

PSN Chapter 4 Multi-format Test**Modified True/False**

Indicate whether the statement is true or false. If false, change the identified word or phrase to make the statement true.

- _____ 1. The strength of gravity as measured on the surface of Earth is 9.8 newtons per kilogram.

- _____ 2. To calculate the weight of an object, the strength of gravity is multiplied by the mass of the object.

- _____ 3. The name for a quantity, like force, that has both a size and a direction is scalar.

- _____ 4. Your body would have the same weight if you were on Earth, the Moon, or Jupiter. _____
- _____ 5. The friction that can be measured when an object is sliding over a surface is static friction.

- _____ 6. Nails are held in place by a normal force when hammered into wood.

Completion

Complete each statement.

Select the correct term to complete each sentence. There are extra terms in the list.

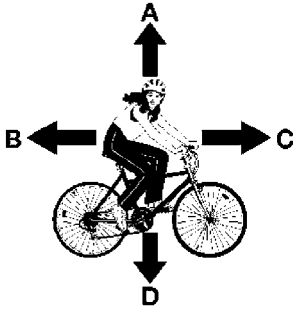
accelerating	direction	equilibrium
free-body	friction	weight
mass	net	normal

7. As a vector, force is represented with a number and _____.
8. The force due to gravity on an object is called _____.
9. A force that resists the motion of objects or surfaces as they move over one another is called _____.
10. The force exerted by the surface on which an object is resting is the _____ force.
11. The force which is the sum of two or more forces on a object is called _____ force.
12. The condition or state that exists when the net force on an object is zero is called _____.
13. A diagram that uses vectors to show all the forces acting on an object is a _____ diagram.

Short Answer

14. Name the units of measurement used to identify each of the following quantities:
- Strength of gravity
 - Mass of an object
 - Weight of an object
 - Force exerted on an object

15. Write the formula expressing the relationship between **weight** and **mass**.
16. List three methods to reduce frictional forces between surfaces.
17. Name two types of energy generated due to friction and give one example of each.
18. The diagram below shows a cyclist moving along a highway. 4 forces, represented by arrows A, B, C, and D are acting on the cyclist as she pedals.

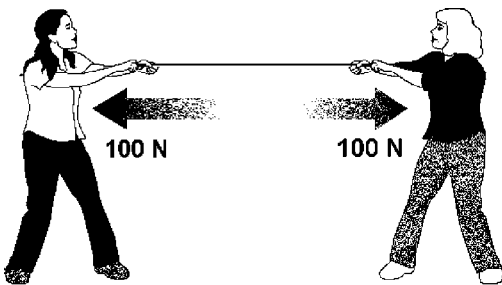


Match the forces below with the letter of the arrow representing each force in the diagram below:

- a. friction force _____
- b. muscle force _____
- c. normal force _____
- d. weight _____

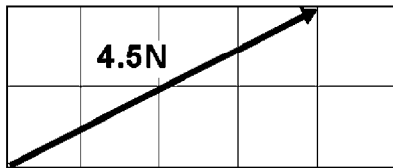
Problem

19. A pound is equivalent to 4.48 newtons of weight. What is the mass of 1 pound?
20. While standing still as shown in the diagram, two people are pulling on a rope, each exerting a force of 100 newtons.



- a. What is the net force on the rope?
- b. What is the tension in the rope?

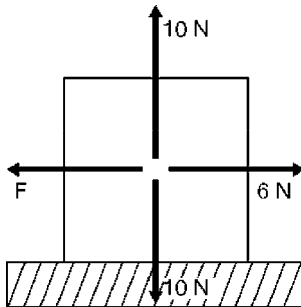
21. A scale of 1 centimeter = 1 newton was used to draw the vector represented. Using a centimeter ruler, draw and identify the magnitude of the horizontal and vertical components of the 4.5-newton force illustrated in the vector drawing below:



22. Ruis decides to represent force vectors on his vector diagram using a scale of 1 cm = 3 N. Using the same scale and a metric ruler, draw a force of 12 newtons directed in a positive x -direction.
23. Yuji, a surfer, weighs 635 newtons on his favorite beach in California. Calculate what Yuji's mass would be on the surface of the Moon.
24. An astronaut weighs 825 newtons on Earth's surface. Since the strength of gravity on the Moon is less than on Earth, the astronaut weighs less on the Moon than on Earth. Calculate the astronaut's weight on the Moon if the strength of gravity on the Moon is 1.6 N/kg.
25. A can of soda sits motionless on a table. Make a free-body diagram of the forces acting upon the can.

