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Ms. Randall General Chemistry

**Unit 3 Atomics: General Chemistry Review**

**SCIENTIFIC THEORIES**

1**. Dalton** theorized that atoms were the smallest particle and could not be divided. Atoms can bond with one another in whole number ratios to form compounds but cannot be created or destroyed. Atoms of the same element are identical. Dalton’s model is known as the **hard sphere model**.

a. According to Dalton, what is inside the atom? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

b. What part of Dalton’s theory has been disproven? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. **Thompson** worked with the cathode ray tube and discovered a ray of light travelling to the positive plate in the tube. This particle was the **electron** which must have a negative charge. Because atoms are neutral, Thompson assumed there must be invisible positively charged particles as well. These discoveries lead to Thompson’s **plum pudding model**.

a. Draw the plum pudding model:

b. Explain why Thompson concluded that electrons are negative.

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3. **Rutherford** shot alpha particles at gold foil in an effort to disprove either Dalton or Thompson’s theory. If Dalton were right, the alpha particle would deflect, if Thompson were right the alpha particle would go straight through. 99% of the alpha particles went straight through. Rutherford concluded the atom was mostly empty space with a dense positive **nucleus** containing **protons** and **neutrons**. His model is known as the **nuclear model**.

a. Draw the nuclear model:

b. If alpha particles are positive and bounce off of the nucleus, what is the charge of the nucleus?

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4. **Bohr** used complicated mathematics to organize electrons into **orbits** around the nucleus with specific energies. His model is known as the **planetary model**.

a. Draw the planetary model:

b. Have the placement of protons and neutrons changed in Bohr’s model since Rutherford’s model? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**SUBATOMIC PARTICLES**

5. Atoms are neutral and contain subatomic particles. **Protons** are positively charged particles located in the nucleus**. Neutrons** are neutral particles located in the nucleus. **Electrons** are negatively charged particles found in orbit around the nucleus. Protons and neutrons both weigh 1 amu and the electron’s mass in negligible.

a. Fill in the chart below:

|  |  |  |  |
| --- | --- | --- | --- |
|  | Charge | Mass | Location |
| Proton |  |  |  |
| Neutron |  |  |  |
| Electron |  |  |  |

b. What is an amu? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

c. What does “the electron’s mass in negligible” mean? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

d. If atoms are neutral, then the number of protons \_\_\_\_\_\_\_\_\_\_\_ the number of electrons because \_\_\_\_\_\_\_\_\_\_

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6. The **atomic number** is the identity of an element. The periodic table and table S are arranged according to the atomic number. It tells you how many protons an atom has.

a. Which element has 36 protons? \_\_\_\_\_\_\_\_\_\_\_\_\_

b. How many protons does chlorine have? \_\_\_\_\_\_\_\_\_\_\_

7. The **mass number** of an element is a whole number equal to the number of protons and neutrons. Every atom has it’s own mass number.

a. Why aren’t electrons counted in the mass number? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

b. How many electrons does C-12 have? \_\_\_\_\_\_\_\_ B-11? \_\_\_\_\_\_\_\_\_\_\_ O-16? \_\_\_\_\_\_\_\_\_\_

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**ISOTOPES**

8. **Isotopes** are atoms of the same element with the same number of protons. But they have different number of neutrons and a different mass.

a. What do isotopes have in common? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

b. How are isotopes different? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

c. Which of the following are isotopes?

126C 157N 146C 157N 125B

9. The **atomic mass** of an element is the weighted average mass of the naturally occurring isotopes.

a. Explain how mass number and atomic mass are different. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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b. What the atomic mass of Carbon? \_\_\_\_\_\_\_\_\_\_\_\_\_\_

c. If there are two isotopes of carbon, C-12 and C-14, which is more abundant? \_\_\_\_\_\_\_\_\_\_

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**ELECTRONS, BOHR, AND SPECTRA**

10. Neils **Bohr** organized the electrons into energy levels. Electrons closer to the nucleus have less energy than electrons further from the nucleus. The first level holds only 2 electrons. The second level holds 8, third holds 18 and fourth 32. These numbers are reported on the periodic table. Each element’s box has an **electron configuration** in the **ground state** showing how many electrons are in each level.

a. What is the electron configuration of Neon? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

b. What is the electron configuration of Strontium? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

c. Which element has the ground state electron configuration 2-8-8-3? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

11. The last level contains **valence** electrons that can be lost or gained to form ions involved in bonding. **Cations** are positive ions that have lost electrons, therefore having more positive protons than negative electrons. **Anions** are negative ions that have gained electrons and then have fewer protons than electrons.

a. How many valence electrons does Sodium have? \_\_\_\_\_\_\_\_

b. How many valence electrons does fluorine have? \_\_\_\_\_\_\_\_

c. If an atom has 8 protons and 10 electrons, what is the charge? \_\_\_\_\_\_\_\_ What type of ion is it? \_\_\_\_\_\_\_\_\_\_\_\_

d. If an atom has 12 protons and 10 electrons, what is the charge? \_\_\_\_\_\_\_ What type of ion is it? \_\_\_\_\_\_\_\_\_\_\_

12. When energy is added to the atom, electrons can move up to higher energy levels, in the excited state. The excited state is unstable. When the electrons return to the ground state they release energy in the form of light called a spectra. Every atom has a different spectrum.

a. Energy is \_\_\_\_\_\_\_\_\_\_\_\_\_ when electrons move from higher to lower energy levels.

b. Energy is \_\_\_\_\_\_\_\_\_\_\_\_\_ when electrons move from higher to lower energy levels.

c. Spectra is observed when electrons move from \_\_\_\_\_\_\_\_\_ to \_\_\_\_\_\_\_\_\_\_ energy levels.

d. Why can you identify atoms by their spectra? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

e. Identify which two gases (A, B, C, or D) are in the unknown mixture: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

