





























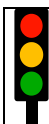


Lesson	Traffic Light																												
	Red	Amber	Green																										
 <div style="display: flex; justify-content: space-between; align-items: center;"> <div style="text-align: center;">  </div> <div style="text-align: center;"> <h2 style="margin: 0;">National 5 Chemistry</h2> <h3 style="margin: 0;">Unit 1.3a Chemical Formulae</h3> </div> <div style="text-align: center;">  </div> </div>																													
37	<p>Compound names are derived from the names of the elements from which they are formed.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 15%;">Ending</th> <th style="width: 45%;">Meaning</th> <th style="width: 40%;">Example</th> </tr> </thead> <tbody> <tr> <td>-ide</td> <td>2 elements in compound</td> <td>Copper sulphide = copper + sulphur</td> </tr> <tr> <td>-ate</td> <td>2 elements in compound + oxygen</td> <td>Copper sulphate = copper + sulphur + oxygen</td> </tr> <tr> <td>-ite</td> <td>2 elements in compound + oxygen</td> <td>Sodium sulphite = sodium + sulphur + oxygen</td> </tr> </tbody> </table>		Ending	Meaning	Example	-ide	2 elements in compound	Copper sulphide = copper + sulphur	-ate	2 elements in compound + oxygen	Copper sulphate = copper + sulphur + oxygen	-ite	2 elements in compound + oxygen	Sodium sulphite = sodium + sulphur + oxygen	  														
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38	<p>Chemical formulae can be written for two element compounds using valency rules and a Periodic Table.</p> <ul style="list-style-type: none"> The valency of an element is worked out from the group number: <table border="1" style="margin-left: 20px; border-collapse: collapse;"> <tr> <th style="width: 15%;">Group Number</th> <td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>0</td> </tr> <tr> <th>Valency</th> <td>1</td><td>2</td><td>3</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td> </tr> </table> The formula of a simple 2-element compound is worked out by the cross-over rule: <table border="1" style="margin-left: 20px; border-collapse: collapse;"> <tr> <td style="width: 25%;">Write down element symbols</td> <td style="width: 25%;">Write down Valency below each element's symbol</td> <td style="width: 25%;">Put in Cross-over Arrows</td> <td style="width: 25%;">Follow arrows and cancel down if necessary to get formula</td> </tr> <tr> <td style="text-align: center; font-size: 2em;">Si O</td> <td style="text-align: center; font-size: 2em;">Si O 4 2</td> <td style="text-align: center; font-size: 2em;">Si O 4 2</td> <td style="text-align: center; font-size: 2em;">Si₂O₄ ↓ SiO₂</td> </tr> </table> 		Group Number	1	2	3	4	5	6	7	0	Valency	1	2	3	4	3	2	1	0	Write down element symbols	Write down Valency below each element's symbol	Put in Cross-over Arrows	Follow arrows and cancel down if necessary to get formula	Si O	Si O 4 2	Si O 4 2	Si ₂ O ₄ ↓ SiO ₂	  
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40	<p>The chemical formula can also be determined from names with prefixes.</p> <table border="1" style="margin-left: 20px; border-collapse: collapse;"> <tr> <th style="width: 15%;">Compound</th> <td>carbon monoxide</td> <td>carbon dioxide</td> <td>sulphur trioxide</td> <td>carbon tetrachloride</td> </tr> <tr> <th>Formula</th> <td>CO</td> <td>CO₂</td> <td>SO₃</td> <td>CCl₄</td> </tr> <tr> <th>Meaning</th> <td>Mono = 1</td> <td>Di = 2</td> <td>Tri = 3</td> <td>Tetra = 4</td> </tr> </table>		Compound	carbon mono xide	carbon di oxide	sulphur tri oxide	carbon tetra chloride	Formula	CO	CO ₂	SO ₃	CCl ₄	Meaning	Mono = 1	Di = 2	Tri = 3	Tetra = 4	  											
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41	<p>The chemical formula of a covalent molecular substance gives the number of each type of atom present in a molecule.</p> <ul style="list-style-type: none"> The formula of a covalent network gives the simplest ratio of each type of atom in the substance. 		  																										
42	<p>Ions containing more than one type of atom are often referred to as group ions.</p>		  																										
43	<p>Chemical formulae can be written for compounds containing group ions</p> <ul style="list-style-type: none"> The valency of a group ion can be worked out from the charge of the ion <table border="1" style="margin-left: 20px; border-collapse: collapse;"> <tr> <td style="width: 25%;">Write down element symbols</td> <td style="width: 25%;">Write down Valency below each element's symbol</td> <td style="width: 25%;">Put in Cross-over Arrows</td> <td style="width: 25%;">Follow arrows and cancel down if necessary to get formula</td> </tr> <tr> <td style="text-align: center; font-size: 2em;">Al SO₄²⁻</td> <td style="text-align: center; font-size: 2em;">Al SO₄²⁻ 3 2</td> <td style="text-align: center; font-size: 2em;">Al SO₄²⁻ 3 2</td> <td style="text-align: center; font-size: 2em;">Al₂(SO₄)₃</td> </tr> </table>		Write down element symbols	Write down Valency below each element's symbol	Put in Cross-over Arrows	Follow arrows and cancel down if necessary to get formula	Al SO ₄ ²⁻	Al SO ₄ ²⁻ 3 2	Al SO ₄ ²⁻ 3 2	Al ₂ (SO ₄) ₃	  																		
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44	<p>Ionic formulae give the simplest ratio of each type of ion in the substance and can show the charges on each ion, if required.</p> <ul style="list-style-type: none"> charges must be superscript and numbers of atoms/ions must be subscript 		  																										
45	<table border="1" style="margin-left: 20px; border-collapse: collapse;"> <tr> <td style="width: 25%;">Work out the formula of the substance</td> <td style="width: 25%;">Work out the ion formed by the metal</td> <td style="width: 25%;">Work out the ion of the non-metal/group ion</td> <td style="width: 25%;">Put the ion in brackets if there is more than one of that ion to get ionic formula</td> </tr> <tr> <td style="text-align: center; font-size: 2em;">Al₂(SO₄)₃</td> <td style="text-align: center; font-size: 2em;">Al³⁺</td> <td style="text-align: center; font-size: 2em;">SO₄²⁻</td> <td style="text-align: center; font-size: 2em;">(Al³⁺)₂(SO₄²⁻)₃</td> </tr> </table>		Work out the formula of the substance	Work out the ion formed by the metal	Work out the ion of the non-metal/group ion	Put the ion in brackets if there is more than one of that ion to get ionic formula	Al ₂ (SO ₄) ₃	Al ³⁺	SO ₄ ²⁻	(Al ³⁺) ₂ (SO ₄ ²⁻) ₃	  																		
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46 Chemical equations, using formulae and state symbols, can be written and balanced.

Write down correct chemical formula of all reactants before the arrow and all products after the arrow.

$$\text{Na}_{(s)} + \text{O}_{2(g)} \longrightarrow \text{Na}_2\text{O}_{(s)}$$

There are 2 oxygen atoms on left hand side but only 1 oxygen atom on right hand side. As the formula of Na₂O cannot be changed, double the number of Na₂O molecules by adding the number 2 *in front* of the formula

$$\text{Na}_{(s)} + \text{O}_{2(g)} \longrightarrow 2\text{Na}_2\text{O}_{(s)}$$

There is 1 sodium atom on the LHS but 4 sodium atoms on the RHS. As the formulae of Na and Na₂O are set and cannot be changed, we must add the number 4 in front of the Na on the LHS to balance the number of Na atoms

$$4\text{Na}_{(s)} + \text{O}_{2(g)} \longrightarrow 2\text{Na}_2\text{O}_{(s)}$$

47 The mass of a mole of any substance, in grams, is equal to the gram formula mass and can be calculated using relative atomic masses. e.g. calculate the gfm of glucose C₆H₁₂O₆.

Write Element Symbol	Number of each atom from formula		Relative Atomic Mass (p7 data book)		Total
C	6	x	12	=	72
H	12	x	1	=	12
O	6	x	16	=	96
			gfm	=	180

48a Calculations can be performed using the relationship between the mass and the number of moles of a substance.

	m = mass	n = no. of moles	GFM = gram formula mass
	$m = n \times \text{gfm}$	$n = \frac{m}{\text{gfm}}$	$\text{gfm} = \frac{m}{n}$

48b Changing number of moles → number of grams

e.g. Calculate the number of moles in 3.6g of water.

Calculate the gfm of H₂O

H	2	x	1	=	2	
O	1	x	16	=	16	
			gfm	=	18g	then

no. of mol = $\frac{\text{mass}}{\text{gfm}}$

= $\frac{3.6}{18}$

= **0.2mol**

48c Changing number of grams → number of moles

e.g. calculate the mass if 0.1 moles of CO₂

Calculate the gfm of CO₂

C	1	x	12	=	12	
O	2	x	16	=	32	then
			gfm	=	44g	

mass = no. of mol x gfm

= 0.1 x 44

= **4.4g**

49 A solution is formed when a solute is dissolved in a solvent.

Name	Definition
solution	a mixture formed when a solute dissolves in a solvent
solute	The substance that is dissolved
solvent	The liquid that does the dissolving

50 The number of moles of solute, volume of solution and concentration of solution can be calculated using the equation:

	n	=	C	x	V
	no. of moles (mol)	=	Concentration (mol l ⁻¹)	x	volume (litres)

$n = V \times C$ $C = \frac{\text{mol}}{V}$ $V = \frac{\text{mol}}{C}$

51	<p>Given a balanced equation, the mass or number of moles of a substance can be calculated given the mass or number of moles of another substance in the reaction.</p> <p>e.g. calculate the mass of carbon dioxide produced if 5g of calcium carbonate reacts with</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: right;">gfm CaCO₃</td> <td style="padding: 0 10px;">Ca</td> <td style="padding: 0 10px;">1</td> <td style="padding: 0 10px;">x</td> <td style="padding: 0 10px;">40</td> <td style="padding: 0 10px;">=</td> <td style="padding: 0 10px;">40</td> <td style="padding: 0 10px;"></td> <td style="padding: 0 10px;">C</td> <td style="padding: 0 10px;">1</td> <td style="padding: 0 10px;">x</td> <td style="padding: 0 10px;">12</td> <td style="padding: 0 10px;">=</td> <td style="padding: 0 10px;">12</td> </tr> <tr> <td></td> <td style="padding: 0 10px;">C</td> <td style="padding: 0 10px;">1</td> <td style="padding: 0 10px;">x</td> <td style="padding: 0 10px;">12</td> <td style="padding: 0 10px;">=</td> <td style="padding: 0 10px;">12</td> <td style="padding: 0 10px;"></td> <td style="padding: 0 10px;">O</td> <td style="padding: 0 10px;">2</td> <td style="padding: 0 10px;">x</td> <td style="padding: 0 10px;">16</td> <td style="padding: 0 10px;">=</td> <td style="padding: 0 10px;">32</td> </tr> <tr> <td></td> <td style="padding: 0 10px;">O</td> <td style="padding: 0 10px;">3</td> <td style="padding: 0 10px;">x</td> <td style="padding: 0 10px;">16</td> <td style="padding: 0 10px;">=</td> <td style="padding: 0 10px;">46</td> <td style="padding: 0 10px;"></td> <td></td> <td></td> <td></td> <td style="padding: 0 10px;">gfm</td> <td style="padding: 0 10px;">=</td> <td style="padding: 0 10px;">44g</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td style="padding: 0 10px;">gfm</td> <td style="padding: 0 10px;">=</td> <td style="padding: 0 10px;">100g</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table> $n = \frac{m}{\text{gfm}} = \frac{5}{100} = 0.05\text{mol}$ <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding: 0 10px;">CaCO₃</td> <td style="padding: 0 10px;">+</td> <td style="padding: 0 10px;">2HCl</td> <td style="padding: 0 10px;">→</td> <td style="padding: 0 10px;">CaCl₂</td> <td style="padding: 0 10px;">+</td> <td style="padding: 0 10px;">H₂O</td> <td style="padding: 0 10px;">+</td> <td style="padding: 0 10px;">CO₂</td> <td style="padding: 0 10px;">m</td> <td style="padding: 0 10px;">=</td> <td style="padding: 0 10px;">n</td> <td style="padding: 0 10px;">x</td> <td style="padding: 0 10px;">gfm</td> </tr> <tr> <td style="padding: 0 10px;">1mol</td> <td></td> <td style="padding: 0 10px;">2mol</td> <td></td> <td style="padding: 0 10px;">1mol</td> <td></td> <td style="padding: 0 10px;">1mol</td> <td></td> <td style="padding: 0 10px;">1mol</td> <td style="padding: 0 10px;">=</td> <td style="padding: 0 10px;">0.05</td> <td style="padding: 0 10px;">X</td> <td style="padding: 0 10px;">44</td> <td></td> </tr> <tr> <td style="padding: 0 10px;">0.05mol</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td style="padding: 0 10px;">0.05mol</td> <td style="padding: 0 10px;">=</td> <td style="padding: 0 10px;">2.2g</td> <td></td> <td></td> <td></td> </tr> </table>	gfm CaCO ₃	Ca	1	x	40	=	40		C	1	x	12	=	12		C	1	x	12	=	12		O	2	x	16	=	32		O	3	x	16	=	46					gfm	=	44g					gfm	=	100g								CaCO ₃	+	2HCl	→	CaCl ₂	+	H ₂ O	+	CO ₂	m	=	n	x	gfm	1mol		2mol		1mol		1mol		1mol	=	0.05	X	44		0.05mol								0.05mol	=	2.2g					☹	☺	☺
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52	<p>The percentage composition of an element in any compound can be calculated from the formula of the compound.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="padding: 5px;">Calculate mass of 1 mole</th> <th style="padding: 5px;">Find mass of element</th> <th style="padding: 5px;">Percentage Fe in Fe₂O₃ calculation</th> </tr> </thead> <tbody> <tr> <td style="padding: 5px;"> Fe₂O₃ = (2x56) + (3x16) = 112 + 48 = 160g </td> <td style="padding: 5px;"> 2 x Fe = (2x56) = 112g </td> <td style="padding: 5px;"> $\frac{112\text{g}}{160\text{g}} \times 100 = 70\%$ </td> </tr> </tbody> </table>	Calculate mass of 1 mole	Find mass of element	Percentage Fe in Fe ₂ O ₃ calculation	Fe ₂ O ₃ = (2x56) + (3x16) = 112 + 48 = 160g	2 x Fe = (2x56) = 112g	$\frac{112\text{g}}{160\text{g}} \times 100 = 70\%$		☹	☺	☺																																																																																												
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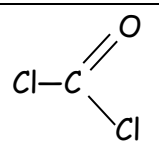
Past Paper Question Bank

Unit 1.3a Chemical Formulae

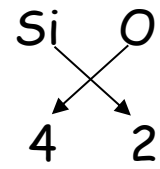
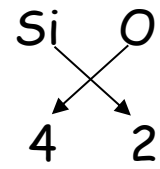
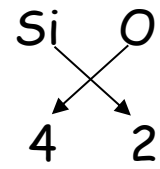
Outcome	Original Specimen Paper	New Specimen Paper	Nat5 2014	Nat5 2015	Nat5 2016	Nat5 2017	Nat5 2018	Nat5 2019									
37		L6e						L8b									
38			L11c					L8c									
39					mc7		L15c										
40							L5c										
41																	
42																	
43																	
44 45	L5a	mc23 L3a	mc3 L3d	mc6 L6b		mc3		L11a									
46	L4a(i)	L5a(i)	mc4	mc8 L14a(i)	mc1 L5c(i) L6b	mc7	L10a(i)										
47							L13a(ii)	L2d									
48a			L3b	mc9		mc8											
48b	L13a	L15a		L7b		L2c											
48c																	
49								mc9									
50	L13b	L15b		L7b	L12d	mc9	mc7 L14b(iii)	L12a(ii)									
51	L4b(i)	L5b(i)	L10b		L3c(ii)	L12c	L16c	L5c(i) L12b(iv)									
52	L11a	L12a	L12b		L4b	L10b		mc10									
Marking Scheme	Back of Paper	Back of Paper	SQA Nat5 2014 Msch	SQA Nat5 2015 Msch	SQA Nat5 2016 Msch	SQA Nat5 2017 Msch	SQA Nat5 2018 Msch	SQA Nat5 2019 Msch									

