Name _____ Class _____ Date _____



# Exercises

## 2.1 Force (pages 13–14)

**1.** A force is a _____ or a _____.

**2.** A force is needed to change the state of _____ of an object.

**3.** Is the following sentence true or false? If an object is sliding on ice, it will continue sliding until a force slows it down. _____

4. Define net force.

_____

_____

*Match the applied forces on an object with the letter of the corresponding net force on the object.*

| | Applied Forces | Net Force |
|---|---|---|
| _____ | **5.** 5 N to the right and 5 N to the left | a. 2 N to the left |
| _____ | **6.** 4 N to the right and 6 N to the left | b. 2 N to the right |
| _____ | **7.** 7 N to the right and 5 N to the left | c. 10 N to the right |
| _____ | **8.** 6 N to the right and 4 N to the right | d. 0 N (no change in motion) |

**9.** Describe the forces that act on a rock at rest in your hand.

_____

_____

**10.** Circle the letter that identifies the force acting upward on an object suspended from a spring scale.

a. gravity b. equilibrium

c. tension d. weight

**11.** A _____ is an arrow that represents the magnitude and direction of a quantity.

**12.** Explain the difference between a vector quantity and a scalar quantity.

_____

_____

_____

**13.** Write *V* beside each vector quantity. Write *S* beside each scalar quantity.

_____ a. time _____ b. area

_____ c. force _____ d. volume

## 2.2 Mechanical Equilibrium (page 16)

**14.** Express the equilibrium rule in words.

_____

_____

_____

**15.** Express the equilibrium rule mathematically, and explain what the symbol in the rule means.

_____

_____

**16.** Circle the letter that describes the forces acting on a suspended object at rest.

a. The forces acting upward on the object are greater than the forces acting downward on the object.

b. The forces acting upward on the object are less than the forces acting downward on the object.

c. The forces acting upward and downward on the object are balanced.

d. No forces are acting on the object.

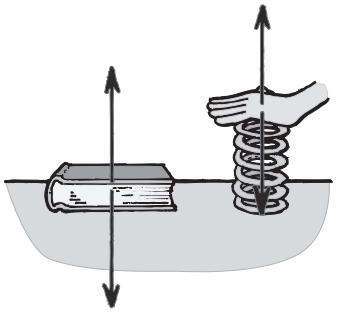
## 2.3 Support Force (page 17)

**17.** Identify the two forces acting on a book at rest on a table. State the direction of each force.

a. _____

b. _____

**18.** The _____ force is the upward force that balances the weight of an object on a surface. Another name for this force is the _____ force.



**19.** Look at the drawing above. Explain how the force of the table pushing up on the book is similar to what happens when the spring is compressed.

_____

_____

_____

**20.** Circle the letter that describes an object at rest on a horizontal surface.

a. The support force is equal to the object's weight.

b. The support force is greater than the object's weight.

c. The support force is less than the object's weight.

## 2.4 Equilibrium for Moving Objects (pages 18–19)

**21.** If an object is moving at a _____ speed in a _____ path, it is in a state of equilibrium.

**22.** Is the following sentence true or false? If a desk is pushed at a constant speed across a horizontal floor, the force of friction must be equal in magnitude and opposite in direction to the pushing force on the desk. _____

**23.** Objects at rest are said to be in _____ equilibrium.

**24.** Objects moving at constant speed in a straight-line path are said to be in _____ equilibrium.

## 2.5 Vectors (pages 19–22)

**25.** Suppose a gymnast with a weight of 300 N is suspended by a single vertical rope. What is the tension in the rope? _____

**26.** Now suppose the same gymnast hangs from two vertical ropes. What are the tensions in the ropes? _____

**27.** Define resultant. _____

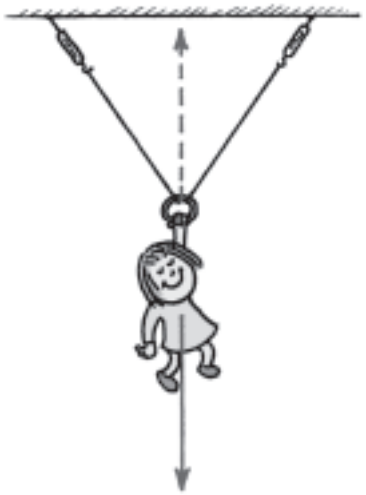
**28.** State the parallelogram rule.

_____

_____

**29.** The gymnast shown below is suspended from two non-vertical ropes. The solid vector represents the gymnast's weight. What does the dashed vector represent? _____

_____



# The Equilibrium Rule

A painter stands on the middle of a board that is suspended at the ends by two vertical ropes. The painter and the board are in mechanical equilibrium. The tension in each rope is 350 N, and the painter's weight is 550 N. What is the weight of the board?

**1. Read and Understand**

*What information are you given?*

Tension in rope 1 = $T_1$ = 350 N

Tension in rope 2 = $T_2$ = 350 N

Weight of painter = $W_1$ = 550 N

**2. Plan and Solve**

*What unknown are you trying to calculate?*

Weight of the board = $W_2$ = ?

*What mathematical equation can you use to calculate the unknown?*

$\Sigma F = 0$

*Determine the directions of all forces.*

The tension in the ropes is upward. The weights of the painter and the board are downward.

*Calculate the sum of the forces, being careful to use the correct signs.*

$\Sigma F = 350\text{ N} + 350\text{ N} - 550\text{ N} - W_2 = 0$

$W_2 = 150\text{ N}$

**3. Look Back and Check**

*Is your answer reasonable?*

The sum of the upward forces is 700 N. The sum of the downward forces is 700 N. The answer is reasonable.

## Math Practice

*On a separate sheet of paper, solve the following problems.*

1. Three vertical ropes hold up a board that weighs 180 N. What is the tension in each rope?

2. Suppose a painter weighing 700 N stands on the middle of a board suspended by two vertical ropes. If the weight of the board is 180 N, what is the tension in each rope?