

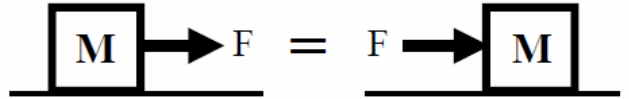
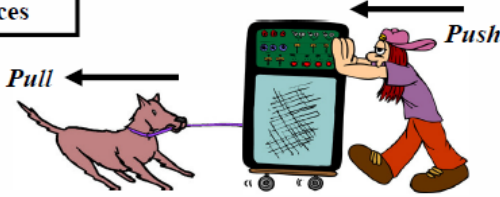
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Types of Forces

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

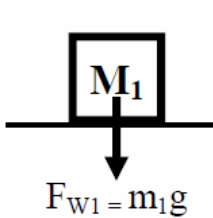
An applied force is any generic push or pull.



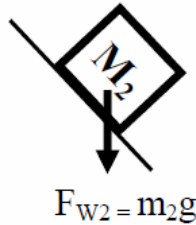
It doesn't matter whether you draw a force as a push or a pull—the effect is the same.

Force of Weight (F_w)

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



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



Force of Weight (in Newtons) → $F_w = mg$

↖ Mass (in kg)

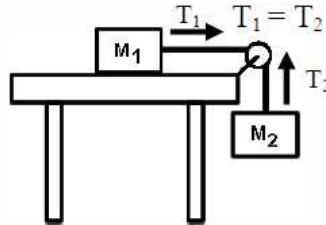
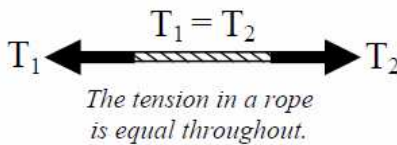
↙ Acceleration due to gravity (9.8 m/sec^2)

Weight equals mass times the acceleration due to gravity.

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

Tension (T)

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

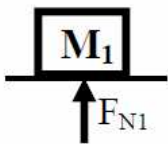


Even if the rope goes over a pulley, the tension at both ends is the same.

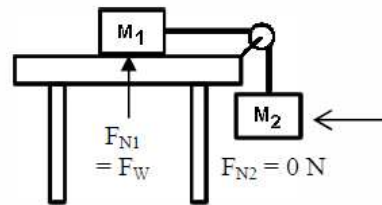
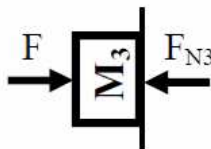
In this diagram, the tension pulling M_1 to the right is equal to the tension pulling up on M_2 .

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.



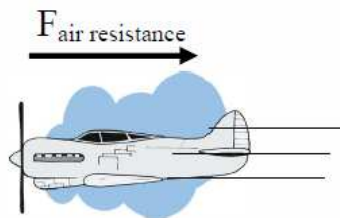
The normal force is ALWAYS perpendicular to the surface, even if the surface is tilted or vertical.



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

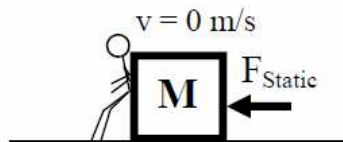
Friction

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.

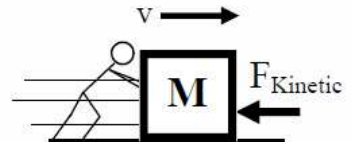


Air friction (also known as air resistance) is what slows moving cars and airplanes. Air friction increases with speed.

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.

1. F , T , F_w , F_f , or F_N ?

- | | |
|---|--|
| <input type="checkbox"/> Normal force | <input type="checkbox"/> A surface pushing up from below. |
| <input type="checkbox"/> Force of friction | <input type="checkbox"/> Any push or pull. |
| <input type="checkbox"/> Weight | <input type="checkbox"/> Resists change of motion. |
| <input type="checkbox"/> Applied force | <input type="checkbox"/> Increases with rough surfaces. |
| <input type="checkbox"/> Tension | <input type="checkbox"/> Always pulls downward. |
| <input type="checkbox"/> Exerted by a string or rope. | <input type="checkbox"/> Is always perpendicular to a surface. |
| <input type="checkbox"/> Caused by gravity. | |
| <input type="checkbox"/> Is equal throughout. | |

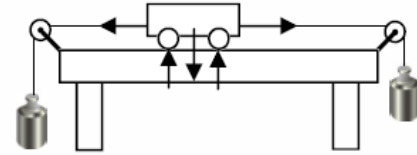
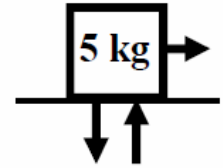
3. Calculate the weight of a 7 kg object.

4. Calculate the mass of a 65 N object.

2. A mass is pulled to the right while on a table.

A. Label the forces.

B. Calculate the object's weight.



5. A. Label the forces on the above object.

B. Which ones are y-direction forces?

C. Which ones are x-direction forces?

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.

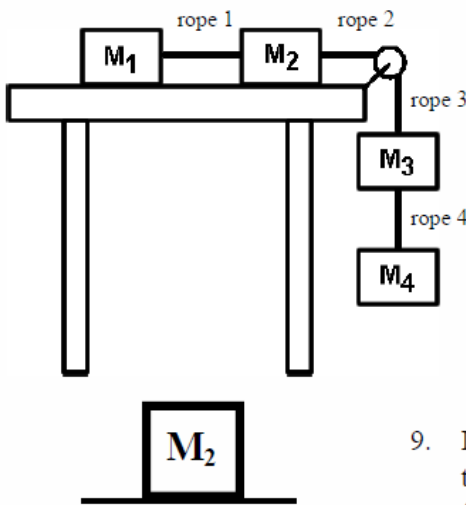


6. What force is acting on all four of the masses?

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

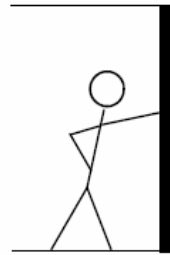
8. If $M_1 = 2$ kg, what is F_{w1} ?

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



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

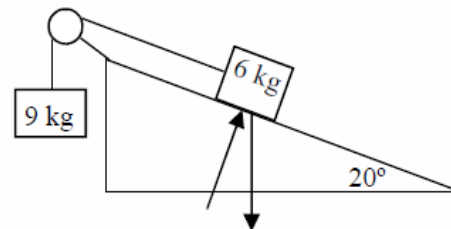
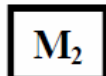
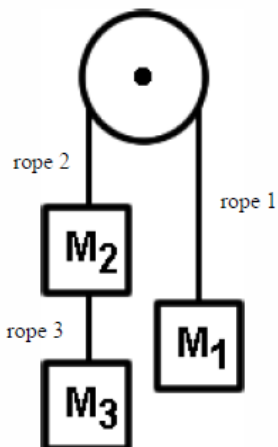
12. Draw all of the forces acting on the person.



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.