



BREEDING
A R E N A
College

THE BREEDER'S GUIDE

**CAMBRIDGE SCIENCE
(PHYSICS)**

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YEAR 7

Term Sow 2024/2025

SCHEME OF WORK

PHYSICS

Science & Technology

January 6th – April 13th

WEEK	TOPIC	SUB-TOPICS
1	Energy (I)	➤ What is Energy ➤ Forms of Energy (Potential Energy)
2	Energy (II)	➤ Forms of Energy (Kinetic Energy)
3	Energy (III)	➤ Energy Changes ➤ Wasted energy
4	Energy (IV)	➤ Fuels ➤ Fossil Fuels ➤ Renewable energy
5	Energy Transfer (I)	➤ Energy Transfer and Transformation ➤ How Energy use has increased
6	Energy Transfer (II)	➤ Energy Transfer diagrams ➤ Sankey diagram
7	Continuous Assessment and Midterm Test	
8	Energy Transfer (III)	➤ Plants and Energy ➤ Energy and ourselves
9	Energy Transfer (IV)	➤ Generating electricity ➤ Conservation of Energy
10	Revision	
11	Revision	
12	Examination	
13	Vacation	
WEEK	TOPIC	SUB-TOPICS

1. ENERGY (I)

Objective: By the end of this class, each student should be able to (I) Explain the basic concept of energy (II) Explain the various forms of potential energy

Duration: 80 mins

Week: 1

Entry Behaviour (How you plan to start your Class): Highlight the everyday use of energy.

In everyday language, we use the word 'Energy' in many different ways, but the scientific way of thinking about energy is that it is the property of something that makes it able to exert a force and do work. To understand this, it is helpful to think about the ways that energy is stored and what happens when it is changed from one form to another.

In simpler terms, Energy is the ability to do work.

Forms of Energy

There are two kinds of energy — stored energy and movement energy. Stored energy is also called **potential energy** because it gives something the potential to use its stored energy, as we shall see in the examples. Movement energy is also called **kinetic energy**. The word 'kinetic' comes from a Greek word meaning 'motion'. There are several forms of each kind of energy

- **Gravitational potential energy**

The force of **gravity** between an object and the Earth pulls the object towards the centre of the planet. If an object is in a position above the surface of the Earth, it possesses stored energy called gravitational potential energy.

Examples of objects with this type of stored energy are plates on a table, books on a shelf, a child at the top of a slide and an apple growing on a branch. Each of these objects is supported by something but if the support is removed, they will accelerate to the Earth's surface and their potential energy will be released and changed into other forms.

- **Strain energy**

Strain energy is also called elastic potential energy. Some materials can be easily squashed, stretched or bent, but spring back shape. Once the force acting on them is removed. They are called **elastic materials**. When their shape is changed by squashing, stretching or bending they Store energy. Which will allow them to return to their original shape.

A spring stores when it is Stretched or squashed. Gases Store strain energy in when they are squashed. For example, when the gas used in an aerosol is squashed into a can it stores strain energy. Some of this is used up when the nozzle is pressed down and some of the gas is released in the spray.

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- **Chemical energy**

Energy can be stored in the chemicals from which a material is made. The chemicals are made from **atoms** that are linked together to make **molecules**. The chemical energy is stored in the links between the atoms. Food, fuel and the chemicals in an electrical cell (or battery) are examples containing stored chemical energy. The energy is released when the links between some of the atoms are broken and the molecule in which the energy was stored is broken down into smaller molecules. For example, carbohydrates are a store of chemical energy in food. During **respiration**, carbohydrate is broken down into carbon dioxide and water. The energy that is released in this process is used by your body to keep you alive. The energy released by a fuel is used to heat homes, to heat water to produce steam for generating electricity in power stations, and for the production of new materials.



REFERENCE	KEYWORDS	EVALUATION/ASSESSMENT
<i>Cambridge Checkpoint Science - Book 1</i>	<ul style="list-style-type: none">• Potential energy• Kinetic energy• Energy forms• Energy	<ol style="list-style-type: none">1. What is energy2. Atoms that are linked together make _____.3. What form of energy is found in materials that are squashed, stretched or bent?4. During Respiration, Carbohydrate is broken down into _____ and _____.

2. ENERGY (II)

Objective: By the end of this class, each student should be able to explain the various forms of kinetic energy

Duration: 80 mins

Week: 2

Entry Behavior (How you plan to start your Class): List the various examples of Kinetic energy.

