**Ch. 4 Subatomic Particles and Average Atomic Mass**

1. Which subatomic particle controls the identity of elements?
   1. Electrons
   2. **Protons**
   3. Neutrons
2. Which subatomic particle controls the charge of ions?
   1. **Electrons**
   2. Protons
   3. Neutrons
3. Are all atoms of the same element identical?
   1. Yes; they all have the same number of protons.
   2. Yes; they all have the same number of protons and electrons.
   3. **No; they can have different numbers of neutrons.**
   4. No; they can have different numbers of protons.
4. How many electrons are in a neutral atom of calcium?
   1. 18
   2. **20**
   3. 22
   4. 40
5. Which type of element is likely to form negatively charged ions?
   1. Main-group metals
   2. **Main-group nonmetals**
   3. Transition metals
   4. Metalloids
6. Which group on the periodic table forms 2+ ions?
   1. Group 1
   2. **Group 2**
   3. Group 4
   4. Group 16
7. Elements with similar physical and chemical properties belong in \_\_\_\_\_\_\_\_\_\_\_.
   1. **Groups**
   2. Periods
   3. Blocks
   4. Sections
8. Which isotope symbol represents an atom with seven protons and seven neutrons?
9. What is the mass and number of protons, neutrons, and electrons for ?
   1. 8, 16, 16, 16
   2. **16, 8, 8, 8**
   3. 16, 8, 8, unknown number of electrons
   4. 8, 16, 16, unknown number of electrons
10. Shape

    Description automatically generatedThe picture to the right represents a nucleus. The white spheres are protons, and the grey spheres are neutrons. Identify the atom and determine the total number of electrons in its most common ion.
    1. Oxygen, 8
    2. Oxygen, 10
    3. Nitrogen, 5
    4. **Nitrogen, 10**
    5. Nitrogen, 4
11. Which chemical symbol represents an ion that contains 36 electrons and has a 2- charge?
    1. Kr2-
    2. **Se2-**
    3. Br2-
    4. Sr2-
12. Consider the species 52Fe, 54Ni, 53Co, and 56Zn. What statement is true?
    1. They all have the same number of protons.
    2. They all have the same number of electrons
    3. **They all have the same number of neutrons.**
    4. They all have the same atomic number.
13. An unidentified element has two isotopes with masses of 66 and 70 amu. The average atomic mass of the element is 67 amu. Estimate the natural abundances for each isotope. The abundances are listed in the order they are in the question.
    1. 90:10
    2. 10:90
    3. 50:50
    4. **75:25**
    5. 25:75
14. An element exists with a mass of 32 amu. Can you identify the element?
    1. Yes; it is sulfur.
    2. Yes; it is germanium.
    3. No; it could be either sulfur or germanium.
    4. **No; it could be any element with an isotope mass of 32 amu.**
15. Chlorine has two stable isotopes: 35Cl and 37Cl. The average atomic mass of chlorine is 35.45 amu. Which statements are true? Select any that apply.
    1. **35Cl is the most abundant isotope.**
    2. 37Cl is the most abundant isotope.
    3. It is not possible to determine which isotope is the most abundant.
    4. It is possible to isolate a chlorine atom with a mass of 35.45 amu.
    5. **No chlorine atoms will have a mass of 35.45 amu.**
16. An unidentified element has three stable isotopes. What is the average atomic mass of the element?

|  |  |  |
| --- | --- | --- |
| Isotope | Mass (amu) | % Natural Abundance |
| X-28 | 27.9769 | 92.21 |
| X-29 | 28.9765 | 4.690 |
| X-30 | 29.9737 | 3.100 |

1. 28.98 amu
2. **28.09 amu**
3. 86.93 amu
4. 48.42 amu
5. An unidentified element with an average atomic mass of 69.956 amu has two stable isotopes. Isotope 1 has a natural abundance of 65.29% and a mass of 72.568 amu. What is the mass for isotope 2?
   1. **65.04 amu**
   2. 34.71 amu
   3. 34.58 amu
   4. 71.66 amu
   5. 67.85 amu

**Element Unknown**

Use the provided information, dynamic periodic table (<https://ptable.com>), and the density information at <https://www.angstromsciences.com/density-elements-chart> to identify the element.

1. This element can form either a 3- or a 5+ ion in compounds and only has one stable isotope, although many others exist. Its 5+ ion contains 28 electrons. What is the element?
   1. N
   2. Ni
   3. V
   4. **As**
   5. Si
2. This element forms no known compounds, although evidence suggests it may form one with fluorine. Its density is 0.900 g/L, and advertisers know how to harness its true color, which is red-orange. What is the element?
   1. Fe
   2. He
   3. **Ne**
   4. Ar
   5. H
3. This element is a solid at 25°C with a density of approximately 7.3 g/cm3. It can form either 2+ or 4+ ions and is commonly used in alloys. What is the element?
   1. **Sn**
   2. In
   3. Pm
   4. Pb
   5. Ge