A Level AQA Chemistry

Chapter 1 – answers

Question	Answers	Extra information	Mark	AO Spec reference
01.1	Sphere/ball of positive charge Electrons embedded in (like plums)		1 1	3.1.1.1 AO1
01.2	Fired alpha particles / He nucleus / $^{4}He^{2+}$ At gold leaf/foil Most passed through AND some bounced back/some deflected Gave evidence for small, dense, positive nucleus	 Allow mass instead of dense	1 1 1 1	3.1.1.1 AO1
02.1	The energy required to <u>remove 1 mole</u> of electrons from one mole of <u>gaseous atoms</u>		1 1	3.1.1.3 AO1
02.2	Aluminium 4th ionisation energy shows a large jump	Accept Al	1 1	3.1.1.3 AO2
02.3	They are both to the same number of significant figures		1	3.1.1.3 MS1.1 AO3
03.1	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1\ 3d^{10}$	4s and 3d in either order Reject noble gas config (it asks for 'full')	1	3.1.1.3 AO1
03.2	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6 3d^{10}$		1	3.1.1.3 AO2
03.3	An element that forms a <u>stable ion</u> with a <u>partially filled d orbital</u>		2	3.2.5.1 AO1
03.4	Same number of protons Different number of neutrons	Allow same atomic number allow different (atomic) mass (number	1 1	3.1.1.2 AO1
03.5	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	3.1.1.2 AO2 MS1.1,1.2,3.2

A Level AQA Chemistry

Chapter 1 – answers

Question	Answers	Extra information	Mark	AO Spec reference
03.6	This question is marked using Levels of Response. Examiners should apply a 'best-fit' approach to the marking. **Level 3 (5–6 marks)** All stages are covered and the explanation of each stage is generally correct and virtually complete. Answer is communicated coherently and shows a logical progression from stage 1 to stage 2, stage 3 and then stage 4. Coherent communication requires that there is a comparison between the types of bonding and that the bonding is correct for each substance. **Level 2 (3–4 marks)** All stages are covered but the explanation of each stage may be incomplete or may contain inaccuracies OR two stages are covered and the explanations are generally correct and virtually complete. Answer is mainly coherent and shows some progression from stage 1 to stage 2, stage 3 and then stage 4. **Level 1 (1–2 marks)** Two stages are covered but the explanation of each stage may be incomplete or may contain inaccuracies OR only one stage is covered but the explanation is generally correct and virtually complete. Answer shows some progression between two stages.	**Stage 1: electrospray** 1a dissolved in polar solvent 1b high pressure through positively charged needle 1c gains a proton OR **Stage 1: Ionisation** 1a gaseous sample 1b Electron fired at atom 1c collides/hits and removes an outer electron correct equation demonstrating ionisation can score all 3 step 1 mark if in context. **Stage 2: Acceleration** 2a negatively charged plate 2b attracts ions 2c leave having constant kinetic energy **Stage 3: Ion drift** 3a in a vacuum 3b smallest ions travel fastest **Stage 4: Detection** 4a ion gains electron when hits detector 4b causes current to flow 4c current is proportional to amount/abundance	6	3.1.1.2 AO1

A Level AQA Chemistry

Chapter 1 – answers

Question	Answers	Extra information	Mark	AO Spec reference
03.7	Hexaaquacopper(II) $[Cu(H_2O)_6]^{2+}$	Allow numerical 2	1 1	3.2.5.2 AO1
03.8	$[Cu(H_2O)_6]^{2+} + 2OH^- \rightarrow [Cu(H_2O)_4(OH^-)_2]^{2+} + 2H_2O$ Blue precipitate		1 1	3.2.6 AO1
04.1	$(4 \times 1.660540 \times 10^{-27}) + (5 \times 1.674929 \times 10^{-27}) + (4 \times 9.109390 \times 10^{-31})$ $= 1.502045 \times 10^{-26}$	1 mark for answer 1 mark for 7 s.f.	2	3.1.1.1 MS1.1 AO2
04.2	$Be^+(g) \rightarrow Be^{2+}(g) + e^-$	1 mark for equation 1 mark for state symbols Ignore (g) on electron	2	3.1.1.3 AO1
04.3	Third electron is being removed from inner shell/1st shell/1s Nearer to nucleus/less shielding More energy required to remove electron	Allow 'being removed from a positive ion' without clarification for 1 mark	1 1 1	3.1.1.3 AO2
04.4	Beryllium has a higher nuclear charge than lithium Same/similar shielding Electron are pulled closer/ more strongly	Allow 'more protons' and converse	1 1 1	3.1.1.3 AO3
05.1	3 peaks At *m/z* of 158,160,162 Peak 160 twice as tall as 158 and 162, which are same heights		1 1 1	3.1.1.2 AO2
05.2	Two bromine atoms in each molecule 79 + 81 twice as likely as 79 + 79 or 81 + 81	Allow diagram that demonstrates relative probability of each mass	1 1	3.1.1.2 AO2
05.3	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}\ 4p^6$		1	3.1.1.3 AO3
05.4	Br^{2-} would be $5s^1$ so adding an extra electron to a new shell	Do not allow adding an electron to a negative ion	1	3.1.1.3 AO3

