HW 1 FORCES

1. Driving down the road you hit the brakes suddenly. As a result, your body moves toward the front of the car. Explain, using Newton's laws.

2. When a plane accelerates down a runway during takeoff, the passengers feel as if they are being pushed back into their seats. Why?

3. A young girl slides down a rope. As she slides faster and faster, she tightens he grip, increasing the force exerted on her by the rope. What happens when this force is equal in magnitude to her weight? Explain.

4. At the local farm you buy a flat of strawberries and place them on the backseat of your car. On the way home you begin to brake as you approach a stop sign. At first the strawberries stay put, but as you brake a bit harder, they begin to slide off the seat. Explain.

5. Felicia, the ballet dancer, has a mass of 45.0 kg.
   a) What is Felicia's weight on Earth?
   b) What is Felicia's mass on Jupiter, where the acceleration due to gravity is 25.0 m/s^2?
   c) What is Felicia's weight on Jupiter?

6. Gunter the weightlifter can lift a 230.0-kg barbell overhead on Earth. The acceleration due to gravity on the sun is 274 m/s^2.
   a) Would the barbells be heavier on the sun or on Earth?
   b) How much would the barbells weigh on the sun (if it were possible to stand on the sun without melting)?

7. Sammy Sosa swings at a 0.15 kg baseball and accelerates it at a rate of 3.0 $x10^4$ m/s^2. How much force does Sosa exert on the ball?

8. If an elephant were chasing you, its enormous mass would be very threatening. But if you zigzagged, the elephant's mass would be to your advantage. Why?

9. What is the weight of Lily Lightweight, who has a mass of 40 kg?

10. What is the net force on a 1000-N barrel falling in air with an air drag of 400 N?

11. When a 1000-N barrel is sinking through the water at a constant speed, what is the upward force of the water on the barrel?

12. If a woman weighs 500 N on Earth, what would she weigh on Jupiter, where the acceleration of gravity is 26 m/s^2?

13. Suppose a cart is being moved by a certain net force. If the net force is doubled, by how much does the cart's acceleration change?

14. What is the net force acting on a 25-N freely falling object?
What is the net force when the object encounters 15 N of air resistance?
When it falls fast enough to encounter 25 N of air resistance?

HW2 - FORCES

1. On the moon, the acceleration due to gravity is 1/6 that on Earth. What would be the weight of 0.10-kg of salami on the moon?

2. On the surface of Jupiter, the acceleration due to gravity is about 3 times that on Earth. How much would a 0.60-kg rock weigh on Jupiter?

3. The following forces act on an object: 10 N north, 50 N south, and 40 N west. What is the magnitude of the net force?

4. A 200.0-kg bear grasping a vertical tree slides down at constant velocity. What is the friction force between the tree and the bear?

5. An unbalanced force of 30 N gives an object an acceleration of 5.0 m/s^2 . What force would be needed to give it an acceleration of 1.0 m/s^2?

6. A certain unbalanced force gives a 5-kg object an acceleration of 2.0 m/s^2. What acceleration would the same force give a 30-kg object?

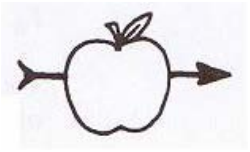
7. A net force of 1.0 N acts on a 2.0 kg object, initially at rest, for 2.0 seconds. What is the distance the object moves during that time?

8. When air resistance on a falling skydiver builds up to 0.25 the weight of the skydiver, what is the acceleration of the skydiver?

9. Suppose that you exert 400 N horizontally on a 50-kg crate on a factory floor, when friction between the crate and the floor is 200 N. What is the acceleration of the crate?

10. Suppose you are on an airplane moving at high constant speed. If you flip a coin straight up it will land in your lap rather than a great distance behind you. Explain.

11. A 30.0-g arrow is shot by William Tell through an 8.00-cm-thick apple sitting on top of his son's head. If the arrow enters the apple at 30.0 m/s and emerges at 25.0 m/s in the same direction, with what force has the apple resisted the arrow?



12. Brian is walking through the school cafeteria but does not realize that the person in front of him has just spilled his glass of chocolate milk. As Brian, who weighs 420 N, steps in the milk, the coefficient of sliding friction between Brian and the floor is suddenly reduced to 0.040. What is the force of sliding friction between Brian and the slippery floor?

13. While redecorating her apartment, Kitty slowly pushes an 82-kg china cabinet across the wooden dining room floor, which resists the motion with a force of friction of 320 N. What is the coefficient of sliding friction between the china cabinet and the floor?

14. A force of 40.0 N accelerates a 5.0-kg block at 6.0 m/s^2 along a horizontal surface.
    a. How large is the frictional force?
    b. What is the coefficient of friction?

15. Howard, the soda jerk at Bea's diner, slides a 0.60-kg root beer from the end of the counter to a thirsty customer. A force of friction of 1.2 N brings the drink to a stop right in front of the customer. a) What is the coefficient of sliding friction between the glass and the counter? b) If the glass encounters a sticky patch on the counter, will this spot have a higher or lower coefficient of friction?

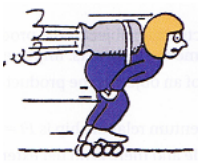
16. In her physics lab, Molly puts a 1.0-kg mass on a 2.0-kg block of wood. She pulls the combination across another wooden board with a constant speed to determine the coefficient of sliding friction between the two surfaces. If Molly must pull with a force of 6.0 N, what coefficient of sliding friction does she calculate for wood on wood?

17. Many automobile passengers suffer neck injuries when struck by cars from behind. How does Newton's law of inertia apply here? How do headrests help to guard against this type of injury?

