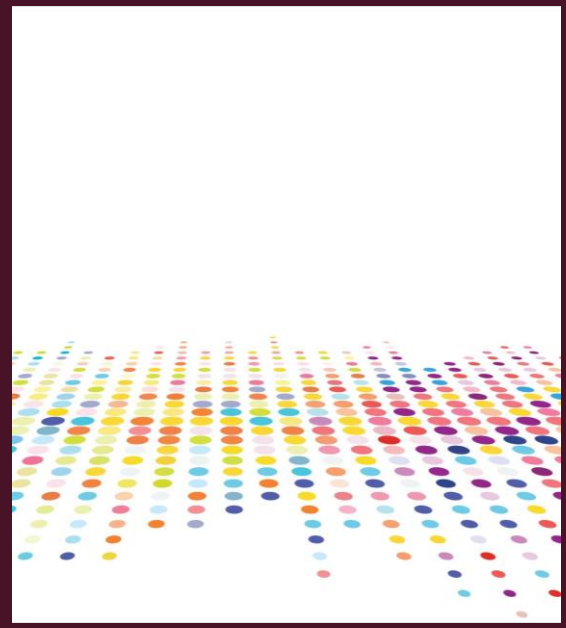
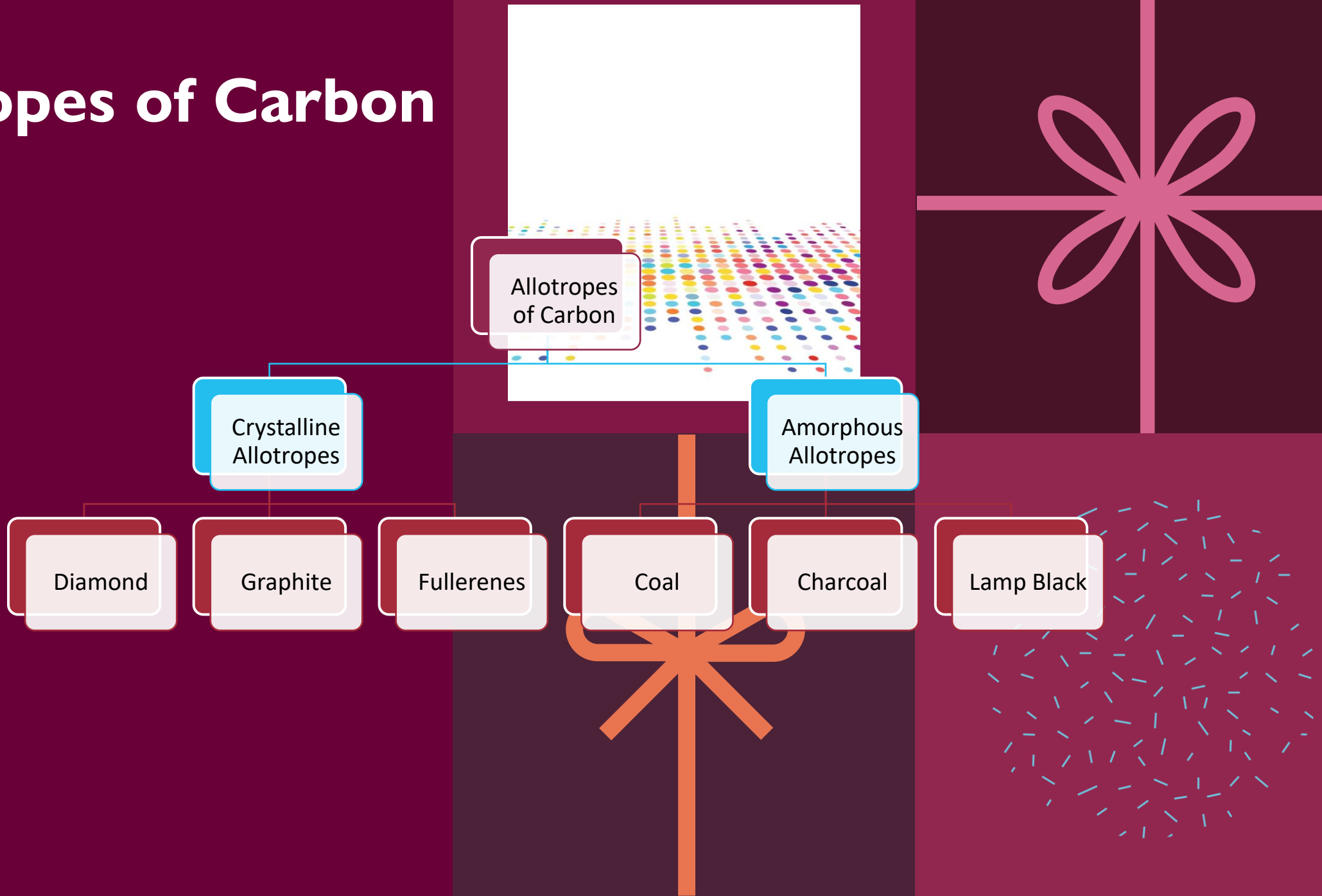
Allotropes

