

كلية المستقبل الجامعة

قسم هندسة تقنيات
الأجهزة الطبية



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عنوان المحاضرة : **Material properties**

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What is Material?

Whatever thing presents in the world, is material. Either Physical or Non-physical. As a body, mobile, laptop, home, It is all material.



What is Engineering Material?

Material that is used as raw material for any part of construction or manufacturing is an organized way of engineering application



Copper



Lead



Tin



Nickel



Steel



Zinc

Material science

Science in which new material is discovered Or by using science in the present material, how can we effectively use it, it is called material science.



Classification of Materials

1. **Metal:** Ferrous and Non-ferrous.
2. **Non-Metal:** Thermoplastic, Thermosets, and Elastomers.
3. **Ceramics:** Glasses, Crystalline ceramics.
4. **Composites:** Metal Matrix, and Ceramic Matrix.
5. **Polymer.**

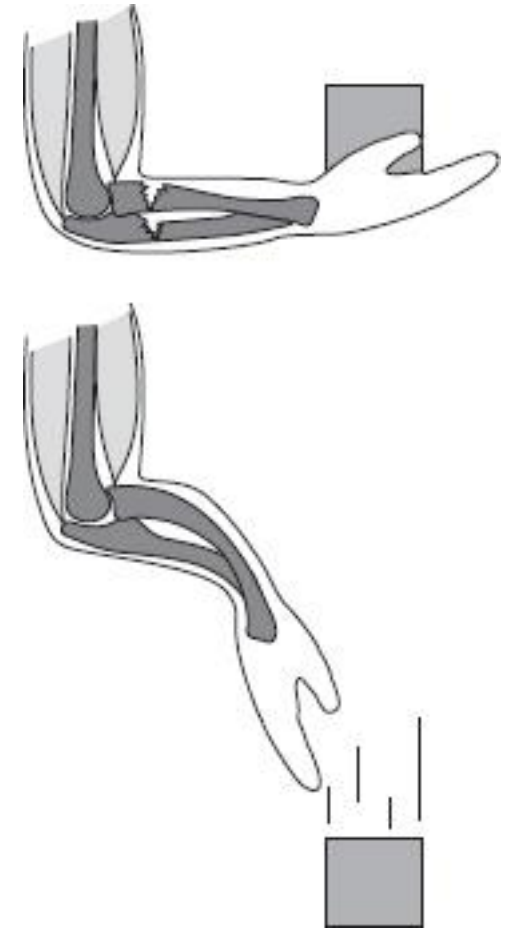
Properties of Materials

There are three properties of materials:

- Mechanical properties of Material
- Electrical properties of Material
- Physical and Chemical properties of Material

Mechanical properties

- The Mechanical properties of a material affect how they behave as it loaded.
- The Mechanical properties of a material are those which affect the mechanical strength and ability of a material to be molded in a suitable shape

