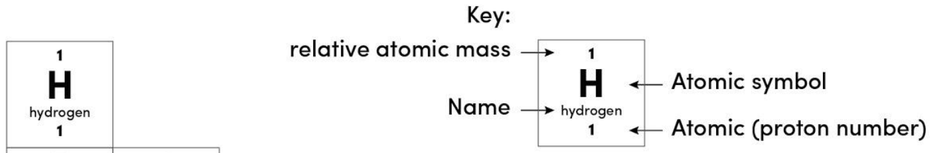
Structures and Bonding
Review 1: Ionic and Covalent Bonding Worksheet

Combined science - Chemistry- Key Stage 4

Mr Robbins

Periodic Table of Elements



1 H hydrogen 1																4 He helium 2
7 Li lithium 3	9 Be beryllium 4											11 B boron 5	12 C carbon 6	14 N nitrogen 7	16 O oxygen 8	19 F fluorine 9	20 Ne neon 10
23 Na sodium 11	24 Mg magnesium 12											27 Al aluminium 13	28 Si silicon 14	31 P phosphorus 15	32 S sulfur 16	35.5 Cl chlorine 17	40 Ar argon 18
39 K potassium 19	40 Ca calcium 20	45 Sc scandium 21	48 Ti titanium 22	51 V vanadium 23	52 Cr chromium 24	55 Mn manganese 25	56 Fe iron 26	59 Co cobalt 27	59 Ni nickel 28	63.5 Cu copper 29	65 Zn zinc 30	70 Ga gallium 31	73 Ge germanium 32	75 As arsenic 33	79 Se selenium 34	80 Br bromine 35	84 Kr krypton 36
85 Rb rubidium 37	88 Sr strontium 38	89 Y yttrium 39	91 Zr zirconium 40	93 Nb niobium 41	96 Mo molybdenum 42	[97] Tc technetium 43	101 Ru ruthenium 44	103 Rh rhodium 45	106 Pd palladium 46	108 Ag silver 47	112 Cd cadmium 48	115 In indium 49	119 Sn tin 50	122 Sb antimony 51	128 Te tellurium 52	127 I iodine 53	131 Xe xenon 54
133 Cs caesium 55	137 Ba barium 56	139 La* lanthanum 57	178 Hf hafnium 72	181 Ta tantalum 73	184 W tungsten 74	186 Re rhenium 75	190 Os osmium 76	192 Ir iridium 77	195 Pt platinum 78	197 Au gold 79	201 Hg mercury 80	204 Tl thallium 81	207 Pb lead 82	209 Bi bismuth 83	[209] Po polonium 84	[210] At astatine 85	[222] Rn radon 86
[223] Fr francium 87	[226] Ra radium 88	[227] Ac* actinium 89	[267] Rf rutherfordium 104	[270] Db dubnium 105	[269] Sg seaborgium 106	[270] Bh bohrium 107	[270] Hs hassium 108	[278] Mt meitnerium 109	[281] Ds darmstadtium 110	[281] Rg roentgenium 87	[285] Cn copemicium 112	[286] Nh nihonium 113	[289] Fl flerovium 114	[289] Mc moscovium 115	[293] Lv livermorium 116	[293] Ts tennessine 117	[294] Og organesson 118

* The lanthanides (atomic numbers 58 - 71) and the Actinides (atomic numbers 90 - 103) have been omitted.

Relative atomic masses for **Cu** and **Cl** have not been rounded to the nearest whole number.

These questions practice aspects of bonding and related content

A. A substance has a high melting point and conducts electricity. What type of structure could it have?

B. Explain your answer to A

C. A student has two white substances. One is giant ionic and the other is giant covalent. How could they tell which is which?

D. A substance is a liquid at room temperature. What type of structure does it have?

E. Would you expect the liquid in E to conduct electricity? Explain your answer.

F. From memory, try and name all four types of structure.

G. Graphite is soft. Explain why.

H. A substance is dissolved in water and can conduct electricity. What type of structure would the substance have had?

I. Why do simple molecular structures have low melting and boiling points?

J. Silicon dioxide is used to make coatings for fire fighters' uniforms. Explain why.

K. Explain why graphite conducts electricity but diamond does not

L. How many layers are in a sheet of graphene?

M. Under what conditions will simple molecular substances conduct electricity?

N. Methane molecules are made of one carbon atom joined to four hydrogen atoms. These bonds are very strong. Explain why methane has a low melting point.

O. When sodium chloride conducts electricity, the way it does so is different to how graphite conducts electricity. Explain how.

P. What is the structural difference between graphene and fullerenes?

Q. $TiCl_4$ is a liquid at room temperature. Explain why this is surprising and what this tells you about its structure.

R. Sucrose is a molecular substance but is solid at room temperature. Explain why this is surprising and suggest why it is solid at room temperature.

S. State 2 properties of graphene

Answers

A. Could be ionic or graphite
B. Because both conduct electricity in some scenarios and both have high melting point
C. Put them in water and see if they conduct electricity
D. Simple molecular covalent
E. No. No free ions or delocalised to flow
F. Ionic, simple molecular, giant covalent
G. Weak forces of attraction between the layers make them easy to separate
H. Ionic lattice
I. Weak forces of attraction between the molecules
J. High melting point due to strong covalent bonds which need a lot of energy to break
K. Graphite has delocalised electrons which can flow between the sheets. Diamond has no delocalised electrons.
L. One sheet
M. They never conduct electricity
N. Strong bonds within the molecule, but weak forces of attraction between the molecules. This needs very little energy to overcome.
O. Sodium chloride conducts when the ions are free to move (solution or molten). Graphite conducts as a solid due to delocalised electrons that can move between the layers
P. Graphene is a single flat sheet but fullerenes are folded into shapes (allow reference to 2D and 3D)
Q. It is an ionic compound and should have a high melting point
R. It is a simple covalent molecule so should have a low melting point. It is a solid because it has many weak forces of attraction between the molecules
S. Any two from: Strong, transparent, fast conductor of electricitiy/heat ,

Bonding

Is it a metal bonding to a non-metal?

Ionic substances

Properties:
- Low melting and boiling points
- Conducts electricity when molten or in solution

Covalent substances

Is it pure carbon or silicon dioxide?

Simple covalent molecules

Properties:
- Low melting and boiling points
- Do not conduct electricity

Giant covalent

Properties:
- High melting and boiling points
- MOST Do not conduct electricity

Graphene / Fullerene

Exam style question

Bromine (Br_2) is a liquid at room temperature but potassium bromide (KBr) is a solid. Use you knowledge of structures and bonding to explain the difference in melting points

- Box and underline
- Identify the bonding
- Identify the property
- Link the property to the bonding
- Explain why

Exam style question

Silicon dioxide (SiO_2) is a solid used to make molds for casting metals. Carbon dioxide (CO_2) is a gas used in fire extinguishers. Explain, using structures and bonding, the difference in melting and boiling points

- Box and underline
- Identify the bonding
- Identify the property
- Link the property to the bonding
- Explain why

Exam style question

Carbon exists as two forms, diamond and graphite. Both melt above 3000 °C. Diamonds are used on cutting blades but graphite is used as a lubricant. Use your knowledge of structures and bonding to explain the similarities and differences.

- Box and underline
- Identify the bonding
- Identify the property
- Link the property to the bonding
- Explain why