Date _____   Period _____   Name _____

Study Guide

Forces in One Dimension
Vocabulary Review
Write the term that correctly completes the statement. Use each term once.

agent	force	Newton's second law
apparent weight	free-body diagram	Newton's third law
contact force	gravitational force	normal force
drag force	inertia	system
equilibrium	interaction pair	tension
external world	net force	terminal velocity
field force	Newton's first law	weightlessness

1. *External world* Everything surrounding a system that exerts forces on it is the _____.

2. *gravitational force* The attractive force that exists between all objects with mass is the _____.

3. *Newton's First Law* "An object that is at rest will remain at rest, and an object that is moving will continue to move in a straight line with constant speed, if and only if the net force acting on the object is zero." This sentence is a statement of _____.

4. *force* An action exerted on an object that causes a change in motion is a(n) _____.

5. *field force* A force that is exerted without contact is a(n) _____.

6. *interaction pair* Two forces that are in opposite directions and have equal magnitudes are a(n) _____.

7. *tension* A force exerted by any segment of a rope or string on an adjoining segment is _____.

8. *net force* The vector sum of two or more forces acting on an object is the _____.

9. *equilibrium* The net force on an object in _____ is zero.

10. *drag force* A force exerted by a fluid on an object moving through the fluid is a(n) _____.

11. *Newton's Second Law* "The acceleration of a body is directly proportional to the net force on it and inversely proportional to its mass." This sentence is a statement of _____.

12. *Apparent weight* The force exerted on a scale by an object and other forces acting upon the object is the _____.

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13. _Contact force_   A force that acts on an object by touching it is a(n) _____.

14. _Newton's Third Law_   "The two forces in an interactive pair act on different objects and are equal in magnitude and opposite in direction." This sentence is a statement of _____.

15. _normal force_   A perpendicular contact force exerted by a surface on another object is a(n) _____.

16. _System_   A defined object or group of objects is a(n) _____.

17. _inertia_   The tendency of an object to resist changes in its motion is _____.

18. _agent_   The specific, identifiable cause of a force is the _____.

19. _free body diagram_   In a(n) _____, a dot represents an object and arrows represent each force acting on it, with their tails on the dot and their points indicating the direction of the force.

20. _Terminal velocity_   The constant velocity that a falling object reaches when the drag force equals the force of gravity is its _____.

**21.** _Weightlessness_   When an object's apparent weight is zero, the object is in a state of _____.

Section 4.1   Force and Motion

In your textbook, read about Newton's first and second laws and combining forces on pages 92–95.

For each statement below, write true *or* false.

1. _T_   Newton's second law can be written as the equation $a = F_{net}/m$.

2. _F_   In the ideal case of zero resistance, a ball rolling on a level surface will accelerate. *will roll at a constant velocity*

3. _T_   The acceleration of an object and the net force acting on it are proportional.

4. _F_   Force and acceleration are scalar *Vector* quantities.

5. _T_   Gravity is a field force.

6. _F_   When the net forces acting on an object sum to zero then the object is accelerating.

7. _F_   According to Newton's first law, an object that is moving will continue to move in a straight line and at a constant speed if and only if the net force acting on it is greater than zero.

8. _T_   Acceleration is a change in velocity caused by an unbalanced force.

In your textbook, read about free-body diagrams and equilibrium on pages 89 and 95, respectively. *Refer to the diagrams below to answer questions 9–16. Circle the letter of the choice that best completes the statement or answers the question.*
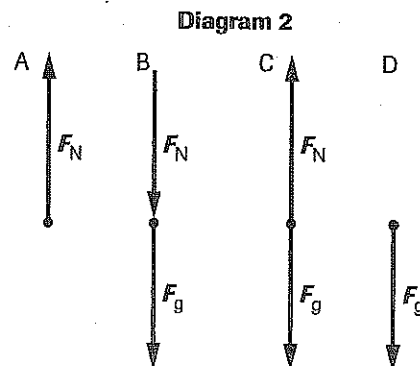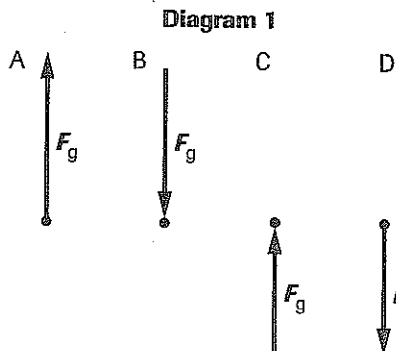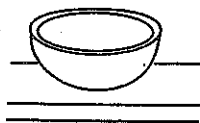
Diagram 1

Diagram 2

9. The agent of F_N is ___d___.

   a. the bowl   c. friction

   b. Earth   d. the shelf

10. The agent of F_g is ___b___.

    a. the bowl   c. friction

    b. Earth   d. the shelf

11. What part of Diagram 2 best represents the bowl in equilibrium?

    a. A   c. C

    b. B   d. D

12. Which part of Diagram 1 best represents the weight force of the bowl sitting on a shelf?

    a. A   c. C

    b. B   d. D

13. F_N is a symbol that represents the _____ force.

    a. friction   c. normal

    b. tension   d. weight

14. The magnitude of the net force on the bowl in equilibrium is _____.

    a. F_N c. 0

    b. F_g d. $2F_g$

15. Which of these is true when the bowl is in equilibrium?

    a. $F_N = F_g$ c. $F_N > F_g$

    b. $F_N \geq F_g$ d. $F_N < F_g$

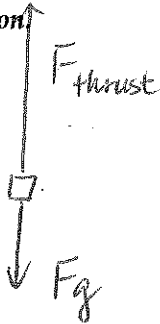**16.** Which part of Diagram 2 best represents the bowl if it falls off the shelf?

a. A

c. C

b. B

(d.) D

Draw a free-body diagram of each situation.

