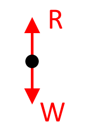
NAME: ______________________________ TEAM:__

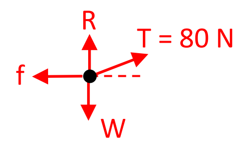
THIS IS A PRACTICE ASSESSMENT. Show formulas, substitutions, answers (in spaces provided) and units!

1. What is the weight (in Newtons) of a 75-kg person? Draw a free body diagram of that person standing on the ground. Be sure to include labels on all of the forces you have included. 1. 750 N

   $W = mg = 75 \times 10 = 750$ N. See diagram



A wooden crate is being dragged along a floor to the right with a tension of 80. N being applied at an angle of 20° above the horizontal. There is friction between the crate and the floor.



2. Draw a labeled free body diagram of the crate. 2. See diagram

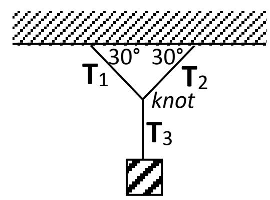
3. If the crate is not accelerating, what is the value of the friction force?

   $\Sigma F = ma \rightarrow T \cos 20^\circ - f = m \times 0 \rightarrow 80 \cos 20^\circ - f = 0 \rightarrow 75.175 \text{ N} = f$. 3. 75 N

4. List the contact force(s) we have discussed. List the action-at-a-distance force(s) we have discussed.

   CONTACT: *tension, normal, friction*. ACTION AT A DISTANCE: *weight*.

A 95-kg mass is supported by three cables as shown. The two cables anchored to the ceiling make an angle of 30° with the ceiling. The three tensions are labeled.



5. Find the numeric value of T_3. 5. 950 N

   $T_3 = mg = 95 \times 10 = 950$ N.

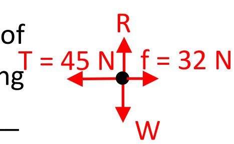
6. Find the numeric values of T_1 and T_2. 6. 950 N

   From symmetry $T_1 = T_2 \equiv T$:

   $\Sigma F_y = ma_y \rightarrow 2T \sin 30^\circ - T_3 = m \times 0 \rightarrow 2T \times (0.5) = T_3 \rightarrow T = T_3 = 950 \text{ N } (= T_1 = T_2)$.

7. A 25-kg crate being pulled leftward by a force of 45 N, has a dynamic friction force of 32 N. Make a labeled free-body diagram of the crate which includes all forces acting on it. Then find the acceleration of the crate. 7. See diagram

   $\Sigma F = ma \rightarrow f - T = ma \rightarrow 32 - 45 = 25a \rightarrow a = -0.52 \text{ ms}^{-2}$. -0.52 ms^{-2}

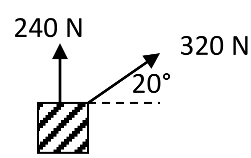


8. What is the acceleration of a 540-newton person who is experiencing a net force of 135 N?

   $W = mg \rightarrow 540 = m \times 10 \rightarrow m = 54$ kg; 8. 2.5 ms^{-2}

   $F = ma \rightarrow 135 = 54a \rightarrow a = 2.5 \text{ ms}^{-2}$.

There are exactly two forces acting on the 35-kg crate, as shown.



9. What is the resultant force acting on it? 9. 460 N

   $F_x = 320 \cos 20^\circ = 300.702$ N

   $F_y = 240 + 320 \sin 20^\circ = 342.606$ N.

   $F^2 = F_x^2 + F_y^2 = 300.702^2 + 342.606^2 \rightarrow F = 455.852$ N.

10. What is the acceleration of the crate? 10. 13 ms^{-2}

$F = ma \rightarrow 455.852 = 35a \rightarrow a = 13.024\ ms^{-2}$.

A 25-N crate is given an initial velocity of 8.0 ms^{-1} on a floor. It slides 12 m.

11. Find the constant acceleration of the crate. 11. 2.7 ms^{-2}

$v^2 = u^2 + 2as \rightarrow 0^2 = 8^2 + 2a\times12 \rightarrow a = 2.667\ ms^{-2}$.

12. Find the friction force that stops the crate. 12. 6.7 N

$f = ma = 2.5(2.667) = 6.6675$ N.

13. Find the coefficient of dynamic friction between the crate and the floor. 13. 0.27

$R = W = 25$ N.

$f = \mu_d R \rightarrow \mu_d = f / R = 6.6675 / 25 = 0.2667$.

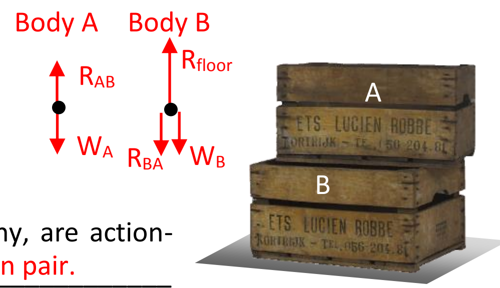
14. Explain the concept of antilock brakes, and why they stop a car in a shorter distance than brakes that completely lock the wheels so that the car skids (the rubber of the wheels slides on the pavement, rather than rolls).

Antilock brakes keep the wheels in the realm of static friction by preventing the wheels from locking and sliding on the pavement. Static friction is greater than dynamic friction.

Consider the two crates resting on the floor.

15. Draw a labeled free-body diagram for each of the crates.

15. See diagram



16. Consider all of the forces you labeled. Which pairs, if any, are action-reaction pairs? 16. R_{AB} and R_{BA} are action and reaction pair.

A 750-kg car accelerates from rest to a speed of 28 ms^{-1} in 7.0 seconds. Its acceleration is constant and its drive wheels never "slip" on the road.

17. Draw and label a free-body diagram of the car. 17. See diagram

18. Calculate the acceleration of the car. 18. 4.0 ms^{-2}

$v = u + at \rightarrow 28 = 0 + a \times 7.0 \rightarrow a = 4.0\ ms^{-2}$.

19. Find the coefficient of friction between the car and the pavement. 19. 0.40 ms^{-2}

$R = W = mg = 750\times10 = 7500$ N. $f = ma = 750(4.0) = 3000$ N.

$f = \mu R \rightarrow \mu = f / R = 3000 / 7500 = 0.40$.

20. Determine which type of friction is giving the car its traction during its acceleration.

Since it is not slipping on the road it is static friction. 20. static