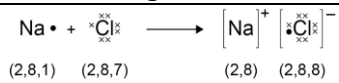
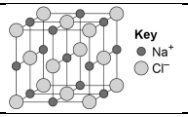
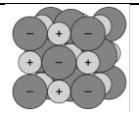
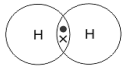
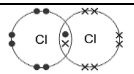
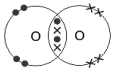
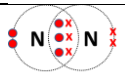
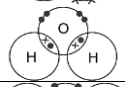
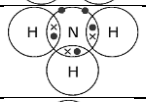
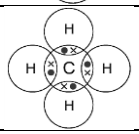
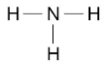
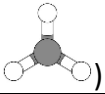
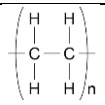
Core questions – Chemistry unit 2 – Bonding and Structure

No.	Question	Answer
1	Where does ionic bonding occur?	In compounds formed from metals combined with non-metals
2	Where does covalent bonding occur?	Non-metallic elements and in compounds of non-metals
3	Where does metallic bonding occur?	In metallic elements and alloys
4	What charge does an ion have when an atom has lost electrons?	Positive
5	What charge does an ion have when an atom has gained electrons?	Negative
6	Describe ionic bonding	The attraction between oppositely charged ions
7	How are ionic compounds held together?	With strong electrostatic forces of attraction between the oppositely charged ions
8	What does a dot cross diagram look like for sodium and chlorine reacting to form sodium chloride (only including the outer shell)?	
9	What does a ball and stick model of sodium chloride look like?	
10	What are the disadvantages of using a ball and stick model to represent ionic compounds?	The model doesn't show the relative sizes of of the ions and it shows gaps between the ions, whereas in reality, there are no gaps between the ions
11	How can you calculate the empirical formula from a 3D diagram of an ionic lattice?	STEP 1: Look at the diagram to work out what ions are in the compound (e.g potassium ions and oxide ions) STEP 2: Work out what charges the ions will form STEP 3: Balance the charges so the charge of the empirical formula is zero  Potassium is in group 1 so forms 1+ ions Oxygen is in group 6 so forms 2- ions A potassium ion only has a 1+ charge, so you'll need two of them to balance out the 2- charge of an oxide ion. The empirical formula is K_2O
12	What charge do ions formed from group 1 elements have?	1+
13	What charge do ions formed from group 2 elements have?	2+
14	What charge do ions formed from group 6 elements have?	2-
15	What charge do ions formed from group 7 elements have?	1-
16	What is a covalent bond?	A shared pair of electrons
17	Name 8 simple covalent molecules?	Hydrogen; chlorine; oxygen; nitrogen; hydrogen chloride; water; ammonia; methane

18	What does a dot cross diagram for hydrogen look like?	
19	What does a dot cross diagram for chlorine look like?	
20	What does a dot cross diagram for oxygen look like?	
21	What does a dot cross diagram for nitrogen look like?	
22	What does a dot cross diagram for hydrogen chloride look like?	
23	What does a dot cross diagram for water look like?	
24	What does a dot cross diagram for ammonia look like?	
25	What does a dot cross diagram for methane look like?	
26	How else can simple covalent structures be represented other than dot and cross diagrams?	Displayed formula (e.g. ) 3D structure (e.g )
27	What is a polymer?	Long chains of repeating units (monomers)
28	How are the atoms in a polymer held together?	With covalent bonds
29	How can polymers be represented?	 poly(ethene)
30	What is metallic bonding?	A lattice of positively charged metal ions surrounded by delocalised electrons
31	How are atoms held together in metallic bonding?	Electrostatic attraction between the delocalised electrons and the positive metal ions
32	Name the process of a solid turning into a liquid	Melting
33	Name the process of a liquid turning into a solid	Freezing
34	Name the process of a liquid turning into a gas	Boiling
35	Name the process of a gas turning into a liquid	Condensing
36	Name the process of a solid turning into a gas	Subliming
37	How is the strength of the forces between particles and the melting and boiling point of a substance related?	The stronger the forces the higher the melting/boiling point

