Question	Answer	Marks	AO Element	Notes	Guidance
1(a)	**A**	**1**			
1(b)	**B**	**1**			
1(c)	**B**	**1**			
1(d)	**E**	**1**			
1(e)	**C**	**1**			
2	number of electrons in O^{2-} ion = 10 (1) number of neutrons in S = 18 (1) number of protons in S = 16 **AND** in O^{2-} ion = 8 (1)	**3**			
3(a)	**E**	**1**			
3(b)	**C**	**1**			
3(c)	**C**	**1**			
3(d)	**D**	**1**			
3(e)	**A**	**1**			
4(a)	8 (mg)	**1**			

Question	Answer	Marks	AO Element	Notes	Guidance
4(b)	hydrogencarbonate / HCO_3^-	**1**			
4(c)	nitrate	**1**			
4(d)	12.5 (mg)	**1**			
5	number of electrons in Ca^{2+} = 18 (1) number of neutrons in Mg = 14 (1) number of protons in Mg = 12 **AND** number of protons in Ca^{2+} = 20 (1)	**3**			
6	B - 1 and 3	**1**			
7	D - tin (Sn)	**1**			
8	D - Positive ions have more protons than electrons.	**1**			
9	A - X and Y are atoms of different elements.	**1**			
10	A	**1**			

Question	Answer	Marks	AO Element	Notes	Guidance
11(a)	bonding electron pairs on both overlap areas between hydrogen and oxygen atoms	**1**		**do not allow**: additional electrons on the hydrogen atom	
	4 non-bonding electrons on outer shell of oxygen	**1**		**note**: these electrons do not have to be paired up	
12	atoms	**1**			
	protons	**1**			
	neutrons	**1**			
13	bonding pair of electrons between H and Cl	**1**		**do not allow**: if extra electrons on the H atom	
	Six non-bonding electrons around the Cl	**1**		**ignore**: inner shell electrons in Cl	
14	7 electrons in the outer shell	**1**			
	2 electrons in inner shell	**1**		**note**: this mark cannot be obtained if other inner shells are drawn	

Question	Answer	Marks	AO Element	Notes	Guidance
15(a)	mixture of metals / mixture of metal(s) + non-metals	**1**		**do not allow**: compound	
15(b)	covers surface / idea of protective layer	**1**			
	prevents contact with air / prevents contact with water / so air (or water) does not react with steel	**1**		**do not allow**: reference to tin being more reactive / sacrificial protection (for second marking point)	
16	bonding pair of electrons between H and Cl and no additional electrons on the H atom	**1**			
	six non-bonding electrons around the chlorine atom	**1**		**ignore**: inner shell electrons in Cl.	
17	protons 92 and 92	**1**			
	neutrons 143 and 146	**1**			

Question	Answer	Marks	AO Element	Notes	Guidance
	electrons 92 and 92	**1**			
18(a)	Any **four** from: • both giant structures • both have layered structures • graphite covalent • sodium chloride ionic • graphite macromolecule / giant covalent structure • graphite has layers which are separated / further apart (than C-C bonds) • sodium chloride has ions touching • graphite has only one type of particle / graphite is an element / only has C atoms • sodium chloride has two types of particles / sodium chloride is a compound • graphite has hexagonal arrangement (of atoms) • sodium chloride has cubic arrangement • graphite has atoms all of one size • sodium chloride has different sized particles / ions	**4**		**ignore**: properties / weak or strong bonding **allow**: square arrangement	

Question	Answer	Marks	AO Element	Notes	Guidance
19(a)	every silicon atom is bonded/attached to 4 oxygen atoms or every oxygen bonded/attached to two silicon atoms	**1**			
19(b)	Any **two** from: high melting point/boiling point hard colourless crystals/shiny poor/non-conductor of electricity/insulator insoluble in water	**2**			
20	different number of neutrons / different mass number / different nucleon number	**1**	AO2		
21	chemically;	**1**			
	different;	**1**			
	fixed;	**1**			

Question	Answer	Marks	AO Element	Notes	Guidance
22(a)(i)	Any **three** suitable differences e.g.: • no noble gases / no Group 0 / no Group 8 / only 7 groups ; • hydrogen / H in same group as halogens / H in same group as F, C*l* ; ORA (e.g. H on own / Period 1) ; • some elements missing / named element present ; • no transition elements (in middle of table / block) ; ORA transition element (block) present • halogens / F and C*l* in first Group ; • not ordered according to atomic number ; • no proton numbers / atomic numbers ; ORA • groups / periods different / comments on different numbers of elements in groups / periods ; • metals and non-metals not grouped together ; ORA • some transition elements in wrong group / examples e.g. Mn placed with N ;	**3**			

