Newton's First Law

Answer the following questions:

1. Define resultant force.
   The net force or the overall effect of the forces acting on an object.
2. State Newton's Third Law.
   Every action has an equal and opposite reaction. If object A exerts a force on object B, object B exerts an equal and opposite force on object A.
3. Explain the difference between speed and velocity.
   Speed is the distance covered per unit time and has a size only (scalar), velocity is speed in a given direction and is a vector.
4. Name a force that acts in the opposite direction to motion.
   Friction, air resistance, water resistance
5. Describe the possible effects of an unbalanced force.
   An unbalanced force can change an object's shape, speed or direction.

Do Now

ArkCurriculum+

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Newton's First Law

P3.1.6

Science
Mastery

P3.1.1 Prior Knowledge Review
P3.1.2 Scalars and Vectors
P3.1.3 Resultant Vectors
P3.1.4 Resolving Vectors
P3.1.5 Newton's Third Law
➢ **P3.1.6 Newton's First Law**
P3.1.7 Acceleration
P3.1.8 Acceleration Investigation

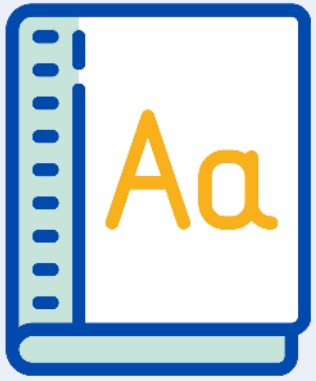
Maths in Science Lesson 17
P3.1.9 Velocity-Time Graphs
P3.1.10 Velocity-Time Graphs 2
P3.1.11 Acceleration Problems

Lesson Objectives

Following this lesson, students will be able to:

- State Newton's First Law.
- Calculate resultant forces.
- Predict the motion of objects based on the forces acting upon them.

Key Words:

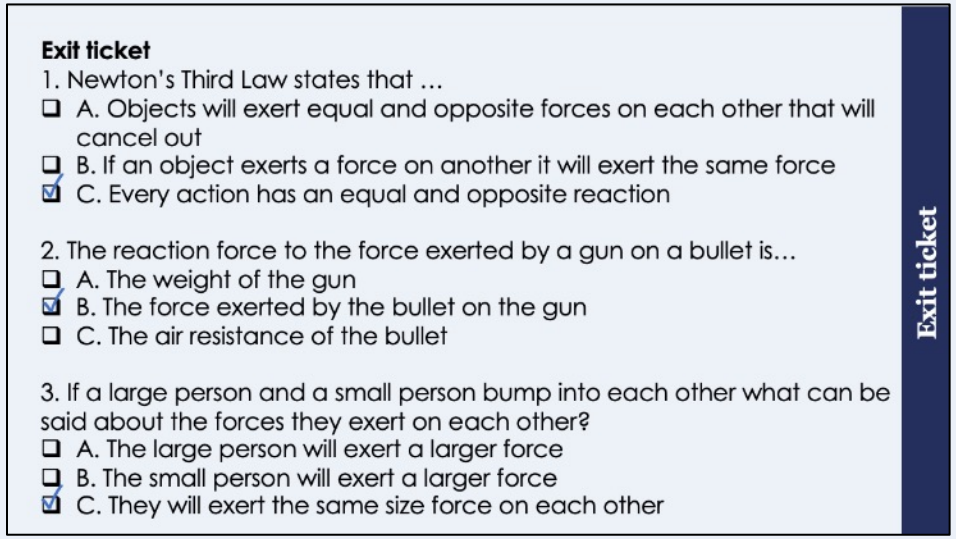


balanced	**unbalanced**	**resultant**
stationary	**acceleration**	**constant velocity**

This is the fix-it portion of the lesson

The **fix-it** is an opportunity to respond to gaps in knowledge, especially those identified by the previous lesson's exit ticket.

- The teacher should customise this slide as needed, to facilitate
  - **reteach**, **explanation, demonstration** or **modelling** of ideas and concepts that students have not yet grasped or have misunderstood.
  - **practise** answering specific questions or of key skills.
  - **redrafting** or **improving** previous work.



Fix-it

Forces and Motion

This shopping trolley is stationary.

