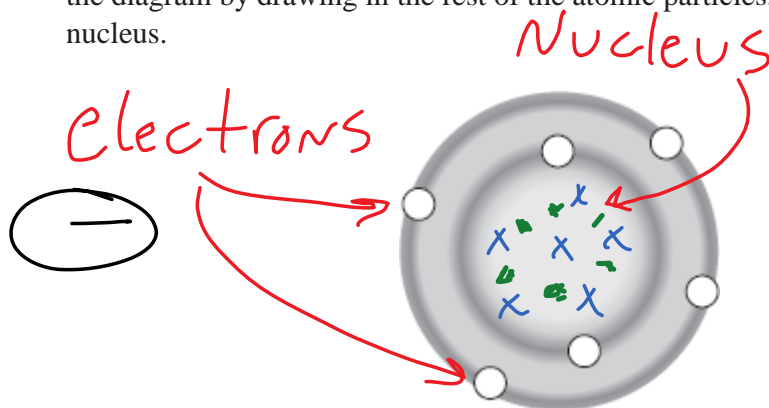


## 2.1 The Nature of Matter

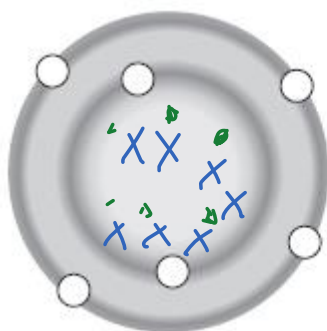
### Atoms

- THINK VISUALLY** The diagram shows a model of a carbon atom, with an atomic number of 6. Complete the diagram by drawing in the rest of the atomic particles, including their charges. Label all particles and the nucleus.

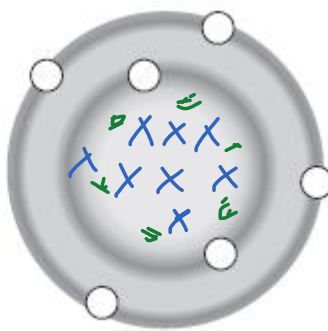


### Elements and Isotopes

- THINK VISUALLY** The diagrams show models of carbon isotopes. Complete the diagrams by drawing in the rest of the atomic particles, including their charges.



**Nonradioactive  
carbon-13**



**Radioactive  
carbon-14**

*Handwritten legend:*  
 • = (+) charge  
 x = no charge

Use your completed diagrams to answer Questions 3–4.

- Identify two differences between carbon-12 and carbon-14.

12-Non-radioactive, only 6 neutrons

14-Radioactive, 8 neutrons

- Identify two ways in which carbon-12, carbon-13, and carbon-14 are alike.

Same number of protons, same # of electrons

- What relationship exists between the mass number of an element and the isotopes of that element?

*The isotopes add 1 mass unit for each extra neutron*

For Questions 5–7, complete each statement by writing the correct word or words.

6. A chemical element is a pure substance that consists entirely of one type of atom.
7. Atoms of the same element that differ in the number of neutrons they contain are called isotopes.

## Chemical Compounds

8. What is a chemical compound?

One or more atoms bonded together in definite proportion

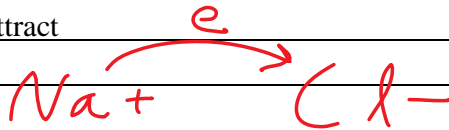
9. What do the formulas for table salt, NaCl, and water, H<sub>2</sub>O, indicate about these compounds?

Which atom they have, and how many of each atom

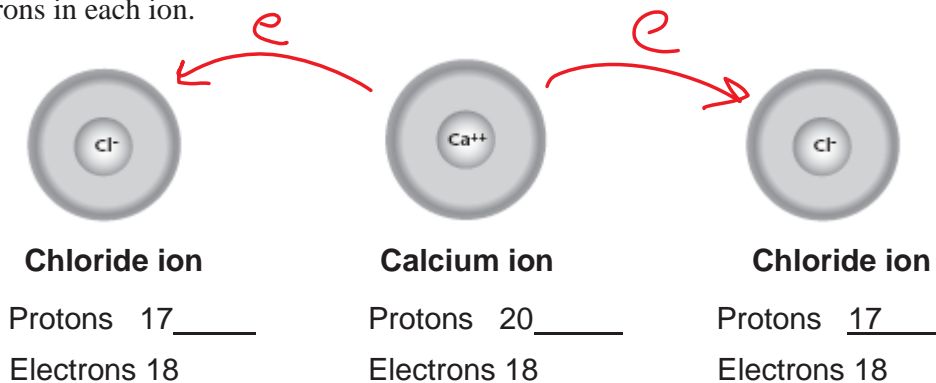
## Chemical Bonds

10. Describe how a sodium atom forms a bond with a chlorine atom. See the chemical reaction on page 37 of your book to help you figure this out.

By transferring one electron from the sodium (outer energy level) to the chlorine,  
then the opposite charges attract



11. Sea salt contains calcium chloride (CaCl<sub>2</sub>), an ionic compound similar to table salt. One atom of calcium (atomic number 20) bonds to two atoms of chlorine (atomic number 17). Fill in the number of protons and electrons in each ion.



