THE DUSTON SCHOOL
Knowledge itself is power
TDS 4-19

Year 7 Science Knowledge Booklet

Term 1

Name:	**Class:**
Homework 1 Due: 16th September	**Homework 2 Due: 30th September**
Homework 3 Due: 14th October	

Science Homework 1

Read all of this knowledge organiser.

Big questions: What are forces?

What are Forces?

How can we describe forces?

What are Contact and Non- Contact Forces?

What are "pairs of forces"?

What effects do balanced and unbalanced forces cause?

What are Newton's first and second laws?

What affects the size of the friction force?

Key vocabulary

Force	A push or a pull. Forces are measured in Newtons(N)
Contact force	A force that happens when objects touch. Friction, reaction forces and air resistance are examples of contact forces.
Non-contact force	Forces that act between objects even if they are not touching. Magnetism, gravity and electrostatic forces are examples of non-contact forces.
Reaction force	The force caused when one object pushes on another. The force is always at right angles to the surfaces.
Friction	A contact force that opposes the motion of one object across or through another. Friction is always in the opposite direction to the motion.
Air resistance	The push of the air on an object that is moving through it. Air resistance is always in the opposite direction to the motion and gets bigger when the object moves faster.
Force arrow	A drawn arrow that shows the size and direction of a force in a force diagram.
Equilibrium	If all of the forces on an object add up to be zero then we say that the forces are balanced.
Unbalanced forces	If the forces on an object do not add up to be zero then we say that the forces are un-balanced.
Resultant force	The overall force acting on an object when we have added all of the forces acting.
Free-body diagram	A diagram showing all of the forces on the one object we are interested in and none of the others in the situation as a whole.

What are Forces?

Forces can be a push a pull or a twist.
You cannot see a force, but you can feel a force and see the effect of the force.

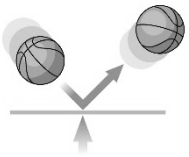
Three effects of forces

Forces can:

1. Change the shape of the object.

2. Change the speed of the object
Speed up or slow down.

3. Change the direction of an object.



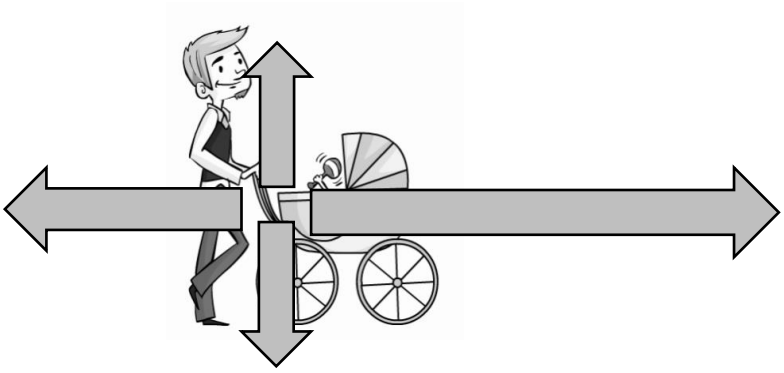
How can we describe forces?

We cannot see forces but we can see the effects of forces. We know that if we drop an object the force of gravity will make the object fall (and speed up).

Forces are an interaction between two objects e.g. the Earth pulling the object down. We therefore need to consider which two object the force acts between and what we can call the force.

We can represent forces in a diagram using an arrow.

- The **direction** of the arrow shows the direction of the force.
- The **length** of the arrow shows the size of the force.
- The arrow **starts on the object** that will "feel" the effect.



What are Contact and Non- Contact Forces?

Contact force – a force that only occurs when two objects are touching.

Examples of contact forces:

- Friction is the force an object exerts on an object that moves across it. The force of friction tends to oppose the motion of the object.

- Air resistance is a type of contact force that air exerts on moving objects. Like friction, air resistance tends to oppose the motion of an object.

Non-contact force - a force that occurs when two objects are not touching.

Examples of non-contact forces

- Magnetic force – a force that exists between certain materials, such as magnetized iron. The force may be attractive (like a pull) or repulsive (like a push).

