

## 29:006 Solutions

### Problems on page 39

**Problem 2.** velocity = acceleration  $\times$  time =  $a \times t$ , so time  $t = \text{velocity} / \text{acceleration}$   
 $t = v / a = (24.6 \text{ m/s}) / (4 \text{ m/s}^2) = 6.15 \text{ s}$ .

**Problem 3.** For problems involving free fall, for an object that falls from rest (dropped),  
velocity = acceleration due to gravity  $\times$  time,  
 $v = g \times t = 3.71 \text{ m/s}^2 \times 3 \text{ s} = 11.13 \text{ m/s}$

**Problem 4.** the distance an object falls =  $(1/2) \times \text{acceleration due to gravity} \times (\text{time})^2$   
distance =  $(1/2) g \times t^2 = (1/2) \times (3.71) \times (3)^2 = 16.7 \text{ m}$

**Problem 6.** If you leap up with a velocity  $v$ , then you get up to a height,  $h$ , given by height,  $h = v^2 / 2g$ . If we know the height then the formula for getting the velocity is  $v = \text{square root of } (2 g h)$ , or  $\rightarrow v = \sqrt{2gh} = \sqrt{2 \times 9.8 \times 0.5} = \sqrt{9.8} = 3.13 \text{ m/s}$

**Problem 7.** The basketball player jumps up and then comes back down. It takes the same time to go up as it does to fall down. If you fall down from a height  $h$  it takes a time  
 $\rightarrow t = \sqrt{\frac{2h}{g}} = \sqrt{\frac{2 \times 0.5}{9.8}} = \sqrt{\frac{1}{9.8}} = \sqrt{0.102} = 0.32 \text{ s}$ , the total time up and then is  
then  $\rightarrow 0.32 \text{ s} + 0.32 \text{ s} = 0.64 \text{ s}$ .

**Problem 11.** If you jump upward with a speed  $v$ , then it takes a time  $\rightarrow t = v / g$  to get to the top of your jump (where you stop rising). So  $\rightarrow t = (2 \text{ m/s}) / 9.8 = 0.2 \text{ s}$ .