**PHYSICAL WORLD – FORCES & MOTION: ENERGY**

**Electronic Science LabBook**

***Designed by FRY & BLU***

When you are required to put an answer in this booklet, the point at which you start typing is marked with a **red X.** Your typed answer should also appear in **red**. Delete the **X** leaving just your answer.

If you are required to paste or draw something, this is stated in **BLUE.** You can then photograph your work and paste it into this LabBook. In many experiments and investigations, you will be asked to photograph or video the experiment. You should insert these in the appropriate place in this LabBook.

When you are asked to look at a website for information to write an answer don’t just cut and paste the information in. Read the information and write an answer in **YOUR OWN WORDS**. You may wish to discuss your answer with your classmates and teacher first to make sure you understand it correctly.

**Learning outcomes for this topic**

# Energy

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## Define energy and the unit with which it is measured

### Task 1

Describe what happens to your iPod if you use it too long without recharging?

X

We say it has run out of **energy**. Energy allows objects to do things.

Which has more energy in it?

* A car moving at 10kmh or a car moving at 100kmh? X
* A block dropped from 10m or from 100m? X
* Water at 20OC or 70OC? X

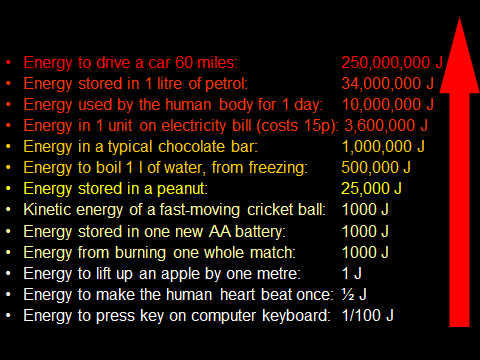
Explain why you came to these conclusions

X

The amount of energy an object has can be measured.

Find out what the unit of measurement is called. X

What is the symbol for this unit? X



Using the information above, calculate

How much energy your heart uses in 1 hour: X

How many AA batteries would you need to power your heart for a day: X

How many megajoules a human body needs each day: X

## Name and classify the different forms of energy

There are nine forms of energy. They are:

HEAT, LIGHT, SOUND, ELECTRICAL, KINETIC (also called MOVEMENT), ELASTIC, GRAVITATIONAL POTENTIAL, NUCLEAR and CHEMICAL.

<http://www.youtube.com/watch?v=iYEWIuQBVyg>

### Task 2

Look at each pair of pictures below and decide which form of energy they both represent.

The Sun and a light bulb: X



A bonfire and a Bunsen burner: X



A speeding bullet and a galloping horse: X



A climber climbing and a rocket gaining height: X



A hamburger and Coal: X



Overhead lines and Electrical cables: X



A megaphone and a singing zebra: X



A stretched bow and a catapult: X



A nuclear power station and an atom bomb: X

Look at each of the pictures above. Some of them give us **more than one** form of energy. Write down three examples in sentences like this:

“The bunsen burner gives off heat and light energy”.

X  
X  
X

### **Task 3**

Name the main type(s) of energy present in the following situations.

An unlit match X

A stretched rubber band X

An orbiting satellite X

A thunder clap X

A bolt of lightning X

A kicked soccer ball X

### Task 4

**Bill Nye the Science Guy on Energy transformations**. See that you understand each situation described. Produce a brief summary for at least 4 instances including the example at time 7:49

<http://www.youtube.com/watch?v=zTXW9aRO23Y>

X

## Write energy chains for everyday examples

**ENERGY FROM THE SUN**

All the energy we eat comes originally from the sun. In fact, all fuels and energy resources come from the sun in some way. Here is an energy chain to show how you might get hot water for your cup of tea:

SUN 🡪 air movement or wind 🡪 wind turbines 🡪 electric cables 🡪 electric kettle 🡪 hot water 🡪 YOU

### Task 5

Draw another energy chain to show how:

Energy gets from the sun into a piece of meat

X

Energy gets from the sun into a car engine.

X

### Task 6

**Burning cracker experiment**

You will burn a cracker and heat a test tube of water with it. By doing a calculation, you will be able to work out the amount of energy in the cracker.

Take a photo of the experiment setup X

(Use 5mL of water in the test tube)

Take the temperature of the water before you light the cracker: X

Take the temperature of the water after the cracker has burned: X

What is the difference in temperatures? X

Calculate the amount of energy by using (4.2 x difference in temperatures) / 5 (use correct units). X

Compare this to the amount of energy in one cracker using the information on the packet.

