UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the May/June 2009 question paper

for the guidance of teachers

0620 CHEMISTRY

0620/02 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) iron(III) oxide / iron oxide / Fe_2O_3; [1]
ALLOW: iron

(ii) lead(II) bromide / lead bromide / $PbBr_2$; [1]
NOT: lead

(iii) calcium carbonate / $CaCO_3$; [1]
NOT: carbonate

(iv) sodium hydroxide / NaOH; [1]
ALLOW: hydroxide / OH^-
NOT: sodium

(v) methane; [1]

(b) (i) oxygen is removed (from the iron oxide); [1]
ALLOW: carbon takes the oxygen from the iron oxide
ALLOW: oxygen goes to the carbon / the oxygen combines with the carbon
ALLOW: oxidation number of iron decreases / electrons added to iron
NOT: the iron oxide loses electrons

(ii) haematite;
limestone;
blast;
slag; [4]

[Total: 10]

2 (a) calcium, magnesium, iron, copper; [1]

(b) bubbles produced steadily / moderately / slowly /
bubbles produced faster than iron and slower than magnesium /
fewer bubbles than magnesium and more than iron; [1]
ALLOW: many bubbles produced but less than magnesium
NOT: bubbles produced rapidly / less rapidly
NOT: less bubbles than magnesium / more bubbles than iron
NOT: reaction / it's faster than iron and slower than magnesium

(c) (i) magnesium floats on top of the magnesium chloride ORA /
magnesium is above the magnesium chloride ORA; [1]
ALLOW: magnesium is on top of the magnesium chloride ORA

(ii) (magnesium) too reactive / above carbon in reactivity series / more reactive than carbon; [1]
ALLOW: magnesium is a reactive metal / magnesium is reactive
ALLOW: too high a temperature needed for the extraction
NOT: magnesium oxide / magnesium will not react with carbon

(iii) to prevent magnesium reacting with the air / oxygen / nitrogen; [1]
ALLOW: to stop magnesium oxidising
NOT: because it is reactive
NOT: to stop it reacting
NOT: because inert gases are unreactive

(iv) nitrogen / helium / neon / argon / krypton / xenon / radon; [1]

(d) (i) structure of ethene showing all atoms and all bonds; [1]
ALLOW: correct electronic structure

(ii) two of: [2]
(1 mark each)

- carbon monoxide + poisonous / toxic;
  ALLOW: carbon monoxide combines with haemoglobin / red blood cells
  ALLOW: carbon monoxide suffocates
  NOT: carbon monoxide harmful / dangerous
- hydrogen + flammable / explosive;
  NOT: hydrogen dangerous
- hydrogen sulfide + poisonous / toxic;
  ALLOW: harmful
  NOT: dangerous / affects breathing
- ethene + flammable;
- methane + flammable;
  ALLOW: explosive

(e) (i) carbon monoxide + water / steam → carbon dioxide + hydrogen; [1]
ALLOW: arrow for equilibrium sign
NOT: carbon oxide instead of carbon monoxide
NOT: mixture of words and symbols

(ii) equilibrium / reversible reaction / the reaction can go both ways / the reaction can go backwards or forwards; [1]
ALLOW: the reaction can also go backwards
NOT: the reaction goes backwards

(iii) add sodium hydroxide (solution) / (aqueous) ammonia; [1]
(red-)brown / rusty red precipitate (both points); [1]
ALLOW: solid for precipitate
ALLOW: yellow-brown precipitate / orange precipitate
IGNORE: references to excess ammonia / sodium hydroxide
NOT: red precipitate

[Total: 13]

3 **(a)** (fractional) distillation; [1]
ALLOW: fractionation

(b) Two of: [2]
- fuel gas / refinery gas;
- naphtha;
- light gas oil / heavy gas oil / fuel oil;
- lubricating oil / lubricating fraction; (NOT: lubricant)
- bitumen; (ALLOW: residue)

IGNORE: kerosene / paraffin / gasoline / petrol / diesel
IGNORE: methane / named chemical compounds
IGNORE: gas alone

(c) oil stoves / aircraft fuel / for jet engines / for car engines; [1]
ALLOW: for making more petrol
ALLOW: for cooking / for heating / for lighting / for fuel

(d) A and D; (both needed) [1]

(e) ethane;
unreactive;
oxygen;
water; [4]

(f) saturated: has only single bonds / contains the maximum amount of hydrogen atoms (that can be combined with carbon atoms); [1]
ALLOW: does not have double bonds
ALLOW: consists of single bonds
NOT: has single bonds
hydrocarbon: (compound / substance) containing hydrogen and carbon only / it has carbon and hydrogen only; [1]
REJECT: it has carbon and hydrogen molecules only / ideas of mixtures of carbon and hydrogen

