

**SANGAM SKM COLLEGE - NADI**  
**LESSON NOTES – WEEK 1**  
**YEAR 13**  
**APPLIED TECHNOLOGY**

<b>Strand</b>	Engineering Materials
<b>Sub-Strand</b>	Types of Test applied on materials
<b>Learning Outcome</b>	Differentiate between different types of Mechanical Testing

Plasticity or plastic deformation is accepted as unrecoverable strain.

TENSILE TEST - By pulling on something, determine how material reacts to forces being applied in tension.

Exercise: sketch and indicate the difference between the tensile testing curve of a ductile and brittle material.

Reference site:

[https://www.youtube.com/watch?v=0mrY3f\\_H7mw](https://www.youtube.com/watch?v=0mrY3f_H7mw)

Strain: expressed as an absolute measurement in the change in length.

Expressed in two different ways:

Engineering strain - the ratio of the change in length to the original length, calculated using

$$e = \frac{L - L_0}{L_0} = \frac{\Delta L}{L_0}$$

True strain - similar but based on instantaneous length of the specimen as the test progresses, calculated using

$$\epsilon = \ln\left(\frac{L_i}{L_0}\right)$$

Reference site: [https://www.youtube.com/watch?v=6SnnBc\\_XjL4](https://www.youtube.com/watch?v=6SnnBc_XjL4)

Stress: intensity of the force at any point in a body subjected to a load. Is measured as the force per unit area. Calculated using

$$\sigma_E = \frac{P}{A_0}$$

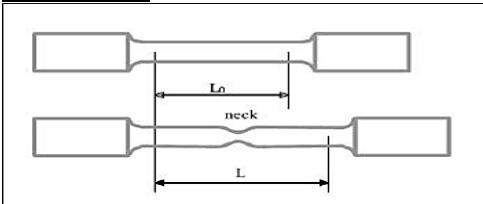
Where P is the force (load) in Newton's and A<sub>0</sub> is the cross sectional area.

Young's modulus: is the ratio of stress and strain

Reference site: <https://www.youtube.com/watch?v=H0gtEx-nuUw>

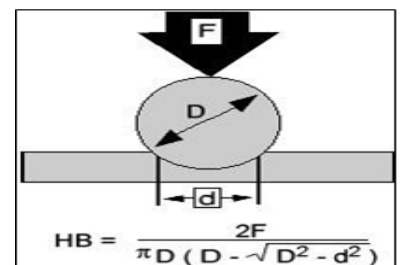
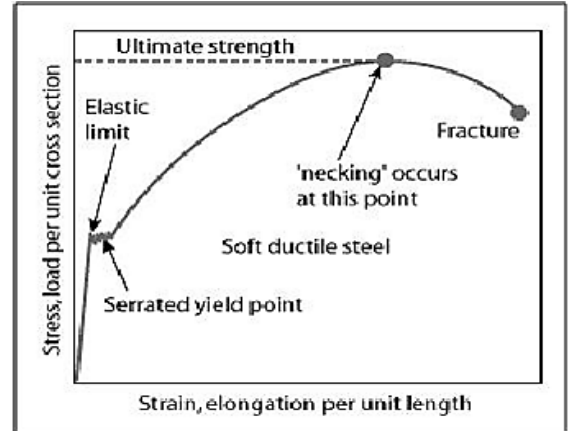
HOOKE'S LAW - relationship between the applied force, or load, and the elongation in linear region of tensile testing or elastic region.

NECKING - localized reduction of cross-sectional area of a specimen under tensile load



COMPRESSION TEST - measure compressibility of material as well as recovery of material that has been compressed to a load and held over a time period.

Reference site: <https://www.youtube.com/watch?v=iYmil0luMEs>



HARDNESS TESTING - Hardness is property of material to resist plastic deformation, by penetration. ( hardness also refer to resistance to bending, scratching, abrasion or cutting.)

Brinell hardness test

Indenter is pressed; force is maintained for 10 - 15 seconds.