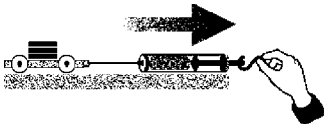


26. The diagram below represents an object moving to the right with a constant velocity.

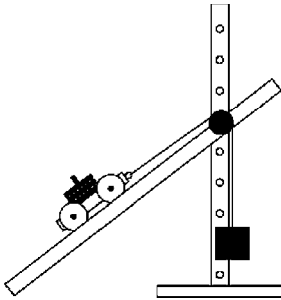


What is the value of force F ?

27. The diagram represents a cart moving at a constant speed to the right. A force of 5 newtons is applied by the spring scale which is attached.



- What is the **size** and the **direction** of the force of friction acting on the cart?
 - Would the reading on the spring scale be **larger** or **smaller** than 5 N to the right if the cart is accelerated to the right?
28. A 4-N weight is attached by a string to a 2-N cart on a ramp as shown in the diagram below. The string passes over a nearly frictionless pulley at the top of the ramp. The cart is free to move to the top of the ramp and to the bottom of the ramp but is attached so it will not leave the ramp.



The cart is given a push toward the bottom of the ramp. Describe the motion of the cart from the moment it is released until it comes to rest.

Essay

- When pushing on an object, it is generally easier to keep the object moving than it is to start the object moving. **Explain** why this is so including the terms **static** and **kinetic friction** in your explanation.
- An empty wagon rolls easily, but a loaded wagon is more difficult to roll. Using your knowledge of friction force and weight, explain why this is so.
- Friction can be useful. List four useful frictional forces and give a brief explanation of how it is useful.

PSN Chapter 4 Multi-format Test Answer Section

MODIFIED TRUE/FALSE

- | | | |
|-------------------------------------|------------|------------------|
| 1. ANS: T
STA: S8CS3a | DIF: basic | REF: section 4.1 |
| 2. ANS: T
STA: S8CS3f | DIF: basic | REF: section 4.1 |
| 3. ANS: F, vector | DIF: basic | REF: section 4.1 |
| 4. ANS: F, mass | DIF: basic | REF: section 4.1 |
| 5. ANS: F
sliding
kinetic | DIF: basic | REF: section 4.1 |
| 6. ANS: F
friction
frictional | DIF: basic | REF: section 4.2 |
| | DIF: basic | REF: section 4.2 |

COMPLETION

- | | | | |
|----------------------|------------|------------------|-------------|
| 7. ANS: direction | DIF: basic | REF: section 4.1 | STA: S8CS6c |
| 8. ANS: weight | DIF: basic | REF: section 4.1 | STA: S8P3b |
| 9. ANS: friction | DIF: basic | REF: section 4.2 | STA: S8P3b |
| 10. ANS: normal | DIF: basic | REF: section 4.3 | STA: S8P3b |
| 11. ANS: net | DIF: basic | REF: section 4.3 | STA: S8CS5b |
| 12. ANS: equilibrium | DIF: basic | REF: section 4.3 | STA: S8Cs5b |

13. ANS: free-body

DIF: basic REF: section 4.3 STA: S8CS6c

SHORT ANSWER

14. ANS:

- newtons per kilogram
- kilograms, grams, milligrams
- newtons, pounds
- newtons, pounds

DIF: basic REF: section 4.1 STA: S8CS3c

15. ANS:

$w = \text{weight}$, $m = \text{mass}$ $g = \text{acceleration due to gravity}$

$w = mg$

DIF: basic REF: section 4.1 STA: S8CS3f

16. ANS:

Answers may vary. Sample answers include:

- Using ball bearings to change sliding friction to rolling friction.
- Separation of two surfaces with a cushion of air to reduce the contact between rough surfaces.
- Using lubricants such as oil or grease to allow rough surfaces to slide over one another more easily.
- Smoothing surfaces by waxing or polishing the surfaces.

