

PROPERTIES OF MATERIALS

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Tap the blue button to view PROPERTIES covered by this Revision PDF



PROPERTIES OF MATERIALS

PROPERTIES OF MATERIALS

(1)

PROPERTIES OF MATERIALS

(2)

PROPERTIES OF MATERIALS

(3)

COMMERCIAL AND WORKSHOP TESTING

STRENGTH

V.Ryan © www.technologystudent.com 2019

The ability of a material to stand up to forces being applied without it bending, breaking, shattering or deforming in any way.

Our technology demonstrates the 'strength' of a material by performing a hand stand on a strong piece of timber (wood). It does not bend even under his weight. He has eaten pies and drunk a large amount of beer for twenty years and yet the strong material does not bend, flex or deform (change shape) in any way.

Tap the image for more information



Tap the blue button for the next
PROPERTIES page.



Tap the red button to return to the
Contents page



ELASTICITY

V.Ryan © www.technologystudent.com 2019

The ability of a material to absorb force and flex in different directions, returning to its original position.

Our technology technician demonstrates the 'elasticity' of a material by springing up and down on a piece of steel rod. Do not try this at home as an accident may result. Our technician is an expert at demonstrating this property, as it is his hobby.

Tap the image for more information



Tap the blue button for the next
PROPERTIES page.



Tap the red button to return to the
Contents page



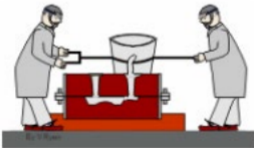
PLASTICITY

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The ability of a material to be change in shape permanently.

Our technology technician and his twin brother demonstrate the 'plasticity' of a molten aluminium by pouring it into a mould. Once the aluminium has cooled down, it can be removed from the casting sand. It has a new shape.

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Tap the blue button for the next
PROPERTIES page.



Tap the red button to return to the
Contents page



DUCTILITY

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The ability of a material to change shape (deform) usually by stretching along its length.

Our technician stretches the lead above his head. As it stretches it deforms (changes shape).

He thinks he is a strong man, little does he realise that lead is a very soft metal and stretches very easily. He performs these tricks in local pubs in an attempt to pass himself off as a 'hard man'.

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Tap the blue button for the next
PROPERTIES page.



Tap the red button to return to the
Contents page



TENSILE STRENGTH

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The ability of a material to stretch without breaking or snapping.

Our technology technician demonstrates 'tensile strength' by stretching a piece of steel until it snaps. He thinks he is incredibly strong. However, his friends at work have substituted a sausage in place of the steel.

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Tap the red button to return to the Contents page



MALLEABILITY

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The ability of a material to be reshaped in all directions without cracking

Our technology technician demonstrates the 'malleability' of a material by heating a piece of mild steel until it is red hot. He then beats it with a large forging hammer to reshape it. Because of the high temperature it reaches while heating the steel becomes malleable, it can be reshaped permanently.

Tap the image for more information



Tap the blue button for the next
PROPERTIES page.



Tap the red button to return to the
Contents page



TOUGHNESS

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A characteristic of a material that does not break or shatter when receiving a blow or under a sudden shock.

Our technology technician demonstrates the 'toughness' of a material by hitting a piece or material to see if it will break or shatter.

Ed has been known to test authentic Chinese Ming Dynasty pottery with the same technique. This is why he is often arrested in Museums and has been banned from the local Antique dealers.

Tap the image for more information



Tap the blue button for the next
PROPERTIES page.



Tap the red button to return to the
Contents page



HARDNESS

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The ability of a material to resist scratching, wear and tear and indentation.

Our technology technician, dressed in a kilt, slides along the floor to see if it will scratch. It will be considered to hard wearing if it resists scratching.

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Tap the blue button for the next
PROPERTIES page.



Tap the red button to return to the
Contents page



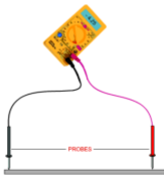
CONDUCTIVITY

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The ability of a material to conduct electricity.

A test for electrical conductivity is seen below. A voltmeter is used to measure resistance. The probes are set to the same distance on each sample. The resistance is a measure of the materials conductivity..

Tap the image for more information



Tap the red button to return to the Contents page



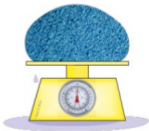
ABSORBENCY

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The ability of a material to absorb another substance, that in itself is capable of being absorbed. Under normal circumstances this would mean a liquid or gas being 'absorbed' by a material.

Our technician demonstrates absorbency, by submerging a sponge in water and then testing if it has increased by weight, a few minutes later.

Tap the image for more information



Tap the blue button for the next
PROPERTIES page.



Tap the red button to return to the
Contents page



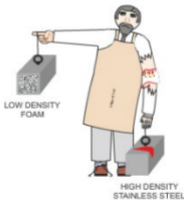
DENSITY

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A material's 'mass', per unit of volume.