Reference site: [https://www.youtube.com/watch?v=J2f\\_NZILR28](https://www.youtube.com/watch?v=J2f_NZILR28)

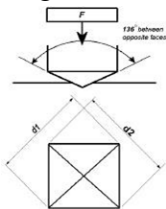
ROCKWELL HARDNESS TEST - indenting test material with diamond cone or hardened steel ball indenter which is forced into test material under a preliminary minor load usually 10 kg. Calculated using:

$$HR = E - e$$

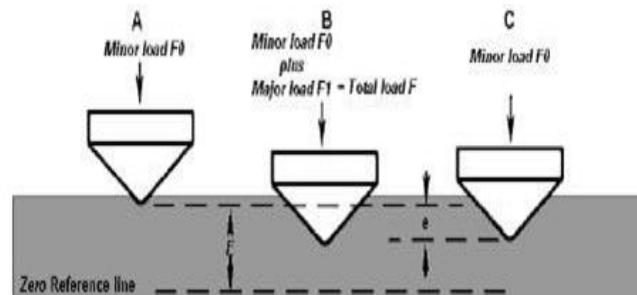
Where

Reference site: <https://www.youtube.com/watch?v=nbl3Ot69Vu0>

Vickers hardness test - diamond indenter, in form of right pyramid with square base and an angle of 136 degrees between opposite faces subjected to a load of 1 to 100 kg applied for 10 to 15 seconds.

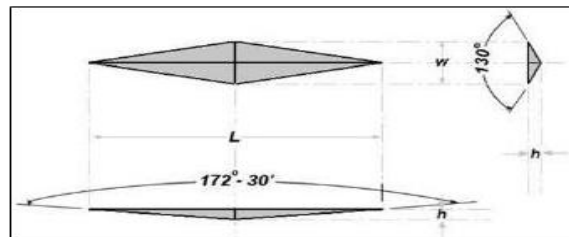


$$HV = \frac{2F \sin \frac{136^\circ}{2}}{d^2} \quad HV = 1.854 \frac{F}{d^2} \text{ approximately}$$



Reference site: <https://www.youtube.com/watch?v=iEQLRrlnxT8>

Knoop (HK) hardness - indenter used is a rhombic-based pyramidal diamond that produces an elongated diamond shaped indent.



$$HK = \text{Constant} \times \text{test force} / \text{indent diagonal squared}$$

Constant is function of indenter geometry and the units of force and diagonal. The Knoop number, ranges from HK 60 to HK1000 for metals, will increase as the sample gets harder.

Reference site: <https://www.youtube.com/watch?v=tDrKXW1CQhs>

Exercise

1. Compare all four hardness testing and list its advantages and disadvantages.
2. What is the difference between engineering strain and true strain?
3. Which test uses diamond indenter?

*Note: if you cannot print and paste the notes you can write in your note book. Answer all exercises in your note book.*

**SANGAM SKM COLLEGE - NADI**  
**LESSON NOTES – WEEK 2 AND 3**  
**YEAR 13**  
**APPLIED TECHNOLOGY**

<b>Strand 3</b>	AT13.3: Engineering Materials
<b>Strand 4</b>	AT 13.4: Basic Home Improvement
<b>Sub-strand</b>	AT 13.3.1 Working With Engineering Materials AT 13.4.1 General Trade Skills – Plumbing and Tiling
<b>Learning Outcome</b>	List the different types of mechanical tests. List general trade skills. Classify safety, materials, and tools in the different trade skills.

**FATIGUE TESTING** - applying cyclic loading to your test specimen.

**Exercise 1:** list applications you have come across where there is cyclic loading and list part which may have needed fatigue testing.

Reference site: [https://www.youtube.com/watch?v=LhUclxBUV\\_E](https://www.youtube.com/watch?v=LhUclxBUV_E)



**Topic: Basic Home Improvement**

**Sanitary plumbing**

- Work of fixing or unfixing any sanitary fixture or sanitary appliance
- All water pipes within boundary of a property, including any fixtures and fittings within that system.
- Includes hot water systems, valves and devices used to control pressure and temperature and to prevent backflow.
- Foul water collection and disposal systems include pipes, vents and devices to control pressure fluctuations and foul air movement.



