Name: Class: Date:

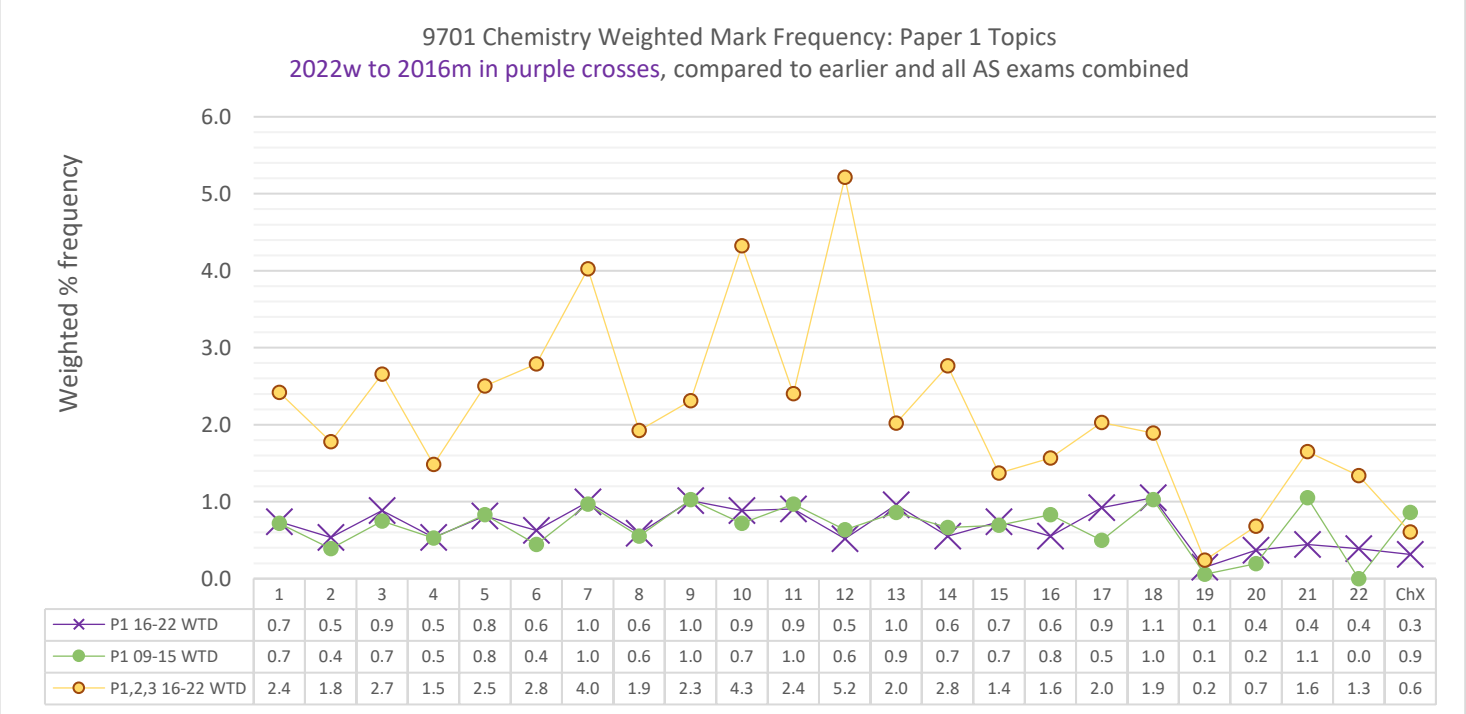
ALvl Chem 12 EQ P1 22w to 09s Paper 1 Nitrogen and sulfur 51marks

As you start and work through this worksheet you can tick off your progress to show yourself how much you have done, and what you need to do next. The first task is just to read the first question and should take you less than one minutes to complete.

Paper 1 **Topic 12**

Checklist Tick each task off as you go along

	RANK:	P1 Noob	P1 Novice	P1 Bronze	P1 Silver	P1 Gold	P1[1] Winner	P1 Hero	P1 Legend
		1 Q started	1 Q done	10% of marks	25% of marks	40% of marks	50% of marks	75% of marks	100% of marks
Topic (marks)	51		1	5	13	20	26	38	51
Time @75s/mark (minutes)	64		1	6	16	26	32	48	64



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	ChX
P1 16-22 WTD	0.7	0.5	0.9	0.5	0.8	0.6	1.0	0.6	1.0	0.9	0.9	0.5	1.0	0.6	0.7	0.6	0.9	1.1	0.1	0.4	0.4	0.4	0.3
P1 09-15 WTD	0.7	0.4	0.7	0.5	0.8	0.4	1.0	0.6	1.0	0.7	1.0	0.6	0.9	0.7	0.7	0.8	0.5	1.0	0.1	0.2	1.1	0.0	0.9
P1,2,3 16-22 WTD	2.4	1.8	2.7	1.5	2.5	2.8	4.0	1.9	2.3	4.3	2.4	5.2	2.0	2.8	1.4	1.6	2.0	1.9	0.2	0.7	1.6	1.3	0.6

What the most thoughtful students will get out of their extensive studying will be a capacity to do meaningful brain-based work even under stressful conditions, which is a part of the self-mastery skillset that will continue to deliver value for the whole of their lives. Outstanding grades will also happen, but the most important goal from skillful action in study is being better at any important task, even if circumstances do not feel ideal.

As you are moving through your studies you can learn more about yourself by trying out new ways to manage yourself, and analysing how effective those new techniques were. In this reflective process not only will you get better at working positively and productively to deliver ambitious and successful outcomes, but you will be working towards one aspect of life's highest pursuit, summarised and inscribed on the Temple of Apollo at Delphi: "know thyself".