Density is calculated by dividing a material's mass (in kilograms) by its volume (in cubic metres). Essentially, mass can be considered as the compactness of a material. For example, a cubic metre of a sponge is lighter and therefore much less dense, than a cubic metre of stainless steel, which is much heavier.

Tap the image for more information



Tap the blue button for the next
PROPERTIES page.



Tap the red button to return to the
Contents page



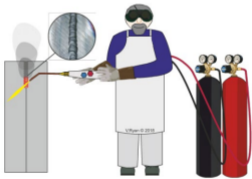
FUSIBILITY

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The ability of a material to be transformed from a solid state to a liquid state, due to the application of heat. This can mean fusing two metals together along a seam / joint (welding) OR fusing thousands of polymer pellets together, through the injection moulding process.

Our technician demonstrates fusibility by welding to metals together, forming a permanent joint.

Tap the image for more information



Tap the red button to return to the Contents page

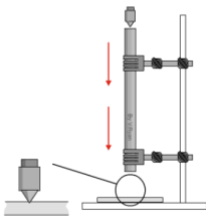


MATERIALS - HARDNESS TESTING

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A sophisticated method of measuring the hardness of a material, is to drop a 'plug' down a tube. When the 'plug' hits the material below, the surface will suffer an indent. The indent produced on different materials, can be compared. Consequently, the smaller the indent, the harder the material.

Tap the image for more ways of testing



Tap the blue button for the next
PROPERTIES page.



Tap the red button to return to the
Contents page



TENSILE TESTING

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A simple workshop test can be seen below. A piece of material is clamped in a vice. A fixed weight is hung from the end. The amount of deflection, is a measure of its resistance and tensile strength. A selection of materials of the same section, cut to exactly the same size, can be tested in this way.

Tap the image for more information



Tap the blue button for the next
PROPERTIES page.



Tap the red button to return to the
Contents page



ELASTICITY TESTING

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A simple workshop test for elasticity can be seen below. A piece of material is clamped in a vice. A fixed weight is hung from the end and the material bends / deflects. When the weight is quickly removed, the material 'springs back'. The amount of deflection, is a measure of its elasticity. A selection of materials of the same section, cut to exactly the same measurements, can be tested in this way.

Tap the image for more information



Tap the blue button for the next
PROPERTIES page.



Tap the red button to return to the
Contents page



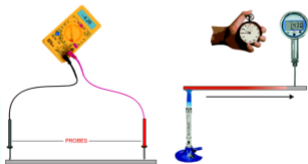
CONDUCTIVITY TESTING

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A test for electrical conductivity is seen below. A voltmeter is used to measure resistance. The probes are set to the same distance on each sample. The resistance is a measure of the materials conductivity.

A test for heat conductivity/transfer is seen below. A bunsen burner is placed at one end of a piece of material and a temperature meter at the other end. The time it takes for the temperature to change at the opposite end of the material is recorded.

Tap the image for more information



Tap the blue button for the next
PROPERTIES page.



Tap the red button to return to the
Contents page

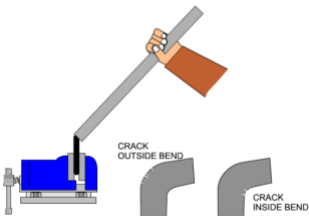


DUCTILITY AND MALLEABILITY

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A piece of tube is placed over a piece of material and used as a lever. The material is folded to 90 degrees. Cracks / damage on the outside of the bend represents a lack of ductility. Cracks / damage on the inside of the bend represents a lack of malleability.

Tap the image for more information



Tap the blue button for the next
PROPERTIES page.



Tap the red button to return to the
Contents page

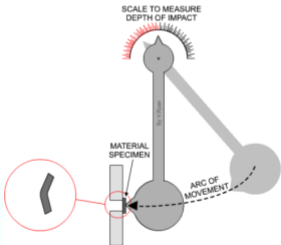


TOUGHNESS TESTING OF MATERIALS

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The industrial device below measures toughness. The pendulum is allowed to 'swing' from a set starting position. The resulting 'distortion' to the sample material can be measured on the scale. This gives an indication of the materials toughness.

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Tap the blue button for the next
PROPERTIES page.



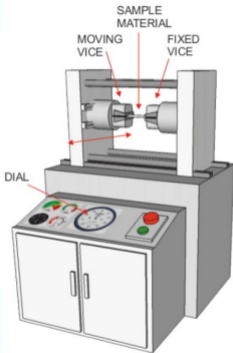
Tap the red button to return to the
Contents page



TESTING MATERIALS IN INDUSTRY

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Tap the image for a range of testing machines and methods.



Tap the red button to return to the
Contents page

