Unit 1

Know the structure of the atom.

a) Define atom-**the smallest particle of an element that can exist either alone or in combination** ,
neutron- **a subatomic particle of about the same mass as a proton but without an electric charge,**
proton- **a positively charged subatomic particle**,
electron- **a subatomic particle with a negative charge and almost no mass,**
atomic number- **the number of protons in the nucleus of an atom**,
atomic mass- **the number of protons and neutrons in the nucleus of an atom.**

b) How would you determine how many protons an atom has? **The atomic number.**
Electrons? **Same as the atomic number in a neutral atom.**
Neutrons? **Subtract the atomic number from the atomic mass.**

c) Which two sub-atomic particles make up the atomic mass of an atom? **Protons + neutrons = mass**

d) Where are the protons, neutrons, and electrons found in an atom? **Protons and neutrons in the nucleus, electrons in the electron cloud**

e) What do all atoms of the same element have in common? (What must never change for the same atom?) **Same number of protons**

f) How many protons, neutrons, and electrons does Ni have? **Protons = 28, electrons = 28, neutrons= 31**

g) How many protons, neutrons, and electrons does Au-197 have? **Protons = 79, electrons = 79, neutrons= 118**

Know the significant scientists, experiments, and finds for the history of the atom.

Know the scientists that contributed to the development of atomic structure and their significant contributions.

a) Rutherford- **Gold Foil Experiment, atom is mostly empty space, nucleus is very dense and positively charged**
b) Bohr- **Solar System Model, electrons move in circular paths around the nucleus of an atom**
c) Schrodinger - **current model of atom, Quantum Mechanical Model (Electron Cloud Model)**
d) J.J. Thomson- **Cathode Ray Tube (Plum Pudding Model), discovered the electron and it was negatively charge**

Know the difference between ion and isotope.

a) Define ion- **an atom with a charge (due to gaining or losing an electron),**
anion- **negatively charged ion (usually a nonmetal),**
cation- **positively charged ion (usually a metal)**,
isotope- **an atom with a different number of neutrons .**

b) What can change between an atom and ion of the same element? **The number of electrons**
c) What can change between an atom and isotope of the same element? **The number of neutrons**
d) Lithium will become a cation or anion? So, it will gain or lose electrons? **Cation, lose electrons, Li^+**
e) How do you find the average atomic mass?

Isotopes	Atomic Mass	% Natural Abundance
^{35}Cl	34.968853	75.78
^{37}Cl	36.965903	24.22

__Solution__

$$Average\ Atomic\ Mass = \frac{(mass\ of\ isotope\ A \times \%\ natural\ abundance) + (mass\ of\ isotope\ B \times \%\ natural\ abundance)}{100}$$

Substitute:

$$Average\ Atomic\ Mass = \frac{(34.968853 \times 75.78) + (36.965903 \times 24.22)}{100}$$

Final Answer:

$$Average\ Atomic\ Mass\ of\ Cl = 35.45253851\ \text{amu}$$

f) Why is the average atomic mass different from a normal average? **The average atomic mass of is calculated by multiplying the mass of each isotope by its natural abundance (the decimal percent). Instead of a normal**

average that is found by adding all of the numbers in a set together and then dividing them by the quantity of numbers in the set.

g) If there are three isotopes of one element that are fairly common. One has a mass of 28.965 and is found 65.5% of the time. Another has a mass of 23.96 and is found 10.1% of the time. The final isotope has a mass of 27.11 and is found 24.4% of the time. Find the average atomic mass of this element.

Average atomic mass = $\frac{(28.965 \times 65.5) + (23.96 \times 10.1) + (27.11 \times 24.4)}{100} = 28.01$

Know how to classify matter.

a) Know key terms like:
matter- **Anything that has mass and occupies space**,
atom- **the smallest particle of an element that can exist either alone or in combination** , element- **A substance that cannot be broken down into simpler substances by chemical means.**
Mixture- **A mixture is a combination of two or more pure substances in which each pure substance retains its individual chemical properties.**
pure substance- **substances that are made of only one type of atom or only one type of molecule (a group of atoms bonded together)**
homogeneous mixture**- any combination of substances that has uniform composition and properties; a *mixture* that is uniform throughout.**
Solution**- is a homogeneous mixture composed of two or more substances. Can be a solid, liquid or gas**
heterogeneous mixture- **any combination of substances that is not uniform in composition and properties;.**
compound- **A compound is a substance formed when two or more chemical elements are chemically bonded together**

b) Identify each as either an element or a compound. Put an E for element and a C for compound.
_E_ Au __C_H_2O _C_NaCl __E_He

c) Describe the difference between an **Element- A substance that cannot be broken down into simpler substances by chemical means. Compound- A compound is a substance formed when two or more chemical elements are chemically bonded together**.