1. To complete these questions, as important as your answer, is checking your answer against the mark scheme.
2. For each page or group of 10 questions, convert your mark score into a percentage. This will allow you to see (and feel) your progress as you get more experience and understanding with each topic.
3. Multiple choice questions, done carefully where you explain and show yourself your thinking using written notes as you move through each question, can be more useful than just Paper 2 for students aiming for a C or B grade. Paper 2 should be the larger focus for students aiming for A and A* grades, however.
4. If you find you get a higher percentage answering short answer questions than multiple choice questions that often means you are NOT using the marking scheme correctly; your correct answer might not be fully complete for all the marks you are awarding. The marks easiest to miss rely on providing the largest amount of detail.

[1] **DO NOT** work on these higher levels of completion in your A2 year unless you have also achieved at least a "**Silver**" (25%) in the same topic in **Paper 2**, which is **MOST** of your **AS grade**, and Paper 3 which is a smaller part of your year but still important.

12 Nitrogen and sulfur

12.1 Nitrogen and sulfur

Learning outcomes

Candidates should be able to:

1 explain the lack of reactivity of nitrogen, with reference to triple bond strength and lack of polarity

2 describe and explain:

(a) the basicity of ammonia, using the Brønsted–Lowry theory

(b) the structure of the ammonium ion and its formation by an acid–base reaction

(c) the displacement of ammonia from ammonium salts by an acid–base reaction

3 state and explain the natural and man-made occurrences of oxides of nitrogen and their catalytic removal from the exhaust gases of internal combustion engines

4 understand that atmospheric oxides of nitrogen (NO and NO_2) can react with unburned hydrocarbons to form peroxyacetyl nitrate, PAN, which is a component of photochemical smog

5 describe the role of NO and NO_2 in the formation of acid rain both directly and in their catalytic role in the oxidation of atmospheric sulfur dioxide

Q# 747/ AS Chemistry/2022/w/TZ 1/Paper 1/Q# 23//www.SmashingScience.org :o)

23 Which statement about ammonia or the ammonium ion is correct?

A Ammonia gas is produced when an aqueous solution containing the ammonium ion is reacted with a strong acid.

B Silver iodide is soluble in a concentrated aqueous solution of ammonia.

C The ammonium ion has the same number of electrons as a methane molecule.

D The square planar ammonium ion contains a dative covalent bond.

Q# 748/ AS Chemistry/2022/s/TZ 1/Paper 1/Q# 29//www.SmashingScience.org :o)

29 Carbon monoxide, CO, nitrogen dioxide, NO_2, and sulfur dioxide, SO_2, are all atmospheric pollutants.

Which reaction occurs in the atmosphere?

A CO is spontaneously oxidised to CO_2.

B NO_2 is reduced to NO by SO_2.

C NO_2 is reduced to NO by CO.

D SO_2 is oxidised to SO_3 by CO_2.

Q# 749/ AS Chemistry/2022/s/TZ 1/Paper 1/Q# 25//www.SmashingScience.org :o)

25 Which reaction mixture produces an acidic gas?

A aqueous ammonium nitrate and solid calcium oxide

B calcium and aqueous hydrochloric acid

C potassium chloride and concentrated sulfuric acid

D sodium oxide and water

Q# 750/ AS Chemistry/2022/m/TZ 2/Paper 1/Q# 24//www.SmashingScience.org :o)

24 The product of the Contact process is Z.

Which reaction or process leads to the formation of a gas that can neutralise an aqueous solution of Z?

A atmospheric lightning

B combustion of fuel in an internal combustion engine

C the Haber process

D thermal decomposition of Group 2 nitrates

Q# 751/ AS Chemistry/2021/s/TZ 1/Paper 1/Q# 18//www.SmashingScience.org :o)

18 Acid rain is a dilute solution of sulfuric acid.

Which pollutant also contributes to the formation of acid rain?

A carbon monoxide

B carbon dioxide

C nitrogen dioxide

D hydrocarbons

Q# 752/ AS Chemistry/2021/s/TZ 1/Paper 1/Q# 13//www.SmashingScience.org :o)

13 The gaseous products of heating a mixture of $Ca(OH)_2$ and NH_4Cl are passed through solid CaO. A single gaseous product, W, is collected.

A sample of W reacts with $Cl_2(g)$ to produce two gases, X and Y.

X is an element. Y is acidic.

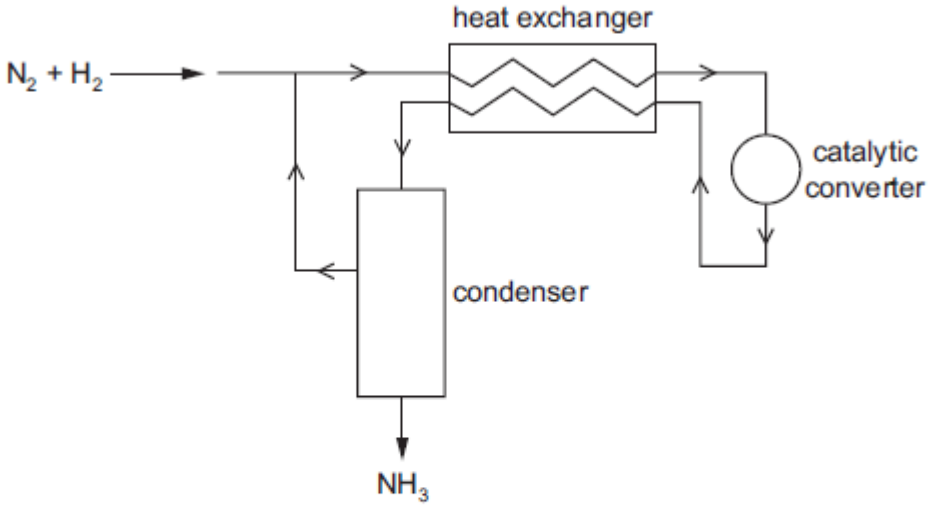
Y reacts with W to produce Z.