Kinetic energy

Any moving object has kinetic energy. The object may be as large a planet or as small as an atom and because of its motion it can do work. When an object with kinetic energy strikes another object, a force acts on them both that will distort the second object or set it moving. For example, if you move your foot and kick a stationary ball, the ball moves away.

Sound energy

Sound energy produced by the vibration of an object such as the twang of a guitar string. The energy passes through the air by the movement of the atoms and molecules, they move backwards and forwards in an orderly way. This makes a wave that spreads out in all directions from the point of the vibration. Sound energy can also pass through solid, liquids and other gases.

The atoms move in a similar way to the turns on a slinky spring when a 'push—pull' wave moves along it.

Electrical energy

Electric current is movement of electric charges through a conductor such as copper or graphite.

The electric charges are given electrical energy by the battery and carry it to the working parts of a circuit. This may be a lamp, for example, where the energy is changed into light and heat.

Internal energy

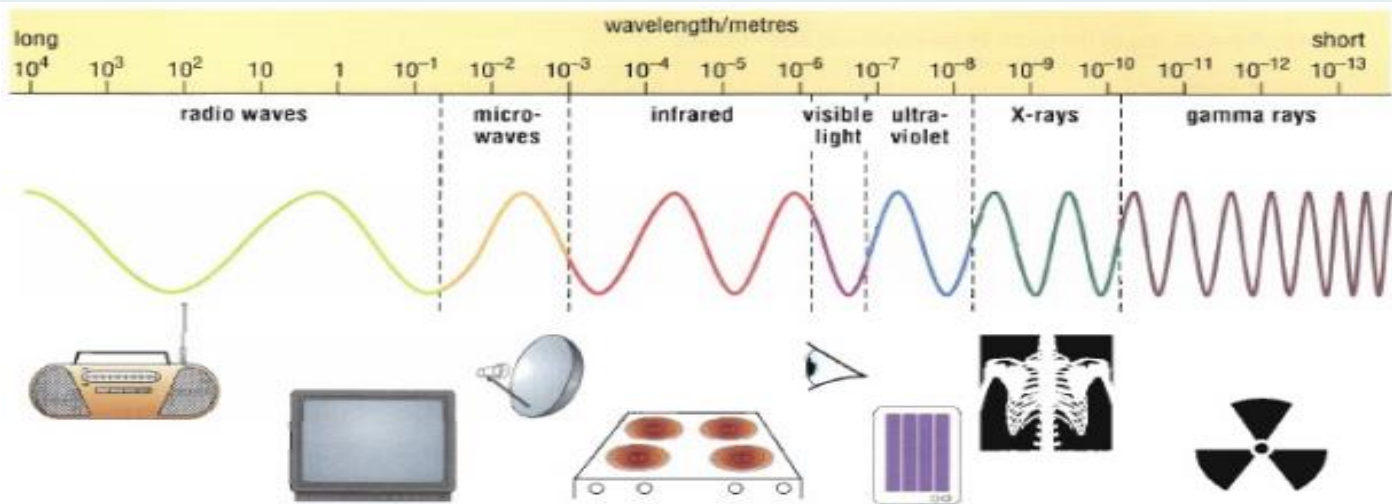
Internal energy is also called thermal energy. All substances are made up of particles. They possess a certain amount of energy, which allows them to move. When a substance is heated this movement increases, for example, the particles in a solid are moving backwards and forwards about a fixed position. The particles in a liquid move more quickly and can move past each other. The particles in a gas can move freely in all directions at high speeds. When a substance is heated, the particles receive more energy and move faster.

Electromagnetic energy

There is a form of energy that can travel through space at the speed of light. This kind of energy travels in waves that have some properties of electricity and some properties of magnetism. They are called electromagnetic waves. As these waves make up rays of light and heat, this form of energy is sometimes called radiation energy. There is a huge range of possible wave sizes, or wavelengths.

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Electromagnetic waves are split into seven groups according to wavelength. The different groups have different properties and different uses. The two most familiar groups are light and radio waves.

Light energy

Light is the energy that we detect with our eyes. The light energy escaping from the Sun can be spread out by a prism or a shower of raindrops into light of different wavelengths, this forms the colors of the rainbow because our eyes see different wavelengths of light as different colors.

