SMITH'S WOOD ACADEMY

Home learning activities

Subject
Science
Year Group
Year 7
Unit of work / Knowledge organiser
Energy – Heating & Cooling
Activities

- Complete the 'Knowledge Check' by clicking on the link below (Mr Tobi has also emailed this link out to you):

https://forms.office.com/Pages/ResponsePage.aspx?id=tWaUKrjGMEuM3bZvypd0-1JR5WsjuLFPvbjI4VXu0Y1UNTc4NEkzMzdYTkNRMUhPSEJXRFdXVlNSTy4u

- Read through Sections 1-9 of the 'Knowledge Organiser' on 'Heating and Cooling'.
- Make careful and detailed notes on Sections 1-9, including writing out the 'Key Words' in Section 1.
- Write down a description of 'Conduction' without looking at your earlier notes from Section 3.
- Read carefully the 'Heating and Cooling Summary Sheets'.
- Write down the factors which affect how much 'thermal energy' there is in an object, without looking at the 'Heating and Cooling Summary Sheets'.
- Complete the 'Heating & Cooling' activity, filling the gaps in the sentences by choosing from the available words; the answers are provided at the end, but do not look at these until you have tried to complete the work yourself (**be strict with yourself here**).
- Complete the 'Heating & Cooling' exam-style questions. Use the mark scheme (**once you have tried the questions**) to mark your answers carefully.

Where do you complete the work?
In Study Books.

SMITH'S WOOD ACADEMY

What to do if you finish the work? (Extension activity)
• Make sure you have completed the previous set work on 'Energy' and then work on the 'Mini Project' on 'Heating and Cooling'.
These websites might help:
• BBC Bitesize -> Secondary -> KS3 -> Science -> Physics -> Energy -> Energy stores and transfers
If you are struggling with your work or if you have finished.
Please email your classroom teacher directly using the email list found in the Home Learning section of the website.

Knowledge Organiser: Year 7 - Heating and Cooling

Section 1: Key Words

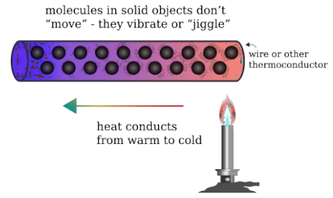
Thermal conductor	A material that will let heat flow through it
Thermal insulator	A material that will not let met flow through it
conduction	The movement of heat (or electricity) through a substance. Heat is conducted due to particles vibrating and hitting each other
Convection	The transfer of heat through a liquid or gas (fluid) Convection occurs when particles with a lot of heat energy in a liquid or gas move and take the place of particles with less heat energy
Radiation	Heat can be transferred by infrared radiation, this is an electromagnetic wave and doesn't use particles
Temperature	temperature is a measure of how hot something is
Heat	heat is a measure of the thermal energy contained in an object.
Thermal energy	Energy that is due to particles moving and results in an object having a temperature. It is transferred as heat

Section 2: Transferring Thermal Energy

	Temperature change	Direction of energy flow
Object hotter than surroundings	Temperature of object decrease until it is the same as the surroundings	Energy flows out of the object to the surroundings
Object colder than surroundings	Temperature of object increases until it is the same as the surroundings	Energy flows into the object to the surroundings
Object the same temperature of the surrounds	The object's temperature stays the same	The is no net flow of energy