What are X and Z?

	X	Z
A	N_2	$CaCl_2$
B	N_2	NH_4Cl
C	O_2	$CaCl_2$
D	O_2	NH_4Cl

Q# 753/ AS Chemistry/2021/s/TZ 1/Paper 1/Q# 10//www.SmashingScience.org :o)

10 The diagram represents the Haber process for the manufacture of ammonia from nitrogen and hydrogen.



What is the purpose of the heat exchanger?

A to cool the incoming gas mixture to avoid overheating the catalyst

B to cool the reaction products and separate the NH_3 from unused N_2 and H_2

C to warm the incoming gas mixture and shift the equilibrium to give more NH_3

D to warm the incoming gas mixture and speed up the reaction

Q# 754/ AS Chemistry/2021/m/TZ 2/Paper 1/Q# 36//www.SmashingScience.org :o)

The responses **A** to **D** should be selected on the basis of

A	B	C	D
1, **2** and **3** are correct	**1** and **2** only are correct	**2** and **3** only are correct	**1** only is correct

36 Nitrogen dioxide gas is produced when petrol is burned in car engines.

Which acids are made in the atmosphere as a result of this release of nitrogen dioxide into the air?

1 H_2SO_3

2 H_2SO_4

3 HNO_3

Q# 755/ AS Chemistry/2021/m/TZ 2/Paper 1/Q# 19//www.SmashingScience.org :o)

19 Methylamine, CH_3NH_2, has similar chemical properties to ammonia, NH_3. Methylamine reacts with hydrogen chloride to form a white crystalline salt, methylammonium chloride.

$$CH_3NH_2 + HCl \rightarrow CH_3NH_3^+Cl^-$$

A sample of methylammonium chloride is heated with aqueous sodium hydroxide.

What are the products?

A ammonia, sodium chloride and water

B ammonia, sodium hydrogencarbonate and sodium chloride

C methylamine, hydrogen chloride and water

D methylamine, sodium chloride and water

Q# 756/ AS Chemistry/2021/m/TZ 2/Paper 1/Q# 18//www.SmashingScience.org :o)

18 NO, NO_2, CO and unburnt hydrocarbons are present in the exhaust gases of internal combustion engines. When catalytic converters are used to remove these compounds from the exhaust gases, redox reactions occur.

What happens to each compound in the catalytic converter?

	NO	NO_2	CO	unburnt hydrocarbons
A	oxidised	oxidised	reduced	oxidised
B	oxidised	oxidised	oxidised	oxidised
C	reduced	reduced	oxidised	oxidised
D	reduced	reduced	reduced	reduced

Q# 757/ AS Chemistry/2020/w/TZ 1/Paper 1/Q# 17//www.SmashingScience.org :o)

17 Ammonia can undergo an acid–base reaction with hydrogen chloride to form ammonium chloride.

Which statement is correct?

A The ammonium ion is basic.

B The hydrogen atom from HCl donates a lone pair of electrons to the nitrogen atom.

C The H–N–H bond angle in ammonia is the same as the H–N–H bond angle in the ammonium ion.

D The H–N–H bond angle in the ammonium ion is the same as the H–C–H bond angle in methane.

Q# 758/ AS Chemistry/2020/m/TZ 2/Paper 1/Q# 19//www.SmashingScience.org :o)

19 Which statement about nitrogen or its compounds is correct?

A In the Haber process the temperature is kept high to give a good equilibrium yield of ammonia.

B Nitrogen gas is unreactive because of the strong nitrogen–nitrogen double bond.

C Nitrogen monoxide will react with carbon monoxide under suitable conditions.

D The formula of ammonium sulfate is NH_4SO_4.

Q# 759/ AS Chemistry/2019/w/TZ 1/Paper 1/Q# 36//www.SmashingScience.org :o)

The responses **A** to **D** should be selected on the basis of

A	B	C	D
1, **2** and **3** are correct	**1** and **2** only are correct	**2** and **3** only are correct	**1** only is correct

36 Nitrogen gas is unreactive, whereas oxygen gas and chlorine gas are reactive.

Which statements help to explain this difference?

1 The two N atoms in an N_2 molecule are held together by a very strong triple bond.

2 The triple bond between two N atoms is not polar. The bonds in O_2 and Cl_2 are polar.

3 The atoms in N_2 have a full outer shell of electrons. The atoms in O_2 and Cl_2 do not have a full outer shell of electrons.

Q# 760/ AS Chemistry/2019/w/TZ 1/Paper 1/Q# 19//www.SmashingScience.org :o)

19 Catalytic converters are fitted in the exhaust systems of many cars.

Which gas:

- causes acid rain if it is released into the air
- is removed from car exhaust fumes by a catalytic converter?

A carbon dioxide

B carbon monoxide

C hydrocarbon vapour

D nitrogen dioxide

Q# 761/ AS Chemistry/2019/s/TZ 1/Paper 1/Q# 19//www.SmashingScience.org :o)

19 Which statement is correct?

A Ammonia reacts with alkalis to form the ammonium ion.

B Ammonium chloride contains ionic, covalent and co-ordinate bonds.

C The ammonium ion reacts with acids to produce ammonia.

D The bond angle in the ammonium ion is approximately 107°.