REFERENCE	KEYWORDS	EVALUATION/ASSESSMENT
Cambridge Checkpoint Science - Book 1	<ul style="list-style-type: none">Kinetic energy	<ol style="list-style-type: none">List and explain 5 forms of Kinetic energy.

Remark:

3. ENERGY (III)

Objective: By the end of this class, each student should understand the concept of Energy changes and wasted energy.

Duration: 80 mins

Week: 3

Entry Behavior (*How you plan to start your Class*):

Energy changes

We use energy in many ways — for example, to cook food, light our homes and move cars and buses. When energy is used it always changes from one form to another and some always changes into heat energy. For example, when you switch on a light, electrical energy is changed into light energy and heat energy. When you play a guitar, chemical energy in your body is changed into movement energy and sound energy.



Figure 15.9 Energy changes occur when a guitar is played.

Wasted energy

When we turn on a lamp, it is because the light is useful to us. We do not use the heat that is produced so it is wasted. Sometimes that wasted energy can cause problems.

For example, some machines make so much noise (wasted sound energy) that people using them have to wear ear protection



Figure 15.10 These workers' ears are protected from noise energy.

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REFERENCE	KEYWORDS	EVALUATION/ASSESSMENT
<i>Cambridge Checkpoint Science - Book 1</i>	<ul style="list-style-type: none">• Energy• Energy changes• Waste energy	<ol style="list-style-type: none">1. List 5 thing we find around ourselves and the wasted energy in them.2. Explain the energy changes that takes place in a Sound system.

Remark:

4. ENERGY (IV)

Objective: By the end of this class, each student should be able to (I) Differentiate between fuels and fossil fuels (II) Identify various examples of renewable

Duration: 80 mins

Week: 4

Entry Behaviour (How you plan to start your Class): Use pictures to show the different examples of fuels.

Fuels

Many substances are burned to release their chemical energy to provide heat and light. They are called **fuels**. Wood, coal, gas, charcoal, oil, diesel oil, petrol, natural gas and wax are examples of fuels. The heat may be used to warm buildings, cook meals, make chemicals in industry, expand gases in vehicle engines and turn water into steam to generate electricity. Some gases and waxes are used to provide light in homes, caravans and tents.

Coal, gas and oil were all formed from plants and animals that lived millions of years ago, so they are known as **fossil fuels**.

Fossil fuels

Coal is formed from large plants that grew in swamps about 275 million years ago. These plants used energy from sunlight in the same way that plants do today. When they died, they fell into the swamps. There was a lack of Oxygen in the swamp water, which prevented bacteria growing and decomposing the dead plants. Eventually the plants formed peat. Later the peat became buried and was squashed by the rocks that formed above it. The increase in pressure squeezed the water out of the peat and warmed it. These processes slowly changed the peat into coal.

Tiny plants and animals live in the upper waters of the oceans and form the plankton. When they die, they sink to the ocean floor. Over 200 million years ago, the dead plankton that collected on the ocean floor did not decompose because there was not enough oxygen there to allow bacterial decomposers to live. The remains instead formed a layer, which eventually became covered by rock. The weight of the rock squeezed the layer and heated it. This slowly converted the layer of dead plankton into oil and methane gas. This gas is supplied to homes as natural gas. Several fuels are obtained from oil.

Renewable resources

Unfortunately, the supplies of fossil fuels are limited and there will come a time when there are not enough to meet our needs. As a result, scientists are trying to develop alternative sources of energy from renewable energy sources such as the movement of the wind, the movement of waves and the tide, the movement of water from rivers (hydroelectricity) and the light of the Sun (solar power).

5. ENERGY TRANSFER (I)

Objective: By the end of this class, each student should be able to (I) Explain the concept of energy transfer and transformation (II) Narrate how energy use has increased over the years.

Duration: 80 mins

Week: 5

Entry Behavior (*How you plan to start your Class*):

Energy transfers and transformations

You are living at this moment because of energy transfers taking place in your body. As the energy is transferred it is transformed. Stored chemical energy in your food is transformed to kinetic (movement) energy when you raise your hand to turn the pages of this book. Some of the stored chemical energy is also transformed into heat to keep your body warm.

