

## CHARACTERISTICS AND DESCRIPTION OF THE NON- METALS

### 1. Bromine

- Has a similarly colored with an offensive and suffocating odor. It is only non-metallic element that is liquid under ordinary conditions, it evaporates easily at standard temperature and pressures in a red vapor that has a strong disagreeable odor resembling that of chlorine. Bromine is less active chemically than chlorine and fluorine but is more active than iodine; its compounds are similar to those of the other halogens. Bromine is soluble in organic solvents and in water.



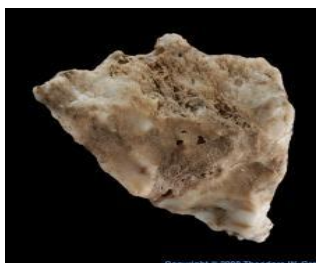
### 2. Carbon

- Is unique in its chemical properties because it forms a number of components superior than the total addition of all the other elements in combination with each other. It forms three gaseous components with the oxygen: carbon monoxide (CO), carbon dioxide (CO<sub>2</sub>) , carbon sub oxide (C<sub>3</sub> O<sub>2</sub>)



### 3. Chlorine

- Gas is two and one half times as heavy as air, has an intensively disagreeable suffocating odor, and is exceedingly poisonous. In its liquid and solid form. It is powerful oxidizing, bleaching, and disinfecting agent. It is extracted from chlorides through oxidation and electrolysis. Chlorine gas is greenish- yellow and combines readily with nearly all other elements .



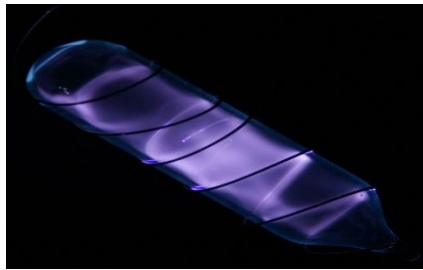
### 4. Fluorine

- Is a univalent poisonous gaseous halogen. It is pale yellow- green and it is the most chemically reactive and electronegative of all the elements. Fluorine is readily forms compounds with most other elements, even with the noble gases krypton, xenon and radon it is also reactive with glass, metals, and even water, as well as other substances, burn with a bright flame in a jet of fluorine gas.



## 5. Hydrogen

- Is the first element in the periodic table. It can be burned in internal combustion engines. Hydrogen fuel cells are being looked into as a way to provide power and research is being conducted on hydrogen as a possible major future fuel. Hydrogen is the most flammable of all the known substances. Hydrogen is slightly more soluble in organic solvents than in water.



## 6. Iodine

- Is a non-metallic, dark-gray/purple-black, lustrous, solid element. Iodine is the most electropositive halogen and the least reactive of the halogens even if it can still form compounds with many elements. Iodine sublimes easily on heating to give a purple vapor. Iodine dissolves in some solvents, such as carbon tetrachloride and it is only slightly soluble in water.



## 7. Nitrogen

- Is a common normally colorless, odorless, tasteless and mostly diatomic non-metal gas. It has five electrons in its outer shell, so it is trivalent in most compounds.



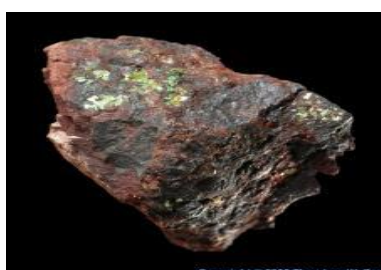
## 8. Oxygen

- Is a colorless, odorless and insipid gas; it condensate in a light blue liquid. Oxygen is reactive and will form oxides with all other elements except helium, neon, argon and krypton. It is moderately soluble in water at 20 Celsius.



## 9. Phosphorous

- Is a multivalent non-metal of the nitrogen group. It is found in nature in several allotropic forms. There are several forms of phosphorous, called white, red and black phosphorous. White phosphorous is the one manufactured industrial; it glows in the dark, is spontaneously flammable when exposed to air and is deadly poison. Red phosphorous can vary in color from orange to purple, due to slight variations in its chemical structure. The third form, black phosphorous, is made under high pressure, looks like graphite and like graphite, and has the ability to conduct electricity.



