

Question Number	Answer	Mark
1	The only correct answer is B (neutron number 44, electron number 36) <i>A is incorrect because the number of electrons is for a ^{79}Br atom</i> <i>C is incorrect because the number of neutrons is for a ^{81}Br atom</i> <i>D is incorrect because the number of neutrons is for a $^{81}\text{Br}^-$ ion</i>	(1)

Question Number	Answer	Mark
6(a)	The only correct answer is D ($[\text{Ar}] 4s^2$) <i>A is not correct because this is the electronic configuration for sodium</i> <i>B is not correct because this is the electronic configuration for potassium</i> <i>C is not correct because this is the electronic configuration for magnesium</i>	(1) Computer

Question Number	Answer	Mark
6(b)	The only correct answer is B ($[\text{Ar}]3d^3$) <i>A is not correct because the 3 electrons have been removed from the 3d orbitals</i> <i>C is not correct because this is the electronic configuration for Cr^{2+}</i> <i>D is not correct because this is the electronic configuration for Cr^+</i>	(1) Computer

Question Number	Answer	Mark
10	The only correct answer is C ($[\text{Ar}] \uparrow \uparrow \uparrow \uparrow \uparrow \uparrow$) <i>A is not correct because the electrons in 4s and 3d have been paired before all the orbitals had been occupied</i> <i>B is not correct because the electrons in the 4s orbital has been paired before all the 3d orbitals had been occupied</i> <i>D is not correct because 4s orbital is doubly filled and these electrons have parallel spins</i>	(1)

Question Number	Answer	Mark
9(a)	The only correct answer is B (1.6734×10^{-24}) <i>A is incorrect because there is one proton and one electron in ^1H. This is the mass of a proton.</i> <i>C is incorrect because this is the mass of one proton and one neutron, not one proton and one electron.</i> <i>D is incorrect because this is the mass of one proton, one neutron and one electron and the atom has no neutron.</i>	(1)

Question Number	Answer	Mark
9(b)	The only correct answer is B (electrons and protons) <i>A is incorrect because all charged particles are deflected so this should be protons too</i> <i>C is incorrect because neutrons are not deflected but electrons are.</i> <i>D is incorrect because neutrons are not deflected</i>	(1)

Question Number	Answer	Mark
2	The only correct answer is C 1s 2s 2p ↑↓ ↑↓ ↑ ↑ ↑ <i>A is incorrect because the 2s orbital should contain 2 electrons</i> <i>B is incorrect the 2s orbital should contain 2 electrons and each 2p orbital should have one electron before any are doubled up</i> <i>D is incorrect because each 2p orbital should have one electron before any are doubled up</i>	(1)

Question Number	Answer	Mark												
4	The only correct answer is D <table><tr><td>1s</td><td>2s</td><td>2p_x</td><td>2p_y</td><td>2p_z</td><td>3s</td></tr><tr><td>↑↓</td><td>↑↓</td><td>↑↓</td><td>↑</td><td>↑</td><td></td></tr></table> A is incorrect because both occupied 2p orbitals are paired and there is one unoccupied 2p orbital B is incorrect because the occupied 2p orbital has two electrons with the same spin C is incorrect because one electron has been promoted into the 3s orbital so the atom is not in its ground state	1s	2s	2p _x	2p _y	2p _z	3s	↑↓	↑↓	↑↓	↑	↑		(1) Computer
1s	2s	2p _x	2p _y	2p _z	3s									
↑↓	↑↓	↑↓	↑	↑										

Question Number	Answer	Mark
3	The only correct answer is A (a molecule of ethene, $^{12}\text{C}_2\ ^1\text{H}_4$) <i>B is incorrect because it contains 16 neutrons</i> <i>C is incorrect because it contains 16 neutrons</i> <i>D is incorrect because it contains 16 neutrons</i>	(1)

Question Number	Answer	Additional Guidance	Mark
22(a)	An answer that makes reference to the following point: to show that the electrons have opposite spin	Allow different spin Allow spin in different / opposite direction Award spin $+\frac{1}{2}$ and $-\frac{1}{2}$ Do not award spin/rotate around the nucleus in opposite direction Do not award references to attraction / positive charges	(1)

Question Number	Answer	Additional Guidance	Mark
22(b)	An explanation that makes reference to the following points: - some of the electrons are in an s sub-shell / orbital and some electrons are in the p sub-shell / orbital (1) (they don't have the same energy because) electrons in p sub-shell / orbital have higher energy (1)	Do not award s / p shell Accept reverse argument Allow mention of singular p orbital Do not award s / p shell Penalise use of s / p shell once only	(2)

Question Number	Answer	Additional Guidance	Mark
22(c)	An explanation that makes reference to the following points: sphere / spherical (1)	Allow ball Do not award just circle / round Ignore diagrams	(1)

(Total for Question 22 = 4 marks)