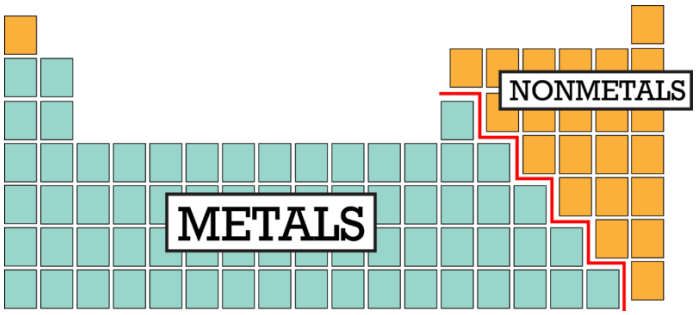
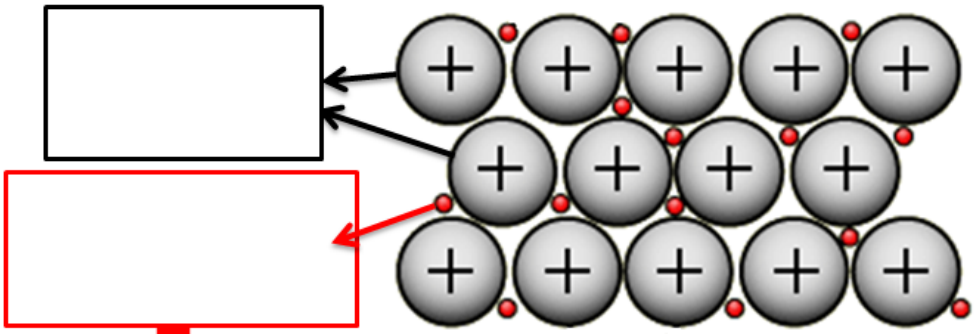
Structure, Bonding and the Properties of Matter



Metallic bonding exists between _____ only!

The attraction between the positive ions and electrons is very _____. This is a metallic bond.

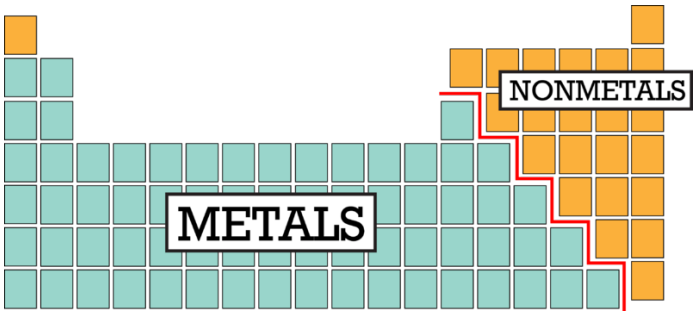
Strong bonds require lots of _____ to break so metals have _____ melting points and are very _____



Because metals have free-moving _____ they can _____ _____ when they are solid or liquid

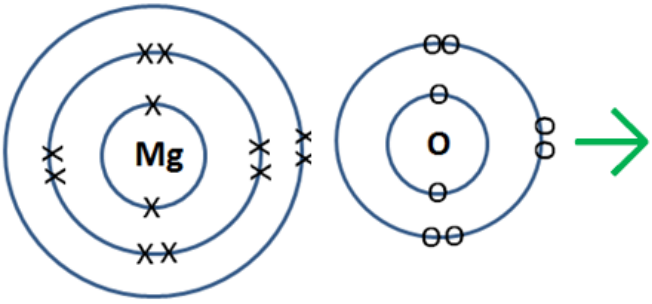
The free-moving electrons also allow the ions to slide over each other so metals are _____ (can be hammered into shape) and _____ (can be stretched into a wire)

An a_____ is a m_____ of two elements, one of which is a metal. Alloys contain atoms of different s_____, which distorts the regular arrangements of atoms. This makes it more difficult for the layers to slide over each other, so alloys are h_____ than the p_____ metals.



<u>Ionic bonding</u> exists between _____ and _____!

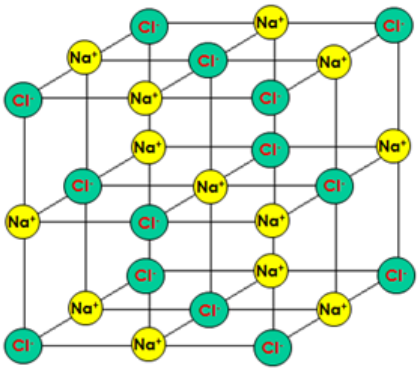
Ions are c_____ p_____ which are formed when atoms g____ or l____ electrons in order to achieve a f___ outermost energy shell.



Millions of ions can be attracted to each other as they are o_____ c_____ and this forms g___ i____ compounds like sodium chloride.

