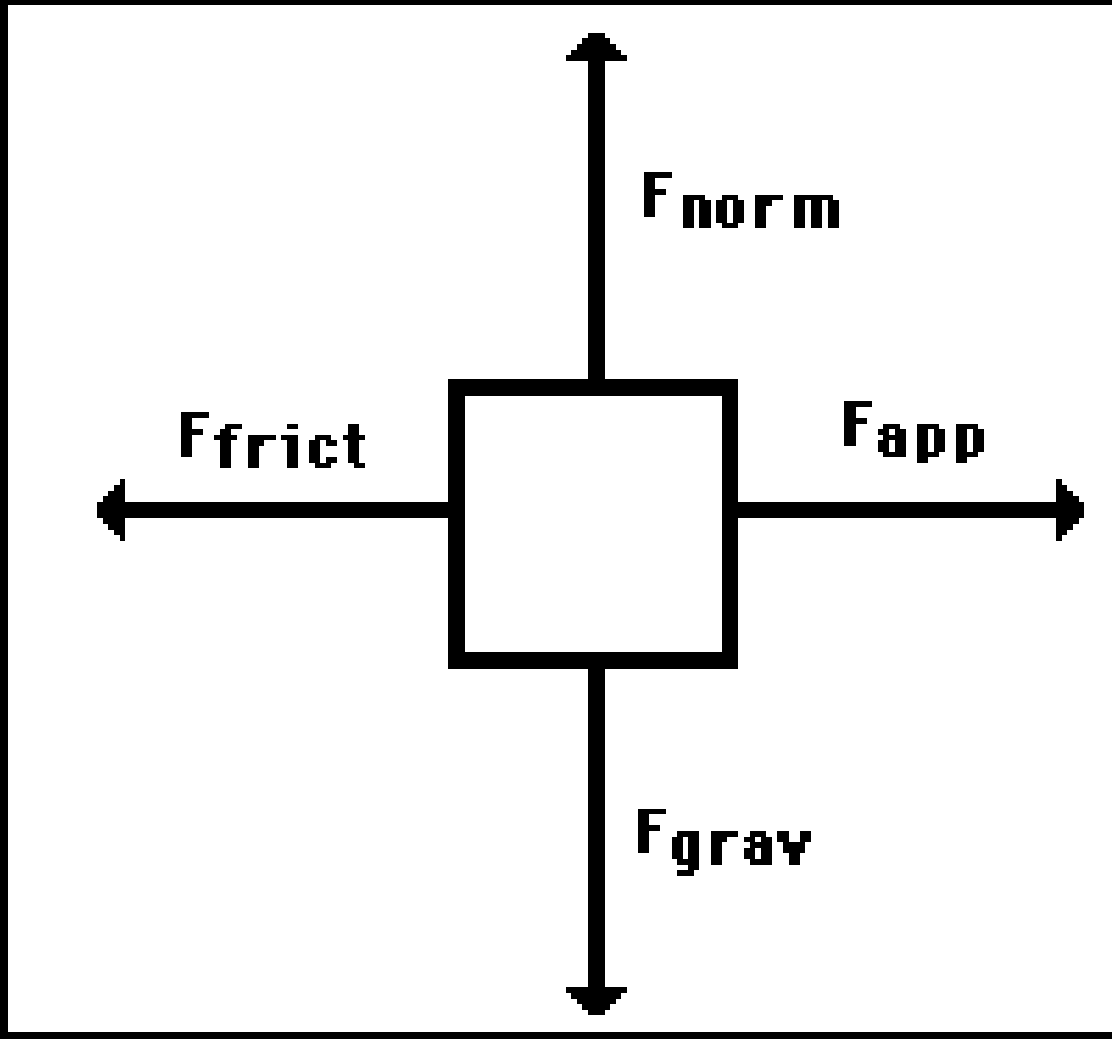
