

## 8 Friction

### Worksheet

Name \_\_\_\_\_

AP Physics B

Select the single best answer to each of the following questions.

- \_\_\_\_\_ 1. When your textbook is at rest on the level desktop and no one is touching it, how much frictional force is acting?  
A.  $mg$                       B.  $\mu_s N$                       C.  $\mu_k N$                       D. zero                      E. unpredictable
- \_\_\_\_\_ 2. If the desktop in question 1 is now tilted, yet the book remains at rest, how does the frictional force change from the value you gave for question 1?  
A. it does not change                      B. it increases                      C. it decreases
- \_\_\_\_\_ 3. There are contrary effects as the table's tilt continues to rise. On one hand, the \_\_\_\_\_ component of the weight vector **increases**, which tends to \_\_\_\_\_ the static friction holding the block at rest.  
A. parallel, increase  
B. parallel, decrease  
C. perpendicular, increase  
D. perpendicular, decrease
- \_\_\_\_\_ 4. On the other hand, the \_\_\_\_\_ component of the weight vector **decreases**, which decreases the normal force and tends to \_\_\_\_\_ the static friction holding the block at rest.  
A. parallel, increase  
B. parallel, decrease  
C. perpendicular, increase  
D. perpendicular, decrease
- \_\_\_\_\_ 5. What is the size of the frictional force on a block of mass  $m$  as it slides up a slope with an angle of  $\theta$  with the horizontal, if the coefficient of kinetic friction between the block and slope is  $\mu_k$ ?  
A.  $\mu_k mg$                       B.  $\mu_k mg \sin \theta$                       C.  $\mu_k mg \cos \theta$
- \_\_\_\_\_ 6. The rear of some sports car feature curved surfaces called spoilers. Spoilers are designed to operate like upside-down airplane wings. That is, air flowing past them exerts a **downward** force. This improves the handling of the vehicle because it...  
A. increases the gravitational force on the car and boosts the friction between the tires and road.  
B. increases the normal force on the car and boosts the friction between the tires and road.  
C. decreases the normal force on the car and lowers the friction between the tires and road.  
D. decreases the gravitational force on the car and lowers the friction between the tires and road.
- \_\_\_\_\_ 7. When would a certain block on a particular level surface have the **LEAST** frictional force on it?  
A. The block is at rest, but is being pulled hard enough that it is about to slip.  
B. The block is being dragged at a constant speed.  
C. The block is at rest, and no forces are applied to it.  
D. All of the above situations have the same amount of frictional force.
- \_\_\_\_\_ 8. When would a certain block on a particular level surface have the **MOST** frictional force on it?  
A. The block is at rest, but is being pulled hard enough that it is about to slip.  
B. The block is being dragged at a constant speed.  
C. The block is at rest, and no forces are applied to it.  
D. All of the above situations have the same amount of frictional force.
- \_\_\_\_\_ 9. Trains are built to be extremely heavy, because the large weight will...  
A. decrease the normal force and reduce the friction.  
B. smooth the track and reduce the friction.  
C. increase the normal force and improve the grip of the wheels on the track.  
D. increase the surface area in contact between the wheels and track, providing a better grip.

Show all work on the following problems. The answers are shown in the box below.

10. What is the greatest acceleration Fluffy can achieve, if the coefficient of static friction between her claws and the ground is 0.950?
11. A railroad flatcar is loaded with crates having a coefficient of static friction of 0.250 with the floor. If the train is moving at 13.333 m/s, in how short a distance can the train be stopped without letting the crates slide?
12. A block weighing 80.0 N rests on a plane inclined at  $20.0^\circ$  to the horizontal. The coefficient of static friction is 0.250, while the coefficient of kinetic friction is 0.150.
- a) What is the minimum applied force **T**, parallel to the plane, that will prevent the block from slipping down the plane?  
CONSTRUCT A FREE-BODY DIAGRAM
- b) What is the minimum applied force **T** that will start the block moving up the plane?  
CONSTRUCT A NEW FREE-BODY DIAGRAM
- c) What applied force **T** is required to move the block up the plane at a constant velocity?

<b>Answers:</b>
10. 9.31 m/s <sup>2</sup>
11. 36.3 m
12. a) 8.57 N
b) >46.2 N
c) 38.6 N