Allotropes are different structural forms of the same element and can exhibit quite different physical properties and chemical behaviors. The change between allotropic forms is triggered by the same forces that affect other structures, i.e., pressure, light, and temperature.



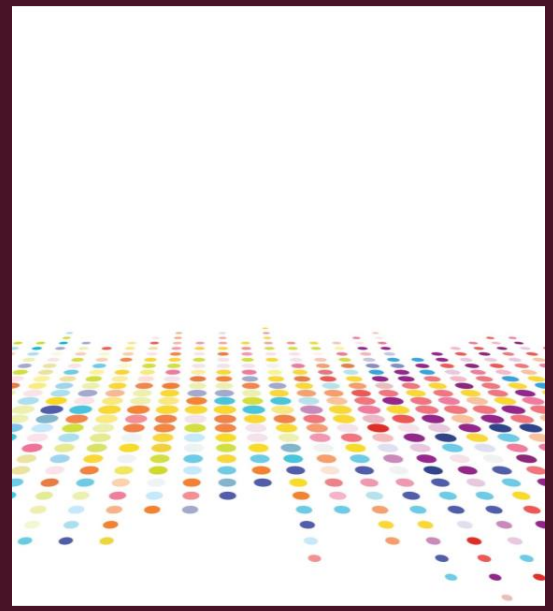
Allotropes of Carbon



GRAPHITE

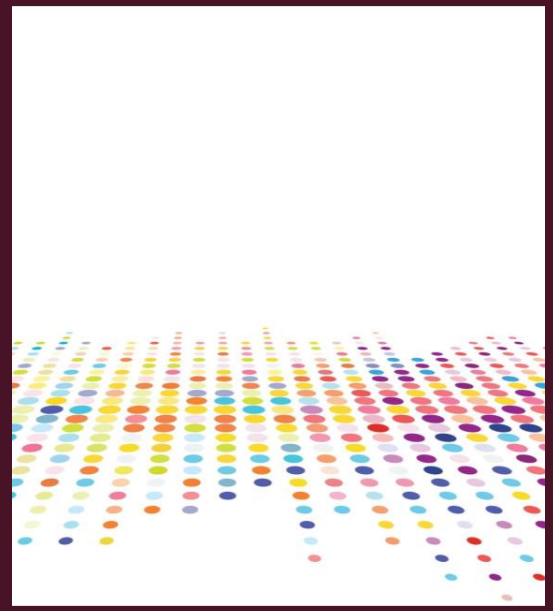
The term graphite is derived from the Greek word “graphene,” which means to write. Graphite is a distinct material as it displays the properties of both a metal and a non-metal.

Although graphite is flexible, it is not elastic and has high electrical and thermal conductivity. It is also chemically inert and highly refractory. Since graphite displays low adsorption of X-rays and neutrons, it is very valuable in nuclear applications.