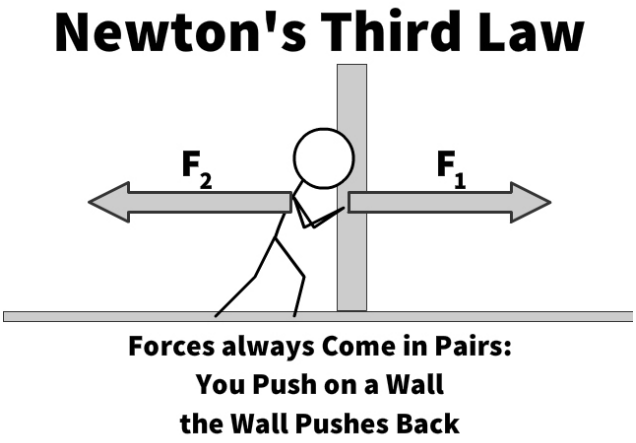
- Electric force – acts between objects that are electrically charged. Objects with like charges tend to repel (push) one another. Objects with unlike charges attract (pull) one another.

- Gravitational force – force of attraction that exists between any two objects that have mass. On Earth, we experience gravity as a downward force.

What are "pairs of forces"?
Newton's Third Law of Motion

Forces always come in pairs because forces are an interaction between two objects. The two forces act in opposite directions and are the same size.

"If object A exerts a force on object B, object B exerts an equal and opposite force on object A"



Science Homework 2

Try to answer all of these key knowledge questions. Then check your answers using the answer page.

Questions in *italics* are from older work.

Key knowledge question	**Your answer**
Describe what is meant by “contact forces”	
Describe what is meant by the term “non-contact forces”	
In which direction does friction act?	
Name the apparatus used to measure force.	
Name the three things forces can be.	
Name the unit of force	
Name three effects of forces.	
Name two contact forces.	
Name two non-contact forces.	
State Newton’s third law.	
What is a carnivore?	
What is a herbivore?	

What effects do balanced and unbalanced forces cause?

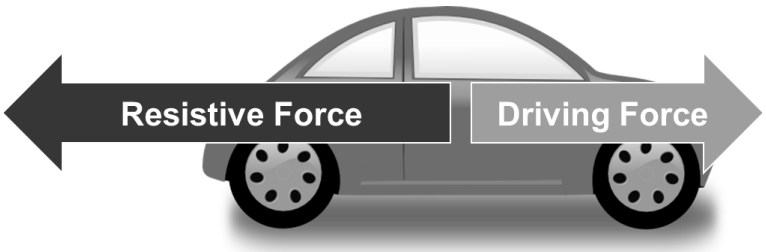
Forces are balanced when they are the same size and acting in the opposite direction.
They are said to be in equilibrium.

If the forces on an object are balanced:
An object that is not moving stays still.
An object that is moving continues to move at the same speed and in the same direction.

Remains stationary or travelling at constant speed

If the forces on an object are unbalanced:
The object changes speed or direction.

Speeds up (accelerates)



Slows down (decelerates)

What are Newton's first and second laws?

Newton's First Law
If the forces are balanced an object will remain stationary or travelling at a constant speed.

Newton's Second Law
A resultant force will cause an acceleration where:

Force = mass x acceleration

F = ma

Resultant force
The overall force - The sum of forces taking the direction into account.

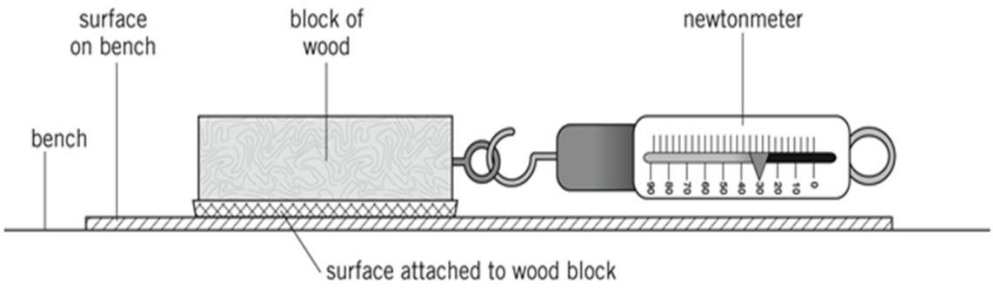
If two forces act in the **same** direction, we can add the forces to find the resultant.

