1 **(a** carbon dioxide (1) [1]

(b) propene (1) [1]

(c) krypton (1) [1]

(d) nitrogen (1) [1]

(e) fluorine (1) [1]

(f) sulfur dioxide (1) [1]

(g) hydrogen (1) [1]

[Total: 7]

2 **(a** **(i)** heat / roast in air / oxygen [1]
accept: burn in air / oxygen

(ii) (reduce) with carbon / carbon monoxide [1]

(b) test it with both hydrochloric acid and sodium hydroxide(aq) [1]
accept: any named strong acid and any strong alkali
if only acid and alkali given then max = 3
basic oxide reacts with acid [1]
acidic oxide reacts with alkali/base [1]
amphoteric reacts with both [1]
accept: for react – form salt and water

(c) **(i)** at equilibrium [1]
rate of forward reaction equals rate of back reaction / concentrations remain constant / macroscopic properties do not change with time [1]
accept: amounts do not change with time

(ii) equilibrium moves to left ($SbOCl$ used up) [1]
hydrochloric acid removed by reacting with $SbOCl$
precipitate dissolves in hydrochloric acid

(iii) add water / dilute / add an alkali / add more $SbCl_3$ / add a base / add a carbonate [1]

3 **(a) (i)** enzymes are proteins / come from living organisms / biological (catalysts) [1]
not enzymes are living or natural

(ii) carbohydrates have 2H:1O ratio [1]
contain elements of water [1]

contain water = [1]
unless they state that carbohydrates contain water, this response scores 2 or 0

(b) correct -O- linkage [1]
cond same correct monomer (this mark is lost if 2 different boxes are shown) [1]
cond continuation (i.e. bonds at **both** ends) [1]

(c) (i) (concentration or amount or mass etc.) of starch decreases (with time) [1]
(concentration etc.) of starch becomes zero / all starch gone [1]
colour (intensity) indicates how much starch is present (can be inferred) [1]

(ii) enzyme denatured / destroyed [1]
not enzymes killed / don't work / saliva denatured

4 red litmus paper blue [1]
OR white fumes/smoke with HC*l* (g) **or** (aq)

chlorine [1]

"pop" with a lighted splint **or** burn with a pop **or** goes pop and extinguishes flame [1]
NOT glowing splint

oxygen [1]

carbon dioxide [1]
ACCEPT correct formulae

[Total: 5]

5

(i)	noble gas	argon
(ii)	acidic oxide	carbon dioxide
(iii)	can be polymerised	ethene
(iv)	active component	oxygen
(v)	treatment of water	chlorine
(vi)	product of respiration	carbon dioxide

[TOTAL = 6]

Question	Answer	Marks	Guidance
6(a)(i)	*Any **one** fossil fuel from:* crude oil / petroleum / natural gas / methane / petrol / gasoline / kerosene / paraffin / diesel (oil) / gas oil / fuel oil / refinery gas / LPG / propane / butane;	1	**I** ethane / oil / naphtha / coal / gas **R** coke / bitumen / lubricating oil / wood
(a)(ii)	(burn to) release energy; take a long time to form (from organic material);	2	If time stated 1000 years or more
(b)(i)	/ air and sulfur (from fuel) react; (forms) sulfur (di)oxide; (sulfur dioxide) reacts with oxygen / air and water (to form sulfuric acid) **OR** sulfur trioxide reacts with water (to form sulfuric acid) **OR** sulfurous acid reacts with oxygen (to form sulfuric acid);	3	**A** correct formulae throughout **A** sulfurous acid if sulfur reacts with oxygen and water
(b)(ii)	oxygen and nitrogen react; making oxides of nitrogen; (oxides of nitrogen) react with water (making nitric acid);	3	**A** nitrogen combust **R** if oxygen or nitrogen originate from the fuel **A** named oxide of nitrogen **A** correct formulae **A** NO_x
(b)(iii)	add sodium hydroxide (solution) and aluminium; (warm) and ammonia made;	2	**A** zinc or Devarda's **A** description of smell of ammonia or test for ammonia

Question	Answer	Marks	Guidance
(b)(iv)	M1 measure pH / describe how to measure pH (such as use universal indicator); M2 lower pH greater concentration of H^+; **OR** M1 add Ca, Mg, Zn, Fe; M2 faster reaction greater concentration of H^+ / faster bubbles or more hydrogen (in same time); **OR** M1 rate of reaction with (metal) carbonate; M2 faster reaction greater concentration of H^+ / faster bubbles or more carbon dioxide (in same time); **OR** M1 electrical conductivity; M2 greater conductivity greater concentration of H^+; **OR** M1 titrate with (named) alkali; M2 correct result;	**2**	**A** M2 if non specified or other metal added in M1

7 **(a) (i)** darker **or** actual colours **[1]**

chlorine	yellow, yellow/green
bromine	orange, brown, brownish red
iodine	black grey, purple

(ii) gas, liquid, solid **[1]**
all three needed

(iii) colourless **or** (pale) yellow **[1]**
gas **[1]**

(b) Must have a correct reagent otherwise wc = 0

add chlorine water **or** bubble in chlorine gas **[1]**
yellow **or** orange **or** brown **[1]**
dark brown **or** grey crystals
(**Accept** colour that is darker than for bromide) **[1]**

OR add (acidified) silver nitrate(aq) **[1]**
off white **or** pale yellow **or** cream precipitate **or** soluble in aqueous ammonia **[1]**
yellow precipitate insoluble in aqueous ammonia **[1]**
precipitate essential then either colour **or** solubility in aqueous ammonia

OR add lead nitrate(aq) **[1]**
pale yellow **or** off white **or** cream precipitate **[1]**
yellow precipitate insoluble in aqueous ammonia **[1]**

Accept any test that could work – electrolysis, iron(III) salt
bromine, potassium dichromate, potassium manganate(VII) etc.

(c) $I_2 + 3Cl_2 = 2ICl_3$ **[2]**
For having either reactants **or** products correct ONLY [1]

(d) chlorine **[1]**
COND lower M_r **or** lower density **or** lighter molecules **or** molecules move faster **[2]**

OR lighter **or** based on A_r MAX [1]
smaller with no additional comment **or** sieve idea [0]
N.B. a total of [3] not [2]

TOTAL = 12