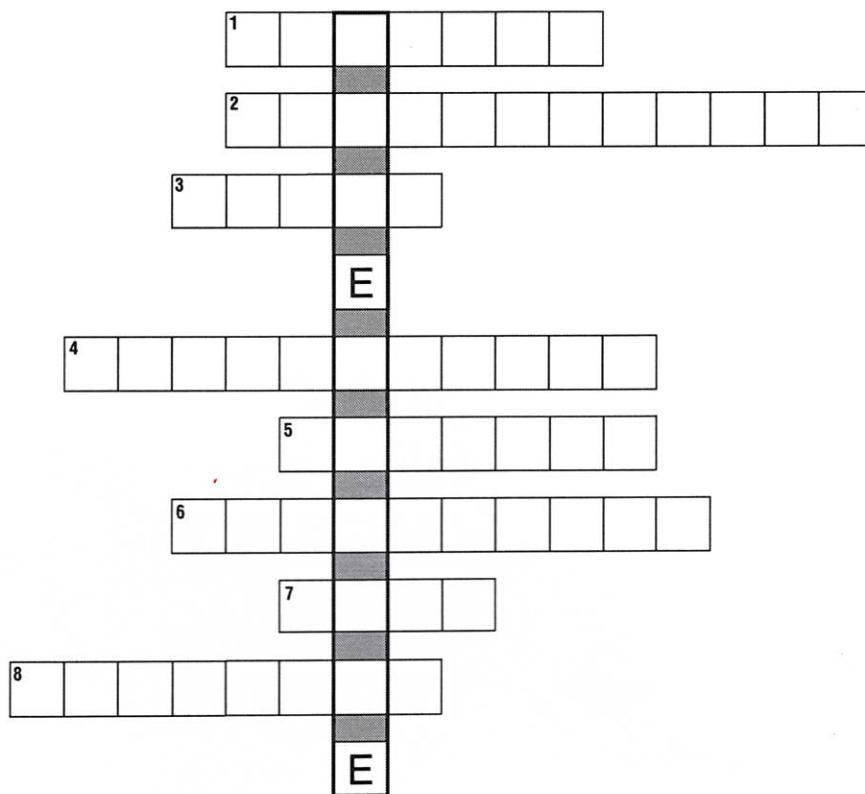




Directed Reading for  
Content Mastery

## Section 2 ■ Newton's Second Law

**Directions:** Write the correct term in the boxes in the puzzle. The boxed letters should spell the word that completes Newton's Second Law in item 9.



- \_\_\_\_\_ exists between any two objects that have mass.
- \_\_\_\_\_ occurs any time an object speeds up, slows down, or changes direction.
- In the formula  $a = \frac{F_{net}}{m}$ ,  $F_{net}$  stands for \_\_\_\_\_.
- When you sit in a chair, it exerts \_\_\_\_\_ against you.
- Force is measured in \_\_\_\_\_.
- A gravitational \_\_\_\_\_ exists between you and every object in the universe.
- In the formula  $a = \frac{F_{net}}{m}$ ,  $m$  stands for \_\_\_\_\_.
- \_\_\_\_\_ describes how fast an object is moving and in what direction.
- An object acted upon by a force will \_\_\_\_\_ in the direction of the force.

