THE Ebbsfleet ACADEMY
Aspire, Excel

Subject: Design Technology
Year: 12
Term: 2
Topic: Core: Materials

1. Physical properties
2. Physical properties
3. Tests
4. Electronic experiments
5. Physical experiments
6. Unit test

Key Assessments
TBA
KA examination no. 1

Core Texts
Ebbsfleet Revision 2.

Key Words: See key list below.

Knowledge Area	What You Must Know
Physical properties	Those that can be determined by the interaction of material with energy and matter
Mass	The measure of the amount of mater a body contains as a constant (measured in KG)
Weight	The force of an object when acted upon by gravity (9.8m/s2) (mass x force in Newtons)
1 Newton	Equivalent to 1KG M/S 2
Conductivity (0) (Siemens per metre)	The ease at which free electrons will move through a material. It is inversely proportional to:
Resistivity(p) or ohm metres	The tendency of a material to resist the flow of free electrons through it o=1/P (see page 80)
Thermal conductivity	When a temperature gradient is present heat will flow through measured in Weber/meter/Degree K
Thermal expansion	The increase in size of a material after heating resulting from the increased vibrations measured in (MM-1 K-1)
Hardness	The resistance of a material to scratching or abrasion.
Scratch hardness	The ability to resist scratching with a sharp point measured in Mohs (After Fredrick Mohs) on a 1-10 scale.
Static indentation hardness	The depth to which a material will be penetrated by a fixed load (several tests used see page 83)
Dynamic Hardness	Tested by dropping an indentor on the surface of a material to measure the elastic recovery after.
Tensile strength	A material's resistance to deformation from a stretching load. Measured in ultimate tensile strength (UTS)
Compressive strength	The ability of a material to resist a crushing force applied to it.
Stiffness	The resistance of a body to reist deflection from an applied force. Often measured using 'Young's Modulus'
Toughness	The ability of a material to resist cracking. (see graphs on page 86)
Fracture toughness	The size of a crack in a material that could be present before a complete fracture occurs. (page 88)
Ductility	Ability of a material to maintain strength when drawn out into thin wire of great length / small cross-section.
Elasticity	The ability of a material to stretch under load and then return to its original length on removal of load.
Plasticity	The ability to continue to elongate past the elastic limit thus permanently changing the shape on load removal.
Stress and Strain	Stress= the force being applied to an area, strain =the change occurring under that stress.
Aesthetic characteristics	Those qualities that appeal to the human sense of beauty and pleasure including smell, taste, texture, sound.
Piezzoelectricity	Material that changes shape or size in response to an electrical current passed through it.
Shape memory	Materials that change shape (beyond elastic limit) and can return to the original shape in a specific temp. range.
Photochromicity	Materials that darken (reversibly) when exposed to UV light. Such as reactive eye-glasses.
Megneto / electro rheostatic	Liquids that can become solids when exposed to electrical current. Revert to liquids when current removed.
Thermoelectricity	Materials that change their electrical potential under different temperatures and vice versa.
Metals	Materials found in an ore consisting of carbonate, oxide or sulphide. Normally conductive of heat /electricity.
Smelting	The process of removing a pure metal from its ore of oxides, sulphides and carbonates.
Lead and Tin	The first to be smelted from their ores by humans due to their low melting points allowing wood to be fuel.
Elements / alloys	Metals that are elements in the atomic table in their own right OR mixtures of several metals.
Work hardening	Material becomes harder as a result of cold working / bending . Molecules are rearranged.
Alloying	Mixing metals with different crystalline structures to achieve different or improved range of properties .
Tempering	Heating metals to a high temperature and then cooled rapidly to achieve higher levels of hardness / strength
Super -alloys	Mixes which have excellent high temp. strength, resistance to thermal shock and resistance to oxidisation.
Oxidisation resistance	The ability to resist the ingress of oxygen into the surface layer which degrades it. Such as rust in steel.
Superalloy applications	Cryogenics (deep freeze) Jet engine components (high heat) Petro-chemical industry 9chemical resistance)
Superalloy examples	Iron-Nikel based (high temperature), Cobalt based (High stress resistance) Nikel based (het resistant)
Typical alloy (stainless steel)	Designed with malleability and strength (steel) oxidisation resiistance (Chrome) Molybdenum (chemical attack)