Name: _____

Period: _____

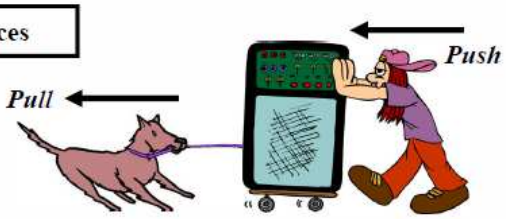
2.2

Types of Forces

This is not an exhaustive list of all possible forces, but the most common ones that are used in basic physics.
Remember: all forces are measured in Newtons and are vectors, so they can be positive or negative.

Applied Forces

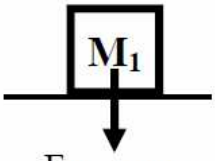
An applied force is any generic push or pull.



It doesn't matter whether you draw a force as a push or a pull—the effect is the same.

Force of Weight (F_W)

Weight is the force of gravity pulling down on any object.



$F_{W1} = m_1 g$

Weight always pulls straight down and is usually in the negative y-direction.

$F_{W2} = m_2 g$

Force of Weight (*in Newtons*) → $F_w = mg$ ← Mass (*in kg*)

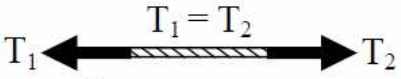
Acceleration due to gravity ($9.8\ m/sec^2$)

Weight equals mass times the acceleration due to gravity.

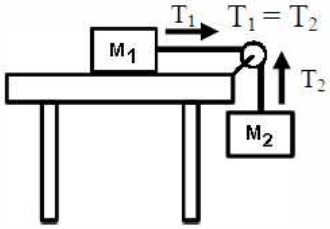
To make calculations easier, we often use $g = 10\ m/s^2$.

Tension (T)

Tension is the force due to a rope or string. Tension never pushes an object.



The tension in a rope is equal throughout.

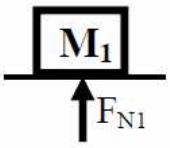


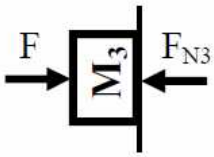
Even if the rope goes over a pulley, the tension at both ends is the same.

In this diagram, the tension pulling M_1 to the right is equal to the tension pulling up on M_2.

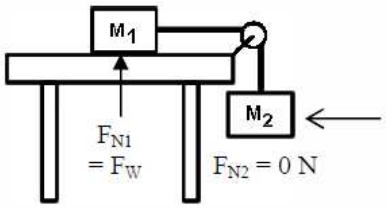
Normal Force (F_N)

The normal force is the supporting force of a surface pushing up against an object.
Without a normal force the object would break thru the surface.





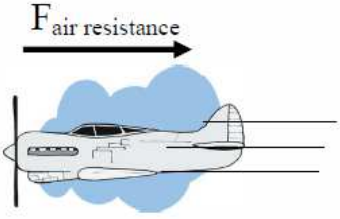
The normal force is ALWAYS perpendicular to the surface, even if the surface is tilted or vertical.



There is no normal force on hanging or dropped objects, since they are not touching any surface.

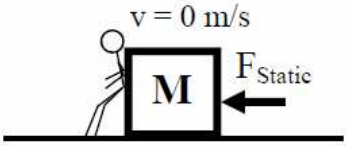
Friction

Friction resists motion and is always in the opposite direction the object is moving or opposite the direction a force is acting on it, if at rest.

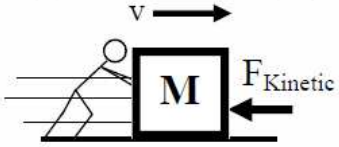


Air friction (also known as air resistance) is what slows moving cars and airplanes. Air friction increases with speed.

Surface friction occurs when surfaces touch each other.
Surface friction depends on the weight of the object and the roughness of the surface.
There are two types of surface friction: static friction (F_s) and kinetic friction (F_k).