If two forces are in **opposite directions**, we take one away from the other. The resultant will be in the direction of the largest force.

What affects the size of the friction force?

- Friction is a resistive force that acts against the motion of an object when it rubs against a surface.
- Friction depends on how rough or smooth a surface is.
- Friction can make it hard for things to move.
- A lubricant can be used to reduce friction.

We can investigate friction using a Newtonmeter



Key knowledge question	**Answer**
Describe what is meant by “contact forces”	A force produced by something that is touching something else
Describe what is meant by the term “non-contact forces”	A force produced by something that is not touching something else
In which direction does friction act?	In the opposite direction to movement
Name the apparatus used to measure force.	Newton meter
Name the three things forces can be.	Push, pull or twist
Name the unit of force	Newtons (N)
Name three effects of forces.	Change the speed, change the direction or change the shape of an object
Name two contact forces.	Friction, air or water resistance, normal contact force
Name two non-contact forces.	Magnetic force, gravitational force, electrostatic force
State Newton’s third law.	If A exerts a force on B, then B exerts an equal but opposite force on A.
Describe what is meant by “contact forces”	In the opposite direction to movement
What is a carnivore?	*Eats animals*
What is a herbivore?	*Eats plants*

Big questions: What are the states of Matter?

What are the common states of matter?

What is melting and freezing?

What happens during melting and freezing?

What is the difference between boiling and evaporating?

How do “smells” travel?

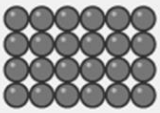
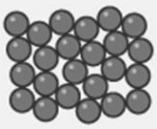
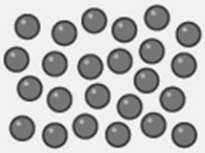
Key vocabulary

Solid	A state of matter in which particles are regularly arranged, vibrate but do not move around. The state has characteristics of holding a shape, having a fixed volume and being incompressible.
Liquid	A state of matter in which particles move around each other but are still held together by weak intermolecular forces. This state has the characteristics of taking the shape of the container, having a fixed volume.
Gas	A state of matter in which particles are free of each other and move around rapidly. This state has the characteristics of taking the shape of and filling the container, not having a fixed volume and shape.
Melt	When a solid becomes a liquid.
Melting point	The temperature at which all of a solid substance becomes a liquid. (This is the same temperature as the FREEZING POINT)
Evaporate	When a liquid becomes a gas.
Boil	A liquid becoming a gas above its boiling point
Boiling point	The temperature at which all of a liquid substance becomes a gas. (NB. This is the same temperature as the CONDENSATION POINT)
Condense	When a gas becomes a liquid.
Freeze	When a liquid becomes a solid.
Sublimation	When a solid becomes a gas with no liquid phase.

What are the common states of matter?

There are three main states of matter to consider. **Solids, liquids and gases.**

A simple way to consider the difference between solids liquids and gases is to think about how the **particles** that make them up are arranged within the actual substance.

State	Solid	Liquid	Gas
Diagram			
Arrangement of particles	Regular arrangement	Randomly arranged	Randomly arranged
Movement of particles	Vibrate about a fixed position	Move around each other	Move quickly in all directions
Closeness of particles	Very close	Close	Far apart

What is melting and freezing?

Melting → The change in state of a substance from a solid to a liquid

Melting requires energy to break the forces holding particles together, it is an **endothermic** process.

Freezing → The change in state of a substance from a liquid to a solid

Freezing gives out energy as more forces holding particles together are made it is an **exothermic** process.

Melting and freezing are both examples of **physical** changes. Physical changes are where you get a change in state only, you do not make any new product.

During melting the particles gain more energy (from the surroundings). This causes the forces between the particles to break or weaken, this allows the particles to move more freely rather than only vibrate. This cause the particles to end up in an irregular arrangement

During freezing the particles lose energy (to the surroundings). This causes the particles to stop moving freely, and they form a regular arrangement as stronger forces form between the particles

The temperature at which a substance melts from a solid to a liquid.

