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**Knowledge Rich Curriculum Plan**

Science – Physics

Year 12

| **Science** **Year 12 Physics**  | **Unit: Materials** |  |  |
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| **Lesson/Learning Sequence**  | **Intended Knowledge:***Students will know that…* | **Tiered Vocabulary**  | **Prior Knowledge:***In order to know this students, need to already know that…* |
| **Lesson:** **Properties of Materials** | * Students will know that Hooke’s law says that extension of a stretched object is proportional to the load of force
* Students will know that the spring constant is a measure of the stiffness of the object
* Students will know that Hooke’s law can be written as F = k Δ L
* Students will know that Hooke’s law applies for all materials until they pass the limit of proportionality.
* Students will know that elastic deformation means that a material returns to its original shape and size once the forces are removed
* Students will know that plastic deformation the material is permanently stretched once forces are removed.
* Students will know that energy is always conserved when materials are stretched.
 | Elastic deformation: a material returns to its original shape and size once forces are removedPlastic deformation: a material is permanently stretched once forces are removed | * ***Students need to already know that density is calculated using mass / volume***
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| **Lesson:** **Stress and Strain** | * Students will know that tensile stress is the force applied divided by the cross sectional area: Stress = F/A
* Students will know that the units of stress are Nm-2 or Pa
* Students will know that tensile strain is the change in length divided by the original length of the material
* Students will know that strain has no units.
* Students will know that if stress is big enough to break a material it is called the breaking stress.
* Students will know that ultimate tensile stress is the maximum stress a material can withstand
* Students will know that breaking stress and ultimate tensile stress depend on conditions
* Students will know that work must be done to stretch a material, and that this work (elastic strain energy) Is equal to the area under a force extension graph.
* Students will know that work done can be calculated using E = 1/2kΔL2
 | Tensile strength: force applied divided by cross sectional area |  |
| **Lesson:** **The Young Modulus** | * Students will know that The Young Modulus is Stress / Strain
* Students will know that The Young Modulus has the units Nm-2
* Students will know that The Young Modulus is a measure of the stiffness of a material
 |  | * ***Students need to already know that stress is calculated using F/A***
* ***Students need to already know that strain is calculated using* ΔL/L**
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| **Lesson:** **Required Practical 4** | * Students will know how to practically determine the Young Modulus of a material
 |  | * ***Students need to already know that The Young Modulus = stress / strain***
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| **Lesson:** **Stress-Strain and Force-Extension Graphs** | * Students will know that there are three important points on a stress-strain graph; the elastic limit (the point the material starts to behave plastically), The yield point (the material suddenly starts to stretch without any extra load) and the limit of proportionality (the material no longer obeys Hooke’s law)
* Students will know that the area under the part of the graph where Hooke’s law follows is equal to the energy stored in the material per unit volume
* Students will know that stress-strain graphs for brittle materials don’t curve. This is due to the fact the material breaks rather than stretches.
* Students will know that force extension graphs are different to stress-strain graphs as they are specific for the tested object and depend on its dimensions, whilst the stress-strain graph is independent of the dimensions.
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