Section 3: Conduction

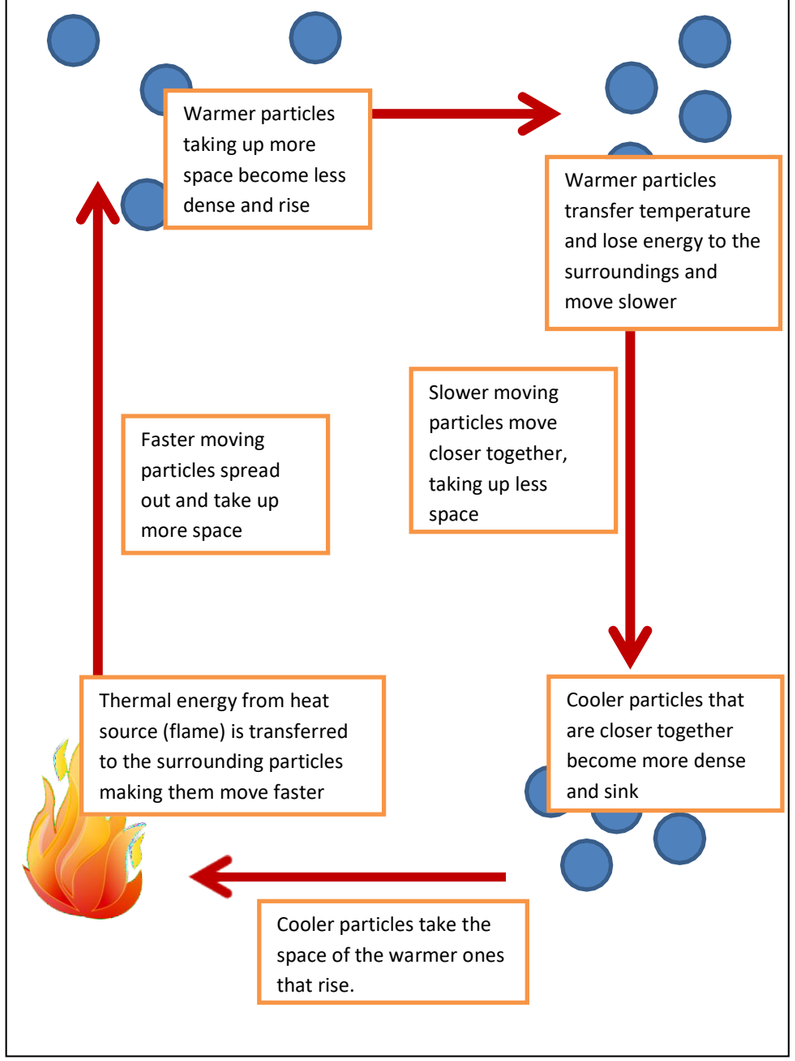
State of matter	Solids
Description	Heat moves from the hotter part of the object to the colder part
Explanation	Particles in the metal are packed closely together. As they are heated the particles gain kinetic energy and vibrate more. The particles that are vibrating collide with other particles and start to make them vibrate. This passes the kinetic energy from the heated particles to the cooler particles causing them to heat up too.



Section 4: Convection

State of matter	Liquids and Gases
Description	Particles with lots of heat energy in a liquid or gas move and take the place of particles with a lot of energy. Heat energy is transferred from hot places to cooler places by convection
Explanation	Liquids and gases expand when they are heated. This happens because the particles in the liquid or gas moves faster when they are heated. This causes the particles to take up more space as the gaps between particles gets bigger. The liquid or gas in hot areas is less dense than the liquid or gas in the cold areas, so it rises into the cold areas. The denser cold liquid or gas falls into the warm areas. In this way, convection currents form that transfer heat from one place to another

Section 5: Convection Currents



Section 6: Radiation

State of matter	n/a
Description	A type of electromagnetic radiation called infrared radiation.
Explanation	Infrared radiation involves waves instead of particles. As such it can travel through a vacuum e.g. space. The hotter an object is, the more infrared radiation it emits.

Section 7: Reflection and absorption of heat by radiation

colour	finish	ability to emit thermal radiation	ability to absorb thermal radiation
dark	dull or matt	good	good
light	shiny	poor	poor

Light, shiny surfaces are also good reflectors of infrared radiation

Section 8: Comparing conduction, convection and radiation

	Conduction	Convection	Radiation
Particles	Y	Y	N
Solids	Y	N	Y
Liquids	N	Y	Y
Gases	N	Y	Y
Particles move far part	N	Y	n/a
Particles vibrate on the spot	Y	N	n/a
Particles rise and fall to transfer energy	N	Y	n/a
Particles hit each other to transfer energy	Y	N	n/a

Section 9: Types of thermal insulation

Appliance/feature	Description
Radiator	This has a large surface area to allow for large amounts of heat energy to be transferred to its surrounding through convection
Boiler	This is specially designed to have a heating element at the bottom. Convection currents heat all the water in it.
Double Glazing	Windows and doors with 2 planes of glass with air trapped between them (or a vacuum between them). Air is a poor conductor and there is no convection because the air is trapped and cannot for convection currents
Loft Insulation	A thick layer of the loft floor. It works because it's a poor conduction and traps air, stopping convection
Floor Insulation	An insulation layer under the floor. Prevents heat loss because it is a poor conductor
Draught excluders	Brushes and seals on doors. Prevents warm air escaping from the home
Cavity wall insulation	Insulation place in the cavity of the walls. It works because it traps air which is a poor conductor. However, energy could still be lost due to convection so a insulating material is ~~injected into the gap to create pockets of air and prevent~~ convection currents forming

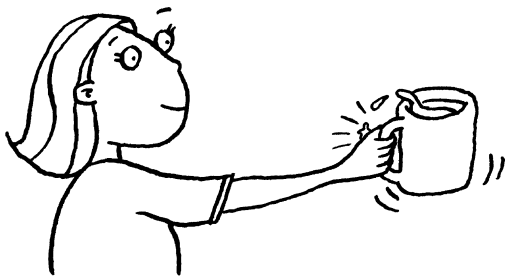
Heating and Cooling Summary Sheets

Heat and temperature

When we know the **temperature** of something we know how hot it is, *not* how much **heat energy** is in it.

