Year 10 Science: Chemical bonding: ions, ionic bonds and covalent bonds

Name: _____ Date: _____

Try these without your notes first, then check the answer key.

Practice

1. Is N_2 a molecule, a compound, both or neither? Explain.

2. How many atoms of each element are in one formula unit of $Ca(OH)_2$?

3. Write the formula of the ion formed by potassium (2,8,8,1) and by sulfur (2,8,6).

4. Write the formula of magnesium oxide and of sodium carbonate.

5. Explain why chlorine atoms bond covalently in Cl_2 but ionically with sodium.

Fix the mistake

6. Correct this statement: "Chlorine gains an electron, so it becomes Cl^+."

7. Correct this statement: "Magnesium oxide is Mg_2O_2, because magnesium loses 2 and oxygen gains 2."

8. Correct this statement: "Calcium nitrate is $CaNO_{32}$."

9. Correct this statement: "Salt is made of NaCl molecules."

Answer key (for parents and tutors)

1. Is N_2 a molecule, a compound, both or neither? Explain.
   A molecule but not a compound: two atoms are bonded, but both are nitrogen, so it is an element.
2. How many atoms of each element are in one formula unit of $Ca(OH)_2$?
   1 calcium, 2 oxygen and 2 hydrogen, because the 2 outside the bracket doubles everything inside.
3. Write the formula of the ion formed by potassium (2,8,8,1) and by sulfur (2,8,6).
   K^+, since potassium loses its single valence electron; S^{2-}, since sulfur gains two to fill its shell.
4. Write the formula of magnesium oxide and of sodium carbonate.
   MgO, because +2 and −2 cancel one to one; Na_2CO_3, because two Na^+ are needed to cancel one CO_3^{2-}.
5. Explain why chlorine atoms bond covalently in Cl_2 but ionically with sodium.
   Two chlorine atoms both need to gain an electron, so they share a pair; sodium readily loses its outer electron, so it transfers to chlorine and the ions attract.
6. Correct this statement: "Chlorine gains an electron, so it becomes Cl^+."
   Electrons are negative, so gaining one makes Cl^-; only losing electrons, as metals do, makes a positive ion.
7. Correct this statement: "Magnesium oxide is Mg_2O_2, because magnesium loses 2 and oxygen gains 2."
   An ionic formula shows the simplest ratio of ions, and one Mg^{2+} already cancels one O^{2-}, so it is MgO.
8. Correct this statement: "Calcium nitrate is $CaNO_{32}$."
   It is $Ca(NO_3)_2$: the nitrate group goes in brackets so the 2 counts whole nitrate ions, not oxygen atoms.
9. Correct this statement: "Salt is made of NaCl molecules."
   Sodium chloride is an ionic lattice of separate Na^+ and Cl^- ions, and NaCl only gives their 1 : 1 ratio.