Q# 762/ AS Chemistry/2019/s/TZ 1/Paper 1/Q# 18//www.SmashingScience.org :o)

18 At 550 °C nitrogen dioxide reacts with unburnt hydrocarbon fragments such as CH_3 in the catalytic converter of a motor vehicle.

$$4CH_3 + 7NO_2 \rightarrow 3\tfrac{1}{2}N_2 + 4CO_2 + 6H_2O$$

Which row gives the energy change for this reaction and a possible reason for it?

	energy change of reaction	reason why the reaction is endothermic or exothermic
A	endothermic	chemical energy is converted to heat energy
B	endothermic	the N≡N bond energy is very high
C	exothermic	CO_2 and H_2O have negative $\Delta H_f^{\ominus}$ values
D	exothermic	double bonds are broken in NO_2

Q# 763/ AS Chemistry/2019/m/TZ 2/Paper 1/Q# 19//www.SmashingScience.org :o)

19 Ammonia, NH_3, and hydrazine, NH_2NH_2, are two compounds of nitrogen, N_2.

Which statement is correct?

A The N–N bond in NH_2NH_2 is polar.

B NH_3 and NH_2NH_2 have lone pairs of electrons but N_2 does not.

C The oxidation number of each nitrogen in NH_2NH_2 is +2.

D The reaction of nitrogen with hydrogen has a high activation energy.

Q# 764/ AS Chemistry/2018/w/TZ 1/Paper 1/Q# 19//www.SmashingScience.org :o)

19 Transition elements and their compounds are widely used as catalysts.

What is the identity and what is the oxidation number of the element present in the catalyst used in the Contact process?

	element	oxidation number
A	iron	0
B	iron	+3
C	vanadium	0
D	vanadium	+5

Q# 765/ AS Chemistry/2018/w/TZ 1/Paper 1/Q# 18//www.SmashingScience.org :o)

18 Which statement explains the observation that magnesium hydroxide dissolves in aqueous ammonium chloride, but not in aqueous sodium chloride?

A The ionic radius of the NH_4^+ ion is similar to that of Mg^{2+} but not that of Na^+.

B NH_4Cl dissociates less fully than $NaCl$.

C The Na^+ and Mg^{2+} ions have the same number of electrons.

D The NH_4^+ ion can donate a proton.

Q# 766/ AS Chemistry/2018/s/TZ 1/Paper 1/Q# 36//www.SmashingScience.org :o)

The responses **A** to **D** should be selected on the basis of

A	B	C	D
1, **2** and **3** are correct	**1** and **2** only are correct	**2** and **3** only are correct	**1** only is correct

36 Which statements correctly describe an oxide of nitrogen acting as an atmospheric pollutant?

1 Nitrogen monoxide, NO, reacts with oxygen to form nitrogen dioxide which contributes to acid rain.

2 Nitrogen dioxide reacts with sulfur dioxide to form sulfur trioxide which reacts with water to form sulfuric acid.

3 Nitrogen oxides react with unburnt hydrocarbons in sunlight to form other pollutants.

Q# 767/ AS Chemistry/2018/s/TZ 1/Paper 1/Q# 17//www.SmashingScience.org :o)

17 Oxides of nitrogen are present in the environment due to natural and man-made sources.

Which row is correct?

	natural source of nitrogen oxides	man-made source of nitrogen oxides
A	electrical discharges in the atmosphere	internal combustion engines
B	electrical discharges in the atmosphere	as a by-product of the Haber process
C	decomposition of dead plants in rivers	internal combustion engines
D	decomposition of dead plants in rivers	as a by-product of the Haber process

Q# 768/ AS Chemistry/2018/m/TZ 2/Paper 1/Q# 18//www.SmashingScience.org :o)

18 When burned, sulfur forms a gaseous product X which can be oxidised to produce a gas Y.

Gas Y reacts with water to produce a product Z.

Which row correctly shows the oxidation states of sulfur in X, Y and Z?

	X	Y	Z
A	–2	+4	+4
B	–2	+4	+6
C	+4	+6	+4
D	+4	+6	+6

Q# 769/ AS Chemistry/2017/w/TZ 1/Paper 1/Q# 36//

The responses **A** to **D** should be selected on the basis of

A	B	C	D
1, **2** and **3** are correct	**1** and **2** only are correct	**2** and **3** only are correct	**1** only is correct

36 Which statements explain why nitrogen gas is unreactive?

1 Nitrogen atoms are highly electronegative.

2 Nitrogen molecules are non-polar.

3 The triple bond between nitrogen atoms is very strong.

Q# 770/ AS Chemistry/2017/s/TZ 1/Paper 1/Q# 36//www.SmashingScience.org :o)

The responses **A** to **D** should be selected on the basis of

A	B	C	D
1, **2** and **3** are correct	**1** and **2** only are correct	**2** and **3** only are correct	**1** only is correct

36 X is either nitrogen or sulfur and forms pollutant oxide Y in a car engine.

Further oxidation of Y to Z occurs in the atmosphere. In this further oxidation, 1 mol of Y reacts with 0.5 mol of gaseous oxygen molecules.

Which statements about X, Y and Z can be correct?

1 The oxidation number of X increases by two from Y to Z.

2 Y has an unpaired electron in its molecule.

3 Y is a polar molecule.

Q# 771/ AS Chemistry/2017/m/TZ 2/Paper 1/Q# 13//www.SmashingScience.org :o)

13 Which reagent, when mixed with ammonium sulfate and then heated, liberates ammonia?

A aqueous bromine

B dilute hydrochloric acid

C limewater

D potassium dichromate(VI) in acidic solution

Q# 772/ AS Chemistry/2016/w/TZ 1/Paper 1/Q# 17//www.SmashingScience.org :o)

17 Compound **T** is a white crystalline solid.

When a sample of **T** was mixed with aqueous sodium hydroxide and heated, a pungent smelling gas was produced which turned damp red litmus paper blue. This same gas produced dense white smoke with hydrogen chloride gas.

