

## Spot the bonding

### Target level

This probe is primarily intended for students undertaking or having completed post-16 chemistry courses. It may also be used with 14–16 year old students, to see if they can identify examples of the more limited range of bond types met at this level.

### Topics

Chemical bonding (including: ionic, covalent, metallic, polar, hydrogen, dipole-dipole, van der Waals, solvation, dative, double, delocalised).

### Rationale

Research suggests that students commonly focus on covalent and ionic bonding, and often fail to spot, or may down-play the importance of, other types of bonding. These ideas are discussed in Chapter 8 of the Teachers' notes. This probe provides a relatively quick way of auditing students' awareness of different bond types. (The probe **Interactions** will provide a means of exploring students' more detailed understanding of the same topic.)

A variety of types of diagram are used in this probe, as it is important for students to be able to interpret and use various ways of representing chemical species (see Chapter 6 of the Teachers' notes).

During piloting, teachers found this a 'very clear and very straight forward' probe, and a useful exercise for revising bonding and focusing and initiating discussion. Some students who had been taught about the types of intermolecular bonding were found to be confused about when different types of bonding would be found.

### Instructions

It may be useful to point out to students that some of the diagrams refer to individual atoms or molecules, whilst others show the some of the particles in named substances. Students should therefore pay close attention to the labels under the figures.

### Resources

Student worksheet  
– Spot the bonding

### Feedback for students

A suggested answer sheet is provided for teachers.

## Spot the bonding – answers

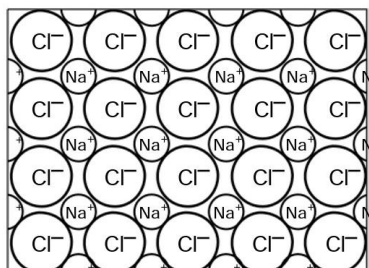
The following answers are suitable for students who have studied bonding at post-16 level. Where the **Spot the bonding** probe is used with students at an earlier stage, then they should not be expected to provide the full range of responses.

1. Sodium chloride lattice: ionic
2. Diamond lattice: covalent
3. Benzene molecule: covalent, delocalised
4. Copper lattice: metallic
5. Hydrogen fluoride molecule: covalent, polar
6. Liquid water: covalent, polar; hydrogen, covalent, van der Waals forces, dipole-dipole forces
7. Fluorine molecule: covalent
8. Silver nitrate solution: covalent, polar; hydrogen, dipole-dipole, van der Waals forces, solvent-solute interactions
9. Oxygen gas: covalent (double/sigma + pi), van der Waals forces
10. Sulfur molecule: covalent
11. Sodium atom: no chemical bonding (although intra-atomic forces of similar nature)
12. Aluminium chloride dimer: polar, including dative (coordinate) covalent
13. Carbon dioxide molecule: covalent, polar (double/sigma + pi)
14. Ethanoic acid dimer: covalent, polar, hydrogen
15. Iodine lattice: covalent, van der Waals forces
16. Ammonia molecule: covalent, polar
17. Magnesium oxide lattice: ionic
18. Liquid hydrogen chloride: covalent, polar, van der Waals forces.

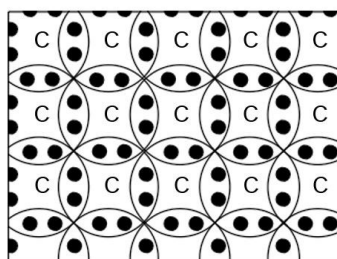
### Notes:

- a) Where a bond has significant polarity, it could be described as polar rather than covalent (or polar covalent.)
- b) The term van der Waals forces has been used for induced dipole-dipole forces.
- c) Students may forget to mention van der Waals forces in cases where they recognise hydrogen-bonds are present (*ie* items 6, 8 and 18).
- d) The presence of some covalent character in the magnesium oxide lattice may be spotted by some students.