# SECTION 2

## Reinforcement

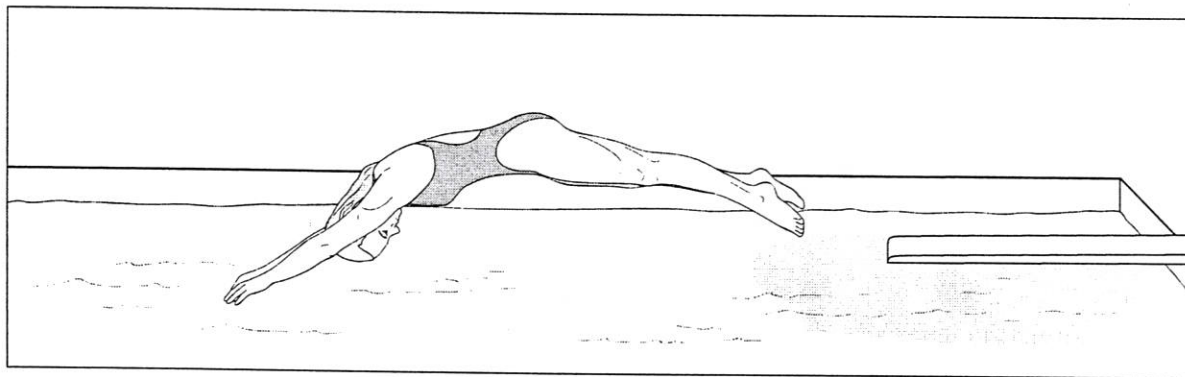
## Newton's Second Law

**Directions:** Select the term from the following list that matches each description. Some terms will not be used.

- |             |   |                                  |
|-------------|---|----------------------------------|
| a. 16 N     | e. $a = \frac{F}{m}$                                    | i. 600 N                         |
| b. -16 N    | f. normal forces  | j. Newton's second law of motion |
| c. gravity  | g. air resistance                                       | k. terminal velocity             |
| d. $F = ma$ | h. $F = m\left(\frac{9.8 \text{ m}}{\text{s}^2}\right)$ | l. Newton's first law of motion  |

- \_\_\_\_\_ 1. acts against the direction of motion and gets larger as an object moves faster
- \_\_\_\_\_ 2. Force is equal to mass times acceleration.
- \_\_\_\_\_ 3. An object acted upon by a net force will accelerate in the direction of that force.
- \_\_\_\_\_ 4. the gravitational force on any object near Earth's surface
- \_\_\_\_\_ 5. the outward forces exerted by a surface
- \_\_\_\_\_ 6. the speed an object reaches when the force of gravity is balanced by the force of air resistance
- \_\_\_\_\_ 7. What force must be applied to a 60-kg object to make it accelerate at  $10 \text{ m/s}^2$ ?

**Directions:** Study the illustration of the diver. Then identify each statement as **true** or **false**. If the statement is false, change the word(s) in *italics* to make it true.



- \_\_\_\_\_ 8. After the diver jumps forward from the diving board, the force of gravity will accelerate the diver *parallel* to the direction of motion.
- \_\_\_\_\_ 9. When the diver hits the water, the force of the water against her body can stop it about *five times faster* than the pull of gravity that accelerated it.
- \_\_\_\_\_ 10. If the diver doesn't have the correct form when she enters the water, the force of the water can *accelerate* her speed.
- \_\_\_\_\_ 11. *Air resistance* prevents the diver from moving in a straight line once she jumps from the platform.

# PROBLEM SET

## FORCE



1. What force is required to accelerate a 5-kg object  $6\text{ m/s}^2$ ?
2. How much force is required to accelerate an 1800-kg truck at  $3\text{ m/s}^2$ ?
3. What is the mass of an object that requires a force of 15 N to accelerate it at  $1.3\text{ m/s}^2$ ?
4. What is the deceleration of a 2200-kg truck if a force of 4000 N is used to stop it?
5. How much force is required to move a 2.5-kg ball if you wish it to accelerate it  $5\text{ m/s}^2$ ?
6. What is the mass of an object that requires a force of 25 N to accelerate it at  $5\text{ m/s}^2$ ?
7. What is the acceleration of a 1.5-kg ball if a force of 9 N is applied to it?
8. How much force is needed to move a 26-kg cart so it accelerates at  $1.5\text{ m/s}^2$ ?
9. What is the mass of an object that requires a force of 4500 N to accelerate it at  $5\text{ m/s}^2$ ?
10. What is the acceleration of a 0.3-kg ball hit with a force of 20 N?
11. What force is required to hit a 0.3-kg ball so it accelerates  $10\text{ m/s}^2$ ?
12. A weight of 75 N acts on a mass and causes an acceleration of  $15\text{ m/s}^2$ . What is the object's mass?
13. A 50-kg skater pushed by a friend accelerates  $5\text{ m/s/s}$ . How much force did the friend apply?
14. A bowling ball rolled with a force of 15 Newtons accelerates at a rate of  $3\text{ m/s/s}$ ; a second ball rolled with the same force accelerates  $4\text{ m/s/s}$ . What are the masses of the **two balls?**
15. How much force is needed to accelerate a 1400-kg car  $2\text{ m/s/s}$ ?
16. How much force is needed to accelerate a 66-kg skier  $1\text{ m/s/s}$ ?
17. What is the force on a 1000-kg elevator that is falling freely at  $9.8\text{ m/s/s}$ ?
18. If a 60-kg person on a 15-kg sled is pushed with a force of 300 Newtons, what will be the person's acceleration?
19. The mass of a large car is 1000 kg. How much force would be required to accelerate the car at a rate of  $3\text{ m/sec}^2$ ?
20. What is the acceleration of a softball if it has a mass of 0.50 kg and hits the catcher's glove with a force of  $25\text{ m/s}^2$ .

