

Fluid Properties

Gauge Pressure = Pressure compared to atmosphere

Absolute Pressure = Pressure compared to vacuum

Standard atmosphere = 101.3 kPa (sea level)

Exam Potion...

Tuesday, 16 July 2013
6:43 PM

Q16: A cylindrical drum of diameter 595 mm and height 1176 mm is full of liquid of mass 615 kg. (a) What is the volume of fluid in the drum?



Work in m!

$$\text{Volume} = \text{Pi} * 0.595^2 / 4 * 1.176 = 0.326987 \text{ m}^3$$

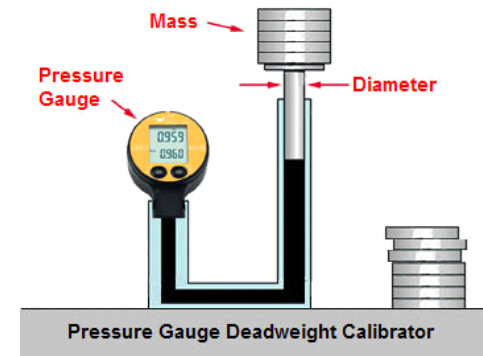
(b) What is the density of fluid in the drum?

$$\begin{aligned} \text{Density} &= \text{mass/volume} \\ &= 615 / 0.326987 = 1880.809 \text{ kg/m}^3 \end{aligned}$$

Pressure Gauge Calibration

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6:49 PM

Q20: A pressure gauge calibrator has a 36.7 mm piston. The total mass of the piston plus weights is 2.5 kg. What would be the correct reading on the pressure gauge?



Pressure = Force / Area

Force = $2.5 \times 9.81 = 24.525$ N

Area = $\pi \times 0.0367^2 / 4 = 0.001057845$ m²

Pressure = $24.525 / 0.001057845 = 23183.93$ Pa (23.18393 kPa)

Q21: A pressure gauge calibrator has a 37.4 mm piston. The piston itself is 0.59 kg. How much mass (deadweights) must be added to give a pressure of 106 kPa?

Area = $\pi \times 0.0374^2 / 4 = 0.001098584$ m²

Pressure = Force / Area

Force = Pressure * Area

= $106000 \times 0.001098584 = 116.449904$ N

Total Mass = Force/9.81 = $116.449904 / 9.81 = 11.87053$ kg

Added Mass = $11.87053 - 0.59 = 11.28053$ kg

Viscosity

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7:00 PM

Q22: A motor oil is graded SAE 30 and has a relative density of 0.86. (a) What is the dynamic viscosity? (use SI units)



$$1 \text{ Centipoise} = 0.001 \text{ Pas}$$

$$\text{SAE} = \text{Centipoise}$$

$$30/1000 = 0.03 \text{ Pas}$$

Kinematic viscosity = dynamic viscosity/density

$$\text{RD} = \text{Density}/1000$$

$$\text{Density} = \text{RD} * 1000 = 0.86 * 1000 = 860$$

$$\begin{aligned} \text{Kinematic viscosity} &= \text{dynamic viscosity}/\text{density} \\ &= 0.03/860 = 0.0000349 \text{ m}^2/\text{s} \end{aligned}$$