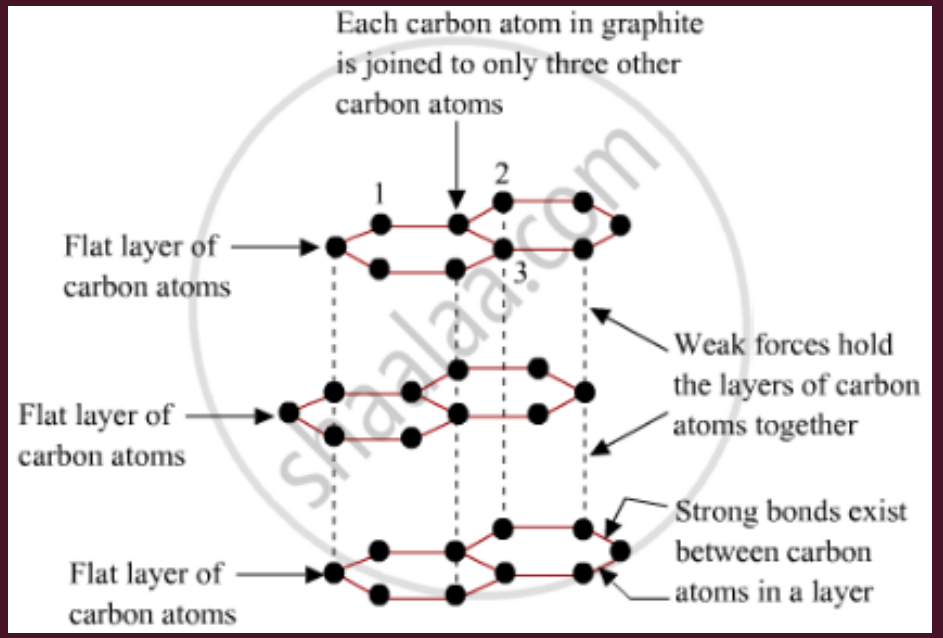


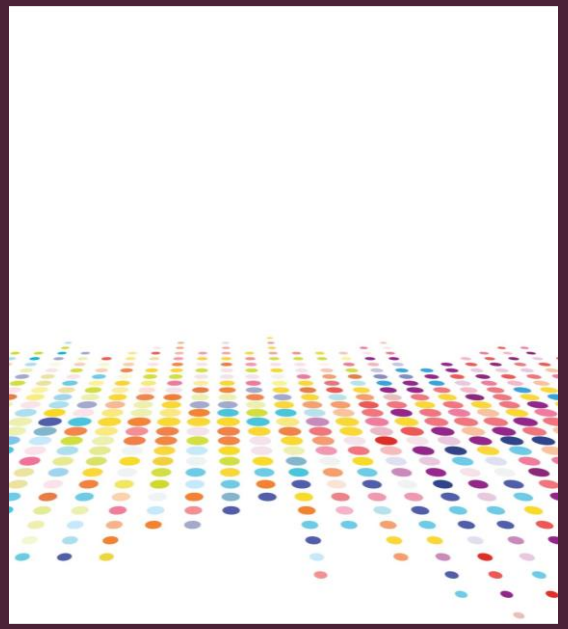
GRAPHITE

This uncommon combination of properties is due to graphite's crystalline structure. The carbon atoms are set hexagonally in a planar condensed ring system. The layers are stacked parallel to each other. The atoms within the rings are bonded covalently, while the layers are loosely linked together by van der Waals forces. Graphite has a high degree of anisotropy, which is caused by two types of bonding acting in different crystallographic directions.

