Question 1

1(d)	water	1

Question 2

2(e)(i)	21 (%)	1
2(e)(ii)	combustion of fossil fuels (containing sulfur)	1
2(e)(iii)	acid rain / stated effect of acid rain, e.g. acidification of lakes	1
2(e)(iv)	flue gas desulfurisation / burning low–sulfur fuels	1
2(e)(v)	H^+	1
2(e)(vi)	$\rightleftharpoons$	1

Question 3

3(f)	O_2	1

Question 4

4(a)	pair of electrons between each H and N and no other electrons on H atoms (1) two non-bonding electrons on N atom (1)	2
4(b)(i)	car engines / car exhausts / vehicle exhausts	1
4(b)(ii)	acid rain / (photochemical) smog / respiratory problems	1
4(c)	acidic because nitrogen is a non-metal	1

Question 5

5(a)	N	1

Question 6

6(a)	oxygen	1
6(b)(i)	sewage / microbes	1
6(b)(ii)	deoxygenate (the water) / remove oxygen (from the water)	1

Question 7

7(a)	1 mark each for any 2 of: • poor thermal conductor / poor conductor of heat • not malleable / brittle • not ductile • low melting point / low boiling point	2
7(b)(i)	car engines	1
7(b)(ii)	respiratory problems / photochemical smog	1

Question 8

8(d)	methane	1

Question 9

9(a)(i)	ammonia	**1**
9(a)(ii)	particulates	**1**
9(a)(iii)	5.0 (ng)	**1**

9(b)(i)	combustion of **fossil** fuels	**1**
9(b)(ii)	acid rain / stated effect of acid rain	**1**
9(b)(iii)	2nd box down ticked (calcium oxide)	**1**

Question 10

10(e)(i)	car engines	**1**
10(e)(ii)	acid rain	**1**

Question 11

11(c)	decreasing use of fossil fuels / use renewable fuels	**1**
	reduction in livestock farming	**1**

Question 12

12(a)(i)	G is oxygen (1) H is nitrogen (1)	**2**
12(a)(ii)	volume increases (as temperature increases)	**1**
12(a)(iii)	they have a full outer shell (of electrons) / they have a complete outer shell (of electrons)	**1**
12(a)(iv)	arrangement: irregular / random (1) separation: far apart (1)	**2**

12(b)(i)	*oxides of nitrogen:* breathing difficulties / irritates lungs / irritates eyes / irritates throat / irritates skin / lung problems (1) *lead compounds:* poisonous / toxic / harms nervous system / harms brain (1)	**2**
12(b)(ii)	1 mark for each correct pollutant and one 1 mark for each correct source e.g. sulfur dioxide (1) burning fossil fuels / volcanoes (1) carbon monoxide (1) incomplete combustion of carbon containing substance / incomplete combustion of named carbon compound (1)	**4**

Question 13

13(a)(i)	B	**1**
13(a)(ii)	G	**1**

Question 14

14(d)(i)	vehicle engines / high temperature furnaces / lightning	1
14(d)(ii)	breathing difficulties / asthma	1

Question 15

15(a)	carbon dioxide	1
15(b)	78 (%)	1
15(c)	calcium oxide	1
15(d)	catalytic converter	1
15(e)(i)	CH_4	1
15(e)(ii)	lowest relative molecular mass	1
15(f)	toxic	1
15(g)	**M1** glucose **M2** oxygen	2

Question 16

16(d)	J	1

Question 17

17(a)(i)	N	1

Question 18

18(a)	sulfur dioxide	1
18(b)	ammonia	1
18(c)	xenon	1
18(d)	oxygen	1

Question 19

19(c)(i)	carbon dioxide	1

19(c)(ii)	**M1** greenhouse gases absorb thermal energy (from the Earth) (1) **M2 and M3** one mark each for any two of: • energy (from the sun) absorbed by Earth's surface • Earth emits or reflects thermal energy • (greenhouse gases) reduces or stops thermal energy loss (into space) • increasing in amount of greenhouse gas results in a higher atmospheric temperature	3

Question 20

20(a)	nitrogen	1

Question 21

21(a)	nitrogen (from air) and oxygen (from air) react react due to high temperatures (of engine)	**2**
21(b)	acid rain	**1**
21(c)(i)	(thermal) decomposition	**1**
21(c)(ii)	HCNO	**1**
21(c)(iii)	(damp red) litmus (litmus) turns blue	**2**
21(d)(i)	$6NO_2$ $8NH_3$ $7N_2$ either $6NO_2$ or $8NH_3$ all three balanced	**2**
21(d)(ii)	(nitrogen) loses oxygen	**1**
21(d)(iii)	reduction **and** oxidation occur	**1**
21(e)	M_r urea = 60 $135 \times 60 = 8100$ and g to kg conversion = 8.1(00) kg	**2**
21(f)(i)	carbon monoxide	**1**
21(f)(ii)	carbon dioxide **and** nitrogen	**1**

Question 22

22(a)	carbon dioxide	**1**
22(f)	carbon dioxide	**1**
22(g)	nitrogen	**1**

Question 23

23(a)	oxygen	**1**
23(b)	carbon	**1**
23(h)	nitrogen	**1**