

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/ CaCO_3 [1]
(ii) E [1]
(iii) C/carbon dioxide/ 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: 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

Page 5	Mark Scheme	Syllabus	Paper
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- (e) (i) chlorine + potassium bromide \rightarrow 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/H₂ [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 \rightarrow magnesium chloride + water + carbon dioxide/
 sulphuric acid + magnesium hydroxide \rightarrow magnesium chloride + water/
 sulphuric acid + magnesium oxide \rightarrow magnesium chloride + water
 or e.g. magnesium + copper sulphate \rightarrow 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]