## 10. Selenium

- Is a non-metallic chemical element, member of the group XVI of the periodic table. In chemical activity and physical properties it resembles sulfur and tellurium. Selenium appears in a number of allotropic forms; the most popular are a red amorphous powder, a red crystalline material, and a gray crystalline metal like form called metallic selenium.



## 11. Sulphur

- Is a multivalent non-metal, abundant, tasteless and odorless. In its native form sulphur is a yellow crystalline solid. In nature it occurs as the pure element or as sulfide and sulfate minerals. The major derivative of sulphur is sulphuric acid ( $\text{H}_2\text{SO}_4$ ), one of the most important elements used as an industrial raw material.



## CHARACTERISTICS AND DESCRIPTION OF THE INERT GASES

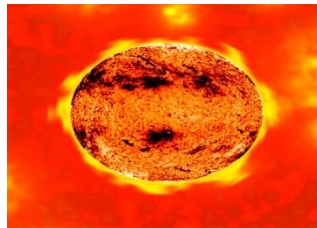
### 1. Argon

- Has approximately the same solubility as oxygen and it is 2.5 times as soluble in water as nitrogen. This chemically inert element is colorless and odorless in both its liquid and gaseous forms. It is not found in any compounds. Argon does not react with the filament in a light bulb even under high temperatures.



## 2. Helium

- Is a colorless, odorless, insipid, and non-toxic gas. It's less soluble in water than any other gas. It's the less reactive element and doesn't essentially form chemical compounds. The density and viscosity of helium vapor are very low. Helium can be liquefied, but its condensation temperature is the lowest among all the known substances. Helium has many unique properties: low boiling point, low boiling point, low density, low solubility, high thermal conductivity and inertness.



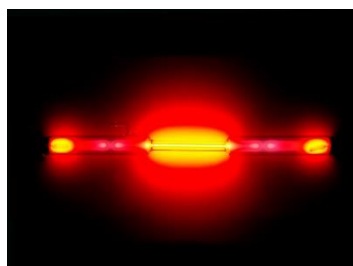
## 3. Krypton

- Is present in the air at about 1ppm. It is characterized by its brilliant green and orange spectral lines. The spectral lines of krypton are easily produced and some are very sharp. Krypton is colorless, odorless, fairly expensive gas.



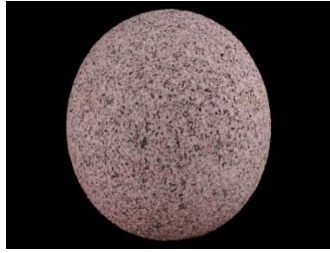
## 4. Neon

- Is the second- lightest noble gas, its color is reddish- orange in a vacuum discharge tube and in neon lamps. The reddish- orange color emitted in neon lights is widely used to make advertising signs.



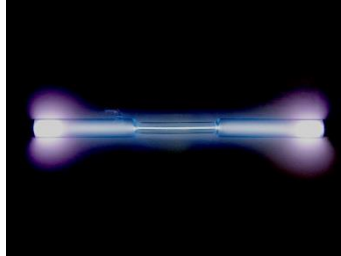
## 5. Radon

- Is colorless at standard temperature and pressure and it is the most dense gas known. It is chemically unreactive, it is highly radioactive and has a short half- life.



## 6. Xenon

- Is a rare, odorless, colorless, tasteless, chemically unreactive gas. It has relatively little commercial use.



## CHARACTERISTICS AND DESCRIPTION OF THE SEMI- CONDUCTORS

### 1. Antimony

- Is a semi- metallic chemical element which can exist in two forms: the metallic form is bright, silvery, hard and brittle; the non- metallic form is a gray powder. It is poor conductor of heat and electricity; it is stable in dry air and is not attacked by dilute acids or alkalis.



### 2. Arsenic

- Appears in three allotropic forms; yellow, black and gray; the stable form is a silver- gray , brittle crystalline solid. It tarnishes rapidly in air, and at high temperatures burns forming a white cloud of arsenic trioxide.



### 3. Astatine

- Is a highly radioactive element and it is the heaviest known halogen. Its chemical properties are believed to be similar to those of iodine.



