

S1/S2 Science

Energy & Forces Topic

Name: _____

Form Class: _____

Science Teacher: _____

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Success Criteria

Level	Success Criteria - Energy	
2	Name the 8 main forms of energy	
2	Identify the main forms of energy in objects	
2	State that an energy conversion is when one form of energy changes into a different form	
2	State that energy cannot be created or destroyed only converted (law of conservation of energy)	
2	Give examples of "useful" and "wasted" energy in conversions	
2	Describe the main energy conversions in a variety of situations	
3	State that heat flows from hot objects to cold objects	
3	Name the 3 methods of heat transfer	
3	Describe heat transfer through solids in terms of particles	
3	State that thermal conductors allow heat to pass easily through them and that thermal insulators allow very little heat to pass through them	
3	Give examples of thermal conductors and insulators	
3	Explain why a certain material is chosen for a job in terms of its thermal conductivity	

Level	Success Criteria - Energy	
3	Describe heat transfer through liquids and gases in terms of particles	
3	Explain why heat transfer through a vacuum is by radiation only	
3	Investigate which types of materials are best at radiating and absorbing heat	
3	Identify situations where heat is travelling by conduction, convection and radiation	
3	Link temperature difference between inside and outside buildings to heat loss	
3	Research and explain how different types of material are used to reduce heat loss from buildings	
3	Investigate the factors which affect the heat loss from a building	

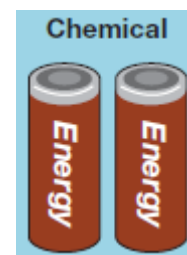
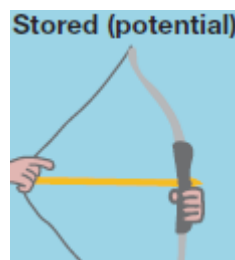
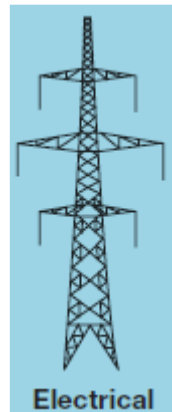
Level	Success Criteria - Forces	
2	State the 3 effects a force can have on an object i.e. change speed, shape and/or direction	
2	Describe examples of situations when a force changes an object's speed, shape and/or direction	
2	State that forces are measured in Newtons using a Newton balance	
2	State that friction acts where surfaces are in contact with each other	
2	State that friction acts in the opposite direction to motion and slows objects down	
2	Give examples of situations when friction is useful	
2	Give examples of situations when friction is a problem	
3	Explain the energy change (kinetic to heat) which causes friction	
3	Describe the different methods used to increase and decrease friction	
3	Research different situations when either high friction or low friction are useful	
3	Explain the different methods used to reduce friction and energy loss to improve the efficiency of moving objects	

Summary Notes

Forms of Energy

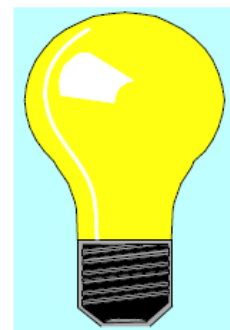
- ☐ The 8 main forms of energy are:

- sound
- light
- heat
- electrical
- kinetic
- potential
- nuclear
- chemical



- ☐ An **energy conversion** is when one form of energy changes into a different form
- ☐ **Energy** cannot be created or destroyed only converted (this is the **law of conservation of energy**)
- ☐ Sometimes some of the **energy** produced is not useful. The energy has been "**wasted**".

For example, the main energy change in a light bulb is electrical to light. However a lot of heat energy is also produced which is not needed.

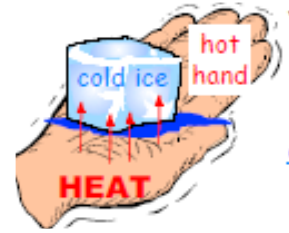


- Examples of the main **energy conversions** (and "wasted" energy) in situations are:

Object	Image	Main energy change	Wasted energy
match burning		chemical to heat	light
catapult firing		potential to kinetic	sound
drumming		kinetic to sound	heat
kettle boiling		electrical to heat	sound
battery		chemical to electrical	heat

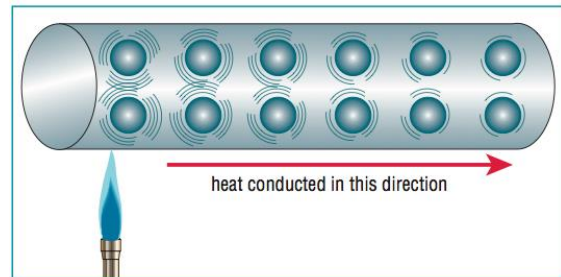
Heat Transfer

- **Heat** flows from **hot** objects to **cold** object
e.g. the heat from your hand will melt the ice cube!