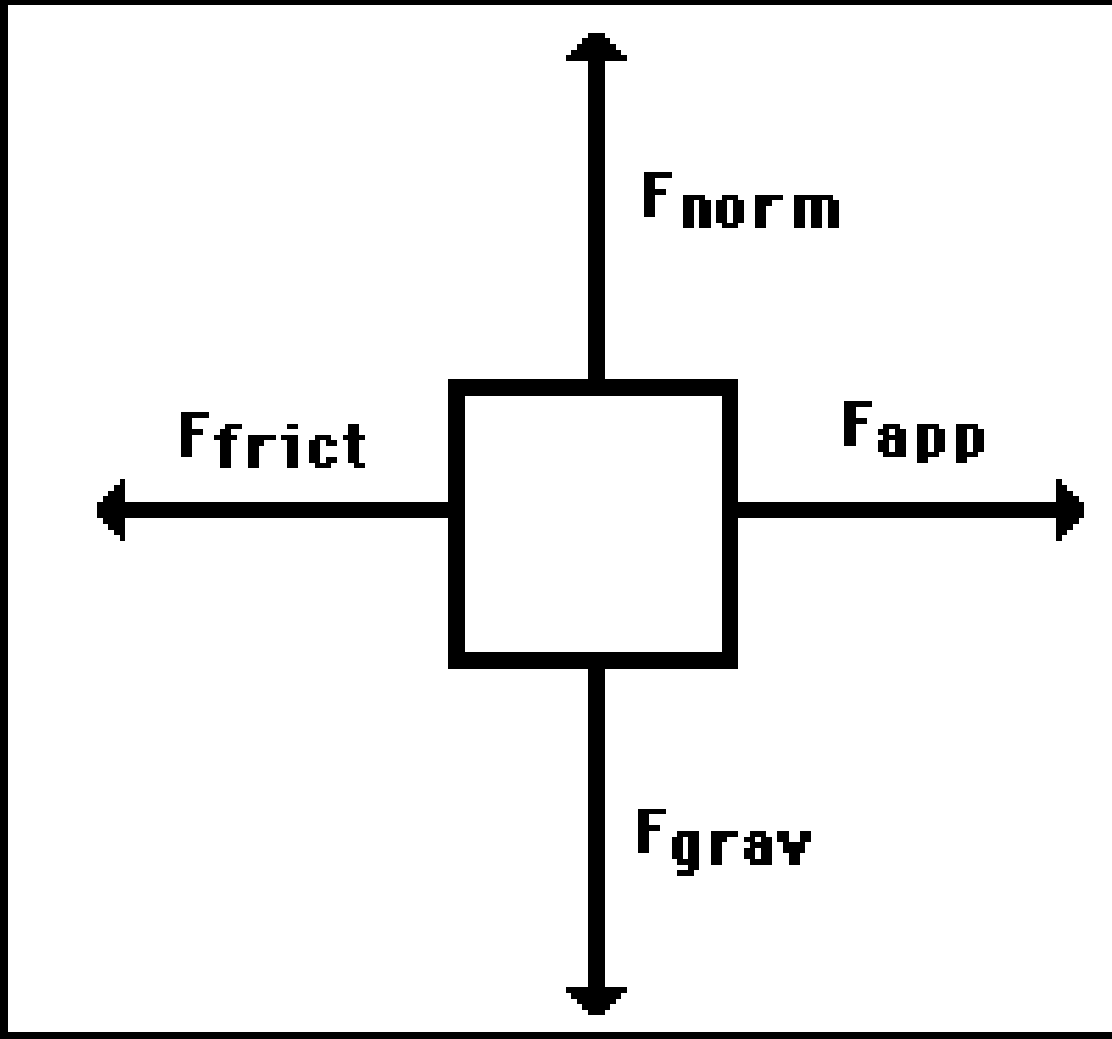
Free-body diagrams