#### 4. Boron

- Is a non-metallic element. It is electron-deficient, possessing a vacant p-orbital. It reacts also with metals to form borides.



#### 5. Germanium

- Is a hard, lustrous, gray-white, brittle metalloid. It has a diamond-like crystalline structure and it's similar in chemical and physical properties to silicon. Germanium is stable in air and water, and is unaffected by alkalis and acids, except nitric acid.



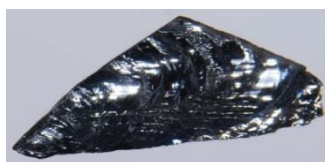
#### 6. Polonium

- Is a radioactive, extremely rare semi-metal. It is reactive, silver-gray. It dissolves in dilute acids, but it is only slightly soluble in alkalis.



#### 7. Silicon

- Is the most abundant electropositive element in the Earth's crust. It's a metalloid with a marked metallic luster and very brittle. It is usually tetravalent in its compounds, although sometimes bivalent, and it's purely electropositive in its chemical behavior. It forms various series of hydrides, various halides and many series of compounds which contain oxygen, which can have ionic or covalent properties.



#### 8. Tellurium

- Is semi-metallic, lustrous, crystalline, brittle, silver-white element. It is usually available as a dark grey powder. It has the properties both of the metals and the non-metals. Tellurium forms many compounds corresponding to those of sulfur and selenium. Tellurium is not affected by water or hydrochloric acid, but dissolves in nitric acid.





## CHARACTERISTICS AND DESCRIPTION OF THE LANTHANIDES AND ACTINIDES

### 1. Americium (Am)

- Is a silvery- white synthetic metal. It slowly tarnishes in dry air, but it is resistant to alkali. It is denser than lead.



### 2. Berkelium (Bk)

- Is a radioactive metallic element that is a member of the actinide group of elements. It is silvery in color and its chemistry has been investigated to a limited extent and several compounds have been made, no practical use of berkelium has done far emerged.

### 3. Californium (Cf)

- Is a radioactive metal which is a member of the actinide group of the periodic table. A sample of the metal itself it has not been produced yet because its compounds resist reduction. It is expected to be readily attacked by air, steam and acids and not by alkali.

### 4. Cerium (Ce)

- Is a malleable, soft, ductile, iron-grey metal, slightly harder than lead. It is very reactive: it tarnishes readily in the air, it oxidizes slowly in cold water and rapidly in hot water. It dissolves in acids. It can burn heated or scratched with a knife.

### 5. Curium (Cm)

- Is a hard, brittle, silvery metal that tarnishes slowly in dry air at room temperature. Curium does not occur naturally; it is typically produced artificially in nuclear reactors through successive neutron captures by plutonium and americium isotopes.

### 6. Dysprosium (Dy)

- Is a lustrous, very soft, silvery metal. It is stable in air at room temperature even if it is slowly oxidized by oxygen. It reacts with cold water and rapidly dissolves in acids. It forms several brightly colored salts.

### 7. Einsteinium

- Is a member of the actinide series, it is metallic and radioactive, with no known uses. It is attacked by oxygen, steam and acids but not alkalis.

### 8. Erbium (Er)

- Is a soft, malleable, lustrous, silvery metal. It is very stable in air, it reacts very slowly with oxygen and water and dissolves in acids. Its salts are rose colored and it has a sharp absorption spectra in visible, ultraviolet and infrared light.

### 9. Europium (Eu)

- Is a soft silvery metal, and expensive. It is the most reactive of the lanthanide group; it tarnishes quickly in air at room temperature, burns at about 150 C and reacts readily with water.

#### 10. Fermium (Fm)

- Is a radioactive element and a member of the actinide group of the periodic table of elements. There are no commercial reasons for fermium to be produced, but it might one day have some use in medicine..

#### 11. Gadolinium (Gd)

- Is a soft, shiny, ductile, silvery metal belonging to the lanthanide group of the periodic table. Gadolinium becomes superconductive below 1083 K. It is strongly magnetic at room temperature.

