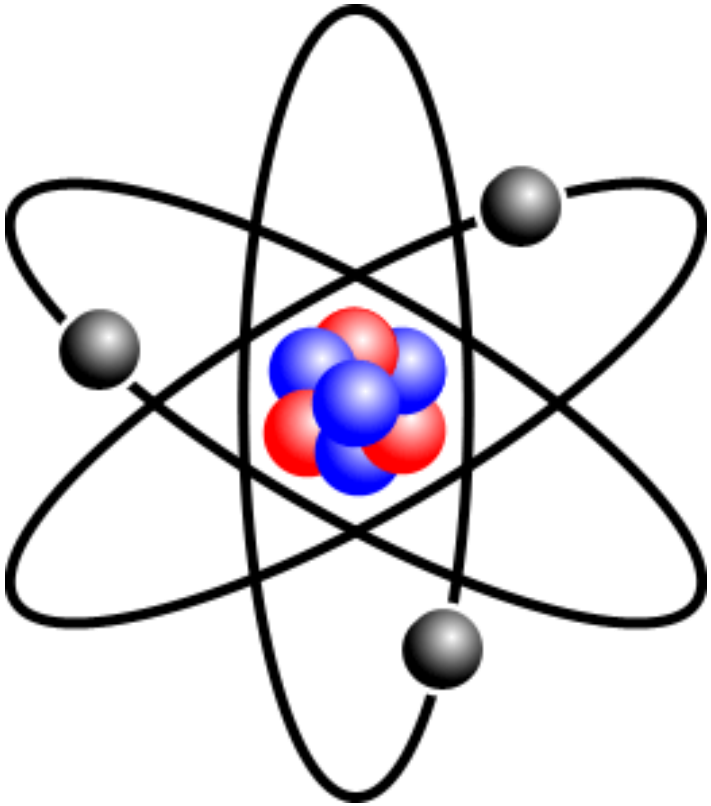
MATTER

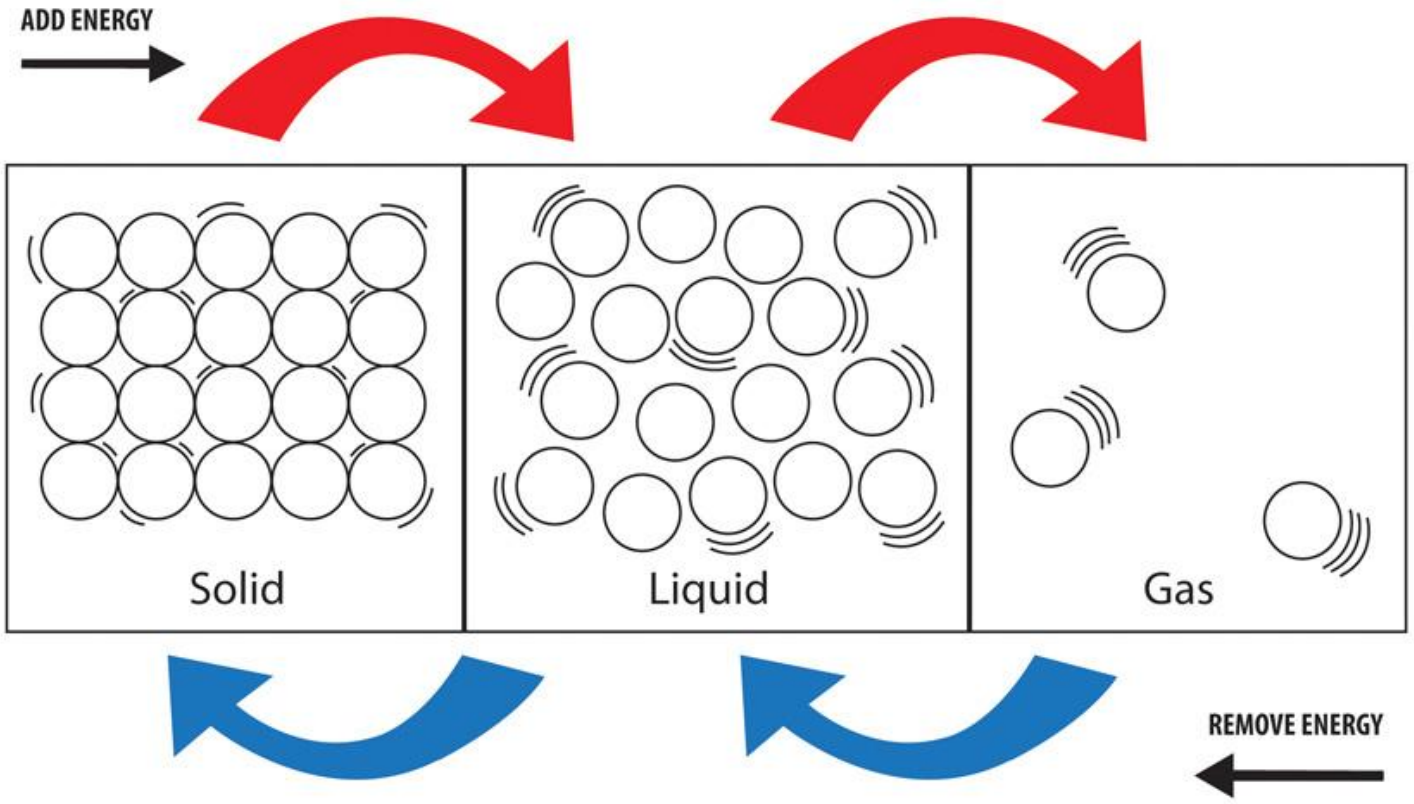


1. WHAT IS MATTER?

- **Matter** is everything that has **mass** and **volume**.
- The different types of matter are called **substances**. Ex: iron, oil.

2. The states of matter

SOLIDS	LIQUIDS	GASES
They have **fixed volume.**	They have a **constant volume.**	They **don't have fixed volume.**
They have **fixed shape.**	They **don't have a shape.** They can **flow.**	They **don't have fixed shape.** They can **expand.**
The particles are **very close together.**	The particles are **less close together** than solids.	The particles are **far apart** from each other.


ADD ENERGY
Solid
Liquid
Gas
REMOVE ENERGY

3. CHANGE OF STATE

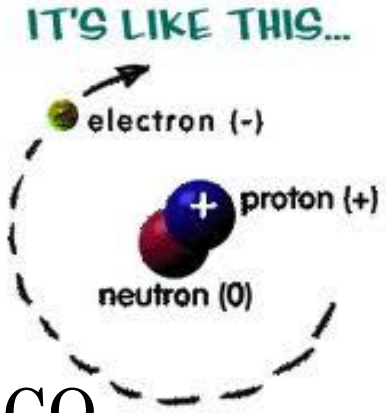
- The heat separates and disperses the particles.

