Name _____

Matter and Atom Notes

- I can identify the parts of an atom.
- I can distinguish between the atomic mass and the atomic number.
- I can state the charge of the subatomic particles.
- I can state the location of the subatomic particles.
- I can determine the number of protons, neutrons, and electrons in any atom.
- I can describe what an atom looks like.

What is matter?

What is mass?

What is matter made of?

1. Matter is anything that takes up _____ and has mass.
2. Mass is the amount of _____ an object contains.
3. Matter is made of _____.
4. Atoms are the basic unit of _____.

Dalton's atomic theory:

5. All elements are composed of tiny particles called _____.
6. Atoms of the same element are _____.

Can half an atom combine with 2/3 of another atom? Why or why not?

What happens during a chemical reaction?

7. Atoms can combine physically or chemically in _____ ratios to form compounds.
8. _____ form when two or more elements are chemically bonded together.
9. Chemical reactions occur when atoms are _____, joined, or rearranged.

Can an atom of aluminum become gold? Why or why not?

10. Atoms of one element are never changed into atoms of another element as a result of a _____.

What are the three particles found in an atom?

What are the two regions of an atom?

Draw a picture of what you think an atom looks like.

11. Atoms are made of three subatomic particles:
12. Protons have a _____ charge.
13. Protons are found in the _____ of the atom.
14. Neutrons are also found in the _____.
15. Neutrons have _____ charge (they are neutral).
16. The third particle found in an atom is the _____.

Name _____

17. Electrons have a _____ charge.
18. They are found in the _____.
19. The protons and neutrons are always found in the _____.

It is much harder to predict the location of an electron, why?

20. Unlike the protons and neutrons, you can't _____ the location of an electron because they are always moving.
21. Electrons are always _____.

Describe an atom in terms of the nucleus and electron cloud.

22. The atom is mostly empty _____ with the nucleus in the middle and the electrons moving around the nucleus.
23. Electrons _____ around the nucleus in the electron cloud in orbitals.
24. The first orbital can hold _____ electrons.
25. The second orbital can hold _____ electrons.
26. The third orbital can hold _____ electrons.
27. Protons and neutrons have a mass of _____.
28. An amu is _____ the mass of a carbon-12 atom.
29. Electrons basically have no _____, they are very small.

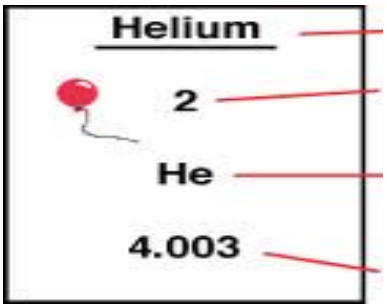
What is an element?

30. Atoms of the same substance combine to form _____.
31. An _____ is a pure substance that consists of only one type of atom.
32. The _____ table contains all of the different elements.

How do you abbreviate an element's name?

33. Elements can be written as symbols. The first letter is always _____ and the second letter is always lower case.

What information can you get from the box on the periodic table?



34. The boxes on the periodic table have the element's name, it's symbol, and two _____.
35. The atomic number is the _____ number and equal to the number of _____.

Name _____

36. The atomic mass is the decimal and equal to the number of _____ plus _____.

What charge does an atom have?

How does the number of protons compare to the number of electrons?

37. Atoms of the same element always have the same number of _____.

38. Atoms are _____, so they have the same number of protons and electrons.

What element has 6 protons?

How many electrons would that element have? Why?

39. To determine the number of protons in an atom, just look at the atomic _____ (the whole number).

40. Remember, in an atom, the number of protons equals the number of _____.

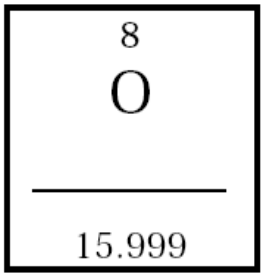
Predict how you would find the number of neutrons for Aluminum whose atomic number is 13 and atomic mass is 27.

41. To find the number of neutrons in an atom you _____ the atomic mass to the nearest whole number.

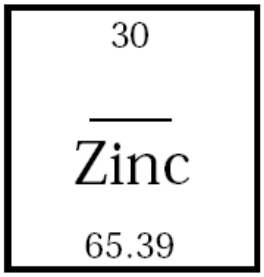
42. Then, you subtract the number of _____ from the atomic mass.

Equation:
# of Neutrons = _____ - _____

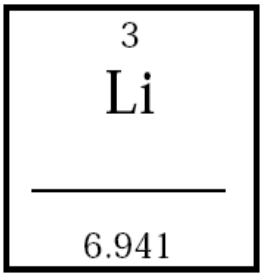
Practice Problems



Atomic # = _____
Atomic Mass = _____
# of Protons = _____
# of Neutrons = _____
# of Electrons = _____



Atomic # = _____
Atomic Mass = _____
# of Protons = _____
# of Neutrons = _____
# of Electrons = _____



Atomic # = _____
Atomic Mass = _____
# of Protons = _____
# of Neutrons = _____
# of Electrons = _____

What element has 12 protons?

What element has 6 protons?