All the changes you can detect around you are due to energy transformations. If you are reading this book by an electric light, electrical energy is being transformed into light energy so that you can see the words. If you can hear someone shuffling about in their seat next to you, some of the kinetic energy of their body being transformed into sound that reaches your ears. Also at each energy change or transformation, some energy is always lost as heat energy.

How energy use has increased

Energy transformations are vital to survival. From the earliest time, people have needed enough stored chemical energy in their bodies to change to kinetic energy to move around and find food. If they could not find enough food (and store it as chemical energy for later use), they simply starved to death. In time, people came to live together in groups and developed machines and other devices to make life easier.

A city in the past

If you consider a busy square in Manchester, England, about 120 years ago. Candles, oil lamps and gaslights lighted the insides of buildings. Coal and wood were used as fuel for fires to keep the buildings warm in winter. The Streets lit by gas lights, People and goods were transported through the streets by carriages and carts pulled by horses. Many people arrived or left the city by trains pulled by Steam locomotives. Some people walked.

A city today

Now let's consider Times Square in New York, today the buildings are lit by electricity. Some buildings have air conditioning by electricity to keep them in summer. They also have heaters powered by electricity to keep them warm in winter. Cars, vans, trucks and buses are used to transport people and goods. These vehicles are

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powered by petrol or diesel engines and are also used by people traveling to and from the city. Many people may also use trains pulled by a locomotive with an electric motor. Some people may come to the city by aircraft, which a fuel called kerosene, similar to petrol.

REFERENCE	KEYWORDS	EVALUATION/ASSESSMENT
<i>Cambridge Checkpoint Science - Book 1</i>	<ul style="list-style-type: none">• Energy transfer• Electricity• Locomotive• Transformation• Transportation	<ol style="list-style-type: none">1. Describe how energy use has evolved over the years

Remark:

6. ENERGY TRANSFER (II)

Objective: By the end of this class, each student should be able to Identify and breakdown an energy transfer diagram.

Duration: 80 mins

Week:

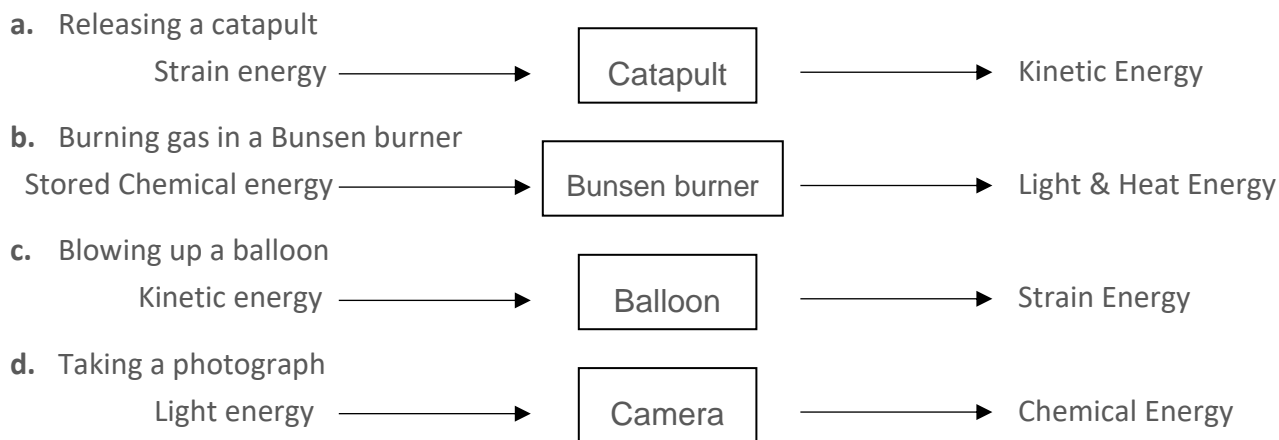
Entry Behaviour (How you plan to start your Class):

Energy Transfer Diagrams

Energy transfer diagrams can show energy transformation. There are three parts to an energy transfer diagram.

1. An arrow showing the energy input
2. A box showing an energy converter or transducer
3. Arrows showing energy output

Here are some examples of energy transfer diagrams



Sankey diagrams

A Sankey diagram is a second kind of diagram that shows energy changes. It features arrows of different widths. The width of the arrow indicates the amount of energy it represents. The unit in which energy and work are measured is called the joule (symbol J). A thousand joules is a kilojoule and is represented by the symbol kJ.