The temperature a substance melts is exactly the same as the temperature a substance freezes

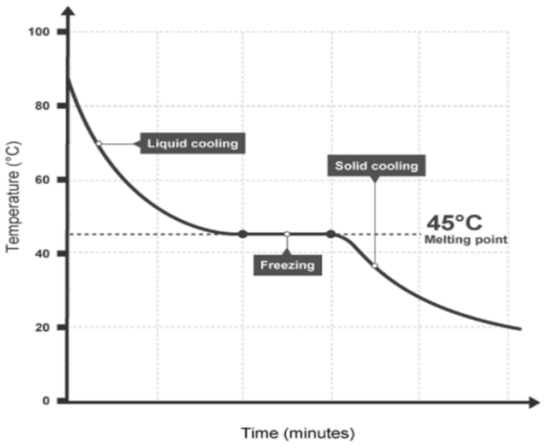
What happens during melting and freezing?

During melting the energy being supplied by heating the substance is used to break the forces / bonds holding the particles together. Because we have to supply the energy, it is referred to as an endothermic process (energy enters).

During freezing the energy is given out by the substance as new forces / bonds holding the particles together are formed. Because it give out energy, it is referred to as an exothermic process (energy exits**).**

Adding other chemicals to make the substance impure changes the melting point. It will occur over a range of temperatures, or changes the temperature when the state change occurs.

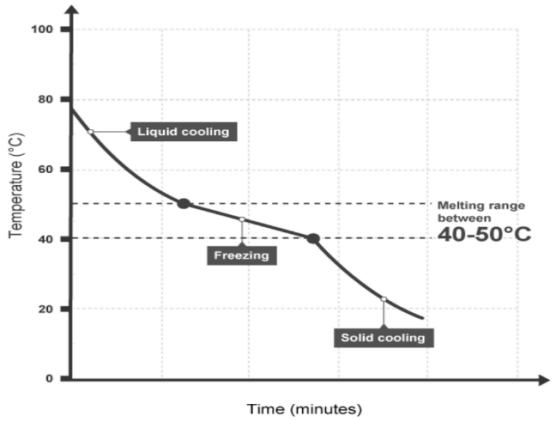
A pure substance



The melting point is clearly defined by horizontal flat section.

The melting point found by seeing where the flat section occurs on y axis.

An impure substance



The melting point is not clearly defined, there is no horizontal flat section, typically a diagonal section on graph.

Science Homework 3

Try to answer all of these key knowledge questions. Then check your answers using the last page.

Questions in *italics* are from older work.

Key knowledge question	**Your answer**
Define melting point.	
Give two physical properties of a liquid.	
Give two properties of a gas.	
How can you tell from heating curve when state change occurs?	
In which state of matter do particles have the greatest energy?	
What are the three states of matter?	
What is the boiling point of pure water?	
What is the name for the state change from gas to liquid?	
Which out of solids, liquids, and gases can easily be compressed?	
Which, out of solids, liquids and gases can the particles only vibrate?	
Why is the melting point different for different substances?	
Describe what is meant by "contact forces"	
Describe what is meant by the term "non-contact forces"	
Name the unit of force	

What is the difference between boiling and evaporating?

Boiling is the state change from a liquid to a gas. Boiling occurs at (or above) the boiling point.

Boiling requires energy to break the forces holding particles together, it is an endothermic process.

Condensing is the state change from a gas to a liquid.

Condensing occurs at (or below) the boiling point.

Condensing gives out energy as more forces holding particles together are made, it is an exothermic process.

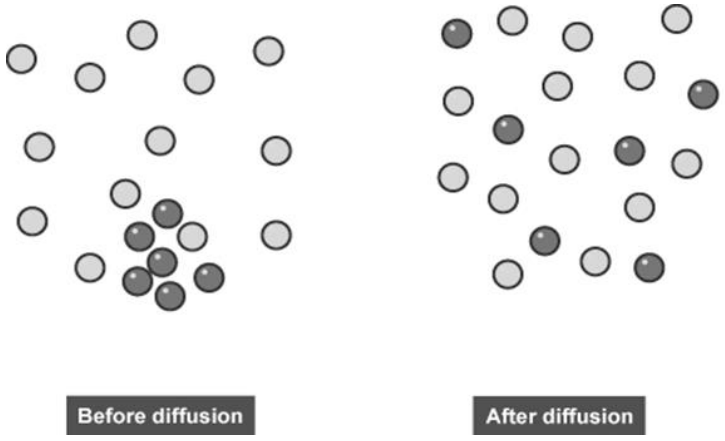
Evaporation is also state change from liquid to a gas, but it occurs below the boiling point as some of the particles have enough energy to break bonds and change state.