DIF: basic REF: section 4.2 STA: S8P3b

17. ANS:

Answers may vary. Sample answers include:

Heat - rubbing hands together transforms mechanical energy to heat.

Mechanical - Moving a key in and out of a lock wears away sharp points on a key.

DIF: intermediate REF: section 4.2 STA: S8CS5b

18. ANS:

- friction force D
- muscle force B
- normal force A
- weight C

DIF: basic REF: section 4.3 STA: S8CS5b

PROBLEM

19. ANS:

$$w = mg$$

$$m = \frac{w}{g}$$

$$m = \frac{4.48 \text{ N}}{9.8 \text{ N/kg}}$$

$$m = 0.457 \text{ kg or } 457 \text{ grams}$$

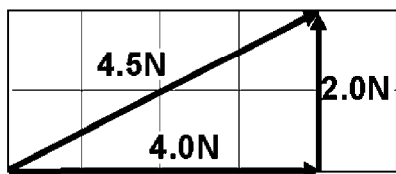
DIF: intermediate REF: section 4.1 STA: S8CS3f

20. ANS:

- a. zero
- b. 100 N

DIF: intermediate REF: section 4.1 STA: S8CS5b

21. ANS:



DIF: intermediate REF: section 4.1 STA: S8P3b

22. ANS:

An arrow drawn 4 centimeters long to the right.

DIF: intermediate REF: section 4.1 STA: S8CS4b

23. ANS:

Since mass is the same on Earth and the Moon, Yuji's mass would be calculated as follows:

$$F_g = mg$$

$$635 \text{ N} = m(9.8 \text{ N/kg})$$

$$m = \frac{635 \text{ N}}{9.8 \text{ N/kg}}$$

$$m = 65 \text{ kg}$$

DIF: advanced REF: section 4.1 STA: S8CS3f

24. ANS:

$$F_{ge} = mg_e$$

$$825 \text{ N} = m(9.8 \text{ N/kg})$$

$$m = \frac{825 \text{ N}}{9.8 \text{ N/kg}}$$

$$m = 84.2 \text{ kg}$$

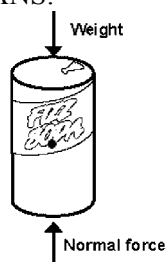
$$F_{gm} = mg_m$$

$$F_{gm} = (84.2 \text{ kg})(1.6 \text{ N/kg})$$

$$F_{gm} = 134.6 \text{ N (or 130 N to two significant figures)}$$

DIF: advanced REF: section 4.1 STA: S8CS3f

25. ANS:



DIF: basic REF: section 4.3 STA: S8P3b

26. ANS:

$$F = 6 \text{ N}$$

DIF: intermediate REF: section 4.3 STA: S8P3b

27. ANS:

a. 5 newtons to the left.

b. greater than 5 newtons to the right

DIF: advanced REF: section 4.3 STA: S8P3b

28. ANS:

The cart moves toward the bottom of the ramp, stops and moves back up the ramp until it is stopped by its attachment to the ramp.

DIF: advanced REF: section 4.3 STA: S8P3b

ESSAY

29. ANS:

To start an object moving, static friction force (and inertia) must be overcome. To keep an object moving, kinetic friction force must be overcome. For a given object, the value for the static friction force is greater than the kinetic friction force. Overcoming inertia requires additional force that contributes to the net force required to start an object moving.

DIF: intermediate REF: section 4.2 STA: S8P3b

30. ANS:

The frictional force between two surfaces is proportional to the force pushing them together. As weight is added to a wagon, the wheels of the wagon and the surface on which it rolls are pushed together with greater force. This increases the frictional force, making it more difficult to roll the wagon.

DIF: intermediate REF: section 4.2 STA: S8CS5a

31. ANS:

Answers will vary. Typical answers may include:

1. Friction between tires and roads allows interaction between tires and road so the direction of the moving car can be changed.
2. Friction between soccer cleats on a player's feet and the ground prevents a player from slipping while accelerating.
3. Friction between nails and wood in construction keeps the nail from slipping out so pieces remain fastened together.
4. Friction between brake pads and the brake discs of a car allows a decelerating force to be applied to the car.

DIF: intermediate REF: section 4.2 STA: S8P3b