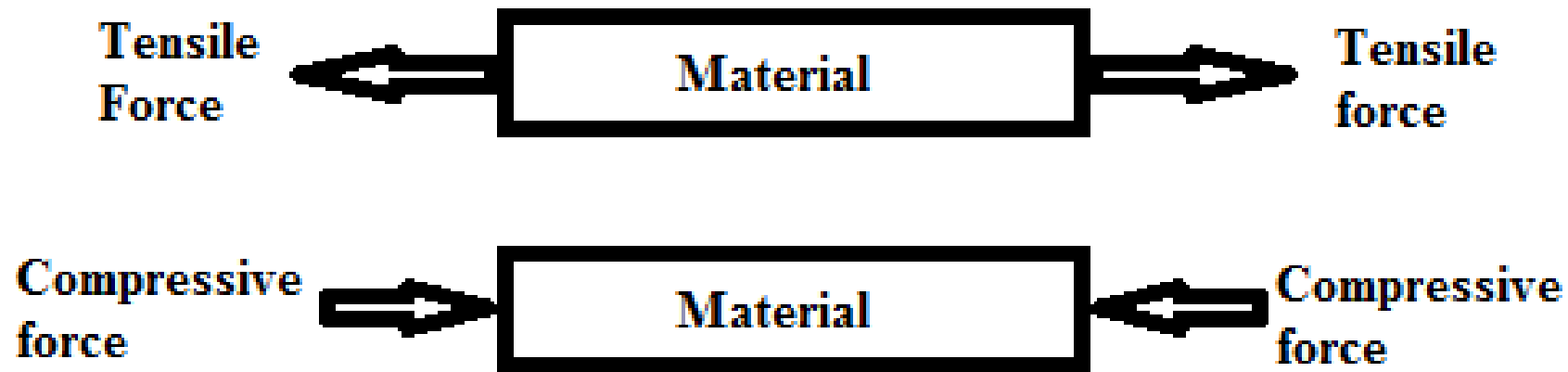


- some important mechanical properties of the engineering materials.

1. Strength
2. Elasticity
3. Plasticity
4. Ductility
5. Malleability
6. Toughness
7. Hardness
8. Brittleness
9. Fatigue
10. Creep

1-Strength

- Strength is defined as the ability of the material to resist the external forces without rupture or yielding.



2.Elasticity

- Elasticity is defined as the ability of the material to regain its original shape and size from deformation when the external forces which caused deformation are removed



3. Plasticity:

- Such a property of material from which if we pull but it cannot regain its original position when leaving it, then it is called plasticity.



Elasticity

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Plasticity

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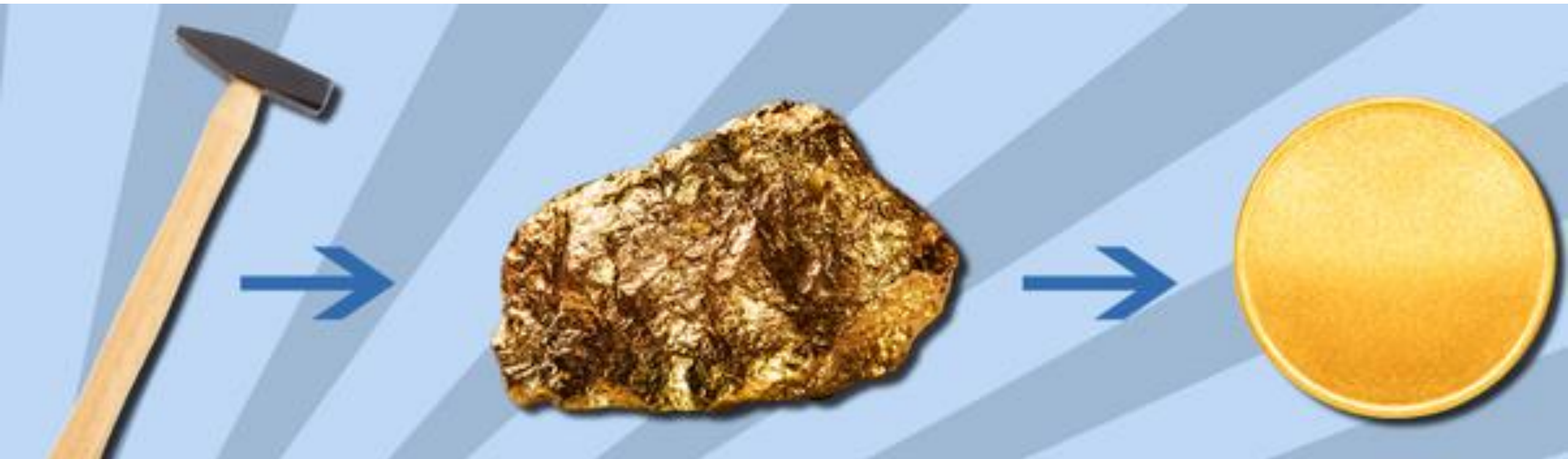
4. Ductility:

- Such property of a material that we can pull and make it into long wire form, we call it Ductility. A ductile material needs to both strong and plastic. e.g. The ductile material used in mild steel, copper, aluminum, nickel, zinc, tin, and lead.