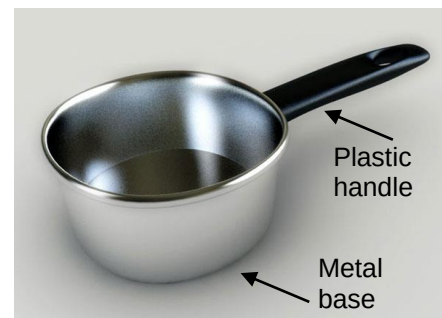


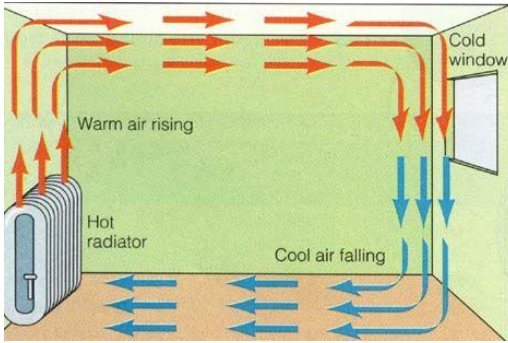
- Heat can travel by **conduction**, **convection** and/or **radiation**

- Heat travels through **solids** by **conduction**. The **heat** energy cause the particles to **vibrate faster** which then bump into the particles beside them transferring the **energy** as they **vibrate faster** also. The particles do **not** change places.



- **Thermal conductors** are materials which allow **heat** to **pass easily** through them e.g. metals
- **Thermal insulators** are materials which allow **very little heat** to pass through them e.g. plastic, wood
- Materials are chosen for a job because of their **thermal conductivity** e.g. a cooking pot has a metal base to allow heat to transfer quickly but it has a plastic handle to stop heat travelling to the person.





□ Heat travels through liquids and gases by convection. The particles are given the heat energy and they **rise upwards** while the cooler particles move downwards. This produces a **convection current**.

□ All **hot** objects give out **infrared radiation** (heat energy). This travels as a **wave** and does **not** need particles to travel through. It can travel through a vacuum e.g. space. Heat from the sun reaches us by radiation.

□ **Dark** materials **absorb** and **radiate** heat more than **light-coloured** materials.

□ **Matt** materials **absorb** and **radiate** more heat than **shiny** materials.



Coffee in a dark, matte mug will cool down a lot quicker than coffee in a shiny, light mug!



□ Examples of heat travelling using different methods:

- metal spoons get hot by conduction
- hot air balloons use convection to float
- the sun heats the Earth by radiation

- ☐ How quickly a house losses heat depends on the temperature difference between the inside and outside of the house.
Houses cool down quicker in winter than in summer.
- ☐ Different types of material used to insulate buildings:

Part of building	Type of insulation	Stops heat loss by
Walls	Cavity wall insulation	convection
Windows	Double/triple glazing	conduction
Roof	Loft insulation	convection
Floors	Carpets	conduction
doors	Draught excluders and rubber seals	convection
Radiators	Silver foil on back	radiation

- ☐ The factors which affect the heat loss from a building are:
 - Type of insulation
 - Thickness of insulation
 - Size of the rooms
 - Temperature difference from inside to outside



Forces and Friction

☐ The 3 effects a force can have on an object :

- change **speed**
- change **shape**
- change **direction**

E.g.

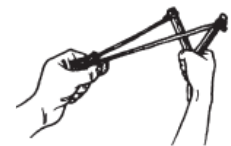
Squeezing a sponge changes its **shape**



Unscrewing a bottle changes the caps **direction**

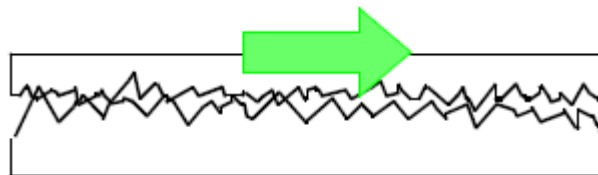


Firing a catapult changes the **speed** of the ball



☐ **Forces** are measured in **Newtons** using a Newton balance.

☐ **Friction** acts where surfaces are in **contact** with each other.



☐ **Friction** acts in the **opposite direction** to motion and **slows** objects down.

☐ The **energy change** which causes **friction** is **kinetic** to **heat**.

☐ Friction can be increased by using rough surfaces, having a large surface area and making objects heavier.