There is a really _____ attraction between the oppositely charged ions, this is called an ionic bond

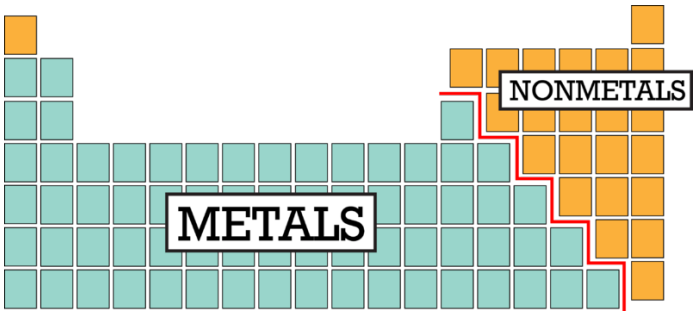
Ions build up to form a _____



Ions in a solid lattice can't _____ so the substance cannot _____ _____

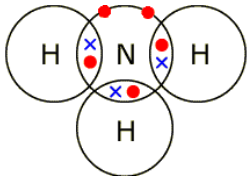
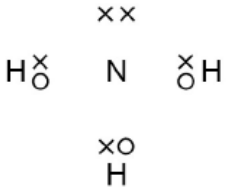
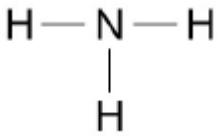
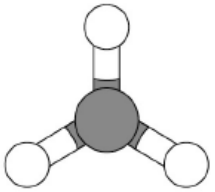
Strong ionic bonds require a lot of _____ to break so ionic compounds have _____ melting points

Ionic salts can _____ though as they are charged. This means that the ions are free to _____ and as a liquid, or in _____, ionic compounds can conduct _____

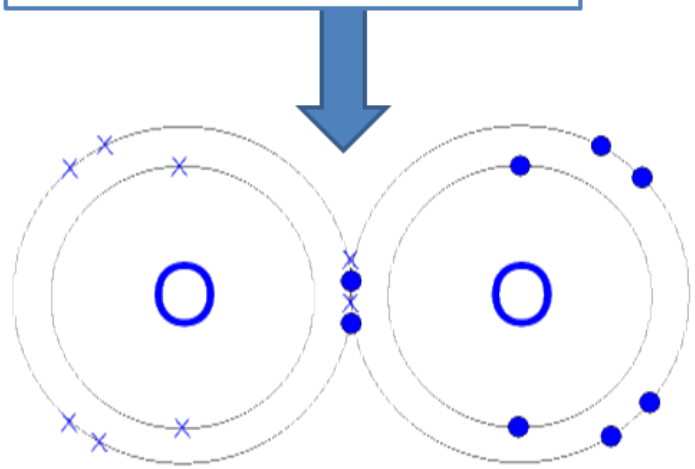


Covalent bonding exists between _____ only!

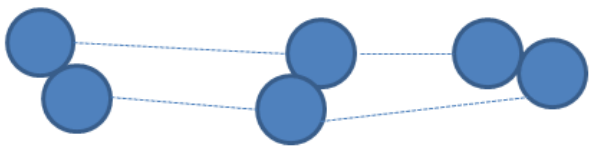
Simple molecular compounds are s____ m_____ made of only a f___ atoms.
Examples of simple molecular compounds include: CH_4, H_2O, O_2, CO_2 and NH_3.

Molecule	Dot and cross	Simplified dot and cross	Line	3D ball and stick
Ammonia, NH_3				
Water, H_2O				

This is a covalent bond. Covalent bonds form when atoms _____ _____ of electrons. Covalent bonds are very _____

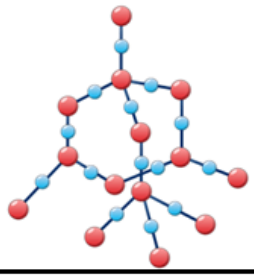


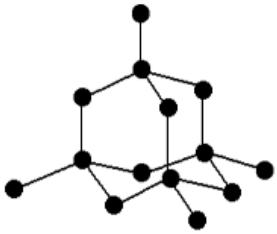
These molecules are small and often _____. This is because when they boil, the covalent bonds are not broken, only the very weak _____ between molecules are broken.

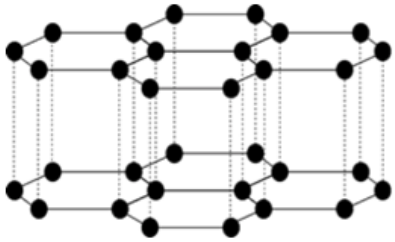


None of electrons are free to _____ so simple molecular compounds can't _____ _____

Some covalent substances can contain millions of atoms. These are called g_____ c_____ substances. There are only a few you need to know…





