RS•C

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.

RS•C

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. Sodium 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.)

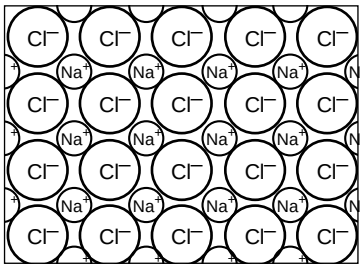
b) The term van der Waals forces has been used for induced dipole-dipole forces.

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

This exercise comprises of a set of diagrams showing a range of chemical species and systems. For each diagram: either write the name or names of the type or types of bonding present, or write none (if there is no chemical bonding) or do not know if you are unsure.



Sodium chloride lattice

1. _____

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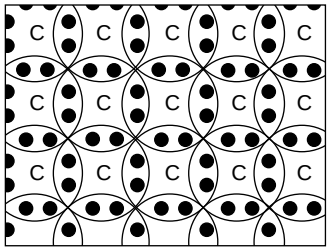

Diamond lattice

2. _____

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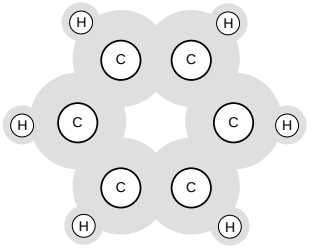

Benzene molecule

3. _____

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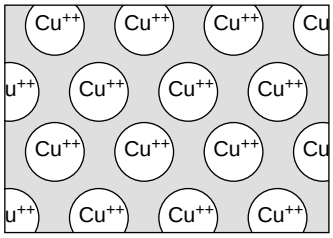

Copper metal lattice

4. _____

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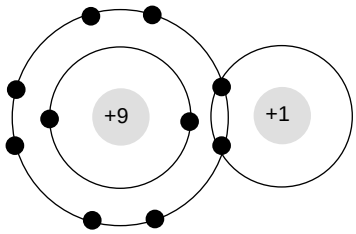

Hydrogen fluoride molecule

Hydrogen fluoride molecule

5. _____

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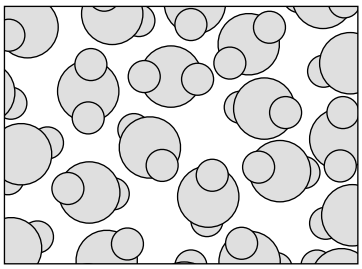

Liquid water

6. _____

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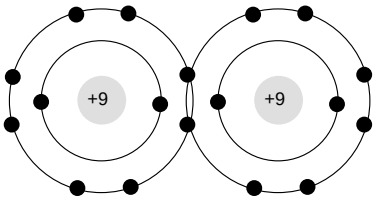

Fluorine molecule

Fluorine molecule

7. _____

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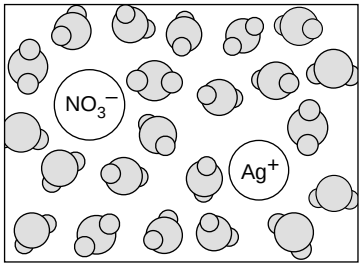

Sodium nitrate solution

8. _____

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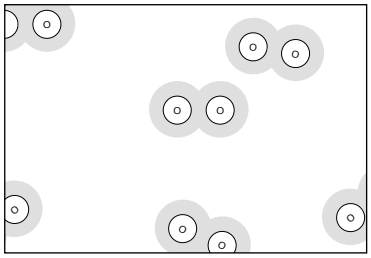

Oxygen gas

9. _____

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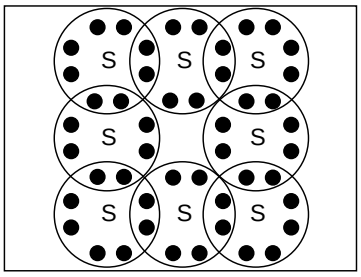

Sulfur molecule

10. _____

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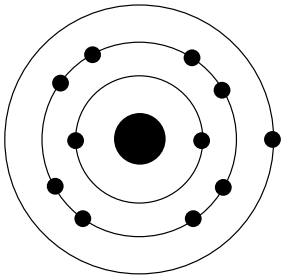

Sodium atom

11. _____

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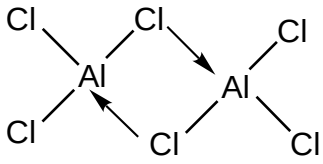

Aluminium chloride dimer

12. _____

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Carbon dioxide molecule

13. _____

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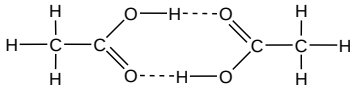

Ethanoic acid dimer

14. _____

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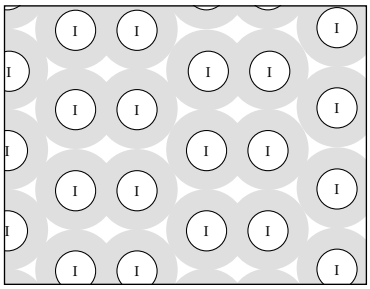

Iodine lattice

15. _____

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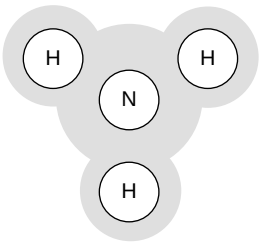

Ammonia molecule

16. _____

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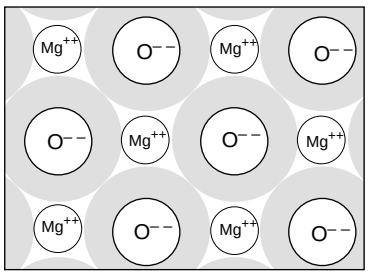

Magnesium oxide lattice

17. _____

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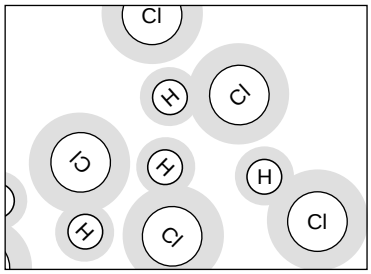

Liquid hydrogen chloride

18. _____

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