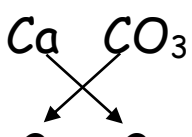
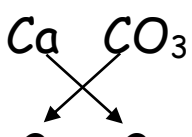
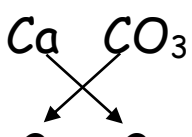
Nat5	Answer	% Correct	Reasoning								
2014 3	A	51	Phosphate PO_4^{3-} is listed in data booklet page 8 \therefore Total negative charge in $\text{Zn}_3(\text{PO}_4)_2$ formula is 6- as there are two phosphate ions All ionic compounds are neutral over all so the total positive charge must be 6+ \therefore Total positive charge in the 3 zinc ions = 6+ \therefore Positive charge on each zinc ion = $6+/3 = 2+$								
2014 4	C	89	$\text{Fe}_2\text{O}_3 + \text{CO} \rightarrow \text{Fe} + \text{CO}_2$ Fe: 2xFe before arrow but 1xFe after arrow \therefore double Fe after arrow $\text{Fe}_2\text{O}_3 + \text{CO} \rightarrow 2\text{Fe} + \text{CO}_2$ O: 4xO before arrow but 2xO after arrow \therefore double CO_2 after arrow $\text{Fe}_2\text{O}_3 + \text{CO} \rightarrow 2\text{Fe} + 2\text{CO}_2$ C: 1xC before arrow but 2xC after arrow \therefore double CO before arrow $\text{Fe}_2\text{O}_3 + 2\text{CO} \rightarrow 2\text{Fe} + 2\text{CO}_2$ O: 5xO before arrow but 4xO after arrow \therefore increase CO to 3 before arrow $\text{Fe}_2\text{O}_3 + 3\text{CO} \rightarrow 2\text{Fe} + 2\text{CO}_2$ C: 3xC before arrow but 2xFe after arrow \therefore increase CO_2 to 3 after arrow $\text{Fe}_2\text{O}_3 + 3\text{CO} \rightarrow 2\text{Fe} + 3\text{CO}_2$								
2015 6	C	51	<table border="1"> <thead> <tr> <th>Chromium chloride has the formula</th> <th>Chloride ions have the formula</th> <th>3 chloride ions per chromium chloride</th> <th>Chromium ion must have 3+ charge to balance charge</th> </tr> </thead> <tbody> <tr> <td>CrCl_3</td> <td>Cl^-</td> <td>$\text{Cr}^{n+}(\text{Cl}^-)_3$</td> <td>$\text{Cr}^{3+}(\text{Cl}^-)_3$</td> </tr> </tbody> </table>	Chromium chloride has the formula	Chloride ions have the formula	3 chloride ions per chromium chloride	Chromium ion must have 3+ charge to balance charge	CrCl_3	Cl^-	$\text{Cr}^{n+}(\text{Cl}^-)_3$	$\text{Cr}^{3+}(\text{Cl}^-)_3$
Chromium chloride has the formula	Chloride ions have the formula	3 chloride ions per chromium chloride	Chromium ion must have 3+ charge to balance charge								
CrCl_3	Cl^-	$\text{Cr}^{n+}(\text{Cl}^-)_3$	$\text{Cr}^{3+}(\text{Cl}^-)_3$								
2015 8	B	90	$2\text{Al}_{(s)} + 3\text{Br}_{2(l)} \longrightarrow 2\text{AlBr}_{3(s)}$								
2015 9	A	69	<input checked="" type="checkbox"/> A 1mol $\text{SO}_2 = (1 \times 32) + (2 \times 16) = 32 + 32 = 64\text{g}$ $\therefore 0.2 \text{ mol } \text{SO}_2 = 12.8\text{g}$ <input checked="" type="checkbox"/> B 1mol $\text{CO} = (1 \times 12) + (1 \times 16) = 12 + 16 = 28\text{g}$ $\therefore 0.2 \text{ mol } \text{CO} = 5.6\text{g}$ <input checked="" type="checkbox"/> C 1mol $\text{CO}_2 = (1 \times 12) + (2 \times 16) = 12 + 32 = 44\text{g}$ $\therefore 0.2 \text{ mol } \text{CO}_2 = 8.8\text{g}$ <input checked="" type="checkbox"/> D 1mol $\text{NH}_3 = (1 \times 14) + (3 \times 1) = 14 + 3 = 17\text{g}$ $\therefore 0.2 \text{ mol } \text{NH}_3 = 3.4\text{g}$								
2016 1	D	62	<input checked="" type="checkbox"/> A products of dissolving should be aqueous solutions of $\text{Na}^+(\text{aq})$ and $\text{Cl}^-(\text{aq})$ ions <input checked="" type="checkbox"/> B correct formula for water should be $\text{H}_2\text{O}(\text{l})$ as water does not dissolve in water <input checked="" type="checkbox"/> C $\text{NaCl}(\text{aq})$ does not exist as $\text{NaCl}(\text{s})$ splits up its lattice into $\text{Na}^+(\text{aq}) + \text{Cl}^-(\text{aq})$ ions <input checked="" type="checkbox"/> D $\text{NaCl}(\text{s})$ dissolves in $\text{H}_2\text{O}(\text{l})$ to form the ions $\text{Na}^+(\text{aq}) + \text{Cl}^-(\text{aq})$								
2016 7	A	45	<input checked="" type="checkbox"/> A silver (I) oxide has the formula Ag_2O <input checked="" type="checkbox"/> B silver (II) oxide has the formula AgO <input checked="" type="checkbox"/> C silver (III) oxide has the formula Ag_2O_3 <input checked="" type="checkbox"/> D silver (IV) oxide has the formula AgO_2								
2017 3	A	67	Dichromate ion formula is $\text{Cr}_2\text{O}_7^{2-}$ \therefore $\text{Cr}_2\text{O}_7^{2-}$ ion must be balanced by a 2+ ion $\therefore \text{Zn}^{2+}$								
2017 7	C	86	$2\text{H}_2\text{O}_2 \rightarrow 2\text{H}_2\text{O} + \text{O}_2$								

2017 8	B	70	$\text{gfm} = \frac{\text{mass}}{\text{no. of mol}} = \frac{7\text{g}}{0.25\text{mol}} = 28\text{g mol}^{-1}$ <input checked="" type="checkbox"/> A gfm $\text{C}_2\text{H}_6 = (2 \times 12) + (6 \times 1) = 24 + 6 = 30\text{g}$ <input checked="" type="checkbox"/> B gfm $\text{C}_2\text{H}_4 = (2 \times 12) + (4 \times 1) = 24 + 4 = 28\text{g}$ <input checked="" type="checkbox"/> C gfm $\text{C}_3\text{H}_8 = (3 \times 12) + (8 \times 1) = 36 + 8 = 44\text{g}$ <input checked="" type="checkbox"/> D gfm $\text{C}_3\text{H}_6 = (3 \times 12) + (6 \times 1) = 36 + 6 = 42\text{g}$
2017 9	A	56	<input checked="" type="checkbox"/> A no of mol = volume \times concentration = 0.1litres \times 0.4mol l^{-1} = 0.04mol <input checked="" type="checkbox"/> B no of mol = volume \times concentration = 0.2litres \times 0.3mol l^{-1} = 0.06mol <input checked="" type="checkbox"/> C no of mol = volume \times concentration = 0.3litres \times 1.0mol l^{-1} = 0.3mol <input checked="" type="checkbox"/> D no of mol = volume \times concentration = 0.4litres \times 0.5mol l^{-1} = 0.2mol
2018 7	C	-	$\text{concentration} = \frac{\text{no of moles}}{\text{volume}} = \frac{0.1 \text{ mol}}{0.25 \text{ litres}} = 0.4 \text{ mol l}^{-1}$
2019 9	A	-	<input checked="" type="checkbox"/> A Calcium hydroxide is the solute as it is the solid which is dissolved <input checked="" type="checkbox"/> B Water is the solvent as it is the liquid doing the dissolving <input checked="" type="checkbox"/> C Calcium hydroxide solution is the solution with the solute dissolved in solvent <input checked="" type="checkbox"/> D Calcium hydroxide must be soluble if it dissolves
2019 10	B	-	$1\text{mol NH}_4\text{NO}_3 = (1 \times 14) + (4 \times 1) + (1 \times 14) + (3 \times 16) = 14 + 4 + 14 + 48 = 80$ $\% \text{N} = \frac{\text{Mass of nitrogen}}{\text{gfm}} \times 100 = \frac{28}{80} \times 100 = 35\%$

Nat5	Answer	Reasoning																
2014 3b	0.022 mol	From passage: 0.86g of potassium in 100g of raisins $\text{no. of mol} = \frac{\text{mass}}{\text{gfm}} = \frac{0.86}{39} = 0.022 \text{ mol}$																
2014 3d	KNO_3	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 33%;">Write down Valency below each ion's symbol</th> <th style="width: 33%;">Put in Cross-over Arrows</th> <th style="width: 33%;">Follow arrows and cancel down to get formula</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;"> $\text{K} \quad \text{NO}_3^-$ $1 \quad 1$ </td> <td style="text-align: center;"> $\text{K} \quad \text{NO}_3^-$  $1 \quad 1$ </td> <td style="text-align: center;"> KNO_3 </td> </tr> </tbody> </table>	Write down Valency below each ion's symbol	Put in Cross-over Arrows	Follow arrows and cancel down to get formula	$\text{K} \quad \text{NO}_3^-$ $1 \quad 1$	$\text{K} \quad \text{NO}_3^-$  $1 \quad 1$	KNO_3										
Write down Valency below each ion's symbol	Put in Cross-over Arrows	Follow arrows and cancel down to get formula																
$\text{K} \quad \text{NO}_3^-$ $1 \quad 1$	$\text{K} \quad \text{NO}_3^-$  $1 \quad 1$	KNO_3																
2014 10b	99g	$\text{gfm C}_9\text{H}_{20} = (9 \times 12) + (20 \times 1) = 108 + 20 = 128\text{g}$ $\text{no of mol} = \frac{\text{mass}}{\text{gfm}} = \frac{32}{128} = 0.25\text{mol}$ $\text{C}_9\text{H}_{20} + 14\text{O}_2 \longrightarrow 9\text{CO}_2 + 10\text{H}_2\text{O}$ $\begin{array}{ccc} 1\text{mol} & & 9\text{mol} \\ 0.25\text{mol} & & 2.25\text{mol} \end{array}$ $\text{gfm CO}_2 = (1 \times 12) + (2 \times 16) = 12 + 32 = 44\text{g}$ $\text{mass} = \text{no of mol} \times \text{gfm} = 2.25 \times 44 = 99\text{g}$																
2014 11c		<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Element</th> <th>Group</th> <th>Valency</th> <th>No of Bonds Element Makes</th> </tr> </thead> <tbody> <tr> <td>Carbon</td> <td>4</td> <td>4</td> <td>4</td> </tr> <tr> <td>Oxygen</td> <td>6</td> <td>2</td> <td>2</td> </tr> <tr> <td>Chlorine</td> <td>7</td> <td>1</td> <td>1</td> </tr> </tbody> </table>	Element	Group	Valency	No of Bonds Element Makes	Carbon	4	4	4	Oxygen	6	2	2	Chlorine	7	1	1
Element	Group	Valency	No of Bonds Element Makes															
Carbon	4	4	4															
Oxygen	6	2	2															
Chlorine	7	1	1															
2014 12b	70%	$\% \text{Fe} = \frac{\text{total mass of Fe}}{\text{gfm Fe}_2\text{O}_3} \times 100 = \frac{(2 \times 56)}{(2 \times 56) + (3 \times 16)} \times 100 = \frac{112}{160} \times 100 = 70\%$																

2014 13b	0.08 mol l ⁻¹	<p>no. of mol = volume × concentration = 0.016litres × 0.1 mol l⁻¹ = 0.0016mol</p> $2\text{HCl} + \text{Na}_2\text{CO}_3 \longrightarrow 2\text{NaCl} + \text{CO}_2 + \text{H}_2\text{O}$ <p style="text-align: center;"> 2mol 1mol </p> <p style="text-align: center;"> 0.0016mol 0.0008mol </p> <p style="text-align: center;"> concentration = $\frac{\text{no. of mol}}{\text{volume}} = \frac{0.0008 \text{ mol}}{0.01 \text{ litres}} = 0.08 \text{ mol l}^{-1}$ </p>						
2015 6b	Fe ₂ O ₃	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%; text-align: center;"> Write down Valency below each element's symbol <div style="display: flex; justify-content: space-around; font-size: 1.5em;"> Fe O </div> <div style="display: flex; justify-content: space-around; margin-top: 10px;"> 3 2 </div> </td> <td style="width: 33%; text-align: center;"> Put in Cross-over Arrows <div style="display: flex; justify-content: space-around; font-size: 1.5em;"> Fe O </div> <div style="display: flex; justify-content: space-around; margin-top: 10px;"> 3 2 </div> </td> <td style="width: 33%; text-align: center;"> Follow arrows to get formula <div style="font-size: 1.5em; margin-top: 20px;">Fe₂O₃</div> </td> </tr> </table>	Write down Valency below each element's symbol <div style="display: flex; justify-content: space-around; font-size: 1.5em;"> Fe O </div> <div style="display: flex; justify-content: space-around; margin-top: 10px;"> 3 2 </div>	Put in Cross-over Arrows <div style="display: flex; justify-content: space-around; font-size: 1.5em;"> Fe O </div> <div style="display: flex; justify-content: space-around; margin-top: 10px;"> 3 2 </div>	Follow arrows to get formula <div style="font-size: 1.5em; margin-top: 20px;">Fe₂O₃</div>			
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2015 7b	0.2	<p>1mol CuSO₄ = (1×63.5) + (1×32) + (4×16) = 63.5+32+64 = 159.5g</p> <p style="text-align: center;">no. of mol = $\frac{\text{mass}}{\text{gfm}} = \frac{3.19}{159.5} = 0.02\text{mol}$</p> <p style="text-align: center;">concentration = $\frac{\text{no. of mol}}{\text{volume}} = \frac{0.02}{0.1} = 0.2 \text{ mol l}^{-1}$</p>						
2015 14a(i)	Carbon monoxide	$\text{TiO}_2 + 2\text{Cl}_2 + 2\text{C} \longrightarrow \text{TiCl}_4 + 2\text{CO}$						
2015 15b	0.0032	<p>no. of moles = volume × concentration = 0.016 × 0.005 = 0.00008 mol</p> $\text{C}_6\text{H}_8\text{O}_6 + \text{I}_2 \longrightarrow \text{C}_6\text{H}_6\text{O}_6 + 2\text{HI}$ <p style="text-align: center;"> 1mol 1mol </p> <p style="text-align: center;"> 0.00008mol 0.00008mol </p> <p style="text-align: center;"> concentration = $\frac{\text{no. of mol}}{\text{volume}} = \frac{0.00008\text{mol}}{0.025\text{litres}} = 0.0032 \text{ mol l}^{-1}$ </p>						
2016 3c(ii)	0.36	$2\text{Al} + 6\text{HNO}_3 \longrightarrow 2\text{Al}(\text{NO}_3)_3 + 3\text{H}_2$ <p style="text-align: center;"> 2mol 6mol 2mol 3mol </p> <p style="text-align: center;"> 0.01mol 0.015mol </p> <p style="text-align: center;">1mol gas = 24litres</p> <p style="text-align: center;">0.015mol gas = 24litres × $\frac{0.015}{1} = 0.36\text{litres}$</p>						
2016 4b	17.3	<p>Gfm Al₂SiO₅ = (2×27) + (1×28) + (5×16) = 54+28+80 = 162g</p> <p style="text-align: center;">% Si = $\frac{\text{total mass of Si}}{\text{gfm Al}_2\text{SiO}_5} \times 100 = \frac{28}{162} \times 100 = 17.3\%$</p>						
2016 5c(i)	CO + O ₂ → CO ₂	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%; text-align: center;"> carbon monoxide Formula is derived directly from name (mono = 1) ↓ CO </td> <td style="width: 33%; text-align: center;"> + oxygen oxygen is one of the seven diatomic elements ↓ O₂ </td> <td style="width: 33%; text-align: center;"> → carbon dioxide Formula is derived directly from name (di = 2) ↓ CO₂ </td> </tr> <tr> <td style="text-align: center;">CO</td> <td style="text-align: center;">+</td> <td style="text-align: center;">O₂ → CO₂</td> </tr> </table>	carbon monoxide Formula is derived directly from name (mono = 1) ↓ CO	+ oxygen oxygen is one of the seven diatomic elements ↓ O ₂	→ carbon dioxide Formula is derived directly from name (di = 2) ↓ CO ₂	CO	+	O ₂ → CO ₂
carbon monoxide Formula is derived directly from name (mono = 1) ↓ CO	+ oxygen oxygen is one of the seven diatomic elements ↓ O ₂	→ carbon dioxide Formula is derived directly from name (di = 2) ↓ CO ₂						
CO	+	O ₂ → CO ₂						
2016 6b	$\text{H}_3\text{PO}_4 + 3\text{NH}_4\text{OH} \longrightarrow (\text{NH}_4)_3\text{PO}_4 + 3\text{H}_2\text{O}$	$\text{H}_3\text{PO}_4 + 3\text{NH}_4\text{OH} \longrightarrow (\text{NH}_4)_3\text{PO}_4 + 3\text{H}_2\text{O}$						
2016 12d	0.02	<p>no. of mol = $\frac{\text{mass}}{\text{gfm}} = \frac{1.8}{90} = 0.02 \text{ mol}$</p>						

