

7.1 Lesson Balanced versus Unbalanced forces.

Review Forces:

1. A force is a push or a pull caused by direct contact.
2. It can also be caused by non contact forces called field forces.
3. Forces cause change in motion .
4. Forces can cause change in shape.
5. Friction is a force that can be helpful or a hindrance.

Give examples of each of the above situations

- 1.
- 2.
- 3.
- 4.
- 5.

New Understandings of force in this unit:

1. Forces act in a certain direction with a certain size. This is represented by straight arrows.
2. Forces are measured in Newtons.
3. If there is no force or the forces are balanced, a body will stay in its present state (moving or stopped). This is called inertia.
4. Unbalanced forces cause objects to accelerate or decelerate.
5. Forces act in pairs (action/reaction)

Measuring Forces

Every force has two important measures.

1. The size of the force:

The size of a force is measured in Newtons or symbol N. To lift a 1kg weight would take about 10 N (newtons)

The size of a force can be measured using a spring or digital balance. They work by stretching a spring or compressing a pressure pad.

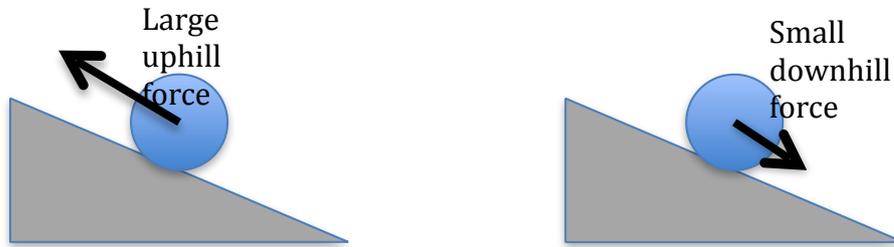
Even a rubber band could be used as an instrument to measure force!

Q. Explain how a rubber band might be used to measure force? What be its limitations?



2. The direction of the force:

The motion of an object depends on where the force acts and in what direction e.g. it is easier to push an object downhill rather than uphill.



The longer the arrow, the larger the force. The arrow shows the direction the force is acting and from where it starts.

Most often, more than one force acts on an object.

Example 1: A thrower will have at least one other force acting on the ball besides his throw.

Q. What do you think it is?

Example 2: An object on a table has at least two forces on it; Gravity force down which is its weight and the table pushing it up. This is called the reaction force.

Q. If the table wasn't there what would the object do?

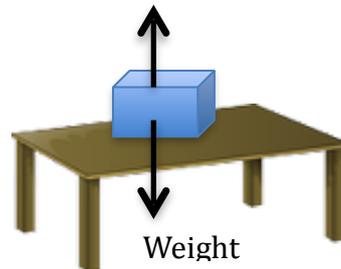
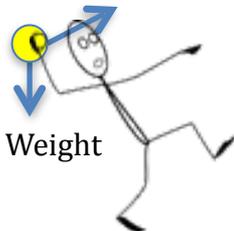


Diagram with arrows to show size and direction of force

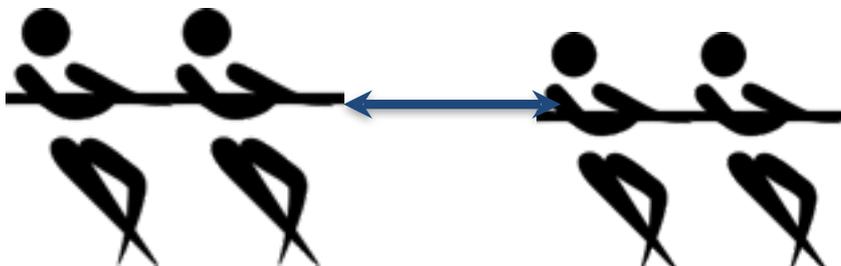
If the two forces are in opposite direction and the same size they will cancel each other out. This is called **Balanced Forces!**

Q. Which diagram above are the two forces balanced?

When this happens the object doesn't move, if it was stationary to start with.

Question. In a tug of war game where no one is winning, what is happening to the two pulling forces? Explain with a diagram:

Answer two forces cancel each other out



Inertia

Balanced or no forces at all, means an object will keep moving at a constant speed or stopped. This is because an object wants to stay doing what it has just been doing.