Free-body diagrams are used to show the relative magnitude and direction of all forces acting on an object.



This diagram shows four forces acting upon an object. There aren't always four forces, For example, there could be one, two, or three forces.

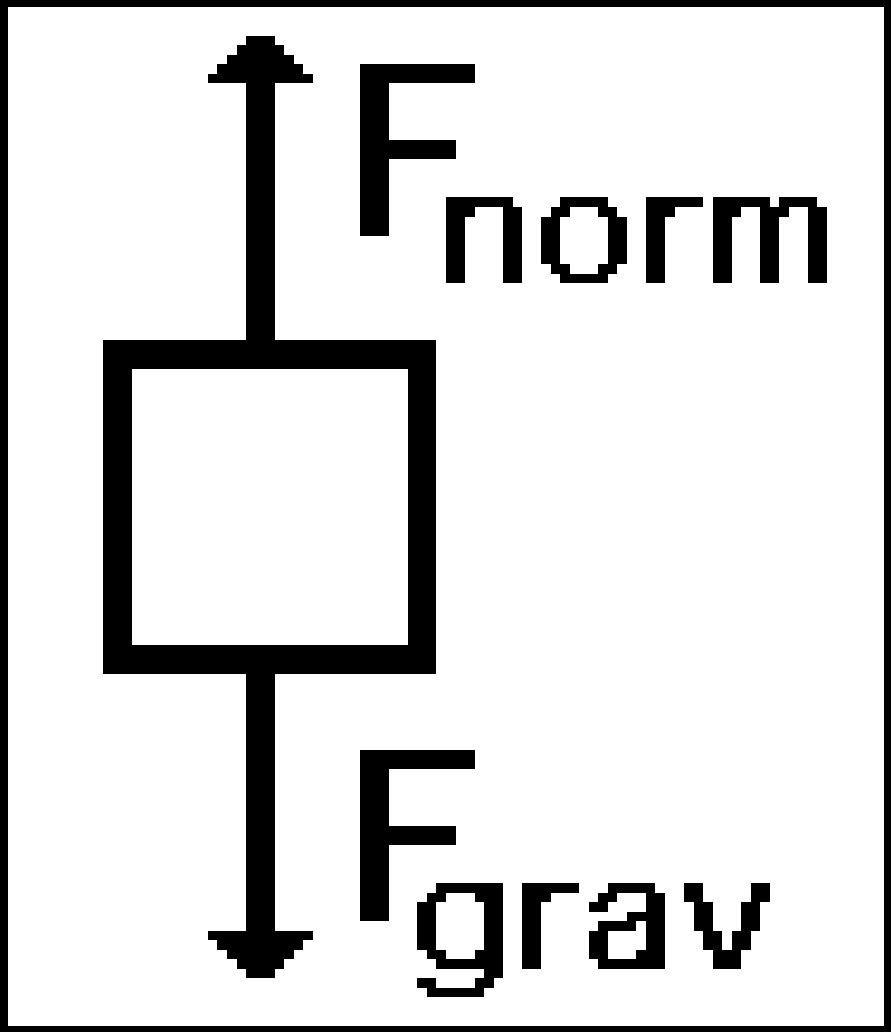


Problem 1

A book is at rest on a table top. Diagram the forces acting on the book.