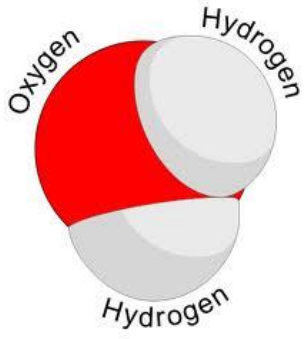
a) Solid to liquid: **Fusion**.
b) Liquid to solid: **Solidification**.
c) Liquid to gas: **Evaporation**.
d) Gas to liquid: **Condensation**.
e) Solid to gas: **Sublimation**
f) Gas to solid: **Inverse sublimation** or deposition.

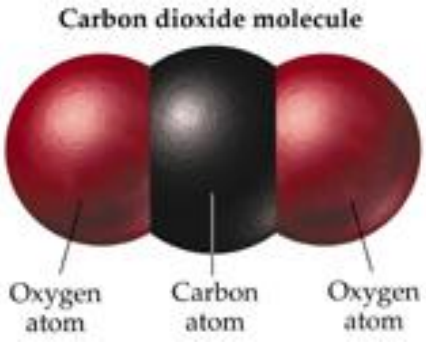
Figure 7.5A Changes of state

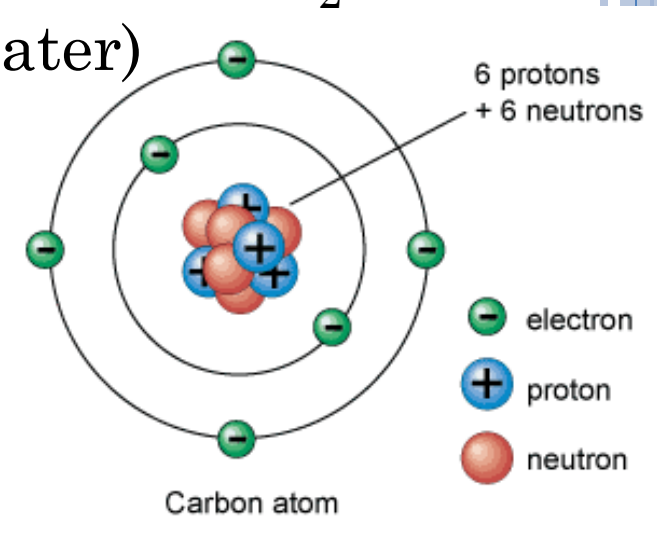
4. ATOMS AND MOLECULES

- All matter is made up of very tiny particles called **atoms.**
- Atoms are the smallest part of any substance.
- Atoms are made up of:
  - A nucleus: **protons** (+) and **neutrons.**(0)
  - **Electrons** (-) around the nucleus.
- Examples: Oxygen, iron, nitrogen, etc.
- Atoms join together to form **molecules**. Ex: CO_2 (Carbon dioxide), O_3 (Ozone), H_2O (water)



