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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UNIVERSITY of CAMBRIDGE
International Examinations

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 <u>more than one</u> type of atom <u>different atoms</u>
ALLOW: more than one type of element/two elements
<u>bonded/joined/(chemically) combined/combination</u> [1]
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]

(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]

(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 though/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

(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 ORA [1]
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_2 [1]
NOT: H

(b) (i) to ensure all the (sulphuric) <u>acid</u> 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 <u>and</u> allow to dry

(d) (i) sulphuric acid + magnesium carbonate/hydroxide/oxide
or magnesium + a less reactive metal sulphate [1]
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

(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 ORA
  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

(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/endothermic

(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 <u>ions</u>
  NOT: copper particles/copper atoms/copper molecules
  NOT: particles slide over each other
- movement of <u>water molecules</u>/<u>water particles</u>
- 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 <u>labelled</u> 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: $Cu^{2+} + 2e^- \rightarrow Cu$ (ignore wrong balance)
impure foil: copper removed/decreases in thickness/appears cleaner [1]
ALLOW: gets lighter/decreases in mass/dissolves/is corroded
ALLOW: $Cu \rightarrow Cu^{2+} + 2e^-$
NOT: wears away
NOT: disappears

[Total: 9]