A Level OCR Chemistry

Chapter 5 – answers

Question	Answers	Extra information	Mark	AO Spec reference
1(a)	The energy required to <u>remove 1 mole</u> of electrons from one mole of <u>gaseous atoms</u>		1 1	3.1.1 AO1
1(b)	Aluminium / Al lots of energy needed to remove 4th electron therefore new shell owtte		1 1	3.1.1 AO2
1(c)	They are both to the same number of significant figures		1	3.1.1 MS1.1 AO3
2(a)	$(4 \times 1.660540 \times 10^{-27}) + (5 \times 1.674929 \times 10^{-27}) + (4 \times 9.109390 \times 10^{-31})$ $= 1.502045 \times 10^{-26}$ (kg)	**1** mark for answer **1** mark for 7 s.f.	2	2.1.1 MS1.1 AO2
2(b)	$Be^{+}(g) \rightarrow Be^{2+}(g) + e^{-}$	**1** mark for equation **1** mark for state symbols Lose state symbol mark if (g) on electron	2	3.1.1 AO1
2(c)	Third electron is being removed from inner shell/1st shell/1s Nearer to nucleus/less shielding More energy required to remove electron	If no other marks allow 'being removed from a positive ion' without clarification for **1** mark	1 1 1	3.1.1 AO2
2(d)	Beryllium has a <u>higher</u> nuclear charge than lithium Same shielding Electron are pulled closer/ more strongly	Allow 'more protons' and converse	1 1 1	3.1.1 AO3
3(a)	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1\ 3d^{10}$	4s and 3d in either order	1	3.1.1 AO1
3(b)	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6 3d^{10}$		1	3.1.1 AO2
3(c)	An element that forms a <u>stable ion</u> with a <u>partially filled d orbital</u>		2	5.3.1 AO1

A Level OCR Chemistry

Chapter 5 – answers

Question	Answers	Extra information	Mark	AO Spec reference
3(d)	Same number of protons Different number of neutrons	Allow same atomic number	1 1	2.1.1 AO1
3(e)	100 − 71.23 = 28.77 $\frac{(63 \times 71.23) + (65 \times 28.77)}{100} = 63.58$	63.575… scores **2** marks 63.57 scores 1	1 1 1	2.1.1 AO2 MS1.1,1.2,3.2
3(f)(i)	Hexaaquacopper(II) $[Cu(H_2O)_6]^{2+}$	Allow numerical 2	1 1	5.3.1 AO1
3(f)(ii)	$[Cu(H_2O)_6]^{2+} + 2OH^- \rightarrow [Cu(H_2O)_4(OH)_2] + 2\ H_2O$ Blue precipitate		1 1	5.3.1 AO1
4(a)	It has an electron in a 2p orbital/subshell	Answer must reference electron shells. Reject 'it is in the p block' or similar	1	3.1.1 AO1
4(b)	$1s^2\,2s^2 3p^1$		1	3.1.1. AO1
4(c)	2s orbital is closer to nucleus than 2p Stronger attraction/harder to remove		1 1	3.1.1 AO3
4(d)	$BeCl_2$ 2 bonding pairs 0 lone pairs Linear 180° BCl_3 3 bonding pairs 0 lone pairs Trigonal planar 120°	ignore diagrams	1 1 1 1 1 1	2.2.2 AO3
5(a)(i)	The bonding between positive metals ions ('sea' of) delocalised electrons		1 1	3.1.1 AO1

A Level OCR Chemistry

Chapter 5 – answers

Question	Answers	Extra information	Mark	AO Spec reference
5(a)(ii)	Rows of ions can slide over each other		1	3.1.1 AO1
5(b)	Fe_2O_3		1	2.1.2 AO1
5(c)	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^5$		1	3.1.1 AO1
5(d)	Iron has (a sea of) delocalised electrons which can move to carry the charge / charges can move Iron oxide has ions which cannot move so charge can't be carried / charges can't move	OWTTE	1 1 1 1	2.2.2 AO1
6(a)	Repeated patterns or trends		1	3.1.1 AO1
6(b)	The general trend is an increase due to increasing nuclear charge But same shielding Dip from Mg to Al caused by outer electron going into 3p orbital Which is at a higher energy so easier to remove Dip from N to O due to pairing of electrons in 3p Repulsion makes it easier to remove.		1 1 1 1 1 1	3.1.1 AO1
6(c)	Sulfur Large jump in ionisation energy after 6th electron / 7^{th} electron on new shell		1 1	3.1.1 AO1
7(a)	Magnesium forms 2+ ions and twice the number of delocalised electrons Stronger attraction so more energy needed		1 1	3.1.1 AO1
7(b)	Silicon is a giant covalent structure with strong covalent bonds that need to be broken Aluminium has metallic bonds, which are weaker	Accept covalent macromolecule	1 1 1	3.1.1 AO1

A Level OCR Chemistry

Chapter 5 – answers

Question	Answers	Extra information	Mark	AO Spec reference
7(c)	Sulfur is rings/molecules of S_8 Phosphorus is P_4 (tetrahedral) More electrons result in stronger van der Waals forces	 Accept VdW/ intermolecular forces	1 1 1	3.1.1 AO1
8(a)	Both are giant covalent/macromolecular Diamond: Each C atom bonded to 4 others. Hard due to 3D structure Strong covalent bonds Graphite: Each C atom bonded to 3 others Layers have weak forces/Van der waals So slide past each other Both have high melting points as strong covalent bonds need to be broken	 Allow diagram (min 5 C atoms) Allow diagram (min 5 C atoms)	1 1 1 1 1 1 1 1	3.1.1 AO1
8(b)(i)	Free/delocalised electrons Which can flow between layers		1 1	3.1.1 AO3
8(b)(ii)	Giant covalent/ macromolecule		1	3.1.1 AO1
8(b)(iii)	Strong covalent bonds Hard to break		1 1	3.1.1 AO3

Skills box answers:

a) $ab^2 = 1.538 \times 10^4 \times 15.98704 = 245880.675\ldots = 245900$ (to 4 s.f.)
b) $a + b + c = 1.538 \times 10^4 + 15.98704 + 19 = 15414.9870\ldots = 15000$ (2 to s.f.))
c) $d \times (b + c) = 3 \times 10^{-6} \times (15.98704 + 19) = 0.000104961\ldots = 0.0001 = 1$ (to 1 s.f.)). Standard form is required.
d) $\log_{10} b = \log_{10} 15.98704 = 1.203768061578\ldots = 1.203768$ (to 7 s.f.))
e) $10^d = 10^{3 \times 10^{-6}} = 1.0000069077\ldots = 1$ (to 1 s.f.))