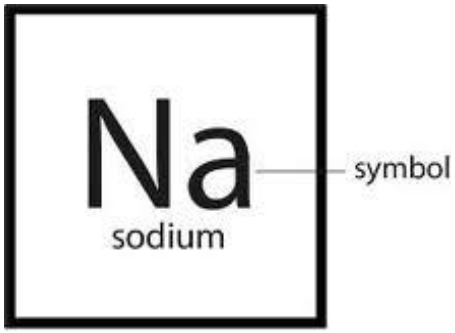


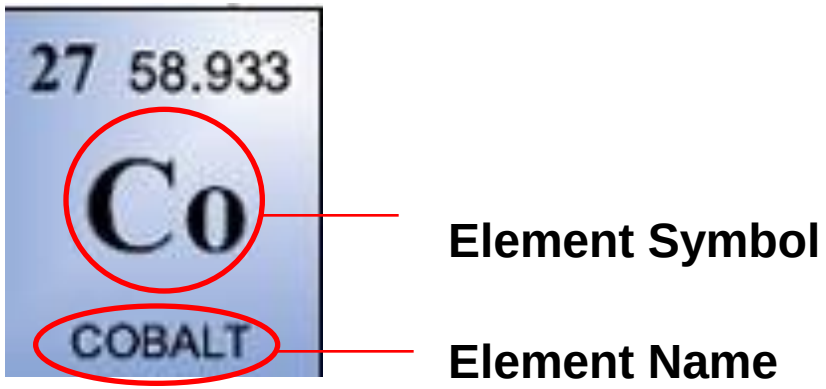




5. ELEMENTS AND COMPOUND

- **Elements** are substances formed by atoms of a single type.
- There are 118 elements.
- It is represented by a **chemical symbol** included in **the periodic table**. Example: Carbon (C)
- **Compounds:** There are two or more different atoms joined together. Ex: Salt (NaCl), water (H_2O)





Periodic Table of the Elements

1A											2A	3A	4A	5A	6A	7A	8A
1 H 1.00794 Hydrogen																	2 He 4.002602 Helium
3 Li 6.941 Lithium	4 Be 9.012182 Beryllium											5 B 10.811 Boron	6 C 12.0107 Carbon	7 N 14.0067 Nitrogen	8 O 15.9994 Oxygen	9 F 18.9984032 Fluorine	10 Ne 20.1797 Neon
11 Na 22.989769 Sodium	12 Mg 24.3050 Magnesium	3B	4B	5B	6B	7B	8B			1B	2B	13 Al 26.9815386 Aluminum	14 Si 28.0855 Silicon	15 P 30.973762 Phosphorus	16 S 32.065 Sulfur	17 Cl 35.453 Chlorine	18 Ar 39.948 Argon
19 K 39.0983 Potassium	20 Ca 40.078 Calcium	21 Sc 44.955912 Scandium	22 Ti 47.867 Titanium	23 V 50.9415 Vanadium	24 Cr 51.9961 Chromium	25 Mn 54.938045 Manganese	26 Fe 55.845 Iron	27 Co 58.933195 Cobalt	28 Ni 58.6934 Nickel	29 Cu 63.546 Copper	30 Zn 65.38 Zinc	31 Ga 69.723 Gallium	32 Ge 72.64 Germanium	33 As 74.92160 Arsenic	34 Se 78.96 Selenium	35 Br 79.904 Bromine	36 Kr 83.798 Krypton
37 Rb 85.4678 Rubidium	38 Sr 87.62 Strontium	39 Y 88.90585 Yttrium	40 Zr 91.224 Zirconium	41 Nb 92.90638 Niobium	42 Mo 95.96 Molybdenum	43 Tc [98] Technetium	44 Ru 101.07 Ruthenium	45 Rh 102.90550 Rhodium	46 Pd 106.42 Palladium	47 Ag 107.8682 Silver	48 Cd 112.411 Cadmium	49 In 114.818 Indium	50 Sn 118.710 Tin	51 Sb 121.760 Antimony	52 Te 127.60 Tellurium	53 I 126.90447 Iodine	54 Xe 131.293 Xenon
55 Cs 132.9054519 Cesium	56 Ba 137.327 Barium	57-71 Lanthanides	72 Hf 178.49 Hafnium	73 Ta 180.94788 Tantalum	74 W 183.84 Tungsten	75 Re 186.207 Rhenium	76 Os 190.23 Osmium	77 Ir 192.217 Iridium	78 Pt 195.084 Platinum	79 Au 196.966569 Gold	80 Hg 200.59 Mercury	81 Tl 204.3833 Thallium	82 Pb 207.2 Lead	83 Bi 208.98040 Bismuth	84 Po [209] Polonium	85 At [210] Astatine	86 Rn [222] Radon
87 Fr [223] Francium	88 Ra [226] Radium	89-103 Actinides	104 Rf [267] Rutherfordium	105 Db [268] Dubnium	106 Sg [271] Seaborgium	107 Bh [272] Bohrium	108 Hs [270] Hassium	109 Mt [276] Meitnerium	110 Ds [281] Darmstadtium	111 Rg [280] Roentgenium	112 Cp [285] Copernicium	113 Uut [284] Ununtrium	114 Uuq [289] Ununquadium	115 Uup [288] Ununpentium	116 Uuh [293] Ununhexium	117 Uus [294] Ununseptium	118 Uuo [294] Ununoctium