2017 2c	20.5	$m = 41g \quad gfm \text{ H}_2 = 2g \text{ mol}^{-1}$ $\text{no of moles} = \frac{\text{mass}}{\text{gfm}} = \frac{41g}{2g \text{ mol}^{-1}} = 20.5 \text{ mol}$						
2017 10b	15.8	$gfm \text{ Al}_2(\text{SO}_4)_3 = (2 \times 27) + (3 \times 32) + (12 \times 16) = 54 + 96 + 192 = 342$ $\% \text{ Al} = \frac{\text{total mass of Al}}{\text{gfm Al}_2(\text{SO}_4)_3} \times 100 = \frac{(2 \times 27)}{342} \times 100 = \frac{54}{342} \times 100 = 15.8\%$						
2017 12c	21.0g	$1 \text{ mol geraniol} = (10 \times 12) + (18 \times 1) + (1 \times 16) = 120 + 18 + 16 = 154g$ $\text{no. of mol} = \frac{\text{mass}}{\text{gfm}} = \frac{15.4}{154} = 0.1 \text{ mol}$ $\begin{array}{ccccccc} \text{geraniol} & + & \text{propanoic acid} & \longrightarrow & \text{geranyl propanoate} & + & \text{water} \\ \text{C}_{10}\text{H}_{18}\text{O} & + & \text{C}_3\text{H}_6\text{O}_2 & \longrightarrow & \text{C}_{13}\text{H}_{22}\text{O}_2 & + & \text{H}_2\text{O} \\ 1 \text{ mol} & & & & 1 \text{ mol} & & \\ 0.1 \text{ mol} & & & & 0.1 \text{ mol} & & \end{array}$ $1 \text{ mol geranyl propanoate} = (13 \times 12) + (22 \times 1) + (2 \times 16) = 156 + 22 + 32 = 210g$ $\text{mass} = \text{no of mol} \times \text{gfm} = 0.1 \times 210 = 21.0g$						
2018 5c	SiO ₂	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding: 5px;">Write down Valency below each element's symbol</td> <td style="padding: 5px;">Put in Cross-over Arrows</td> <td style="padding: 5px;">Follow arrows to get formula</td> </tr> <tr> <td style="text-align: center; padding: 10px;"> $\begin{array}{cc} \text{Si} & \text{O} \\ 4 & 2 \end{array}$ </td> <td style="text-align: center; padding: 10px;">  </td> <td style="text-align: center; padding: 10px;"> $\begin{array}{c} \text{Si}_2\text{O}_4 \\ \text{Cancel Down} \\ \text{SiO}_2 \end{array}$ </td> </tr> </table>	Write down Valency below each element's symbol	Put in Cross-over Arrows	Follow arrows to get formula	$\begin{array}{cc} \text{Si} & \text{O} \\ 4 & 2 \end{array}$		$\begin{array}{c} \text{Si}_2\text{O}_4 \\ \text{Cancel Down} \\ \text{SiO}_2 \end{array}$
Write down Valency below each element's symbol	Put in Cross-over Arrows	Follow arrows to get formula						
$\begin{array}{cc} \text{Si} & \text{O} \\ 4 & 2 \end{array}$		$\begin{array}{c} \text{Si}_2\text{O}_4 \\ \text{Cancel Down} \\ \text{SiO}_2 \end{array}$						
2018 10a(i)	$\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3$							
2018 13a(ii)	134	$Gfm \text{ C}_4\text{H}_6\text{O}_5 = (4 \times 12) + (6 \times 1) + (5 \times 16) = 48 + 6 + 80 = 134g$						
2018 14b(iii)	0.000161	$\text{number of moles} = \text{volume} \times \text{concentration} = 0.00805 \text{ litres} \times 0.02 \text{ mol l}^{-1} = 0.000161 \text{ mol}$						
2018 15c	$\begin{array}{c} \text{Fe}_2\text{O}_3 \\ \downarrow \\ \text{O}_2 + \text{Fe}_5\text{O}_7 \end{array}$	Problem Solving Question						
2018 16c	960	$gfm \text{ CH}_3\text{OH} = (1 \times 12) + (4 \times 1) + (1 \times 16) = 12 + 4 + 16 = 32g$ $n = \frac{\text{mass}}{\text{gfm}} = \frac{640g}{32g \text{ mol}^{-1}} = 20 \text{ mol}$ $\begin{array}{ccccccc} \text{CH}_3\text{OH} & + & \text{H}_2\text{S} & \longrightarrow & \text{CH}_3\text{SH} & + & \text{H}_2\text{O} \\ 1 \text{ mol} & & & & 1 \text{ mol} & & \\ 20 \text{ mol} & & & & 20 \text{ mol} & & \end{array}$ $gfm \text{ CH}_3\text{SH} = (1 \times 12) + (4 \times 1) + (1 \times 32) = 12 + 4 + 32 = 48g$ $\text{mass} = \text{no of mol} \times \text{gfm} = 20 \text{ mol} \times 48g \text{ mol}^{-1} = 960g$						
2019 2d	90	<p>Lactic acid is the harmless product mentioned in the text.</p> <p>Formula of lactic acid = C₃H₆O₃</p> $1 \text{ mol} = (3 \times 12) + (6 \times 1) + (3 \times 16) = 36 + 6 + 48 = 90$						

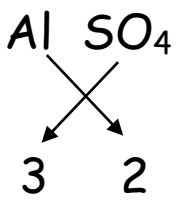
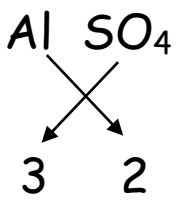
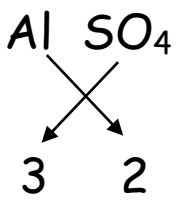
2019 5c(i)	140	$1\text{mol C}_6\text{H}_{10} = (6 \times 12) + (10 \times 1) = 72 + 10 = 82\text{g}$ $\text{no. of mol} = \frac{\text{mass}}{\text{gfm}} = \frac{410}{82} = 5\text{mol}$ $\text{C}_2\text{H}_4 + \text{C}_4\text{H}_6 \longrightarrow \text{C}_6\text{H}_{10}$ $\begin{array}{ccc} 1\text{mol} & & 1\text{mol} \\ 5\text{mol} & & 5\text{mol} \end{array}$ $1\text{mol C}_2\text{H}_4 = (2 \times 12) + (4 \times 1) = 24 + 4 = 28\text{g}$ $\text{mass} = \text{no of mol} \times \text{gfm} = 5 \times 28 = 140\text{g}$			
2019 8b	beryllium aluminium silicon oxygen	Beryl is beryllium aluminium silicate. Silicate means both silicon and oxygen are also found in the compound.			
2019 8c	$\text{BeCl}_2 + \text{K} \rightarrow \text{Be} + \text{KCl}$	Beryllium chloride + Potassium \rightarrow Beryllium + Potassium chloride $\text{BeCl}_2 + \text{K} \rightarrow \text{Be} + \text{KCl}$ $\text{BeCl}_2 + 2\text{K} \rightarrow \text{Be} + 2\text{KCl}$			
2019 11a	$\text{Ca}^{2+}\text{CO}_3^{2-}$	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding: 5px;"> Write down Valency below each element's symbol $\text{Ca} \quad \text{CO}_3$ $2 \quad 2$ </td> <td style="padding: 5px;"> Put in Cross-over Arrows $\text{Ca} \quad \text{CO}_3$  $2 \quad 2$ </td> <td style="padding: 5px;"> Follow arrows to get formula $\text{Ca}_2(\text{CO}_3)_2$ Cancel Down CaCO_3 </td> </tr> </table>	Write down Valency below each element's symbol $\text{Ca} \quad \text{CO}_3$ $2 \quad 2$	Put in Cross-over Arrows $\text{Ca} \quad \text{CO}_3$  $2 \quad 2$	Follow arrows to get formula $\text{Ca}_2(\text{CO}_3)_2$ Cancel Down CaCO_3
Write down Valency below each element's symbol $\text{Ca} \quad \text{CO}_3$ $2 \quad 2$	Put in Cross-over Arrows $\text{Ca} \quad \text{CO}_3$  $2 \quad 2$	Follow arrows to get formula $\text{Ca}_2(\text{CO}_3)_2$ Cancel Down CaCO_3			
2019 12a(ii)	21.2	$\text{no. of moles} = \text{volume} \times \text{concentration} = 0.2\text{litres} \times 1\text{mol l}^{-1} = 0.2\text{mol}$ $\text{gfm Na}_2\text{CO}_3 = (2 \times 23) + (1 \times 12) + (3 \times 16) = 46 + 12 + 48 = 106\text{g mol}^{-1}$ $\text{mass} = \text{no of mol} \times \text{gfm} = 0.2\text{mol} \times 106\text{g mol}^{-1} = 21.2\text{g}$			
2019 12b(iv)	1.5	$\text{no of mol Na}_2\text{CO}_3 = \text{volume} \times \text{concentration} = 0.015\text{ litres} \times 1\text{mol l}^{-1} = 0.015\text{mol}$ $\text{Na}_2\text{CO}_3 + 2\text{HCl} \rightarrow 2\text{NaCl} + \text{H}_2\text{O} + \text{CO}_2$ $\begin{array}{ccc} 1\text{mol} & 2\text{mol} & \\ 0.015\text{mol} & 0.030\text{mol} & \end{array}$ $\text{concentration} = \frac{\text{no of moles}}{\text{volume}} = \frac{0.030\text{mol}}{0.02\text{litres}} = 1.5\text{ mol l}^{-1}$			

Past Paper Question Bank

Unit 1.3a Chemical Formulae

Outcome	Int2 2000	Int2 2001	Int2 2002	Int2 2003	Int2 2004	Int2 2005	Int2 2006	Int2 2007	Int2 2008	Int2 2009	Int2 2010	Int2 2011	Int2 2012	Int2 2013	Int2 2014	Int2 2015
37						mc2					L11b(i)	mc2				
38			L1a													
39	L5b			L13c				L11c		mc11 L14a		L4a(ii)	L1b	mc7		
40																
41																
42																
43		L4a	mc4	mc8	L14d	L2a(i)	mc8		L15a		mc7			L6c	L14b	
44 45		mc6	mc5				L3a					mc8			mc6	mc9 L4b(ii)
46	mc25 L11b	L6c(ii)	L4a	L2b	mc2 L2a	mc8 L5a	L1b(i)	L4a(i) L8a	L3a	mc5 L4a	mc8 L2b	L3a	L2b	mc2 mc8	mc9	Mc11 L5b(i)
47	L5c		mc7	mc29			mc10							mc9	mc10	mc10
48a																
48b		mc8			L5b	L4c(ii)	mc9	L14b	mc9				L4c	L6a		
48c																
49							mc2	mc5	mc2	mc2	L2c			mc3	mc2	mc4
50		L4b(ii)	mc22	mc17	mc21	mc21	L13a(i)	mc21	mc23	L12c(i) L12c(ii)			L15a(i)	mc21	L10a	
51	L6b	L9b	L12b L13a	L9d	L8b	L13c	L5b L13a(ii)	L4b	L11a	L4b	mc20 L4b	L3d L5b	L15a(ii)	L12c	L4c(ii)	L12b
52																
Marking Scheme	Not Published	Not Published	Not Published	SQA Int2 2003 MSch	SQA Int2 2004 MSch	SQA Int2 2005 MSch	SQA Int2 2006 MSch	SQA Int2 2007 MSch	SQA Int2 2008 MSch	SQA Int2 2009 MSch	SQA Int2 2010 MSch	SQA Int2 2011 MSch	SQA Int2 2012 MSch	SQA Int2 2013 MSch	SQA Int2 2014 MSch	SQA Int2 2015 MSch