Temperature is measured in **degrees Celsius** (°C).

Heat (**thermal**) energy is measured in **joules** (J).

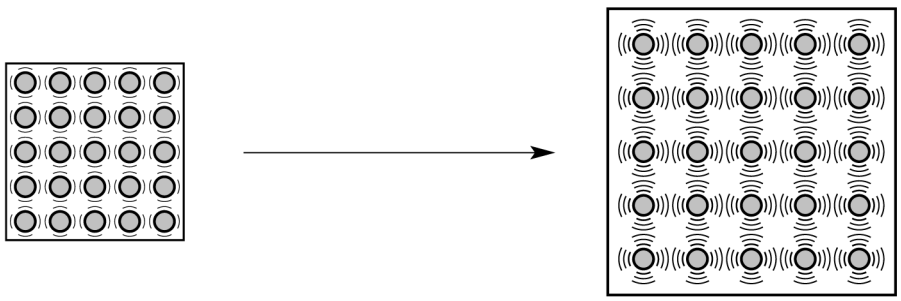


The amount of heat or **thermal energy** in something depends upon

- how hot it is (its temperature)
- the material it is made from
- its mass.

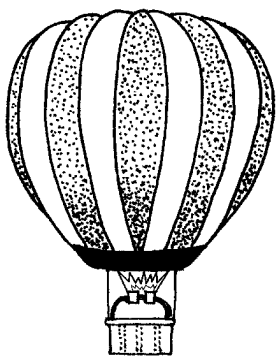
Travelling heat

The **kinetic theory** or **particle model of matter** helps to explain how some forms of heat energy travel. The theory suggests that everything is made of moving or vibrating particles. When these particles are heated they move faster.



When the particles vibrate faster the material expands.

When the air particles in the balloon are heated, they move apart and the air expands and becomes less dense. This causes the hot air to rise, and the balloon rises too.

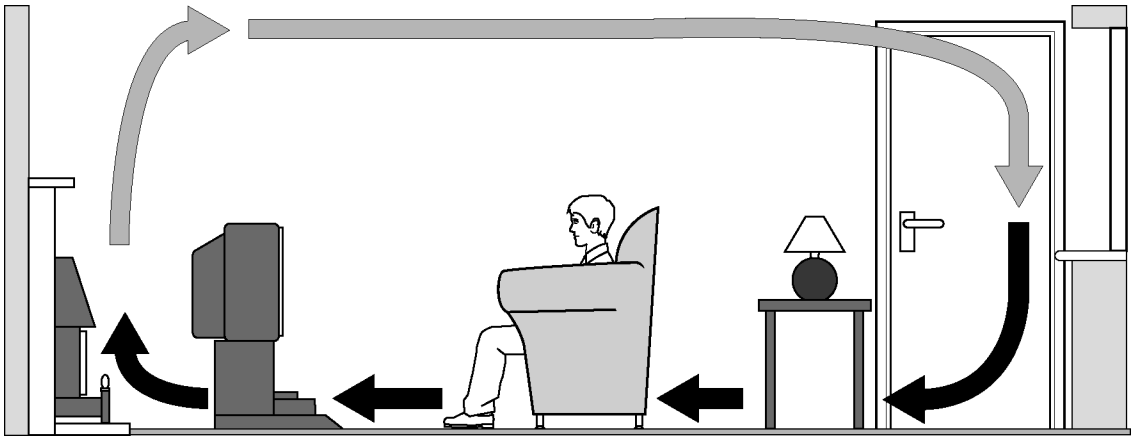


Thermal energy can travel in three different ways.

Conduction takes place in solids and can also happen in liquids (although not very well). The particles in a solid are held together tightly. When they gain energy they vibrate faster and the vibrations are passed on. Particles are not as close in a liquid, so conduction is not very good. Metals are the best conductors. Most other solids are poor conductors.

Something which does not conduct heat very well is an **insulator**. Liquids, gases, and solids which contain a lot of trapped air are insulators.

Convection takes place in liquids and gases.



When the air near the fire is heated, the particles spread further apart and the air becomes less dense and rises. As it rises it meets cooler air and passes the energy on. Having passed on the energy, it cools and becomes denser. The denser air sinks, setting up a cycle or **convection current**.