Lanthanides	57 La 138.90547 Lanthanum	58 Ce 140.116 Cerium	59 Pr 140.90765 Praseodymium	60 Nd 144.242 Neodymium	61 Pm [145] Promethium	62 Sm 150.36 Samarium	63 Eu 151.964 Europium	64 Gd 157.25 Gadolinium	65 Tb 158.92535 Terbium	66 Dy 162.500 Dysprosium	67 Ho 164.93032 Holmium	68 Er 167.259 Erbium	69 Tm 168.93421 Thulium	70 Yb 173.054 Ytterbium	71 Lu 174.9668 Lutetium
Actinides	89 Ac [227] Actinium	90 Th 232.03806 Thorium	91 Pa 231.03588 Protactinium	92 U 238.02891 Uranium	93 Np [237] Neptunium	94 Pu [244] Plutonium	95 Am [243] Americium	96 Cm [247] Curium	97 Bk [247] Berkelium	98 Cf [251] Californium	99 Es [252] Einsteinium	100 Fm [257] Fermium	101 Md [258] Mendelevium	102 No [259] Nobelium	103 Lr [262] Lawrencium

Alkali Metals	Alkaline Earth	Basic Metal	Halogen	Noble Gas	Non Metal	Rare Earth	Semi Metal	Transition Metal

6. PURE SUBSTANCES AND MIXTURES

- **Pure substances** are formed by similar particles (atoms or molecules). Ex: iron or sugar.
- **Mixture** is the physical combination of two or more pure substances. Types:
  - **Homogeneus mixture (solution)**: The substances can't be identified. Ex: sea water, wine, chocolate.
  - **Heterogeneus mixture**: The substances can be identified. Ex: water and oil, soup, orange juice.
- Some methods for separating mixtures are magnetic separation, decantation, crystallization and filtration.

ACTIVITIES

1. **What is matter?**
2. **What is a substance?**
3. **State which of the following are matter:** beauty, water, liberty, trees, paper, glass, sadness.
4. **Make a grid and classify the following thing into solid, liquid or gas**: rocks, river water, the air we breath, ice, milk, a fork, an orange juice.
5. **Why does the physical state of a substance change?**
6. **The temperature of an imaginary substance at fusion is 20ºC.**

    a) What state is that substance in if the room temperature is 25ºC?

    b)And if the temperature is 15ºC?

7. **Match the two columns.** (The items on the left can be matched to one or more of the items on the right)

a) Atom	1. Fe
b) Chemical element	2. CH_4
c) Compound	3. Mg
d) Molecules	4. N_2

8. The formula of methane is CH_4. What types of atoms are there in this compound? How many of each type?

9. Draw a nitrogen (N_2) and an ammonia (NH_3) with coloured balls. Use a different colour for each type of atom.

10. **Make a list of five solutions used in daily life.**

11. Classify as pure substance or mixture: sugar, clouds, soup, aluminium.

12. Copy the two columns and match them:

a) Constant shape and volume	1. Fusion
b) Change from gas to solid	2. Gas state
c) Constant volume and variable shape.	3. Solid state
d) From solid to liquid.	4. Sublimation
e) Variable volume and shape.	5. Liquid state

13. let's imagine you put some perfume. Why can people near you smell it? What is that property called?

14. Write the simbols for the following elements: iron, potasium, sodium, phosphorus, sulfur, carbon.

15. **Classify the following into two lists: elements and compounds:** Al, CH_4, O_2, $CaCO_3$, S, H_2

16. True or false? Correct the false sentences.

a) Solutions are mixtures.

b) Sea water and air are solutions.

c) Cow's milk is a pure substance.

17. If we wash a glass and let the water drip, after a while the glass will be dry. What has happened to the water?