

FINDING ρ of H₂O BY DIRECT MEASUREMENT

EACH PAIR OF STUDENTS NEEDS: 100 ml graduated cylinder
scientific balance

BALANCE # _____

Mass of empty graduated cylinder: _____ = A

Volume of water in graduated cylinder: _____ = V

Mass of graduated cylinder + water: _____ = B

CALCULATION: Mass of water in graduated cylinder = B — A = _____ = M

Density = $\frac{\text{mass}}{\text{volume}} = \frac{M}{V} = \frac{\text{g}}{\text{ml}} = \text{g/mL}$

Note: the density of water is 1.00 g/ml at 25°C (room temperature) and at standard pressure: 101.3 kPa

FINDING ρ of metals BY INDIRECT MEASUREMENT

EACH PAIR OF STUDENTS NEEDS: 100 ml graduated cylinder
scientific balance
1 piece of metal

SAMPLE #1: _____

Mass of metal: _____ = M

Initial Volume of water in graduated cylinder: _____ = A

Volume of metal + water: _____ = B (*"Water Displacement Method"*)

CALCULATION: Volume of metal = B — A = _____ = V

Density = $\frac{\text{mass}}{\text{volume}} = \frac{m}{V} = \frac{\text{g}}{\text{mL}} = \text{g/mL}$

DISCUSSION QUESTIONS:

- 1) Why was our first activity a DIRECT measurement of density?
- 2) Why was our second activity an INDIRECT measurement of density?
- 3) What types of matter can have their density determined directly?
- 4) When will indirect measurements of density *not* work?