Edexcel Chemistry A-level - Atomic Structure & Periodicity MCQ

Questions

Q1.

This question is about atomic structure and the Periodic Table.

Atomic emission spectroscopy provides evidence for the existence of

(1)

- ☒ **A** atoms
- ☒ **B** electrons
- ☒ **C** isotopes
- ☒ **D** quantum shells

(Total for question = 1 mark)

Q2.

Which is the electronic configuration for the S^{2-} ion?

(1)

- ☒ **A** $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^2$
- ☒ **B** $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^4$
- ☒ **C** $1s^2\ 2s^2\ 2p^6\ 3p^6$
- ☒ **D** $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6$

(Total for question = 1 mark)

Q3.

Which is the most likely sequence of values, in kJ mol^{-1} , for the first four ionisation energies of barium?

(1)

- ☒ **A** 1000 2251 3361 4564
- ☒ **B** 496 4563 6913 9544
- ☒ **C** 503 965 3458 4530
- ☒ **D** 578 1817 2745 11578

(Total for question = 1 mark)

Q4.

This question is about s-block elements and some of their compounds.

Which list contains only s-block elements?

(1)

- ☒ **A** Li, Na, Mg and Cl
- ☒ **B** K, Ca, Co and Rb
- ☒ **C** Mg, Al, Sr and Ba
- ☒ **D** Be, Rb, Ba and Ra

(Total for question = 1 mark)

Q5.

This question is about isotopes, mass spectra and hydrocarbons.

Hydrogen has three isotopes, ^{1}H, ^{2}H and ^{3}H.

Which is the correct number of subatomic particles in ^{3}H?

(1)

	Number of subatomic particles		
	Protons	Neutrons	Electrons
☒ **A**	2	1	2
☒ **B**	1	2	0
☒ **C**	1	2	1
☒ **D**	2	1	3

(Total for question = 1 mark)

Q6.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

What is the electronic configuration of the sulfide ion, S^{2-} ?

- ☐ **A** $1s^2 2s^2 2p^6 3s^2 3p^2$
- ☐ **B** $1s^2 2s^2 2p^6 3p^4$
- ☐ **C** $1s^2 2s^2 2p^6 3s^2 3p^4$
- ☐ **D** $1s^2 2s^2 2p^6 3s^2 3p^6$

(Total for question = 1 mark)

Q7.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

This question is about the electronic structure of some Group 5 elements.

Which is the electronic configuration of the arsenide ion, As^{3-}?

(1)

- ☐ **A** $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2$
- ☐ **B** $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^3$
- ☐ **C** $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^6$
- ☐ **D** $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^3 4d^3$

(Total for question = 1 mark)

Q8.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

This question is about atoms, molecules and ions.

The total number of electrons in **all** the occupied **p** orbitals in a chloride ion, Cl^-, is

(1)

- ☐ **A** 5
- ☐ **B** 6
- ☐ **C** 12
- ☐ **D** 18

(Total for question = 1 mark)

Q9.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

This question is about atoms, molecules and ions.

The numbers of subatomic particles in an ^{18}O atom are

(1)

- ☐ **A** 8 protons, 10 neutrons and 8 electrons
- ☐ **B** 9 protons, 9 neutrons and 9 electrons
- ☐ **C** 10 protons, 8 neutrons and 10 electrons
- ☐ **D** 18 protons, 18 neutrons and 18 electrons

(Total for question = 1 mark)

Q10.

Electrons in atoms occupy orbitals.

Successive ionisation energies can give information about the electronic structure of an element.

Which of the following sets of data showing the first four ionisation energies, in kJ mol^{-1}, of four elements is most likely to belong to boron?

(1)

☒ **A** 1086, 2353, 4621, 6223.

☒ **B** 900, 1757, 14 849, 21 007.

☒ **C** 801, 2427, 3660, 25 026.

☒ **D** 578, 1817, 2745, 11 578.

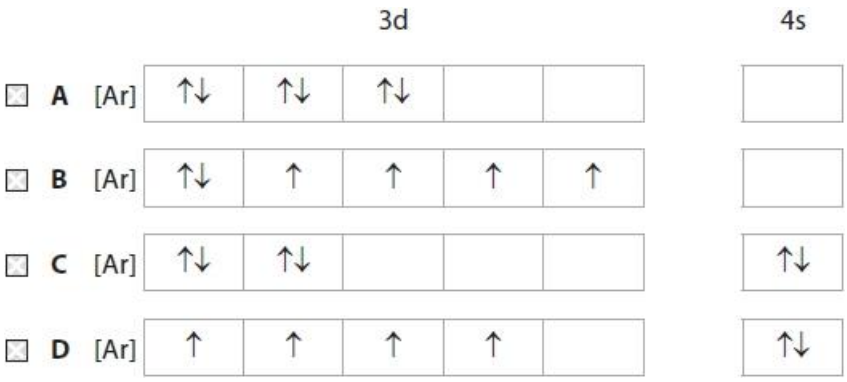
(Total for question = 1 mark)

Q11.