How many protons, neutrons, and electrons are in Sulfur?

How many protons, neutrons, and electrons are in Potassium?

Review Questions

- What is the atomic number?

Name _____

- What makes up the atomic mass?
- What charge does an atom have?
- In an atom, how do the number of protons compare to the number of electrons?
- Where do you find protons, neutrons, and electrons in an atom?
- What are the charges of protons, neutrons, and electrons?

Chemical Symbols and Ions—Notes

- **I can write an element as a complete symbol.**
- **I can determine the number of protons, neutrons, and electrons in an atom and an ion.**
- **I can determine the charge of an ion.**

Predict how you would write the complete chemical symbol for Neon. What do you need to include?

Writing elements as complete symbols:

1. To write an element as a _____ symbol, you must include the symbol, the atomic mass and the atomic number.
2. To begin with, write the element using its abbreviation or _____.
3. _____ the atomic mass to the nearest whole number.
4. Place the atomic mass in the _____ left (Big # on top).
5. The atomic mass is still equal to the number of protons and _____.
6. The atomic number goes on the _____ left.
7. The atomic number is equal to the number of _____.
8. If the atom has a charge, place it in the _____ right.

Examples:

Ions:

What is the only particle in an atom that can be gained or lost? Why?

1. Atoms can gain or lose _____.
2. When atoms gain or lose electrons, they are no longer neutral, and gain a _____.
3. Atoms with a charge are called _____.

If an atom has more protons than electrons, will it be positive or negative?

When an atom gains an electron, will it be positive or negative?

4. An ion that has more _____ than electrons is _____.
5. An ion that has less _____ than electrons is _____.

Name _____

When chlorine gains an electron, does it become a new element? Why or why not?

What determines the type of element an atom is?

6. When an atom becomes an ion, the _____ symbol does not change.
7. To write an ion as a complete symbol, you add the charge to the _____ right.
8. The atomic mass and atomic number are still _____.

9. Equation for ions:

10. Hint: Write the electrons as a negative number.

Examples:

Practice with Chemical Symbols and Ions—Notebook Grade

1. Write the complete chemical symbol for lead.
2. Write the complete chemical symbol for silver.
3. Write the complete chemical symbol for nickel.
4. Write the complete chemical symbol for the element that has 86 protons.
5. Write the complete chemical symbol for the element that has 41 protons.

Ions

1. An atom of nitrogen has 7 protons and 10 electrons, write its chemical symbol.
2. An atom of strontium has 38 protons and 36 electrons, write its chemical symbol.
3. How many protons, electrons, and neutrons are present in the $^{24}_{12}Mg^{+2}$ ion?
4. How many protons, neutrons, and electrons are present in the $^{31}_{15}P^{-3}$ ion?
6. Write the complete chemical symbol for the ion with 52 protons, 76 neutrons and 54 electrons.
7. Write the complete chemical symbol for the ion with 13 protons, 14 neutrons, and 10 electrons.

Name _____

Review Questions

- What information is included when writing elements as complete symbols?
- What number goes on the top on the left side?
- What number goes on the bottom of the left side?
- What is an ion?
- How does an atom become an ion?
- When writing ions as symbols, where does the charge go?
- How do you determine the number of electrons in an ion?

Radioactive Decay Notes

- I can identify the different types of decay.
- I can write nuclear decay equations for alpha and beta decay.
- I can determine what element will remain after alpha or beta decay occurs.

Do atoms become something new when they gain or lose an electron to become an ion? Why or why not?

1. When atoms become ions, the atom does not _____.
    - A calcium ion is still _____.

What do you think radioactive decay is?

2. Radioactive decay is the spontaneous breakdown of an _____ atomic nucleus.
3. When radioactive decay occurs, the atom usually becomes a new _____.
4. There are _____ types of radioactive decay.

Name	Symbol	Charge
Alpha		
Beta		
Gamma		

5. Alpha particles are made of two _____ and two _____.

What element does an alpha particle seem to be similar to?

6. An alpha particle is written as:
7. Alpha particles are easily stopped by _____.

An alpha particle takes two protons out of the nucleus, what is that going to do to the atomic number?

What do you think a neutron is made of? If it breaks down, what would it make?

8. Beta particles are caused by the breakdown of a neutron into:
9. The proton stays in the _____.
10. The electron is _____.
11. Beta particles are written as:

Name _____

What do you think the e stands for in a beta particle?

Since the proton stays in the nucleus, what is that going to do to the atomic number of the element?

The mass number of a beta particle is 0, what does that mean?

12. The atomic mass number of a beta particle is zero because _____ have no mass.
13. Beta particles can penetrate _____ into solid material, including skin.
14. Gamma rays are very energetic forms of _____.
15. They are similar to _____ and can't be seen.
16. Gamma particles are written as:
17. Gamma particles are able to penetrate _____ material, including body tissues
18. Gamma particles are only stopped by _____, concrete, and other thick materials.

Nuclear Equations:

1. Nuclear equations keep track of the _____ parts.
2. Arrows in an equation mean _____ or produce.
3. Arrows point in the direction the _____ occurs.
4. First, write the element you start with as a _____ symbol.
5. Draw an _____ pointing to the right.
6. After the arrow, place the symbol for the type of _____ and a _____ sign.
7. Subtract across the equation to find the new _____, and write it as a complete symbol.