How do "smells" travel?

Diffusion → The movement of particles from an area of high concentration to an area of low concentration (along a concentration gradient).

Concentration → The number of particles per unit of volume.

What's happens during diffusion?



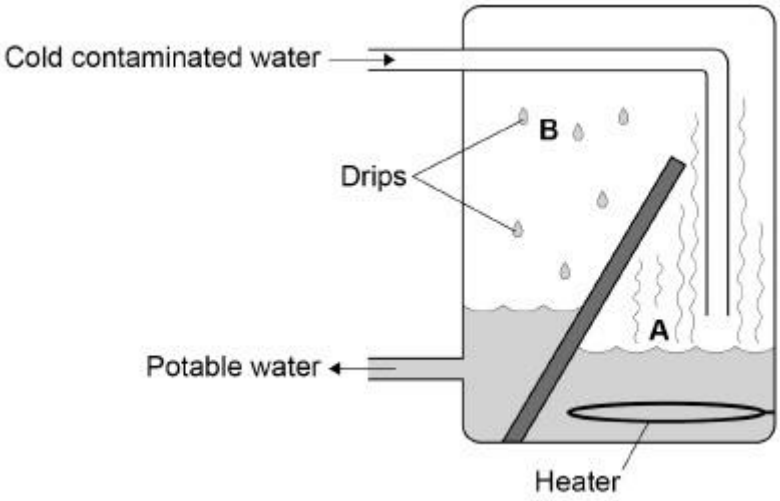
Before diffusion there is a high concentration of particles at the bottom. The particles spread out, moving from high concentration to low concentration. This is because the particles move randomly in all directions. They do this until the particles are evenly spread. Once spread out, they still keep moving randomly in all directions.

This is an example of the sort of question you might be asked about changes in state.

Large water companies can treat millions of litres of water a day.

Figure 1 shows a distillation unit.

Figure 1



(a) What is happening to the water at point **A**?

Tick **one** box.

- Filtration ☐
- Evaporation ☐
- Melting ☐
- Sublimation ☐

(1)

(b) What is happening at point B?

Tick **one** box.

- Water is being boiled ☐
- Water is being lost ☐
- Water is condensing ☐
- Water is freezing ☐

(1)

Wider reading

Find out more about changes of state at BBC bitesize:

https://www.bbc.co.uk/bitesize/guides/zc9q7ty/revision/4

How to get the most out of your knowledge organiser:

- To get the most use out of the knowledge organisers you should be learning sections and then self-testing.

- There are several different things you can do
  - Look, cover, write, check, correct
  - Read through the organisers
  - Mind maps
  - Key spellings
  - Make a glossary
  - Missing out key words
  - Questions/answers answers/questions
  - Flash cards
  - Revision clock learning
  - Mnemonics

Science Learning Tools and wider study:

The Oak Academy – Online Science lessons
BBC Bitesize KS3 science
You tube channels:
Fuse school
Ted talks
Free science lessons
Primrose Kitten
Shows on Netfilx
Our planet
Tiny creatures
A life on our planet

Key knowledge question	**Answer**
Define melting point.	The temperature where a solid becomes a liquid
Give two physical properties of a liquid.	Flows, fixed volume, non-fixed shape, cannot be compressed
Give two properties of a gas.	Flows, non-fixed volume, non-fixed shape, can be compressed
How can you tell from heating curve when state change occurs?	Heating continues but temperature does not change (a flat line)
In which state of matter do particles have the greatest energy?	Gas
What are the three states of matter?	Solid. Liquid and gas
What is the boiling point of pure water?	100^{o}C
What is the name for the state change from gas to liquid?	Condensation
Which out of solids, liquids, and gases can easily be compressed?	Gases
Which, out of solids, liquids and gases can the particles only vibrate?	Solids
Why is the melting point different for different substances?	Different strengths of attraction between different particles
Describe what is meant by "contact forces"	*A force produced by something that is touching something else*
Describe what is meant by the term "non-contact forces"	*A force produced by something that is not touching something else*
Name the unit of force	*Newtons (N)*