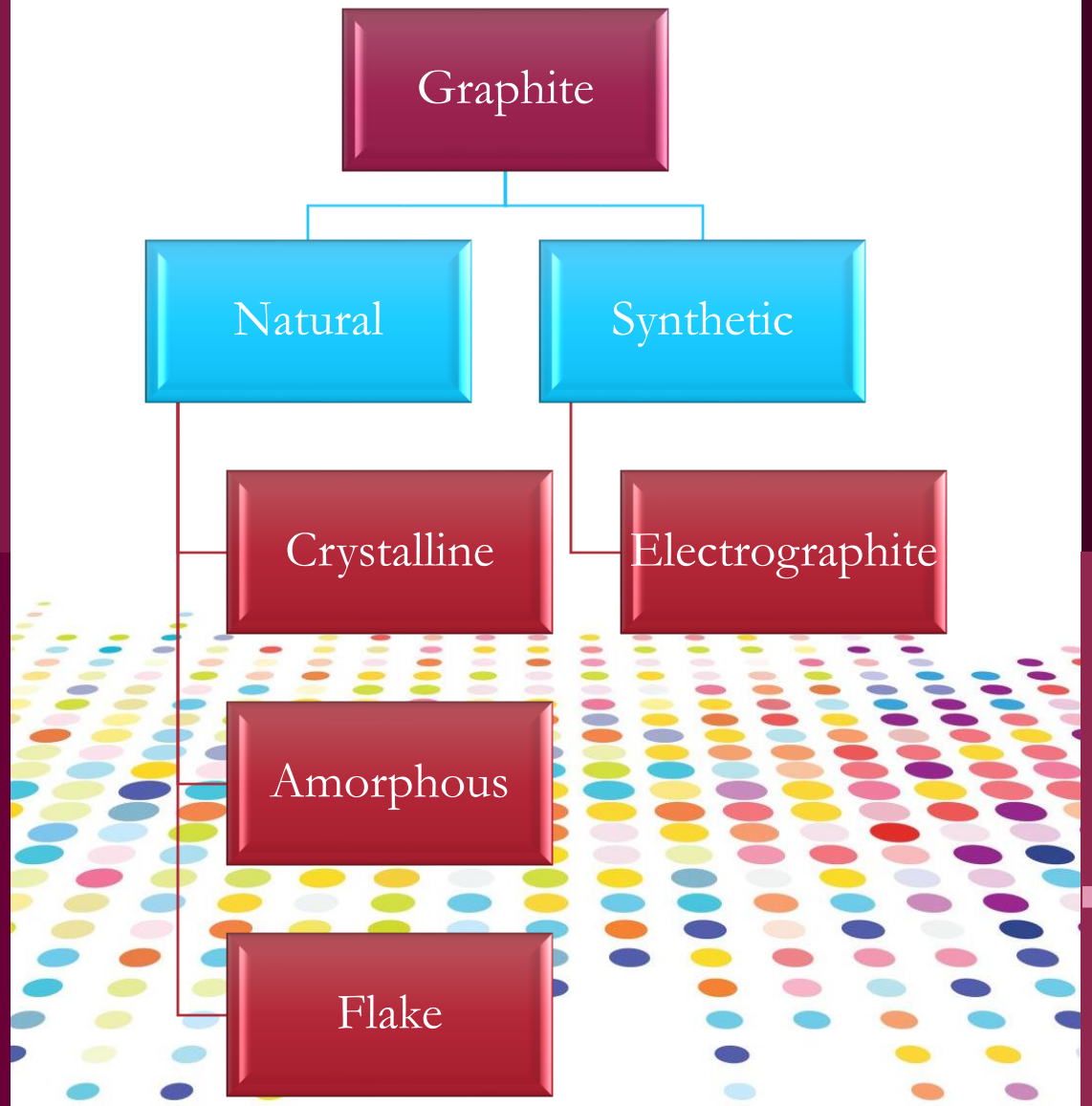


GRAPHITE


Each carbon atom in graphite is joined to only three other carbon atoms
1
2
3
Flat layer of carbon atoms
Flat layer of carbon atoms
Flat layer of carbon atoms
Weak forces hold the layers of carbon atoms together
Strong bonds exist between carbon atoms in a layer



