked lime is calcium
- hydroxide / slaked lime is a hydroxide / slaked lime is basic
- slaked lime reacts with ammonium (salts)

allow:: slaked lime reacts with fertiliser

- ammonia escapes from soil / gas escapes from soil

(f) positive: anode and negative cathode

at + electrode → chlorine

at – electrode → potassium [1]

[Total: 9]

8 **(a)** Any four from: [4]

- dissolving
- diffusion
- in iodine solid the particles are close together
- in iodine solid the particles only vibrate ALLOW: particles do not move
- in solution the iodine molecules are further / far apart
- in solution the particles are randomly arranged/ no particular arrangement
- in solution, particles move (fairly) freely / in solution particles slide over solvent molecules

allow: in solution particles move slowly (from place to place)

- in solution there is bulk movement of particles from higher to lower concentration / particles spread out in solution / move everywhere / mix up

allow: particles move from higher to lower concentration

- ideas of explanation of dissolving in terms of solvent molecules getting between the iodine particles
- ideas about forces between particles of iodine being weakened on dissolving

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

(ii) heat causes astatine to melt / energy causes astatine to melt [1]
allow:: the astatine has melted / radioactivity melts the astatine

(iii) At_2 on right [1]

2 (NaAt) on left [1]
note: 2nd mark dependent on At_2 or 2At on right

[Total: 8]