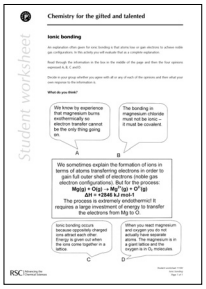
Ionic bonding



Student worksheet: CDROM index 11SW

Discussion of answers: CDROM index 11DA

Topics

Ionic bonding, electrostatic attraction and energetic stability.

Level

Very able pre–16 students.

Prior knowledge

Atomic structure, ionic bonding and the formation of ions.

Rationale

This activity helps students to think through the importance of the electrostatic attraction between ions to the model of ionic bonding.

Use

This could be used as an extension activity for very able students after a lesson on ionic bonding.

The instructions can be given verbally or printed in the first sheet. Students should work in groups of two or three.

Student worksheet

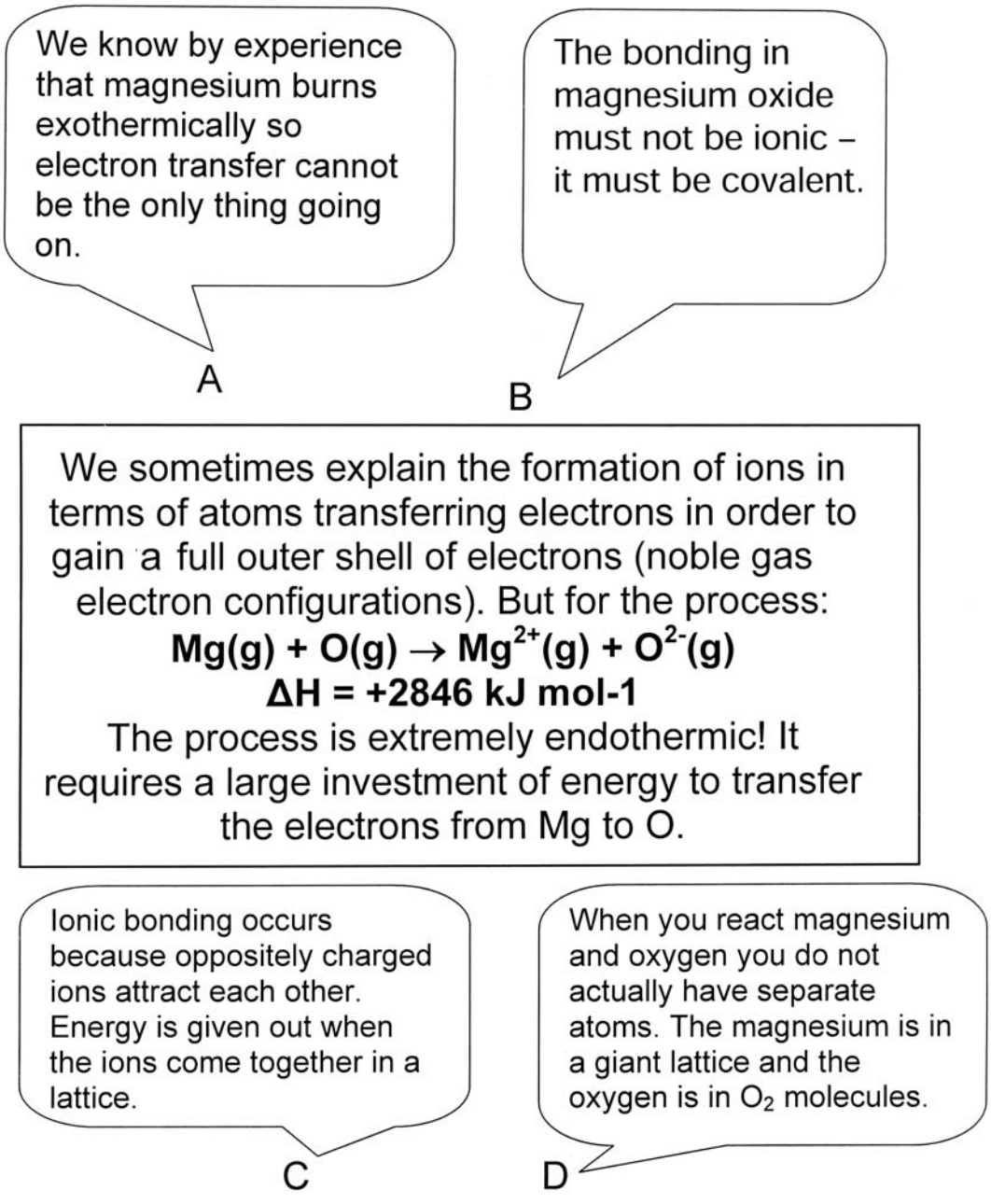
Ionic bonding

An explanation often given for ionic bonding is that atoms lose or gain electrons to achieve noble gas configurations. In this activity you will evaluate that as a complete explanation.

Read through the information in the box in the middle of the page, and then the four opinions expressed A, B, C and D.

Decide in your group whether you agree with all, or any, of each of the opinions and then what your own response to the information is.

What do you think?



Discussion of answers

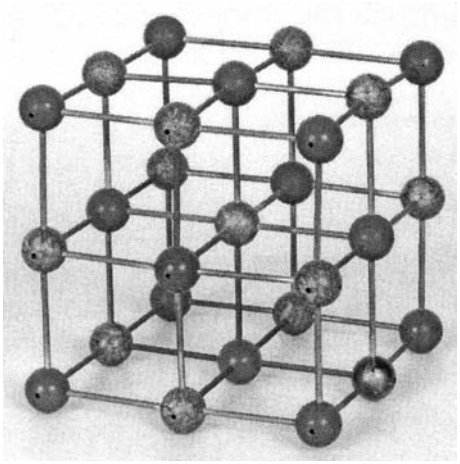
Ionic bonding

Person A is making a sensible point. The information given suggests that the process of electron transfer on its own is strongly endothermic. Since burning magnesium is exothermic, it must involve more than electron transfer.

Person B has abandoned the ionic model too readily. There is good evidence for the existence of ions – *eg* the conductivity of solutions and molten salts. Since magnesium is a metal and oxygen a non–metal, the bonding is ionic.

Person D is correct that the data are about isolated atoms but the real reaction is between solid magnesium and oxygen molecules. However, this observation only gets us so far. You can form the isolated atoms of magnesium and oxygen from the solid and gas by investing the energy to break all the bonds. Breaking the bonds will be endothermic, so we have not explained why the process of burning is exothermic and indeed what drives the magnesium to react with the oxygen.

Person C has made a crucial point. The exothermic part of the whole process comes from the coming together of oppositely charge ions into a giant lattice. Opposite charges have potential energy when they are held apart which is converted to heat when they move closer. The mutual attraction of oppositely charged ions is the driving force behind ionic bonding.



A model of an ionic lattice; the ions are held to each other by electrostatic attraction