Problem 1

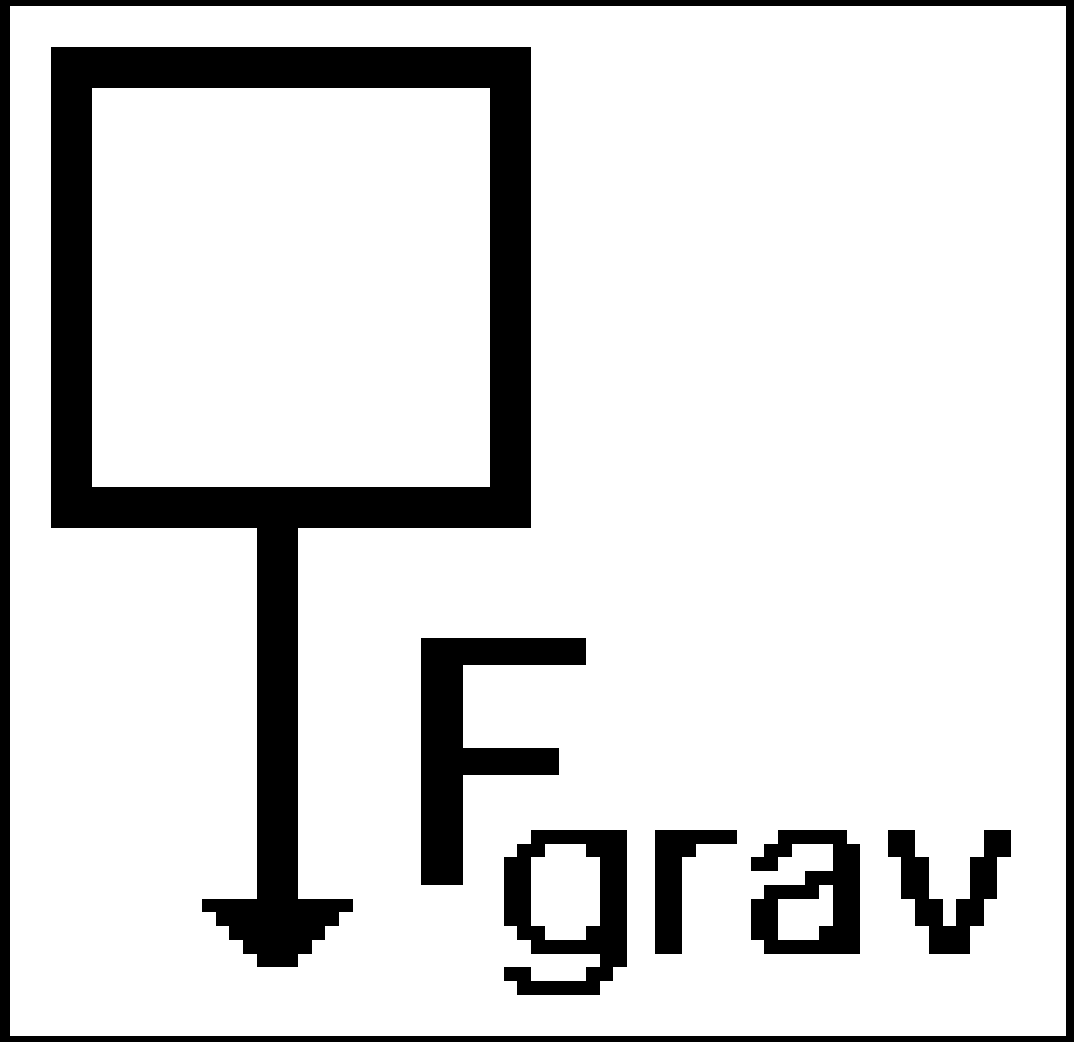
In this diagram, there are normal and gravitational forces on the book.



Problem 2

An egg is free-falling from a nest in a tree. Neglect air resistance. Draw a free-body diagram showing the forces involved.

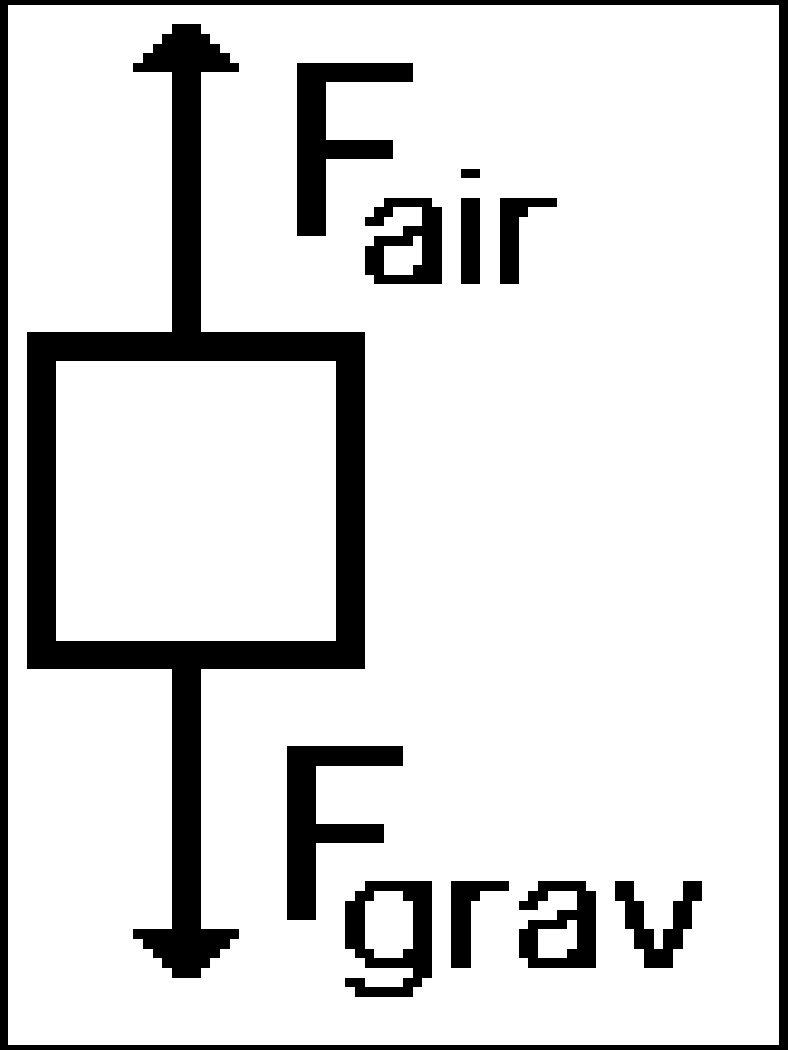
Gravity is the only force acting on the egg as it falls.



