Lesson 2 - Mechanical properties of materials

Teacher's notes

- ✓ The students must have the handouts with the power point presentation in front of them in order to take notes on them. The power point file is *L2-3-properties*

Vocabulary

- ✓ The teacher should clarify the following vocabulary:

Word	Meaning	Antonym	Catalan translation
Tough (**toughness**)	Ability of a material to withstand blows or sudden shocks without breaking	**Brittle** (**brittleness**)	*Tenaç /fràgil Tenacitat / fragilitat*
Strong (**strength**)	It is equivalent to *mechanical resistant*. It is not a really a technical term	**Weak** (**weakness**) Not really a technical term	*Fort /feble*
Hard (**hardness**)	Can not be easily scratched	**Soft** (**softness**)	*Dur / tou Duresa / tovor*
Stiff or rigid (**stiffness** or **rigidity**)	Not easily bent (no deformations occur before breaking)	**Flexible** (**flexibility**) **Elastic** / **plastic**, it depends on the way it deforms	*Rígid /rigidesa Flexible flexibilitat elàstic / plàstic*

Words

Compression (compressive stress), tension (tensile stress), bending, torsion (twist), shearing (shear stress), take apart, elongate, put together, shrink, beam, load, rotational force, tangential force, physical principle, hard (hardness), soft (softness), tough (toughness), brittle (brittleness), sudden force, elastic and plastic deformation, ductile (ductility), malleable (malleability), plate, (kitchen) foil, rolling process, stiff (stiffness)

Structures

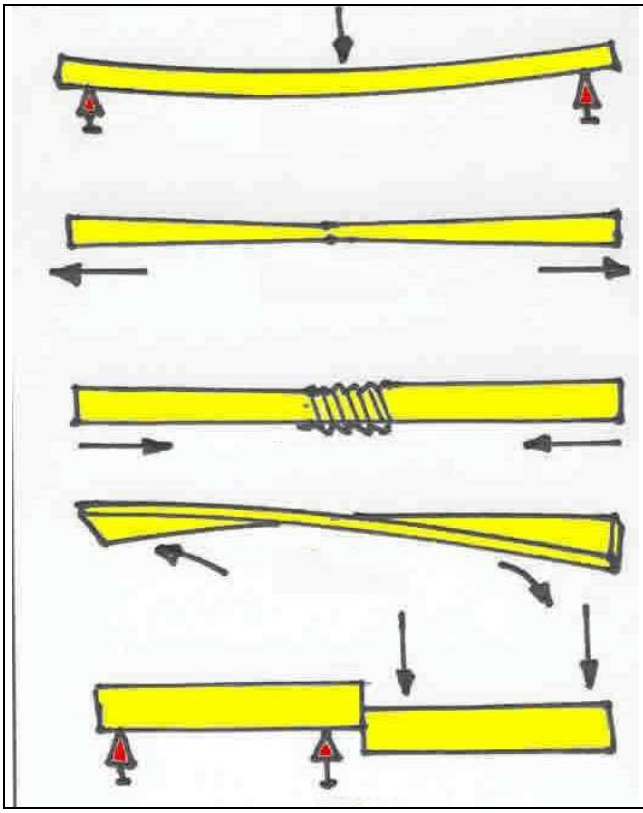
Stress induced at a point, body subjected to loads, susceptible to fracture, no deformation before breaking, the stress is removed, not easily bent

Tasks

The following tasks must be carried out in groups. After a group discussion,

Task 1

Work out which kind of stress is exerted in each case (tension, compression, torsion, bending, shearing):

	**1. Bending**
	2. Tension
	3. Compression
	4. Torsion
	5. Shearing

Task 2

Match up the following lists with arrows:

- ✓ A material that breaks easily when it drops — is brittle
- ✓ A material that doesn't change after a sudden blow — is tough
- ✓ A material easily scratched — is soft
- ✓ A material which surface remains smooth after being scratched — is hard

Task 3

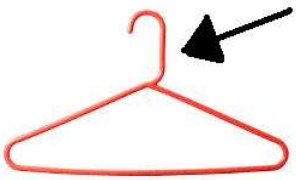
Work out which kind of stress is exerted in each case (tension, compression, torsion, bending, shearing):

<table>
<tr><td>  </td><td>  </td><td colspan="2">  </td></tr>
<tr><td>1. A pair of scissors:

shearing</td><td>2. The column of a bridge:

compression</td><td>3. The seat of a stool:

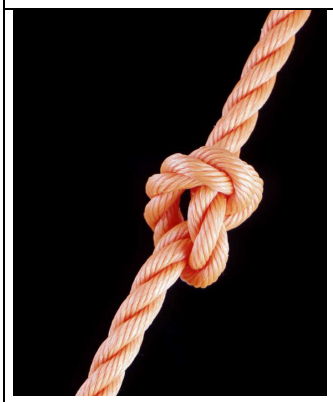
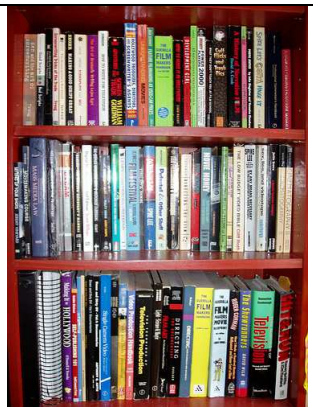
bending</td><td>4. The legs of a stool:

compression</td></tr>
<tr><td>  </td><td>  </td><td>  </td><td>  </td></tr>
<tr><td>5. a knob:

torsion</td><td>6. a seat:

compression / bending</td><td>7. This piece of a hanger:

tension</td><td>8. Soles of shoes:

compression</td></tr>
<tr><td> 
¡Error!</td><td>  </td><td colspan="2">¡Error!Argumento de modificador desconocido.</td></tr>
<tr><td>9. Tightened rope:</td><td>10. A shelf with books on it:</td><td colspan="2">11. a beam of a bridge:</td></tr>
</table>

tension	bending	bending

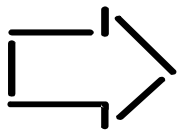
Task 4

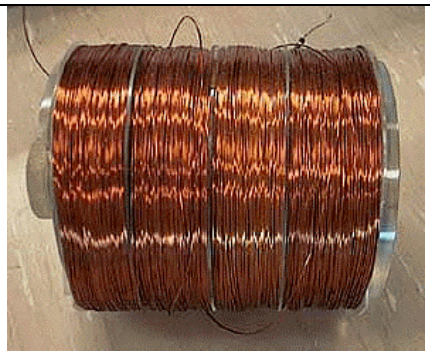
a) We exert a force on a piece of material. No deformation occurs. We keep exerting a force until the piece of material breaks. The material is ___**stiff**_____

b) We exert a force on a piece of material. A deformation occurs. When the force is removed, the material returns to its original shape. The material is _____**elastic**___

c) We exert a force on a piece of material. A deformation occurs. When the force is removed, the material doesn't return to its original shape. It keeps deformed. The material is _____p**lastic**_____

d) A very thick copper wire can be drawn into a very thin wire. Copper is a ___**ductile**_____ material





e) A thick aluminium plate can be converted into a very thin aluminium foil. Aluminium is a _____**malleable**_____ material