NAME: _____

NEWTON'S SECOND LAW

Draw a free-body diagram for each problem.
Show all calculations.

1. A 4.0 kg mass is acted upon by a net force of 10 N [R]. What is the acceleration of the mass?

2. During a satellite recovery, the 250 kg satellite is partially supported by a parachute that supplies an upward force of 950 N. (a) What is the net force acting on the satellite? (b) What is the acceleration of the satellite?

3. A 75 kg box is pulled across a floor with an applied force of 120 N [L] against a 75 N force of friction. (a) What is the net force acting on the box? (b) What is the acceleration of the box?

4. An horizontal force of 15 N [E] is applied to a 2.0 kg mass, which gives it an acceleration of 3.0 m/s^2 [E] sliding along a floor (a) What is the net force acting on the mass? (b) What is the force of friction experienced by the mass?

5. A child exerts a forward push of 50.0 N on a cart. The cart weighs 300 N. (a) What is the mass of the cart? (b) What is the acceleration of the cart, (assume there is no friction)?

6. A sled of mass 30 kg coasts over the ice with an acceleration of -0.50 m/s^2. What is the retarding force of friction?

7. A 6.0 kg mass is moving at a constant velocity of 15 m/s [R]. (a) What force is needed to bring the mass to rest in 9.0 s? (b) How far does the mass move while the force is stopping it?

8. A 3.0 kg mass is pulled by an 8.0 N force while experiencing a 3.5 N force of friction. What is the acceleration of the mass while it is pulled?

9. A vertical rope is attached to a 35.0 kg cart. The cart is given a velocity of 4.00 m/s [UP] in 0.500 s. (a) What is the net force experienced by the cart? (b) What is the force applied to the cart by the rope?

10. An 1000kg elevator is supported by a cable that can apply a maximum force of 1.20×10^4 N before it breaks. What is the greatest upward acceleration that the elevator can receive?

11. A 90.0 kg rock climber repels down a cliff at a constant velocity. (a) What is the net force acting on the rock climber? (b) What is the force of friction acting on the rock climber?

12. A construction crane lowers a load, which weighs 1.25×10^4 N, while exerting a force of 7.0×10^3 N [UP] through its cable. What is the acceleration of the load?

13. A worker pushes a 65 kg crate across a floor with an applied force of 45 N [R] with an acceleration of 0.20 m/s^2 [R].(a) What is the force of friction acting on the crate? (b) What is the coefficient of friction for the crate and the floor?

14. A 25.0 kg mass accelerates from rest to 40.0 m/s in a time of 5.00 s as it falls. What is the average force of air resistance experienced by the object?

15. A 500 kg rocket experiences an upward thrust of 1.50×10^4 N from its engines as it leaves the ground. What is the rocket's initial acceleration? (assume air friction is initially negligible)

Answers:

1. (2.5 m/s^2 [R]) 2. (1500 N [DOWN], 6.0 m/s^2 [DOWN]) 3. (45 N [L], 0.60 m/s^2 [L])
4. (6.0 N [E], 9.0 N [W]) 5. (30.6 kg, 1.63 m/s^2) 6. (- 15 N) 7. (10 N [L], 68 m)
8. (1.5 m/s^2 [FORWARD]) 9. (280 N [UP], 623 N [UP]) 10. (2.2 m/s^2 [UP]) 11. (0 N, 882 N [UP])
12. (4.31 m/s^2 [DOWN]) 13. (32 N [L], 0.050) 14. (45.0 N [UP]) 15. (20.2 m/s^2 [UP])