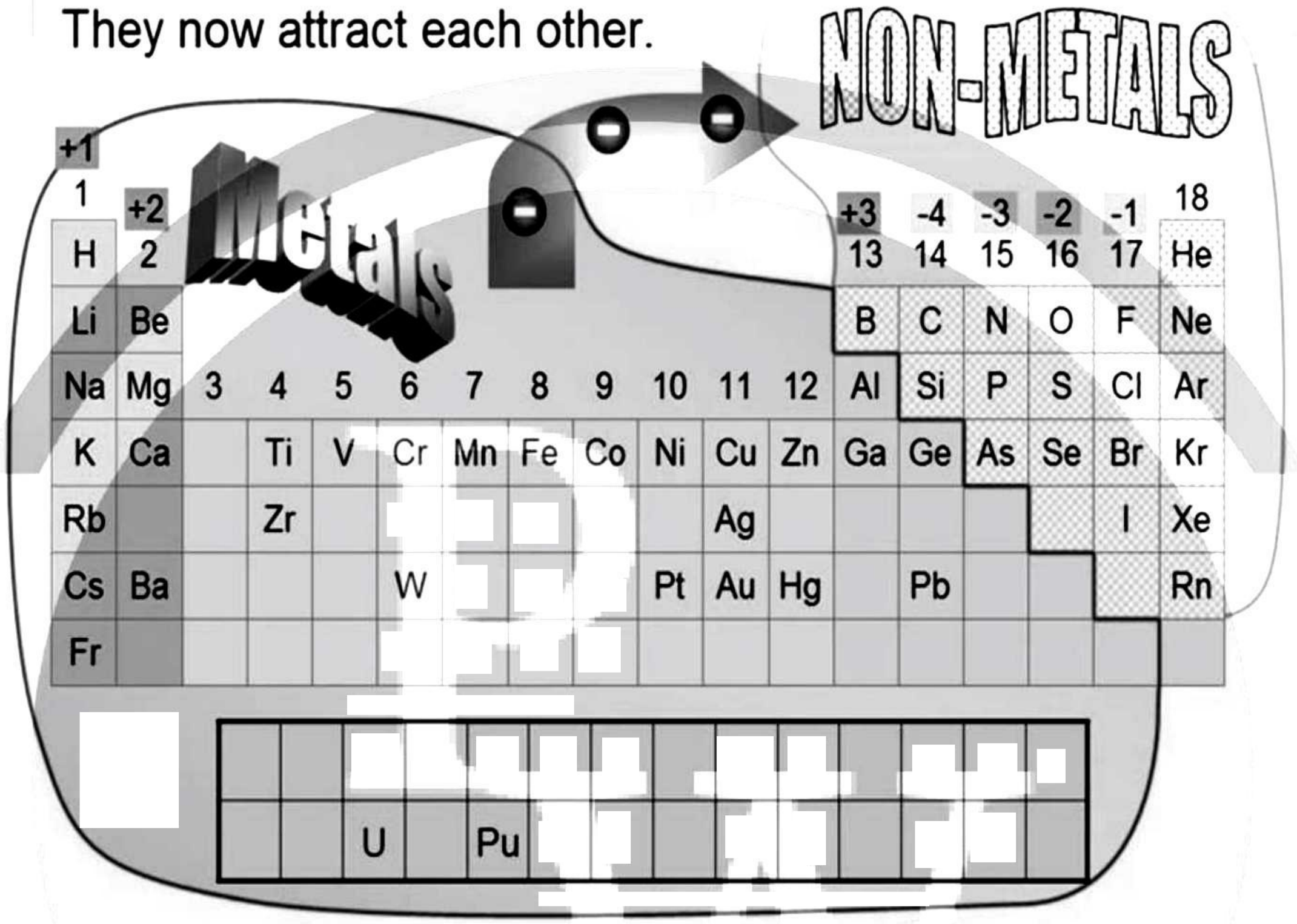
Metal and Non-Metal

A metal gives electron(s) to a non-metal. The metal becomes positive and the non-metal becomes negative. They now attract each other.



Properties of Non-metals

- **Non-metals are not malleable or brittle:** Non-metals cannot be hammered or beaten into thin sheets without breaking. Non-metals break into pieces when hammered or stretched. Sulphur, phosphorus are powders and cannot be made into a sheet. Brittleness is a characteristic property of non-metals.
- **Non-metals are not ductile:** Non-metals cannot be melted and drawn into thin wires. Non-metals do not have free electrons. Thus the bonds between atoms in the elements are weak and they snap when stretched.
- **Non-metals are bad conductors of heat and electricity:** In non-metals, the bonds formed are weak as there are no free electrons to share. Graphite is able to conduct electricity because of its special crystalline arrangement.
- **Non-metals have no lustre:** Non-metals are in the form of powder or are gaseous. Hence they cannot be polished and they do not have any lustre. Most of the powders are dull in colour. Only graphite can be polished to some degree. Iodine shows some luster.

