

Atomic Structure

Mark Scheme 3

Level	IGCSE(9-1)
Subject	Chemistry
Exam Board	Edexcel IGCSE
Module	Double Award (Paper 1C)
Topic	Principles of Chemistry
Sub-Topic	Atomic Structure
Booklet	Mark Scheme 3

Time Allowed: 63 minutes

Score: /52

Percentage: /100

Grade Boundaries:

9	8	7	6	5	4	3	2	1
>90%	80%	70%	60%	50%	40%	30%	20%	10%

Question number				Answer	Notes	Marks
1	a	i	M1	35 on lines 1 and 3		1
			M2	44 on line 2		1
		ii		isotopes		1
		iii		same number of electrons (in outer shell) OR same electron arrangement or configuration	Ignore references to protons and neutrons unless incorrect, eg different numbers of protons, same number of neutrons	1
		iv	M1	^{79}Br	Accept just 79	1
			M2	79 is closer to 79.9/more accurate value	Accept 79 is closer to relative atomic mass M2 dependent on M1	1

Question number				Answer	Notes	Marks
1	b	i	M1		shared pair of electrons	1
			M2		other electrons correct (not necessary to be paired)	1
					M2 dependent on M1 Accept any combinations of dots and crosses Circles not needed but if drawn must overlap or touch – if not, then 0/2 Ignore inner electron shells even if incomplete or incorrect	
					Do not penalise incorrect symbols, eg br/BR If Na used in place of H, max 1 No marks if ions shown	
		ii	M1	shared (two/pair of) electrons	Not share an electron	1
			M2	attracted to <u>both</u> nuclei	M2 dependent on M1 or near miss eg the electrons are attracted to the nucleus scores 0 the electrons are attracted to both nuclei scores M2 but not M1	1
					0/2 if references to ions / ionic bond / intermolecular forces	

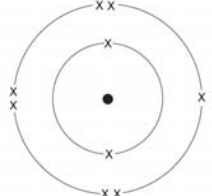
Question number			Answer	Notes	Marks
1	b	iii	M1 (sodium bromide) ionic bonding / + and – ions	Reject covalent bonding / shared electrons	1
			M2 (hydrogen bromide) attraction between molecules / intermolecular forces (of attraction)	Accept dipole-dipole attractions / van der Waals' forces / IMF / vdW Ignore hydrogen bonds Reject ions/ionic	1
			M3 ionic bonding stronger OR IMF / attractions between HBr molecules weaker	Accept ionic bonds stronger M3 dependent on comparison of intermolecular forces and ionic bonding Accept correct references to energy needed to overcome bonding / attractions	1
				Ignore references to reactivity and mass	

Question number			Answer			Notes	Marks
1	c	M1	Na <u>13.8</u> 23	Br <u>47.9</u> 80	O <u>38.3</u> 16	0/3 if division by atomic number(s) /division wrong way round If only two elements shown correctly, only M1 can be awarded	1
		M2	0.6	0.6	2.4	Accept 1 : 1: 4	1
		M3	NaBrO ₄			Accept elements in any order Penalise M3 for incorrect symbol, eg SBrO ₄ or NaBO ₄	1
						Dividing by 160 instead of 80 gives Na ₂ BrO ₈ Dividing by 32 instead of 16 gives NaBrO ₂ Award 2 in these cases Both these errors give Na ₂ BrO ₄ Award 1 in this case	
						Correct final answer scores 3 marks	
						Total	16