Problem 3

A flying squirrel is gliding (no wing flaps) from a tree to the ground at constant velocity. Consider air resistance. A free body diagram for this situation looks like…

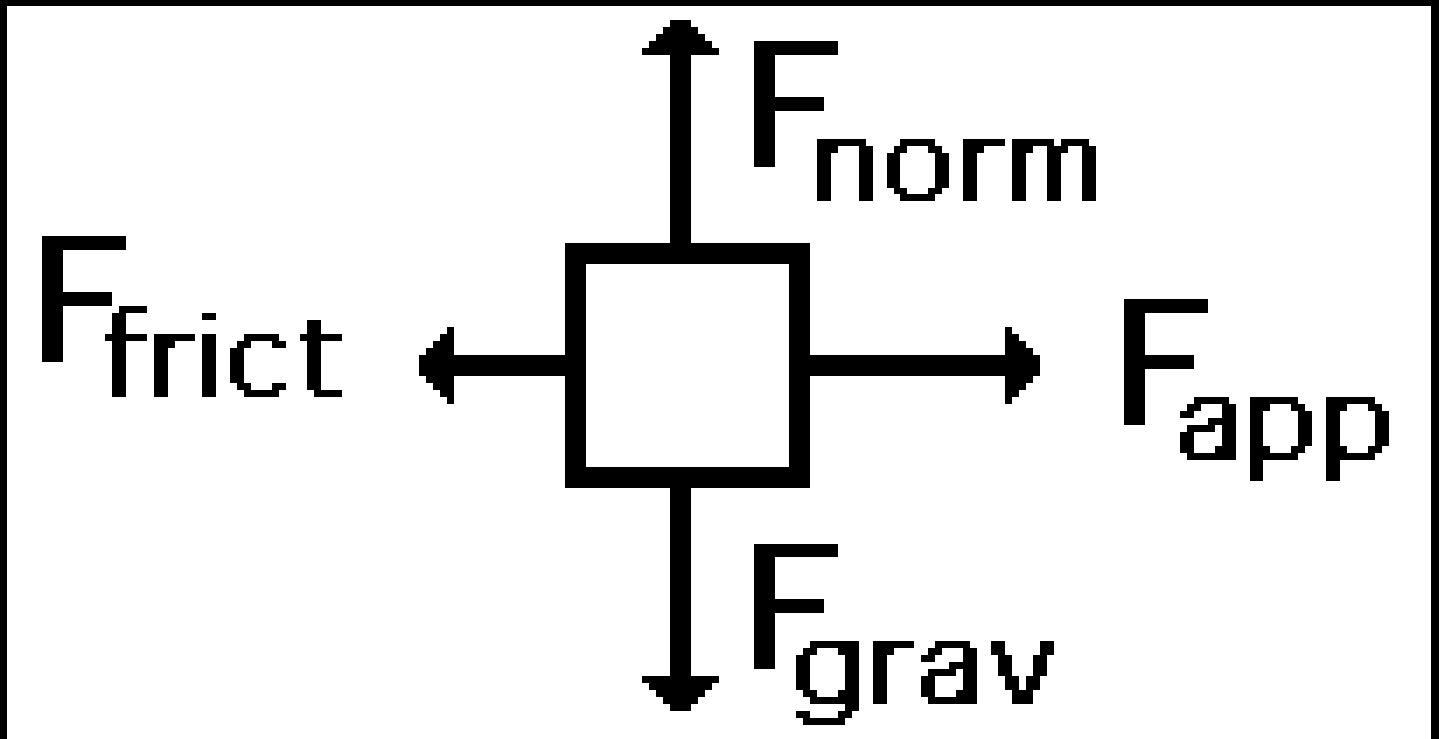
Gravity pulls down on the squirrel while air resistance keeps the squirrel in the air for a while.



