

# Mechanical engineering test questions

[Engineering](#)



**ASSIGN  
BUSTER**

For a pipe, calculate  $J$  for the outside diameter, then SUBTRACT the  $J$  for the inside diameter (the hole). We do not have torsion equations for square shapes - these equations only work for circular shapes (round rods and pipes). Anything else will deform under torsion and will not obey these formulas. Open shapes like a slit pipe can be almost as strong in bending as a closed pipe, but hundreds of times weaker in torsion. To measure torque, convert the mass to Newton's. (Take the mass in kg and multiply by 9.81 for gravity). Now multiply by the perpendicular distance to the axis of the rod to get torque in NM.

Errors Repeated from Beam Bending Laboratory) Record the absolute error for each measurement: The absolute error is the sum of several factors:  
Absolute error = (Resolution / 2) + (Parallax error) + (misalignment error) + (systematic error) Where: Resolution Error = smallest increment in the measurement scale. The human limit is considered to be half of this again. For example, this dial gauge has smallest increment = 0.01 mm, so it is considered to be readable to 0.005 mm. Parallax error is an error caused by viewing the measurement at an angle.

Parallax is an apparent displacement or difference of orientation of an object viewed along two different lines of sight. This is why the passenger in a car thinks you are going over the speed limit, but from the driver's view, the needle says the car is going the right speed! Parallax is avoided by looking straight-on, and also kept to a minimum by keeping the needle close to the scale. Your estimate of parallax error depends on the geometry of the measurement, but for the gauge above the parallax error would be only

about 10% of the increment. Misalignment error: Not taking the measurement parallel or perpendicular.

Egg. The dial gauge is not vertical, the tape measure is at an angle, the caliper is not perpendicular etc. This is not supposed to happen if you take the measurement carefully, but some measurements are more difficult than others. Systematic error: An error inherent in the measuring instrument itself. Egg a tape measure is inaccurate due to temperature change, or it is actually printed wrong! Hopefully this is not a problem, but the only way to check is Calculating with Errors There are two ways to specify error - absolute and relative (%).  $50 \pm 1$  mm has an absolute error of mm, and a relative error of 10%.