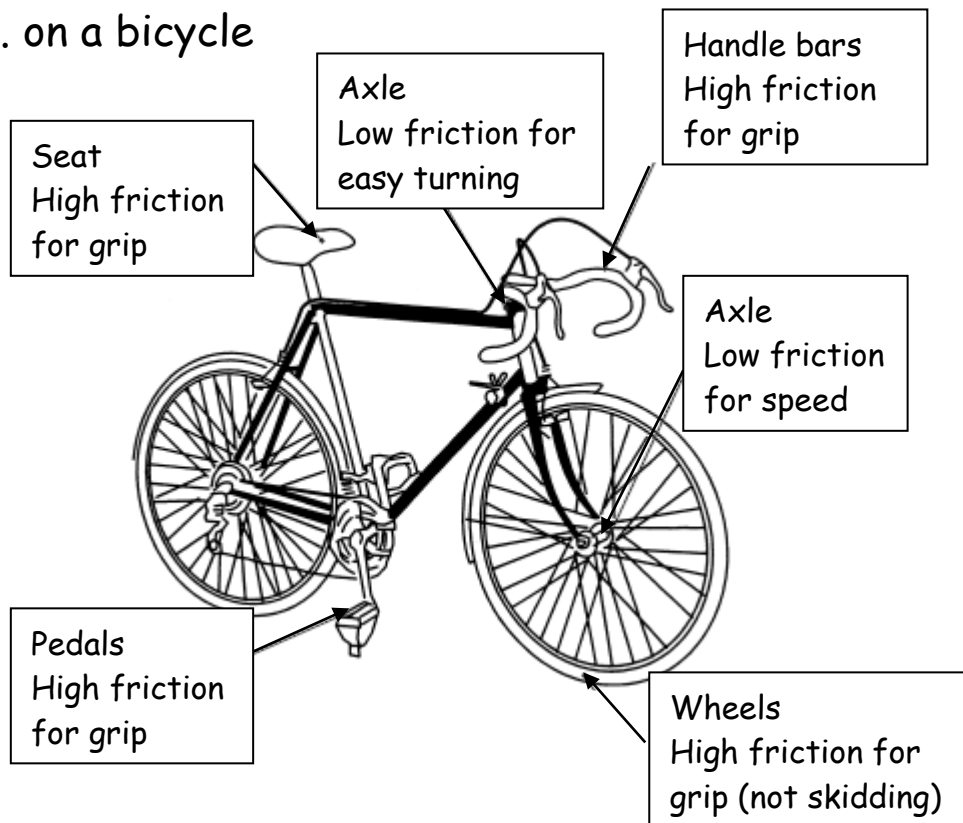


- Friction can be decreased by using smooth surfaces, streamlining and making objects lighter.



- High friction or low friction can be useful in different situations.

E.g. on a bicycle



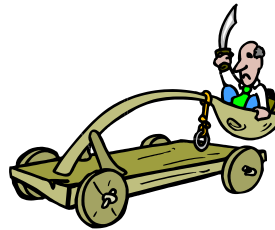
Homework

Homework 1 - Energy Changes

1. Name the 8 forms of energy.

_____	_____
_____	_____
_____	_____
_____	_____

2. Write down the main energy changes for each of the items and the "wasted" energy produced.



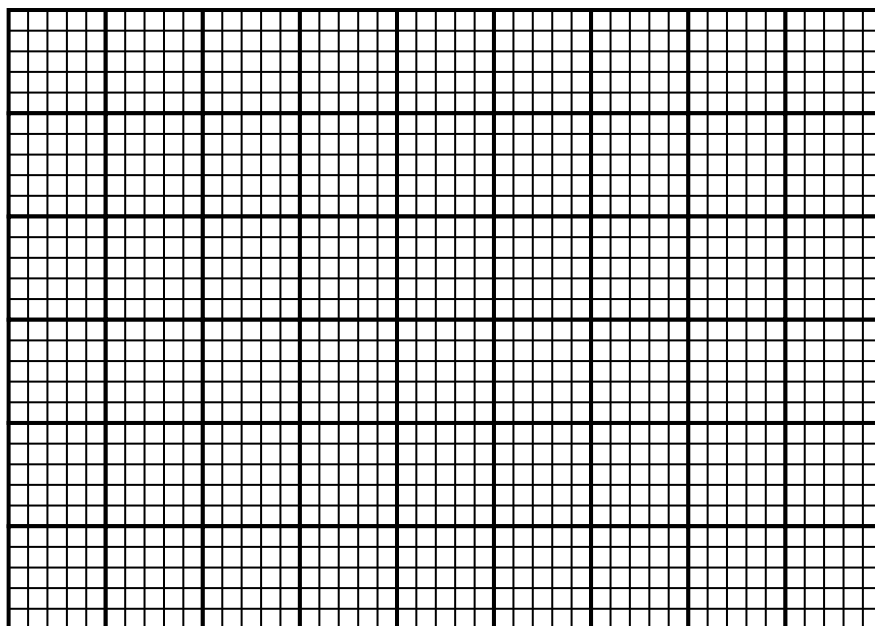
Item	Main energy change	"wasted" energy
hairdryer		
candle		
catapult		
microphone		