Int2	Answer	% Correct	Reasoning										
2000 25	B	73	$\text{concentration} = \frac{\text{no. of mol}}{\text{volume}} = \frac{0.25 \text{ mol}}{0.5 \text{ litres}} = 0.5 \text{ mol l}^{-1}$										
2001 6	B	30	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%; text-align: center;">Write down formula $\text{Fe}_2(\text{SO}_4)_3$</td> <td style="width: 25%; text-align: center;">Reverse cross-over rule $\begin{array}{cc} \text{Fe} & \text{SO}_4 \\ \swarrow & \searrow \\ 3 & 2 \end{array}$ </td> <td style="width: 25%; text-align: center;">Lift valency from each ion <table border="1" style="margin: auto;"> <tr><th>Ion</th><th>Valency</th></tr> <tr><td>Fe</td><td>3</td></tr> <tr><td>SO₄</td><td>2</td></tr> </table> </td> <td style="width: 25%; text-align: center;">Write Ionic Formula $(\text{Fe}^{3+})_2(\text{SO}_4^{2-})_3$</td> </tr> </table>	Write down formula $\text{Fe}_2(\text{SO}_4)_3$	Reverse cross-over rule $\begin{array}{cc} \text{Fe} & \text{SO}_4 \\ \swarrow & \searrow \\ 3 & 2 \end{array}$	Lift valency from each ion <table border="1" style="margin: auto;"> <tr><th>Ion</th><th>Valency</th></tr> <tr><td>Fe</td><td>3</td></tr> <tr><td>SO₄</td><td>2</td></tr> </table>	Ion	Valency	Fe	3	SO ₄	2	Write Ionic Formula $(\text{Fe}^{3+})_2(\text{SO}_4^{2-})_3$
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Ion	Valency												
Fe	3												
SO ₄	2												
2001 8	A	49	$\text{gfm Na}_2\text{CO}_3 = (2 \times 23) + (1 \times 12) + (3 \times 16) = 46 + 12 + 48 = 106\text{g}$ $\text{no. of mol} = \frac{\text{mass}}{\text{gfm}} = \frac{5.3}{106} = 0.05\text{mol}$										
2002 4	B	74	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%; text-align: center;">Write down Formulae of ions Mg SO_3^{2-}</td> <td style="width: 25%; text-align: center;">Write down Valency below each ion Mg SO_3^{2-} 2 2</td> <td style="width: 25%; text-align: center;">Put in Cross-over Arrows $\begin{array}{cc} \text{Mg} & \text{SO}_3 \\ \swarrow & \searrow \\ 2 & 2 \end{array}$ </td> <td style="width: 25%; text-align: center;">Follow arrows and cancel down to get formula MgSO_3</td> </tr> </table>	Write down Formulae of ions Mg SO_3^{2-}	Write down Valency below each ion Mg SO_3^{2-} 2 2	Put in Cross-over Arrows $\begin{array}{cc} \text{Mg} & \text{SO}_3 \\ \swarrow & \searrow \\ 2 & 2 \end{array}$	Follow arrows and cancel down to get formula MgSO_3						
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2002 5	C	42	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%; text-align: center;">Write down Formulae CrCl_3</td> <td style="width: 25%; text-align: center;">Reverse crossover rule from formula $\begin{array}{cc} \text{Cr} & \text{Cl} \\ \swarrow & \searrow \\ 3 & 1 \end{array}$ </td> <td style="width: 25%; text-align: center;">Work out valency from cross over rule <table border="1" style="margin: auto;"> <tr><th>Element</th><th>Valency</th></tr> <tr><td>Cr</td><td>3</td></tr> <tr><td>Cl</td><td>1</td></tr> </table> </td> <td style="width: 25%; text-align: center;">Ionic Formula $\text{Cr}^{3+}(\text{Cl}^-)_3$</td> </tr> </table>	Write down Formulae CrCl_3	Reverse crossover rule from formula $\begin{array}{cc} \text{Cr} & \text{Cl} \\ \swarrow & \searrow \\ 3 & 1 \end{array}$	Work out valency from cross over rule <table border="1" style="margin: auto;"> <tr><th>Element</th><th>Valency</th></tr> <tr><td>Cr</td><td>3</td></tr> <tr><td>Cl</td><td>1</td></tr> </table>	Element	Valency	Cr	3	Cl	1	Ionic Formula $\text{Cr}^{3+}(\text{Cl}^-)_3$
Write down Formulae CrCl_3	Reverse crossover rule from formula $\begin{array}{cc} \text{Cr} & \text{Cl} \\ \swarrow & \searrow \\ 3 & 1 \end{array}$	Work out valency from cross over rule <table border="1" style="margin: auto;"> <tr><th>Element</th><th>Valency</th></tr> <tr><td>Cr</td><td>3</td></tr> <tr><td>Cl</td><td>1</td></tr> </table>	Element	Valency	Cr	3	Cl	1	Ionic Formula $\text{Cr}^{3+}(\text{Cl}^-)_3$				
Element	Valency												
Cr	3												
Cl	1												
2002 7	C	84	$1 \text{ mol of } (\text{NH}_4)_2\text{SO}_4 = (2 \times 14) + (8 \times 1) + (1 \times 32) + (4 \times 16) = 28 + 8 + 32 + 64 = 132\text{g}$										
2002 22	B	28	<input checked="" type="checkbox"/> A no of mol = volume x concentration = 0.1 x 4 = 0.4mol <input checked="" type="checkbox"/> B no of mol = volume x concentration = 0.2 x 3 = 0.6mol <input checked="" type="checkbox"/> C no of mol = volume x concentration = 0.3 x 1 = 0.3mol <input checked="" type="checkbox"/> D no of mol = volume x concentration = 0.4 x 0.5 = 0.2mol										
2003 8	B	89	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%; text-align: center;">Write down Formulae of ions Al SO_4^{2-}</td> <td style="width: 25%; text-align: center;">Write down Valency below each ion Al SO_4 3 2</td> <td style="width: 25%; text-align: center;">Put in Cross-over Arrows $\begin{array}{cc} \text{Al} & \text{SO}_4 \\ \swarrow & \searrow \\ 3 & 2 \end{array}$ </td> <td style="width: 25%; text-align: center;">Follow arrows to get formula $\text{Al}_2(\text{SO}_4)_3$</td> </tr> </table>	Write down Formulae of ions Al SO_4^{2-}	Write down Valency below each ion Al SO_4 3 2	Put in Cross-over Arrows $\begin{array}{cc} \text{Al} & \text{SO}_4 \\ \swarrow & \searrow \\ 3 & 2 \end{array}$	Follow arrows to get formula $\text{Al}_2(\text{SO}_4)_3$						
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2003 17	C	55	$\text{concentration} = \frac{\text{no. of mol}}{\text{volume}} = \frac{0.25 \text{ mol}}{0.5 \text{ litres}} = 0.5 \text{ mol l}^{-1}$										
2003 29	C	93	$1 \text{ mol of } (\text{NH}_4)_2\text{CO}_3 = (2 \times 14) + (8 \times 1) + (1 \times 12) + (3 \times 16) = 28 + 8 + 12 + 48 = 96\text{g}$										

2004 2	A	78	<input checked="" type="checkbox"/> A $\text{HCl(g)} + \text{H}_2\text{O(l)} \rightarrow \text{H}^+(\text{aq}) + \text{OH}^-(\text{aq})$ is the correct equation <input checked="" type="checkbox"/> B Solution of H^+ and OH^- are written as $\text{H}^+(\text{aq}) + \text{OH}^-(\text{aq})$ not $\text{H}^+(\text{l}) + \text{OH}^-(\text{l})$ <input checked="" type="checkbox"/> C Hydrogen chloride gas is written as HCl(g) not HCl(aq) <input checked="" type="checkbox"/> D Solution of H^+ and OH^- are written as $\text{H}^+(\text{aq}) + \text{OH}^-(\text{aq})$ not $\text{H}^+(\text{l}) + \text{OH}^-(\text{l})$												
2004 21	D	70	$\text{concentration} = \frac{\text{no. of mol}}{\text{volume}} = \frac{0.5 \text{ mol}}{0.250 \text{ litres}} = 2 \text{ mol l}^{-1}$												
2005 2	D	61	<input checked="" type="checkbox"/> A magnesium hydroxide contains magnesium, hydrogen and oxygen <input checked="" type="checkbox"/> B magnesium phosphate contains magnesium, phosphate and oxygen <input checked="" type="checkbox"/> C magnesium sulphite contains magnesium, sulphur and oxygen <input checked="" type="checkbox"/> D magnesium nitride contains magnesium and nitrogen												
2005 8	D	53	<table border="1"> <tbody> <tr> <td>1mol CaSiO_3</td> <td>= (1x40) + (1x28) + (3x16)</td> <td>= 40 + 28 + 48</td> <td>= 118g</td> </tr> <tr> <td>1mol CaO</td> <td>= (1x40) + (1x16)</td> <td>= 40 + 16</td> <td>= 56g</td> </tr> <tr> <td>1mol SiO_2</td> <td>= (1x28) + (2x16)</td> <td>= 28 + 32</td> <td>= 62g</td> </tr> </tbody> </table> <p>1 mol of reactants = 118g and 1 mol of products = 56g+62g = 118g</p>	1mol CaSiO_3	= (1x40) + (1x28) + (3x16)	= 40 + 28 + 48	= 118g	1mol CaO	= (1x40) + (1x16)	= 40 + 16	= 56g	1mol SiO_2	= (1x28) + (2x16)	= 28 + 32	= 62g
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2005 21	C	50	$\text{concentration} = \frac{\text{no. of mol}}{\text{volume}} = \frac{0.2 \text{ mol}}{0.1 \text{ litres}} = 2 \text{ mol l}^{-1}$												
2006 2	A	63	<table border="1"> <tbody> <tr> <td>Solute</td> <td>Sugar Lemon Juice carbon dioxide</td> <td>The substance which is dissolved</td> </tr> <tr> <td>Solvent</td> <td>Water</td> <td>The liquid which does the dissolving</td> </tr> <tr> <td>Solution</td> <td>Lemonade</td> <td>The mixture produced when solute dissolves in solvent</td> </tr> </tbody> </table>	Solute	Sugar Lemon Juice carbon dioxide	The substance which is dissolved	Solvent	Water	The liquid which does the dissolving	Solution	Lemonade	The mixture produced when solute dissolves in solvent			
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Al SO_4^{2-}	Al SO_4 3 2	Al SO_4 	$\text{Al}_2(\text{SO}_4)_3$												
2006 9	B	71	<p>1mol $\text{C}_6\text{H}_{12}\text{O}_6 = (6 \times 12) + (12 \times 1) + (6 \times 16) = 72 + 12 + 96 = 180\text{g}$</p> $\text{no. of mol} = \frac{\text{mass}}{\text{gfm}} = \frac{18}{180} = 0.1 \text{ mol}$												
2006 10	A	76	<input checked="" type="checkbox"/> A 1 mol $\text{SO}_2 = (1 \times 32) + (2 \times 16) = 32 + 32 = 64\text{g}$ <input checked="" type="checkbox"/> B 1 mol $\text{CO} = (1 \times 12) + (1 \times 16) = 12 + 16 = 28\text{g}$ <input checked="" type="checkbox"/> C 1 mol $\text{CO}_2 = (1 \times 12) + (2 \times 16) = 12 + 32 = 44\text{g}$ <input checked="" type="checkbox"/> D 1 mol $\text{NH}_3 = (1 \times 14) + (3 \times 1) = 14 + 3 = 17\text{g}$												
2007 5	C	68	<table border="1"> <tbody> <tr> <td>Solute</td> <td>Ethanoic acid</td> <td>The substance which is dissolved</td> </tr> <tr> <td>Solvent</td> <td>Water</td> <td>The liquid which does the dissolving</td> </tr> <tr> <td>Solution</td> <td>Vinegar</td> <td>The mixture produced when solute dissolves in solvent</td> </tr> </tbody> </table>	Solute	Ethanoic acid	The substance which is dissolved	Solvent	Water	The liquid which does the dissolving	Solution	Vinegar	The mixture produced when solute dissolves in solvent			
Solute	Ethanoic acid	The substance which is dissolved													
Solvent	Water	The liquid which does the dissolving													
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2007 21	B	69	<table border="1"> <tbody> <tr> <td>Volume</td> <td>Concentration</td> <td>No of Moles</td> <td>Mass of Solid</td> </tr> <tr> <td>100cm³</td> <td>1 mol l⁻¹</td> <td>0.1mol</td> <td>14.2g</td> </tr> <tr> <td>50cm³</td> <td>2 mol l⁻¹</td> <td>0.1mol</td> <td>14.2g</td> </tr> </tbody> </table>	Volume	Concentration	No of Moles	Mass of Solid	100cm ³	1 mol l ⁻¹	0.1mol	14.2g	50cm ³	2 mol l ⁻¹	0.1mol	14.2g
Volume	Concentration	No of Moles	Mass of Solid												
100cm ³	1 mol l ⁻¹	0.1mol	14.2g												
50cm ³	2 mol l ⁻¹	0.1mol	14.2g												
2008 2	C	67	<input checked="" type="checkbox"/> A Ethanoic Acid is the solute (substance which is dissolved) <input checked="" type="checkbox"/> B Saturated describes a solution where no more solute will dissolve in the solvent <input checked="" type="checkbox"/> C Water is the solvent (the liquid which does the dissolving) <input checked="" type="checkbox"/> D Vinegar is the solution (ethanoic acid dissolved in water)												

2008 9	A	81	$1 \text{ mol NH}_3 = (1 \times 14) + (3 \times 1) = 17\text{g}$ $\text{no. of mol} = \frac{\text{mass}}{\text{gfm}} = \frac{1.7}{17} = 0.1\text{mol}$								
2008 23	B	47	<input checked="" type="checkbox"/> A no. of mol = vol x concentration = $0.25 \times 0.4 = 0.1\text{mol}$ <input checked="" type="checkbox"/> B no. of mol = vol x concentration = $0.25 \times 4 = 1\text{mol}$ <input checked="" type="checkbox"/> C no. of mol = vol x concentration = $0.2 \times 0.5 = 0.1\text{mol}$ <input checked="" type="checkbox"/> D no. of mol = vol x concentration = $0.2 \times 1 = 0.2\text{mol}$								
2009 2	C	69	Solute is the solid being dissolved. <ul style="list-style-type: none"> adding more solute will increase the concentration of the solution. Solvent is the liquid which is doing the dissolving adding more solvent will decrease the concentration. 								
2009 5	B	74	<input checked="" type="checkbox"/> A Solutions of ions are written $\text{Na}^+(\text{aq}) + \text{Cl}^-(\text{aq})$ not $\text{Na}^+(\text{l}) + \text{Cl}^-(\text{l})$ <input checked="" type="checkbox"/> B (s) = solid, (l) = liquid, (g) = gas and (aq) = aqueous <input checked="" type="checkbox"/> C water is written as $\text{H}_2\text{O}(\text{l})$ as water is the solvent not the solute <input checked="" type="checkbox"/> D NaCl is a solid before it is dissolved in the solvent water.								
2009 11	A	44	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 33%;">Write down Formulae</th> <th style="width: 33%;">Write Down Reverse of Cross Over Rule</th> <th style="width: 33%;">Follow arrows to get formula</th> </tr> </thead> <tbody> <tr> <td style="text-align: center; vertical-align: middle;">Ag_2O</td> <td style="text-align: center; vertical-align: middle;"> $\begin{array}{cc} \text{Ag} & \text{O} \\ & \swarrow \searrow \\ & 1 & 2 \end{array}$ </td> <td style="text-align: center; vertical-align: middle;"> Valency of Ag=1 Valency of O=2 </td> </tr> </tbody> </table>	Write down Formulae	Write Down Reverse of Cross Over Rule	Follow arrows to get formula	Ag_2O	$\begin{array}{cc} \text{Ag} & \text{O} \\ & \swarrow \searrow \\ & 1 & 2 \end{array}$	Valency of Ag=1 Valency of O=2		
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Ag_2O	$\begin{array}{cc} \text{Ag} & \text{O} \\ & \swarrow \searrow \\ & 1 & 2 \end{array}$	Valency of Ag=1 Valency of O=2									
2010 7	B	79	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 33%;">Write down Valency below each ion's symbol</th> <th style="width: 33%;">Put in Cross-over Arrows</th> <th style="width: 33%;">Follow arrows and cancel down to get formula</th> </tr> </thead> <tbody> <tr> <td style="text-align: center; vertical-align: middle;"> $\begin{array}{cc} \text{Mg} & \text{SO}_3^{2-} \\ 2 & 2 \end{array}$ </td> <td style="text-align: center; vertical-align: middle;"> $\begin{array}{cc} \text{Mg} & \text{SO}_3^{2-} \\ & \swarrow \searrow \\ & 2 & 2 \end{array}$ </td> <td style="text-align: center; vertical-align: middle;">MgSO_3</td> </tr> </tbody> </table>	Write down Valency below each ion's symbol	Put in Cross-over Arrows	Follow arrows and cancel down to get formula	$\begin{array}{cc} \text{Mg} & \text{SO}_3^{2-} \\ 2 & 2 \end{array}$	$\begin{array}{cc} \text{Mg} & \text{SO}_3^{2-} \\ & \swarrow \searrow \\ & 2 & 2 \end{array}$	MgSO_3		
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$\begin{array}{cc} \text{Mg} & \text{SO}_3^{2-} \\ 2 & 2 \end{array}$	$\begin{array}{cc} \text{Mg} & \text{SO}_3^{2-} \\ & \swarrow \searrow \\ & 2 & 2 \end{array}$	MgSO_3									
2010 8	B	89	<ol style="list-style-type: none"> Write down reactants and product formulae $\text{Al}(\text{s}) + \text{Br}_2(\text{l}) \rightarrow \text{AlBr}_3(\text{s})$ 1 aluminium on each side $\text{Al}(\text{s}) + \text{Br}_2(\text{l}) \rightarrow \text{AlBr}_3(\text{s})$ \therefore no action $2 \times \text{Br}$ before arrow and $3 \times \text{Br}$ after arrow $\text{Al}(\text{s}) + 3\text{Br}_2(\text{l}) \rightarrow 2\text{AlBr}_3(\text{s})$ \therefore make both sides up to $6 \times \text{Br}$ $1 \times \text{Al}$ before arrow and $2 \times \text{Al}$ after arrow $2\text{Al}(\text{s}) + 3\text{Br}_2(\text{l}) \rightarrow 2\text{AlBr}_3(\text{s})$ \therefore make both sides up to $2 \times \text{Al}$ 								
2010 20	C	63	$\text{no. of mol (NH}_4)_2\text{SO}_4 = \text{volume} \times \text{concentration} = 0.5\text{litres} \times 1\text{mol l}^{-1} = 0.5\text{mol}$ $\text{gfm (NH}_4)_2\text{SO}_4 = (2 \times 14) + (8 \times 1) + (1 \times 32) + (4 \times 16) = 28 + 8 + 32 + 64 = 132\text{g}$ $\text{mass} = \text{no. of mol} \times \text{gfm} = 0.5 \times 132 = 66\text{g}$								
2011 2	D	71	<input checked="" type="checkbox"/> A magnesium hydroxide contains 3 elements (magnesium, hydrogen and oxygen) <input checked="" type="checkbox"/> B magnesium phosphate contains 3 elements (magnesium, phosphorus and oxygen) <input checked="" type="checkbox"/> C magnesium sulphite contains 3 elements (magnesium, sulphur and oxygen) <input checked="" type="checkbox"/> D magnesium nitride contains 2 elements (magnesium and nitrogen)								
2011 8	C	54	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 25%;">Chromium chloride has the formula</th> <th style="width: 25%;">Chloride ions have the formula</th> <th style="width: 25%;">3 chloride ions per chromium chloride</th> <th style="width: 25%;">Chromium ion must have 3+ charge to balance charge</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">CrCl_3</td> <td style="text-align: center;">Cl^-</td> <td style="text-align: center;">$\text{Cr}^{n+}(\text{Cl}^-)_3$</td> <td style="text-align: center;">$\text{Cr}^{3+}(\text{Cl}^-)_3$</td> </tr> </tbody> </table>	Chromium chloride has the formula	Chloride ions have the formula	3 chloride ions per chromium chloride	Chromium ion must have 3+ charge to balance charge	CrCl_3	Cl^-	$\text{Cr}^{n+}(\text{Cl}^-)_3$	$\text{Cr}^{3+}(\text{Cl}^-)_3$
Chromium chloride has the formula	Chloride ions have the formula	3 chloride ions per chromium chloride	Chromium ion must have 3+ charge to balance charge								
CrCl_3	Cl^-	$\text{Cr}^{n+}(\text{Cl}^-)_3$	$\text{Cr}^{3+}(\text{Cl}^-)_3$								

