

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

MARK SCHEME for the May/June 2011 question paper
for the guidance of teachers

0620 CHEMISTRY

0620/21

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 must be read in conjunction with the question papers and the report on the examination.

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Page 2	Mark Scheme: Teachers' version	Syllabus	Paper
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- 1 (a) E / nitrogen (di)oxide / NO_2 [1]
- (b) B / potassium nitrate / KNO_3 [1]
- (c) A / ammonia / NH_3 [1]
- (d) E / nitrogen(di)oxide / NO_2 [1]
- (e) C / NCl_3 / nitrogen (tri)chloride [1]
- (f) B / potassium nitrate / KNO_3 [1]
- 2 (a) atoms of same element with different number of neutrons / same type of atom with different mass number / atoms with same proton number but different number of neutrons / atoms with same proton number but different nucleon number/ atoms with same atomic number but different nucleon number [1]
- (b) 23 protons [1]
23 electrons [1]
27 neutrons [1]
- (c) non [1]
medicine [1]
cancer [1]
- (d) 2nd box ticked [1]
5th box ticked [1]

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- 3 (a) anhydrous copper sulfate / white copper sulfate [1]
 ignore oxidation numbers
 turns blue [1]

OR

anhydrous cobalt chloride / blue cobalt chloride (1 mark)
 ignore oxidation numbers
 turns pink (1 mark)
 note second mark is dependent on the first being correct BUT cobalt chloride turns pink = 1 mark

- (b) coolant / solvent / hydroelectric power [1]
 allow for cooling / to cool
 allow specific reactions e.g. making sulfuric acid / making ethanol
 allow: for washing or cleaning if specific industrial process mentioned
 allow for agriculture / for growing crops (on a large scale) / brewing
 ignore for cooking / for drinking / for power (unqualified) / for watering plants / for cooling food

- (c) substance OR liquid which dissolves another (substance) /
 substance which does the dissolving [1]
 ignore it dissolves / it is a liquid / names of solvents

- (d) (i) burning coal / burning fossil fuels / burning petrol petrol / burning specified fuel (as long
 as it contains sulfur) / from volcanoes / from heating sulphide ores [1]
 ignore burning pure substances e.g. hydrogen, methane / car exhausts
 ignore from ores without qualification /

- (ii) any two effects (1 mark each) e.g. [2]
- forest death / kills trees / deforestation / destroys trees / damages trees
 ignore kills plants / rots trees / kills crops
 - acidification of lakes / acidification of rivers
 ignore acidifies soils
 - kills fish / aquatic plants / plant in lakes or rivers
 ignore kills fish or plants in the sea / kills animal (unqualified) / kills plants
 (unqualified)
 - erodes buildings made from limestone / erodes carbonate rocks / damages buildings
 made from limestone / damages carbonate rocks
 allow destroys building made from limestone / destroys carbonate rocks
 ignore just erosion of buildings or rocks unqualified / dissolves buildings / chemical
 weathering
 - corrosion of metal structures / corrosion of named metal structures e.g. bridges or
 railings / damages metal structures
 allow erosion of metal structures / damaging metal structures / destroys metal
 structures / reacts with metals
 ignore dissolves metals
 ignore effects on humans

- (iii) 64 (g) [1]

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(e) In each of these points, the explanation mark depends on the correct step

filtration or words to that effect [1]

removal of undissolved substances / solids / impurities get trapped / removes insoluble impurities [1]

allow removes dirt

ignore solids which would sediment rapidly or are large e.g. pieces of metal, batteries, twigs etc. / removes impurities

chlorination / adding chlorine [1]

allow chlorification

kills bacteria [1]

allow kills microbes / kills germs / disinfection / sterilisation

ignore kills bugs / removes bacteria

allow other stages with correct explanation e.g.

screening (1 mark) removing large objects / removing twigs etc. (1 mark)

sedimentation (1 mark) allowing particles to settle (1 mark)

adding carbon (1 mark) removes tastes / removes smells (1 mark)

flocculation (1 mark) coagulates clay / makes small particles clump together (1 mark)

lime (1 mark) idea of neutralisation or removal of acids (1 mark)

(f) (i) 20 (%) allow 19–21 (%) [1]

(ii) 28 (g) [1]

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- 4 (a) (i) D [1]
- (ii) B [1]
- (iii) E [1]
- (iv) C [1]
- (b) (i) 4 (H₂O) [1]
5 (O₂) [1]
note 2nd mark dependent on 4 (H₂O) being correct
- (ii) any 2 of:
carbon monoxide / carbon
allow soot
water
allow correct formulae [2]
- (c)
- $$\begin{array}{c} \text{O} \\ || \\ -\text{C}-\text{O}-\text{H} \end{array}$$
- [1]

