

Later in our study of physics we will learn that work can be calculated using  $W = \vec{F} \cdot \vec{x}$  where  $\vec{F}$  is the force acting on an object and  $\vec{x}$  is the displacement of the object. Suppose you need to determine the work done to move a particle from one point in a viscous material to another. The force is constant and is described by  $\vec{F} = 1.0 \vec{x} + 4.1 \vec{z}$  and the displacement is described by  $\vec{x} = 2.1 \vec{x} + -3.7 \vec{y} + -2.2 \vec{z}$ . Let the force be measured in millinewtons and the displacement in centimeters.

$$\begin{aligned}
 W &= \vec{F} \cdot \vec{x} & \vec{F} &= 1.0 \vec{x} + 4.1 \vec{z} \\
 & & \vec{x} &= 2.1 \vec{x} + -3.7 \vec{y} + -2.2 \vec{z} \\
 &= F_x x_x + F_y x_y + F_z x_z \\
 &= (1.0 \times 10^{-3} \text{ N})(2.1 \times 10^{-2} \text{ m}) + (0 \text{ N})(-3.7 \times 10^{-2} \text{ m}) + (4.1 \times 10^{-3} \text{ N})(-2.2 \times 10^{-2} \text{ m}) \\
 &= -0.0179 \text{ Nm}
 \end{aligned}$$

$$\boxed{-0.018 \text{ Nm}}$$