Further testing of a solution of **T** with barium chloride solution produced a dense white precipitate which did not dissolve when dilute hydrochloric acid was added to the mixture.

What is the identity of compound **T**?

A ammonium carbonate

B ammonium sulfate

C sodium carbonate

D sodium sulfate

Q# 773/ AS Chemistry/2016/s/TZ 1/Paper 1/Q# 18//www.SmashingScience.org :o)

18 Which statement about the ammonia molecule and/or the ammonium ion is correct?

A Ammonia molecules are basic because they can donate H^+ ions.

B Ammonium ions are basic because they can accept H^+ ions.

C If ammonium ions are heated with NaOH(aq), ammonia molecules are formed.

D The bond angle in NH_4^+ is 2.5° less than the bond angle in NH_3.

Q# 774/ AS Chemistry/2016/m/TZ 2/Paper 1/Q# 17//www.SmashingScience.org :o)

17 Ammonium sulfate, $(NH_4)_2SO_4$, and ammonium nitrate, NH_4NO_3, are used as fertilisers.

These salts have different percentages by mass of nitrogen. They have the same effect as each other on the pH of neutral soil.

Which row is correct?

	higher percentage of nitrogen by mass	effect on pH of soil
A	ammonium nitrate	decrease
B	ammonium nitrate	increase
C	ammonium sulfate	decrease
D	ammonium sulfate	increase

Q# 775/ AS Chemistry/2015/w/TZ 1/Paper 1/Q# 19//www.SmashingScience.org :o)

19 Element X forms a pollutant oxide Y. Y can be further oxidised to Z. Two students made the following statements.

Student P 'The molecule of Y contains lone pairs of electrons.'

Student Q 'The oxidation number of X increases by 1 from Y to Z.'

X could be carbon or nitrogen or sulfur.

Which student(s) made a correct statement?

A P only

B Q only

C both P and Q

D neither P nor Q

Q# 776/ AS Chemistry/2015/s/TZ 1/Paper 1/Q# 18//www.SmashingScience.org :o)

18 Mohr's salt is a pale green crystalline solid which is soluble in water. It contains two cations, one of which is Fe^{2+}, and one anion which is SO_4^{2-}.

The identity of the second cation was determined by heating Mohr's salt with aqueous sodium hydroxide. A colourless gas was evolved which readily dissolved in water giving an alkaline solution.

A green precipitate was also formed.

What are the identities of the gas and the precipitate?

	gas	precipitate
A	NH_3	$Fe(OH)_2$
B	NH_3	Na_2SO_4
C	SO_2	$Fe(OH)_2$
D	SO_2	Na_2SO_4

Q# 777/ AS Chemistry/2014/s/TZ 1/Paper 1/Q# 35//www.SmashingScience.org :o)

The responses **A** to **D** should be selected on the basis of

A	B	C	D
1, **2** and **3** are correct	**1** and **2** only are correct	**2** and **3** only are correct	**1** only is correct

35 Pollutant oxide **Y**, which contains non-metallic element **X**, is formed in a car engine.

Further oxidation of **Y** to **Z** occurs in the atmosphere. In this further oxidation, 1 mol of **Y** reacts with 0.5 mol of gaseous oxygen molecules.

X could be either nitrogen or sulfur.

Which statements about **X**, **Y** and **Z** can be correct?

1 The oxidation number of **X** increases by two from **Y** to **Z**.

2 **Y** has an unpaired electron in its molecule.

3 **Y** is a polar molecule.

Q# 778/ AS Chemistry/2013/w/TZ 1/Paper 1/Q# 17//www.SmashingScience.org :o)

17 Which statement explains the observation that magnesium hydroxide dissolves in aqueous ammonium chloride, but not in aqueous sodium chloride?

A The ionic radius of the NH_4^+ ion is similar to that of Mg^{2+} but not that of Na^+.

B NH_4Cl dissociates less fully than $NaCl$.

C The Na^+ and Mg^{2+} ions have the same number of electrons.

D The NH_4^+ ion can donate a proton.

Q# 779/ AS Chemistry/2012/w/TZ 1/Paper 1/Q# 25//www.SmashingScience.org :o)

25 One of the reactions taking place in a catalytic converter in a car exhaust system is between nitrogen oxide and octane (unburned petrol). The products of this reaction are non-toxic.

Which is the correct equation for the reaction?

A $C_8H_{16} + 16NO \rightarrow 8CO + 8N_2 + 8H_2O$

B $C_8H_{16} + 24NO \rightarrow 8CO_2 + 12N_2 + 8H_2O$

C $C_8H_{18} + 17NO \rightarrow 8CO + 8\frac{1}{2}N_2 + 9H_2O$

D $C_8H_{18} + 25NO \rightarrow 8CO_2 + 12\frac{1}{2}N_2 + 9H_2O$

Q# 780/ AS Chemistry/2012/w/TZ 1/Paper 1/Q# 16//www.SmashingScience.org :o)

16 In a car engine, non-metallic element *X* forms a pollutant oxide *Y*. *Y* can be further oxidised to *Z*. Two students made the following statements.

Student P	The molecule of *Y* contains lone pairs of electrons.
Student Q	The oxidation number of *X* increases by 1 from *Y* to *Z*.

X could be carbon or nitrogen or sulfur.

Which student could be correct if *X* were any of these elements?