**Exercise 2:** list all sanitary fixtures at you home

Reference site: <https://www.youtube.com/watch?v=IQbh-Ve4kUU>

**Three main ways faulty plumbing cause serious health and safety issues**

Risk of disease, Necessity for a fresh and clean water supply and Hazards associated with producing hot water

**Sanitary plumbing does not include:**

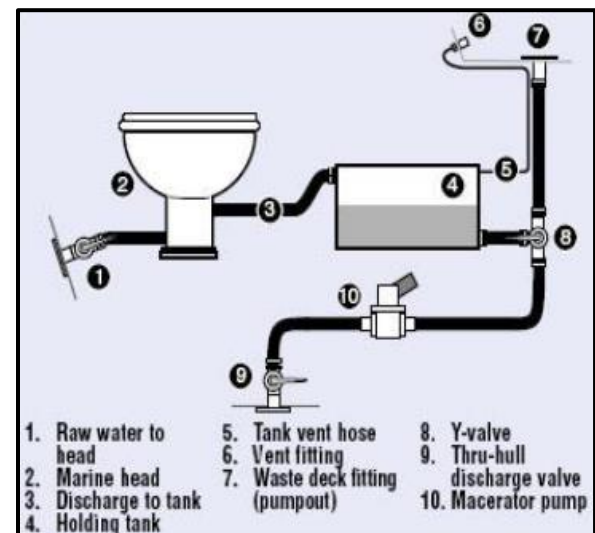
- Plumbing fixtures in boat ships and vehicles
- bedpan, dishwasher and washing machine fixtures
- replacing tap parts and shower over a bath

**Unlicensed person (including a home owner) can undertake, includes:**

- Maintenance of taps and tap washers
- Installing/replacing spotting and downpipes
- Roof work

**Exercise 3:** explain how you will you replace tap washer at home.

Reference site: <https://www.youtube.com/watch?v=sMaFmHBPrpy4>



## Major categories of plumbing

- Potable cold and hot tap water supply
- Plumbing drainage venting
- Sewage systems and septic systems with or without hot water heat recycling and gray water recovery and treatment systems
- Rainwater, surface, and subsurface water drainage

## Water services and systems

Water systems include:

Domestic, multi living units, large developments, multi-story construction, non-drinking, flushing system, hot water and fire systems

Exercise: Select the correct water system in which you live in and state its difference from any other from the above list.

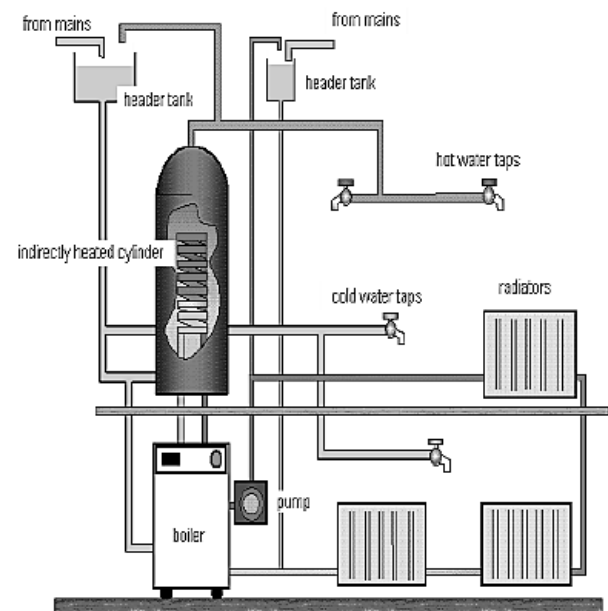
## Hot Water System

Appliances that store and/or heat water must be available and a pipework system designed that transports the heated water to the required discharge points

Energy sources to heat: Electricity, gas (LPG) and solar  
Solar- solar collectors heat used directly, or collected by photovoltaic cells that converted to electricity stored for future use.

Operate in two ways:

1. Solar collector units that transfer radiant heat directly to water in a storage tank
2. Solar heat pump units draw heat from the air and store it in the water tank



**Exercise 4:** sketch the components of a basic solar hot water system

Reference site: <https://www.youtube.com/watch?v=SXMFq0rELIY>

Cold water supply system: supplied to a building and surrounds by variety of methods

Non portable water – reclaimed from recycled water systems and not used for drinking but for washing, gardening and flushing.

To boost the pressure in multi-story buildings pressure pumps are used

## Combined Hot Water Storage Cylinder

The cold water storage cistern is mounted immediately above the hot water storage cylinder in a combined unit.

