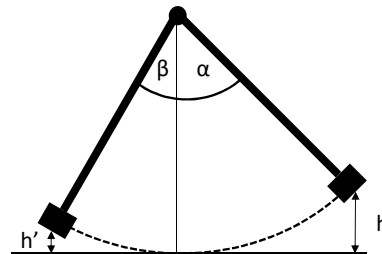


Impact, Hardness and Creep

CB 251
Testing of Materials
Dr. Karim Helmi

Impact Tests

- Impact tests are used to compare the impact resistance of different materials.
- Impact tests are conducted by setting a pendulum to angle, α , which then swings through specimen and reaches the final angle, β .



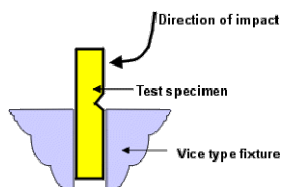
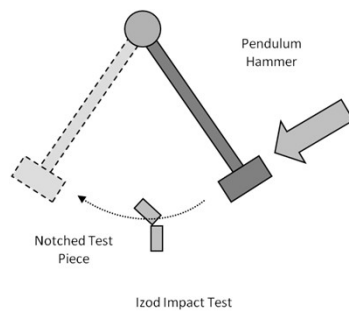
Impact Tests

- The energy absorbed by the specimen will reduce the height of the specimen from h to h'
- The absorbed energy by the specimen is calculated by;

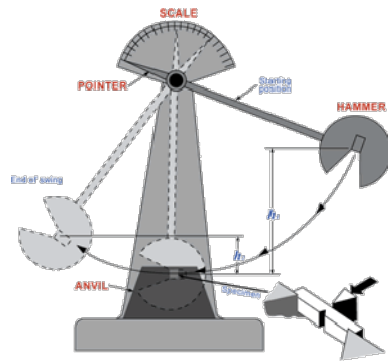
$$E = w(h-h')$$

- Where w is the weight of the pendulum

Izod Impact Test



Charpy Impact Test

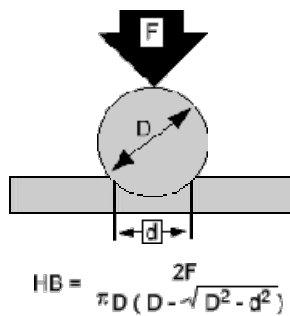


Hardness

- Hardness is the resistance of materials to surface deformation such as scratching and indentation.
- Hardness tests are conducted as a basis for comparing the hardness of different materials

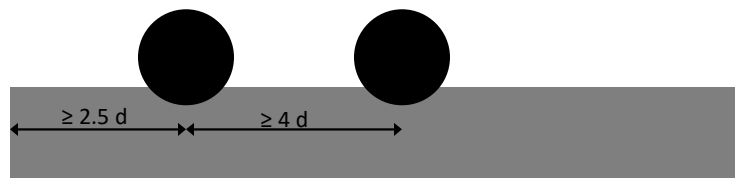
Brinell Hardness Test

- In this test a sphere is pressed into the surface with a known load, the hardness number is the load divided by the surface area of the indentation



Brinell Hardness Test

Material	Brinell Hardness
Wood	1.6 - 7
Lead	5
Aluminum	15
Mild steel	120
Stainless steel	200
Glass	1550



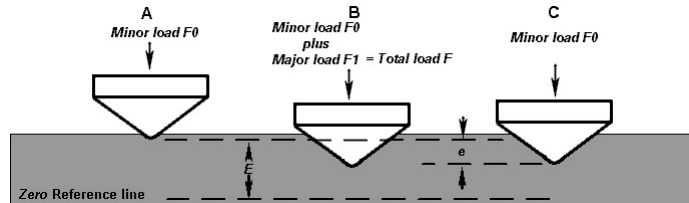
Brinell Hardness Test

- Advantages
 - Well known throughout industry with well accepted results
 - Tests are run quickly (within 2 minutes)
 - Test inexpensive to run once the machine is purchased
- Disadvantages
 - Not well adapted for very hard materials
 - Not well adapted for thin specimens
 - Not well adapted for surface hardened materials

Rockwell Hardness Test

- Indenter can be 1/16 in hardened steel ball, 1/8 in steel ball, or 120° diamond cone with a somewhat rounded point (brale)
- Hardness number is an arbitrary value that is inversely related to the depth of indentation
- Minor load is applied (10 kg) to set the indenter in material
- Dial is set and the major load applied (60 to 140 kg)
- Major load is removed and hardness reading is measured

Rockwell Hardness Test

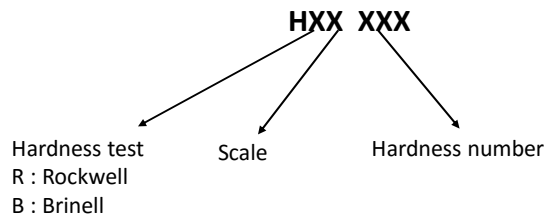


Hardness number = E - e

Rockwell Hardness Test

Scale	Indenter	Minor load (kg)	Major load (kg)	Total Load (kg)	E
A	Diamond cone	10	50	60	100
B	1/16" steel ball	10	90	100	130
C	Diamond cone	10	140	150	100
D	Diamond cone	10	90	100	100
E	1/8" steel ball	10	90	100	130

Hardness Number Identification



Examples:

HRC 110
110 hardness number obtained from Rockwell hardness test C scale

HB 50
50 hardness number obtained from Brinell hardness test

Creep

- Creep is the plastic deformation resulting from the application of a long-term constant load.
- Creep is affected by temperature
 - Metals usually have insignificant creep under normal temperature, but becomes significant under elevated temperatures
 - Concrete and polymers have large creep under room temperature and must be accounted for when calculating deformations

Creep

