

**Title:** Balanced and Unbalanced Forces

**Learning objective:** Calculate resultant forces and explain their effect.

**Instructions:** Complete each activity either in your exercise book or on lined paper and self-assess all answers.

**Do Now:**

1. What does the length of an arrow tells us about the force? (1)
2. What piece of equipment is used to measure force? (1)
3. What are the unit for measuring force? (include the symbol used) (2)
4. Why do we need to have control variables in an experiment? (1)
5. Calculate the average for this set of results:  
4N, 2N, 3N (show your working out). (2)

**Challenge:** Draw a free body to show a ball falling (use a cross for the ball). Label all the forces acting on the boat

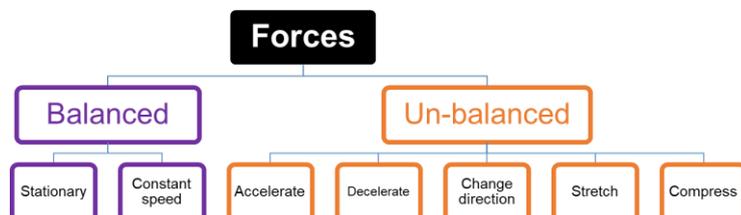
**New Knowledge:**



So far we have learned that forces act on objects to make them change their speed, shape or direction. We know that we can't see these forces, but we can see what effect they have on objects.

For example, to make this football move, we must apply a force to it. But how do we know how much force to apply? And what effect will changing the size or direction of the force have on objects? How do we know?

Forces can be balanced or unbalanced  
When forces are balanced the objects motion will not change, meaning if its stationary it will remain stationary and if its moving it will  
When the forces are unbalanced the objects motion will change making it speed up, accelerate, or slow down, decelerate.



If the forces acting on an object are balanced, the object is either stationary (not in motion) or moving at a constant (the same) speed. We can tell by the size of the arrows in a free body diagram.



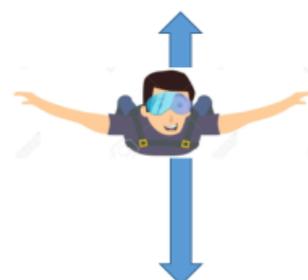
If the arrows are the same size, the forces are balanced. This aeroplane is in motion (moving) but is travelling a constant speed because the arrows for both the forwards and backwards forces are the same.

If the forces acting on an object are unbalanced, the object must be accelerating or decelerating.

If a object is accelerating, it is speeding up.

If a object is decelerating it is slowing down.

This sky diver has just jumped out a plane and is accelerating (speeding up) towards the ground as the downwards force is greater than the opposing force.



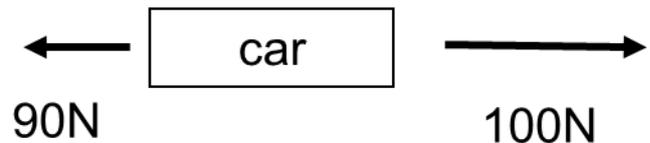
In this example, there is a greater force acting to the right, so the plane would accelerate in the rightwards direction.



In this example, there is a greater force acting to the left, so the plane would decelerate



When we start to assign values to the amount of force being applied, we can actually work out the overall force acting on the object. Here we have an object with two opposing forces acting on it. We can see that the largest force is being applied to the right with a smaller force applied to the left. What is the net (overall) force acting on the object and how will it change what the object is doing? We can calculate this by subtracting 90N from 100N. This gives us a total of 10N acting to the right.



We can find this net force resultant force. It is the resultant force which determines what will happen to the object.

The second diagram shows the resultant force: a single force that has the same effect as all the original forces acting together



**Key knowledge:**

Spend 5 minutes completing 'Look, Cover, Write, Check' of this knowledge, or get someone to quiz you on it.

What happens to an object if the forces acting on an object are balanced?	...either stationary (not in motion) or moving at a constant (the same) speed.
What happens to an object if the forces acting on an object are unbalanced?	...accelerating or decelerating.
What does accelerating mean?	...it is speeding up.
What does decelerating mean?	...it is slowing down.
What is the resultant force?	the overall result of all forces acting on an object.

**Quiz:**

Which statement is true?

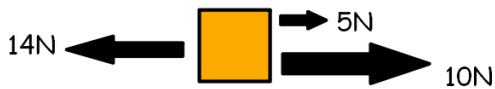
1. objects with unbalanced forces stay still
2. objects with unbalanced forces accelerate or decelerate
3. Objects with unbalanced forces accelerate, decelerate or can be stretched or compressed

A resultant force is...

1. A single force that has the same effect as all forces acting in the same direction
2. A single force that has the same effect as all the original forces acting together.
3. A free-body diagram

Which statement is true?

1. The forces on this object are balanced
2. The forces on this object are unbalanced
3. The resultant force is 0N



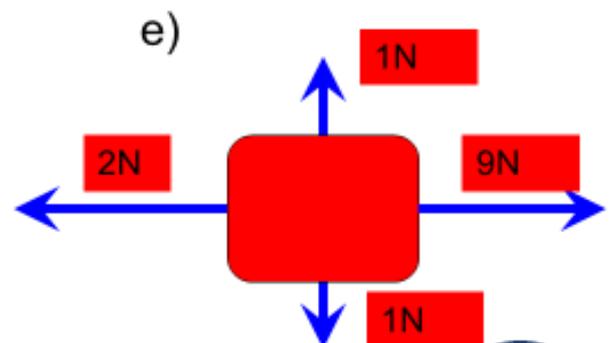
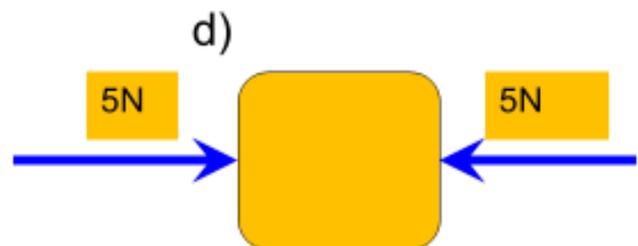
Which statement is true?

1. This object would stay still
2. This object would decelerate
3. This object would accelerate the right



**Independent Task:**

Give the resultant force:



**Key terms:** resultant force, acceleration, deceleration



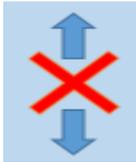
## Answers:

### Do now:

1. What does the length of an arrow tells us about the force? The size of the force (1)
2. What piece of equipment is used to measure force?  
A newton meter (1)
3. What are the unit for measuring force? (include the symbol used) Newtons (N) (2)
4. Why do we need to have control variables in an experiment? To make sure our results are valid (1)
5. Calculate the average for this set of results:

$$(4\text{N}+2\text{N}+3\text{N})/3 = 3\text{N} \quad (2)$$

Challenge:



## Quiz

Which statement is true?

1. objects with unbalanced forces stay still
2. objects with unbalanced forces accelerate or decelerate
3. Objects with unbalanced forces accelerate, decelerate or can be stretched or compressed

A resultant force is...

1. A single force that has the same effect as all forces acting in the same direction
2. A single force that has the same effect as all the original forces acting together.
3. A free-body diagram

Which statement is true?

1. The forces on this object are balanced
2. The forces on this object are unbalanced
3. The resultant force is 0N



Which statement is true?

1. This object would stay still
2. This object would decelerate
3. This object would accelerate the right



## Independent Task:

- a) 3N right
- b) 1N right
- c) 3N Left
- d) Stationary or a constant speed
- e) 7N right