Advantages - reduction in pipe work required.

Disadvantages - Because the cold water storage is not in the attic it will likely be significantly lower and this reduces the head of water.

## Direct Hot water Supply

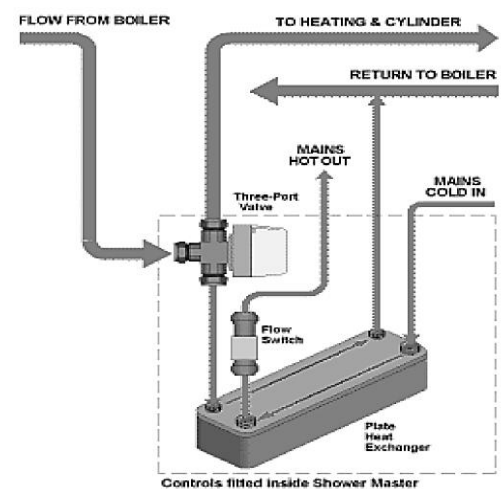
Water heated by a boiler in which case the primary flow goes from the boiler to the hot water cylinder, heating the water within, and returns from the bottom of the cylinder to the boiler again.

Exercise: how is pressure boosted in rural domestic indirect water system without a pressure pump?

Sewage and septic system - efficiently remove waste from the premises and dispose of it safely and responsibly.

Septic:

- uses natural biological (bacteria) process to break down waste
- effluent still contains 70% of pollutant
- remain liquid flows to drain field



- Emptying once every year  
Sewer treatment:
- Involves rotating media discs designed to create aerobic bacterial digestion
- effluent has the appearance of clear water and is 95% clean
- Emptying between 3-60 months

**Exercise 5:** differentiate between septic and sewer treatment

Reference site: <https://www.youtube.com/watch?v=z2o5R9IAFaE>

## **Topic: Basic Home Improvement**

### **Paint**

- Is liquid, liquefiable, or mastic composition that, after application to a substrate in a thin layer, converts to a solid film.
  - Commonly used to protect, color, or provide texture to objects
- Components: vehicle, binder, diluent, pigment & filler and additives.

Application: applied as a solid, a gaseous suspension (aerosol) or a liquid

Product variants: primer, emulsion, flat finish, matte finish, egg shell finish, pearl finish, semi-gloss, varnish, stain, lacquer, enamel, glaze, roof finger paints inks, anti-graffiti coating, anti-climb, anti-foul, insulative, anti-slip, road marking and luminous paints.

Exercise 6: identify and state three different types of paint used at your home

Reference site: <https://www.youtube.com/watch?v=H5OlpcACyJI>

Failure of paint: dilution, contamination, peeling/blistering, chalking, cracking and erosion.

Paint brush: used to apply paint or sometimes ink

Parts:

1. **Bristles:** Transfer paint onto the substrate surface
2. **Ferrule:** Retains the bristles and attaches them to the handle
3. **Handle:** The intended interface between the user and the tool

Reference site: <https://www.youtube.com/watch?v=-vCrFPkoQNg>

Spray painting -painting technique where a device sprays coating (paint, ink, varnish, etc.) through air onto a surface.

Air gun spraying - process where paint is applied to an object through use of an air-pressurized spray gun

Types of nozzles - are full cone, hollow cone, and flat stream.

Types of spraying systems: HVLP (High Volume Low Pressure), LVLP (Low Volume Low Pressure), Electrostatic spray painting, direct and turbo charging, post atomization charging, rotational bell electric fan, hot spray, air assisted airless, airless, automated linear and automated flat line

Spraying booth: pressure controlled closed environment, used to paint vehicles in a body shop.

**Exercise 7:** sketch the basic parts of spray painting

Reference site: <https://www.youtube.com/watch?v=JXcxMzaCem0>

## **Topic: Basic Home Improvement**

### **Tiles and tiling:**

tile - manufactured piece of hard-wearing material such as ceramic, stone, metal, or even glass, generally used for covering roofs, floors, walls, showers, or other objects such as table tops.

Application and types: Roof, floor, and wall

Materials: ceramic, pebble, quarry, mosaic, cork/vinyl & lino,

*Note: if you cannot print and paste the notes you can write in your note book. Answer all exercises in your note book.*