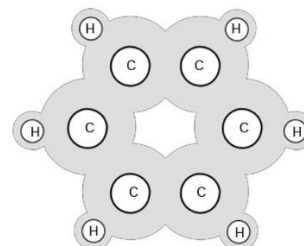
## Spot the bonding



1. Sodium chloride lattice



2. Diamond lattice



3. Benzene molecule

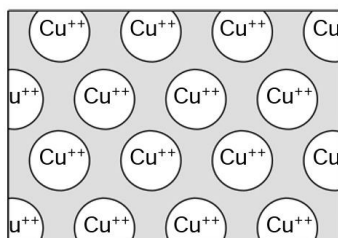
---



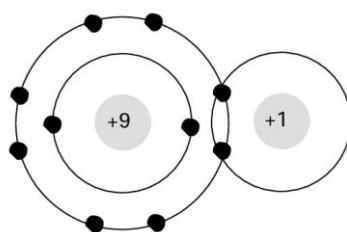
---



---

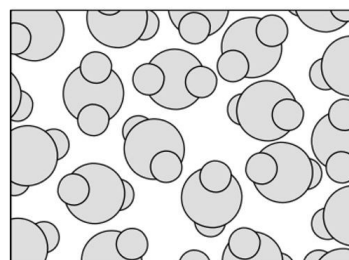


4. Copper metal lattice



Hydrogen fluoride molecule

5. Hydrogen fluoride molecule



6. Liquid water

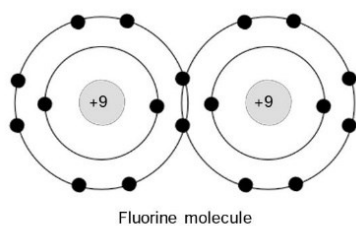
---



---

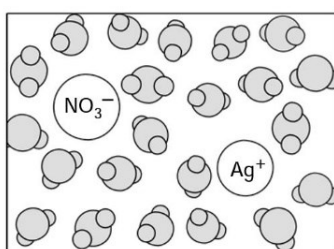


---

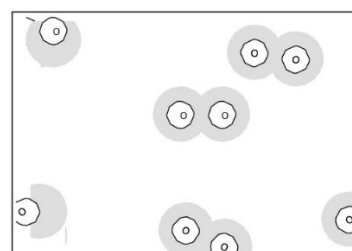


Fluorine molecule

7. Fluorine molecule



8. Silver nitrate solution



9. Oxygen gas

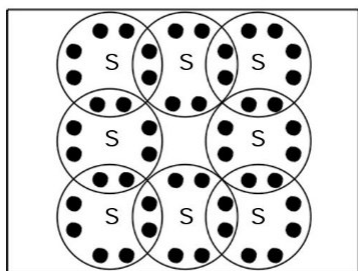
---



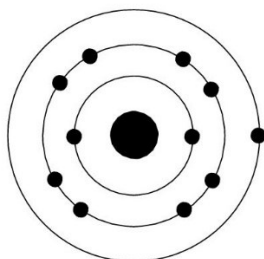
---



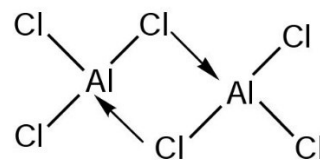
---



10. Sulfur molecule



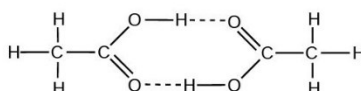
11. Sodium atom



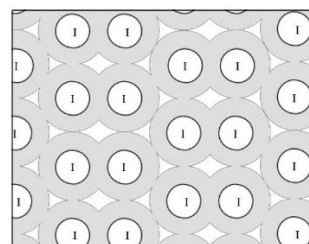
12. Aluminium chloride dimer



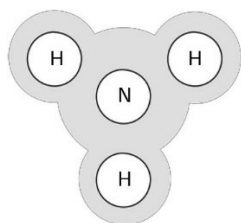
13. Carbon dioxide molecule



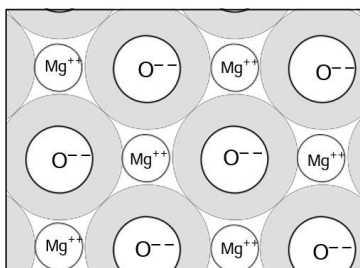
14. Ethanoic acid dimer



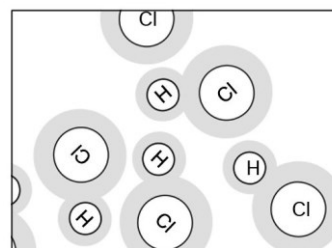
15. Iodine lattice



16. Ammonia molecule



17. Magnesium oxide lattice



18. Liquid hydrogen chloride