2. What is the law of conservation of energy?

3. The table below shows the energy given off when different fuels are burned.

<i>Fuel</i>	<i>Energy given off (MegaJoules)</i>
Wood	13
Peat	15
Coal	27
Petrol	47

Present the information as a bar graph.



Homework 2 -Heat Transfer

1. Name the three methods of heat transfer.

2. Name 2 thermal conductors and 2 thermal insulators.

3. A wooden spoon and a metal spoon have been left in a pot of soup. Which spoon will be hotter? Explain why.

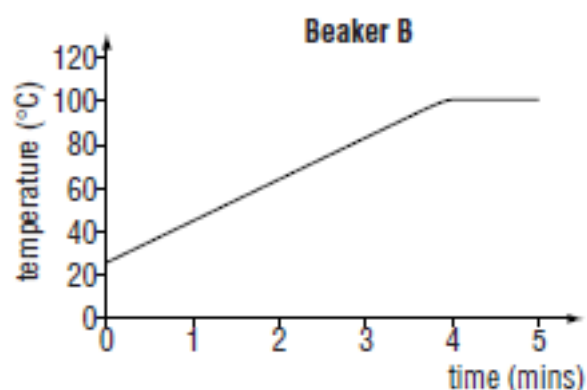
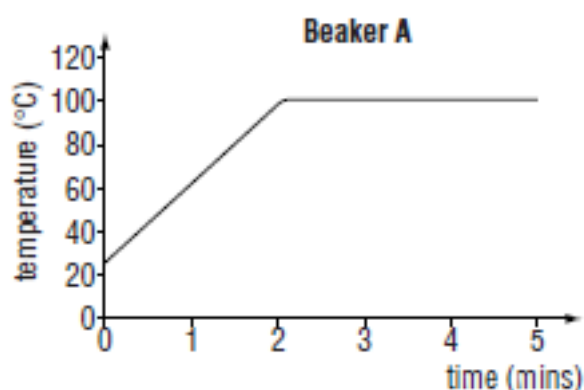
4. It is always warmer near ceiling of a room than the floor. Explain in terms of air particles why this happens.

5. Why are houses and buildings in hot countries (e.g. Egypt) painted white?

6. Match each method of saving energy to how it reduces heat losses in the home. Draw arrows to match them.

1	loft insulation	A	helps to keep water hot
2	cavity wall insulation	B	reduces heat loss through roof
3	lag water tank	C	reduces heat loss around doors
4	double glazing	D	reduces heat loss through walls
5	draught excluders	E	reduces heat loss through windows

7. Two beakers of water (100 ml and 200 ml) were heated using the same bunsen flame. The results are shown below.



(a) Which beaker reached the maximum temperature first?

(b) Which beaker contained 200 ml of water? Explain why.

(c) Predict the time taken to heat a 400 ml beaker of water.

Homework 3 - Forces and Friction

1. Name the three effects a force can have on an object.

2. Friction is a force.

(a) What direction does friction act in?

(b) What is the energy change caused by friction?

