

1.8 The *Phoenix* with a mass of 350 kg was a spacecraft used for exploration of Mars. Determine the weight of the *Phoenix*, in N, (a) on the surface of Mars where the acceleration of gravity is 3.73 m/s^2 and (b) on Earth where the acceleration of gravity is 9.81 m/s^2 .

KNOWN: *Phoenix* spacecraft has mass of 350 kg.

FIND: (a) Weight of *Phoenix* on Mars, in N, and (b) weight of *Phoenix* on Earth, in N.

SCHEMATIC AND GIVEN DATA:

$$\begin{aligned}m &= 350 \text{ kg} \\g_{\text{Mars}} &= 3.73 \text{ m/s}^2 \\g_{\text{Earth}} &= 9.81 \text{ m/s}^2\end{aligned}$$

ENGINEERING MODEL:

1. Acceleration of gravity is constant at the surface of both Mars and Earth.

ANALYSIS: Weight is the force of gravity. Applying Newton's second law using the mass of the *Phoenix* and the local acceleration of gravity

$$F = mg$$

(a) On Mars,

$$F = (350 \text{ kg}) \left(3.73 \frac{\text{m}}{\text{s}^2} \right) \left| \frac{1 \text{ N}}{1 \text{ kg} \cdot \text{m/s}^2} \right| = \underline{\underline{1305.5 \text{ N}}}$$

(b) On Earth,

$$F = (350 \text{ kg}) \left(9.81 \frac{\text{m}}{\text{s}^2} \right) \left| \frac{1 \text{ N}}{1 \text{ kg} \cdot \text{m/s}^2} \right| = \underline{\underline{3433.5 \text{ N}}}$$

Although the mass of the Phoenix is constant, the weight of the Phoenix is less on Mars than on Earth since the acceleration due to gravity is less on Mars than on Earth.