What is the speed of a stationary object?

What can we tell about the forces acting on the trolley?

What would a free-body force diagram look like for this stationary trolley?

Talk Task

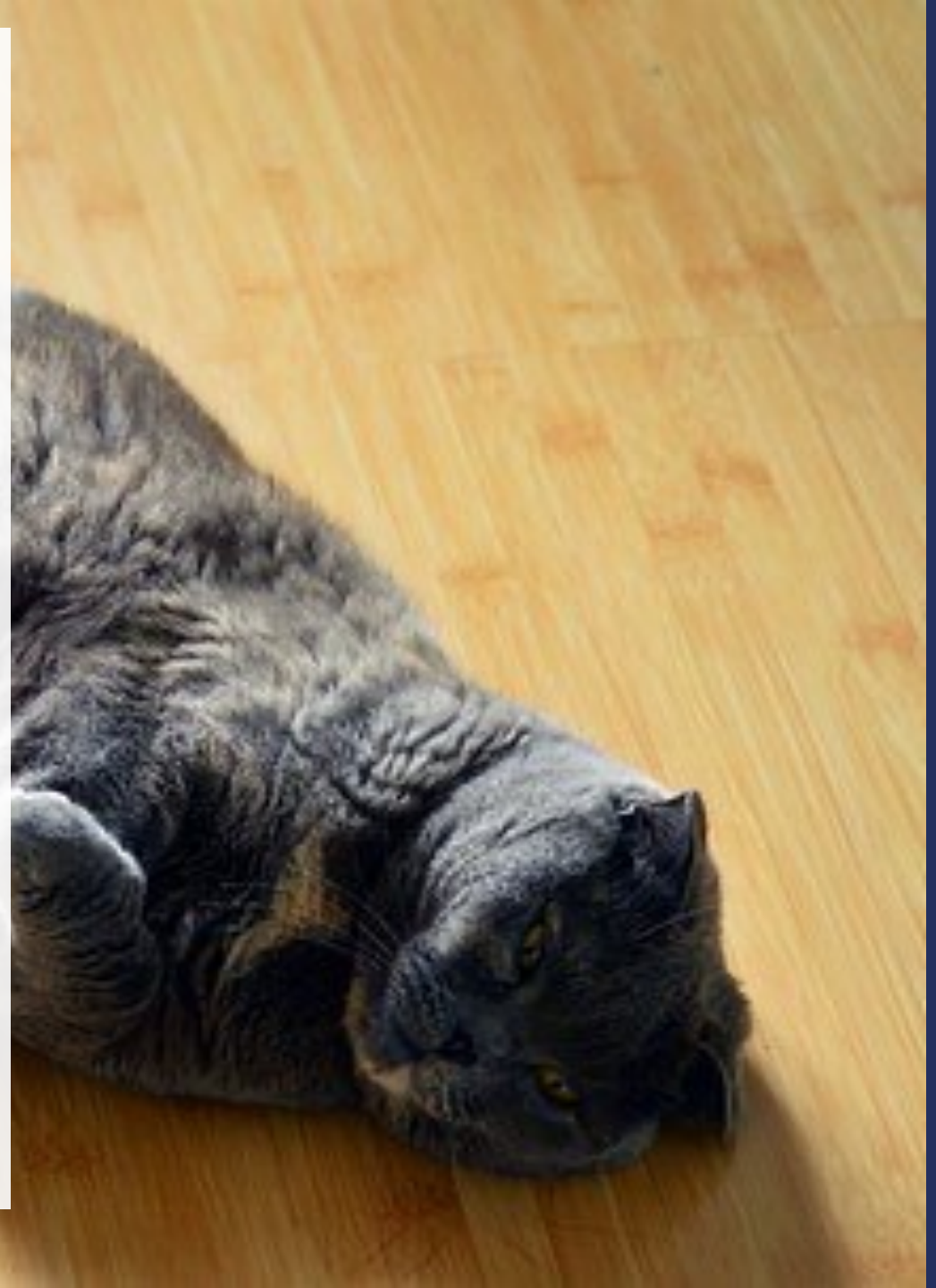
Newton's First Law

Newton's First Law states that an **object's motion will not change unless acted upon by an unbalanced force.**

The tendency of objects to continue in their state of motion is called **inertia.**

An unbalanced force is a **non-zero** resultant force.

