Question	Answer	Marks
1(a)	cobalt chloride (paper) / anhydrous cobalt chloride / $CoCl_2$; from blue; to pink; **or** copper sulfate / anhydrous copper sulfate / $CuSO_4$; from white; to blue;	**3**
1(b)	boils at 100 °C / boiling point 100 °C / freezes at 0 °C / freezing point 0 °C / melts at 0 °C / melting point 0 °C;	**1**
1(c)	any two from: • filtration / sedimentation / sieving / screening / (pass through) gravel (beds) / flocculation / decantation / clarification / coagulation / flotation / settling tank / add aluminium sulfate; • (add) carbon; • chlorination / (add) chlorine / add Cl_2; • fluoridation / add fluoride; • ozone dosing; • desalination; • aeration; • distillation;	**2**
1(d)	any two from: making steel; making paper; textiles; generating electricity / energy / power / turbines; HEP; water mills; steam power (e.g. steam engines); geothermal power; agriculture; livestock; irrigation; hydration of alkenes / manufacture of ethanol / alcohols; manufacture of sulfuric acid / Contact process; manufacture of hydrogen; solvent / dissolving; coolant / cooling; cleaning / washing; (supply of) drinking (water); central heating; production of slaked lime; cooking;	**2**

2 **(a)** **(i)** filtration (1)

chlorination (1) [2]

(ii) Any **two** from: [2]

- manufacture of ethanol
- used in the manufacture of sulfuric acid **or** in the Contact process
- manufacture of hydrogen **or** ammonia **or** for the Haber process

(iii) Any **two** from: [2]

- cooking
- washing or laundry
- drinking
- toilets
- watering plants
- (domestic) heating

(b) boiling or turning to steam (1)

then condensing / condensation (1) [2]

[Total: 7]

3 **(a) (i)** evaporation / boiling / vaporisation / evaporate / vaporise; [1]
condensation / liquefaction / condense / liquefy; [1]

(ii) condensation **accept:** correct equation $H_2O_{(g)} \rightarrow H_2O_{(l)}$
because energy / heat is given out / gas has more energy than liquid / need to supply energy to change liquid to gas so reverse must give out energy / bonds form; [1]

(b) chlorination / chlorine to kill microbes; [1]

filtration or filter; [1]
accept: sedimentation or sand or gravel or grit

(c) (i) combustion of fossil fuels; [1
(which contain) sulfur; [1]
sulfur dioxide formed; [1]
(reacts in air / with water to form) **sulfurous / sulfuric acid**; [1]
OR
nitrogen and oxygen in air; [1]
react at high temperatures / in engines; [1]
to form oxides of nitrogen **or** named oxide of nitrogen; [1]
(reacts in air / with water to form) nitrous / nitric acid; [1]
[max 4]

(ii) calcium oxide is soluble in water / reacts with water to form calcium hydroxide; [1]
pH above 7 / the water becomes alkaline; [1]
OR
calcium carbonate insoluble in water; [1]
pH cannot be above 7 / water is neutral / does not make water alkaline; [1]
[max 2]

[Total: 11]

4 **(i** chloromethane [1]
cond biggest molecular mass / biggest mass of one mole / its molecules
move slowest / heaviest molecule / highest density [1]
accept atomic mass if correct numerical value given
ignore it is the heaviest (gas) / biggest molecule
accept particles or molecules
not atoms

(ii) carbon dioxide / calcium carbonate [1]
not methane
water [1]
sodium chloride / brine / seawater [1]

(iii) chlorine [1]
not chlorine water
cond light / UV / heat / high temperature if numerical value given about 200^{o}C / lead tetraethyl [1]
not warm

(iv) oxygen and nitrogen (in air) [1]
not from fuel, negates mark 1
(react) at high temperatures / lightning / in engine [1]
not combustion or exhaust, negates mark 2

(v) $2O_3 \rightarrow 3O_2$ [2]
not balanced = [1]

5 **(a) (i)** argon **or** krypton **or** helium [1]
Accept xenon and radon even though percentages are very small
NOT hydrogen

(ii) water and carbon dioxide [2]

(b) (i) sulfur dioxide **or** lead compounds **or** CFCs **or** methane **or** particulates **or** unburnt hydrocarbons **or** ozone etc. [1]

(ii) <u>incomplete combustion</u> [1]
of a fossil fuel **or** a named fuel **or** a fuel that contains carbon [1]

(iii) at high temperature **or** inside engine [1]
nitrogen and oxygen (from the air) react [1]

(iv) it changes carbon monoxide to carbon dioxide [1]
oxides of nitrogen to nitrogen [1]

OR symbol **or** word equation of the type:
$2NO + 2CO \rightarrow CO_2 + N_2$ [2]

OR a redox explanation – the oxides of nitrogen oxidise carbon monoxide to carbon dioxide, [1]
they are reduced to nitrogen [1]

OR $2NO \rightarrow N_2 + O_2$ [1]
$2CO + O_2 \rightarrow 2CO_2$ [1]

[Total: 10]

6 **(a) (i)** lithium oxide / strontium oxide [1]

(ii) sulfur dioxide / nitrogen dioxide [1]

(iii) aluminium oxide [1]

(iv) carbon monoxide [1]
accept: correct formulae

(b) sulfur dioxide [1]
burn (fossil) fuel containing sulfur / volcanoes [1]
nitrogen dioxide [1]
reaction of nitrogen and oxygen [1]
high temperatures / in car engine [1]
not: exhaust

(c) (i) strontium oxide [1]
accept: aluminium oxide

(ii) use correct formula [1]
cond: charges on ions
6x and 2o around oxygen [1]
ignore: electrons around Li

7 **(i)** methane / water vapour / oxides of nitrogen / hydrofluorocarbons / perfluorocarbons / ozone [1]
not sulfur dioxide

(ii) living organisms / plants and animals / cells [1]
produce energy (from food / glucose / carbohydrates) [1]
this forms carbon dioxide (could be in an equation) [1]

(iii) when growing the crop removed carbon dioxide from atmosphere / crop photosynthesised and used carbon dioxide [1]
combustion returned the carbon dioxide [1]

(iv) increased combustion [1]
of fossil fuels / named fossil fuel [1]

or deforestation [1]
less photosynthesis [1]
not greater population

[Total: 8]