AS UNIT 1: THE LANGUAGE OF CHEMISTRY, STRUCTURE OF MATTER AND SIMPLE REACTIONS

MARK SCHEME

GENERAL INSTRUCTIONS

Recording of marks

Examiners must mark in red ink.

One tick must equate to one mark, apart from questions where a banded mark scheme is applied.

Question totals should be written in the box at the end of the question.

Question totals should be entered onto the grid on the front cover and these should be added to give the script total for each candidate.

Extended response questions

A level of response mark scheme is applied. The complete response should be read in order to establish the most appropriate band. Award the higher mark if there is a good match with content and communication criteria. Award the lower mark if either content or communication barely meets the criteria.

Marking rules

All work should be seen to have been marked.
Marking schemes will indicate when explicit working is deemed to be a necessary part of a correct answer.
Crossed out responses not replaced should be marked.

Marking abbreviations

The following may be used in marking schemes or in the marking of scripts to indicate reasons for the marks awarded.
cao = correct answer only
ecf = error carried forward
bod = benefit of doubt

Credit should be awarded for correct and relevant alternative responses which are not recorded in the mark scheme.

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MARK SCHEME

Section A

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
1.				1.5×10^{-2} (accept 15×10^{-3})		1		1	1	
2.	*(a)*			rate of the forward reaction is equal to the rate of the reverse reaction	1			1		
	(b)			no change in properties (named property)	1			1		
3.	*(a)*			C_2N_2		1		1		
	(b)			CN		1		1		
4.				oxidation states $SF_6 \rightarrow +6$; $H_2S \rightarrow -2$; $S \rightarrow 0$ all 3 correct (1) oxidation state of S in SF_6 decreases which is reduction therefore H_2S must be reducing agent (1)		2		2		
5.				$[H^+] = 0.02$ (1) pH = 1.7 (1) award (2) for correct answer only (cao)		1 1		2	1	2
6.				9.0 ± 0.2		1				
				Section A total	**2**	**8**	**0**	**10**	**2**	**2**

Section B

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
7.	*(a)*	(i)		electrons exist in shells	1			1		
		(ii)		fourth electron attracted much more strongly by the nucleus (1) fourth electron is closer to the nucleus / has less shielding from inner electrons (1)		2		2		
	(b)	(i)		Be point plotted between B and C Ne point plotted between F and He	1			1		
		(ii)		$Be(g) \rightarrow Be^{+}(g) + e^{-}$		1		1		
		(iii)		extra electron in oxygen paired in an orbital (1) greater electron-electron repulsion (1)	2			2		
	(c)	(i)		significant changes in successive ionisation energies seen in part *(a)* (1) big fall from He to Li / general increase from Li to Ne in part *(b)* (1)	2			2		
		(ii)		part *(b)* provides additional evidence i.e. for the existence of orbitals			1	1		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
7.	*(d)*	(i)		$f = c / \lambda = 3.28 \times 10^{15}$ (1) $E = hf$ (1) 2.17×10^{-18} (1) error carried forward (ecf) possible award (3) for cao	1	1 1		3	1 1	
		(ii)		for 1 mol = $N_A \times 2.17 \times 10^{-18} = 1305024$ (1) energy = 1305 (1) ecf possible award (2) for cao		2		2	1	
		(iii)		ionisation energy	1			1		
				Question 7 total	**8**	**7**	**1**	**16**	**3**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
8.	*(a)*	(i)		volumetric flask / standard flask	1			1		1
		(ii)		identification of 23.95 as an anomalous result (1) 23.15 cm^3 (1) award (2) for correct answer only (cao) award (1) for correctly calculated mean based on all four titres		1	1	2		2
		(iii)	I	n(HCl) = 2.315×10^{-3} (1) n(Na_2CO_3) = 1.16×10^{-3} (1)		2		2	2	
			II	n(Na_2CO_3) = 1.16×10^{-2} (1) mass = $0.0116 \times 106 = 1.23$ g (1) % by mass = $(1.23 / 2.05) \times 100 = 60$ % (1)		3		3	3	
	(b)	(i)		only mass of solid needed / all carbonate precipitated out of solution			1	1		1
		(ii)		n($BaCO_3$) = 1.15×10^{-2} (1) from equation n(Na_2CO_3) = 1.15×10^{-2} (1) mass of Na_2CO_3 = 1.22g % by mass = $(1.22 / 2.05) \times 100 = 60$% (1)			3	3	3	