Question number	Answer	Accept	Reject	Marks
2 (a) (i)	B	lower case letters		1
(ii)	D			1
(iii)	A			1
(iv)	C			1
(b)	<p>M1 - (a substance) containing (two or more) elements IGNORE atoms for M1 only</p> <p>M2 – bonded (together) /<u>chemically</u> combined (in a fixed ratio)</p>	<u>chemically</u> joined	<p>mixture for M1 only</p> <p>molecules/particles bonded, etc for M1 and M2</p>	1 1
(c) (i)	<p>M1 - Na loses electron(s)</p> <p>M2 – Cl gains electron(s)</p> <p>M3 – Na becomes 2.8 AND chlorine becomes 2.8.8</p> <p>If incorrect number of electrons transferred, max 2</p> <p>IGNORE references to full shells</p> <p>max 1 for mention of covalent bonding</p> <p>All 3 marks can be scored from correct dot and cross diagrams showing electron transfer</p>			1 1 1

(ii)	M1 – Na = 23 <u>AND</u> Cl = 35.5			1
	M2 – 58.5			1
	M2 dep on M1			
	IGNORE units			
	Correct answer with no working scores 2			

(Total marks for Question 2 = 11 marks)

Question number	Answer	Notes	Marks
3 (a) (i)	A (Ag)		1
(ii)	D (Zr)		1
(b) (i)	3		1
(ii)	(The atom has) three <u>electrons</u> in its outer / valence shell	'energy level' for 'shell' ignore references to inner shells ignore 'it has a valency of 3'	1
(iii)	3		1
(iv)	(The atom has) electrons in three shells / three shells are occupied (with electrons)	'energy levels' for 'shells' accept 'it has three shells'	1
(v)	aluminium / Al		1
(c)		accept any symbol for electrons, eg dots, the letter 'e'	1

Question number	Answer	Notes	Marks												
4 (a)	C (halogens)		1												
(b) (i)	M1 <u>atoms</u> of the same element M2 with different masses	accept ' <u>atoms</u> with the same atomic number' / ' <u>atoms</u> with the same number of protons' accept 'different mass numbers' / 'different numbers of neutrons' ignore references to electrons unless incorrect	1 1												
(ii)	<table border="1"> <thead> <tr> <th>Isotope</th> <th>Number of protons</th> <th>Number of neutrons</th> <th>Number of electrons</th> </tr> </thead> <tbody> <tr> <td>${}^{79}_{35}\text{Br}$</td> <td>35</td> <td>44</td> <td>35</td> </tr> <tr> <td>${}^{81}_{35}\text{Br}$</td> <td>35</td> <td>46</td> <td>35</td> </tr> </tbody> </table>	Isotope	Number of protons	Number of neutrons	Number of electrons	${}^{79}_{35}\text{Br}$	35	44	35	${}^{81}_{35}\text{Br}$	35	46	35		3
Isotope	Number of protons	Number of neutrons	Number of electrons												
${}^{79}_{35}\text{Br}$	35	44	35												
${}^{81}_{35}\text{Br}$	35	46	35												

	M1 first column correct M2 second column correct M3 third column correct		
(c)	ethane – no change (in colour)	accept '(stays) orange' ignore 'no reaction' /'nothing happens'	1
	ethene – (orange to) colourless / decolourises	ignore 'discolours' ignore starting colour of bromine	1

Question number	Answer	Notes	Marks
5 a	C (lithium reacts with water to form an alkali)		1
b	A (have the same number of outer shell electrons)		1
c	(similar) bubbles / fizzing / effervescence OR moves / darts / floats OR gets smaller / disappears potassium shows a flame / sparks / explodes OR potassium melts / forms ball	Accept gas given off /evolved/formed/produced Accept hydrogen <u>gas</u> Ignore identity of gas Accept dissolves Accept reverse arguments for lithium	1 1
d	K ₂ O KCl	Accept K ₂ O ₂ and KO ₂ Reject KO If formula shown as <u>product</u> of an equation, ignore reactants and balancing Ignore coefficients	1 1
e	s l aq g		1
f	85 AND 87 calculated (even if not identified) (85 × 0.72) + (87 × 0.28) = 85.6	Accept 37+48 and 37+50 Correct final answer = 2 marks 85.5 or 85.56 = 1 mark No ECF from incorrect mass numbers Ignore units	1 1
Total 9 marks			