A P only

B Q only

C both P and Q

D neither P nor Q

Q# 781/ AS Chemistry/2012/s/TZ 1/Paper 1/Q# 5//www.SmashingScience.org :o)

5 Two conversions are outlined below.

$NH_4^+ \rightarrow NH_3$

$C_2H_4 \rightarrow C_2H_6$

What similar feature do these two conversions have?

A a lone pair of electrons in the product

B change in oxidation state of an element

C decrease in bond angle of the species involved

D disappearance of a π bond

Q# 782/ AS Chemistry/2012/s/TZ 1/Paper 1/Q# 34//www.SmashingScience.org :o)

The responses **A** to **D** should be selected on the basis of

A	B	C	D
1, **2** and **3** are correct	**1** and **2** only are correct	**2** and **3** only are correct	**1** only is correct

34 Ammonia and chlorine react in the gas phase.

$$8NH_3 + 3Cl_2 \rightarrow N_2 + 6NH_4Cl$$

Which statements are correct?

1 Ammonia behaves as a reducing agent.

2 Ammonia behaves as a base.

3 The oxidation number of the hydrogen changes

Q# 783/ AS Chemistry/2012/s/TZ 1/Paper 1/Q# 19//www.SmashingScience.org :o)

19 Carbon monoxide, CO, nitrogen monoxide, NO, and sulfur dioxide, SO_2, may all be present in the exhaust fumes from a car engine.

Which reaction concerning these compounds occurs in the atmosphere?

A CO is spontaneously oxidised to CO_2

B NO_2 is reduced to NO by CO

C NO_2 is reduced to NO by SO_2

D SO_2 is oxidised to SO_3 by CO_2

Q# 784/ AS Chemistry/2011/w/TZ 1/Paper 1/Q# 36//www.SmashingScience.org :o)

The responses **A** to **D** should be selected on the basis of

A	B	C	D
1, **2** and **3** are correct	**1** and **2** only are correct	**2** and **3** only are correct	**1** only is correct

36 In a car engine, non-metallic element X forms a pollutant oxide Y.

Further oxidation of Y to Z occurs spontaneously in the atmosphere. In this further oxidation, 1 mol of Y reacts with 0.5 mol of gaseous oxygen.

Which statements about X, Y and Z are correct?

1 X forms a basic hydride.

2 Y is a diatomic molecule.

3 Z is a polar molecule.

Q# 785/ AS Chemistry/2011/w/TZ 1/Paper 1/Q# 34//www.SmashingScience.org :o)

The responses **A** to **D** should be selected on the basis of

A	B	C	D
1, **2** and **3** are correct	**1** and **2** only are correct	**2** and **3** only are correct	**1** only is correct

34 A farmer spreads lime on land which has already been treated with an ammonium nitrate fertiliser.

Which reactions will occur in the treated soil?

1 $Ca(OH)_2 + 2NH_4^+(aq) \rightarrow Ca^{2+}(aq) + 2NH_3 + 2H_2O$

2 $Ca(OH)_2 + 2H^+(aq) \rightarrow Ca^{2+}(aq) + 2H_2O$

3 $Ca(OH)_2 + CO_2 \rightarrow CaCO_3 + H_2O$

Q# 786/ AS Chemistry/2011/s/TZ 1/Paper 1/Q# 37//www.SmashingScience.org :o)

The responses **A** to **D** should be selected on the basis of

A	B	C	D
1, **2** and **3** are correct	**1** and **2** only are correct	**2** and **3** only are correct	**1** only is correct

37 Which descriptions of the ammonium ion are correct?

1 It contains ten electrons.

2 It has a bond angle of 109.5°.

3 It has only three bonding pairs of electrons.

Q# 787/ AS Chemistry/2011/s/TZ 1/Paper 1/Q# 18//www.SmashingScience.org :o)

18 Nitrogen monoxide, NO, is a primary pollutant produced by petrol engines and is found in their exhaust gases.

Which reaction occurs in a catalytic converter and decreases the emission of nitrogen monoxide?

A $NO(g) + CO(g) \rightarrow NO_2(g) + C(s)$

B $NO(g) + CO_2(g) \rightarrow NO_2(g) + CO(g)$

C $2NO(g) + 2CO(g) \rightarrow N_2(g) + 2CO_2(g)$

D $2NO(g) + CO_2(g) \rightarrow 2NO_2(g) + C(s)$

Q# 788/ AS Chemistry/2010/w/TZ 1/Paper 1/Q# 36//www.SmashingScience.org :o)

The responses **A** to **D** should be selected on the basis of

A	B	C	D
1, **2** and **3** are correct	**1** and **2** only are correct	**2** and **3** only are correct	**1** only is correct

36 Element X is a solid. It occurs as a contaminant of carbonaceous fuels.

Its oxide Y is formed in car engines.

Further oxidation of Y to Z can occur in the atmosphere.

Which statements about Y and Z are correct?

1 Molecule Y has lone pairs of electrons.

2 The atmospheric oxidation of Y to Z is a catalysed reaction.

3 Y is a colourless gas.

Q# 789/ AS Chemistry/2010/w/TZ 1/Paper 1/Q# 30//www.SmashingScience.org :o)

30 Which environmental problem is **not** made worse by the release of oxides of nitrogen from car engines?

A acidification of lakes

B corrosion of buildings

C photochemical smog

D the hole in the ozone layer

Q# 790/ AS Chemistry/2010/w/TZ 1/Paper 1/Q# 15//www.SmashingScience.org :o)

15 Ammonium sulfate in nitrogenous fertilisers in the soil can be slowly oxidised by air producing sulfuric acid, nitric acid and water.

How many moles of oxygen gas are needed to oxidise completely one mole of ammonium sulfate?

