

Question	Answer	Marks	AO Element	Notes	Guidance
1	C - nitrogen dioxide	1			
2	any two from: carbon or soot / carbon monoxide / water	2			
3	any two from: • sulfur (oxidises / burns) to form sulfur dioxide • acid rain / acidic gas formed • effect of acid rain, e.g. kills animals in ponds (or lakes) / kills plants / soil demineralisation / erodes limestone buildings / iron structures corroded	2			
4	any two from: • fossil fuels contain sulfur / named fossil fuel contains sulfur; • burning fossil fuel; • sulfur reacts with oxygen / sulfur reacts with air; • sulfur dioxide is a gas (so escapes into air);	2			
5	21%	1			

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6(a)	4.76 (dm ³)	1			
6(b)	moves equilibrium to right	1			
	increases yield (of sulfur trioxide) / uses up more sulfur dioxide	1			
6(c)(i)	moves equilibrium to left	1			
	(forward reaction) exothermic	1			
6(c)(ii)	decreases rate	1			
	molecules have less energy / move slower	1			
	fewer collisions (per second) / fewer particles have the activation energy / fewer collisions have the activation energy	1			
6(d)(i)	moves to right	1			
6(d)(ii)	high yield at 2 atm	1			
7	poisonous / toxic / death	1			

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8	<p><i>Any two from:</i></p> <p>M1 lowers pH or acidifies lakes / rivers or kills fish</p> <p>M2 changes composition of soils or reduces fertility of soil or reduces crop yields deforestation or kills crops / trees / plants / leaves</p> <p>M3 attacks (limestone) buildings or statues</p> <p>M4 attacks metal (structures) / bridges</p>	2			
9	<p>M1 oxygen and nitrogen (from air) react;</p> <p>M2 oxides of nitrogen OR nitrogen oxide(s) are formed;</p> <p>M3 nitrogen oxides formed react with water (to form acid);</p>	3			
10	irritates eyes / nose / mouth / skin / airways / lungs	1			
11(a)	speeds up rate of reaction / makes reaction faster	1			

Question	Answer	Marks	AO Element	Notes	Guidance
11(b)	any suitable source, e.g. from car engines / lightning / high temperature furnaces	1			
11(c)	irritates eyes / nose / mouth / skin / airways / lungs	1			
12	carbon monoxide	1			
13(a)	(combustion of) leaded petrol	1			
13(b)	brain damage (in children)/ damage to nervous system	1			
14	B / sulfur dioxide / SO ₂	1			
15	sulfur dioxide/SO ₂ (1) burning fossil fuels/burning named fossil fuel/volcanoes (1)	2			
16	21 (%)	1			
17	carbon monoxide	1			
18	SO ₂ / sulfur dioxide	1			
19	poisonous / toxic	1			

Question	Answer	Marks	AO Element	Notes	Guidance
20	One mark each for any 3 of: • more nitrogen in petrol engine / ORA for diesel • more carbon dioxide in petrol engine / ORA for diesel • more water vapour in petrol engine / ORA for diesel • more carbon monoxide in petrol engine / ORA for diesel • less oxides of nitrogen in petrol engine / ORA for diesel • more hydrocarbons in petrol engine / ORA for diesel • less sulfur dioxide in petrol engine / ORA for diesel • less or no oxygen in petrol engine / ORA for diesel	3			
21(a)	15.5 (%)	1			
21(b)	hydrogen / H ₂	1			
22(a)	72 (%)	1			
22(b)	hydrogen / H ₂	1			not H
23	nitrogen / N ₂	1			

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24	12 (%)	1			
25	breathing difficulties / irritates eyes / irritates nose / irritates throat / irritates lungs / (potentiates) asthma	1			
26	A	1			allow SO ₂
27	breathing difficulties / irritates nose / irritates eyes / irritates throat	1			
28	toxic / poisonous	1			
29	burning fossil fuels / volcanoes / high temperature furnaces / burning named fossil fuel	1			
30	air / oxygen (1) water (1)	2			
31	B - oxides of nitrogen and sulfur dioxide	1			
32	A - carbon dioxide and oxygen	1			

Question	Answer	Marks	AO Element	Notes	Guidance
33	affects nervous system (of children) / affects learning of children / affects brain development / poisonous / harmful / toxic / brain damage	1	AO1		
34	poisonous / toxic;	1			
35	causes acid rain / it is acidic / it acidifies (something);	1			
	erodes (limestone) buildings / erodes mortar / corrodes metalwork / corrodes bridges / erodes named carbonate rock;	1			
36(a)	carbon monoxide	1			
36(b)	propene	1			
36(c)	carbon dioxide	1			
36(d)	chlorine	1			
36(e)	sulfur dioxide	1			
37	water and oxygen / air	1			
38(a)	(it causes) acid rain	1			

Question	Answer	Marks	AO Element	Notes	Guidance
38(b)	test – (aqueous) potassium manganate(VII) (1) (purple to) colourless (1)	2			
39(a)	$C + O_2 \rightarrow CO_2$ (2) if two marks not scored: 1 mark for $C + 2O \rightarrow CO_2$	2			
39(b)	acidic oxide (1) sulfur is a non-metal (oxide) (1)	2			
40(a)	burning fossil fuels / volcanoes / heating (sulfide) ores	1			
40(b)	substance which speeds up a reaction / substance which increases the rate of reaction	1			
40(c)	pH 4	1			
40(d)	erodes buildings (made of carbonate rocks) / wears away buildings (made of carbonate rocks) / reacts with mortar / corrodes iron work / corrodes metal	1			

- Mark Scheme

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					[Total: 77]

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