Heat can be transferred through empty space by **infrared radiation**. Radiation does not require the movement of particles. Any hot or warm object gives off or **emits** radiation. When something takes in heat energy from radiation, it is said to **absorb** it.

Infrared radiation travels as waves. It can be reflected and it can also be focused.

Heating & Cooling Activity

The 3 ways of transferring energy are _____, _____ and radiation.

Conduction-

This is the _____ of heat energy through a _____ from a hotter part to a _____ part. This happens without any movement of the substance.

A substance is a _____ conductor of heat if the _____ flows through it easily. An example of a good conductor is _____. A poor heat conductor is called an _____. An example of a good insulator is _____.

wood good cooler transfer substance energy metal insulator

Convection-

This is the transfer of _____ energy through the movement of _____ themselves. _____ moves from _____ areas to cooler areas.

Liquids and _____ can transfer heat by _____ because the _____ can move around unlike the particles in a solid.

particles heat gases particles energy hotter convection

Radiation-

This is the transfer of heat energy by _____. Radiated heat can travel through a _____, an empty space with no particles in it.

This is why an ice cream will melt in the sun.

vacuum waves.

Answers

The 3 ways of transferring energy are ____**conduction**_____, _____**convection**_____ and radiation.

Conduction-

This is the _____**transfer**_____ of heat energy through a ____**substance**____ from a hotter part to a _____**cooler**_____ part. This happens without any movement of the substance.

A substance is a ___**good**_____ conductor of heat if the _____**energy**_____ flows through it easily. An example of a good conductor is _____**metal**_____. A poor heat conductor is called an _____**insulator**_____. An example of a good insulator is ____**wood**_____.

wood good cooler transfer substance energy metal insulator

Convection-

This is the transfer of ___**heat**_____ energy through the movement of _____**particles**_____ themselves. _____**energy**_____ moves from ____**hotter**_____ areas to cooler areas.

Liquids and _____**gases**_____ can transfer heat by _____**convection**_____ because the _____**particles**_____ can move around unlike the particles in a solid.

particles heat gases particles energy hotter convection

Radiation-

This is the transfer of heat energy by ____**waves**_____. Radiated heat can travel through a _____**vacuum**_____, an empty space with no particles in it.

This is why an ice cream will melt in the sun.

vacuum waves.

Name

Heating & Cooling Exam Qs

Q1 Freya is investigating different types of insulators. She wraps different insulators around a metal can of hot water.

At the start the water is at 90 °C. She measures the how long it takes for the temperature to reach 60 °C.

Material	paper	cotton	foam	wool
Time to drop to 60 °C (minutes)	4	7	15	10

a State the type of energy transfer through the metal can.

_____ (1 mark)

b Name the best insulator.

_____ (1 mark)

Q2a You might have heard the phrase 'hot air rises'. Name the process of transferring energy using moving gas or liquid.

_____ (1 mark)

b Here are three sources of infrared radiation.

candle flame	ice cube	cat

Name the source that emits the **most** infrared radiation.

_____ (1 mark)

Name

Heating & Cooling Exam Qs

Answers

Question number	Answer	Marks
1 a	conduction	1
1 b	foam	1
2 a	convection	1
2 b	candle flame	1

Heating and cooling

Watch this video: https://www.youtube.com/watch?v=UCFgM1GkTyM

Task	Description
1	Makre a poster (A4) of your model of heat flow that you discussed in class.
2	Write definitions, either dictionary or in your own words, for the following: solid, liquid, gas, state of matter, particle, conduction, convection, radiation, insulator and conductor.
3	Draw labelled particle diagrams for a solid, liquid and a gas at normal temperatures. Repeat but showing how they change when heated up. For each, explain whether the process is conduction, convection and / or radiation.
4	Produce a leaflet detailing how a hot air balloon works. Include a labelled diagram, and explain your answer using the appropriate transfer of energy.
5	Draw a graph to show temperature changes with time as ice is heated. This should be a line graph. Label the axes, including the units, and give your work a title, (underlined). Don't forget to use a ruler and pencil. Mark parts of the graph where the ice is a solid, liquid and gas and explain what is happening when the graph levels out at 2 stages.
6	Saving energy at home: Think about ways that energy is used and wasted in your house. Draw your house and show where heat is lost, for example, through the windows and doors. Say whether the heat is being lost by conduction, convection, and / or radiation. Make suggestions as to how you could stop heat escaping and so reduce the household bills.
7	Explain why • Food cooks faster at the top of an oven • Fire-fighters enter smoke-filled rooms by crawling • Houses in hot countries are often white. • There is shiny metal behind the bar of an electric fire.