Static friction is gripping friction: *the object is not sliding. If you push to the right, static friction resists, pushing to the left to keep it from sliding.*



Kinetic friction is slipping friction: *the object is sliding. If it is sliding to the right, kinetic friction acts to the left, trying to slow down and stop the object.*

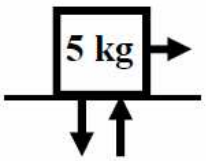
All sections marked with a ⚡ are considered essential concepts and must be completed to receive full credit on WS.

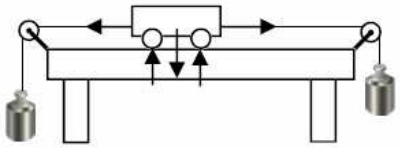
1. *F, T, F_W, F_f, or F_N?*

____Normal force
____Force of friction
____Weight
____Applied force
____Tension
____Exerted by a string or rope.
____Caused by gravity.
____Is equal throughout.

___ A surface pushing up from below.
___ Any push or pull.
___ Resists change of motion.
___ Increases with rough surfaces.
___ Always pulls downward.
___ Is always perpendicular to a surface.

2. A mass is pulled to the right while on a table.
   A. Label the forces.
   B. Calculate the object's weight.

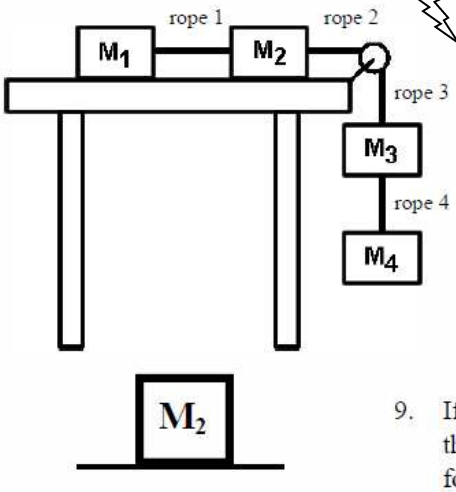




3. Calculate the weight of a 7 kg object.

4. Calculate the mass of a 65 N object.

5. A. Label the forces on the above object.
   B. Which ones are y-direction forces?
   C. Which ones are x-direction forces?



6. What force is acting on all four of the masses?

7. What force is NOT acting on the hanging masses?

8. If M_1 = 2 kg, what is F_{W1}?

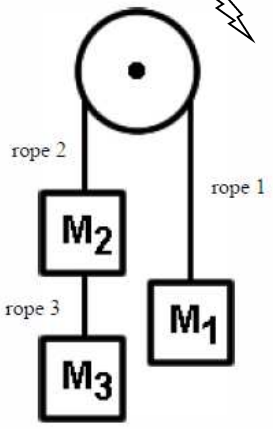
9. If there IS friction on the table, draw the forces acting on M_2.

10. Static friction, Kinetic friction, or Air friction?

A. ____ Depends on the roughness of the surface.
B. ____ Between tires and the road, normally.
C. ____ When an object is at rest.
D. ____ When an object slides.
E. ____ Gripping friction.
F. ____ Increases with speed.
G. ____ When you slip on ice.
H. ____ Resists the motion of an object.
I. ____ Keeps a falling object from speeding up forever.

11. What kind of force is keeping the person from falling thru the wall?

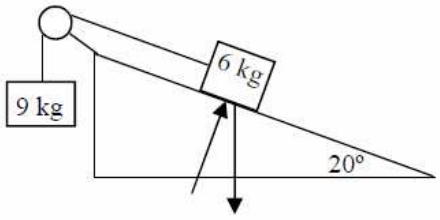
12. Draw all of the forces acting on the person.



13. What force cannot be acting on the objects?

14. On the diagram at the left draw all of the forces acting on M_1.

15. Draw the force diagram for M_2, below.



16. Label the two shown forces acting on the 6 kg mass, giving actual numbers if you know them.

17. If the 9 kg object moves down and there IS friction on the ramp, label all of the other forces acting on the objects.