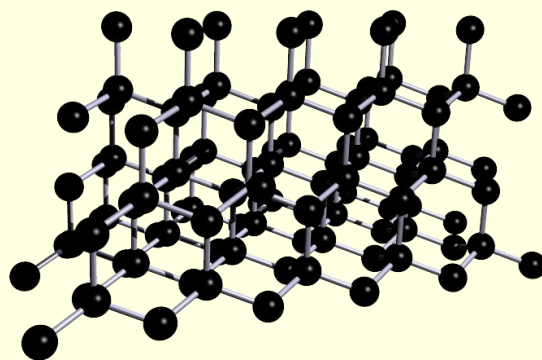
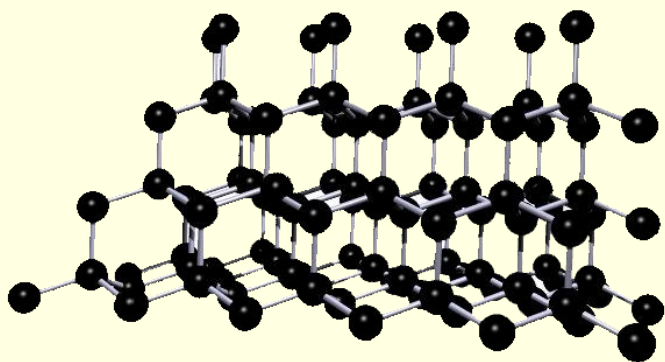


Diamond and graphite

Answer all the questions below then check your answers.

1. What is an allotrope?
2. Name the allotropes of carbon.
3. The images below show a representation of the structure of diamond from 2 slightly differing views.

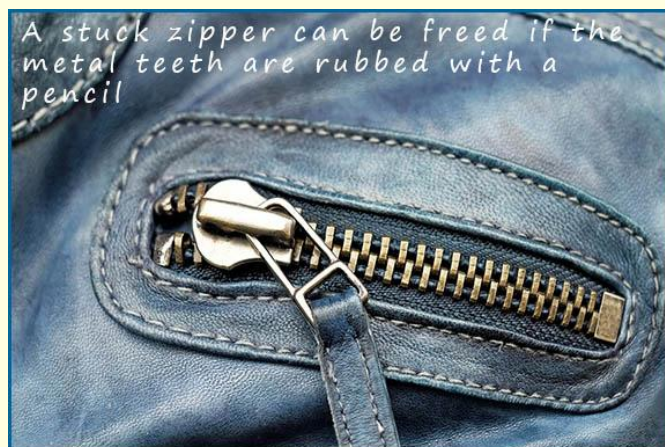


- a. What type of structure does diamond have?
- b. How many covalent bonds does each carbon atom in diamond make?
- c. Diamond has a high melting point. Explain why.
- d. Why is diamond an electrical insulator?

d. Why are diamonds hard?

4. The image opposite shows a stuck zipper.

Explain why rubbing the zip with a pencil lead will free the jammed zip.

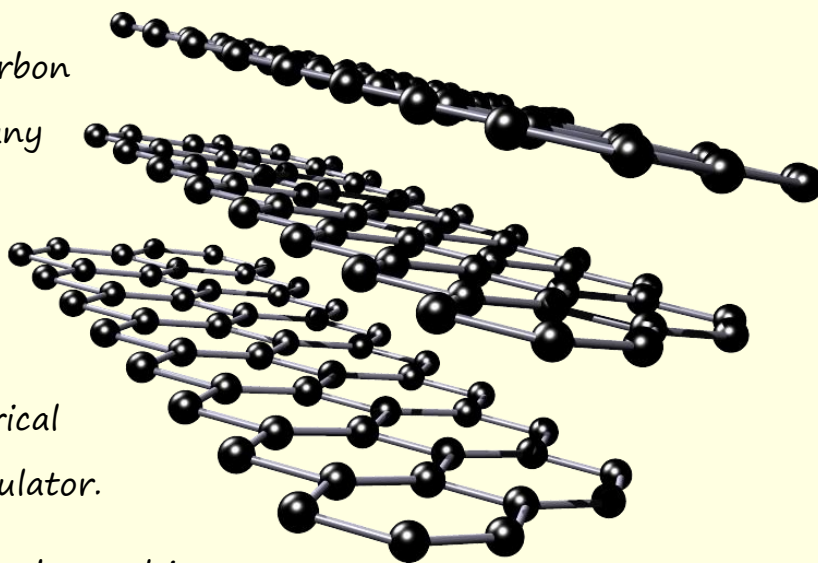


5. The image below shows the structure of another allotrope of carbon. Which allotrope has this structure?

a. How many covalent bonds do carbon atoms normally make? How many covalent bonds are the carbon atoms in the graphite structure making?

b. Explain why graphite is an electrical conductor but diamond is an insulator.

