A2 · Valence electrons and electron dot diagrams for atoms · Practice key

This is the worked key. Every practice question is worked step by step.

Worked examples

Read these first. There is one for each kind of question in this lesson.

Example 1 · Draw the electron dot diagram of an atom

Draw the electron dot diagram for a nitrogen atom.

1. Find the group number: nitrogen is in group 15.
2. Count the valence electrons: use the last digit, so nitrogen has 5.
3. Place one dot on each side, up to four: that uses 4 dots.
4. Pair the rest, one side at a time: the fifth dot makes 1 pair.
5. Check: the dots, 5, equal the valence electrons.

Answer: N with five dots: one pair and three single dots.

Example 2 · Find the bonding electrons and lone pairs

An oxygen atom has 6 valence electrons. How many bonding electrons and lone pairs does its diagram show?

1. Four dots go on the four sides. The other two dots make pairs.
2. So the diagram has 2 pairs and 2 single dots.
3. A single dot is a bonding electron. Two dots together are a lone pair.

Answer: Oxygen has 2 bonding electrons and 2 lone pairs.

Practice

Questions 1 to 4 are easy. Questions 5 to 8 are medium. Questions 9 and 10 are harder.

EASY

1. Magnesium is in group 2. How many valence electrons does a magnesium atom have?

1. For groups 1 and 2, the count is the group number.
2. Magnesium has 2 valence electrons.

EASY

2. Bromine is in group 17. How many valence electrons does a bromine atom have?

1. For groups 13 to 18, use the last digit of the group number.
2. Bromine has 7 valence electrons.

EASY

3. Draw the electron dot diagram for a carbon atom. Carbon is in group 14. Say how many dots are paired.

1. Carbon has 4 valence electrons.
2. Put one dot on each of the four sides.
3. None is paired.

EASY

4. What does the octet rule say?

1. For most atoms, a full outer level means 8 valence electrons.
2. An atom with a full outer level is stable.

MEDIUM

5. Draw the electron dot diagram for an oxygen atom. Oxygen is in group 16. Say how many lone pairs and bonding electrons it has.

1. Oxygen has 6 valence electrons.
2. Four dots go on the four sides. The other two make pairs.
3. It has 2 lone pairs and 2 bonding electrons.

MEDIUM

6. Draw the electron dot diagram for a neon atom. Neon is in group 18. Explain why neon forms no bonds.

1. Neon has 8 valence electrons, in four pairs.
2. It has no single dots, so it has no bonding electrons.
3. Its outer level is full, so neon is stable.

MEDIUM

7. An electron dot diagram has three lone pairs and one bonding electron. How many valence electrons does the atom have? Name its group.

1. Three lone pairs are 6 electrons. Add 1 bonding electron.
2. 6 + 1 = 7 valence electrons.
3. The atom is in group 17.

MEDIUM

8. Explain why a hydrogen atom is full with only 2 electrons.

1. Hydrogen's outer level is the first energy level.
2. The first level holds only 2 electrons.

HARDER

9. Sodium is a metal in group 1. Sulfur is a non-metal in group 16. Say how each one reaches a full outer level when they meet. Give each ion.

1. Sodium loses its 1 valence electron and becomes Na^{+}.
2. Sulfur gains 2 electrons and becomes S^{2-}.
3. Metals lose electrons. Non-metals gain them when they meet a metal.

HARDER

10. The electron dot diagram of an atom X has two lone pairs and two bonding electrons. X is in the second row of the periodic table. Name the element. Then say how many more electrons it needs to reach 8.

1. Two lone pairs are 4 electrons. Add 2 bonding electrons. That is 6 valence electrons.
2. So X is in group 16. In the second row, that is oxygen.
3. 8 − 6 = 2, so it needs 2 more electrons.