#### 12. Holmium (Ho)

- Is a malleable, soft, lustrous metal with a silvery color, belonging to the lanthanides series of the periodic table of elements. It is slowly attacked by oxygen and water and dissolves in acids. It is stable in dry air at room temperature.

#### 13. Lawrencium (Lr)

- Is the second transactinoid element with the most stable isotope <sup>262</sup>Lr having a half-life of 216 minutes. Its chemical data are limited to its atomic number, its half-life and isotopes. It is named after Ernest O. Lawrence, the inventor of the cyclotron, the research instrument with which several new elements have been first produced. The transactinoid elements have either application nor economic role.

#### 14. Lutetium (Lu)

- Is very expensive to obtain in useful quantities and therefore it has very few commercial uses.

#### 15. Mendelevium (Md)

- Is the first transactinoid element with the most stable isotope <sup>258</sup>Md having a half-life of 52 days. It is named after Dmitri Mendeleev, who produced one of the first periodic table. The transactinoid elements have neither application nor economic role.

#### 16. Neodymium (Nd)

- Is a lustrous silvery – yellow metal. It is very reactive and quickly tarnishes in air and the coated formed does not protect the metal from further oxidation, so it must be stored away from contact with air. It reacts slowly with cold water and rapidly with hot.

#### 17. Neptunium (Np)

- Is a ductile, silvery, radioactive metal. Neptunium forms numerous chemical compounds. Chemically it is extremely reactive and is attacked by oxygen, steam and acids, but not alkalis. Neptunium has been used in neutron detectors. It does not have any commercial application.

#### 18. Nobelium (No)

- Is the second transactinoid element with the most stable isotope <sup>259</sup>No having a half-life of 58 minutes. Its chemical data are limited to its atomic number, its half-life and isotopes. The transactinoid elements have neither application nor economic role.



19. Plutonium (Pu)

- Is a key fissile component in modern nuclear weapons; care must be taken to avoid accumulation of amounts of plutonium which approach critical mass, the amount of plutonium which will self- generate a nuclear reaction.

20. Praseodymium (Pr)

- Is a soft malleable, silvery- yellow metal. It is a member of the lanthanide group of the periodic table elements. It reacts slowly with oxygen; when exposed to air it forms a green oxide that does not protect it from further oxidation. It is more resistant to corrosion in air. The other rare metals, but It still needs to be stored under oil or coated with plastic. It reacts rapidly with water.

21. Promethium (Pm)

- Is a rare-earth metal that emits beta radius. It is very radioactive and rare, so it is little studied; its chemical and physical properties are not well defined.

22. Protactinium (Pa)

- Is a silver metallic element that belongs to the actinide group. it is malleable, shiny, silver-gray, and radioactive. It does not tarnish rapidly in air, it is attacked by oxygen, steam and acids, but not by alkalis. Due to its scarcity, high radioactivity and toxicity, there are currently no uses for protactinium outside of basic scientific research.

23. Samarium (Sm)

- Is a silvery- white metal belonging to the lanthanide group of the periodic table. It is relatively stable at room temperature in dry air, but it ignites when heated above 150 C and forms an oxide coating in moist air.

24. Terbium (Tb)

- Is a soft, malleable, ductile, silver- gray metal member of the lanthanide group of the periodic table. It is reasonably stable in air, but it is slowly oxidized and it reacts with cold water . Terbium is rare and expensive, It has a few commercial uses.

25. Thorium (Th)

- Is slowly attacked by water, but does not dissolve readily in most common acids, except hydrochloric. Powdered thorium metal is often pyrophoric and should be carefully handled. When heated in air, thorium turnings ignite and burn brilliantly with a white light.

26. Uranium (U)

- Is a hard, dense, malleable, ductile, silvery- white, radioactive metal. Uranium metal has very high density. When finely divided, it can react with cold water. In air it is coated by uranium oxide, tarnishing rapidly, it is attacked by steam and acids. Uranium can form solid solution and intermetallic compounds with many of other metals.

27. Ytterbium (Yb)

- Is a soft, malleable and rather ductile element that exhibits a bright silvery luster. A rare earth, the element is easily attacked and dissolved by mineral acids, slowly reacts with water, and oxidizes in air.