5. Malleability:

- If we beat any metal that causes it to spread and form into a sheet form, So we call this property Malleability. A malleable material needs to be plastic but it is not essential to be strong.



6. Toughness

- Material that if we bend or twist, how much energy can absorb before it breaks is called Toughness.



7. Hardness

- It is the ability of a material to resist to permanent shape change due to external stress. There are various measure of hardness – Scratch Hardness, Indentation Hardness and Rebound Hardness.

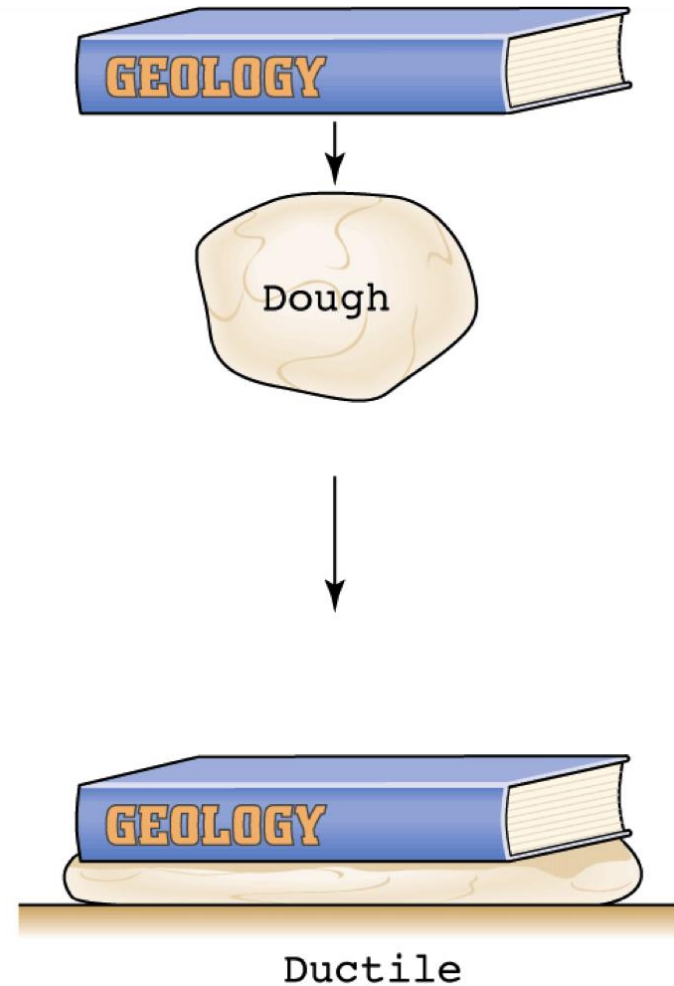
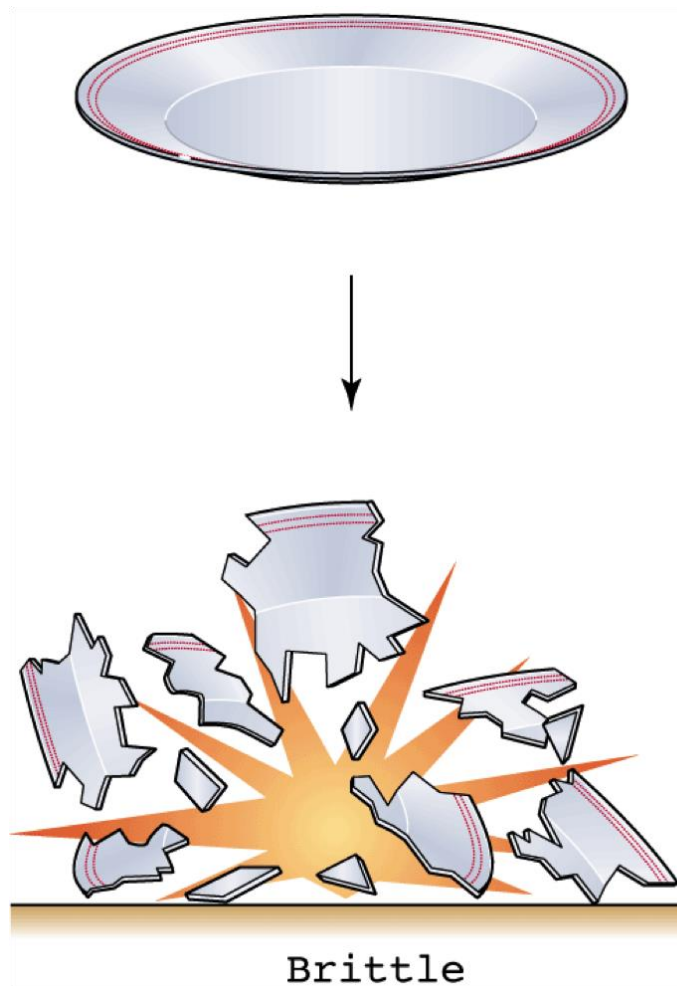