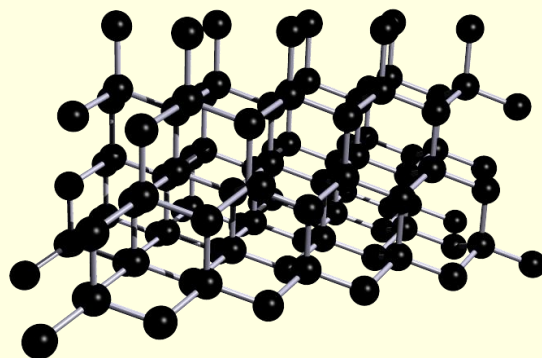
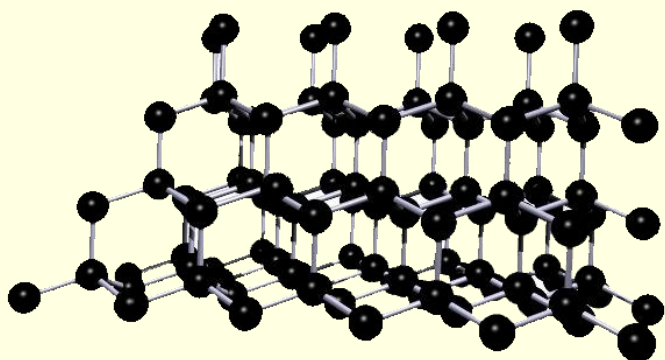
e. Why is graphite so soft that it can be used in pencil leads?



Giant macromolecular structures

Answers

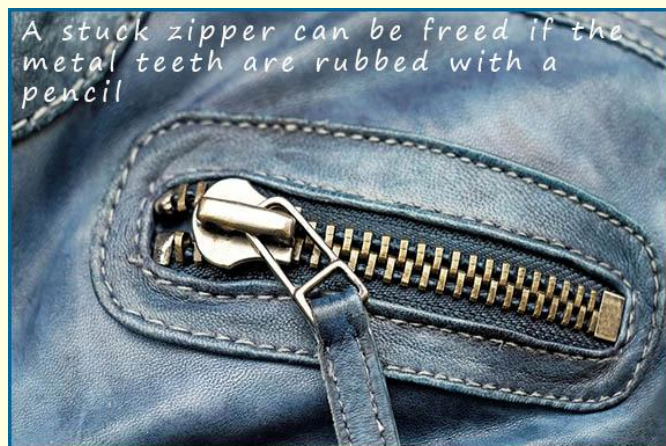
1. What is an allotrope? *Different structural forms of the same element*
2. Name the allotropes of carbon. *Diamond, graphite, fullerenes*
3. The images below show a representation of the structure of diamond from 2 slightly differing views.



- a. What type of structure does diamond have? *Giant macromolecular structure*
- b. How many covalent bonds does each carbon atom in diamond make? *4*
- c. Diamond has a high melting point. Explain why. *It has a giant structure with lots of strong bonds that need to be broken to allow the carbon atoms to move freely. This will require lots of energy.*
- d. Why is diamond an electrical insulator? *All the electrons are held tightly in covalent bonds and are not free to move.*

d. Why are diamonds hard? Giant structure with lots of strong bonds which need large amounts of energy to break them.

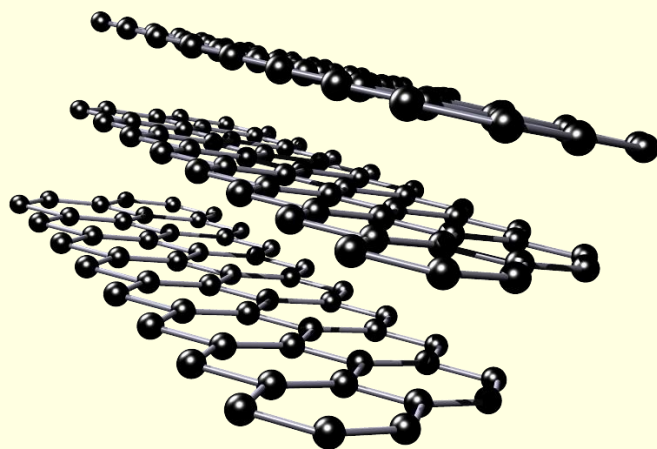
4. The image opposite shows a stuck zipper. Explain why rubbing the zip with a pencil lead will free the jammed zip.



Graphite is a good lubricant. Rubbing the pencil lead on the metal teeth will leave layers of flat hexagons of carbon atoms, these layers are able to slide over each other.

5. The image below shows the structure of another allotrope of carbon. Which allotrope has this structure? *graphite*

a. How many covalent bonds do carbon atoms normally make? *4* How many covalent bonds are the carbon atoms in the graphite structure making? *Only 3, 1 free electron which is delocalised, free to move.*



b. Explain why graphite is an electrical conductor but diamond is an insulator.

Graphite has free moving delocalised electrons between the flat hexagon layers, this makes it an excellent conductor of electricity.

e. Why is graphite so soft that it can be used in pencil leads? The bonds holding the flat layers of hexagons together are strong covalent bonds which need large amounts of energy to break them. However the bonds holding the flat layers together are weak intermolecular bonds (Van der Waals) and are easily broken. When a force is applied the bonds holding the layers together break and the layers are free to slide over each other. This is one of the reasons why graphite is a good lubricator.