**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

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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]**