- **Non-metals are not strong:** Due to their non-ductile and non-malleable properties, non-metals are not strong at all. Their bonds break easily.
- **Melting and boiling points:** All non-metals have low melting and boiling points. Graphite and diamonds have high melting points.
- **Density of non-metals:** Non-metals have low densities as compared to metals, which have high densities.

  Non-Metals are not Sonorous. Non-metals do not make any characteristic sound when hit with an object.

DIFFERENCES IN PHYSICAL PROPERTIES OF METALS AND NON-METALS

S.No	Property	Metals	Non Metals
1.	Physical State	Metals are crystalline solids (except mercury, which is a liquid)	**Non-metals are either gases or solids [Exception: Bromine is a liquid]**
2.	Metallic lustre	In their pure state, metals shine. This property is called metallic lustre. In other words, metals can be polished.	**Non-metals are dull to look at, i.e., they cannot be polished [Exceptions: Graphite and iodine are lustrous].**
3.	Density	Metals have high density (except sodium, potassium and lithium)	**Non-metals have low density [Exception: Diamond has high density].**
4.	Hardness	Metals are hard solids (except sodium and potassium, which are soft and can be cut with a knife).	**Non-metals are not hard. If solid they are soft and brittle. For example, phosphorus and sulphur are soft solids and iodine is brittle [Exception : Diamond is the hardest natural substance].**
5	Melting point	Metals have high melting points and high boiling points	**Non-metals have both low melting and low boiling points [Exceptions : Carbon, silicon and boron have both high melting and high boiling points].**
6.	Malleability	Metals are malleable, i.e., they can be hammered into sheets. Gold, silver, copper, aluminium and tin can be beaten into very thin sheets called foils. (But zinc is brittle, i.e., it breaks into pieces when it is hammered).	**Non-metals are non-malleable. When they are hammered they turn into a powder, i.e., non-metals are of a brittle nature.**

7.	Ductility	Metals are ductile, i.e., they can be drawn into wires. Gold, silver, copper and aluminium are highly ductile metals, gold being the most ductile of all metals. [Exception : Zinc, arsenic & antimony cannot be drawn into wires].	**Non-metals are not ductile [Exception: Carbon fibre, a recently developed allotrope of carbon, is ductile]**
8	Tensile strength	Metals have **high tensile strength, i.e., they can bear a lot of strain** [Exception : Zinc].	**Non-metals have low tensile strength [Exception: Carbon fibre has high tensile strength].**
9	Thermal and electrical conductivity	Metals are good conductors of heat and electricity. Silver is the best conductor of heat and electricity.	**Non-metals are bad conductors of heat and electricity [Exceptions: Graphite is good conductor of heat and electricity].**
10	**Sonority**	**Metals produce a twangy sound when they are struck with a hard object, i.e., they are sonorous substances.**	**Solid non-metals do not produce a sound when they are struck, i.e., they are not sonorous substances.**

METAL REACTIVITY SERIES

The reactivity series of metals			
Elements	**Reaction with oxygen**	**Reaction with water**	**Reaction with acid**
1. K **2. Na** **3. Ca**	React with oxygen at ordinary temperature to form oxides (1, 2 & 3)	React with cold water vigorously (1 &2); reacts moderately with water (3)	React **explosively with dilute acids to give hydrogen (1 & 2); reacts less vigorously (3)**
4. Mg **5. Al** **6. Zn** **7. Fe**	Form oxides on heating, but aluminium reacts at ordinary temperature (4, 6 & 7)	Reacts with hot water or steam (4); react with steam only to form oxide & hydrogen (5, 6 & 7)	**React moderately with acid, to produce hydrogen (4, 5, 6 & 7)**
8. Pb **9. [H]** **10. Cu** **11. Hg**	Form oxides on very strong heating (8, 10 & 11)	No reaction with hot water or steam (8, 10 & 11)	**Reacts with conc. HCl to give H_2(8); do not react with dilute acids (10 & 11)**

12. Ag **13. Pt** **14. Au**	**Do not react with oxygen even on strong heating (12, 13 & 14)**	**No reaction with hot water or steam (12, 13 & 14)**	**Do not react with dilute acids (12, 13 & 14)**