CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the May/June 2014 series

0620 CHEMISTRY

0620/22 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 / carbon [1]

(ii) Pb / lead [1]

(iii) A*l* and O / aluminium and oxygen [1]
(both required)

(iv) Cs / Caesium [1]

(v) Fe / iron [1]

(vi) H / hydrogen / H_2 [1]

(b) O_2 [1]

4 (Rb) [1]
note: mark dependent on correct balance of O_2 (**allow:** 2O)

(c) affects nervous system (of children) / affects learning of children / affects brain development / poisonous / harmful / toxic / brain damage [1]

[Total: 9]

2 **(a)** A = flask [1]

B = measuring cylinder [1]

(b) calcium chloride ; [1]

water ; [1]

(c) 1st box ticked [1]

(d) **(i)** no oxygen present / carbon dioxide does not support combustion / flame requires oxygen to burn / not enough oxygen [1]
allow: carbon dioxide does not burn

(ii) denser than air ; [1]

(iii) oxygen present / oxygen increased / air present ; [1]

carbon dioxide has escaped / carbon dioxide has diffused [1]

[Total: 9]

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

- filter funnel
- filter paper in filter funnel ;
  not: filter paper lying flat across top of funnel
- container below funnel to collect filtrate ;
- river water poured into filter funnel ;
- insoluble material / residue / solid on filter paper + labelled **OR** as written statement ;
- filtrate / solution collected in container **OR** as written statement

(b) **(i)** Mg^{2+} / magnesium ; [1]

(ii) sulfate ; [1]

(iii) 32 (mg) [1]

(iv) 1.6 (mg) [1]
allow: ecf from part **(i)**

(v) sodium chloride ; [1]
allow: NaC*l*

(c) **(i)** points all correctly plotted ; [2]
1 mark for 6 points correctly plotted

best curve (through the points) ; [1]

(ii) value from candidate's graph at 25°C to within ± 0.1 mg / dm^3 ; [1]

(iii) 21% / 20% ; [1]

[Total: 14]

4 **(a)** alkenes / cycloalkanes / arenes / alkynes ; [1]

(b) **(i)** increase lower for alkanes with odd number of C atoms / increase higher for alkanes with even number of C atoms ; [2]

1 mark for general increase / reference to zigzag increase / specific example of something on graph ;

(ii) both increase ; [1]

increase between the 8^{th} and 9^{th} C atoms lower than increase between 9^{th} and 10^{th} C atoms ; [1]

(c) **(i)** any suitable source e.g. animal flatulence / marshes / rice paddy fields ; [1]

(ii) global warming / greenhouse effect ; [1]

(d) CO_2 as product ; [1]

2 (O_2) ; [1]
note: second mark dependent on the first being correct

[Total: 9]

5 **(a)** addition of oxygen / combining with oxygen / react with oxygen / increase in oxidation number / loss of electrons ; [1]

(b) they are gases / vapours ; [1]

(c) **(i)** 4 (P) ; [1]

(ii) acidic because P is a non-metal / non-metallic oxides are acidic ; [1]

(d) calcium oxide / lime added; [1]

(reacts to form a) slag ; [1]
slag floats on top of steel / slag skimmed off from surface ; [1]

(e) **(i)** mild steel: any suitable use e.g. bridges / car bodies / girders / cars / construction materials ; [1]

stainless steel: any suitable use e.g. chemical plant / cutlery / surgical instruments ; [1]

(ii) B ; [1]

(f) the more zinc, the stronger (the brass) / the less copper the stronger (the brass); [1]

(g) **(i)** copper + nitric acid → copper nitrate + nitrogen dioxide + water [2]
1 mark if one / two errors

(ii) any **three** from: [3]

- blue (solution) / blue (precipitate) ;
- precipitate / ppt ;
- in excess the precipitate redissolves ;
- dark blue solution (above precipitate) ;

(iii) car engines / car exhausts / lightning / high temperature furnaces ; [1]

[Total: 17]

6 **(a)** **(i)** Any **three** suitable differences e.g.: [3]

- no noble gases / no group 0 / no group 8 / only 7 Groups ;
- hydrogen / H in same Group as halogens / H in same Group as F, C*l*; ORA (e.g. H on own / Period 1)
- some elements missing / named element present
- no transition elements (in middle of table / block) ; ORA transition element (block) present
- halogens / F and C*l* in first Group;
- not ordered according to atomic number;
- no proton numbers / atomic numbers ORA
- Groups / Periods different / comments on different numbers of elements in groups / periods
- metals and non-metals not grouped together ORA
- some transition elements in wrong Group / examples e.g. Mn placed with N
- no Actinoids / Lanthanoids

(ii) Any answer referring correctly to (some) elements being in the same Group e.g. Li, Na, K in same Group / vertical section / column ; [1]

(b) colour of astatine: black / dark grey / greyish-black ; [1]

boiling point of Br_2: **allow:** between 30–90 °C ; [1]
(actual = 59 °C)

state of iodine: gas / vapour ; [1]

(c) **(i)** (from light green / colourless to)
reddish brown / brown / orange / yellow ; [1]

(ii) potassium chloride ; [1]

(iii) bromine less reactive than chlorine ORA ; [1]

(iv) two atoms in the molecule ;

[Total: 11]

7 **(a)** rest of structure completed correctly including all atoms and all bonds ; [1]

(b) any **two** from:
carbon monoxide / carbon / water ; [2]

(c) **(i)** steam / water ; [1]

(ii) 1st and 3rd boxes ticked ; [2]
1 mark each

(iii) Any **five** from: [5]

- flask with liquid mixture in it
- ethanol has lower boiling point than water / state boiling points of ethanol and water.
- on heating ethanol evaporates more easily / ethanol forms vapour more easily
- some idea of difference between fractional distillation and simple distillation e.g. long vertical tube / column (above flask)
- fractional distillation used to separate substances with boiling points which are fairly close to each other
- temperature gradient in the column / column colder at top than bottom
- ethanol separated (partly) from water in distillation column / ethanol moves further up column (than water) ORA
- condenser or long tube.
- ethanol vapour gets into condenser first / ethanol comes off first
- ethanol vapour goes to ethanol liquid in condenser
- ethanol collected in receiver
- water vapour condenses back into the flask / lower in the column

[Total: 11]