Alpha decay examples:
Write the alpha decay of Lead.

Write the alpha decay of Platinum.

Hint: The sum of the mass numbers and atomic numbers must be the same before and after the equation.

Beta decay examples:
Write the beta decay of Uranium.

Write the beta decay equation for Tin.

In gamma decay, the atom does not _____ into a different element.

Name _____

Review Questions

- What is radioactive decay?
- What are the three types of radioactive decay?
- Which type of decay is similar in structure to a helium atom?
- What type of decay causes the most damage to humans?
- What is broken down in beta decay?
- What two types of decay result in new elements?

Isotopes

- I can define an isotope.
- I can explain how isotopes affect atomic mass.
- I can calculate atomic mass based on relative abundance.

In an atom of a specific element, like carbon, what subatomic particle is always the same?

1. Atoms of the same element always have the same number of _____.
2. If the atom is neutral, the number of _____ equals the number of protons.
3. Atoms of the same element can have different numbers of _____.

If an atom of aluminum has 15 neutrons instead of 14, what is that going to change?

4. An _____ is an atom with the same number of protons but a different number of neutrons.
5. Most elements in the first two rows have at least _____ isotopes.
6. For instance, hydrogen has _____ isotopes.
7. To name an isotope**,** use the name of the element followed by the isotope's _____ number.

Example:
Hydrogen- Hydrogen- Hydrogen-

In hydrogen-1, hydrogen-2, and hydrogen-3, what subatomic particle is changing?

Is this going to change the properties of hydrogen in any way? Why or why not?

8. Isotopes of the same element have the same _____ properties.
9. In other words, the atoms of isotopes _____ the same way.
10. The major difference between two isotopes is their _____.
11. Adding a neutron _____ the mass of an isotope.
12. The atomic mass is an _____ of the isotopes of an atom.
13. This why the atomic mass is a _____ on the periodic table.
14. Isotopes of an atom do not occur in nature in the same _____.
15. Therefore, an average is used to calculate atomic _____.

The atomic mass of hydrogen on the periodic table is 1.0079, which isotope do you think is the most abundant? Why?

Example:

Name _____

How are we going to find the atomic mass of carbon using the information below?

Isotope	Mass	Percent Abundance
Carbon-12	12	.9889
Carbon-13	13.003	.0111

16. To find the atomic mass, you _____ the mass by the percent abundance.

15. You then add all of the masses together to get the _____ mass.

Example:
Calculate the atomic mass of copper if copper-63 is 69.17% abundant and copper-65 is 30.83% abundant.

	Chromium-58	Chromium-63
# of protons		
# of neutrons		
# of electrons		

Review Questions

- What is an isotope?
- What subatomic particle is different in an isotope?
- Do the chemical and physical properties of an isotope change? Why or why not?
- How do you write the name of an isotope?
- Why is atomic mass a decimal on the periodic table and not a whole number?

Half-Life Notes

- I can define half-life.
- I can determine how much sample is left after a set number of half lives.
- I can explain why mass is not conserved in radioactive decay.

Why does an atom undergo radioactive decay?

1. A _____ is an isotope that has an unstable nucleus and undergoes radioactive decay.
2. Every radioisotope has a characteristic _____ of decay.

Predict what you think a half life is.

3. A _____ is the time required for one-half of the radioisotopes to decay to products.
4. After one half-life, _____ of the original radioactive atoms have decayed into atoms of a new element.
5. The other half of the atoms are _____.
6. Half-lives may be as short as a _____ of a second or billions of years.

How could half-lives be useful?

7. Scientists use the half-lives of some naturally occurring radioisotopes to determine the _____ of ancient artifacts.

Name _____

8. Since all live things contain _____, the radioisotope _____ can be used to determine the age of anything that was once living.

9. This is called Carbon _____.

10. Carbon-14 has a half-life of _____ years.

11. However, carbon dating can only date objects between _____ and _____ years old.

Why is there a limit to how old an artifact can be to use carbon dating?

12. The limit is due to the fact that after so many half-lives, the amount of _____ is too small to detect.

Calculations

1. Iodine-131 has a half life of 8 days, how much is remaining after 24 days if you start with 12 grams?

2. A sample initially contains 248 grams of strontium-90, which has a half-life of 29 years. How much strontium-90 is left after 52 years?

Mass Defect

What do we know about the mass of atoms before an after a chemical reaction?

1. During radioactive decay, a small amount of _____ is lost during the reaction.

2. That mass is converted into _____.

3. Therefore, matter is not _____ during nuclear reactions.

4. Einstein discovered this and it is explained in his equation _____.

5. Where E is equal to _____.

6. The m is equal to _____.

7. Finally, c is equal to the speed of _____.

8. Mass _____ is the small amount of mass lost during radioactive decay.

Review Questions

- What is half life?
- How are half-lives useful?
- What is a radioisotope?
- Why is mass not conserved during radioactive decay?
- What equation explains mass defect?