4 REVIEW

13. because Earth has a very large mass

14. An object with greater mass requires a larger force for a given acceleration.

15. One-sixth of the force needed to lift an object on Earth is needed on the moon.

16. on the horse: the force of the cart, F_g down, F_n up, a reaction force of the ground on the hooves; on the cart: the force of the horse, F_g down, F_n up, kinetic friction

17. push it gently; With a smaller force, the astronaut will experience a smaller reaction force.

18. As the climber exerts a force downward, the rope supplies a reaction force that is directed upward. When this reaction force is greater than the climber's weight, the climber accelerates upward.

19. **a.** zero
b. zero

20. 3.52 m/s^2

21. 55 N to the right

22. **a.** 770 N at 8.1° to the right of forward
b. 0.24 m/s^2 at 8.1° to the right of forward

23. Mass is the inertial property of matter. Weight is the gravitational force acting on an object. Weight is equal to mass times the free-fall acceleration.

24. **a.** −1.47 N
b. −1.47 N

25. **a.** $\mathbf{F_g}$ points down, and $\mathbf{F_n}$ points up.
b. $\mathbf{F_g}$ points down, and $\mathbf{F_n}$ points up perpendicular to the surface of the ramp.
c. same as (b)
d. same as (b)

26. **a.** 54 N
b. 53 N

NEWTON'S SECOND AND THIRD LAWS

Review Questions

13. The force that attracts Earth to an object is equal to and opposite the force that Earth exerts on the object. Explain why Earth's acceleration is not equal to and opposite the object's acceleration.

14. State Newton's second law in your own words.

15. An astronaut on the moon has a 110 kg crate and a 230 kg crate. How do the forces required to lift the crates straight up on the moon compare with the forces required to lift them on Earth? (Assume that the astronaut lifts with constant velocity in both cases.)

16. Draw a force diagram to identify all the action-reaction pairs that exist for a horse pulling a cart.

Conceptual Questions

17. A space explorer is moving through space far from any planet or star and notices a large rock, taken as a specimen from an alien planet, floating around the cabin of the ship. Should the explorer push it gently or kick it toward the storage compartment? Why?

18. Explain why a rope climber must pull downward on the rope in order to move upward. Discuss the force exerted by the climber's arms in relation to the weight of the climber during the various stages of each "step" up the rope.

19. An 1850 kg car is moving to the right at a constant speed of 1.44 m/s.
a. What is the net force on the car?
b. What would be the net force on the car if it were moving to the left?

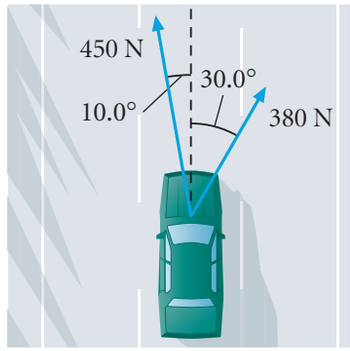
Practice Problems

For problems 20–22, see Sample Problem C.

20. What acceleration will you give to a 24.3 kg box if you push it horizontally with a net force of 85.5 N?

21. What net force is required to give a 25 kg suitcase an acceleration of 2.2 m/s^2 to the right?

22. Two forces are applied to a car in an effort to accelerate it, as shown below.
a. What is the resultant of these two forces?
b. If the car has a mass of 3200 kg, what acceleration does it have? (Disregard friction.)



WEIGHT, FRICTION, AND NORMAL FORCE

Review Questions

23. Explain the relationship between mass and weight.

24. A 0.150 kg baseball is thrown upward with an initial speed of 20.0 m/s.
a. What is the force on the ball when it reaches half of its maximum height? (Disregard air resistance.)
b. What is the force on the ball when it reaches its peak?

25. Draw free-body diagrams showing the weight and normal forces on a laundry basket in each of the following situations:
a. at rest on a horizontal surface
b. at rest on a ramp inclined 12° above the horizontal
c. at rest on a ramp inclined 25° above the horizontal
d. at rest on a ramp inclined 45° above the horizontal

26. If the basket in item 25 has a mass of 5.5 kg, find the magnitude of the normal force for the situations described in (a) through (d).