A 1 B 2 C 3 D 4

Q# 791/ AS Chemistry/2010/s/TZ 1/Paper 1/Q# 35//www.SmashingScience.org :o)

The responses **A** to **D** should be selected on the basis of

A	B	C	D
1, **2** and **3** are correct	**1** and **2** only are correct	**2** and **3** only are correct	**1** only is correct

35 In a car engine, non-metallic element X forms a pollutant oxide Y.

Further oxidation of Y to Z occurs in the atmosphere. In this further oxidation, 1 mol of Y reacts with ½ mol of gaseous oxygen.

What can X be?

1 carbon

2 nitrogen

3 sulfur

Q# 792/ AS Chemistry/2009/w/TZ 1/Paper 1/Q# 35//www.SmashingScience.org :o)

The responses **A** to **D** should be selected on the basis of

A	B	C	D
1, **2** and **3** are correct	**1** and **2** only are correct	**2** and **3** only are correct	**1** only is correct

35 A farmer added lime to damp soil, followed by the nitrogenous fertiliser ammonium sulfate. A chemical reaction occurred in the soil.

Which substances were formed in this reaction?

1 sulfuric acid

2 calcium sulfate

3 ammonia

Q# 793/ AS Chemistry/2009/w/TZ 1/Paper 1/Q# 19//www.SmashingScience.org :o)

19 In an historically famous experiment Wöhler heated 'inorganic' ammonium cyanate in the absence of air. The only product of the reaction was 'organic' urea, $CO(NH_2)_2$. No other products were formed in the reaction.

What is the formula of the cyanate ion present in ammonium cyanate?

A CNO^- **B** CNO^{2-} **C** CO^- **D** NO^-

Q# 794/ AS Chemistry/2009/w/TZ 1/Paper 1/Q# 18//www.SmashingScience.org :o)

18 Most modern cars are fitted with three-way catalytic converters in the exhaust system.

Which three gases are removed by such a catalytic converter?

A carbon monoxide, hydrocarbons, nitrogen oxides

B carbon monoxide, carbon dioxide, nitrogen oxides

C carbon monoxide, nitrogen oxides, sulfur dioxide

D hydrocarbons, nitrogen oxides, sulfur dioxide

Q# 795/ AS Chemistry/2009/s/TZ 1/Paper 1/Q# 34//www.SmashingScience.org :o)

The responses **A** to **D** should be selected on the basis of

A	B	C	D
1, **2** and **3** are correct	**1** and **2** only are correct	**2** and **3** only are correct	**1** only is correct

34 The following reaction takes place using liquid ammonia as a solvent.

$$Na^+ NH_2^- + NH_4^+Cl^- \rightarrow Na^+Cl^- + 2NH_3$$

Which statements best explain why this reaction should be classified as a Brønsted-Lowry acid-base reaction?

1 The ammonium ion acts as a proton donor.

2 Na^+Cl^- is a salt.

3 Ammonia is always basic.

Q# 796/ AS Chemistry/2009/s/TZ 1/Paper 1/Q# 18//www.SmashingScience.org :o)

18 Mohr's salt is a pale green crystalline solid which is soluble in water. It is a 'double sulfate' which contains two cations, one of which is Fe^{2+}.

The identity of the second cation was determined by heating solid Mohr's salt with solid sodium hydroxide and a colourless gas was evolved. The gas readily dissolved in water giving an alkaline solution. A grey-green solid residue was also formed which was insoluble in water.

What are the identities of the gas and the solid residue?

	gas	residue
A	H_2	$FeSO_4$
B	NH_3	Na_2SO_4
C	NH_3	$Fe(OH)_2$
D	SO_2	$Fe(OH)_2$

Q# 797/ AS Chemistry/2009/s/TZ 1/Paper 1/Q# 17//www.SmashingScience.org :o)

17 Deposits of ammonium compounds have been discovered in areas of high atmospheric pollution.

They are believed to arise from the following reaction.

$$SO_3 + H_2O + 2NH_3 \rightarrow (NH_4)_2SO_4$$

What does **not** occur in this reaction?

A acid / base neutralisation

B dative bond formation

C ionic bond formation

D oxidation / reduction

Q# 747/ AS Chemistry/2022/w/TZ 1/Paper 1/Q# 23//www.SmashingScience.org :o)

23	C

Q# 748/ AS Chemistry/2022/s/TZ 1/Paper 1/Q# 29//www.SmashingScience.org :o)

29	B

Q# 749/ AS Chemistry/2022/s/TZ 1/Paper 1/Q# 25//www.SmashingScience.org :o)

26	C

Q# 750/ AS Chemistry/2022/m/TZ 2/Paper 1/Q# 24//www.SmashingScience.org :o)

24	C

Q# 751/ AS Chemistry/2021/s/TZ 1/Paper 1/Q# 18//www.SmashingScience.org :o)

18	C

Q# 752/ AS Chemistry/2021/s/TZ 1/Paper 1/Q# 13//www.SmashingScience.org :o)

13	B

Q# 753/ AS Chemistry/2021/s/TZ 1/Paper 1/Q# 10//www.SmashingScience.org :o)

10	D

Q# 754/ AS Chemistry/2021/m/TZ 2/Paper 1/Q# 36//www.SmashingScience.org :o)

36	C

Q# 755/ AS Chemistry/2021/m/TZ 2/Paper 1/Q# 19//www.SmashingScience.org :o)

19	D

Q# 756/ AS Chemistry/2021/m/TZ 2/Paper 1/Q# 18//www.SmashingScience.org :o)

18	C

Q# 757/ AS Chemistry/2020/w/TZ 1/Paper 1/Q# 17//www.SmashingScience.org :o)