2013 2	A	83	<input checked="" type="checkbox"/> A $\text{HCl(g)} + \text{H}_2\text{O(l)} \rightarrow \text{H}^+(\text{aq}) + \text{Cl}^-(\text{aq})$ is the correct equation including state symbols <input checked="" type="checkbox"/> B hydrogen chloride HCl is a gas in the question but a liquid in the equation <input checked="" type="checkbox"/> C hydrogen chloride HCl is a gas in the question but an aqueous in the equation <input checked="" type="checkbox"/> D H^+ and Cl^- ion are aqueous (aq) when in solution not liquids						
2013 3	B	69	<table border="1"> <tbody> <tr> <td>Solute</td> <td>Substance which is dissolved (ethanol)</td> </tr> <tr> <td>Solvent</td> <td>Liquid which does the dissolving (water)</td> </tr> <tr> <td>Solution</td> <td>Mixture of solute dissolved in the solvent (whisky)</td> </tr> </tbody> </table>	Solute	Substance which is dissolved (ethanol)	Solvent	Liquid which does the dissolving (water)	Solution	Mixture of solute dissolved in the solvent (whisky)
Solute	Substance which is dissolved (ethanol)								
Solvent	Liquid which does the dissolving (water)								
Solution	Mixture of solute dissolved in the solvent (whisky)								
2013 7	B	39	<input checked="" type="checkbox"/> A vanadium (V) oxide has a formula V_2O_5 <input checked="" type="checkbox"/> B vanadium (IV) oxide has a formula VO_2 <input checked="" type="checkbox"/> C vanadium (III) oxide has a formula V_2O_3 <input checked="" type="checkbox"/> D vanadium (II) oxide has a formula VO						
2013 8	A	64	<p>Equation in question $4\text{NH}_3 + x\text{O}_2 \rightarrow 4\text{NO} + y\text{H}_2\text{O}$</p> <p>12H before arrow $4\text{NH}_3 + x\text{O}_2 \rightarrow 4\text{NO} + 6\text{H}_2\text{O}$ $\therefore 6\text{H}_2\text{O}$ required to balance 12H</p> <p>$4\text{NO} + 6\text{H}_2\text{O}$ before arrow = $10 \times \text{O}$ $4\text{NH}_3 + 5\text{O}_2 \rightarrow 4\text{NO} + 6\text{H}_2\text{O}$ $\therefore 5\text{O}_2$ required to balance $10 \times \text{O}$</p>						
2013 9	D	82	<input checked="" type="checkbox"/> A gfm of $\text{CO} = (1 \times 12) + (1 \times 16) = 12 + 16 = 28\text{g}$ <input checked="" type="checkbox"/> B gfm of $\text{CO}_2 = (1 \times 12) + (2 \times 16) = 12 + 32 = 44\text{g}$ <input checked="" type="checkbox"/> C gfm of $\text{N}_2 = (2 \times 14) = 28\text{g}$ <input checked="" type="checkbox"/> D gfm of $\text{CH}_4 = (1 \times 12) + (4 \times 1) = 12 + 4 = 16\text{g}$						
2013 21	C	60	$\text{concentration} = \frac{\text{no. of moles}}{\text{volume}} = \frac{0.25 \text{ mol}}{0.5 \text{ litres}} = 0.5 \text{ mol l}^{-1}$						
2014 2	A	76	<input checked="" type="checkbox"/> A water is the liquid which does the dissolving \therefore water is the solvent <input checked="" type="checkbox"/> B sugar is a solid which is dissolved \therefore sugar is a solute <input checked="" type="checkbox"/> C lemon juice is a liquid which is dissolved \therefore lemon juice is a solute <input checked="" type="checkbox"/> D carbon dioxide is a gas which is dissolved \therefore carbon dioxide is a solute						
2014 6	A	54	<p>Phosphate PO_4^{3-} is listed in data booklet page 8 \therefore Total negative charge in $\text{Zn}_3(\text{PO}_4)_2$ formula is 6- as there are two phosphate ions All ionic compounds are neutral over all so the total positive charge must be 6+ \therefore Total positive charge in 3 zinc ions = 6+ \therefore Positive charge on zinc ion = $6^+ / 3 = 2^+$</p>						
2014 9	C	90	$\text{Fe}_2\text{O}_3 + \text{CO} \rightarrow \text{Fe} + \text{CO}_2$ <p>Fe: $2 \times \text{Fe}$ before arrow but $1 \times \text{Fe}$ after arrow \therefore double Fe after arrow</p> $\text{Fe}_2\text{O}_3 + \text{CO} \rightarrow 2\text{Fe} + \text{CO}_2$ <p>O: $4 \times \text{O}$ before arrow but $2 \times \text{O}$ after arrow \therefore double CO_2 after arrow</p> $\text{Fe}_2\text{O}_3 + \text{CO} \rightarrow 2\text{Fe} + 2\text{CO}_2$ <p>C: $1 \times \text{C}$ before arrow but $2 \times \text{C}$ after arrow \therefore double CO before arrow</p> $\text{Fe}_2\text{O}_3 + 2\text{CO} \rightarrow 2\text{Fe} + 2\text{CO}_2$ <p>O: $5 \times \text{O}$ before arrow but $4 \times \text{O}$ after arrow \therefore increase CO to 3 before arrow</p> $\text{Fe}_2\text{O}_3 + 3\text{CO} \rightarrow 2\text{Fe} + 2\text{CO}_2$ <p>C: $3 \times \text{C}$ before arrow but $2 \times \text{Fe}$ after arrow \therefore increase CO_2 to 3 after arrow</p> $\text{Fe}_2\text{O}_3 + 3\text{CO} \rightarrow 2\text{Fe} + 3\text{CO}_2$						
2014 10	C	81	<input checked="" type="checkbox"/> A $1 \text{ mol CH}_4 = (1 \times 12) + (4 \times 1) = 12 + 4 = 16\text{g} \therefore 0.5 \text{ mol} = 8\text{g}$ <input checked="" type="checkbox"/> B $1 \text{ mol CO}_2 = (1 \times 12) + (2 \times 16) = 12 + 32 = 44\text{g} \therefore 0.5 \text{ mol} = 22\text{g}$ <input checked="" type="checkbox"/> C $1 \text{ mol NO}_2 = (1 \times 14) + (2 \times 16) = 14 + 32 = 46\text{g} \therefore 0.5 \text{ mol} = 23\text{g}$ <input checked="" type="checkbox"/> D $1 \text{ mol NH}_3 = (1 \times 14) + (3 \times 1) = 14 + 3 = 17\text{g} \therefore 0.5 \text{ mol} = 8.5\text{g}$						

2015 4	B	83	<input checked="" type="checkbox"/> A Solute: the substance which is dissolved <input checked="" type="checkbox"/> B Solvent: the liquid which does the dissolving <input checked="" type="checkbox"/> C Solution: the mixture formed when solute dissolves in solvent <input checked="" type="checkbox"/> D Saturated: a solution where no more solute can dissolve in the solvent								
2015 9	B	68	<table border="1"> <thead> <tr> <th>Iron nitrate has the formula</th> <th>Nitrate ions have the formula</th> <th>3 nitrate ions per iron nitrate</th> <th>iron ion must have 3+ charge to balance charge</th> </tr> </thead> <tbody> <tr> <td>$\text{Fe}(\text{NO}_3)_3$</td> <td>NO_3^-</td> <td>$\text{Fe}^{n+}(\text{NO}_3^-)_3$</td> <td>$\text{Fe}^{3+}(\text{NO}_3^-)_3$</td> </tr> </tbody> </table>	Iron nitrate has the formula	Nitrate ions have the formula	3 nitrate ions per iron nitrate	iron ion must have 3+ charge to balance charge	$\text{Fe}(\text{NO}_3)_3$	NO_3^-	$\text{Fe}^{n+}(\text{NO}_3^-)_3$	$\text{Fe}^{3+}(\text{NO}_3^-)_3$
Iron nitrate has the formula	Nitrate ions have the formula	3 nitrate ions per iron nitrate	iron ion must have 3+ charge to balance charge								
$\text{Fe}(\text{NO}_3)_3$	NO_3^-	$\text{Fe}^{n+}(\text{NO}_3^-)_3$	$\text{Fe}^{3+}(\text{NO}_3^-)_3$								
2015 10	A	87	<input checked="" type="checkbox"/> A $1\text{mol SO}_2 = (1 \times 32) + (2 \times 16) = 32 + 32 = 64\text{g} \therefore 0.2\text{mol} = 64 \times 0.2 = 12.8\text{g}$ <input checked="" type="checkbox"/> B $1\text{mol CO} = (1 \times 12) + (1 \times 16) = 12 + 16 = 28\text{g} \therefore 0.2\text{mol} = 28 \times 0.2 = 5.6\text{g}$ <input checked="" type="checkbox"/> C $1\text{mol CO}_2 = (1 \times 12) + (2 \times 16) = 12 + 32 = 44\text{g} \therefore 0.2\text{mol} = 44 \times 0.2 = 8.8\text{g}$ <input checked="" type="checkbox"/> D $1\text{mol NH}_3 = (1 \times 14) + (3 \times 1) = 14 + 3 = 17\text{g} \therefore 0.2\text{mol} = 17 \times 0.2 = 3.4\text{g}$								
2015 11	C	49	$2\text{Al} + \text{CuSO}_4 \longrightarrow 3\text{Cu} + \text{Al}_2(\text{SO}_4)_3$ <p style="text-align: center;"> 2mol 3mol 1mol 1.5mol </p>								

Int2	Answer	Reasoning			
		Write down Formulae of elements	Write down Valency below each ion	Put in Cross-over Arrows	Follow arrows and cancel down to get formula
2000 5b	SnF ₂	Sn F	Sn F 2 1	Sn F 2 1	SnF ₂
2000 5c	144g	1mol Na ₂ PO ₃ F = (2x23) + (1x31) + (3x16) + (1x19) = 46 + 31 + 48 + 19 = 144g			
2000 6b	145.5kg	gfm CO ₂ = (1x12) + (2x16) = 12 + 32 = 44g $\text{no. of mol} = \frac{\text{mass}}{\text{gfm}} = \frac{200000}{44} = 4545.5\text{mol}$ $6\text{CO}_2 + 6\text{H}_2\text{O} \longrightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$ <div style="display: flex; justify-content: space-between; width: 100%;"> <div style="text-align: center;"> 6mol 1mol 4545.5mol 1mol O₂ = 2x16 = 32g </div> <div style="text-align: center;"> 6mol 1mol 4545.5mol </div> </div> $\text{mass} = \text{no. of mol} \times \text{gfm} = 4545.5 \times 32 = 145454\text{g} = 145.5\text{kg}$			
2000 11b	4Al + 3O ₂ → 2Al ₂ O ₃	4Al + 3O ₂ → 2Al ₂ O ₃			
2001 4a	Cu(NO ₃) ₂	Cu NO ₃ ⁻	Cu NO ₃ ⁻ 2 1	Cu NO ₃ 2 1	Cu(NO ₃) ₂
2001 4b(ii)	0.05	no. of mol = volume x concentration = 0.25litres x 0.2 mol l ⁻¹ = 0.05mol			
2001 6c(ii)	Fe ₂ O ₃ + 3CO ↓ 2Fe + 3CO ₂	Fe ₂ O ₃ + 3CO → 2Fe + 3CO ₂			
2001 9b	600.9g	1mol LiClO ₄ = (1x7) + (1x35.5) + (4x16) = 7 + 35.5 + 64 = 106.5g $\text{no. of mol} = \frac{\text{mass}}{\text{gfm}} = \frac{1000}{106.5} = 9.39\text{mol}$ $\text{LiClO}_4 \longrightarrow \text{LiCl} + 2\text{O}_2$ <div style="display: flex; justify-content: space-around; width: 100%;"> <div style="text-align: center;"> 1mol 9.39mol </div> <div style="text-align: center;"> 2mol 18.78mol </div> </div> 1mol O ₂ = (2x16) = 32g $\text{mass} = \text{no. of mol} \times \text{gfm} = 18.78 \times 32 = 600.9\text{g}$			

2002 1a	BaCl ₂	Write down Formulae of elements	Write down Valency below each atom	Put in Cross-over Arrows	Follow arrows to get formula
		Ba Cl	Ba Cl 2 1	Ba Cl 2 1	BaCl ₂
2002 4a	$C_4H_{10} + 13N_2O$ ↓ $4CO_2 + 5H_2O + 13N_2$	$C_4H_{10} + 13N_2O \longrightarrow 4CO_2 + 5H_2O + 13N_2$			
2002 12b	605g	gfm C ₃ H ₆ = (3×12) + (6×1) = 36 + 6 = 42g $\text{no. of mol} = \frac{\text{mass}}{\text{gfm}} = \frac{100}{42} = 2.38\text{mol}$ $I_2 + C_3H_6 \longrightarrow C_3H_6I_2$ $\begin{array}{ccc} 1\text{mol} & & 1\text{mol} \\ 2.38\text{mol} & & 2.38\text{mol} \end{array}$ gfm I ₂ = (2×127) = 254g $\text{mass} = \text{no. of mol} \times \text{gfm} = 2.38 \times 254 = 605\text{g}$			
2002 13a	31.9	$\text{no. of mol} = \text{volume} \times \text{concentration} = 0.4 \text{ litres} \times 0.50 \text{ mol l}^{-1} = 0.2 \text{ mol}$ $\text{mass} = \text{no. of mol} \times \text{gfm} = 0.2 \text{ mol} \times 159.5\text{g mol}^{-1} = 31.9\text{g}$			
2003 2b	2 mol	$2N_2O \longrightarrow 2N_2 + O_2$ $\begin{array}{ccc} 2\text{mol} & & 1\text{mol} \\ 4\text{mol} & & 2\text{mol} \end{array}$			
2003 9d	24.1g	gfm Mg = 24.5g $\text{no. of mol} = \frac{\text{mass}}{\text{gfm}} = \frac{4.9}{24.5} = 0.2\text{mol}$ $Mg + H_2SO_4 \longrightarrow MgSO_4 + H_2$ $\begin{array}{ccc} 1\text{mol} & & 1\text{mol} \\ 0.2\text{mol} & & 0.2\text{mol} \end{array}$ Gfm MgSO ₄ = (1×24.5) + (1×32) + (4×16) = 24.5 + 32 + 64 = 120.5g $\text{mass} = \text{no. of mol} \times \text{gfm} = 0.2 \times 120.5 = 24.1\text{g}$			
2003 13c	Cr ₂ O ₃	Write down Formulae of ions	Write down Valency below each ion	Put in Cross-over Arrows	Follow arrows to get formula
		Cr O	Cr O 3 2	Cr O 3 2	Cr ₂ O ₃
2004 2a	$2CO + 2NO$ ↓ $2CO_2 + N_2$	$2CO + 2NO \longrightarrow 2CO_2 + N_2$			
2004 5b	0.5	1 mol urea H ₂ NCONH ₂ = (4×1) + (2×14) + (1×12) + (1×16) = 4 + 28 + 12 + 16 = 60g $\text{no. of mol} = \frac{\text{mass}}{\text{gfm}} = \frac{30}{60} = 0.5 \text{ mol}$			