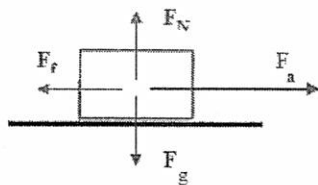


## Net Force Problems

To calculate "net force" - which means total force - first you have to decide if the forces are working together or in opposite directions. If they are working together, then you add the forces to get the net force. Note - N is the standard abbreviation for the unit of force, Newtons.

21. I want to push my tarantula's 8.7kg cage across the table. I push with 29N of force, and there is a force due to friction of 8N between the table and the cage. **Determine** how much the cage will accelerate.

Since nothing is happening along the y-axis, we can ignore the  $F_g$  and  $F_N$  forces.



For each diagram, determine the net force acting on the object. (Use the formula  $?N - ?N = ?N$ ). Then, write whether or not there will be a change in motion. If yes, write the direction the object will move in.

22.



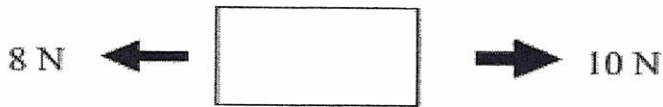
- A. What is the net force? \_\_\_\_\_  
B. Change in motion: \_\_\_\_\_

23.



- A. What is the net force? \_\_\_\_\_  
B. Change in motion: \_\_\_\_\_

24.



- A. What is the net force? \_\_\_\_\_  
B. Change in motion: \_\_\_\_\_

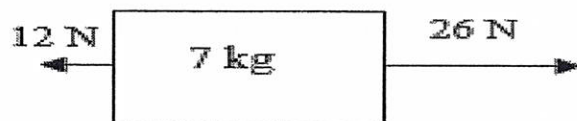
25. Grace is pushing a heavy couch to another part of her living room. Grace is pushing with a force of 10 N while the couch is pushing against Grace with a force of 8 N. What is the total net force due to Grace's pushing? Are forces balanced or unbalanced? What will happen to the motion of the heavy couch?



26. Calculate the net force if Ella pushes a piano across the floor with a force of 25 N and Aviella pushes the piano in the same direction with a force of 15 N. Are forces balanced or unbalanced? What will happen to the piano's motion? Show your work!
27. Ben and Olivia are playing tug of war. Ben has a force of 20 N to the right. Olivia has a force of 20 N to the left. Who is winning the tug of war? Are forces balanced or unbalanced? What will happen to the motion of the box? Are forces balanced or unbalanced? What will happen to the motion of the box? Show your work!
28. A large television requires a force of 390 N to be lifted. An average person can lift with a force of 50 N. How many average people would it take to move this large television? Show your work! Hint: on this problem, you will have to use another math operation OTHER than addition or subtraction.



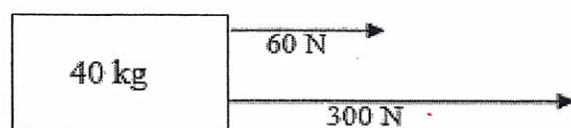
29.



A. Net Force: \_\_\_\_\_

B.  $a = F/m =$  \_\_\_\_\_

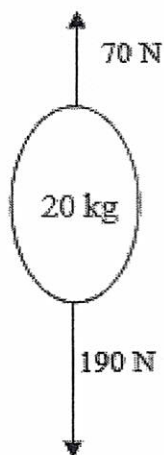
30.



A. Net Force: \_\_\_\_\_

B.  $a = F/m =$  \_\_\_\_\_

31.



A. Net Force: \_\_\_\_\_

B.  $a = F/m =$  \_\_\_\_\_