

Mark Scheme - 1.2 Atomic Structure and the Periodic Table

1.

Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
(a)			2	AlCl_3 (1) formula must be correct to get balancing mark 2,3,2 (1)			
(b)	(i)		2	102 (2) if incorrect allow (1) for $(27 \times 2) + (16 \times 3)$ no ecf within part (i)			
	(ii)		1	47 ecf possible from part (i)	47.1		

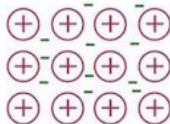
2.

Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
(a)			3	mass carbon and hydrogen divided by respective A_r values e.g. carbon 9/12 and hydrogen 2/1 (1) ratio of 3:8 (1) C_3H_8 (1) ecf possible if formula given is an alkane award (1) mark only for correct answer with no working			
(b)			2	$M_r(C_4H_{10}) = 58$ (1) $(48/58) \times 100 = 82.76$ (1) consequential marking	82.8 / 83		

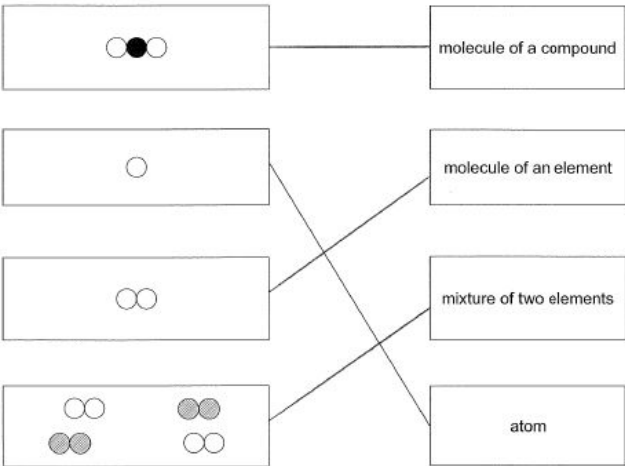
3.

Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
(a)			3	<p>two discrete diagrams needed</p> <ul style="list-style-type: none"> - diagram 1 showing transfer of electrons - diagram 2 showing ions <p>diagram 1 two potassium atoms lose 1 electron each (1) one sulfur atom gains 2 electrons (1)</p> <p>diagram 2 two K^+ ions and one S^{2-} ion formed (1) <i>octet of electrons around S^{2-} not needed</i></p>	if transferred electrons on both potassium and sulfur award (1)		
(b)			2	<p>two shared pairs of electrons (S—F) (1)</p> <p>octet of electrons around S and both F atoms (1)</p>			

4.

Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
(a)			1	2,8,1			
(b)			2	 <p>positive ions fixed positions electrons mobile / sea</p> <p>– all four points (2) – two/three points (1)</p>			
(c)	(i)		1	floats moves fizzes / bubbles goes into a round shape / melts – any two		vigorous reaction dissolves	
	(ii)		1	sodium hydroxide and hydrogen – both needed	NaOH + H ₂	H	
(d)			1	potassium burns / lilac flame		potassium moves faster	yellow / orange / red / green flame
(e)			2	atoms get bigger / greater distance between the (positive) nucleus and the (outer) electron (1) outer electron more weakly held (1)			



5.

Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
(a)			2	 <p>all three correct for (2) any one for (1)</p>			
(b)			2	<p>A electron negative B nucleus positive</p> <p>all four correct for (2) any two for (1)</p>			

6.

Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
(a)			1	electron		e	
(b)			2	proton (1) neutron (1)		p n	
(c)	(i)		1	14			
	(ii)		1	2,8,4			

7.

Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
(a)	(i)		1	 <i>atoms must be touching</i>			
	(ii)		1	NH ₃	H ₃ N		
(b)	(i)		1	O ₂ / He / Ne <i>any two</i>	oxygen / helium / neon		O
	(ii)		1	CO ₂ / CH ₄ / SO ₂ <i>any two</i>	carbon dioxide / methane / sulfur dioxide		
(c)	(i)		1	1			
	(ii)		1	5			
(d)	(i)		1	Mg ²⁺ Cl ⁻ <i>both ions needed (including charges)</i>	2Cl ⁻		Cl ⁻ ₂
	(ii)		1	NaOH	Na ⁺ OH ⁻		

8.

Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
(a)			3	<p>two discrete diagrams needed:</p> <ul style="list-style-type: none"> - diagram 1 showing transfer of electrons - diagram 2 showing ions <p>diagram 1 two lithium atoms losing 1 electron each (1) one sulfur atom gaining 2 electrons (1)</p> <p>diagram 2 $2 \times \text{Li}^+$ and S^{2-} formed (1)</p>			
(b)			2	<p>magnesium and/or oxide ions have a greater charge than sodium and/or chloride ions (1)</p> <p>this gives a greater attraction between the ions / stronger ionic bonds / more energy is needed to break bonds (1)</p>			
(c)			2	<p>shared electron pair between H atoms and adjacent O atoms and between the two O atoms (1)</p> <p>8 electrons in outer shell of both O atoms (1)</p>			

9.

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	(ii)		1	47 ecf possible from part (i)	47.1		

10.

Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
(a)	(i)		1	sodium atom 1 chlorine atom 7 both needed			
	(ii)	I	2	sodium (atom) loses one electron (1) chlorine (atom) gains one electron (1) award (2) for electron transferred from sodium to chlorine maximum (1) if transfer of more than 1 electron implied			
		II	1	sodium chloride / NaCl			
(b)			2	$23 + 35.5 + 3(16)$ (1) 106.5 (1) award (2) for cao no ecf			

11.

Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
(a)			2	number of moles = 0.05 (1)			
				concentration = 0.2 (1)			
				follow through error (ft) cao (2)			
(b)			4	calculation of mean 22.5 cm ³ (1)	mean of 22.65 cm ³		0.2 without workings
				0.2×0.0225 (1)			
				$0.0045 / 0.025$ (1)			
				0.18 (1)			
				follow through error (ft) cao (4)			

12.

Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
(a)			2	moles = conc \times vol/1000 $= \frac{0.1 \times 17.5}{1000}$ (1) $= 0.00175$ (1) award (2) for cao			
(b)			1	176			
(c)			2	ecf possible from parts (a) and (b) mass = moles \times M_r = 0.00175×176 (1) 0.308 g /308 mg (correct unit required) therefore statement incorrect (1)	alternative method using given 300 mg mass		

13.

Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
(a)			2	atomic masses (1) reactions / properties of elements (1)		'relative' mass number	
(b)			2	similarity – groups / periods (1) difference – gaps / two elements in some blocks / some elements in different groups / no noble gases or transition elements in early table (1)	no atomic number in early table / named examples of elements that have changed position	properties columns / rows	
(c)			2	He <div style="display: flex; justify-content: space-around; align-items: center;"> 2 3 4 </div> all four correct for (2) any 2 for (1)			




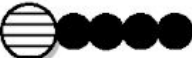
14.

Mark	Answer
6 QWC	<p>Indicative content</p> <ul style="list-style-type: none"> • element has a mass number of 35 and atomic number of 17 • 17 protons given by atomic number; must have same number of electrons because atoms are neutral • 17 electrons arranged in shells; electronic structure 2, 8, 7 • element is in Period 3; number of occupied electron shells • element is in Group 7; number of electrons in the outer shell • element E is chlorine • number of neutrons is 18; difference between mass number and atomic number <p>5-6 marks: The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.</p> <p>3-4 marks: The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.</p> <p>1-2 marks: The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.</p> <p>0 marks: The candidate does not make any attempt or give a relevant answer worthy of credit.</p>

15.

Sub-section	Mark	Answer	Accept	Neutral answer	Do not accept
(a)	1	B	Ne / neon		
(b)	2	D and F (1) both needed <i>either order</i> (D and F) are in the same group / (D and F) are both in Group 6 (D and F) both have 6 electrons in their outer shell (1) [Marks linked (unless no letters given)]			
(c)	2	Set of properties: 2 (1) both metallic and non-metallic properties / metalloid / semi-metal [If referring to specific properties from table it must clearly convey the idea that one (or more) is a metallic property and another is a non-metallic property, e.g. high m.p. and b.p. (like a metal) and brittle (like a non-metal); no credit for a simple list of all properties] (1) [Marks linked (unless no number is given) i.e. second mark cannot be awarded if first is not]	'high m.p., b.p. and shiny BUT brittle'	Reference to Group 4	

16.

Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
(a)			1	calcium and chlorine - both needed		Ca and Cl	chloride
(b)			1	sodium/magnesium/aluminium	Na/Mg/Al		
(c)	(i)		1	nitrogen		N	
	(ii)		2	eg hydrogen  carbon   (1) {atoms need to touch}			
(d)			1	H_2CO_3	CO_3H_2		

17.

Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
(a)			2	negative / -1 (1) 1 (1)			
(b)			1	19 9 – both needed			
(c)			2	17 (1) 20 (1)			
(d)			1	2,8,1			
(e)			1	2,8,8,2			

18.

Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
(a)			3	<i>mass number</i> 7 (1) <i>atomic number</i> 6 (1) <i>number of neutrons</i> 12 (1)			
(b)	(i)		1	2,8			
	(ii)		2	two shells (containing electrons) outer shell is full / can't accept any more electrons		8 in outer shell	
(c)			2	B and C (1) same number of protons but different numbers of neutrons / same atomic number but different mass number (1) [marks linked i.e. second mark cannot be awarded if first is not given]		reference to electrons	

19.

Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
(a)			1	B and F (both needed)			
(b)			1	D			
(c)	(i)		2	it is a semi metal / metalloid / shows properties of both metal and non-metal (1) must give example of one property of a metal and one of non-metal e.g. conducts electricity but low density etc. (1)	idea of conflicting properties	A	
	(ii)		1	D and E (both needed)			
(d)	(i)		2	310 – 250 (1) 540 / 60 = 9 g / cm ³ (1) cao (2)			
	(ii)		2	measurements are inaccurate / not precise / incorrect credit (1) for basic idea and additional (1) for sensible reason e.g. measuring cylinder not precise enough, only measures to nearest 10cm ³ (2) accept any other sensible answers e.g. sample is impure / oxidised or volume (liquid or solid) changes with temperature		human error	