17	D

Q# 758/ AS Chemistry/2020/m/TZ 2/Paper 1/Q# 19//www.SmashingScience.org :o)

19	C

Q# 759/ AS Chemistry/2019/w/TZ 1/Paper 1/Q# 36//www.SmashingScience.org :o)

36	D

Q# 760/ AS Chemistry/2019/w/TZ 1/Paper 1/Q# 19//www.SmashingScience.org :o)

19	D

Q# 761/ AS Chemistry/2019/s/TZ 1/Paper 1/Q# 19//www.SmashingScience.org :o)

19	B

Q# 762/ AS Chemistry/2019/s/TZ 1/Paper 1/Q# 18//www.SmashingScience.org :o)

18	C

Q# 763/ AS Chemistry/2019/m/TZ 2/Paper 1/Q# 19//www.SmashingScience.org :o)

19	D

Q# 764/ AS Chemistry/2018/w/TZ 1/Paper 1/Q# 19//www.SmashingScience.org :o)

19	D

Q# 765/ AS Chemistry/2018/w/TZ 1/Paper 1/Q# 18//www.SmashingScience.org :o)

18	D

Q# 766/ AS Chemistry/2018/s/TZ 1/Paper 1/Q# 36//www.SmashingScience.org :o)

36	A

Q# 767/ AS Chemistry/2018/s/TZ 1/Paper 1/Q# 17//www.SmashingScience.org :o)

17	A

Q# 768/ AS Chemistry/2018/m/TZ 2/Paper 1/Q# 18//www.SmashingScience.org :o)

18	D

Q# 769/ AS Chemistry/2017/w/TZ 1/Paper 1/Q# 36//

36	C

Q# 770/ AS Chemistry/2017/s/TZ 1/Paper 1/Q# 36//www.SmashingScience.org :o)

36	A

Q# 771/ AS Chemistry/2017/m/TZ 2/Paper 1/Q# 13//www.SmashingScience.org :o)

13	C

Q# 772/ AS Chemistry/2016/w/TZ 1/Paper 1/Q# 17//www.SmashingScience.org :o)

17	**B**

Q# 773/ AS Chemistry/2016/s/TZ 1/Paper 1/Q# 18//www.SmashingScience.org :o)

18	**C**

Q# 774/ AS Chemistry/2016/m/TZ 2/Paper 1/Q# 17//www.SmashingScience.org :o)

17	**A**

Q# 775/ AS Chemistry/2015/w/TZ 1/Paper 1/Q# 19//www.SmashingScience.org :o)

19	**A**

Q# 776/ AS Chemistry/2015/s/TZ 1/Paper 1/Q# 18//www.SmashingScience.org :o)

18	**A**

Q# 777/ AS Chemistry/2014/s/TZ 1/Paper 1/Q# 35//www.SmashingScience.org :o)

35	**A**

Q# 778/ AS Chemistry/2013/w/TZ 1/Paper 1/Q# 17//www.SmashingScience.org :o)

17 D

Q# 779/ AS Chemistry/2012/w/TZ 1/Paper 1/Q# 25//www.SmashingScience.org :o)

25 D

Q# 780/ AS Chemistry/2012/w/TZ 1/Paper 1/Q# 16//www.SmashingScience.org :o)

16 A

Q# 781/ AS Chemistry/2012/s/TZ 1/Paper 1/Q# 5//www.SmashingScience.org :o)

5 C

Q# 782/ AS Chemistry/2012/s/TZ 1/Paper 1/Q# 34//www.SmashingScience.org :o)

34 B

Q# 783/ AS Chemistry/2012/s/TZ 1/Paper 1/Q# 19//www.SmashingScience.org :o)

19 C

Q# 784/ AS Chemistry/2011/w/TZ 1/Paper 1/Q# 36//www.SmashingScience.org :o)

36 A

Q# 785/ AS Chemistry/2011/w/TZ 1/Paper 1/Q# 34//www.SmashingScience.org :o)

34 A

Q# 786/ AS Chemistry/2011/s/TZ 1/Paper 1/Q# 37//www.SmashingScience.org :o)

37 B

Q# 787/ AS Chemistry/2011/s/TZ 1/Paper 1/Q# 18//www.SmashingScience.org :o)

18 C

Q# 788/ AS Chemistry/2010/w/TZ 1/Paper 1/Q# 36//www.SmashingScience.org :o)

36 A

Q# 789/ AS Chemistry/2010/w/TZ 1/Paper 1/Q# 30//www.SmashingScience.org :o)

30 D

Q# 790/ AS Chemistry/2010/w/TZ 1/Paper 1/Q# 15//www.SmashingScience.org :o)

15 D

Q# 791/ AS Chemistry/2010/s/TZ 1/Paper 1/Q# 35//www.SmashingScience.org :o)

35 C

Q# 792/ AS Chemistry/2009/w/TZ 1/Paper 1/Q# 35//www.SmashingScience.org :o)

35 C

Q# 793/ AS Chemistry/2009/w/TZ 1/Paper 1/Q# 19//www.SmashingScience.org :o)

19 A

Q# 794/ AS Chemistry/2009/w/TZ 1/Paper 1/Q# 18//www.SmashingScience.org :o)

18 A

Q# 795/ AS Chemistry/2009/s/TZ 1/Paper 1/Q# 34//www.SmashingScience.org :o)

34 D

Q# 796/ AS Chemistry/2009/s/TZ 1/Paper 1/Q# 18//www.SmashingScience.org :o)

18 C

Q# 797/ AS Chemistry/2009/s/TZ 1/Paper 1/Q# 17//www.SmashingScience.org :o)

17 D