18. What is the cause of friction, and in what direction does it act with respect to the motion of a sliding object?

19. The force of gravity is twice as great on a 2-kg rock as on a 1-kg rock. Why does the 2-kg rock not fall with twice the acceleration?

20. Skelly the child skater is propelled by rocket power. Skelly and the rocket together have a mass of 25 kg. When the thrusting force is 100 N and friction is 20 N, (a) what will be Skelly's acceleration? (b) How far will he go in 5 s if he starts from rest?



22. A 15-N net force is applied for 6.0 s to a 12-kg box initially at rest. What is the speed of the box at the end of the 6.0-s interval?

23. A 810-kg car accelerates from rest to 27 m/s in a distance of 120 m. What is the magnitude of the average net force acting on the car?

24. A constant force of 8.0 N is exerted for 4.0 s on a 16-kg object initially at rest. The change in speed of this object will be:

25. Two forces are applied to a 5.0-kg object; one is 6.0 N to the north and the other is 8.0 N to the west. The magnitude of the acceleration of the object is:

26. A forward force of 12 N is used to pull a 240-N sled at constant velocity on a frozen pond. The coefficient of friction is:

27. The velocity of a 4.0-N hockey puck, sliding across a level ice surface, decreases at the rate of 0.61 m/s^2. The coefficient of kinetic friction between the puck and ice is:

28. A net force **F** is required to give an object with mass *m* an acceleration **a**. If a net force 6**F** is applied to an object with mass 2*m*, what is the acceleration on this object?

a) **a** b) 2**a** c) 3**a** d) 4**a** e) 6**a**

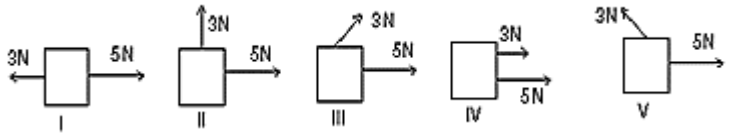
29. When a certain force is applied to the 1-kg standard mass its acceleration is 5.0 m/s^2. When the same force is applied to another object its acceleration is one-fifth as much. The mass of the object is:

a) 0.2 kg b) 0.5 kg c) 1.0 kg d) 5.0 kg e) 10 kg

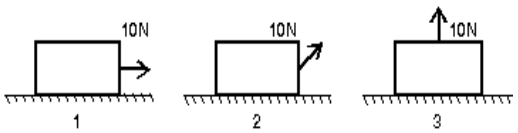
30. An object placed on an equal-arm balance requires 12 kg to balance it. When placed on a spring scale, the scale reads 12 kg. Everything (balance, scale, set of masses and object) is now transported to the moon where free-fall acceleration is one-sixth that on Earth. The new readings of the balance and spring scale (respectively) are:

a) 12 kg, 12 kg b) 2 kg, 2 kg c) 12 kg, 2 kg d) 2 kg, 12 kg e) 12 kg, 72 kg

31. Two forces, one with a magnitude of 3 N and the other with a magnitude of 5 N, are applied to an object. For which orientations of the forces shown in the diagrams is the magnitude of the acceleration of the object the least?

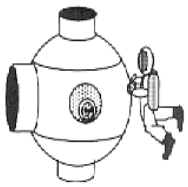


32. A crate rests on a horizontal surface and a woman pulls on it with a 10-N force. Rank the situations shown below according to the magnitude of the normal force exerted by the surface on the crate, least to greatest.



a) 1, 2, 3 b) 2, 1, 3 c) 2, 3, 1 d) 1, 3, 2 e) 3, 2, 1

33. A 70.0-kg astronaut pushes to the left on a spacecraft with a force **F** in "gravity-free" space. The spacecraft has a total mass of 1.0×10^4 kg. During the push, the astronaut accelerates to the right with an acceleration of 0.36 m/s^2



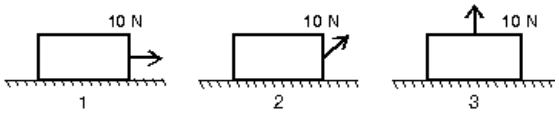
I. Which one of the following statements concerning this situation is true?

a. The spacecraft does not move, but the astronaut moves to the right with a constant speed.
b. The astronaut stops moving after he stops pushing on the spacecraft.
c. The force exerted on the astronaut is larger than the force exerted on the spacecraft.
d. The force exerted on the spacecraft is larger than the force exerted on the astronaut.
e. The velocity of the astronaut increases while he is pushing on the spacecraft.

II. Determine the magnitude of the acceleration of the spacecraft.

34. A rock is thrown straight up from the earth's surface. Which one of the following statements concerning the *net force* acting on the rock at the top of its path is true?
    a) It is equal to the weight of the rock.
    b) It is instantaneously equal to zero newtons.
    c) Its direction changes from up to down.
    d) It is greater than the weight of the rock.
    e) It is less than the weight of the rock, but greater than zero newtons.

36. A crate rests on a horizontal surface and a woman pulls on it with a 10-N force. No matter what the orientation of the force, the crate does not move. Rank the situations below according to the magnitude of the frictional force exerted by the surface on the crate, least to greatest.



a) 1, 2, 3 b) 2, 1, 3 c) 2, 3, 1 d) 1, 3, 2 e) 3, 2, 1

37. Someone at the other end of the table asks you to pass the salt. feeling quite dashing, you slide the 50.0-g salt shaker in their direction, giving it an initial speed of 1.15 m/s. If the shaker comes to rest in 0.840 m, what is the coefficient of kinetic friction between the shaker and the table?

38. Sarah, whose mass is 40.0 kg, is on her way to school after a winter storm when she accidentally slips on a patch of ice whose coefficient of sliding friction is 0.060. What force of friction will eventually bring Sarah to a stop?