4 Newton's Second Law of Motion

Solutions to Chapter 4 Exercises

3. No. An object can move in a curve only when a force acts. With no force its path would be a straight line.

14. Ten kilograms weighs about 100 N on the Earth (weight = mg = 10 kg × 10 m/s^2 = 100 N, or 98 N if g = 9.8 m/s^2 is used). On the Moon the weight would be 1/6 of 100 N = 16.7 N (or 16.3 N if g = 9.8 m/s^2 is used). The mass would be 10 kg everywhere.

27. Note that 30 N pulls 3 blocks. To pull 2 blocks then requires a 20-N pull, which is the tension in the rope between the second and third block. Tension in the rope that pulls only the third block is therefore 10 N. (Note that the net force on the first block, 30 N – 20 N = 10 N, is the force needed to accelerate that block, having one-third of the total mass.)

28. (a) No. Air resistance is also acting. By free fall is meant free of all forces other than that due to gravity. A falling object may experience air resistance; a freely falling object experiences only the force due to gravity. (b) Yes. Although getting no closer to the Earth, the satellite is falling (more about this in Chapter 10).

34. The acceleration at the top or anywhere else in free fall is g, 10 m/s^2, downward. The velocity of the rock is momentarily zero, but the rate of change of velocity is still there. Or better, by Newton's 2nd law, the force of gravity acts at the top as elsewhere; divide this net force by the mass and you have the acceleration of free fall. That is, $a = F_{net}/m = mg/m = g$.

36. You explain the distinction between an applied force and a net force. It would be correct to say no *net* force acts on a car at rest.

46. A sheet of paper presents more surface area to the air in falling, and therefore has a smaller terminal speed. A wadded piece presents less area and therefore falls faster before reaching terminal speed.

Chapter 4 Problem Solutions

2. $a = F/m$ = 200 N/40 kg = **5 m/s²**.

8. Acceleration will be $g/2$. From $a = F/m = (W - R)/m = (W - W/2)/m = (W/2)/m = W/(2m)$. Since $W/m = g$, we see $W/(2m) =$ ***g*/2**.