2004 8b	304	$\text{gfm FeO} = (1 \times 56) + (1 \times 16) = 56 + 16 = 72\text{g}$ $\text{no. of mol} = \frac{\text{mass}}{\text{gfm}} = \frac{144000}{72} = 2000 \text{ mol}$ $\text{FeO} + \text{H}_2\text{SO}_4 \longrightarrow \text{FeSO}_4 + \text{H}_2\text{O}$ $\begin{array}{ccc} 1\text{mol} & & 1\text{mol} \\ 2000\text{mol} & & 2000\text{mol} \end{array}$ $1\text{mol FeSO}_4 = (1 \times 56) + (1 \times 32) + (4 \times 16) = 56 + 32 + 64 = 152\text{g}$ $\text{mass} = \text{no. of mol} \times \text{gfm} = 2000 \times 152 = 304000\text{g} = 304\text{kg}$									
2004 14d	$\text{Na}_2\text{S}_2\text{O}_8$	Write down Formulae of ions	Write down Valency below each ion	Put in Cross-over Arrows	Follow arrows to get formula						
		Na $\text{S}_2\text{O}_8^{2-}$	Na $\text{S}_2\text{O}_8^{2-}$ 1 2	Na S_2O_8 1 2	$\text{Na}_2\text{S}_2\text{O}_8$						
2005 2a(i)	Na_2CO_3	Write down Formulae of ions	Write down Valency below each ion	Put in Cross-over Arrows	Follow arrows to get formula						
		Na CO_3^{2-}	Na CO_3 1 2	Na CO_3 1 2	Na_2CO_3						
2005 4c(ii)	0.02	$\text{no. of mol} = \frac{\text{mass}}{\text{gfm}} = \frac{1.27}{63.5} = 0.02 \text{ mol}$									
2005 5a	$\begin{array}{c} \text{C}_2\text{H}_4 + 3\text{O}_2 \\ \downarrow \\ 2\text{CO}_2 + 2\text{H}_2\text{O} \end{array}$	$\text{C}_2\text{H}_4 + 3\text{O}_2 \longrightarrow 2\text{CO}_2 + 2\text{H}_2\text{O}$									
2005 13c	3.18g	$1\text{mol NH}_4\text{Cl} = (1 \times 14) + (4 \times 1) + (1 \times 35.5) = 14 + 4 + 35.5 = 53.5\text{g}$ $\text{no. of mol} = \frac{\text{mass}}{\text{gfm}} = \frac{10}{53.5} = 0.187 \text{ mol}$ $\text{NH}_4\text{Cl} + \text{NaOH} \longrightarrow \text{NaCl} + \text{H}_2\text{O} + \text{NH}_3$ $\begin{array}{ccc} 1\text{mol} & & 1\text{mol} \\ 0.187\text{mol} & & 0.187\text{mol} \end{array}$ $1\text{mol NH}_3 = (1 \times 14) + (3 \times 1) = 14 + 3 = 17\text{g}$ $\text{mass} = \text{no. of mol} \times \text{gfm} = 0.187 \times 17 = 3.18\text{g}$									
2006 1b(i)	$\begin{array}{c} 2\text{CH}_3\text{SH} + \text{H}_2 \\ \downarrow \\ \text{C}_2\text{H}_6 + 2\text{H}_2\text{S} \end{array}$	$2\text{CH}_3\text{SH} + \text{H}_2 \longrightarrow \text{C}_2\text{H}_6 + 2\text{H}_2\text{S}$									
2006 3a	2-	<table border="1"> <thead> <tr> <th>Formula</th> <th>Ionic Formula</th> <th>Charge on oxide ion</th> </tr> </thead> <tbody> <tr> <td>Fe_2O_3</td> <td>$(\text{Fe}^{3+})_2(\text{O}^{2-})_3$</td> <td>$\text{O}^{2-}$</td> </tr> </tbody> </table>				Formula	Ionic Formula	Charge on oxide ion	Fe_2O_3	$(\text{Fe}^{3+})_2(\text{O}^{2-})_3$	O^{2-}
Formula	Ionic Formula	Charge on oxide ion									
Fe_2O_3	$(\text{Fe}^{3+})_2(\text{O}^{2-})_3$	O^{2-}									

2006 5b	30g	$\text{gfm of CH}_3\text{OH} = (1 \times 12) + (4 \times 1) + (1 \times 16) = 12 + 4 + 16 = 32\text{g}$ $\text{no. of mol} = \frac{\text{mass}}{\text{gfm}} = \frac{16}{32} = 0.5 \text{ mol}$ $\text{CH}_3\text{OH} + \text{CO} \longrightarrow \text{CH}_3\text{COOH}$ $\begin{array}{ccc} 1\text{mol} & & 1\text{mol} \\ 0.5\text{mol} & & 0.5\text{mol} \end{array}$ $\text{gfm CH}_3\text{COOH} = (2 \times 12) + (4 \times 1) + (2 \times 16) = 24 + 4 + 32 = 60\text{g}$ $\text{mass} = \text{no. of mol} \times \text{gfm} = 0.5 \times 60 = 3.18\text{g}$						
2006 13a(i)	0.1	$\text{no. of mol} = \text{volume} \times \text{concentration} = 0.1 \text{ litres} \times 1 \text{ mol l}^{-1} = 0.1 \text{ mol}$						
2006 13a(ii)	0.3	$\begin{array}{ccc} \text{citric acid} + \text{sodium hydrogencarbonate} & \longrightarrow & \text{products} \\ 1\text{mol} & & 3\text{mol} \\ 0.1\text{mol} & & 0.3\text{mol} \end{array}$						
2007 4a(i)	(aq)	<p>Magnesium chloride is soluble in water (p8 of data booklet) The symbol of dissolved in water is (aq), which means aqueous</p>						
2007 4b	0.4	$\text{gfm Mg} = 24.3\text{g}$ $\text{no. of mol} = \frac{\text{mass}}{\text{gfm}} = \frac{4.9}{24.5} = 0.2 \text{ mol}$ $\begin{array}{ccccccc} \text{Mg} & + & 2\text{HCl} & \longrightarrow & \text{MgCl}_2 & + & \text{H}_2 \\ 1\text{mol} & & & & & & 1\text{mol} \\ 0.2\text{mol} & & & & & & 0.2\text{mol} \end{array}$ $\text{gfm H}_2 = 2\text{g}$ $\text{mass} = \text{no. of mol} \times \text{gfm} = 0.2 \times 2 = 0.4\text{g}$						
2007 8a	$\begin{array}{c} \text{C}_6\text{H}_{12}\text{O}_6 \\ \downarrow \\ 2\text{C}_2\text{H}_5\text{OH} + 2\text{CO}_2 \end{array}$	$\text{C}_6\text{H}_{12}\text{O}_6 \longrightarrow 2\text{C}_2\text{H}_5\text{OH} + 2\text{CO}_2$						
2007 11c	Fe ₂ O ₃	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="padding: 5px;">Write down Valency below each element's symbol</th> <th style="padding: 5px;">Put in Cross-over Arrows</th> <th style="padding: 5px;">Follow arrows to get formula</th> </tr> </thead> <tbody> <tr> <td style="text-align: center; padding: 10px;"> $\begin{array}{cc} \text{Fe} & \text{O} \\ 3 & 2 \end{array}$ </td> <td style="text-align: center; padding: 10px;"> $\begin{array}{cc} \text{Fe} & \text{O} \\ & \diagdown \quad \diagup \\ & 3 \quad 2 \end{array}$ </td> <td style="text-align: center; padding: 10px;"> Fe_2O_3 </td> </tr> </tbody> </table>	Write down Valency below each element's symbol	Put in Cross-over Arrows	Follow arrows to get formula	$\begin{array}{cc} \text{Fe} & \text{O} \\ 3 & 2 \end{array}$	$\begin{array}{cc} \text{Fe} & \text{O} \\ & \diagdown \quad \diagup \\ & 3 \quad 2 \end{array}$	Fe_2O_3
Write down Valency below each element's symbol	Put in Cross-over Arrows	Follow arrows to get formula						
$\begin{array}{cc} \text{Fe} & \text{O} \\ 3 & 2 \end{array}$	$\begin{array}{cc} \text{Fe} & \text{O} \\ & \diagdown \quad \diagup \\ & 3 \quad 2 \end{array}$	Fe_2O_3						
2007 14b(i)	3.6g	$45\% \text{ of } 8\text{g} = \frac{45}{100} \times 8\text{g} = 3.6\text{g}$						
2007 14b(ii)	0.075mol	$\text{no of mol} = \frac{\text{mass}}{\text{gfm}} = \frac{3.6}{48} = 0.075 \text{ mol}$						
2008 3a	$\begin{array}{c} 4\text{N}_2\text{O} + \text{CH}_4 \\ \downarrow \\ 4\text{N}_2 + \text{CO}_2 + 2\text{H}_2\text{O} \end{array}$	$4\text{N}_2\text{O} + \text{CH}_4 \longrightarrow 4\text{N}_2 + \text{CO}_2 + 2\text{H}_2\text{O}$						

2008 11a	1.62	<p>gfm Al = 27g</p> $\text{no of mol} = \frac{\text{mass}}{\text{gfm}} = \frac{0.135}{27} = 0.005 \text{ mol}$ $3\text{Ag}_2\text{S} + 2\text{Al} \longrightarrow 6\text{Ag} + \text{Al}_2\text{S}_3$ <p style="text-align: center;"> 2mol 6mol </p> <p style="text-align: center;"> 0.005mol 0.015mol </p> <p>gfm Ag = 108g</p> $\text{mass} = \text{no. of mol} \times \text{gfm} = 0.015 \times 108 = 1.62\text{g}$								
2008 15a	KMnO ₄	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 25%;">Write down Formulae of ions</th> <th style="width: 25%;">Write down Valency below each ion</th> <th style="width: 25%;">Put in Cross-over Arrows</th> <th style="width: 25%;">Follow arrows to get formula</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">K⁺ MnO₄⁻</td> <td style="text-align: center;">K⁺ MnO₄⁻ 1 1</td> <td style="text-align: center;"> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">K</div> <div style="text-align: center;">MnO₄</div> </div> <div style="display: flex; justify-content: space-around; margin-top: 10px;"> <div style="text-align: center;">1</div> <div style="text-align: center;">1</div> </div> </td> <td style="text-align: center; vertical-align: middle;">KMnO₄</td> </tr> </tbody> </table>	Write down Formulae of ions	Write down Valency below each ion	Put in Cross-over Arrows	Follow arrows to get formula	K ⁺ MnO ₄ ⁻	K ⁺ MnO ₄ ⁻ 1 1	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">K</div> <div style="text-align: center;">MnO₄</div> </div> <div style="display: flex; justify-content: space-around; margin-top: 10px;"> <div style="text-align: center;">1</div> <div style="text-align: center;">1</div> </div>	KMnO ₄
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2009 4a	$\text{Fe}_2\text{O}_3 + 3\text{CO}$ <p style="text-align: center;">↓</p> $2\text{Fe} + 3\text{CO}_2$	$\text{Fe}_2\text{O}_3 + 3\text{CO} \longrightarrow 2\text{Fe} + 3\text{CO}_2$								
2009 4b	5600	<p>gfm C = 12g</p> $\text{no of mol} = \frac{\text{mass}}{\text{gfm}} = \frac{1200000\text{g}}{12 \text{ g mol}^{-1}} = 100000 \text{ mol}$ $\text{CO}_2 + \text{C} \longrightarrow 2\text{CO}$ <p style="text-align: center;"> 1mol 2mol </p> <p style="text-align: center;"> 100000mol 200000mol </p> <p>Gfm Co = (1x12)+(1x16) = 12+16 = 28g</p> $\text{mass} = \text{no. of mol} \times \text{gfm} = 200000 \times 28 = 5600000\text{g} = 5600\text{kg}$								
2009 12c(i)	0.1	no. of moles = volume x concentration = 0.1litres x 1.0 mol l ⁻¹ = 0.1mol								
2009 12c(ii)	0.25	$2\text{MnO}_4^- + 5\text{C}_2\text{H}_2\text{O}_4 + 6\text{H}^+ \longrightarrow 2\text{Mn}^{2+} + 10\text{CO}_2 + 8\text{H}_2\text{O}$ <p style="text-align: center;"> 2mol 5mol 2mol </p> <p style="text-align: center;"> 0.1mol 5mol x 0.1/2 </p> <p style="text-align: center;">= 0.25mol</p>								
2009 14a	Fe ₂ O ₃	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 33%;">Write down Valency below each element's symbol</th> <th style="width: 33%;">Put in Cross-over Arrows</th> <th style="width: 33%;">Follow arrows to get formula</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;"> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">Fe</div> <div style="text-align: center;">O</div> </div> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">3</div> <div style="text-align: center;">2</div> </div> </td> <td style="text-align: center;"> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">Fe</div> <div style="text-align: center;">O</div> </div> <div style="display: flex; justify-content: space-around; margin-top: 10px;"> <div style="text-align: center;">3</div> <div style="text-align: center;">2</div> </div> </td> <td style="text-align: center; vertical-align: middle;">Fe₂O₃</td> </tr> </tbody> </table>	Write down Valency below each element's symbol	Put in Cross-over Arrows	Follow arrows to get formula	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">Fe</div> <div style="text-align: center;">O</div> </div> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">3</div> <div style="text-align: center;">2</div> </div>	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">Fe</div> <div style="text-align: center;">O</div> </div> <div style="display: flex; justify-content: space-around; margin-top: 10px;"> <div style="text-align: center;">3</div> <div style="text-align: center;">2</div> </div>	Fe ₂ O ₃		
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2010 2b	(s) (l) (aq)	$\text{NH}_4\text{NO}_3(\text{s}) + \text{H}_2\text{O}(\text{l}) \longrightarrow \text{NH}_4\text{NO}_3(\text{aq})$								
2010 2c	Solvent	<table border="1" style="width: 100%; border-collapse: collapse;"> <tbody> <tr> <td style="width: 20%;">Solute</td> <td>Substance which is dissolved</td> </tr> <tr> <td>Solvent</td> <td>Liquid which does the dissolving</td> </tr> <tr> <td>Solution</td> <td>Mixture of solute dissolved in the solvent</td> </tr> </tbody> </table>	Solute	Substance which is dissolved	Solvent	Liquid which does the dissolving	Solution	Mixture of solute dissolved in the solvent		
Solute	Substance which is dissolved									
Solvent	Liquid which does the dissolving									
Solution	Mixture of solute dissolved in the solvent									

