Instrument (Please base on the actual goods)

No.	Accessory	Qty	No.	Accessory	Qty
1	Aluminum base - 600mm long	1	2	Iron supporting bracket- 300mm (H)	2
3	Moveable aluminum track stand Note: base is movable and can be fixed to the groove.	1	4	Movable dial indicator w/ stand Note: stand is movable and can be fixed to the groove.	1
5	Slotted weight set 5.1 mass 50g*5 5.2 mass 10g*10	1	6	Weight holder: with V-shaped opening	1
7	Measuring beam set - Unit:mm 7.1 Steel bar (L)500x (W)21.5x(Thk)1.50 7.2 Steel bar (L)500x(W)14.5x(Thk)1.50 7.3 Steel bar (L)500x(W)10.0x(Thk)1.90 7.4 Steel bar (L)500x(W)10.0x(Thk)3.00 7.5 Aluminum bar (L)350x(W)10.0x(Thk)2.00	1			

	7.6 Cooper bar (L)350x(W)10.0x(Thk)2.00				

Introduction

1. When applying downward force to the center part of the metal beam, strain occurs in the beam and it bends downward. The bent height – H should be proportional to the adding weight. (As Figure -1)

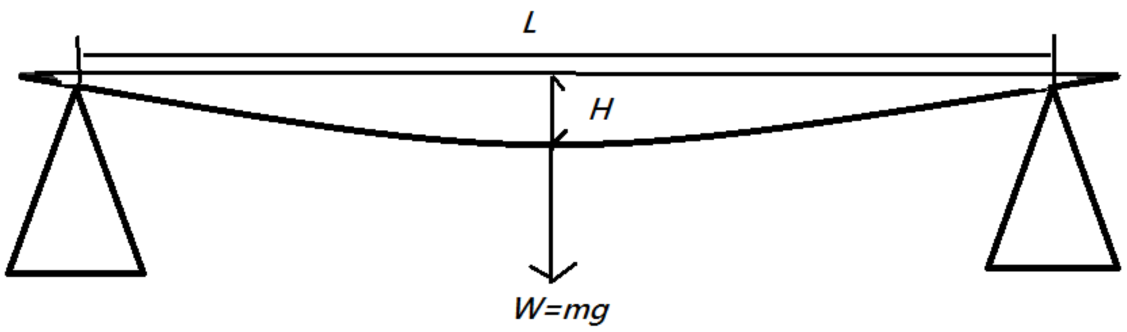

Figure -1.Bending beam method

2. Young's Modulus formula: $Y = \frac{WL^3}{4Hbt^3}$ Unit: $GPa = 10^9 Pa = 10^9 N/m^2$

   W：The weight added to the beam (kgw)

   L：The distance of two edges

   H：The height of the beam bent

   b：Beam width

   t：Beam thickness

3. Calculate young's modulus using the equation:
   Compare the young's modulus of the same material with different width and different thickness.
   Measure the young's modulus of different material beams.
4. The Young's modulus for steel, aluminum and cooper:

Material	Y/ GPa
Steel	190-210
Aluminum	69
Cooper	103-124

Procedure:

1. Put the measuring beam through the holder and have it set on the supporting brackets.
2. Place weights on the holder and add up to the maximum mass (250g).
3. Adjust the height of the dial indicator, move the weight holder directly below to it and have it fixed to the slot on the weight.
   Observe the dial reading and adjust it to the proper position.
4. Adjust the brackets to the proper distance and record it as L.
5. Remove the masses one by one and record the weight and the readings.
   Note that both the bent beam and dial indicator resume to their original positions in different times and ways. To proceed this step continuously and not to put the masses back on to avoid the readings differences. In addition, keep the desk steady when conducting the experiment and remove the masses gently to avoid errors.
6. Add up the masses slowly to the maximum weight and record the weight and the readings of dial indicator in proper order.
7. Weights and bent height should be in linear relationship.
8. Place the next measuring beam and repeat step 2 to step 6 until you complete all measurements for six beams.
9. Calculate the young's modulus and compare with figure-1 to get the tolerance.

Experiment Results

1. Width 21.5 mm, Thickness 1.47mm

   Steel beam with the distance of 400mm between the two ends.

Mass(kg)	Weight(kgw)	Height (m)	ΔH(m)	Y(GPa)	Error (%)
Average					

2. Width 14.5 mm, Thickness 1.5mm

   Steel beam with the distance of 400mm between the two ends.

Mass (kg)	Weight(kgw)	Height (m)	ΔH(m)	Y(GPa)	Error (%)
Average					

3. Width 10 mm, Thickness 1.92mm

   Steel beam with the distance of 400mm between the two ends.

Mass (kg)	Weight(kgw)	Height (m)	ΔH(m)	Y(GPa)	Error (%)
Average					

4. Width 10 mm, Thickness 3.1mm

Steel beam with the distance of 400mm between the two ends.

Mass(kg)	Weight(kgw)	Height(m)	ΔH(m)	Y(GPa)	Error (%)
Average					

5. Width 10 mm, Thickness 2mm

Aluminum beam with the distance of 300mm between the two ends.

Mass(kg)	Weight(kgw)	Height (m)	ΔH(m)	Y(GPa)	Error (%)
Average					

6. Width 10 mm, Thickness 2mm

Aluminum beam with the distance of 300mm between the two ends.

Mass(kg)	Weight(kgw)	Height (m)	ΔH(m)	Y(GPa)	Error (%)
Average					