

Mark Scheme

Q1.

Question number	Answer	Mark
	<p>The only correct answer is D (quantum shells)</p> <p><i>A is incorrect because atomic emission spectroscopy does not provide evidence for the existence of atoms</i></p> <p><i>B is incorrect because atomic emission spectroscopy does not provide evidence for the existence of electrons</i></p> <p><i>C is incorrect because evidence for isotopes is provided by mass spectrometry</i></p>	(1)

Q2.

Question Number	Answer	Mark
	<p>The only correct answer is D ($1s^2 2s^2 2p^6 3s^2 3p^6$)</p> <p><i>A is not correct because two electrons have been removed instead of added to the sulfur atom</i></p> <p><i>B is not correct because this is the electronic configuration of the sulfur atom</i></p> <p><i>C is not correct because this is the incorrect electronic configuration of the sulfur atom</i></p>	(1)

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Q3.

Question Number	Answer	Mark
	<p>The only correct answer is C (503 965 3458 4530)</p> <p><i>A is not correct because there is no significant rise from 2nd to 3rd IE, therefore not a Group 2 element</i></p> <p><i>B is not correct because there is a significant rise between 1st and 2nd IEs, indicating a Group 1 element</i></p> <p><i>D is not correct because there is a significant rise from 3rd to 4th IE, indicating a Group 3 element</i></p>	(1)

Q4.

Question Number	Answer	Mark
	<p>The only correct answer is D (Be, Rb, Ba and Ra)</p> <p><i>A is not correct because chlorine is in Group 7 therefore it is a p block element</i></p> <p><i>B is not correct because cobalt is a transition element therefore it is a d block element</i></p> <p><i>C is not correct because aluminium is a Group 3 element therefore it is a p block element</i></p>	(1)

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Q5.

Question Number	Answer	Mark
	<p>The only correct answer is C ($p = 1, n = 2, e = 1$)</p> <p>A is not correct because the number of protons (p) and neutrons (n) are reversed, and the number of electrons is incorrect</p> <p>B is not correct because an atom of ${}^3\text{H}$ contains one electron</p> <p>D is not correct because the number of protons (p) and neutrons (n) are reversed, and an atom of ${}^3\text{H}$ contains only one electron</p>	(1)

Q6.

Question Number	Answer	Mark
	<p>The only correct answer is D ($1s^2, 2s^2, 2p^6, 3s^2, 3p^6$)</p> <p>A is not correct because $1s^2, 2s^2, 2p^6, 3s^2, 3p^2$ is for an S^{2+} ion</p> <p>B is not correct because $1s^2, 2s^2, 2p^6, 3p^4$ is for an S^{2+} ion with electrons removed from the 3s subshell</p> <p>C is not correct because $1s^2, 2s^2, 2p^6, 3s^2, 3p^4$ is for the sulfur atom</p>	(1)

Q7.

Question Number	Answer	Mark
	<p>The only correct answer is C ($1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^6$)</p> <p>A is not correct because this is the electron configuration of ${}^{33}\text{As}^{3+}$</p> <p>B is not correct because this is the electron configuration of ${}^{33}\text{As}$</p> <p>D is not correct because this has added electrons in the 4d orbital</p>	(1)

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Q8.

Question Number	Answer	Mark
	<p>The only correct answer is C</p> <p><i>A is not correct because this is only the number of electrons in the 3p orbitals of the chlorine atom</i></p> <p><i>B is not correct because this is only the number of electrons in the 3p orbitals of the chloride ion</i></p> <p><i>D is not correct because this is the total number of electrons in the chloride ion, not just those in the p orbitals</i></p>	(1)

Q9.

Question Number	Answer	Mark
	<p>The only correct answer is A</p> <p><i>B is not correct because oxygen atoms do not have this number of protons</i></p> <p><i>C is not correct because oxygen atoms do not have this number of protons</i></p> <p><i>D is not correct because oxygen atoms do not have this number of protons</i></p>	(1)

Q10.

Question Number	Answer	Mark
	<p>The only correct answer is C</p> <p><i>A is not correct because this does not show a large increase for the fourth ionisation so is not in Group 3</i></p> <p><i>B is not correct because it shows a large increase for the third ionisation so is in Group 2</i></p> <p><i>D is not correct because it is a Group 3 element as it has a large increase for the fourth ionisation but it has a first ionisation energy which is lower than C so it is below it in Group 3, so cannot be Boron</i></p>	(1)

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Q11.

Question Number	Answer	Mark
	<p>The only correct answer is B</p> <p><i>A is not correct because 4 of the 3d electrons should be unpaired</i></p> <p><i>C is not correct because there should not be any electrons in the 4s orbital</i></p> <p><i>D is not correct because there should not be any electrons in the 4s orbital</i></p>	(1)

Q12.

Question Number	Answer	Mark
	<p>The only correct answer is C</p> <p><i>A is not correct because it is $3d^3$ not $3d^5$</i></p> <p><i>B is not correct because it is $3d^6$ not $3d^5$</i></p> <p><i>D is not correct because it is $3d^4$ not $3d^5$</i></p>	(1)

Q13.

Question Number	Answer	Mark
	<p>The only correct answer is C (c)</p> <p><i>A is not correct because it is carbon</i></p> <p><i>B is not correct because it is nitrogen</i></p> <p><i>D is not correct because it is aluminium</i></p>	(1)

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Q14.

Question Number	Answer	Mark
(i)	<p>The only correct answer is D ($\text{Br}^+(\text{g}) - \text{e}^- \rightarrow \text{Br}^{2+}(\text{g})$)</p> <p><i>A is not correct because $\text{Br}(\text{g}) + \text{e}^- \rightarrow \text{Br}^-(\text{g})$ is an equation for first electron affinity</i></p> <p><i>B is not correct because $\text{Br}^-(\text{g}) + \text{e}^- \rightarrow \text{Br}^{2-}(\text{g})$ is an equation for second electron affinity</i></p> <p><i>C is not correct because $\text{Br}(\text{g}) - 2\text{e}^- \rightarrow \text{Br}^{2+}(\text{g})$ is an equation that combines first and second ionisations</i></p>	(1)

Question Number	Answer	Mark
(ii)	<p>The only correct answer is B (801, 2 427, 3 660, 25 026, 32 828)</p> <p><i>A is not correct because 738, 1 451, 7 733, 10 541, 13 629 is typical of Group 2 elements</i></p> <p><i>C is not correct because 1 086, 2 353, 4 621, 6 223, 37 832 is typical of Group 4 elements</i></p> <p><i>D is not correct because 1 402, 2 856, 4 578, 7 475, 9 445 could be for Group 5, 6, 7, 8 or transition elements</i></p>	(1)

Q15.

Question Number	Answer	Mark
	<p>The only correct answer is D (Na^+ and Mg^{2+})</p> <p><i>A is not correct because the chloride ion has an extra shell of electrons compared to the nitride ion</i></p> <p><i>B is not correct because the sulfide ion has an extra shell of electrons compared to the oxide ion</i></p> <p><i>C is not correct because the potassium ion has an extra shell of electrons compared to the sodium ion</i></p>	(1)