11
Forces Quiz Solutions

1.	a. ☐	b. ☒	c. ☐	d. ☐
2.	a. ☐	b. ☒	c. ☐	d. ☐
3.	a. ☐	b. ☒	c. ☐	d. ☐
4.	a. ☐	b. ☐	c. ☒	d. ☐
5.	a. ☐	b. ☐	c. ☐	d. ☒
6.	a. ☐	b. ☐	c. ☐	d. ☒
7.	a. ☐	b. ☒	c. ☐	d. ☐
8.	a. ☐	b. ☐	c. ☒	d. ☐
9.	a. ☐	b. ☐	c. ☐	d. ☒
10.	a. ☐	b. ☐	c. ☒	d. ☐
11.	a. ☐	b. ☒	c. ☐	d. ☐
12.	a. ☐	b. ☒	c. ☐	d. ☐
13.	a. ☒	b. ☐	c. ☐	d. ☐
14.	a. ☐	b. ☐	c. ☒	d. ☐
15.	a. ☐	b. ☒	c. ☐	d. ☐

1. **Problem**
The gravitational force exerted by a large body, such as the Earth, is called

   a. inertial mass
   b. weight
   c. gravitational mass
   d. gravitational field strength

   Solution
   The gravitational force exerted by a large body, such as the Earth, is called **weight**. (p. 94)

2. **Problem**
A box, of mass M, is suspended by a string from the ceiling inside an elevator. The elevator is moving upward, but slowing down. The tension in the string is

   a. less than Mg.
   b. equal to Mg.
   c. greater than Mg.
   d. zero.

   Solution
   The elevator is accelerating downward, so the tension is less than Mg.

3. **Problem**
Why is a greater force needed to start moving a heavy box from rest than to keep pushing it with constant velocity? In the choices below, μ_k is the coefficient of kinetic friction and μ_s is the coefficient of static friction.

   a. The normal force is greater when the box is at rest.
   b. $\mu_k < \mu_s$
   c. $\mu_s < \mu_k$
   d. The inertia of the box is greater when it is at rest.

   Solution
   $\mu_k < \mu_s$. The coefficient of kinetic friction is less than the coefficient of static friction.

4. **Problem**
What force is needed to keep a 96-kg box moving at a constant velocity across a warehouse floor if the coefficient of kinetic friction between the box and the floor is 0.37?

   a. 440 N
   b. 300 N
   c. 350 N
   d. 180 N

   Solution
   The applied force needed for constant velocity (zero acceleration) is one that balances the friction force.

$$F_f = \mu_k F_N = \mu mg = (0.37)(96\,\text{kg})(9.8\,\text{N/kg}) = 350\,\text{N}$$

5. **Problem**
A person stands on top of a box on the ground. What is the magnitude of the normal force that the ground applies to the box?

   a. 617 N
   b. 157 N
   c. 704 N
   d. 931 N

   Solution
   The normal force is

6. **Problem**
What is the net force on a person who is standing in an elevator moving up with a constant velocity of 10.00 m/s?

   a. It depends on the mass of the person.
   b. 10.00 N, down
   c. 10.00 N, up
   d. 0 N

   Solution
   The elevator is moving with constant velocity so the acceleration is zero and the net force must also be zero.

7. **Problem**
A net force of 60 N is applied to an object, and it accelerates at 65 m/s/s in the direction of the applied force. What is the mass of the object?

   a. 0.77 kg
   b. 0.92 kg
   c. 1.1 kg
   d. 3900 kg

   Solution
   According to Newton's Second Law of Motion

$$m = F/a = (60\,\mathrm{N})/(65\,\mathrm{m/s^2}) = 0.92\,\mathrm{kg}$$

8. **Problem**
In a rugby game, Bob (mass = 94 kg) tackles Joe (mass = 99 kg) and knocks Joe to the ground. During the collision who applied the greater force on whom?

   a. Bob applied a greater force on Joe (than Joe did on him).
   b. Joe applied a greater force on Bob (than Bob did on him).
   c. Bob and Joe applied the same magnitude force on each other.
   d. It depends on the relative speeds of Bob and Joe.

   Solution
   According to Newton's Third Law of Motion, the force of Bob on Joe is equal (but opposite) the force of Joe on Bob.

9. **Problem**
A box of slides on the floor in the $+x$ direction. It slows down and comes to a stop with a constant acceleration of $-5.95\,\mathrm{m/s^2}$. What is the coefficient of kinetic friction between the object and the floor?

   a. 0.898
   b. 0.442
   c. 0.503
   d. 0.607

   Solution
   The net force is the friction force, so

$$F_f = F_{net} = ma$$

   The normal force, F_N, is the weight of the box, mg, so

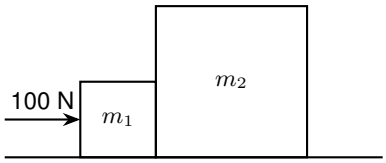
$$\mu_k = \frac{F_f}{F_N} = \frac{ma}{mg} = \frac{a}{g} = \frac{5.95}{9.80} = 0.607$$

10. **Problem**
Which has greater inertia? A bowling ball of mass 2 kg traveling at 5 m/s or a bullet of mass 0.02 kg traveling at 500 m/s?

   a. The bullet.
   b. The bowling ball and the bullet have the same inertia.
   c. The bowling ball.
   d. Not enough information to determine.

   Solution
   Inertia depends only on mass. Therefore, the bowling ball has the greater inertia.

11. **Problem**
Two boxes are in contact with each other on a frictionless table. The mass of the first box is $m_1 = 18$ kg and the mass of the second box is $m_2 = 162$ kg. If you push on the first box with a horizontal force of 100 N to the right, then the second box will experience a net force of



   a. 113 N
   b. 90 N
   c. 100 N
   d. 121 N

   Solution
   The acceleration of the system of two boxes is

$$a = \frac{100\,\mathrm{N}}{18\,\mathrm{kg} + 162\,\mathrm{kg}}$$

The net force on m_2 is its mass times its acceleration

$$F_{net,2} = (162\,\text{kg})\left(\frac{100\,\text{N}}{18\,\text{kg}+162\,\text{kg}}\right) = 90\,\text{N}$$

12. **Problem**
A box, of mass M, is suspended by a string from the ceiling inside an elevator. The elevator is traveling downward with a constant speed. The tension in the string is

    a. less than Mg.
    b. equal to Mg.
    c. greater than Mg.
    d. impossible to determine without knowing the speed.

    Solution
    The elevator is moving with constant velocity so the acceleration is zero and the net force must also be zero. Therefore, the tension force must balance (equal) the gravitational force, Mg.

13. **Problem**
An object weight 86 N on Earth. What is its mass?

    a. 8.8 kg
    b. 86 kg
    c. 840 kg
    d. 6.6 kg

    Solution
    Weight is related to mass by

$$m = W/g = (86\,\text{N})/(9.8\,\text{N/kg}) = 8.8\,\text{kg}$$

14. **Problem**
The mass of an object is 40 kg. What is its weight on Earth?

    a. 410 N
    b. 40 N
    c. 390 N
    d. 580 N

    Solution
    Weight is related to mass by

$$W = mg = (40\,\text{kg})(9.8\,\text{N/kg}) = 390\,\text{N}$$

15. **Problem**
A person of mass 65 kg pushes on a wall with 83 N of force. What is the magnitude of the force that the wall exerts on the person?

    a. 8.5 N
    b. 83 N
    c. 640 N
    d. 810 N

    Solution
    According to Newton's Third Law of Motion, the wall exerts an equal and opposite force on the person (the person's mass has nothing to do with the answer).