38	What are the limitations of the particle model?	In the model there are no forces, particles are represented as spheres, the spheres are solid
39	What does the state symbol (s) represent?	Solid
40	What does the state symbol (l) represent?	Liquid
41	What does the state symbol (g) represent?	Gas
42	What does the state symbol (aq) represent?	Aqueous
43	What does aqueous mean?	Dissolved in water
44	What are the properties of ionic compounds?	High melting and boiling points; can conduct electricity when molten (or dissolved), but not as a solid
45	Why do ionic compounds have high melting/boiling points?	Large amount of energy is needed to break the strong attractions between oppositely charged ions
46	Why don't solid ionic compounds conduct electricity?	The ions are not free to move
47	Why do aqueous and liquid ionic compounds conduct electricity?	The ions are free to move
48	What are the properties of simple molecules?	Low melting and boiling points; do not conduct electricity
49	Why are simple molecules usually gases or liquids at room temperature?	They have low melting and boiling points
50	Why do simple molecules have low melting /boiling points?	The forces **between** the molecules are weak (intermolecular forces) and so require little energy to break
51	What is broken when simple molecules are melted/boiled?	The forces **between** the molecules (the intermolecular forces)
52	Why do larger molecules have higher melting points?	Larger molecules have stronger intermolecular forces
53	Why don't simple molecules conduct electricity?	The molecules do not have an overall electric charge AND do not have free flowing electrons
54	Why are polymers solid at room temperature?	Polymers are very large molecules and so have strong intermolecular forces
55	What is a giant covalent structure?	One where all the atoms in the structure are covalently bonded to other atoms
56	Name three giant covalent structures.	Diamond, graphite, silicon dioxide
57	Why do giant covalent structures have high melting points?	Lots of energy is needed to break the covalent bonds between the atoms
58	What are the properties of pure metals?	High melting and boiling points; easily bent and shaped
59	Why do metals have high melting/boiling points?	The strong electrostatic attraction between the positive metal ions and the delocalised electrons needs lots of energy to be broken
60	Why can pure metals be easily bent and shaped?	The atoms are arranged in layers, which allows the atoms to slide over each other easily
61	What is an alloy?	A substance made of two or more elements, at least one of which is a metal
62	Why are alloys harder than pure metals?	The layers of metal ions are distorted by the differing size of the other atoms, which prevents the layers from sliding over each other as easily
63	Why are metals good conductors of electricity?	Because the delocalised electrons can carry electrical charge throughout the structure
64	Why are metals good conductors of heat?	Because thermal energy can be transferred by the delocalised electrons

65	Describe the structure of diamond.	Each carbon atom is covalently bonded to four others
66	What are the properties of diamond?	High melting point, hard, doesn't conduct electricity
67	Why does diamond have a high melting point?	The strong covalent bonds between each atom takes a lot of energy to break
68	Why is diamond hard?	Because each carbon atom forms four covalent bonds with other carbon atoms
69	Why doesn't diamond conduct electricity?	Because it does not have free electrons that are able to move
70	Describe the structure of graphite.	Each carbon atom is covalently bonded to three others to form layers of hexagonal rings
71	How are the layers in graphite held together?	Intermolecular forces
72	What are the properties of graphite?	High melting point; soft; can conduct thermal and electrical energy
73	Why does graphite have a high melting point?	The strong covalent bonds between each atom takes a lot of energy to break
74	Why can graphite conduct electricity?	One electron from each carbon atom is delocalised and can carry charge through the structure
75	Why is graphite soft and slippery?	Because the layers are held by weak intermolecular forces, so are able to slide over each other easily
76	What is graphene?	A single layer of graphite
77	What are the properties of graphene?	Very light; very strong; can conduct electricity
78	What real life applications can graphene be used for?	Composite materials and in electronic equipment
79	Why can graphene be used in composite materials?	It makes materials very strong without adding too much weight
80	Why can graphene be used in electronics?	It has delocalised electrons meaning it can conduct electricity
81	What is a fullerene?	A molecule of carbon atoms with a hollow shape
82	Describe the structure of a fullerene?	Mainly made of carbon atoms arranged in hexagons. They can also contain pentagon (5) or heptagon (7) rings
83	What was the first fullerene to be discovered?	Buckminsterfullerene (C_{60}) and forms a hollow sphere
84	Give two uses of fullerenes?	They can be used to 'cage' other molecules, meaning they could be used to deliver drugs to inside the body They have can be used as catalysts because they have huge surface areas
85	What is a carbon nanotube?	Cylindrical fullerenes with very high length to diameter ratios
86	What do the properties of carbon nanotubes makes them useful for?	Nanotechnology, electronics, materials
87T	What type of structures does Nano science refer to? **(Triple only)**	Structures that are 1-100 nm in size, of the order of a **few hundred atoms**
88T	What is the diameter of a fine particle ($PM_{2.5}$)? **(Triple only)**	Between 100 and 2500 nm (1×10^{-7} m and 2.5×10^{-6} m)
89T	What is the diameter of a coarse particle (PM_{10})? **(Triple only)**	Between 2500 and 10 000 nm (1×10^{-5} m and 2.5×10^{-6} m)
90T	What are coarse particles more commonly referred to as? **(Triple only)**	Dust
91T	If the side of a cube decreases by a factor of 10, what does the surface area to volume ratio increase by? **(Triple only)**	10

92T	Why do nanoparticles have different properties than those for the same material in bulk (e.g. a big lump of gold compared to a gold nanoparticle) **(Triple only)**	They have very high surface area to volume ratios
93T	Why are nanoparticles being used in medicine? **(Triple only)**	To deliver drugs into the right cells in the body
94T	Why are nanoparticles being used in electronics? **(Triple only)**	Some nanoparticles conduct electricity so are used in tiny circuit boards
95T	Why are nanoparticles being used in cosmetics? **(Triple only)**	They can improve moisturisers without making them really oily
96T	Why are nanoparticles being used in deodorants? **(Triple only)**	Silver nanoparticles have antibacterial properties
97T	Why are nanoparticles being used as catalysts? **(Triple only)**	They have huge a huge surface area to volume ratio
98T	What are the possible risks associated with nanoparticles? **(Triple only)**	We don't fully understand how they affect the body; they could damage the environment when washed away