d) Identify each as either a homogeneous mixture (Ho) or heterogeneous mixture (He).
_He Chocolate Chip Cookie Dough __He Trail Mix
__Ho Air __Ho Salt Water (completed dissolved)
___He Granite __Ho Shampoo

Know the difference between physical and chemical properties and changes.

a) Define physical change- **Any change that occurs without altering the chemical composition of a substance is a physical change. (Ex: freezing, melting, cutting).**
Define chemical change **- a change where one or more substances are altered into new and different substances. (ex: burning)**

b) What are the five indicators of a chemical change? **Color change, production of gas, production of a solid (precipitate), production of light or heat, production of an odor**

c) Identify each of the examples as a physical (P) or chemical (C) change.
__(P) _ glass breaking ___(C) __ burning toast __(C) ___frying an egg
____(C) ___ a nail rusting ____(P) _ making salt water ___(P) _ mowing the lawn

d) Identify each of the examples as a physical (P) or chemical (C) property.
___(P) ___ **color (as a description not a color change!!)** ___(P) __ taste
____(P) __ ability to dissolve ___(C) ability to rust ___(C) flammability ____(P) density

Know how to identify elements from the periodic table as metals, nonmetals, and metalloids.

a) Describe the main characteristics and properties of each type of element:
Metal- **good conductor of heat and electricity, ductile & malleable, lustrous (shiny)**
Nonmetal- **Brittle, dull, poor conductor of heat and electricity**
metalloid/semi-metal- **brittle, good conductor of heat and electricity, lustrous (shiny)**

b) Identify each of the elements below as metals (M), nonmetals (N), or metalloid/semi-metal (S).
_(S)_ Si (N) F (M) Li (M) Ag (N) C

c) If an element is shiny, good conductor of electricity it is probably a Metal

Know the organization of the periodic table.

a) What are the vertical columns called? Group or family Horizontal rows? periods

b) Where are the alkali metals? Group 1A Alkaline earth metals? Group 2A Halogens? Group 7A Noble gases? Group 8A

Know the periodic trends: atomic radius, ionic radius, ionization energy, and electronegativity

a) Define atomic radius, ionic radius, ionization energy, and electronegativity.
Atomic radius – the size of the atom
Ionic radius – the size of the ion
Ionization energy – the energy required to remove an electron from the outer most energy level of an atom
Electronegativity – the likelihood to gain an electron

b) What is the trend for atomic radius going across the periodic table? Ionization? Electronegativity?
As you go across the periodic table, the atomic radius decreases.
As you go across the periodic table, the ionization energy increases.
As you go across the periodic table, the electronegativity increases.

c) What is the trend for ionization energy going down the periodic table? Ionization? Electronegativity?
As you go down the periodic table, the atomic radius increases.
As you go down the periodic table, the ionization energy decreases.
As you go down the periodic table, the electronegativity decreases.

d) Why does the ionic radius decrease going across a period?
As you go across the periodic table, you are adding more + and – into the same energy level. The build-up of these charges have a greater attraction to each other and can such the atom in more, making it smaller in size.

e) Why does ionization energy increase going across a period?
As you go across the periodic table, the atoms are smaller and can hold all their electrons closer. When they do that, it will require more energy in order to remove one of those electrons. The bigger the atom, the easier it is to remove an electron.

f) Why does electronegativity increase going across a period?
As you go across the periodic table, the smaller atoms can hold electrons close and are eager to grab one or two electrons to become a noble gas. So the smaller the atom and the closer it is to being a noble gas, the more it wants to bring electrons in.

g) Is a sulfur atom or sulfur ion bigger? Why?
Sulfur ion (anion) is bigger because it brings in electrons when it becomes an ion.

h) Is a potassium atom or potassium ion bigger? Why?
Potassium atom is bigger because when it becomes an ion it loses electrons and becomes smaller.