A Level AQA Chemistry

Chapter 1 – answers

Question	Answers	Extra information	Mark	AO Spec reference
05.5	1st mark curly arrow from double bond to Br delta+ 2nd mark $Br^{-}Br$ bond to delta-Br atom. 3rd mark structure of haloalkane with C^{+} and Br^{-} 4th mark curly arrow from lone pair on Br^{-} to C^{+} Electrophilic addition		1 1 1 1	3.3.4.2 AO1
06.1	Average mass of 1 atom realative to 1/12th of carbon-12		1 1	3.1.1.2 AO1
06.2	$\frac{(40 \times 96.46) + (42 \times 0.70) + (43 \times 0.30) + (44 \times 2.20) + (48 \times 0.34)}{100} = 40.14$	Allow 1 mark for correct working	2	3.1.1.2 MS1.2 AO2
06.3	Second ionisation energy is removing an electron from a positive ion More energy required to overcome stronger attraction	Allow no mutual repulsion between 4s e^{-}	1 1	3.1.1.3 AO3
06.4	Ca has more electron shells / more electrons so more shielding So easier to remove electron from outer shell		1 1 1	3.1.1.3 AO3
06.5	$Ca\,(s) + 2H_2O \rightarrow Ca^{2+}(aq) + 2OH^{-}(aq) + H_2(g)$	1 mark for equation 1 mark state symbols	2	3.2.2 AO3
07.1	Different number of neutrons / mass (number)		1	3.1.1 AO1
07.2	Same chemical properties Same electron configuration		1 1	3.1.1.2 AO1
07.3	All ions have constant kinetic energy Heavier ions move slower		1 1	3.1.1.2 AO1

A Level AQA Chemistry

Chapter 1 – answers

Question	Answers	Extra information	Mark	AO Spec reference
07.4	$\frac{(24 \times 80) + (25 \times a) + (26 \times (20 - a))}{100} = 24.3$ $\frac{1920 + 25a + 520 - 26a}{100} = 24.3$ $\frac{2440 - a}{100} = 2430$ $2440 - a = 2430$ $-a = -10$ $a = 10\%$ $20 - 10 = 10\%$	Allow any method that shows 80% 10% 10%	1 1 1	3.1.1.2 MS2.1 AO2
07.5	$\frac{24 \times 10^{-2}}{6.022 \times 10^{23}} = 3.985 \times 10^{-26}$ (kg) $v^2 = \frac{2ke}{M} = \frac{(2 \times 4.58 \times 10^{-16})}{3.985 \times 10^{-26}} = 2.29839 \times 10^{10}$ (m^2/s^2) $v = \sqrt{2.29839 \times 10^{10}}$ ($v = 1.51604 \times 10^5$ m s^{-1}) $v = d/t$ or $d = vt$ or with numbers $d = (1.51604 \times 10^5 \times 1.34 \times 10^{-5}) = 2.03$ (m) Alternative method $\frac{24 \times 10^{-3}}{6.022 \times 10^{23}} = 3.985 \times 10^{-26}$ (kg)	Calculation of mass into kg If not converted to kg, max 4 If not divided by L lose M1 and M5, max 3 For re-arrangement For expression with square root Must be 3 s.f. to score mark 5	1 1 1 1 1	3.1.1.2 MS1.11.2 AO2

A Level AQA Chemistry

Chapter 1 – answers

Question	Answers	Extra information	Mark	AO Spec reference
	$v = d/t$ $d^2 = \frac{ke \times 2t^2}{m}$ $d = \sqrt{\frac{ke \times 2t^2}{m}} = \sqrt{\frac{4.58\times10^{-16} \times 2 \times (1.34\times10^{-5})^2}{3.985\times10^{-26}}}$ $d = 2.03$ (m)	M2, M3 and M4 are for algebraic expressions or correct expressions with numbers Must be to 3 s.f.	1 1 1 1	
08.1	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^4$		1	3.1.1.3 AO1
08.2	Both are molecular covalent So van der Waals are the intermolecular force Sulfur molecules have more electrons so stronger van der Waals More energy needed to break forces resulting in higher melting and boiling points	Must identify covalently bonded	1 1 1 1	3.1.3.7 AO3
08.3	Reversible reaction where the forwards and backwards rates are equal. So the concentrations of reactant remain constant		1 1	3.1.3.6, AO1
08.4	No effect		1	3.1.3.6, AO1
08.5	pp = 12 kPa Mole fraction = pp ÷ total pressure = 12/104 = 0.115	Ignore units	1 1	3.1.10 AO2 MS1.1 MS2.2 MS2.3

A Level AQA Chemistry

Chapter 1 – answers

Question	Answers	Extra information	Mark	AO Spec reference
08.6	68 kPa	Allow e.c.f. from 08.5	1	3.1.10 AO2 MS1.1 MS2.2MS2.3
08.7	$Kp = \frac{(pSO_3)^2}{(pSO_2)^2 \times (pSO_2)}$ $Kp = \frac{68^2}{24^2 \times 12} = 0.669$	Allow e.c.f. from 08.5 + 08.6 1 mark for substitution 1 mark for answer	1 1 1 1	3.1.10 AO2 MS1.1 MS2.2MS2.3
08.8	Shift to the right/ forwards/products/SO_3 Increasing pressure favours side with fewest moles		1 1	3.1.10 AO3

Skills box answers:

1. 39.13
2. 94%
3. 24.32