2012 15a(i)	0.5	no. of mol = volume × concentration = 0.25 litres × 2 mol l ⁻¹ = 0.5 mol		
2012 15a(ii)	40g	gfm Fe ₂ O ₃ = (2×56)+(3×16) = 112+48 = 160g $\begin{array}{ccc} \text{Fe}_2\text{O}_3 & + & 2\text{H}_3\text{PO}_4 & \longrightarrow & 2\text{FePO}_4 & + & 3\text{H}_2\text{O} \\ 1\text{mol} & & 2\text{mol} & & & & \\ 0.25\text{mol} & & 0.5\text{mol} & & & & \end{array}$ Mass Fe ₂ O ₃ = no. of mol × gfm = 0.25 × 160 = 40g		
2013 6a	0.01	no. of mol = $\frac{\text{mass}}{\text{gfm}} = \frac{1.57}{157} = 0.01 \text{ mol}$		
2013 6c	Ca ₃ (PO ₄) ₂	Write down Valency below each ion's symbol $\begin{array}{cc} \text{Ca} & \text{PO}_4^{3-} \\ 2 & 3 \end{array}$	Put in Cross-over Arrows $\begin{array}{cc} \text{Ca} & \text{PO}_4^{3-} \\ \swarrow & \searrow \\ 2 & 3 \end{array}$	Follow arrows and cancel down to get formula $\text{Ca}_3(\text{PO}_4)_2$
2013 12c	8.52	gfm C ₁₈ H ₃₆ O ₂ = 890g (in question) no of mol = $\frac{\text{mass}}{\text{gfm}} = \frac{8.9}{890} = 0.01 \text{ mol}$ glyceryl tristearate + water \longrightarrow glycerol + stearic acid $\begin{array}{ccc} \text{C}_{57}\text{H}_{110}\text{O}_6 & + & 3\text{H}_2\text{O} & \longrightarrow & \text{C}_3\text{H}_8\text{O}_3 & + & 3\text{C}_{18}\text{H}_{36}\text{O}_2 \\ 1\text{mol} & & & & & & 3\text{mol} \\ 0.01\text{mol} & & & & & & 0.03\text{mol} \end{array}$ gfm C ₁₈ H ₃₆ O ₂ = (18×12)+(36×1)+(2×16) = 216+36+32 = 284g mass = no. of mol × gfm = 0.03 × 284 = 8.52g		
2014 4c(ii)	1490	1mol NH ₃ = (1×14)+(3×1) = 14+3 = 17g no of mol = $\frac{\text{mass}}{\text{gfm}} = \frac{510}{17} = 30 \text{ mol}$ $\begin{array}{ccc} 3\text{NH}_3 & + & \text{H}_3\text{PO}_4 & \longrightarrow & (\text{NH}_4)_3\text{PO}_4 \\ 3\text{mol} & & & & 1\text{mol} \\ 30\text{mol} & & & & 10\text{mol} \end{array}$ 1mol (NH ₄) ₃ PO ₄ = (3×14)+(12×1)+(1×31)+(4×16) = 42+12+31+64 = 149g mass = no. of mol × gfm = 10 × 149 = 1490g		
2014 10a	1	1mol CH ₃ COOH = (2×12)+(4×1)+(2×16) = 24+4+32 = 60g no. of mol = $\frac{\text{mass}}{\text{gfm}} = \frac{6}{60} = 0.1 \text{ mol}$ concentration = $\frac{\text{no. of mol}}{\text{volume}} = \frac{0.1\text{mol}}{0.1\text{litres}} = 1 \text{ mol l}^{-1}$		
2014 14b	Al(OH) ₃	Write down Valency below each ion's symbol $\begin{array}{cc} \text{Al} & \text{OH}^- \\ 3 & 1 \end{array}$	Put in Cross-over Arrows $\begin{array}{cc} \text{Al} & \text{OH}^- \\ \swarrow & \searrow \\ 3 & 1 \end{array}$	Follow arrows and cancel down to get formula $\text{Al}(\text{OH})_3$

2015 4b(ii)	Na^+H^-	Sodium is a group 1 metal so forms an sodium ion with formula Na^+ The negative ion to balance this is the hydride ion will formula H^- . The cross over rule would give the formula NaH as both ions have a valency of one.
2015 5b(i)	$\text{TiCl}_4 + 4\text{Na}$ \downarrow $\text{Ti} + 4\text{NaCl}$	$\text{TiCl}_4 + 4\text{Na} \longrightarrow \text{Ti} + 4\text{NaCl}$
2015 12b	0.2	$1\text{mol CuSO}_4 = (1 \times 63.5) + (1 \times 32) + (4 \times 16) = 63.5 + 32 + 64 = 159.5\text{g}$ $\text{no of mol} = \frac{\text{mass}}{\text{gfm}} = \frac{3.19}{159.5} = 0.02\text{mol}$ $\text{concentration} = \frac{\text{no of mol}}{\text{volume}} = \frac{0.02\text{mol}}{0.1\text{litres}} = 0.2\text{mol l}^{-1}$

Past Paper Question Bank

Unit 1.3a Chemical Formulae

Outcome	2000 Credit	2001 Credit	2002 Credit	2003 Credit	2004 Credit	2005 Credit	2006 Credit	2007 Credit	2008 Credit	2009 Credit	2010 Credit	2011 Credit	2012 Credit	2013 Credit		
37		13a(i)						17a						11a(i)		
38	13a											16b(ii)				
39							11c									
40								17d								
41																
42																
43																
44 45		18b	14d		17a			19b	20b	10b	13c 16a(i)	18c	15d	16b(ii)		
46	13e	12a	12a(i)	10b(i)	17b(i)	16a	16a	10c(i)	12b	16b	14b(i)	20a(i)	15a			
47																
48a																
48b				19b												
48c					11b(ii)					16d			21c(ii)			
49																
50		14c	19a(ii)	19b	21b(ii)			20a	14c			20c(ii)	17b	18b(i)		
51	18b	12c	15b(ii)	12c		20b	15a		20a	19c	12e	17b		17c		
52		13c(ii)	12b	15c	11b(i) 17c	11b	11b	17c	16a	14b	16a(ii)		15c 21c(i)	16b(i)		

2002C 12a(i)	$\text{TiCl}_4 + 2\text{H}_2\text{O}$ \downarrow $\text{TiO}_2 + 4\text{HCl}$	$\text{TiCl}_4 + 2\text{H}_2\text{O} \longrightarrow \text{TiO}_2 + 4\text{HCl}$				
2002C 12b	60%	$\text{gfm TiO}_2 = (1 \times 48) + (2 \times 16) = 48 + 32 = 80\text{g}$ $\% \text{Ti} = \frac{\text{mass of Ti}}{\text{gfm}} \times 100 = \frac{48}{80} \times 100 = 60\%$				
2002C 14d	$(\text{Na}^+)_2\text{CO}_3^{2-}$	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%; text-align: center;"> Write down Valency below each ion's symbol Na CO_3^{2-} 1 2 </td> <td style="width: 33%; text-align: center;"> Put in Cross-over Arrows Na CO_3^{2-} \swarrow \searrow 1 2 </td> <td style="width: 33%;"> Follow arrows and cancel down to get formula Na_2CO_3 Work out charges on ions. If more than one of ion put ion in brackets and number outside $(\text{Na}^+)_2\text{CO}_3^{2-}$ </td> </tr> </table>	Write down Valency below each ion's symbol Na CO_3^{2-} 1 2	Put in Cross-over Arrows Na CO_3^{2-} \swarrow \searrow 1 2	Follow arrows and cancel down to get formula Na_2CO_3 Work out charges on ions. If more than one of ion put ion in brackets and number outside $(\text{Na}^+)_2\text{CO}_3^{2-}$	
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2002C 15b(ii)	1120 tonnes	$1 \text{ mol Fe}_2\text{O}_3 = (2 \times 56) + (3 \times 16) = 112 + 48 = 160\text{g}$ $\text{no. of mol} = \frac{\text{mass}}{\text{gfm}} = \frac{1600\text{g}}{160\text{g mol}^{-1}} = 10\text{mol}$ $\text{Fe}_2\text{O}_3 + 3\text{CO} \longrightarrow 2\text{Fe} + 3\text{CO}_2$ <table style="margin-left: auto; margin-right: auto;"> <tr> <td style="text-align: center;">1mol</td> <td style="text-align: center;">2mol</td> </tr> <tr> <td style="text-align: center;">10mol</td> <td style="text-align: center;">20mol</td> </tr> </table> $1 \text{ mol Fe} = 56\text{g}$ $\text{mass} = \text{no. of mol} \times \text{gfm} = 20\text{mol} \times 56\text{g mol}^{-1} = 1120\text{g}$ <p style="text-align: center;">160g Fe_2O_3 produces 1120g of Fe</p> <p style="text-align: center;">\therefore 160tonnes Fe_2O_3 produces 1120tonnes of Fe</p>	1mol	2mol	10mol	20mol
1mol	2mol					
10mol	20mol					
2002C 19a(ii)	0.00201mol	$\text{no. of mol} = \text{volume} \times \text{concentration}$ $= 0.0201\text{litres} \times 0.1 \text{ mol/l}$ $= 0.00201 \text{ mol}$				
2003C 10b(i)	$\text{CH}_4 + 2\text{O}_2$ \downarrow $\text{CO}_2 + 2\text{H}_2\text{O}$	$\text{CH}_4 + 2\text{O}_2 \longrightarrow \text{CO}_2 + 2\text{H}_2\text{O}$				
2003C 12c	32.75g	$\text{no. of mol H}_2 = 0.5\text{mol (in question)}$ $\text{Zn} + 2\text{HCl} \longrightarrow \text{ZnCl}_2 + \text{H}_2$ <table style="margin-left: auto; margin-right: auto;"> <tr> <td style="text-align: center;">1mol</td> <td style="text-align: center;">1mol</td> </tr> <tr> <td style="text-align: center;">0.5mol</td> <td style="text-align: center;">0.5mol</td> </tr> </table> $1 \text{ mol Zn} = 65.5\text{g}$ $\text{mass} = \text{no. of mol} \times \text{gfm} = 0.5\text{mol} \times 65.5\text{g mol}^{-1} = 32.75\text{g}$	1mol	1mol	0.5mol	0.5mol
1mol	1mol					
0.5mol	0.5mol					
2003C 15c	38.7%	$\text{gfm Ca}_3(\text{PO}_4)_2 = (3 \times 40) + (2 \times 31) + (8 \times 16) = 120 + 62 + 128 = 310\text{g}$ $\% \text{Ca} = \frac{\text{mass of Ca}}{\text{gfm}} \times 100 = \frac{120}{310} \times 100 = 38.7\%$				
2003C 19b	6.725g	$1 \text{ mol CuCl}_2 = (1 \times 63.5) + (2 \times 35.5) = 134.5\text{g}$ $\text{no. of mol} = \text{volume} \times \text{concentration}$ $= 0.05\text{litres} \times 1 \text{ mol/l}$ $= 0.05\text{mol}$ $\text{mass of CuCl}_2 = \text{no. of mol} \times \text{gfm}$ $= 0.05\text{mol} \times 134.5\text{g mol}^{-1}$ $= 6.725\text{g}$				

2006C 15a	8g	$1\text{mol N}_2\text{O} = (2 \times 14) + (1 \times 16) = 28 + 16 = 44\text{g}$ $\text{no. of mol} = \frac{\text{mass}}{\text{gfm}} = \frac{22\text{g}}{44\text{g mol}^{-1}} = 0.5\text{mol}$ $2\text{N}_2\text{O} \longrightarrow 2\text{N}_2 + \text{O}_2$ $\begin{array}{ccc} 2\text{mol} & & 1\text{mol} \\ 0.5\text{mol} & & 0.25\text{mol} \end{array}$ $1\text{mol O}_2 = 32\text{g}$ $\text{mass} = \text{no. of mol} \times \text{gfm} = 0.25\text{mol} \times 32\text{g mol}^{-1} = 8\text{g}$							
2006C 16a	$\text{Ba(OH)}_2 + 2\text{NH}_4\text{Cl}$ \downarrow $2\text{NH}_3 + \text{BaCl}_2 + 2\text{H}_2\text{O}$	$\text{Ba(OH)}_2 + 2\text{NH}_4\text{Cl} \longrightarrow 2\text{NH}_3 + \text{BaCl}_2 + 2\text{H}_2\text{O}$							
2007C 10c(i)	$2\text{AgNO}_3 + \text{Cu}$ \downarrow $2\text{Ag} + \text{Cu(NO}_3)_2$	$2\text{AgNO}_3 + \text{Cu} \longrightarrow 2\text{Ag} + \text{Cu(NO}_3)_2$							
2007C 17a	zinc sulphide	<table border="1"> <tbody> <tr> <td>-ide</td> <td>Compound contains the two named elements</td> <td rowspan="3">NB metal always comes first in name</td> </tr> <tr> <td>-ate</td> <td>Compound contains 3 elements (two named elements + oxygen)</td> </tr> <tr> <td>-ite</td> <td>Compound contains 3 elements (two named elements + oxygen)</td> </tr> </tbody> </table>	-ide	Compound contains the two named elements	NB metal always comes first in name	-ate	Compound contains 3 elements (two named elements + oxygen)	-ite	Compound contains 3 elements (two named elements + oxygen)
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-ate	Compound contains 3 elements (two named elements + oxygen)								
-ite	Compound contains 3 elements (two named elements + oxygen)								
2007C 17c	51.3%	$1\text{mol CaF}_2 = 40 + 19 + 19 = 78\text{g}$ $\% \text{Ca} = \frac{\text{mass of Ca}}{\text{mass of CaF}_2} \times 100 = \frac{40}{78} \times 100 = 51.3\%$							
2007C 17d	$\text{Fe}_2\text{O}_3 + \text{CO}$ \downarrow $\text{Fe} + \text{CO}_2$	<p>The reaction in a blast furnace has the reduction of iron ore (Fe_2O_3) by carbon monoxide. Carbon monoxide is made by incomplete combustion of carbon in the blast furnace.</p> $\text{Fe}_2\text{O}_3 + 3\text{CO} \rightarrow 2\text{Fe} + 3\text{CO}_2$							
2007C 19b	$\text{Ni}^{2+}(\text{NO}_3^-)_2$	NO_3^- ions have a valency of 1. Use cross over rule to calculate formula							
2007C 20a	0.2	$\text{no. of mol} = \text{volume} \times \text{concentration} = 0.05\text{litres} \times 4\text{ mol/l} = 0.2\text{ mol}$							
2008C 12b	$2\text{NaN}_3 \rightarrow \text{N}_2 + 2\text{Na}$	Balancing Equation Exercise [Clue: Get 6 Nitrogens on both sides]							
2008C 14c	0.0033	$\text{no. of mol.} = \text{volume} \times \text{concentration}$ $= 0.33\text{l} \times 0.01\text{ mol/l}$ $= 0.0033\text{ mol}$							
2008C 16a	68.3%	$1\text{mol PbSO}_4 = 207 + 32 + (4 \times 16) = 207 + 32 + 64 = 303\text{g}$ $\% \text{Pb} = \frac{\text{mass of Pb}}{\text{mass of PbSO}_4} \times 100 = \frac{207}{303} \times 100 = 68.3\%$							
2008C 20a	28g	$1\text{mole Fe}_2\text{O}_3 = (2 \times 56) + (3 \times 16) = 112 + 48 = 160\text{g}$ $\text{no. of mol} = \frac{\text{mass}}{\text{gfm}} = \frac{40\text{g}}{160\text{g mol}^{-1}} = 0.25\text{mol}$ $2\text{Al} + \text{Fe}_2\text{O}_3 \longrightarrow 2\text{Fe} + \text{Al}_2\text{O}_3$ $\begin{array}{ccc} 1\text{mol} & & 2\text{mol} \\ 0.25\text{mol} & & 0.5\text{mol} \end{array}$ $1\text{mol Fe} = 1 \times 56 = 56\text{g}$ $\text{mass} = \text{no. of mol} \times \text{gfm} = 0.5\text{mol} \times 56\text{g mol}^{-1} = 28\text{g}$							
2008C 20b	3+	Fe with valency 3 will give formula of Fe_2O_3 via cross-over rule. Iron with valency of 3 will give iron ions with 3+ charge (Fe^{3+})							