If the resultant force is 0 N the forces are **balanced** and the object is in **equilibrium.**



Newton's First Law

If the **resultant force is 0 N:**

- A stationary object will **stay stationary**
- An object in motion will **continue moving at the same velocity**

If the **resultant force is not 0 N:**

- A stationary object will **accelerate** in the direction of the resultant force
- An object in motion will **accelerate** in the direction of the resultant force

Newton's First Law

What can you say about the forces acting on these objects?

Explain your answers using the idea of Newton's First Law.

Weightlifter at the top of their lift

Truck slowing down at traffic lights.

Sprinter running at their top speed

Talk Task

Determine if the following statements are true or false:

1. Newton's Third Law states that an objects motion will not change unless acted upon by balanced forces **False**

2. An object can be said to be in equilibrium if the forces acting upon it are balanced **True**

3. A stationary object acted upon by an unbalanced force will remain stationary **False**

4. An object in motion acted upon by an unbalanced force will maintain constant velocity **False**

Check for understanding

Drill

1. What is Newton's first law?
2. What is inertia?
3. If the resultant force is greater than 0N we say that the pair of forces are...
4. When is an object at equilibrium?
5. If the resultant force is 0N what would happen to a stationary object?
6. If an object is moving and has a resultant force of 0N how will it move?
7. A car accelerates whilst moving, what is its resultant force be like?
8. A car starts to slow down, what will it resultant force be like?
9. If there is resultant force is not 0N what would happen to a stationary object?

Check for understanding

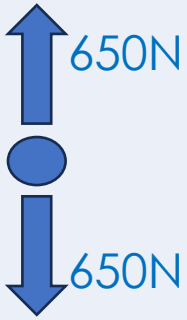
Drill answers

1. Newton's first law states that an object's motion will not change unless acted upon by an unbalanced force.
2. Inertia is the tendency of an object to continue in their state of motion.
3. A resultant force that is greater than 0N is an unbalanced force.
4. An object is at equilibrium if the resultant force is 0N and so the forces are balanced.
5. When the resultant force is 0N a stationary object, it will remain stationary.
6. A moving object with a resultant force of 0N will move at steady speed /velocity.
7. An accelerating car has a resultant force greater than 0N in the forward direction.
8. A car that slows down will have a resultant force greater than 0N in the backwards direction.
9. If the result of force is greater than 0N then stationary object will start to accelerate.

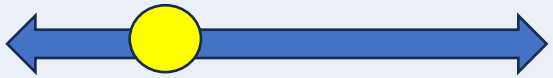
Check for understanding

I do: Free body diagrams

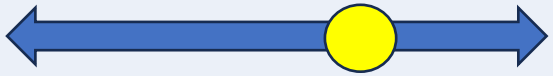
This sprinter was in the 'on your mark' position. They weigh 650N. Draw a free body diagram to represent them



The sprinter hears 'go' and accelerate. Draw a free body diagram to represent them now.



The sprinter wins and hits the ribbon! Draw a free body diagram to represent them right after this.



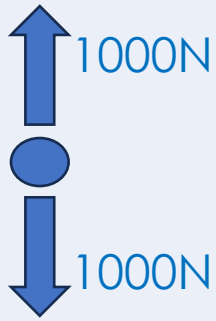
This sprinter did not immediately stop when they hit the ribbon. Why not?

The sprinter did not immediately stop due to inertia. Inertia is the tendency of an object to continue in their state of motion

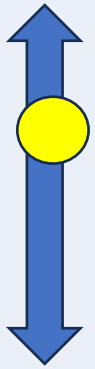
Apply

We do: Free body diagrams

1. This weightlifter is resting the weights on their shoulder They weigh 1000 N. Draw a free body diagram to represent them



