

**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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- 1 (a) E / nitrogen (di)oxide /  $\text{NO}_2$  [1]
- (b) B / potassium nitrate /  $\text{KNO}_3$  [1]
- (c) A / ammonia /  $\text{NH}_3$  [1]
- (d) E / nitrogen(di)oxide /  $\text{NO}_2$  [1]
- (e) C /  $\text{NCl}_3$  / nitrogen (tri)chloride [1]
- (f) B / potassium nitrate /  $\text{KNO}_3$  [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) 2<sup>nd</sup> box ticked [1]  
5<sup>th</sup> 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 (H<sub>2</sub>O) [1]  
5 (O<sub>2</sub>) [1]  
note 2<sup>nd</sup> mark dependent on 4 (H<sub>2</sub>O) 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]

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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 H<sub>2</sub>
- (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) H<sub>2</sub> on right [1]  
ignore numbers in front of H<sub>2</sub> unless equation balanced  
2 on left [1]

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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 / cm<sup>3</sup>) [1]  
 (actual = 0.86)

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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]