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
8.	*(c)*	(i)		titration gives more accurate value as it is a mean value calculated from concurrent results / uses more accurate or more precise apparatus or technique			1	1		1
		(ii)		repeat precipitation / wash precipitate / heat to constant mass / use a more precise balance any 2 for (1) each			2	2		2
				Question 8 total	**1**	**6**	**8**	**15**	**8**	**7**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
9.	*(a)*	(i)		**B** (1) conducts when molten (1)	2			2		2
		(ii)	I	**A** and **E**	1			1		
			II	melting point – no mark diamond has four strong covalent bonds holding each carbon in place – lot of energy needed to overcome (1) iodine has weak id-id forces between molecules – require much less energy to overcome (1)	1 1			2		
		(iii)		solubility in water (1) sodium chloride soluble – electrostatic forces between ions and polar water molecules strong enough to overcome electrostatic forces inside the lattice (1) iodine insoluble – weak id-id forces between separate molecules too weak to overcome hydrogen bonding between water molecules (1)	 1 1	1		3		

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
9.	*(b)*		Indicative content • BF_3 is trigonal planar • 3 bonding pairs and no lone pairs • NH_3 trigonal pyramidal • 3 bonding pairs and one lone pair • extra lone pair on N which is absent from B • different number of electron pairs around central atom **5-6 marks** Each point included; clarity in description of bonding/lone pairs *The candidate constructs a relevant, coherent and logically structured account including all key elements of the indicative content. A sustained and substantiated line of reasoning is evident and scientific conventions and vocabulary are used accurately throughout.* **3-4 marks** Both shapes described/drawn/named; reference to bonding and lone pairs and to different numbers of electron pairs around central atom *The candidate constructs a coherent account including most of the key elements of the indicative content and little irrelevant material. Some reasoning is evident in the linking of key points and use of scientific conventions and vocabulary is generally sound.* **1-2 marks** Reference to both molecules; link between number of electron pairs and shape *The candidate attempts to link at least two relevant points from the indicative content. Coherence is limited by omission and/or inclusion of irrelevant material. There is some evidence of appropriate use of scientific conventions and vocabulary.* **0 marks** *The candidate does not make any attempt or give an answer worthy of credit.*	2	4		6		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
9.	*(c)*	(i)		coordinate / dative (covalent)	1			1		
		(ii)		109.5 °	1			1		
		(iii)		4 bonding pairs on B (3 + extra coordinate bonding pair)			1	1		
				Question 9 total	**11**	**5**	**1**	**17**	**0**	**2**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
10.	*(a)*	(i)		$Cl_2 + 2Br^- \rightarrow Br_2 + 2Cl^-$		1		1		
		(ii)		oxidation state of Br goes from –1 to 0 (1) which is oxidation therefore chlorine must be the oxidising agent (1) accept oxidation state of Cl goes from 0 to –1 which is reduction (1) oxidising agents are reduced in reaction (1)	1	1		2		
		(iii)		iodine is a larger molecule (1) greater id-id forces than bromine (1)	2			2		
	(b)	(i)		peak at 127 (1) peak at 254 (1) ignore peak heights			2	2		
		(ii)		must contain an isotope with a higher relative mass than the stable ^{127}I isotope			1	1		
	(c)	(i)	I	cloudy solution (1) bubbles (1)	2			2		2
			II	$Ca + 2H_2O \rightarrow Ca(OH)_2 + H_2$		1		1		
			III	no reaction / very slow formation of bubbles	1			1		1
		(ii)	I	n(HCl) = 0.0392 from equation n(Ca) = 0.0196 (1) mass = 0.784 g (1)		2		2	2	2
			II	$0.470\,dm^3$		1		1	1	1
				Question 10 total	**6**	**6**	**3**	**15**	**3**	**6**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
11.	*(a)*			accepts a proton /H^+	1			1		
	(b)	(i)		fewer gas particles in products (1) equilibrium shifts towards products to reduce pressure (1)		2		2		
		(ii)		equilibrium shifts towards products (1) ammonia replaced (1)		2		2		
	(c)			rate of reverse endothermic reaction increases equilibrium shifts towards reactants therefore K_c decreases		1	1	2		
				Question 11 total	**1**	**5**	**1**	**7**	**0**	**0**

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SUMMARY OF ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
Section A	2	8	0	10	2	2
7.	8	7	1	16	3	0
8.	1	6	8	15	8	7
9.	11	5	1	17	0	2
10.	6	6	3	15	3	6
11.	1	5	1	7	0	0
TOTAL	**29**	**37**	**14**	**80**	**16**	**17**