EL Elements of life
Answers to practice questions

Question number	Answer	Marks	Guidance
1	D	B1	There are 4 moles of H in one mole of CH_4, so answer is 4 x Avogadro constant
2	C	B1	M_r Al_2O_3 = 102. Moles Al_2O_3 = 5.10/102 = 0.0500. Amount Al = 0.100 mol, mass = 2.7 g
3	C	B1	A and D will not work as $BaSO_4$ is insoluble and other compounds are formed in the filtrate. B will not work as the solid is not washed before drying, meaning that other soluble compounds will form as well as $BaSO_4$
4	A	B1	(Note that no element has an ionic structure – two elements are required)
5	B	B1	Only very few particles were deflected at all and some came almost straight back showing they had hit something massive (the nucleus)
6	B	B1	Iron has two oxidation states Fe(II) and Fe(III)
7	C	B1	A – barium is too electropositive for its chloride to be hydrolysed B – barium hydroxide is formed D – barium sulfate is insoluble
8	D	B1	2. they are caused by electrons falling energy levels 3. the lines get closer at higher **frequency**
9	A	B1	All correct
10	D	B1	2. the electron groups repel, not the atoms 3. this is the wrong way round
11 (a)	fusion	B1	
11 (b)	same number of protons different number of neutrons	B1 B1	Because of the way this question is worded, it cannot be answered in terms of mass number and atomic number
11 (c) (i)	dark lines on a bright/coloured background	B1	
11 (c) (ii)	hydrogen nuclei do not have	B1	

	electrons (and electrons cause atomic spectra)		
11 (c) (iii)	at least two horizontal lines with upper gaps smaller than lower ones two downward arrows starting and finishing on an energy level	B1 B1	What is shown is the minimum to gain the marks. The label 'energy' for the y-axis as a good thing to put in, as are a few more energy levels (following the rule of the gaps getting smaller further up). Only draw two downward arrows as this answers the question.
11 (d)	H $^{\bullet}_{x}$ H the attractive forces between the nuclei and the electrons (outweigh the repulsive forces between the nuclei)	B1 B1	Note the words in brackets are not required for one mark, but they would be for a more detailed treatment.
11 (e) (i)	$H(g) \rightarrow H^+(g) + e^-$	B1	This is one of the few occasions where you are expected to include state symbols without being prompted, as the equation does not represent the first ionisation enthalpy without them. Do not write a state symbol for the electron.
11 (e) (ii)	it would be larger because the attraction (between nucleus and electron) is greater because... the electron in lithium is (in a shell that is) further from the nucleus	B1 B1	**ALLOW** 'more screening'
12 (a)	$CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$	B1	
12 (b)	(Ca^{2+}) dip wire in HCl (and solid) – gives (brick) red flame OH^- shows alkaline colour with litmus/indicator (paper)	B1 B1	Note that some reference to the practical procedure is required by the question.
12 (c) (i)	M_r $CaCO_3$ = 100(.1) Amount $CaCO_3$ = 0.35/100 = 0.0035 mol 0.0035 mol of CO_2 formed	B1	Note here that some of the data is to two significant figures, so the best answer is to two significant figures

	0.0035 × 24 = 0.084 dm^3/ 84 cm^3 CO_2	B1	
12 (c) (ii)	Amount $BaCO_3$ = 0.0035 mol Mass = 0.0035 × 197(.3) = 0.69 g	B1	
12 (c) (iii)	**Level 3 (5–6 marks)** Candidate answer the question fully with all main points and three subsidiary points *The ideas are well structured providing significant clarity in the communication of the science* **Level 2 (3–4 marks)** Candidate answers the question but without full detail by including all main points and at least one subsidiary point. *There is partial structuring of the ideas with the communication of the science generally clear* **Level 1 (1–2 marks)** Candidate makes a reasonable attempt at the answer by giving two main points or one main point and one subsidiary point *The ideas expressed are poorly structured and do not contribute to the communication of the science* **Level 0 (0 marks)** No response or no response worthy of credit.	B1 × 6	**Main points:** • diagram of tube connected to a gas syringe or a measuring cylinder over water • heat samples of both carbonates • first to produce significant amount of gas (or any volume over 10 cm^3 or 84 cm^3) is less (thermally) stable (or reverse argument) **OR** in terms of calcium carbonate being less thermally stable. **Subsidiary points** • labels on diagram (heat, syringe/measuring cylinder) • diagram is proper cross-section with passage for gases and no leaks • use of equal amounts (moles) of each (or 0.35 g and answer to 12 (c) (ii)) • some indication of need to make the method of heating similar
12 (c) (iv)	Smaller ions (with the same charge) have higher charge density (and thus) distort the (large) carbonate ion, so that (the compound)	B1 B1	Words in brackets need not be included.

	EITHER decomposes at lower temperature. **OR** has lower thermal stability		
12 (d)	dot/cross diagram two areas of electron density around C atom that repel and get as far away from each other as possible 180	B1 B1 B1	
13 (a) (i)	A – (anhydrous) $CuSO_4$ and $CuCO_3$ B – Nothing (on the filter paper) C – anhydrous $CuSO_4$	B1 B1 B1	**ALLOW** names for formulae
13 (a) (ii)	React excess $CuCO_3$ with H_2SO_4. and filter evaporate filtrate (to half volume) and allow to crystallise	B1 B1	
13 (a) (iii)	Amount sulfuric acid = 0.04 mol Mass $CuCO_3$ = 0.04 × 123.5 = 4.9 g	B1 B1	Data is given to two significant figures, so answer should be given to the same precision.
13 (a) (iv)	dissolve in water, add $BaCl_2$(aq) white ppt of $BaSO_4$ (indicates sulfate)	B1 B1	**ALLOW** names for formulae
13 (d)	dot and cross diagram 120	B1 B1	