# YEAR 2021-2022 _____ TERM

**‘An ambitious curriculum that meets the needs of all’**

## Medium Term Planning - Topic: Materials

**Curriculum Intent**

**In addition to working further on objectives from Year 12, pupils will be taught, following National Curriculum guidelines, the following this term:**

**Skills/Assessment Objective Links**

### 3.4.2 Materials

#### 3.4.2.1 Bulk properties of solids

| Content | Opportunities for skills development |
|---|---|
| Density, $\rho = \frac{m}{V}$<br>Hooke’s law, elastic limit,<br>$F = k\Delta L$ , $k$ as stiffness and spring constant.<br>Tensile strain and tensile stress.<br>Elastic strain energy, breaking stress.<br>$energy\ stored = \frac{1}{2}F\Delta L = area\ under\ force-extension\ graph$<br>Description of plastic behaviour, fracture and brittle behaviour linked to force–extension graphs.<br>Quantitative and qualitative application of energy conservation to examples involving elastic strain energy and energy to deform.<br>Spring energy transformed to kinetic and gravitational potential energy.<br>Interpretation of simple stress–strain curves.<br>Appreciation of energy conservation issues in the context of ethical transport design. | **MS 0.2, 4.3 / PS 3.3, 4.1**<br>Students can compare the use of analogue and digital meters.<br>**MS 0.4, 4.3 / AT e**<br>Estimate the volume of an object leading to an estimate of its density. |

#### 3.4.2.2 The Young modulus

| Content | Opportunities for skills development |
|---|---|
| $Young\ modulus = \frac{tensile\ stress}{tensile\ strain} = \frac{FL}{A\Delta L}$<br>Use of stress–strain graphs to find the Young modulus.<br>(One simple method of measurement is required.) | **MS 3.1** |
| **Required practical 4:** Determination of the Young modulus by a simple method. | |

**Spiritual, moral, social, and cultural development**

**SMSC:** Listening to each other and valuing each person’s contributions in discussions, working together in lessons to problem solve and achieve a shared goal. Learning about different scientists and learning how their understanding of the world evolved.
**PSHE/British Values:** Working together in practical and problem-solving work. The practical work in this section requires two people to work together to take the measurements whilst holding the equipment in place.
**Skills Builder:** development of practical skills through the numerous practical activities.

**Numeracy**

Constant numerical development in every lesson. Measuring skills, graph skills, problem solving. Exam questions build on topics with mechanics components frequently brought in.

**Literacy**

**Vocabulary Tier 2:** density, weak, strong, stiff, tough, brittle, Hooke’s Law
**Vocabulary Tier 3:** Limit of proportionality, eureka can, plastic deformation, elastic limit, yield point, UTS, elastic potential energy, Young modulus, tensile stress, tensile strain, hysteresis.
**Reading:** Reading of the booklet and questions. Students need to be able to read the methods for practical lessons and ensure they complete them in the right order, using the right equipment.
**Writing:** Students are exposed to a number of questions, both numerical and short and long written answers. Students need to be able to write in a concise way whilst using the key words.
**Oracy:** Class discussions are incredibly important in physics where students regularly participate in class discussion to discuss abstract concepts. Students need to be able to express their understanding of concepts and theories.

**Becoming future ready**

**Careers/Employability:** The topic of materials is key for engineering, specifically civil engineering plus architecture.

| | |
|---|---|
| **Adaptation** | |
| **QFT/SEND Provision** | Throughout this topic, quality first teaching will provide differentiation:<br>**By product:** different learners are asked different questions, different level of detailed responses expected and the level of scaffolding for the problem solving questions are varied.<br>**By resource:** All resources are the same, however, extra scaffolding may be provided if necessar<br>**By Intervention**: by providing different levels of supervision and support<br>**By Progressive Questioning:** exploring pupils' understanding through interactive dialogue.<br>**By Grouping:** according to prior attainment, gender, social preference, preferred learning style.<br>**By Task:** Pupils should be involved in the identification of targets which are meaningful to them and in the selection of an appropriate task from the given range.<br>**By Offering Optional Activities:** In class or as homework, to extend learning.<br>This QFT/SEND provision will be explicit within the lesson-by-lesson schemes of work. |
| **Implementation Curriculum Delivery** | • To be able to: |
| **Learning Outcomes (Knowledge)** | • To know how to calculate the density of a regular shaped object.<br>• To know how to calculate the density of an irregular shaped object.<br>• To know how to calculate the density of an alloy.<br>• To know how to use and apply the formula for Hooke's Law<br>• To determine the spring constant of a spring<br>• To be able to sketch a Force - extension graph and label key points<br>• To know the definitions and formulas for stress and strain<br>• To know that different materials respond in different ways.<br>• To know what brittle, ductile, strong materials are the know how to draw the graphs.<br><br>• To know how to conduct the practical on different materials safely.<br>• To understand how each object behaves under tensile stress.<br>• To draw the tables and graphs appropriately for the stretchy men practical.<br>• To understand Young's Modulus.<br>• To know how to rearrange the equation & understand the formulas<br>• To complete the example exam questions on the topic with confidence.<br><br>• To complete the practical on The Young Modulus of a Wire<br><br>Red denotes interleaving; aspects of knowledge covered previously. |
| **Current learning to be developed in the future within:** | The topic of materials comes up with mechanics too, with the questions often being linked. Materials is also linked in with waves, when the composition of waves produced on stringed instruments are analysed. |
| **Assessment** | Refer to assessment maps for formative and summative assessment opportunities. |
| **Impact** | Attainment and Progress – Refer to assessment results / data review documentation. |