2009C 10b	$(Al^{3+})_2(O^{2-})_3$	$ \begin{array}{ccc} Al^{3+} & & O^{2-} \\ & \swarrow \quad \searrow & \\ 3 & & 2 \end{array} $ $(Al^{3+})_2(O^{2-})_3$						
2009C 14b	35%	$1 \text{ mol } NH_4NO_3 = (2 \times 14) + (4 \times 1) + (3 \times 16) = 28 + 4 + 48 = 80 \text{g}$ $\%N = \frac{\text{Weight of N}}{\text{Weight of } NH_4NO_3} = \frac{28}{80} \times 100 = 35\%$						
2009C 16b	$ \begin{array}{c} C_6H_{12}O_6 \\ \downarrow \\ 2C_2H_5OH + 2CO_2 \end{array} $	$ \begin{array}{ccccc} \text{glucose} & \xrightarrow{\text{yeast}} & \text{alcohol} & + & \text{carbon dioxide} \\ C_6H_{12}O_6 & \longrightarrow & 2C_2H_5OH & + & 2CO_2 \end{array} $						
2009C 16d	5	$1 \text{ mol } C_2H_5OH = (2 \times 12) + (6 \times 1) + (1 \times 16) = 24 + 6 + 16 = 46 \text{g}$ $\text{no. of mol} = \frac{\text{mass}}{\text{gfm}} = \frac{230 \text{g}}{46 \text{g mol}^{-1}} = 5 \text{mol}$						
2009C 19c	9	$1 \text{ mol of } C_9H_{20} = (9 \times 12) + (20 \times 1) = 108 + 20 = 128 \text{g}$ $\text{no. of mol} = \frac{\text{mass}}{\text{gfm}} = \frac{6.4 \text{g}}{128 \text{g mol}^{-1}} = 0.05 \text{mol}$ $ \begin{array}{ccc} C_9H_{20} + 14O_2 & \longrightarrow & 9CO_2 + 10H_2O \\ 1 \text{mol} & & 10 \text{mol} \\ 0.05 \text{mol} & & 0.5 \text{mol} \end{array} $ $1 \text{ mol of } H_2O = (2 \times 1) + (1 \times 16) = 2 + 16 = 18 \text{g}$ $\text{mass} = \text{no. of mol} \times \text{gfm} = 0.5 \text{mol} \times 18 \text{g mol}^{-1} = 9 \text{g}$						
2010C 12e	0.4g	$1 \text{ mol Mg} = 24.5 \text{g}$ $\text{no. of mol} = \frac{\text{mass}}{\text{gfm}} = \frac{4.9 \text{g}}{24.5 \text{g mol}^{-1}} = 0.2 \text{mol}$ $ \begin{array}{ccc} Mg + H_2SO_4 & \longrightarrow & MgSO_4 + H_2 \\ 1 \text{mol} & & 1 \text{mol} \\ 0.2 \text{mol} & & 0.2 \text{mol} \end{array} $ $1 \text{ mol } H_2 = 2 \times 1 = 2 \text{g}$ $\text{mass} = \text{no. of mol} \times \text{gfm} = 0.2 \text{mol} \times 2 \text{g mol}^{-1} = 0.4 \text{g}$						
2010C 13c	$Ni^{2+}CrO_4^{2-}$	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 33%;">Write down Valency below each element's symbol</th> <th style="width: 33%;">Put in Cross-over Arrows</th> <th style="width: 33%;">Follow arrows and cancel down to get formula</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;"> $\begin{array}{cc} Ni^{2+} & CrO_4^{2-} \\ 2 & 2 \end{array}$ </td> <td style="text-align: center;"> $\begin{array}{cc} Ni^{2+} & CrO_4^{2-} \\ 2 & 2 \end{array}$ </td> <td style="text-align: center;"> $\begin{array}{c} Ni^{2+}CrO_4^{2-} \end{array}$ </td> </tr> </tbody> </table>	Write down Valency below each element's symbol	Put in Cross-over Arrows	Follow arrows and cancel down to get formula	$ \begin{array}{cc} Ni^{2+} & CrO_4^{2-} \\ 2 & 2 \end{array} $	$ \begin{array}{cc} Ni^{2+} & CrO_4^{2-} \\ 2 & 2 \end{array} $	$ \begin{array}{c} Ni^{2+}CrO_4^{2-} \end{array} $
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2010C 14b(i)	$ \begin{array}{c} TiCl_4 + 4Na \\ \downarrow \\ Ti + 4NaCl \end{array} $	$TiCl_4 + 4Na \longrightarrow Ti + 4NaCl$						
2010C 16a(i)	2+	Sulphur is a group 6 non-metal element and forms S^{2-} ions For PbS to be balanced in charge, lead ion must have charge Pb^{2+}						
2010C 16a(ii)	86.6%	$1 \text{ mol } PbS = (1 \times 207) + (1 \times 32) = 207 + 32 = 239 \text{g}$ $\%Pb = \frac{\text{mass of Pb}}{\text{mass of } PbS} = \frac{207}{239} \times 100 = 86.6\%$						

2011C 16b(ii)	Al_2O_3	<div style="display: flex; justify-content: space-around;"> <div style="border: 1px solid black; padding: 5px;"> <p>Write down Valency below each element's symbol</p> <p style="font-size: 2em; text-align: center;">Al O</p> <p style="font-size: 2em; text-align: center;">3 2</p> </div> <div style="border: 1px solid black; padding: 5px;"> <p>Put in Cross-over Arrows</p> <p style="font-size: 2em; text-align: center;">Al O</p> </div> <div style="border: 1px solid black; padding: 5px;"> <p>Follow arrows and cancel down if necessary to get formula</p> <p style="font-size: 2em; text-align: center;">Al_2O_3</p> </div> </div>						
2011C 17b	51g	$1\text{mol H}_2\text{NCONH}_2 = (1 \times 12) + (2 \times 14) + (1 \times 16) + (4 \times 1) = 12 + 28 + 16 + 4 = 60\text{g}$ $\text{no. of mol} = \frac{\text{mass}}{\text{gfm}} = \frac{90\text{g}}{60\text{g mol}^{-1}} = 1.5\text{mol}$ $\text{H}_2\text{NCONH}_2 + \text{H}_2\text{O} \longrightarrow \text{CO}_2 + 2\text{NH}_3$ <div style="display: flex; justify-content: space-around; width: 100%;"> <div style="text-align: center;">1mol 1.5mol</div> <div style="text-align: center;">2mol 3mol</div> </div> $1\text{mol NH}_3 = (1 \times 14) + (3 \times 1) = 14 + 3 = 17\text{g}$ mass = no. of mol \times gfm = 3mol \times 17g mol⁻¹ = 51g						
2011C 18c	Co^{2+} or 2+	Chlorine is a non-metal in group 7, with a valency of 1 and forms the Cl^- ion. CoCl_2 has two Cl^- ions \therefore Cobalt ion must be 2+ to balance charge \therefore Co^{2+} ion						
2011C 20a(i)	$\text{Pb}(\text{NO}_3)_2 + 2\text{NaI}$ \downarrow $\text{PbI}_2 + 2\text{NaNO}_3$	$\text{Pb}(\text{NO}_3)_2 + 2\text{NaI} \longrightarrow \text{PbI}_2 + 2\text{NaNO}_3$						
2011C 20c(ii)	0.002	$\text{no. of moles} = \text{volume} \times \text{concentration}$ $= 0.02\text{litres} \times 0.1\text{ mol l}^{-1}$ $= 0.002\text{ mol}$						
2012C 15a	$2\text{KOH} + \text{H}_2\text{SO}_4$ \downarrow $\text{K}_2\text{SO}_4 + 2\text{H}_2\text{O}$	$2\text{KOH} + \text{H}_2\text{SO}_4 \longrightarrow \text{K}_2\text{SO}_4 + 2\text{H}_2\text{O}$						
2012C 15c	44.8%	$\text{gfm K}_2\text{SO}_4 = (2 \times 39) + (1 \times 32) + (4 \times 16) = 78 + 32 + 64 = 174\text{g}$ $\% \text{K} = \frac{\text{mass K}}{\text{gfm}} = \frac{78}{174} \times 100 = 44.8\%$						
2012C 15d	$(\text{NH}_4^+)_3\text{PO}_4^{3-}$	Formula of ammonium phosphate is $(\text{NH}_4)_3\text{PO}_4$ Ammonium ions have a formula of NH_4^+ and phosphate ions PO_4^{3-}						
2012C 17b	0.005mol	$\text{no. of moles} = \text{volume} \times \text{concentration} = 0.05\text{litres} \times 0.1\text{mol l}^{-1} = 0.005\text{mol}$						
2012C 21c(i)	25	$\text{Mass Al} = 10\% \text{ of } 250\text{g} = \frac{10}{100} \times 250\text{g} = 25\text{g}$						
2012C 21c(ii)	0.926	$\text{no. of mol} = \frac{\text{mass}}{\text{gfm}} = \frac{25\text{g}}{27\text{g}} = 0.926\text{mol}$						
2013C 11a(i)	Sodium phosphate	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center; border-bottom: 1px solid black;">Metal comes first in the name</td> <td style="text-align: center; border-bottom: 1px solid black;">Non-metal comes second in the name</td> <td style="text-align: center; border-bottom: 1px solid black;">3rd element is oxygen = -ate</td> </tr> <tr> <td style="text-align: center;">sodium</td> <td style="text-align: center;">phosph-</td> <td style="text-align: center;">-ate</td> </tr> </table>	Metal comes first in the name	Non-metal comes second in the name	3 rd element is oxygen = -ate	sodium	phosph-	-ate
Metal comes first in the name	Non-metal comes second in the name	3 rd element is oxygen = -ate						
sodium	phosph-	-ate						
2013C 16b(i)	86.2%	$\text{gfm HgS} = (1 \times 200.5) + (1 \times 32) = 200.5 + 32 = 232.5\text{g}$ $\% \text{Hg} = \frac{\text{mass of Hg}}{\text{total mass}} \times 100 = \frac{200.5}{232.5} \times 100 = 86.2\%$						

2013C 16b(ii)	Hg ²⁺	<p>Hg (mercury) is a transition metal and does not have a set valency to work out the charge on the metal ion.</p> <ul style="list-style-type: none"> • The sulphide ion has a negative charge as it is a non-metal ion • The sulphide ion has a two negative charge as sulphur is in group 6 and has a valency of 2 ∴ S²⁻ ion • The mercury ion must have a positive charge as it is a metal ion <p>The mercury ion has a two positive charge to balance the two negative charge of the S²⁻ion ∴ Hg²⁺</p>
2013C 17c	35.5g	<p>1mol N₂ = 2x14 = 28g</p> $\text{no. of mol} = \frac{\text{mass}}{\text{gfm}} = \frac{7\text{g}}{28\text{g mol}^{-1}} = 0.25\text{mol}$ $\begin{array}{ccc} \text{N}_2 + 3\text{F}_2 & \longrightarrow & 2\text{NF}_3 \\ 1\text{mol} & & 2\text{mol} \\ 0.25\text{mol} & & 0.5\text{mol} \end{array}$ <p>1mol NF₃ = (1x14)+(3x19) = 14+57 = 71g mass = no. of mol x gfm = 0.5mol x 71g mol⁻¹ = 35.5g</p>
2013C 18b(i)	0.001	no. of moles = volume x concentration = 0.02litres x 0.05 mol l ⁻¹ = 0.001 mol
2013C 18b(ii)	0.04	concentration = $\frac{\text{no. of mol}}{\text{volume}} = \frac{0.001 \text{ mol}}{0.025 \text{ litres}} = 0.04 \text{ mol l}^{-1}$

Past Paper Question Bank

Unit 1.3a Chemical Formulae

Outcome	2000 <i>General</i>	2001 <i>General</i>	2002 <i>General</i>	2003 <i>General</i>	2004 <i>General</i>	2005 <i>General</i>	2006 <i>General</i>	2007 <i>General</i>	2008 <i>General</i>	2009 <i>General</i>	2010 <i>General</i>	2011 <i>General</i>	2012 <i>General</i>	2013 <i>General</i>		
37					14a	10c	13a		10c		13a					
38				12b				14c(ii)		10b(i)			16c(ii)	19a		
39																
40							16b		15b(i)							
41																
42																
43						16b										
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50																
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SG General	Answer	Reasoning															
2003G 12b	SiO_2	<p>The two most common elements in the pie chart are silicon and oxygen:</p> <table border="1"> <thead> <tr> <th>Write down Elements and their valency below</th> <th>Write Down Arrow of Cross Over Rule</th> <th>Follow arrows and cancel down to get formula</th> </tr> </thead> <tbody> <tr> <td> Si O 4 2 </td> <td> Si O </td> <td>SiO_2</td> </tr> </tbody> </table>	Write down Elements and their valency below	Write Down Arrow of Cross Over Rule	Follow arrows and cancel down to get formula	Si O 4 2	Si O 	SiO_2									
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2004G 14a	magnesium, sulphur & oxygen	<table border="1"> <thead> <tr> <th>Ending</th> <th>Meaning</th> <th>Example</th> </tr> </thead> <tbody> <tr> <td>-ide</td> <td>2 elements in compound</td> <td>copper sulphide = copper + sulphur</td> </tr> <tr> <td>-ate</td> <td>2 elements in compound + oxygen</td> <td>copper sulphate = copper + sulphur + oxygen</td> </tr> <tr> <td>-ite</td> <td>2 elements in compound + oxygen</td> <td>sodium sulphite = sodium + sulphur + oxygen</td> </tr> </tbody> </table>	Ending	Meaning	Example	-ide	2 elements in compound	copper sulphide = copper + sulphur	-ate	2 elements in compound + oxygen	copper sulphate = copper + sulphur + oxygen	-ite	2 elements in compound + oxygen	sodium sulphite = sodium + sulphur + oxygen			
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2006G 13a	lead, nitrogen and oxygen	<table border="1"> <thead> <tr> <th>Ending</th> <th>Meaning</th> <th>Example</th> </tr> </thead> <tbody> <tr> <td>-ide</td> <td>2 elements in compound</td> <td>Copper sulphide = copper + sulphur</td> </tr> <tr> <td>-ate</td> <td>2 elements in compound + oxygen</td> <td>Copper sulphate = copper + sulphur + oxygen</td> </tr> <tr> <td>-ite</td> <td>2 elements in compound + oxygen</td> <td>Sodium sulphite = sodium + sulphur + oxygen</td> </tr> </tbody> </table>	Ending	Meaning	Example	-ide	2 elements in compound	Copper sulphide = copper + sulphur	-ate	2 elements in compound + oxygen	Copper sulphate = copper + sulphur + oxygen	-ite	2 elements in compound + oxygen	Sodium sulphite = sodium + sulphur + oxygen			
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2007G 14c(ii)	Al_2O_3	<table border="1"> <thead> <tr> <th>Write down Valency below each element's symbol</th> <th>Put in Cross-over Arrows</th> <th>Follow arrows to get formula</th> </tr> </thead> <tbody> <tr> <td> Al O 3 2 </td> <td> Al O </td> <td>Al_2O_3</td> </tr> </tbody> </table>	Write down Valency below each element's symbol	Put in Cross-over Arrows	Follow arrows to get formula	Al O 3 2	Al O 	Al_2O_3									
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2008G 10c	aluminium + silicon + oxygen	<table border="1"> <tbody> <tr> <td>-ide</td> <td>Compound contains the two named elements</td> </tr> <tr> <td>-ate</td> <td>Compound contains 3 elements (two named elements + oxygen)</td> </tr> <tr> <td>-ite</td> <td>Compound contains 3 elements (two named elements + oxygen)</td> </tr> </tbody> </table>	-ide	Compound contains the two named elements	-ate	Compound contains 3 elements (two named elements + oxygen)	-ite	Compound contains 3 elements (two named elements + oxygen)									
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2009G 10b(i)	$MgCl_2$	Write down Valency below each element's symbol $Mg \quad Cl$ $2 \quad 1$	Put in Cross-over Arrows $Mg \quad Cl$ $2 \quad 1$	Follow arrows to get formula $MgCl_2$												
2010G 13a	Potassium, carbon and oxygen	<table border="1"> <thead> <tr> <th>Ending</th> <th>Meaning</th> <th>Example</th> </tr> </thead> <tbody> <tr> <td>-ide</td> <td>2 elements in compound</td> <td>Copper sulphide = copper + sulphur</td> </tr> <tr> <td>-ate</td> <td>2 elements in compound + oxygen</td> <td>Copper sulphate = copper + sulphur + oxygen</td> </tr> <tr> <td>-ite</td> <td>2 elements in compound + oxygen</td> <td>Sodium sulphite = sodium + sulphur + oxygen</td> </tr> </tbody> </table>	Ending	Meaning	Example	-ide	2 elements in compound	Copper sulphide = copper + sulphur	-ate	2 elements in compound + oxygen	Copper sulphate = copper + sulphur + oxygen	-ite	2 elements in compound + oxygen	Sodium sulphite = sodium + sulphur + oxygen		
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2012G 16c(ii)	Li_2O	Write down Valency below each element's symbol $Li \quad O$ $1 \quad 2$	Put in Cross-over Arrows $Li \quad O$ $1 \quad 2$	Follow arrows to get formula Li_2O												
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2013G 19a	AlI_3	Write down Valency below each element's symbol $Al \quad I$ $3 \quad 1$	Put in Cross-over Arrows $Al \quad I$ $3 \quad 1$	Follow arrows to get formula AlI_3												