Energy in a car engine

A car engine has an energy input of 200 kJ. The energy output is 80 kJ of kinetic energy and 120 kJ of heat energy.

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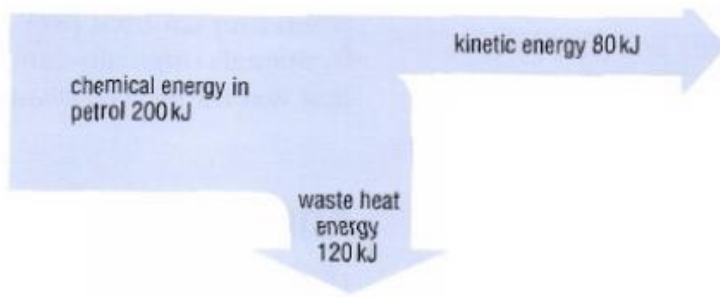


Figure 16.5 This Sankey diagram shows what happens to the energy passing through a car engine every second.

Energy from the Sun

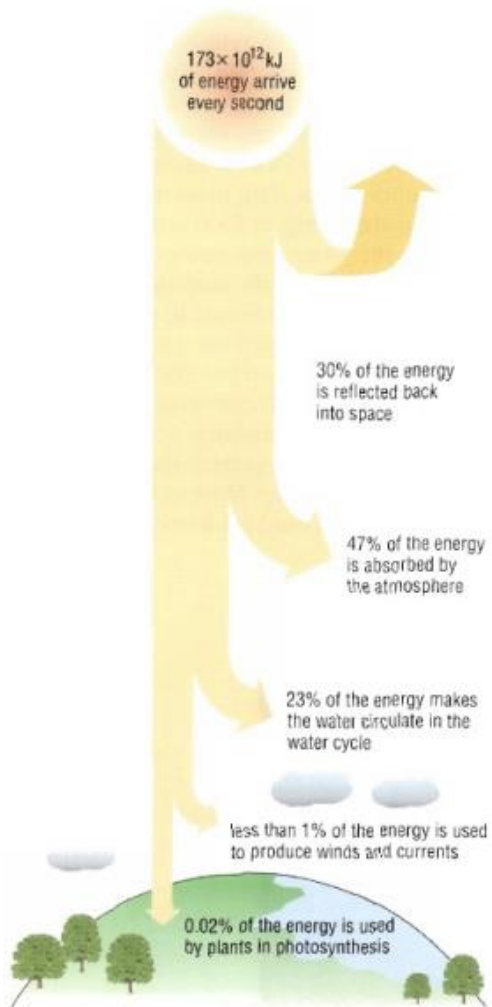


Figure 16.6 Sankey diagram of energy from the Sun

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REFERENCE	KEYWORDS	EVALUATION/ASSESSMENT
<i>Cambridge Checkpoint Science - Book 1</i>	<ul style="list-style-type: none">• Energy transfer• Sankey diagram• Chemical energy	<ol style="list-style-type: none">1. How many KJ of energy is wasted in a car engine?2. _____ of the sun's energy is reflected back into space.3. Explain the energy transfer used in a light bulb.

Remark:

7. MIDTREM TEST AND BREAK

8. ENERGY TRANSFER (III)

Objective: By the end of this class, each student should (I) Understand the relationship between plants and energy (II) Energy and ourselves

Duration: 80 mins

Week: 8

Entry Behaviour (*How you plan to start your Class*):

Plants and energy

When a seed germinates, its skin breaks open and the tip of the root pops out. Energy stored inside the seed is used as the root grows and seeks out water. The growing shoot also uses stored energy. The shoot grows up through the soil and eventually reaches the surface. Energy from below, in the seed, is used as the shoot sends out leaves.

Some of the light energy falling on the leaves is trapped inside them. It is converted into stored chemical energy as the plant makes food using water from the soil and carbon dioxide from the air. This process of making food using light energy is called **photosynthesis**.

The chemical energy stored in a plant is transferred to a herbivorous animal when it eats it. The herbivorous animal then has a store of chemical energy, which it uses to keep itself alive and to move about. Carnivorous animals feed on herbivorous animals. They take in stored chemical energy when they eat their prey. Thus the energy stored and used by animals originally came from light energy from the Sun that was trapped by plants.