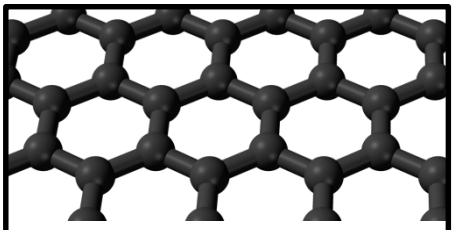


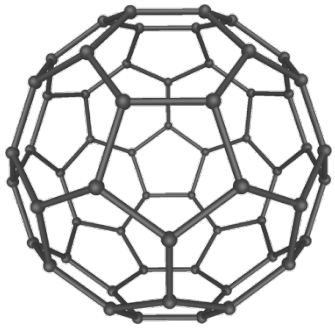
Similar

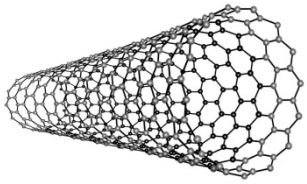
- All of them contain _____ covalent bonds. This means lots of _____ is needed to break them so they all have _____ melting points

Differences

- Graphite is in _____. The _____ can slide over each other so graphite is very _____
- Silicon dioxide and diamond have _____ so _____ conduct electricity. Graphite has free-moving electrons between the layers so _____







Graphene is a single l_____ of graphite and has properties that make it useful in e_____ and composites.

Fullerenes are molecules of carbon atoms with hollow shapes. The first fullerene to be discovered was Buckminsterfullerene (C_{60}) which has a s_____ shape.

Carbon nanotubes are cylindrical fullerenes with very high l_____ to d_____ ratios. Their properties make them useful for n_____, e_____ and materials.

1 This question is about sodium chloride and iodine.

(a) Describe the structure and bonding in sodium chloride.

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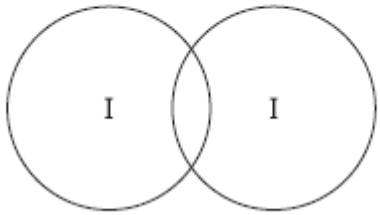
(4)

(d) The bonding in iodine is similar to the bonding in chlorine.

(i) Complete the diagram below to show the bonding in iodine.

Show the outer electrons only.



(2)

(ii) Explain why iodine has a low melting point.

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(3)

(iii) Explain, in terms of particles, why liquid iodine does not conduct electricity.

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(2)
(Total 14 marks)

2

(a) Suggest why carbon nanotubes are used as lubricants.

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(2)

(b) Explain why graphite can conduct electricity.

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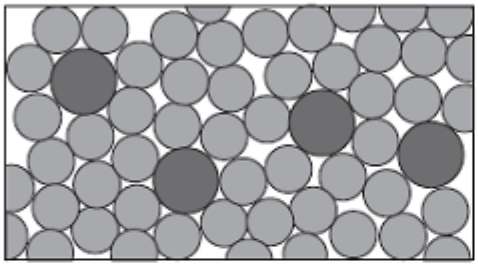
(2)
(Total 4 marks)

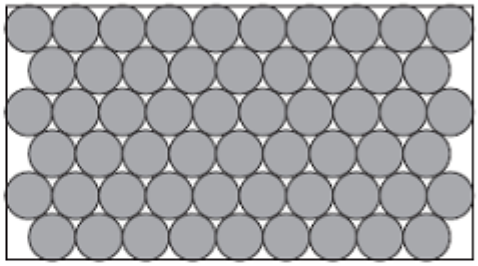
3 (a) Drills are made from an alloy of iron.

The diagrams show the particles in the alloy and in pure iron.

Alloy



Pure iron



Use the diagrams to explain why the alloy is harder than pure iron.

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(2)

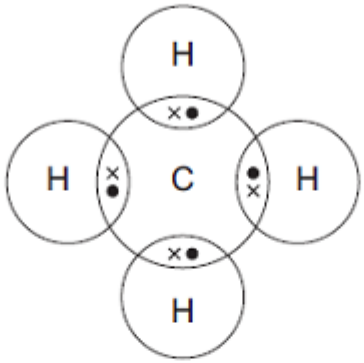
(b) Drill heads contain diamonds.

Tick (✓) **two** reasons why diamonds are hard.

Reason	Tick (✓)
Diamonds have a giant covalent structure.	
Diamonds have high melting points.	
Diamonds are unreactive.	
Diamonds have strong bonds between carbon atoms.	

(2)

(c) Methane gas is often found where crude oil is found.
The diagram shows how atoms bond in methane.
Only the outer electrons are shown.



(i) Draw a ring around the correct answer to complete the sentence.

Methane is

a compound.
an element.
a mixture.

(1)

(ii) Draw a ring around the correct answer to complete each sentence.

The formula of methane is

C_4H_4
C_4H
CH_4

(1)

(iii) Name the type of bond between the carbon and hydrogen atoms in methane.

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(1)

(d) Explain why methane is a gas at 20°C.

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(2)

(Total 9 marks)

4 This question is about metals and alloys.

(a) Explain how electricity is conducted in a metal.

To gain full marks you must include a description of the structure and bonding of a metal.

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(4)