PHYA2 3.2.2

Materials

AS Physics:

what you need to know

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| **Bulk properties of solids** | I can do this already | Covered in class | Strength | Weakness | I have  revised this | Book references |
| I understand that **density** is defined as **mass per unit volume**. |  |  |  |  |  | AQA: 162 & 163; APfY: 288 |
| I can recall and use the equation for **density** (ρ):  **=**  , where *m* is mass and *V* volume. |  |  |  |  |  | AQA: 162;  APfY: 288 |
| I can explain the meaning of the terms **tensile** and **compressive** when used to describe forces. |  |  |  |  |  | AQA: 167  APfY: 292 |
| I can describe an experiment to investigate the response of a material to a progressively increasing tensile force. |  |  |  |  |  | AQA: 164 |
| I can explain the meaning of the term **extension** (Δ*L*). |  |  |  |  |  | AQA: 164;  APfY: |
| I can sketch an **extension** vs **force** graph for a material subjected to a progressively increasing tensile force. |  |  |  |  |  | AQA: 167;  APfY: 282 |
| I can explain the meaning of the terms **elastic** and **plastic** when used to describedeformation**.** |  |  |  |  |  | AQA: 168;  APfY: 282 |
| I understand that a material obeys **Hooke’s law** when its extension is directly proportional to the stretching force (i.e. *F* ∝ Δ*L*), and that **F = kΔL**. |  |  |  |  |  | AQA: 164;  APfY: 282 |
| I recall that the constant ***k*** in the equation F = kΔL is called the **force** (or ‘spring’) **constant**, and is defined as the force required to produce unit extension. |  |  |  |  |  | AQA: 164;  APfY: 282 |
| I can identify elastic and plastic deformation, and the **elastic limit** on a force - extension graph. |  |  |  |  |  | AQA: 168;  APfY: 282 |
| I can define **tensile stress** as **tensile force per unit cross-sectional area**. |  |  |  |  |  | AQA: 168;  APfY: 284 |
| I calculate **tensile stress** () using the equation , where *T* is **tensile force** (‘tension’) and *A* **cross-sectional area**. |  |  |  |  |  | AQA: 167;  APfY: 284 |
| I understand that the SI unit of stress is the **pascal** (Pa), and that 1 Pa = 1 Nm-2. |  |  |  |  |  | AQA: 167;  APfY: 284 |
| I can define the **ultimate tensile stress** (‘breaking stress’) of a material (e.g. steel or concrete) as the **maximum stress** it can withstand before breaking. |  |  |  |  |  | AQA: 169;  APfY: 284 |
| I can define **tensile strain** as the **extension per unit length.** |  |  |  |  |  | AQA: 168;  APfY: 285 |
| I calculate **tensile strain** () using the equation , where Δ*L* is **extension** and *L* is**original length**. |  |  |  |  |  | AQA: 167;  APfY: 285 |
| I understand that strain has no unit as it is the ratio of two lengths. |  |  |  |  |  | AQA: ;  APfY: 285 |
| I understand that work is done in stretching an object (e.g. a spring or wire), and that this is equal to the **strain energy** stored in the deformed object. |  |  |  |  |  | AQA: ;166 & 170; APfY: 283 |
| I understand that the strain energy stored in an object is equal to the area under its force – extension graph. |  |  |  |  |  | AQA: 166;  APfY: 283 |
| I can derive the equation for the strain energy stored in an object obeying Hooke’s law (). |  |  |  |  |  | AQA: 166;  APfY: 283 |
| I can sketch typical stress – strain graphs for metals, polymers and ceramics, and define the behaviour of these material using the terms elastic, plastic, and brittle. |  |  |  |  |  | AQA: 169 - 171;  APfY: 287 & 291 |
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| **The Young modulus** | I can do this already | Covered in class | Strength | Weakness | I have  revised this | Book references |
| I can define the **Young modulus** (*E*) of a material as |  |  |  |  |  | AQA: 168;  APfY: 285 |
| I understand that the SI unit for the Young modulus is the **pascal** (Pa) or Nm-2. |  |  |  |  |  | AQA: 168;  APfY: 285 |
| I can describe an **experiment** to determine the Young modulus of a material. |  |  |  |  |  | AQA: 168;  APfY: 286 |
| I can determine the Young modulus of a material from its stress – strain graph. |  |  |  |  |  | AQA: 168; APfY: 285 |

**Book references:** AQA = ***AQA Physics A*** by Breithaupt (Pub. Nelson Thornes) – the AQA endorsed textbook

APfY =***Advanced physics*** *for you* by Johnson, Hewett, Holt and Miller (Pub. Nelson Thornes)