Question	Answer	Marks	AO Element	Notes	Guidance
	• no Actinoids / Lanthanoids ;				
22(a)(ii)	Any answer referring correctly to (some) elements being in the same group e.g. Li, Na, K in same group / vertical section / column ;	**1**			
23(a)	Any **four** suitable differences e.g.: • no noble gases / only 7 (standard) Groups ORA; • hydrogen / H in same column as Li ORA; • some elements missing / named element missing / empty spaces ORA; • groups are horizontal rather than vertical / reference to groups or periods being different ORA; • not ordered according to atomic number / no proton numbers; • Zn put in same group as Be and Mg ORA;	**4**			

Question	Answer	Marks	AO Element	Notes	Guidance
23(b)	any **two** from: fluorine, chlorine, bromine, oxygen , nitrogen , hydrogen	**1**			
24(a)	idea that ethene is the monomer / idea that monomers are the simple (or basic) units which add together; idea that poly(ethene) is the polymer / idea that the polymer is formed by adding ethene units / simple units combine to form polymer / idea that polymer is a very long (hydrocarbon) chain;	**2**		**note**: (ethene) monomers join to make a polymer = 2 marks	
24(b)	mixture of metals / mixture of metal + non metal;	**1**			

Question	Answer	Marks	AO Element	Notes	Guidance
25	<table><tr><td>number of electrons</td><td>number of neutrons</td><td>number of protons</td><td>symbol</td></tr><tr><td>**M1** 13</td><td></td><td></td><td></td></tr><tr><td>**M2** 10</td><td>**M3** 13</td><td></td><td></td></tr><tr><td></td><td></td><td></td><td>**M4** 19 9 **M5** F **M6** –</td></tr></table>	**6**			
26(a)	**M1** same number of electrons **M2** (same number of) electrons in outer shell	**2**			
26(b)	$Mg + 2HCl \rightarrow MgCl_2 + H_2$ **M1** $MgCl_2$ as product **M2** fully correct equation	**2**			
26(c)	**M1** test: lighted / burning splint **M2** result: (squeaky) pop	**2**			

Question	Answer	Marks	AO Element	Notes	Guidance
27	$^{9}_{4}Be$ any element symbol with a single negative charge (1) use of Cl (1) use of $^{37}_{17}$ (1)	**4**			
28(a)	**4**KI + **2**$CuSO_4$ → **2**CuI + I_2 + **2**K_2SO_4 (2)	**2**			allow multiples / fractions
28(b)	1+ / +1	**1**			
28(c)	gains electron(s)	**1**			
28(d)	KI / potassium iodide / iodide (ions) / I^-	**1**			
29	nucleons: 27 (1) neutrons: 14 (1) electrons: 10 (1)	**3**			
30	strong attractive forces/strong ionic bonds in lithium nitride	**1**			
	weak (attractive) forces between molecules in NF_3	**1**			
31(a)	soft because weak forces between layers/sheets/rows	**1**			

Question	Answer	Marks	AO Element	Notes	Guidance
	layers can slip/slide	**1**			
	good conductor because electrons can move/mobile	**1**			
31(b)	it is soft: pencils **or** lubricant **or** polish	**1**			
	good conductor: electrodes **or** brushes (in electric motors)	**1**			
32(a)	$6Li + N_2 = 2Li_3N$ species (1) balancing (1)	**2**			
32(b)	N^{3-} ion drawn correctly	**1**			
	charges correct (minimum 1 × Li ion and 1 nitride ion)	**1**			
33	3 × shared pairs between N and 3 × F	**1**			
	only 2 non-bonding electrons on N, 6 non-bonding electrons on each F	**1**		**COND** on first point	

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>AO Element</th><th>Notes</th><th>Guidance</th></tr>
<tr><td>34</td><td>1 electron in outer shell (1)
inner shells correct i.e. 2.8.8 (1)</td><td>2</td><td>AO2</td><td></td><td></td></tr>
<tr><td>35</td><td>2 inner shell electrons for C (1)
4 bonding pairs representing each C-H bond (1)</td><td>2</td><td>AO1</td><td></td><td></td></tr>
<tr><td>36(a)</td><td><table>
<tr><td>group number</td><td>I</td><td>II</td><td>III</td><td>IV</td><td>V</td><td>VI</td><td>VII</td></tr>
<tr><td>symbol</td><td>Na</td><td>Mg</td><td>Al</td><td>Si</td><td>P</td><td>S</td><td>Cl</td></tr>
<tr><td>number of valency electrons</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr>
<tr><td>valency</td><td>1</td><td>2</td><td>3</td><td>4</td><td>3</td><td>2</td><td>1</td></tr>
</table>(1) for each line</td><td>2</td><td></td><td></td><td></td></tr>
<tr><td>36(b)</td><td>number of valency electrons = the group number</td><td>1</td><td></td><td></td><td></td></tr>
</table>

Question	Answer	Marks	AO Element	Notes	Guidance
36(c)	for Na to Al the valency is the same as the number of valency (outer) electrons (1) (because) this is the number of electrons **lost** (for full energy level) (1)	**2**			
	for P to Cl the valency is 8 – [number of valency (outer) electrons] **or** valency + valency electrons = 8 (1) (because) this is number of electrons **needed** (or to be **gained**) (for full energy level) (1)	**2**			
					[Total: 113]