[Total: 11]

4 **(a)** ammonia / NH_3; [1]

(b) goes blue; [1]
ALLOW: goes purply-blue
NOT: goes blue then bleaches
NOT: goes purple

(c) ammonium chloride;
carbon dioxide;
water; [3]
NOT: formulae
NOT: ammonia chloride

(d) **(i)** to replace nitrogen lost from soil; [1]
ALLOW: to make (crop) plants grow better
ALLOW: to make plants grow more / faster
ALLOW: to improve crop yield
IGNORE: to replace minerals lost from the soil / to replace nutrients

(ii) more nitrogen / greater percentage of nitrogen; [1]
NOT: more nitrate

(iii) 80; [1]

(e) oxygen / O_2; [1]
NOT: O

(f) acid rain / effect of acid rain e.g. trees or plants die / pond animals die / fish die / erosion of buildings / corrosion of bridges; [1]
ALLOW: smog / damages buildings
NOT: destroys buildings
NOT: breathing difficulties / lung damage / irritation to throat / poisonous / harmful

[Total: 10]

5 **(a)** carbon dioxide released / gas is released / gas is formed; [1]
NOT: we get carbon dioxide, calcium chloride and water

(b) **(i)** 615 s; [1]
ALLOW: in numbers in range 600–630 s

(ii) X on or near the line at beginning of experiment; [1]
ALLOW: on or near line up to 50 s

(iii) shallower curve at initial rate; [1]
starts levelling off at 100.2 g; [1]
ALLOW: (beginning to) level off between 100.15 and 100.25 g

(c) **(i)** increases / goes faster; [1]
NOT: takes less time / becomes fast / reaction increases

(ii) increases / goes faster; [1]
NOT: takes less time / becomes fast / reaction increases

(d) combustion;
small;
large; [3]

(e) **(i)** respiration; [1]
NOT: oxidation

(ii) (substance / compound / it) speeds up / increases the rate of a reaction; [1]
ALLOW: changes rate of reaction
NOT: decreases the rate
IGNORE: references to biological substances

[Total: 12]

6 **(a)** Br_2; [1]

(b) particles random AND roughly similar size to the one shown; [1]
particles very close together or touching; [1]

(c) Any three of: [3]
- bromine evaporates / liquid evaporates; (NOT: it evaporates)
- more energetic particles from liquid to vapour;
- diffusion;
- random movement of molecules / particles move everywhere / both air and bromine particles are moving;
- (bromine and air) particles get mixed up / collision of bromine and air particles;
  ALLOW: molecules in place of particles
  NOT: atoms in place of particles

(d) (light) green; [1]
IGNORE: yellow
to
reddish-brown / brown / orange / yellow-brown; [1]
NOT: yellow / red

(e) bromine higher in reactivity series than iodine / bromine more reactive than iodine; [1]
NOT: bromide more reactive than iodide
NOT: magnesium bromide more reactive
NOT: bromine stronger than iodine

(f) **(i)** NaBr; [1]
ALLOW: Na^+Br^-
NOT: multiples e.g. 2NaBr

(ii) zinc bromide; [1]
ALLOW: zinc(II) bromide
NOT: $ZnBr_2$

(iii) covalent; [1]
NOT: single bonding

(iv) A and D; (both needed) [1]

(v) the ions can move / ions are mobile; [1]
ALLOW: the ions are free (from each other)
NOT: ions delocalised / charged particles moved
REJECT: electrons and ions move

[Total: 14]

7 **(a)** Cl_2; [1]
correct balancing; [1]

(b) bonding pair; [1]
chlorine electrons all correct and no other electrons on hydrogen; [1]
ALLOW: use of circle / dot for chlorine and cross for hydrogen
IGNORE: inner electrons

(c) pH1; [1]

(d) hydrogen; [1]
NOT: H_2

(e) Any two of: [2]
- evaporate off some of the water / heat solution to crystallisation point;
  ALLOW: concentrate the solution
  NOT: boil off the water / implication that all the water is removed
  NOT: heat without further qualification
- leave to crystallise / leave in the warm / leave in the air / leave on a window sill / leave at room temperature;
  NOT: let it cool / leave it to cool
- dry crystals with filter paper;
  NOT: heat / warm to dry / put in an oven

(f) **(i)** chlorine / Cl_2; [1]
NOT: Cl

(ii) zinc / Zn; [1]

[Total: 10]