3. For each of the situations described, decide if friction has been increased or decreased.

(a) oiling the chain on a bike

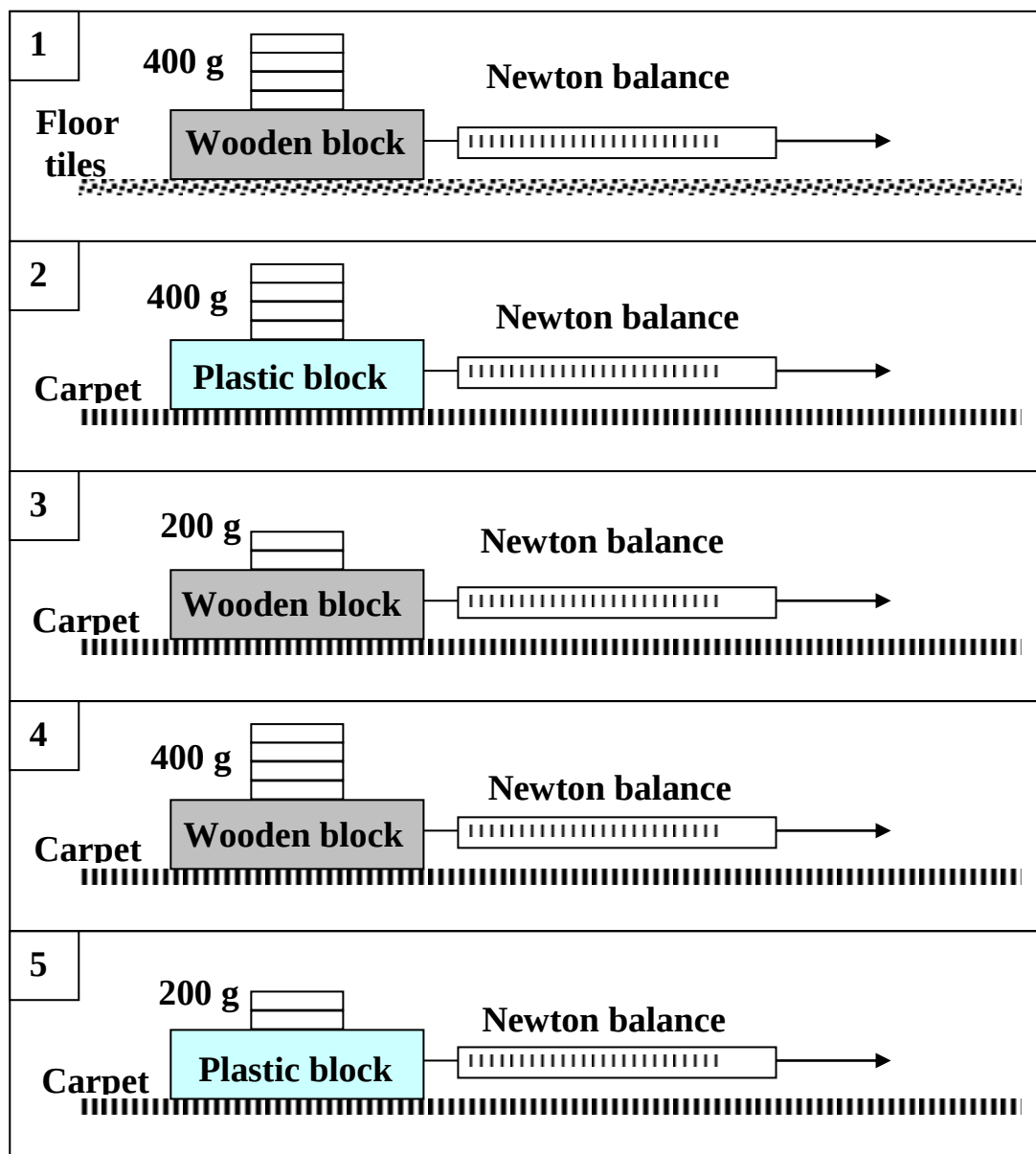
(b) wearing running shoes with spikes on the bottom

(c) crouching down low on a racing bike



(d) opening a parachute during a sky dive

4. Ronan wanted to investigate the slipperiness of floors.



a) Which **two** boxes show the equipment needed to compare the slipperiness of a tiled floor with a carpeted floor?

b) Jill carried out another investigation using the equipment in boxes 3 and 5. What was Jill trying to find out?

Home Experiments

MARVIN AND MILO

033

DO TRY THIS AT HOME

featuring: **MARVIN and MILO**

What you need: • uncooked rice • a pencil
• a large empty jar with a narrow neck

Today I'm going to show you how to lift this jar up using just a pencil and some rice!

Fill the jar up to the brim with uncooked rice.

(Make sure you have a jar which narrows towards the top.)

Push the pencil right into the rice.

When you feel a firm grip, carefully lift up the jar by the pencil.

As you push it in, the pencil forces the grains sideways, but they fall back into the gap as you pull it out. The rice becomes more and more tightly packed until the friction between the rice and the pencil is so great you can lift the jar.

Then, alternating between shallow and deep stabs, stab the rice repeatedly. It could take about 40 stabs, but you'll start to feel the pencil gripping the rice.

www.physics.org keywords: friction

Vic Le Ballon

Useful Websites

<http://www.sciencekids.co.nz/sciencefacts/energy.html>

<http://www.sciencekids.co.nz/gamesactivities/friction.html>

<http://www.eschooltoday.com/energy/kinds-of-energy/all-about-energy.html>

Videos

<https://www.brainpop.com/science/energy/formsofenergy/>

<https://www.youtube.com/watch?v=A-jb04sERNo>