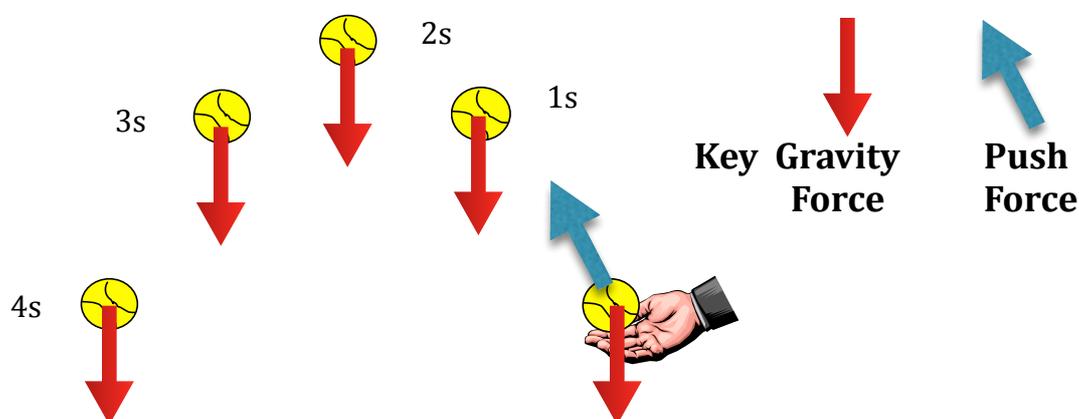
This is called INERTIA.

Question can you think of an example of when an object wants to keep moving?

Answers

In fact every situation where an object is moving, it needs a force to stop it. Heavy objects are the most obvious. In a road accident the damage shows how hard it is for something to stop.

Demonstrations of Inertia and forces acting Throwing a Ball in the Air



The ball moves to the positions shown every 1 second but after it leaves the hand there is only **one force acting (gravity)** if you ignore air resistance. **The push force of the hand stops once it leaves the hand!**

Q. Why then does the ball keep going up for awhile and away from the hand if the push force has stopped?

A. Inertia

Do Group Activity: 7.2 Nuclear Reactor Game

2. Unbalanced Forces.

Unbalanced forces cause, change or stop motion. When one force is bigger than another, the difference between those forces decides how much movement will happen. If an object speeds up it is called **acceleration** if it slows down its called **deceleration**.

Examples of using unbalanced forces:

1. Friction



You learnt in year 4 that Friction is a contact force due to the roughness of surfaces that pushes against movement. Friction never gives up but it does change:

1. It increases against a force as it is applied to get an object moving.
2. It reaches a limit. A force applied beyond this limit starts an object moving. This limit is called maximum Static friction.
3. It drops once an object starts to move but never gives up. This is called Kinetic friction. It may be the friction against an object sliding or rolling if it's on wheels.
4. When a force is no longer applied to a moving object, kinetic friction will slow it down until it stops. (e.g. braking)
5. The size of friction depends on the type and area of the surfaces in contact and the weight of the load.

Questions:

Q1. Why can we not move some objects?

Answer: The static friction is just too great.

Q2. What is normally higher; sliding or rolling kinetic friction?

Answer: Sliding friction as long as the wheels or rollers don't get stuck.

Q3. What changes when braking quickly compared to braking slowly or just coasting?

Answer: Friction is increased by locking the wheels and changing from rolling to sliding friction.

Q4. Why is it important to have good tread on your tyres?

Answer: Friction is a nuisance when it makes things hard to move, slows things down or wears things out but it is also very important when braking or getting a grip when taking off. This is why tyres have to have tread. Then the friction is high and the car won't skid.

Q5. Wheels reduce friction by changing:

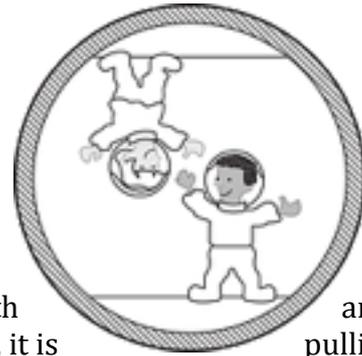
- a) the type of surface
- b) area in contact
- c) weight of the object
- d) all of the above

Answer. Could be all of the above but mostly it reduces the area in contact c)

Do 7.3 Investigating Friction and Load

3. Gravity

As you learnt in Grade 4 Gravity is a non contact force. It actually exists between any two objects but because it is dependent on the mass of the object, on earth the only gravity we notice is the one that the earth makes (because it is so big!)



Earth's gravity is strongest on the surface of the earth actually changes according to the mass of the object, it is on.

and pulling

In fact the earth will pull a heavy object harder than a light object so that they both hit the ground at the same time. Pretty smart earth!

Another name of the earth's gravity force is called **weight**. So when we talk about how much something weighs, we are really talking about how much the earth is pulling on it. The weight of an object depends on its mass but they are not the same. Weight is a force measured in Newtons. Mass is the amount of matter an object has measured in kilograms.



Question How much do you weigh?

Answer:

This is a trick question because if you mean what is my mass? It will be so many kilograms e.g. 100kg.

But if you mean what is my weight? It will be in Newtons. Generally on earth to convert your mass into weight multiply by 10 e.g. 100kg has a weight of 1000N.

Also weight does depend on how close to the earth or some other planet you are.

Astronauts in outerspace can be weightless because they are near no planets or moons and have almost no gravity force acting on them.

Do 7.4 Investigate Mass versus Weight