5.1.2 Introduction to forces

Forces are pushes or pulls which can cause an object to speed up, slow down, change direction or change shape.

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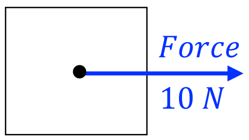
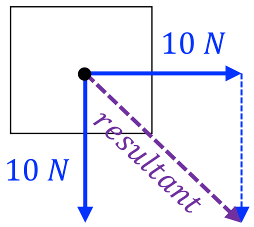
Force is a vector quantity – it has a magnitude (size) and a direction. We can represent vectors with arrows, where the length of the arrow shows the magnitude of the force and the direction of arrow shows the direction the force is acting. The unit for force is the newton (N).



The diagram (left) shows a force of 10 newtons acting on a block towards the right.

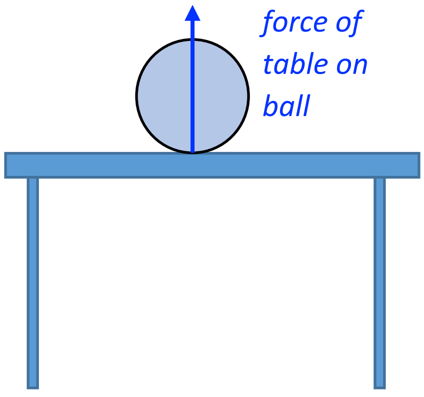
If there is more than one force acting on an object, the 'resultant force' (overall force) is the vector addition of the two forces. (see worksheet 5.1.1)



The diagram (left) shows two forces acting on a block. The vector addition of the two gives the resultant force.

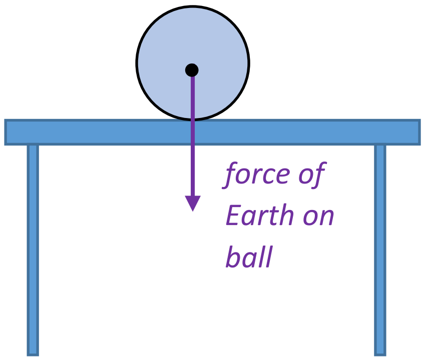
(1)✐What is the magnitude of the resultant force (above)? (Hint: Use Pythagoras' theorem)

Forces arise as interactions between objects. If the objects need to be touching for the forces to be generated, we call these forces 'contact' forces.



The diagram (left) a ball resting on a table. The upward force on the ball comes from the surface of the table pushing upwards on the bottom of the ball. This is a contact force because the surfaces are in contact.

There is another force acting on the ball caused by the gravitational attraction of the Earth.



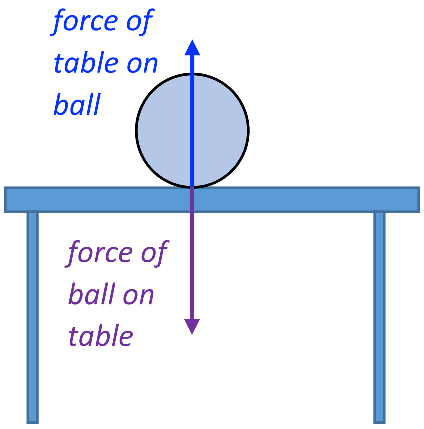
The diagram (left) a ball resting on a table. The downward force on the ball comes from the gravitational attraction of the Earth on the ball. This is called the weight. It is a non-contact force.

(2)✐How does the magnitude of the two forces compare for example above?

(3)✐Decide whether the following are contact or non-contact forces.

description of force	*name of force*	*contact or non-contact?*
water pushing up on a floating object	upthrust	
air pushing up on the wings of an aeroplane	lift	
air pushing backwards on object that is moving though air	air resistance	
two north poles of a magnet repelling	magnetic	
force pulling down on a falling object	weight	
force of Earth on the Moon	gravity	
resisting force between two surfaces rubbing together	friction	
the pull from a rope on an object	tension	

The force between objects is always equal and opposite. For example, for the ball resting on the table, the force of the table acting on the ball is equal in magnitude and opposite in direction to the force of the ball acting on the table.



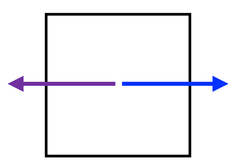
Interacting objects experience equal (in size) and opposite (in direction) forces.

(4)✐Describe the opposite force to the gravitational force of the Earth acting on the ball.

(5)✐Describe the three forces acting on the table.

Balanced/unbalanced forces

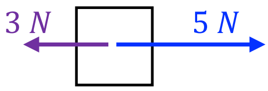
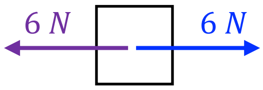
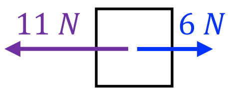
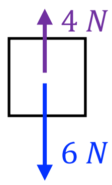
When the forces acting on one object add up to be zero (i.e. the resultant force is zero), we say the forces are balanced. When forces are balanced there is no change in the motion of the object (i.e. no change in speed or direction).



Forces are balanced. No change in speed or direction of block.

When there is a resultant force acting on an object, the object will accelerate in the direction of the resultant force.

(6)✐ *For the following, state whether the forces are balanced or unbalanced and describe how the motion of the object changes (whether speeding up, slowing down or changing direction, or no change).*

force/motion diagram	*balanced/unbalanced*	*change in motion*
start: object stationary 		
start: constant speed to right 		
start: constant speed to right 		
start: constant speed to right 		
start: stationary