

Diamonds

This activity is aimed at GCSE students. The material here is part of the WJEC curriculum for Chemistry and Double Science

Carbon Revision

		Group																	
		I	II											III	IV	V	VI	VII	VIII
Period	1	1 H																	2 He
	2	3 Li	4 Be										5 B	6 C	7 N	8 O	9 F	10 Ne	
	3	11 Na	12 Mg										13 Al	14 Si	15 P	16 S	17 Cl	18 Ar	
	4	19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
	5	37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
	6	55 Cs	56 Ba	* Lanthanides	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
	7	87 Fr	88 Ra	** Actinides	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Cn	113 Nh	114 Fl	115 Mc	116 Lv	117 Ts	118 Og
	8	119 Uun																	
* Lanthanides		57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu			
** Actinides		89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr			

https://commons.wikimedia.org/wiki/File:Periodic_Table_Armtuk3.svg

Look at carbon's position on the Periodic Table of Elements shown above.

What does its position on the table tell us about the properties and structure of Carbon?

How many electrons does carbon have?

How many shells does carbon have?

How many electrons on the outer shell?

Covalent Bonding

What is covalent bonding?

Carbon has four electrons in its outer shell meaning it can 'share' an electron with up to four other atoms.

This allows carbon to form giant covalent structures.

Graphite

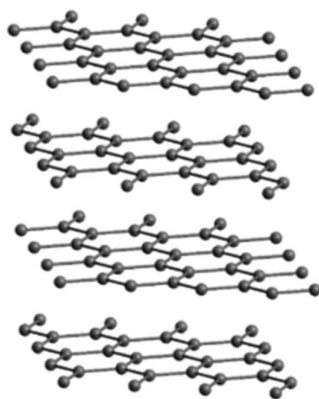
The first giant covalent structure of carbon we shall look at, is graphite.



<https://commons.wikimedia.org/wiki/File:Graphite-233436.jpg>

Graphite is the material used as 'lead' in pencils. With this in mind, what properties does graphite have?

Let us zoom in closer to see how the carbon atoms are bonded together.



Each carbon atom is attached to three others in a 2-dimensional layer (called graphene). The graphite is made up of lots of these layers.

With this information, try to work out the following:

Why does graphite have a high melting point?

Why is graphite soft and easily broken?

Why can graphite conduct electricity?

Hints:

Covalent bonds within a molecule are strong

There are only weak bonds between layers

The spare fourth electron from each atom moves freely between the layers

Diamond

Diamonds are another form of carbon in a giant covalent structure.



<https://www.flickr.com/photos/jurvetson/156830367>

The below image shows the structure of carbon atoms within diamond.



https://commons.wikimedia.org/wiki/File:Carbon_allotropes.svg

Compare this to the structure of graphite to answer the following questions.

Why does diamond have a higher melting point (approx. 4027 °C) than graphite (approx. 3600 °C)?

Why is diamond a harder material than graphite?

Can diamond conduct electricity? Explain your answer.