17. A rocket immediately after vertical liftoff

F_{thrust}

F_g

18. A penny sliding at constant velocity on a desktop

F_N

F_f

F_{app}

$F_{net} = 0$

F_g
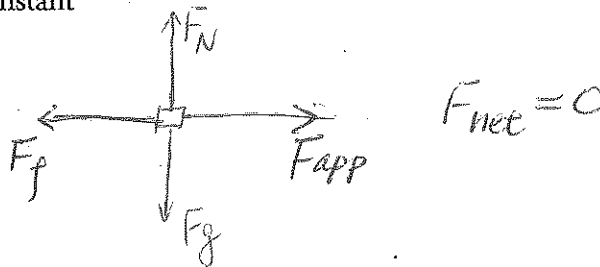
19. A penny immediately after sliding off a desktop

F_g

Section 4.2   Using Newton's Laws

In your textbook, read about mass, weight, and apparent weight on pages 96–98.
For each term on the left, write the letter of the matching item.

_C_	**1.** name of gravitational force acting on object	**a.** g
_d_	**2.** magnitude of acceleration due to gravity	**b.** newton
_a_	**3.** symbol for the acceleration due to gravity	**c.** weight
_g_	**4.** symbol for the force due to gravity	**d.** 9.80 m/s^2
_f_	**5.** expression for the weight of an object	**e.** weightlessness
_b_	**6.** unit of force	**f.** mg
_h_	**7.** property of an object that does not vary from location to location	**g.** F_g
_e_	**8.** having an apparent weight of zero	**h.** mass

Name _____

In your textbook, read about scales and apparent weight on pages 96–98.

Read the description below and refer to the diagram at right to answer questions 9–14. Circle the letter of the choice that best completes the statement or answers the question.

A 1.0-kg mass at rest is suspended from a spring scale. The direction of positive forces that are acting or could act on the 1.0-kg mass are shown to the right.

9. The 1.0-kg mass and spring scale are being lifted at a constant speed. The net force on the mass is _____.

   a. 0 N

   b. +10 N

   c. −10 N

   d. +20 N

10. The 1.0-kg mass and spring scale are being lifted so that the 1.0-kg mass is being accelerated in the positive upward direction at 1.0 m/s². What is the net force acting on the mass?

    a. 0 N

    b. +1 N

    c. −1 N

    d. +20 N

    $F = ma = 1\,kg \cdot 1.0\,m/s^2$
    $= 1\,N$

11. In problem 10, what is the relationship among the magnitudes of the forces acting on the mass?

    a. $F_{net} = F_{scale} + F_g$

    b. $F_{net} = F_{scale} - F_g$

    c. $F_{net} = -(F_{scale} + F_g)$

    d. $F_{net} = F_g - F_{scale}$

12. In problem 10, what is the spring scale reading?

    a. <10 N

    b. 10 N

    c. >10 N

    d. 0 N

13. If the scale is accidentally dropped, the net force acting on the 1.0-kg mass is _____.

    a. 0 N

    b. +10 N

    c. −10 N

    d. +20 N

    $F = ma = 1\,kg(-9.8\,m/s^2)$
    $= -10\,N$

14. If the scale is accidentally dropped, the reading of the spring scale as it falls is _____.

    a. 0 N

    b. +10 N

    c. −10 N

    d. +20 N

In your textbook, read about the drag force and terminal velocity on pages 100–101.

For each statement below, write true or rewrite the italicized part to make the statement true.

15. direction opposite to   A fluid exerts a drag force on an object moving through it in the *same direction as* the motion of the object.

16. _____true_____   The drag force is dependent on the properties of the object, the properties of the fluid the object is moving through, and the *motion of the object.*

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17. _____more_____ A light object with a large surface area is *less* affected by the drag force than a more compact object is when both objects are falling.

18. _the drag force equals the force of gravity_ The terminal velocity of a falling object is reached when *the object impacts on a surface.*

Section 4.3 Interaction Forces

In your textbook, read about interaction pairs on pages 102–104.
Refer to the diagram below to complete Table 1.
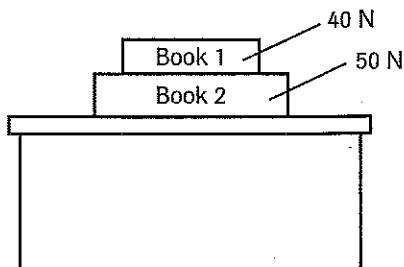
Table 1		
Force	**Magnitude**	**Direction**
$F_{\text{book 1 on book 2}}$	40 N	down
$F_{\text{book 2 on book 1}}$	40 N	up
$F_{\text{book 2 on desktop}}$	50 N	down
$F_{\text{desktop on book 2}}$	50 N	up
$F_{\text{books 1 and 2 on desktop}}$	90 N	down
$F_{\text{desktop on books 1 and 2}}$	90 N	up

In your textbook, read about tension on pages 105–106.
For each statement below, write true or false.

1. ___F___ A book lying on a table involves tension.

2. ___T___ A chandelier hanging from a ceiling involves tension.

3. ___T___ Two teams participating in a tug-of-war involves tension.

4. ___F___ An automobile moving along a road involves tension.

5. ___T___ An elevator moving in a building shaft involves tension.

6. ___F___ A basketball passed from one player to another involves tension.

7. ___T___ A horse pulling a cart involves tension.

8. ___T___ A truck towing a boat behind it involves tension.

9. ___T___ Water skiing involves tension.

10. ___T___ A trapeze act involves tension.

11. ___F___ Paddling a canoe involves tension.

12. ___T___ Parachuting involves tension.