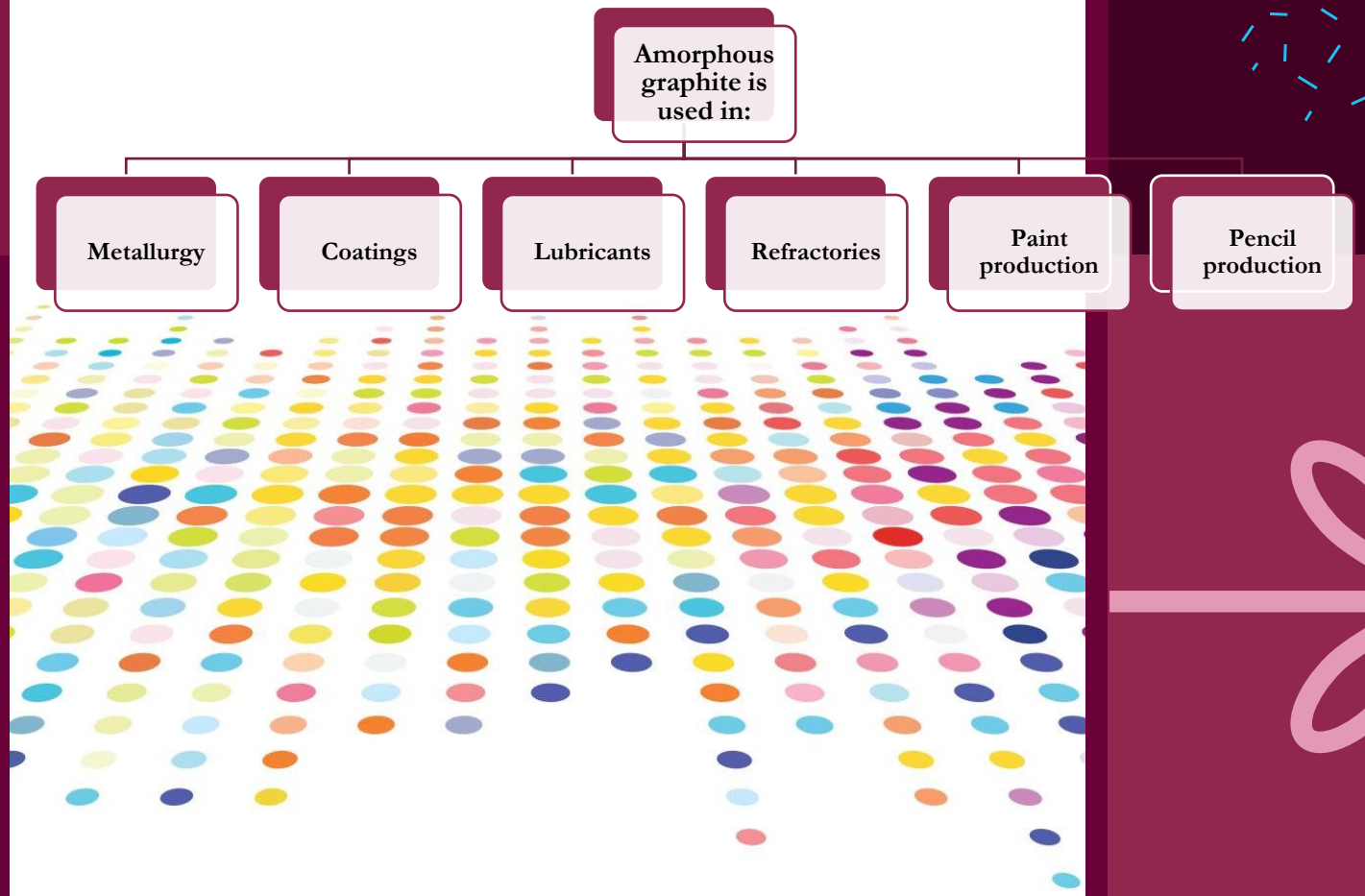
CLASSIFICATION OF GRAPHITE


Graphite
Natural
Synthetic
Crystalline
Electrographite
Amorphous
Flake

PHYSICAL PROPERTIES

Property	Commercial graphite
Bulk Density (g/cm^3)	1.3-1.95
Porosity (%)	0.7-53
Modulus of Elasticity (GPa)	8-15
Compressive strength (MPa)	20-200
Flexural strength (MPa)	6.9-100
Coefficient of Thermal Expansion ($x10^{-6}$ °C)	1.2-8.2
Thermal conductivity (W/m.K)	25-470

APPLICATIONS



APPLICATIONS

Crystalline graphite can be used include:

- Lubricants
- Powder metallurgy
- Grinding wheels
- Batteries

APPLICATIONS

Synthetic graphite's are used include:

- Aerospace applications
- Carbon brushes
- Graphite electrodes for electric arc furnaces, for metallurgical processing
- Moderator rods in nuclear power plants
- Batteries

Thank you !

https://asbury.com/resources/education/graphite-101/structural-description/