W3.13 Quick-Hit Newton's Law Problems 2

1. How much tension must a rope withstand if it is used to accelerate a 1050 kilogram car horizontally at 1.20 m/s^2? Ignore friction.

2. What average force is required to stop an 1100 kilogram car in 8.0 seconds if it is traveling at 90 km/hr?

3. How much tension must a rope withstand if it is used to accelerate a 1200 kilogram crate vertically upwards at 0.80 m/s^2? Ignore friction.

4. A 10-kilogram bucket is lowered by a rope in which there is 63 N of tension. What is the acceleration of the bucket?

5. The cable supporting a 2100-kilogram elevator has a maximum strength of 21, 750 N. What maximum upward acceleration can it give the elevator without breaking?

6. According to a simplified model of a mammalian heart, at each pulse, approximately 20 g of blood is accelerated from 0.25 m/s to 0.35 m/s during a period of 0.10 seconds. What is the magnitude of the force being exerted by the heart muscle?

7. A fisherman in a boat is using a "10-pound test" fishing line. This means that the line can exert a force of 45 N without breaking (1 lb = 4.45 N). (A) How heavy a fish can the fisherman land if he pulls the fish up vertically at a constant speed? (B) If he accelerates the fish upwards at 2.0 m/s^2, what maximum weight fish can he land?

8. A wet bar of soap (m = 150 grams), starting from rest, slides without friction down a ramp 2.0 meters long inclined at 7.3˚. How long does it take to reach the bottom? How would this change if the soap's mass were 250 grams?

9. At the instant a race began, a 65-kilogram sprinter was found to exert a force of 800 N on the starting block at a 22 angle with respect to the ground. (A) What was the horizontal acceleration of the sprinter? (B) If the force was exerted for 0.38 s, with what speed did the sprinter leave the starting block?

10. One 3.0 kilogram paint bucket is hanging by a massless cord from another 3.0 kilogram paint bucket, also hanging by a massless cord. (A) If the buckets are at rest, what is the tension in each of the cords? (B) If the two buckets are pulled upward with an acceleration of 1.60 m/s^2 by the upper cord, calculate the tension in each cord.

11. A mover pushes a couch with a force of 520 newtons horizontally. Assuming the couch starts at rest, is that enough to move it? Assume that the couch has a mass of 150 kilograms, a $\mu_s = 0.60$ and a $\mu_k = 0.30$.

12. A student applies a horizontal force on a refrigerator. The refrigerator has a mass of 75 kilograms, and coefficients of friction between it and the floor are $\mu_s = 0.50$ and $\mu_k = 0.40$. (A) What force is needed to get the refrigerator moving? (B) What force is needed to keep it going at a constant velocity?

13. A box is given a push so that it slides across the floor. How far will it go, given that the coefficient of kinetic friction is 0.20 and the push imparts an initial velocity of 4.0 m/s?

14. Police lieutenants, examining the scene of an accident involving two cars, measure the skid marks of one of the cars, which nearly came to a stop before colliding to be 80 m long. The coefficient of kinetic friction between rubber and the pavement is about 0.80. Estimate the initial speed of the car assuming a level road.

W3.13 Quick-Hit Newton's Law Problems 2 - KEY

1. How much tension must a rope withstand if it is used to accelerate a 1050 kilogram car horizontally at 1.20 m/s^2? Ignore friction. 1260 N

2. What average force is required to stop an 1100 kilogram car in 8.0 seconds if it is traveling at 90 km/hr? 3437.5 N

3. How much tension must a rope withstand if it is used to accelerate a 1200 kilogram crate vertically upwards at 0.80 m/s^2? Ignore friction. 12960 N

4. A 10-kilogram bucket is lowered by a rope in which there is 63 N of tension. What is the acceleration of the bucket? 3.7 m/s^2

5. The cable supporting a 2100-kilogram elevator has a maximum strength of 21,750 N. What maximum upward acceleration can it give the elevator without breaking? 0.357 m/s^2

6. According to a simplified model of a mammalian heart, at each pulse, approximately 20 g of blood is accelerated from 0.25 m/s to 0.35 m/s during a period of 0.10 seconds. What is the magnitude of the force being exerted by the heart muscle? 0.02 N

7. A fisherman in a boat is using a "10-pound test" fishing line. This means that the line can exert a force of 45 N without breaking (1 lb = 4.45 N). (A) How heavy a fish can the fisherman land if he pulls the fish up vertically at a constant speed? (B) If he accelerates the fish upwards at 2.0 m/s^2, what maximum weight fish can he land? (A) 45 N (B) 37.5 N

8. A wet bar of soap (m = 150 grams), starting from rest, slides without friction down a ramp 2.0 meters long inclined at 7.3˚. How long does it take to reach the bottom? How would this change if the soap's mass were 250 grams? 1.77 s, no change

9. At the instant a race began, a 65-kilogram sprinter was found to exert a force of 800 N on the starting block at a 22 angle with respect to the ground. (A) What was the horizontal acceleration of the sprinter? (B) If the force was exerted for 0.38 s, with what speed did the sprinter leave the starting block? (A) 11.4 m/s^2 (B) 4.34 m/s

10. One 3.0 kilogram paint bucket is hanging by a massless cord from another 3.0 kilogram paint bucket, also hanging by a massless cord. (A) If the buckets are at rest, what is the tension in each of the cords? (B) If the two buckets are pulled upward with an acceleration of 1.60 m/s^2 by the upper cord, calculate the tension in each cord. (A) 30 N (bottom), 60 N (top) (B) 34.8 N (bottom), 69.6 (top)

11. A mover pushes a couch with a force of 520 newtons horizontally. Assuming the couch starts at rest, is that enough to move it? Assume that the couch has a mass of 150 kilograms, a μ_s = 0.60 and a μ_k = 0.30. No.

12. A student applies a horizontal force on a refrigerator. The refrigerator has a mass of 75 kilograms, and coefficients of friction between it and the floor are μ_s = 0.50 and μ_k = 0.40. (A) What force is needed to get the refrigerator moving? (B) What force is needed to keep it going at a constant velocity? (A) 375 N (B) 300 N

13. A box is given a push so that it slides across the floor. How far will it go, given that the coefficient of kinetic friction is 0.20 and the push imparts an initial velocity of 4.0 m/s? 4 m

14. Police lieutenants, examining the scene of an accident involving two cars, measure the skid marks of one of the cars, which nearly came to a stop before colliding to be 80 m long. The coefficient of kinetic friction between rubber and the pavement is about 0.80. Estimate the initial speed of the car assuming a level road. 35.8 m/s