Problem 4

A rightward force is applied to a book in order to move it across a desk. Consider frictional forces. Neglect air resistance. Construct a free-body diagram. Let's see what this one looks like.

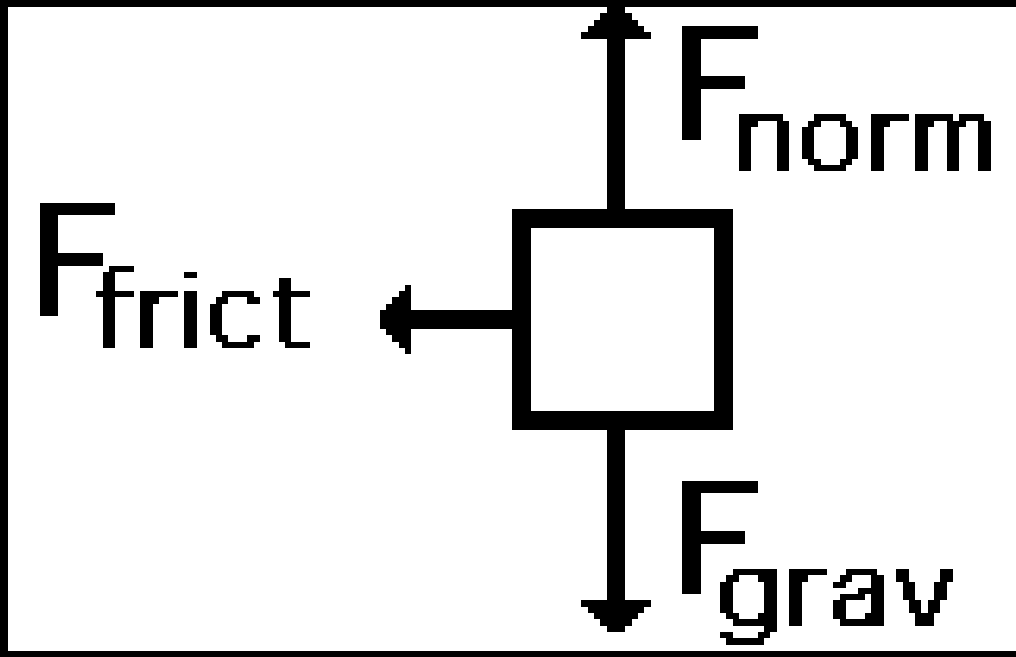
Note the applied force arrow pointing to the right. Notice how friction force points in the opposite direction. Finally, there is still gravity and normal forces involved.



Problem 5

A car runs out of gas and is coasting down a hill.

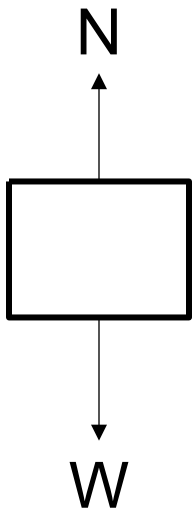
Even though the car is coasting down the hill, there is still the dragging friction of the road (left pointing arrow) as well as gravity and normal forces.



Force/Free Body Diagrams

Create a free body diagram (FBD) for each of the following situations. Draw a FBD of the gorilla:

Sitting Gorilla

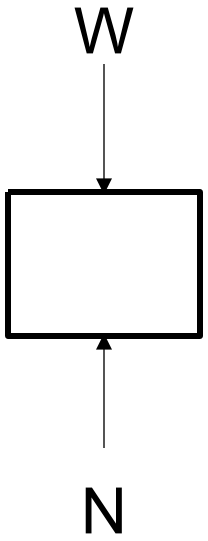


Free Body Diagram of the Sitting Gorilla (The box represents the gorilla, W = weight of the gorilla, N = Normal force)

Force/Free Body Diagrams

Create a free body diagram (FBD) for each of the following situations. Draw a FBD of the gorilla:

Sitting Gorilla

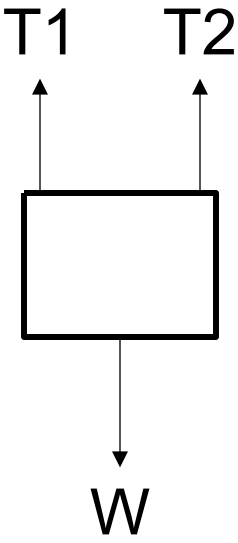


This is also an acceptable diagram.

