Question	Answer	Marks	AO Element	Notes	Guidance
1	any five from: - 11 electrons - electrons – (negatively) charged - electrons outside nucleus in shells - nucleus contains protons and neutrons - protons – (positively) charged - neutrons no charge - 11 protons - 12 neutrons - electron arrangement 2,8,1 / 1 electron in outer shell	**5**			
2	it is a molecule / covalent compound	**1**			
3(a)	giant structure / lots of carbon atoms joined to each other / lattice of covalent bonds	**1**			
	strong (covalent) bonds throughout	**1**			
3(b)	weak forces between layers	**1**			

Question	Answer	Marks	AO Element	Notes	Guidance
	layers can slide (over each other)	**1**			
4	cancer treatment / tracer / test thyroid function	**1**			
5	138	**1**			
6	substance containing (two or more) different atoms bonded / substance containing (two or more) different atoms combined	**1**			
7(a)	substance containing only one type of atom / substance which cannot be broken down further by chemical means	**1**			
7(b)	O_2	**1**			
	4 (HF)	**1**			
8	have same proton number / same element / same atomic number	**1**			

Question	Answer	Marks	AO Element	Notes	Guidance
	different number of neutrons / nucleons / mass number	**1**			
9	number of nucleons = 45;	**1**			
	number of charged particles = 42;	**1**			
10	magnesium / Mg	**1**			
11	• number of protons = 29; • number of neutrons = 35; • number of electrons = 27; three correct = [2]; two correct = [1]	**2**			

Question	Answer	Marks	AO Element	Notes	Guidance
12	any two from: • treating cancer or radiotherapy; • biological tracer; • thickness (of paper or foil); • (checking for) leaks / cracks (in pipes); • (carbon) dating; • (generating) energy / electricity; • smoke detectors; • fill levels in packages; • sterilising surgical instruments;	**2**			
13	carbon dioxide has a simple molecular structure	**1**			

Question	Answer	Marks	AO Element	Notes	Guidance
14	any three from: • each oxygen is joined to two silicons / atoms; • each silicon is joined to four oxygens / atoms; • tetrahedral (around silicon) / similar to diamond; • linear around oxygen	**3**			
15	any three from: • high melting point / boiling point • hard • strong • (colourless) crystalline (solid) • brittle / not malleable • poor / non-conductor (of electricity) / insulator • insoluble (in water)	**3**			

Question	Answer	Marks	AO Element	Notes	Guidance
16	- atoms with same number of protons but different number of neutrons / - atoms with same atomic number but different number of neutrons / - atoms with same number of protons but different mass number	**1**			
17(a)	ions / cations **and** anions	**1**			
17(b)	solid (particles / ions) close together	**1**			
	(particles / ions) regularly arranged / in rows / lattice	**1**			
18	He: number of neutrons = 1	**1**			
	Ar: number of electrons = 18	**1**			

Question	Answer	Marks	AO Element	Notes	Guidance
	symbol for neon is: $^{21}_{10}Ne$	**1**			
19	2,8	**1**			
20(a)	pair of electrons between two (hydrogen) atoms	**1**			
20(b)	covalent	**1**			
21	atoms (in first space)	**1**			
	combined (in second space)	**1**			
22	- gas - molecular - solid - ions	**4**			1 mark each
23	49	**1**			

Question	Answer	Marks	AO Element	Notes	Guidance
24	atoms with same number of protons but different number of neutrons **OR** atoms with same atomic number but different number of neutrons **OR** atoms with same number of protons but different mass number	**1**			
25	evaporates easily / vaporises readily	**1**			
26	$^{12}_{6}C$	**1**			
27	A	**1**			
	good electrical conductor	**1**			
28	C	**1**			
29	A and B	**1**			

Question	Answer	Marks	AO Element	Notes	Guidance
	(very) high melting points	**1**			
30(a)	*Any **one** from*: (making) car (bodies) machinery chains pylons white goods nails screws as a building material sheds / roofs reinforcing concrete	**1**			
30(b)	*Any **one** from*: knives drills railway tracks machine / cutting tools / hammers razor blades chisels	**1**			
30(c)	M1 atoms or cations or (positive) ions or metal ions M2 arranged in a lattice or in layers or in rows or in a regular structure M3 rows or layers slide over one another	**3**			

Question	Answer	Marks	AO Element	Notes	Guidance
30(d)	M1 carbon **atoms** or **particles** in structure different size (to cations) M2 so reduce moving or interrupt movement	**2**			
31	protons: 20 (1) electrons: 20 (1) neutrons: 24 (1)	**3**			
32	protons: 16 (1) electrons: 16 (1) neutrons: 17 (1)	**3**			
33	6 electrons in outer shell (1) 2, 8 electrons in inner shells (1)	**2**			
34	any suitable use e.g. measuring thickness of paper / testing for leaks in pipes / energy production	**1**			
35(a)	protons: 11 (1) electrons: 11 (1) neutrons: 12 (1)	**3**			
35(b)	treating cancer / thyroid function / tracer for diagnosis	**1**			

Question	Answer	Marks	AO Element	Notes	Guidance
36	**M1** 6 protons in all three rows **M2** 6,7 and 8 neutrons	**2**			
37	D	**1**			
38	oxygen	**1**			
39	any suitable e.g. treating cancer / checking thyroid function / tracer (in the body)	**1**			
40	any suitable use e.g. measuring the thickness of paper / energy from nuclear reactors / finding leaks (in pipelines) / smoke alarms / energy production	**1**			
					[Total: 83]