

**UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS**  
International General Certificate of Secondary Education

## **MARK SCHEME for the May/June 2008 question paper**

### **0620 CHEMISTRY**

**0620/02**

Paper 2 (Core Theory), maximum raw mark 80

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- 1 (a) (i) B/calcium carbonate/ $\text{CaCO}_3$  [1]  
(ii) E [1]  
(iii) C/carbon dioxide/ $\text{CO}_2$  [1]  
(iv) D/ethane [1]
- (b) bromine water/bromine [1]  
decolourises/turns colourless [1]  
NOT: turns clear  
ALLOW: (acidified) potassium manganate(VII); turns colourless (2 marks)  
IGNORE: original colour of bromine/potassium manganate(VII)
- (c) calcium carbonate [1]  
NOT:  $\text{CaCO}_3$
- (d) lubricant/2nd box down ticked [1]  
IF: more than one box ticked = 0
- (e) substance containing more than one type of atom different atoms [1]  
ALLOW: more than one type of element/two elements  
bonded/joined/(chemically) combined/combination  
**Both parts needed.**  
IF: word mixture appears = 0
- (f) covalent [1]  
NOT: single bonding
- [Total: 10]**
- 2 (a) calcium carbonate [1]
- (b) any 4 from:  
  - statue becomes (chemically) eroded;  
ALLOW: statue becomes corroded/amount of limestone reduced  
NOT: destroys limestone/limestone melting/damages the statue
  - iron pins corroded/eroded/eaten away OWTTE
  - acid rain;
  - caused by burning fossil fuels;
  - sulphur dioxide formed/from sulphur in fossil fuels;  
ALLOW: nitrogen dioxide formed/from car exhausts
  - sulphur dioxide dissolves to form acid;  
ALLOW: nitrogen dioxide dissolves to form acid
  - sulphuric acid in air  
ALLOW: nitric acid in air
  - acid reacts with limestone/carbonate/statue/iron/pins  
NOT: (unqualified) acid reacts
[4]

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- (c) iron/pin(s) corrode/rust/eaten away/erode/oxidises [1]  
ALLOW: iron pins dissolve away  
ALLOW: iron/pins react with (acid) in air  
NOT: iron pins have reacted/weak and break  
NOT: it/the arm has rusted
- (d) (i) atoms (of same element) with different number of neutrons/atoms with different numbers of nucleons but same number of protons/ same elements [1]  
ALLOW: atoms with same atomic number but different mass number
- (ii) –/negative [1]  
0/no charge [1]  
+/positive [1]  
IGNORE: numbers in front of – or +
- (iii) 56 [1]  
ALLOW: 30 + 26
- (e) any suitable use e.g. measuring thickness of paper/detecting leaks in pipes (ALLOW: checking leakage for suitable substances e.g. water/oil) /sterilization of surfaces/making electricity/power stations/ [1]  
NOT: medical uses
- (f) iron + nitric acid → iron nitrate + hydrogen [1]  
IGNORE: oxidation numbers unless incorrect/dilute (nitric acid)  
NOT: heat on either side of equation/equation without arrow  
ALLOW: = for arrow

[Total: 13]

- 3 (a)  $Cl^-$ /chloride [1]
- (b) sulphate [1]  
IGNORE: oxidation numbers
- (c) potassium + sodium (both needed for the mark) [1]  
ALLOW:  $K^+$  and  $Na^+$ /K and Na
- (d) sodium chloride [1]  
ALLOW: NaCl  
ALLOW: salt
- (e) any two of: calcium/magnesium/potassium/sodium [2]

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- (f) (i) 3 (rd period) [1]
- (ii) single bonding pair [1]  
6 non-bonding electrons in each atom [1]  
IGNORE: incorrect inner electrons

- (g) any 2 of: [2]
- distillation removes dissolved ions/ salts;  
ALLOW: distillation removes only the water/extracts water/solvent  
IGNORE: reference to impurities without qualification
  - filtration doesn't remove dissolved ions/salts;  
ALLOW: filtration can't remove very small particles OWTTE  
ALLOW: filtration only removes large particles  
IGNORE: filtration removes solids  
IGNORE: reference to impurities
  - filtration does not remove bacteria/germs;
  - distillation removes/kills bacteria/germs  
IGNORE: cost/speed arguments

[Total: 11]

- 4 (a) any suitable e.g. as a coolant/for specific named reactions e.g. making ethanol from ethene/making sulphuric acid [1]  
ALLOW: as a solvent  
ALLOW: to make hydroelectricity/electricity  
NOT: (unspecified) making chemicals  
NOT: to drink/wash, etc.

- (b) any two of: [2]
- sand has very fine/small spaces (between the grains)  
(idea of small spaces)
  - water/small molecules/small particles can pass through;  
(idea of small molecules going through)
  - water molecules are small/water is a liquid;  
(water molecules small/liquid)
  - (large) particles cannot pass through spaces/are trapped by sand/blocks particles/  
(idea of particles not getting through/trapping by sand)  
NOT: by filtering  
NOT: filter takes out the smaller molecules in water  
IGNORE: references to absorbing/impurities

- (c) add sodium hydroxide; [1]  
white ppt/milky ppt/white solid (both white and ppt/solid needed); [1]  
soluble in excess/gives colourless solution in excess [1]  
**OR**  
add (aqueous) ammonia; white ppt; insoluble in excess/does not redissolve

- (d) to kill bacteria/germs [1]  
ALLOW: antibacterial/kills harmful organisms  
NOT: dissolves bacteria  
ALLOW: to stop bacteria growing

