

ENT 310 – Unit Conversions for lbs-mass to lbs-force

$$\text{Weight} = \text{Force} = m a = m g$$

In the SI system, mass is in kg and force is expressed in Newtons and we convert using the formula: mass = weight/gravity.

The same is true for English units, lbs-mass must be converted to lbs-force. Just as kilograms do not equal Newtons, lbs-mass does not equal lbs-force. However, here on earth, we use lbs for both properties. The official English units for mass are slugs where 1 slug = 32.2 lb_m.

$$F = ma \text{ therefore, } m = \frac{F}{a} = \frac{lb_{force}}{ft / s^2} = \frac{lb_f \cdot s^2}{ft}$$

If mass is specified in lbs-mass (which will be avoided – usually it will be designated as weight which is already a force), we will need to convert it to lbs-force using the conversion constant g_c .

$$g_c = \frac{32.2 lb_m \cdot ft}{lb_f \cdot s^2} \quad \text{Then, Weight} = F = \frac{m \cdot g}{g_c}$$

Example: What does a 100 lb_m object weigh?

$$W = \frac{m \cdot g}{g_c} = \frac{(100 lb_m) \cdot (32.2 ft / s^2)}{1} \times \frac{lb_f \cdot s^2}{lb_m \cdot 32.2 ft / s^2} = 100 lb_f$$

Answer: a 100 lb_m object exerts a force of 100 lb_f due to the earth's gravity. This conversion technique only works for objects on earth. The constant is designed for objects at sea level, since as you gain altitude, gravity becomes less. But we will accept the variance as negligible.

So we will use weight properties to avoid confusion.