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

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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) [1]
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)** <u>mixture</u> of metals / <u>mixture</u> 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 C*l* and no additional electrons on the H atom [1]
six non-bonding electrons around the chlorine atom [1]
ignore: inner shell electrons in C*l*.

[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]