Page 6	Mark Scheme: Teachers' version	Syllabus	Paper
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- 5 (a) breakdown (of substance / electrolyte) by electricity / splitting up of substance by electricity / decomposition by electricity [1]
allow current / voltage for electricity
ignore separation by electricity / division by electricity
note idea of breakdown AND idea of current / electricity for the mark
- (b) anode [1]
- (c) hydrogen [1]
allow H₂
- (d) platinum [1]
inert [1]
- (e) (i) 2,8,7 as numbers or as shown in electron shell diagram [1]
(ii) pair of electrons between two chlorine atoms [1]
rest of electrons correct [1]
ignore inner shells
(iii) (damp) litmus (paper) / universal indicator (paper) [1]
allow indicator paper / pH paper
bleaches / goes white [1]
allow goes red then bleaches
reject changes colour of bromides / iodides
- (f) (i) calcium chloride + water (1 mark each) [2]
apply listing for extra elements / compounds
allow correct formulae
(ii) H₂ on right [1]
ignore numbers in front of H₂ unless equation balanced
2 on left [1]

Page 7	Mark Scheme: Teachers' version	Syllabus	Paper
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- 6 (a) (i) copper → zinc → magnesium → calcium [1]
- (ii) cold water → no reaction [1]
 steam → fairly rapid / moderately rapidly / moderately / slowly / very slowly [1]
 ignore less rapidly than zinc / more rapidly than copper / it reacts [1]
 reject rapidly
- (b) zinc + water → zinc oxide + hydrogen [1]
 allow steam in place of water
- (c) Any three of: [3]
- conducts electricity
 - conducts heat
 - malleable / can be bent
 - ductile /
 - shiny / lustrous
 - sonorous / rings when hit
 - solid
- ignore reference to melting point / boiling point / density / strength
 ignore colours e.g. grey
- (d) (i) allow any figures in the range 120–200°C [1]
 (actual = 181°C)
- (ii) less hard (down the Group) / softer (down the Group) [1]
 allow decreases (in hardness)
 ignore from hard to soft / the softer is at the bottom and the harder at the top / gets softer
 as melting point decreases
- (iii) allow any figures in the range 0.7–1.3 (g / cm³) [1]
 (actual = 0.86)

Page 8	Mark Scheme: Teachers' version	Syllabus	Paper
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- 7 (a) top left box → oxygen [1]
bottom right box → slag [1]
bottom left box → (molten) steel [1]
- (b) (i) they are gases / gases escape easily / sulphur oxides are gases / named sulfur oxides are gases / carbon dioxide is a gas / named oxide of carbon is gas / the products are gases [1]
- (ii) any three of:
- phosphorus(V) oxide is acidic oxide
ignore it is acidic
 - calcium oxide is basic oxide
 - idea of calcium oxide neutralising OR reacting with phosphorus oxide
allow they combine together / they react together / it reacts with the phosphorus oxide
ignore they react (unqualified)
 - slag formed (by the reaction) / slag is removed [3]
- (c) (i) D [1]
- (ii) any suitable use e.g. chemical plant / cutlery / surgical instruments / (ball) bearings / [1]
allow facings of buildings (not buildings without qualification)
parts of aircraft engines (not aircraft without qualification)
bridges
car decoration / trim / radiator grills / exhaust pipes (not cars without qualification)
washing machine drums
razor blades
chemical tankers / road tankers (not tankers unqualified)
cooking utensils ignore for cooking
watches

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- 8 (a) any three of [3]
- particles move faster / in liquid particles move slowly AND in gas they move rapidly
 - particles more spread out / in liquid particles are touching (or very close) AND in gas they are far apart
 - particles more randomly arranged / in liquid the particles have some order AND in gas the particles are random
 - particles move more freely / in liquid particles do not move freely AND in gases particles are freely moving / in liquid particles have limited motion (or slide over each other) AND in gases particles are free
- (b) (i) chlorine + (bromide ions) → chloride (ions) + bromine [1]
allow correct symbols
- (ii) vaporises easily / forms a gas easily [1]
allow vaporises (very) fast / evaporates (very) fast / low boiling point
reject ideas of reaction
- (c) (i) substance which speeds up reaction / makes reaction go faster / lowers the activation energy [1]
allow changes rate of reaction
ignore slows down reaction
- (ii) it gains hydrogen / oxygen accepts hydrogen / hydrogen peroxide accepts hydrogen / oxidation number of oxygen decreases [1]
allow it loses oxygen / hydrogen peroxide loses oxygen / hydrogen peroxide gains electrons / oxygen gains electrons
ignore comments related to hydrogen bromide alone
- (iii) sodium bromide [1]
carbon dioxide AND water [1]

[Total: 80]