Explain the difference in amounts of energy from your experimental results and the pack information.

X

**Energy conversions/transformations**

### Task 7

<http://www.youtube.com/watch?v=zTXW9aRO23Y>

What is an energy transformation?

X

Complete the energy transformations:

A microphone changes X energy to X energy.

A photosynthesizing plant changes X energy to X energy.

A climber climbing changes X energy to X energy and X energy.

A skydiver falling changes X energy to X energy

A hair dryer changes X energy to X energy, X energy and X energy

A burning candle changes X energy to X energy and X energy.

When a catapult is released it changes X energy to X energy and X energy.

The Sun changes X energy to X energy and X energy.

A springboard changes X energy to X energy and X energy.

The sun is a giant hydrogen bomb. It uses X energy to create solar energy. This solar energy is a mixture of different types of radiant energy such as X and X. This radiant energy can travel through X to earth and the earth absorbs some of it and X some of it. Plants use chlorophyll to absorb light energy except for the colour X which they reflect. They store this energy in their leaves and roots as X potential energy.

## Explain the Law of Conservation of Energy and apply it to different situations

### Task 8

Write the Law of Conservation of Energy

X

Complete the following energy chains by adding the correct number of Joules for each type of energy

Light bulb:

Chemical potential energy (6000J) 🡪 Light energy (4000J) + Heat energy (X J)

Archery bow:

Elastic potential energy (10,000J) 🡪 Kinetic energy (7,000J) + Heat energy (250J) + Sound energy (X J)

Usually only one of the energies is actually wanted. What are the forms that “waste” energy comes in during these transformations? X

The energies of motion (kinetic - Ek) and height (gravitational potential - Egpe) are continually being transformed into each other in our everyday lives, the efficiency of these conversions depends on the amount of energy “wasted or lost”, mostly as heat and sound due to friction.

View the following videoclips and write a brief summary.

Swinging bowling ball – conservation of energy. Explain all the energy changes experienced by the ball during 1 swing.

<http://www.youtube.com/watch?v=BVxEEn3w688>

X

Conservation of energy – roller coaster example

<http://www.youtube.com/watch?v=-dpBVtAbKJU>

X

Energy may be converted from another form to either or Ek and Egpe, this other form of energy (often chemical) can be used to do Work (W). The change in Ek and/or Egpe plus any energy “wasted or lost” equals the amount of work done.

Use the following animation to reinforce your understanding of the Conservation of energy

<http://phet.colorado.edu/en/simulation/energy-skate-park-basics>

## Describe heat and the ways it can be transferred

**HEAT ENERGY** transferred from **HOT** to **COLD** objects OR from a hot object to its surroundings.

<http://www.youtube.com/watch?v=pRnURDgfByE>

EXAMPLES: A hot cooking pot put into cold water. Ice blocks put into a glass of water.

### Task 9

When objects gain heat energy they usually **EXPAND** – reason?

X

What is temperature? Write a brief explanation.

<http://www.youtube.com/watch?v=SUnEyFbqyZQ>

<http://www.youtube.com/watch?v=0fy83ABQ9WA>

X

When an object loses heat energy its temperature normally **DECREASES**. Why?

X

Heat could be transferred from one object to another by **CONDUCTION** , **CONVECTION** and **RADIATION**. When this happens, the heat energy **stays** as heat.

View the following and produce a brief summary. See whether you were able to answer the questions.

<http://www.youtube.com/watch?v=1fbG4zt9xn4>

### Task 10

***CONDUCTION***

Briefly describe what happens in conduction

X

Your teacher will demonstrate the Maltese Cross experiment.

Explain what happened in the experiment.

X

Which metal was the best conductor of heat? Explain your answer

X

### Task 11

***CONVECTION***

Briefly describe what happens in conduction

X

Convection currents in water – potassium permanganate. Do the experiment. Do you agree with everything the presenter said?

<http://www.youtube.com/watch?v=xq1Q5DwfVNU>

### Task 12

***RADIATION***

The transfer of heat by electromagnetic energy. - heating of a metal – the surface absorbs energy and emits some of it – dull surfaces absorb more radiant energy than bright surfaces.

So, the shinier a surface is, the less radiant energy it is going to absorb

<http://www.youtube.com/watch?v=RlV6lEu5CBk>

### Task 13

ENERGY TRANSFER SUMMARY

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

Conduction

wood good cooler transfer substance energy metal insulator

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

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

Convection

particles heat gases particles energy hotter convection

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

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

Radiation

vacuum waves.

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