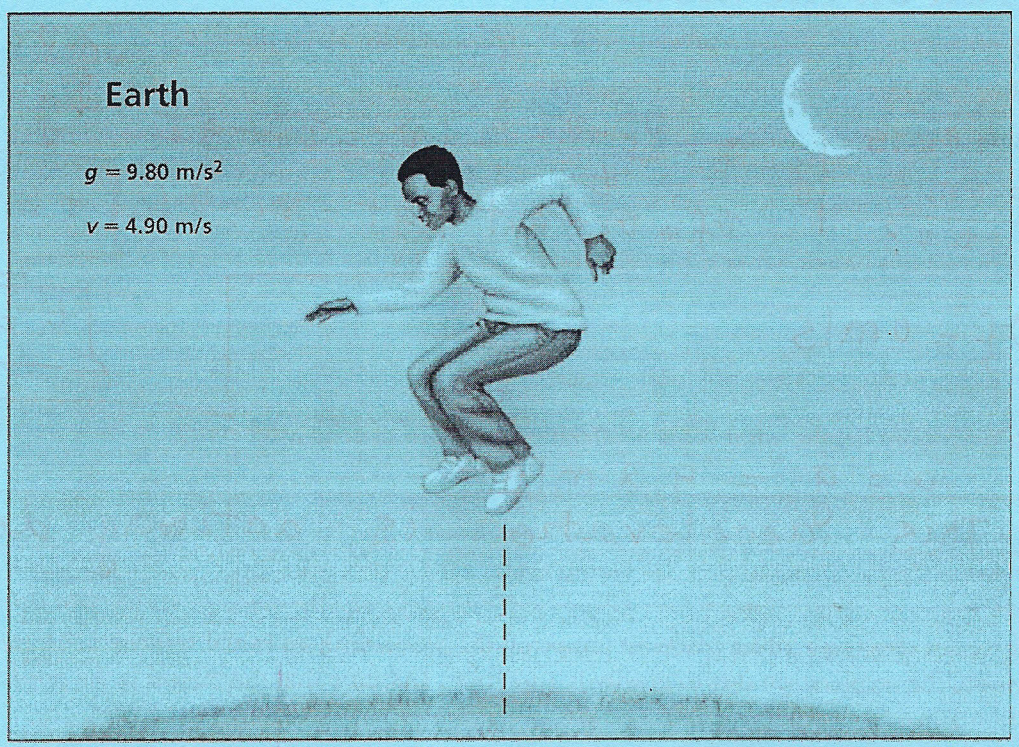
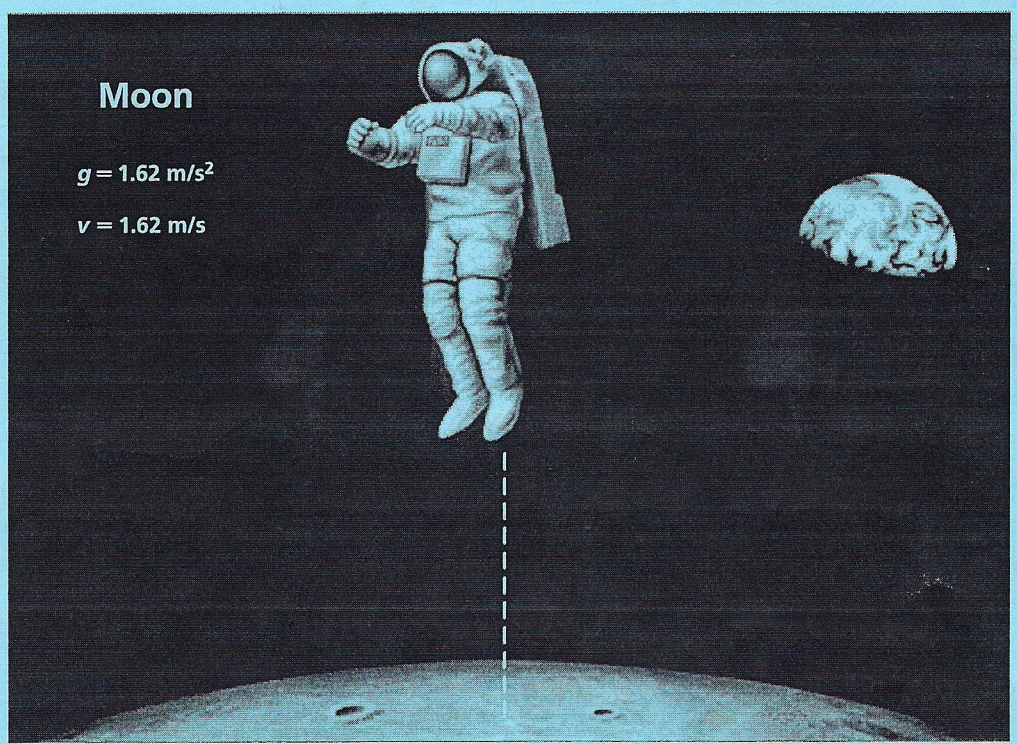
CHAPTER 3

