Answer on Question #69315 - Physics / Other

An alien life form on the planet Vulcan throws a 1.8 kg package at 12 m/s [vertically down] toward some visiting human astronauts who are 55 m directly beneath him. If the planet Vulcan has a mass of 5.78 x 1023 kg and a radius of 4.37 x 106 m, find

1. the acceleration of gravity on Vulcan.

2. the time it takes for the package to reach the unsuspecting astronauts.

3. the amount of force an astronaut would have to exert upwards to stop the package. Assume that the package goes from its maximum speed to not moving over the course of 1.2 meters.

Solution

1. $g = \frac{GM}{r^2}$;

   $g = \frac{6.67 \times 10^{-11} \times 5.78 \times 10^{23}}{\left(4.37 \times 10^{6}\right)^2} = 2.02\,\text{m/s}^2$

2. $h = v_0 t + \frac{gt^2}{2}$;

   $t = 3.53$ s.

3. $Fd = \frac{mv^2}{2} \Leftrightarrow F = \frac{mv^2}{2d}$;

   $v = v_0 + gt$;

   $v = 12 + 2.02 \times 3.53 = 19.13\,\text{m/s}$

   $F = \frac{1.8 \times 19.13^2}{2 \times 1.2} = 274.5\,\text{N}$