

Mastering Physics Prerequisites
Solving for an Unknown Value
Problems 1-5

1. When a piece of hot metal is immersed in water, the metal cools off and the water gets somewhat warmer until they reach an equilibrium temperature. A physics student is solving for the equilibrium temperature and came up with the following equation.

$$89,600 \text{ J} - \left(224 \frac{\text{J}}{^{\circ}\text{C}}\right) T_f = \left(16,744 \frac{\text{J}}{^{\circ}\text{C}}\right) T_f - 334,880 \text{ J}$$

Solve for the equilibrium temperature, T_f . Note that the J in the equation stands for joules, which is a unit of energy.

2. A chemistry student is trying to determine the volume of four moles of a gas that is at 300 K at a pressure of 100,000 N/m². Using the ideal gas law, she gets

$$\left(100,000 \frac{\text{N}}{\text{m}^2}\right) V = (4 \text{ moles}) \left(8.314 \frac{\text{J}}{\text{mol K}}\right) (300 \text{ K})$$

What is the volume of the gas? Of course, you must include units. Note that a Joule, which is abbreviated J, is a newton – meter, which is abbreviated N·m.

3. When solving for the initial speed of a stone that takes 1.414 seconds to reach the ground from a height of 25 meters, a student developed the following equation.

$$-25 \text{ m} = \frac{1}{2} \left(-10 \frac{\text{m}}{\text{sec}^2}\right) (1.414 \text{ seconds})^2 + v_i (1.414 \text{ seconds})$$

Solve the equation for v_i .

4. When calculating the acceleration of a block on a plane that has a rope pulling it up the plane, a student has the following equation.

$$75 \text{ N} - (8 \text{ kg}) \left(\frac{10 \text{ m}}{\text{sec}^2}\right) \sin 15^{\circ} - (0.4)(77.27 \text{ N}) = (8 \text{ kg}) a_x$$

Solve the equation for a_x . Include units. Note that a kg · m/sec² is a Newton, which is abbreviated N.

5. A physics student has the following equation for the initial vertical speed of a golf ball hit from a raised tee.

$$-30 \text{ yards} = \frac{1}{2} \left(-8.97 \frac{\text{yd}}{\text{sec}^2} \right) (6 \text{ sec})^2 + v_{i,y} (6 \text{ sec})$$

Solve this expression for the initial vertical speed of the ball, $v_{i,y}$.