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- (e) (i) chlorine + potassium bromide → potassium chloride + bromine [2]  
 (–1 for each error or omission including no arrows/heat on left)
- (ii) it/iodine is less reactive than bromine/iodine lower in the reactivity series than bromine [1]  
 ORA  
 NOT: iodine lower in the reactivity series than bromide  
 NOT: iodine lower in the reactivity series than potassium bromide/iodine can't displace bromine  
 NOT: its not reactive enough/lower in the Periodic Table

- (f) (i) exothermic [1]
- (ii) ionic [1]
- (iii) sodium (atom) loses an electron [1]  
 chlorine (atom) gains an electron [1]  
 [sodium (atom) gives an electron to chlorine = 2]  
 IGNORE: incorrect number of electrons/ reference to charges  
 NOTE: any reference to sharing electrons = 0]

[Total: 14]

- 5 (a) hydrogen/H<sub>2</sub> [1]  
 NOT: H
- (b) (i) to ensure all the (sulphuric) acid reacted [1]  
 NOT: to ensure it reacted
- (ii) filtration/filter ALLOW: decanting/pouring off the solution [1]  
 NOT: distillation/evaporation of sulphuric acid
- (c) evaporate water/evaporation/leave in a warm place; [1]  
 ALLOW: heat/boil then allow solution to cool/heat then evaporate  
 NOT: not heat/boil (to get the crystals)  
 NOT: crystallisation/allow to crystallise;
- dry crystal on filter paper [1]  
 ALLOW: filter off crystals and allow to dry
- (d) (i) sulphuric acid + magnesium carbonate/hydroxide/oxide [1]  
 or magnesium + a less reactive metal sulphate  
 NOT: magnesium + sulphuric acid (since in question)
- (ii) sulphuric acid + magnesium carbonate → magnesium chloride + water + carbon dioxide/  
 sulphuric acid + magnesium hydroxide → magnesium chloride + water/  
 sulphuric acid + magnesium oxide → magnesium chloride + water  
 or e.g. magnesium + copper sulphate → magnesium sulphate + copper [1]  
 ALLOW: correct answer(s) in either parts (i) or (ii)  
 ALLOW: correct symbols equations

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(iii) contaminants might harm health/may make you ill/cause side effects [1]  
ALLOW: medicine would not work as well/might cause health problem  
IGNORE: contain contaminants/poisonous/kills you  
IGNORE: medicine would not work  
NOT: decrease the effect (unless specified of what i.e. of the medicine)

(e) 6 (g) [1]  
IF: unit incorrect = 0

(f) 97.5 (%) [1]

[Total: 10]

6 (a) (i) (group of) molecules/compounds with similar boiling points/group of molecules/compounds which distil at same place in the fractionating column [1]

(ii) fuel gas [1]  
ALLOW: methane

(iii) Any two of:  

- temperature gradient in column/column hotter at bottom/column colder at top;
- different fractions have different boiling points  
ALLOW: separated according to their boiling points/each fraction forms at a different temperature
- molecules condense/turn from gas to liquid at different heights in the column;
- molecules condense/turn to liquid when temperature drops below their boiling point;  
ALLOW: molecules condense at their boiling point;
- smaller molecules move further up the column OR  
larger molecules/molecules with higher boiling point condense lower in the column  
or smaller molecules/molecules with lower boiling point condense higher in column  
= 2 [2]

(iv) oil stoves/aircraft (fuel)/(fuel for) lamps [1]  
NOT: fuels for power stations/for burning/starting fires

road (surfacing)/(tar for) roofing [1]  
ALLOW: paint  
NOT: tar without qualification

(b) (i) breaking down of larger molecules/hydrocarbons/converting large molecules into small molecules/large chains to small chains [1]  
IGNORE: conditions  
NOT: implication of reacting with something else  
NOT: breaking larger substances to smaller  
NOT: breaking high fractions to low fractions

(ii)  $C_{12}H_{26}$  [1]  
ALLOW: other correctly balanced combinations within reason e.g.  $C_{10}H_{22} + 2C_2H_4$  or with 3 species

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- (c) (i) speeds up rate of reaction [1]  
ALLOW: alters/changes rate of reaction
- (ii) reversible (reaction)/equilibrium (reaction)/reaction can go both ways [1]  
IGNORE: exothermic/endothemic
- (iii) fermentation [1]
- (iv) turns red/pink; [1]  
bubbles/ effervescence/fizzes [1]  
IGNORE: temperature changes/ppt/neutralises  
NOT: gas/carbon dioxide formed

[Total: 13]

- 7 (a) Any 2 of:
- crystals dissolve
  - water molecules colliding with crystal
  - diffusion
  - movement of ions  
NOT: copper particles/copper atoms/copper molecules  
NOT: particles slide over each other
  - movement of water molecules/water particles
  - movement is random  
[movement of (unspecified) particles = 1 maximum]  
NOT: movement of water/copper sulphate/crystals  
NOT: particles spread out  
IGNORE: movement from high to low concentration [2]
- (b) arrangement: regular [1]  
ALLOW: particles close together/linear/in lines/lattice/closely packed  
motion: none/vibrating [1]  
NOT: does not move a lot
- (c) suitable container with filter paper dipping into labelled solvent; [1]  
spot above solvent level [1]  
IF: metal ion where the solvent should be = 0 marks
- (d) (i) cathode [1]
- (ii) pure foil: gets further copper deposit/increases in thickness/gets less shiny [1]  
ALLOW: gets heavier/mass increases  
ALLOW:  $\text{Cu}^{2+} + 2\text{e}^- \rightarrow \text{Cu}$  (ignore wrong balance)  
impure foil: copper removed/decreases in thickness/appears cleaner [1]  
ALLOW: gets lighter/decreases in mass/dissolves/is corroded  
ALLOW:  $\text{Cu} \rightarrow \text{Cu}^{2+} + 2\text{e}^-$   
NOT: wears away  
NOT: disappears

[Total: 9]