*Ca = 20  
Cl = 17*

11. What is the difference between an ionic bond and a covalent bond?

Ionic- transferred electrons

Covalent- shared electrons

12. How are chemical bonds important in metabolism?

Chemical bonds store energy. This energy can be released from the molecules when the bonds are broken in the cells of living things

13. Of the three subatomic particles, electrons are most involved in forming chemical bonds.

\_\_\_c\_\_\_ 14. If an atom contains 4 protons, 5 neutrons, and 4 electrons, its mass number is

- a. 4.
- b. 5.
- c. 9.
- d. 13.

\_\_\_b\_\_\_ 15. If an atom contains 11 protons, 12 neutrons, and 11 electrons its atomic number is

- a. 1.
- b. 11.
- c. 12.
- d. 23.

# of protons

\_\_\_a\_\_\_ 16. If an atom contains 11 protons, 12 neutrons, and 10 electrons, the atom's charge is

- a. +1.
- b. -1.
- c. 0.
- d. +2.

## 2.2 Properties of Water

### The Water Molecule

For Questions 1–4, write True or False on the line provided.

- t \_\_\_\_\_ 1. Water is a polar molecule.
- t \_\_\_\_\_ 2. Hydrogen bonds are responsible for adhesion.
- f \_\_\_\_\_ 3. Covalent bonds give water a low heat capacity.
- f \_\_\_\_\_ 4. A hydrogen bond is stronger than a covalent bond.

Fill in

5. A water molecule is polar because there is an uneven distribution of electrons, charge between the oxygen and the hydrogen atoms.

## Solutions and Suspensions

5. Complete the table

Substance	Definition	Example(s)
Mixture	Physical combination of two or more substances	Cinnamon sugar
Solute	Substance that is dissolved	Salt in saltwater
Solvent	Substance in which solute dissolves	Water in saltwater
Suspension	Mixture of water and non-dissolved substance	Blood
Solution	Mixture in which all substances are evenly distributed	Saltwater

## Acids, Bases, and pH

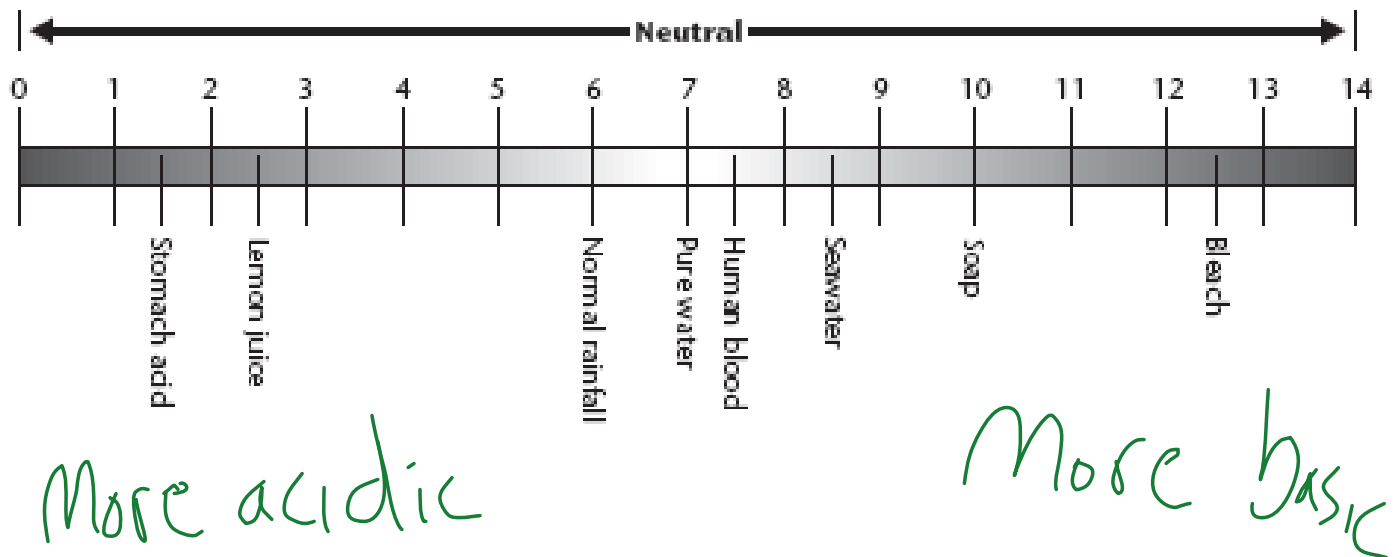
6. What makes pure water neutral? (use IONS in your answer)

It has the same concentration of  $H^+$  and  $OH^-$  ions

7. What does the pH scale measure?

The amount (concentration) of  $H^+$  in a solution (acidity)

8. On the pH scale, indicate which direction is increasingly acidic and which is increasingly basic



9. Identify two solutions that have more  $H^+$  ions than  $OH^-$  ions.

Stomach acid, lemon juice

10. Identify two solutions that have more  $OH^-$  ions than  $H^+$  ions.

Bleach, soap

11. Why are buffers important to living things?

Buffers react with strong acids or bases to prevent sharp, sudden changes in pH.

In living things, controlling pH is important for maintaining homeostasis

12. When working in the laboratory, you discover that the solutions you are working with are tomato juice with a pH of 4 and soap with a pH of 10. By comparing the pH of these substances with that of pure water, would you find that each of these substances is acidic or basic? Explain.

*Tomato juice is acidic since it is below 7, and the soap is basic because it is higher than 7*