Iron and zinc are in the d-block of the Periodic Table.

Which of these is the electronic configuration of an iron(II) ion, Fe^{2+}?

(1)



(Total for question = 1 mark)

Q12.

This question is about transition metals.

Which of these ions has the electronic configuration $[Ar]3d^5$?

(1)

- ☒ **A** Cr^{3+}
- ☒ **B** Fe^{2+}
- ☒ **C** Mn^{2+}
- ☒ **D** Mn^{3+}

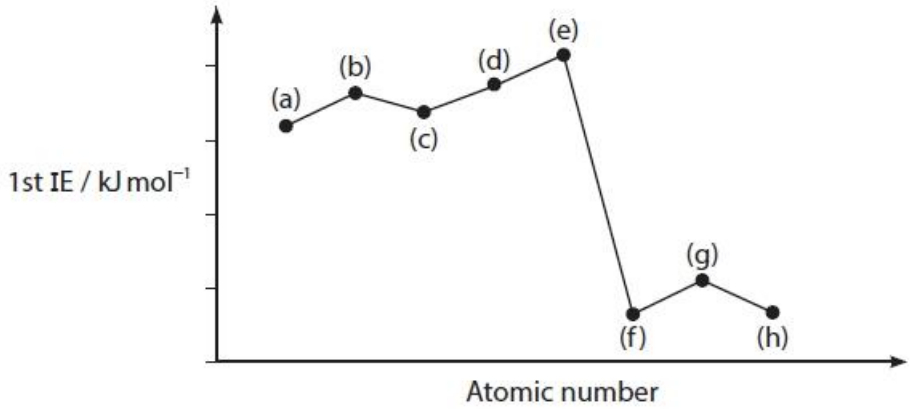
(Total for question = 1 mark)

Q13.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

The graph shows the first ionisation energies (IE) of eight successive elements from the first 20 elements in the Periodic Table.

Which letter represents the first ionisation energy of oxygen?



(1)

- ☒ **A** (a)
- ☒ **B** (b)
- ☒ **C** (c)
- ☒ **D** (h)

(Total for question = 1 mark)

Q14.

Answer the questions with a cross in the boxes you think are correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

This question is about ionisation energies.

(i) Which equation represents the **second** ionisation of bromine?

(1)

☒ **A** $Br(g) + e^- \rightarrow Br^-(g)$

☒ **B** $Br^-(g) + e^- \rightarrow Br^{2-}(g)$

☒ **C** $Br(g) - 2e^- \rightarrow Br^{2+}(g)$

☒ **D** $Br^+(g) - e^- \rightarrow Br^{2+}(g)$

(ii) Which set of successive ionisation energies is most likely to be associated with the element boron?

(1)

☒ **A** 738, 1 451, 7 733, 10 541, 13 629

☒ **B** 801, 2 427, 3 660, 25 026, 32 828

☒ **C** 1 086, 2 353, 4 621, 6 223, 37 832

☒ **D** 1 402, 2 856, 4 578, 7 475, 9 445

(Total for question = 2 marks)

Q15.

Answer the question with a cross in the box you think is correct ☒ . If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒ .

This is a question about atoms, isotopes and ions.

Which of the following pairs of ions is isoelectronic?

(1)

☐ **A** N^{3-} and Cl^{-}

☐ **B** O^{2-} and S^{2-}

☐ **C** Na^{+} and K^{+}

☐ **D** Na^{+} and Mg^{2+}

(Total for question = 1 mark)

Mark Scheme

Q1.

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

Q2.

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

Q3.

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

Q4.

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

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Q5.

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

Q6.

Question Number	Answer	Mark
	The only correct answer is D ($1s^2,2s^2,2p^6,3s^2,3p^6$) *A is not correct because* $1s^2,2s^2,2p^6,3s^2,3p^2$ *is for an* S^{2+} *ion* *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* *C is not correct because* $1s^2,2s^2,2p^6,3s^2,3p^4$ *is for the sulfur atom*	**(1)**

Q7.

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

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Q8.

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

Q9.

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

Q10.

Question Number	Answer	Mark
	The only correct answer is C ***A*** *is not correct because this does not show a large increase for the fourth ionisation so is not in Group 3* ***B*** *is not correct because it shows a large increase for the third ionisation so is in Group 2* ***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 that C so it is below it in Group 3, so cannot be Boron*	**(1)**

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Q11.

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

Q12.

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

Q13.

Question Number	Answer	Mark
	The only correct answer is C (c) **A** *is not correct because it is carbon* **B** *is not correct because it is nitrogen* **D** *is not correct because it is aluminium*	**(1)**

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Q14.

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

Question Number	Answer	Mark
(ii)	**The only correct answer is B** (801, 2 427, 3 660, 25 026, 32 828) **A** *is not correct because* 738, 1 451, 7 733, 10 541, 13 629 *is typical of Group 2 elements* **C** *is not correct because* 1 086, 2 353, 4 621, 6 223, 37 832 *is typical of Group 4 elements* **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*	(1)

Q15.

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