Force/Free Body Diagrams

Draw a FBD of the wooden swing:

Parrot on wooden swing hung by ropes

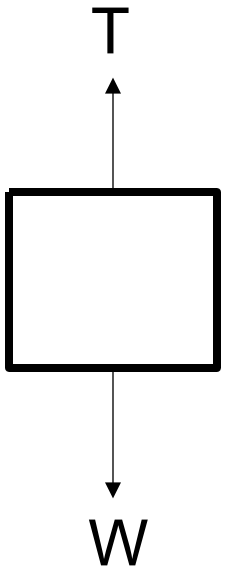


Free Body Diagram of the wooden swing (The box represents the wooden swing, W = weight of the swing and the parrot, T represents the ropes that are in tension supporting the weight)

Force/Free Body Diagrams

Draw a FBD of bucket the bungee jumper leaped from:

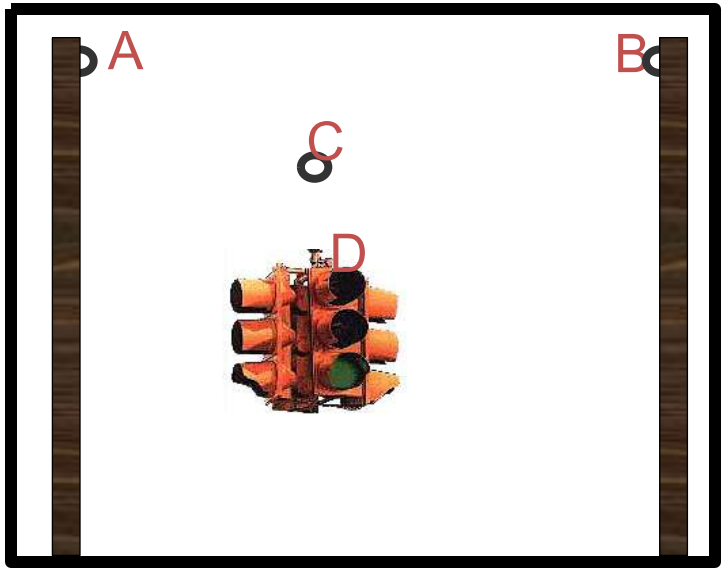
Bungee jumping from crane



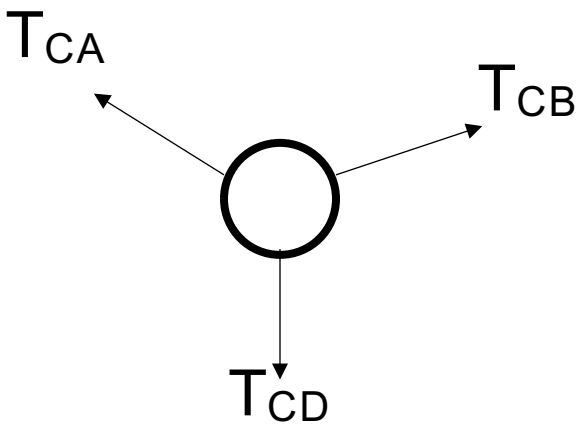
Free Body Diagram of the bucket (T represents the tensile force of the cable the bucket is suspended from, and W is the weight of the diver and the bucket)

Force/Free Body Diagrams

Draw a FBD of the ring at point C:



