

**MARK SCHEME for the May/June 2009 question paper**  
**for the guidance of teachers**

<b>0620/02</b>	<b>0620 CHEMISTRY</b> Paper 2 (Core Theory), maximum raw mark 80
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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 /  $\text{Fe}_2\text{O}_3$ ; [1]  
ALLOW: iron
- (ii) lead(II) bromide / lead bromide /  $\text{PbBr}_2$ ; [1]  
NOT: lead
- (iii) calcium carbonate /  $\text{CaCO}_3$ ; [1]  
NOT: carbonate
- (iv) sodium hydroxide /  $\text{NaOH}$ ; [1]  
ALLOW: hydroxide /  $\text{OH}^-$   
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; [4]  
limestone;  
blast;  
slag;
- [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

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- (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]

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- 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; [4]  
unreactive;  
oxygen;  
water;
- (f)** saturated: has only single bonds / contains the maximum amount of hydrogen atoms [1]  
(that can be combined with carbon atoms);  
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 [1]  
carbon and hydrogen only;  
REJECT: it has carbon and hydrogen molecules only / ideas of mixtures of carbon and hydrogen

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- 4 (a) ammonia / NH<sub>3</sub>; [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<sub>2</sub>; [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]**

Page 6	Mark Scheme: Teachers' version	Syllabus	Paper
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- 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; [3]  
 small;  
 large;
- (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

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Page 7	Mark Scheme: Teachers' version	Syllabus	Paper
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- 6 (a) Br<sub>2</sub>; [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<sup>+</sup>Br<sup>-</sup>  
NOT: multiples e.g. 2NaBr
- (ii) zinc bromide; [1]  
ALLOW: zinc(II) bromide  
NOT: ZnBr<sub>2</sub>
- (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]

Page 8	Mark Scheme: Teachers' version	Syllabus	Paper
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- 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]**