2. The weights are too heavy, and they drop downwards. Draw the free body diagram.



3. The weights are now on the ground. Draw the free body diagram now

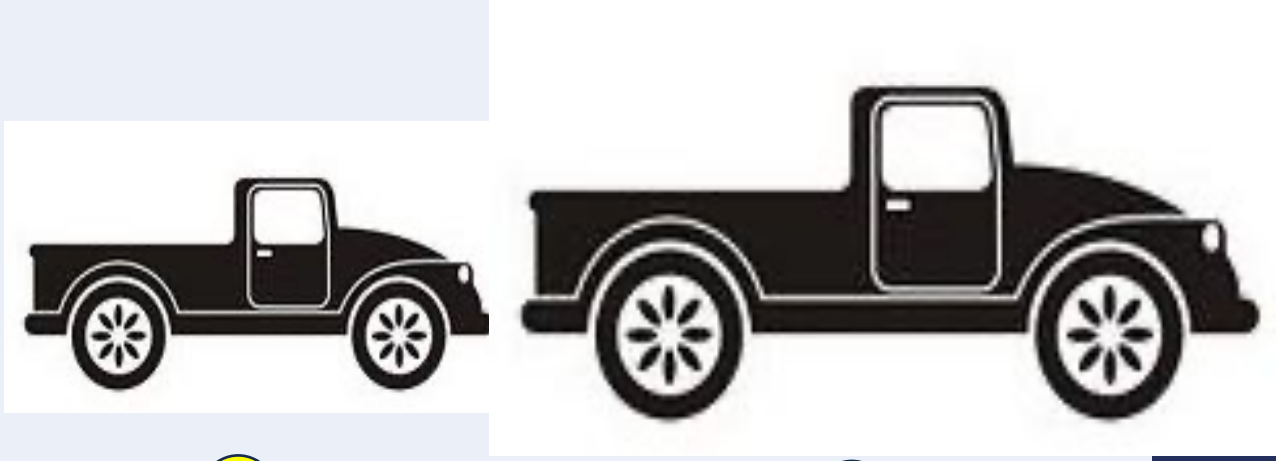
How can you tell that the weights are in equilibrium in scenario 1 and 2?

When all the forces acting upon an object are equal/balanced

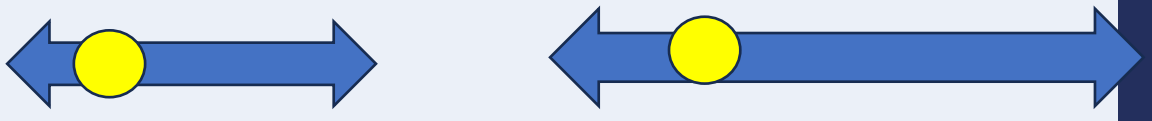
Apply

You do: Free body diagrams

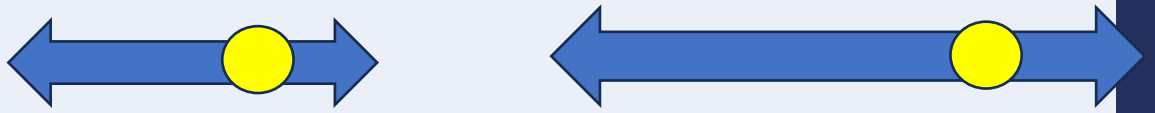
1. Both trucks are moving at a steady speed. Draw their free body diagrams.



2. Both trucks accelerate. Draw the free body diagrams.



3. Both trucks decelerate. Draw the free body diagrams.



Why might the bigger truck need a greater engine force to accelerate as much as the smaller truck?

It has greater mass so needs a greater force to accelerate as much as the smaller truck.

Apply

Answer the questions below.

1. Newton's First Law states that …

- [x] A. Objects' motion will not change unless acted upon by an unbalanced force
- [ ] B. Objects will remain stationary if they are acted upon by an unbalanced force
- [ ] C. Every action has an equal and opposite reaction

2. An object that is moving at 0.5 m/s to the right is acted upon by a resultant force of 5 N left. Which best describes its resulting motion?

- [ ] A. It will move at 0.5 m/s to the left
- [ ] B. It will now be stationary
- [x] C. It will slow down but continue moving towards the right

3. Which of these resultant forces would cause a stationary object to accelerate to the left?

- [ ] A. 0 N
- [x] B. 5 N left
- [ ] C. 5 N right

Exit ticket

Feedback

Lesson P3.1.6	
What was good about this lesson?	What can we do to improve this lesson?

Send us your feedback by clicking this link
or by emailing sciencemastery@arkonline.org
Thank you!