Transparency 3-4

Free Fall on the Moon





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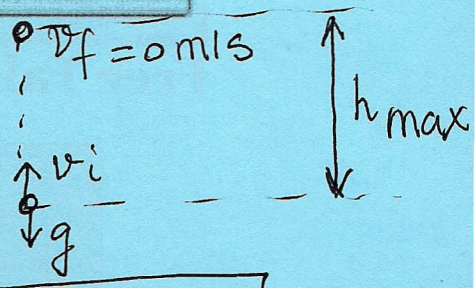
3 Transparency 3-4 Worksheet

Free Fall on the Moon

1. A boy on Earth jumps straight upward with an initial velocity of 4.9 m/s.



a. How long does it take for him to reach maximum height?

$v_i = 4.9$ m/s, $v_f = 0$ m/s, $t = ?$

$g = a = \frac{v_f - v_i}{t}$

$v_f = v_i + a \cdot t$

$v_f = v_i - gt$

$gt = v_i - v_f$

$t = \frac{v_i - v_f}{g} = \frac{4.9 \text{ m/s}}{9.8 \text{ m/s}^2}$

$t = 0.5$ s

b. At maximum height, what is his velocity?

$v_f = 0$ m/s

c. At maximum height, what is his acceleration? Explain your answer.

$a = g = 9.8 \text{ m/s}^2$

This acceleration is acting downward.

2. An astronaut wearing a 20-kg spacesuit jumps on the Moon with an initial velocity of 16 m/s. On the Moon, the acceleration due to gravity is 1.62 m/s^2. (Assume that downward is the positive direction.)

a. How long does it take him to reach maximum height?

$m = 20$ kg, $v_i = 16$ m/s, $g = 1.62 \text{ m/s}^2$

$g = a = \frac{v_f - v_i}{t}$

$t = \frac{v_i - v_f}{g}$

$t = \frac{16 \text{ m/s} - 0 \text{ m/s}}{1.62 \text{ m/s}^2} = 9.87$ s

$t = 9.87$ s

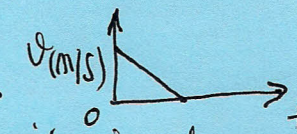
b. What is the maximum height he reaches?

$h = d = v_i t - \frac{g t^2}{2} = 16 \text{ m/s} \cdot 9.87 \text{ s} - 1.62 \text{ m/s}^2 \cdot \frac{(9.87 \text{ s})^2}{2}$

$h = 79$ m

c. If you drew a velocity-time graph for the motion of the astronaut, what would be the slope of the line?

Slope $= -g = -1.62 \text{ m/s}^2$



negative slope, the velocity is decreasing.

d. Are the vectors for acceleration and initial velocity pointed in the same or different directions? Explain your answer.

These vectors have opposite directions; acceleration is acting downward, initial velocity is acting upward.

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