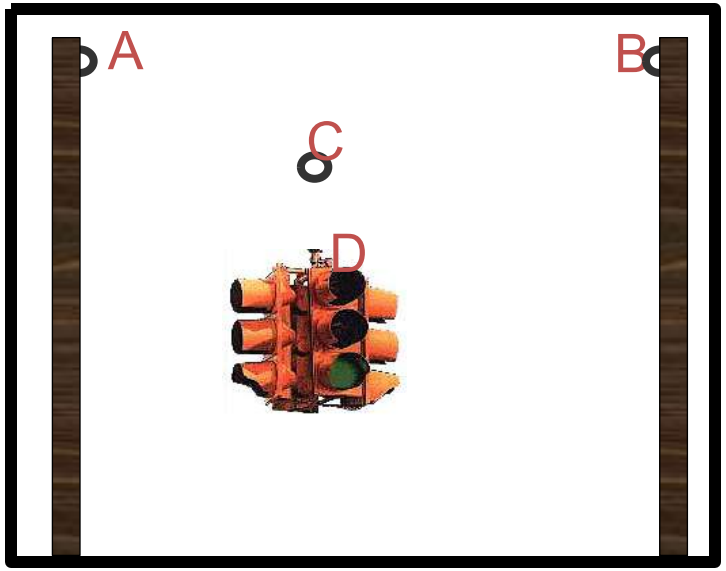
Traffic Light
supported by cables



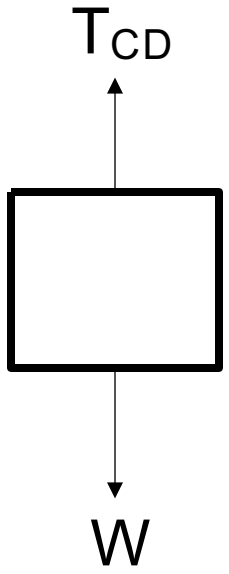
Free Body Diagram of the ring at point C (T represents the force of the cables that are in tension acting on the ring)

Force/Free Body Diagrams

Draw a FBD of the traffic light:



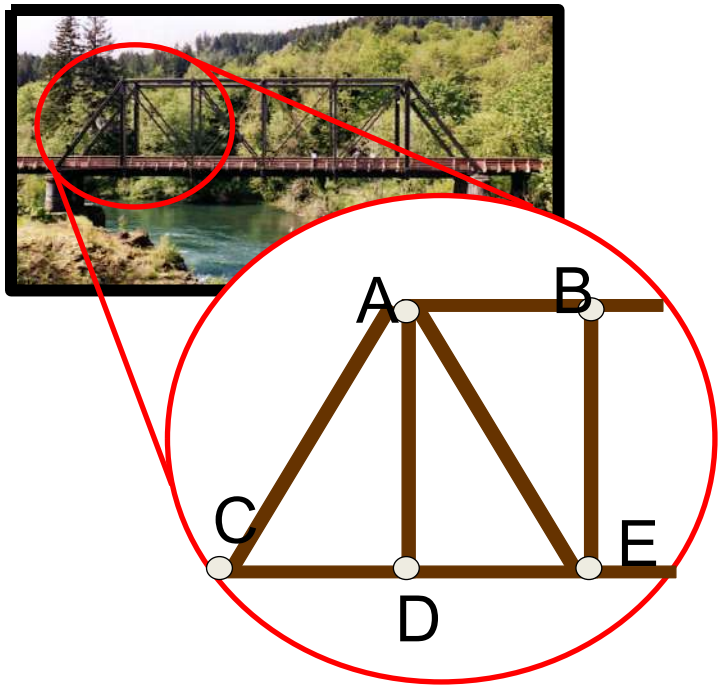
Traffic Light
supported by cables



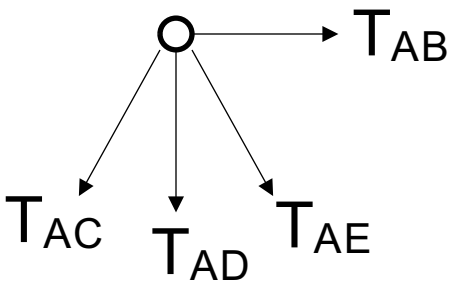
Free Body Diagram of the traffic light (T_{CD} represents the force of the cables acting on the light and W is the weight acting on the light)

Force/Free Body Diagrams

Draw a FBD of the pin at point A:



Pin-Connected Pratt Through Truss Bridge



Free Body Diagram of pin A

(If you consider the third dimension, then there is an additional force acting on point A into the paper: The force of the beam that connects the front of the bridge to the back of the bridge.)