**333**

**Hardness and Tensile Testing of Materials**

****

****

**Acknowledgement**

Mr John Gibson is a highly regarded educator and engineer. John taught Industrial Arts at a number of high schools before taking a position at Sydney Teachers’ College, then University of Sydney. He had an engineering education consultancy and has extensive experiencing working with NESA on Engineering Studies syllabus development and the HSC examination committee. The STEM Industry School Partnerships (SISP) Program asked John for his responses to the iTeachSTEM topic discussion questions. SISP is grateful to John for submitting these example discussion responses.

# Define the engineering term hardness.

Hardness is defined as a material’s resistance to indentation. Soft materials will produce a deep indent, whilst hard specimens, a small indent.

1. **Describe the engineering term tension.**

The term tension is used to describe a process where a material is placed under an active force that pulls, or tends to pull the material apart.

1. **Describe the engineering term compression.**

The term compression is used to describe a process where a material is placed under an active force that squeezes, or tends to squeeze the material together.

1. **List the testing machines often used to assess tensile strength.**
* for school, or small testing laboratory ~ the Hounsfield Tensometer
* for school, or small testing laboratory ~ the Monsanto Tensometer
1. **Describe the process of how data for a load/extension diagram is collected.**
* prepare test machine ~ correct load and extension settings
* prepare specimen ~ measure and record gauge length and diameter (if round)
* insert specimen into machine
* load specimen
* start graph recorder, continue to failure, stop recorder
* record maximum load, remove specimen
* record the extension (new length – original length/100)
* record the change in area (original area – new area/100)
* assess information from the graph
* the numeric data is recorded, the graph provided by the machine is analysed and relevant decisions made
1. **Explain what material properties can be assessed by reading a load/extension diagram.**
* region of elastic behaviour
* yield stress
* proportional limit
* ductility
* maximum strength
* region of work hardening
* region of plastic behaviour
* failure stress
* material stiffness
1. **List the machines often used to assess hardness.**

* Moh’s Scale of Hardness
* Rockwell Hardness
* Brinell Hardness
* Vickers Hardness
* Shore Hardness
* Durometer Hardness
1. **Describe the process of how the data from a hardness test is collected.**

Hardness tests rely on a specimen being placed on an anvil and partially indented by a standardised indentor under a set load. When the indentor is removed, the size of the indent in the specimen is measured, and recorded.

1. **Explain what units are used for hardness and how hardness test data is used.**

The scales used with the machine allow different materials to be tested. Most units relate to a set number rather than direct measurement, example, Rockwell C scale for steels. Often, particular hardness values are set for items under manufacture; this is to ensure quality control.