8. Brittleness

- Brittleness of a material indicates that how easily it gets fractured when it is subjected to a force or load. When a brittle material is subjected to a stress it observes very less energy and gets fractures without significant strain.

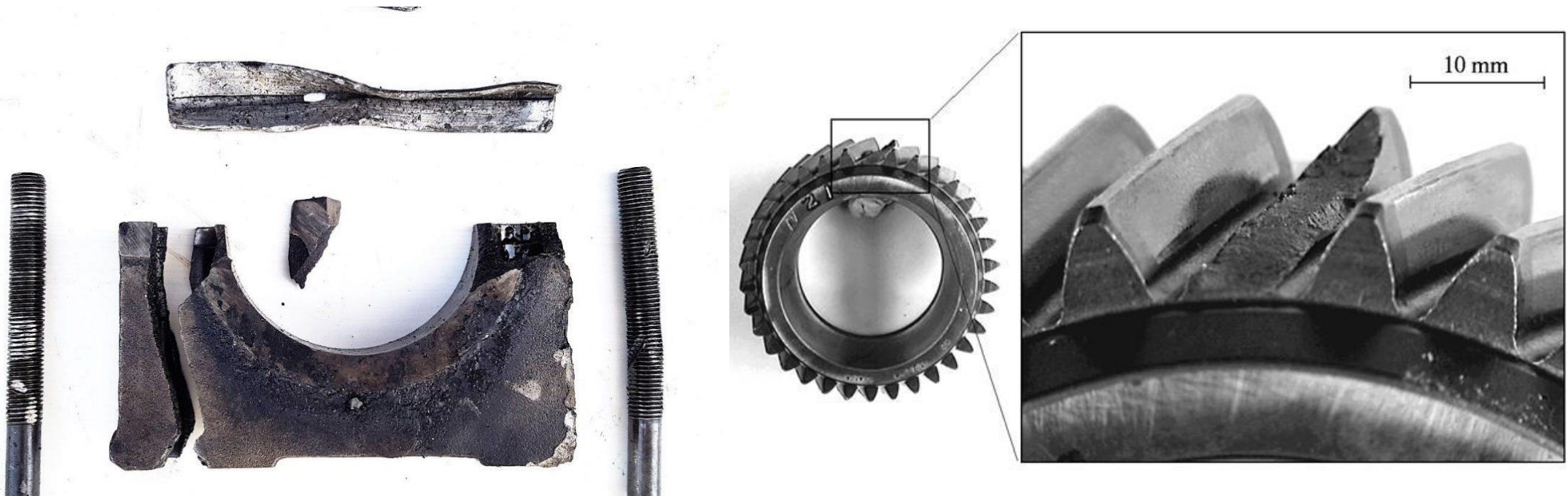


- Brittleness is converse to ductility of material. Brittleness of material is temperature dependent. Some metals which are ductile at normal temperature become brittle at low temperature.



9. Fatigue

- When a material loads more than a specific load, then there is a chance of failure But in fatigue, Any material fails even at low load if we apply a repetitive load. This failure is known as fatigue.



10.Creep

- Creep is the property of a material which indicates the tendency of material to move slowly and deform permanently under the influence of external mechanical stress.