Energy and ourselves

Have you ever cooked meat on a barbecue? If you have, you might have seen Fat dropping through the grill and bursting into flames as it hit the hot charcoal below. If you did not take enough care when cooking the meat, you may even have seen it catch fire too. The meat and fat burn because they contain chemical energy, just like the charcoal fuel that is heating them. In fact, all foods contain energy.

If you look at many packets of food, you will find an information box. It tells you about the ingredients used and the nutrients present in the food. It also tells you about the amount of energy in a 100g mass of the food. The units used to measure energy in food are the joule and kilojoule. They are the same units as those used to measure energy and work in scientific investigations.

The chemical energy in food is released in a process called **respiration**. Oxygen is needed for this process and your body takes it in from the air you breathe into your lungs. When the energy is released, carbon dioxide and water are produced. carbon dioxide is released into the air when you breathe out. The water is used in your body or released in sweat and urine. Most of the energy that is released in your body is used for movement and for keeping the body warm.

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REFERENCE	KEYWORDS	EVALUATION/ASSESSMENT
<i>Cambridge Checkpoint Science - Book 1</i>	<ul style="list-style-type: none">• Photosynthesis• Chemical Energy• Respiration• Herbivores	<ol style="list-style-type: none">1. From the third paragraph under Plants and Energy, it can be deduced that stored energy animals used originates from _____2. Describe the process of respiration with the equation.

Remark:

9. ENERGY TRANSFER (IV)

Objective: By the end of this class, each student should be able to (I) Analyze how energy is generated (II) Explain how energy is conserved.

Duration: 80 mins

Week: 9

Entry Behaviour (How you plan to start your Class):

Generating Energy

Electrical energy is a very useful form of energy because it is easy to generate and can be transported quickly to wherever it is needed. These properties make it the most widely used form of energy in the highly developed countries of the world.

Michael Faraday (1791—1867), an English physicist, discovered that an electric current could be made to flow in a wire if the wire was made to move through **magnetic field**. This principle is used to generate electricity in a bicycle dynamo and in a power station generator.

The bicycle dynamo

A bicycle dynamo is an electrical device, which can be located in the hub of a wheel (hub dynamo) or clamped onto the bicycle frame close to a tyre (bottle or sidewall dynamo). The bottle dynamo has a wheel on top, which can be made to touch the tyre. When the dynamo wheel is in contact with the tyre it rotates as the bicycle wheel turns. Inside the dynamo, the magnet turns and its field sweeps through the wires, generating an electric current that lights the bicycle's lamps.

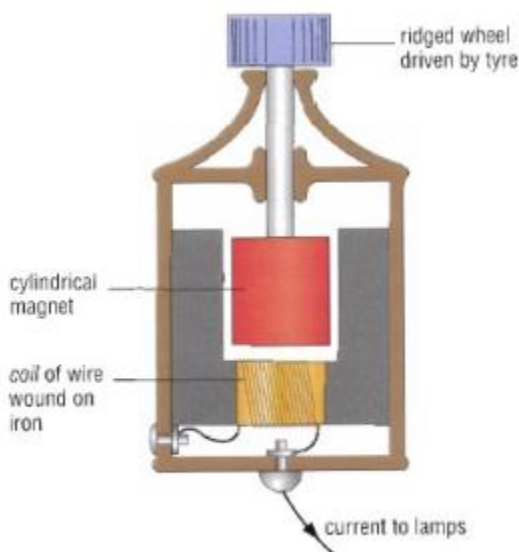


Figure 16.9 Inside a bottle or sidewall dynamo

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The Power Station Generator

Inside a power station, there is a generator consisting of a huge electromagnet surrounded by coils of wire. The electromagnet is attached to a shaft to which turbine blades are attached. When the turbines are made to spin, the electromagnet also spins, generating an electric current in the surrounding coils of wire.

In about two-thirds of the world's power stations, water is heated to make steam. This takes place in a boiler. The energy that the water molecules receive increases their kinetic energy so much that they move apart from each other to form a gas — steam. The steam expands rapidly and exerts a force, which drives it from the boiler to the turbine blades. Here as much as possible of the steam's kinetic energy is passed to the turbine blades as the steam pushes past them, making the blades spin on the central shaft.

The generator's electromagnet is connected to the end of the shaft. As it spins using kinetic energy from the turbine blades, it generates an electric current in the coils of wires surrounding it. The electricity flows away from the power station to towns and cities in overhead power lines or underground cables.

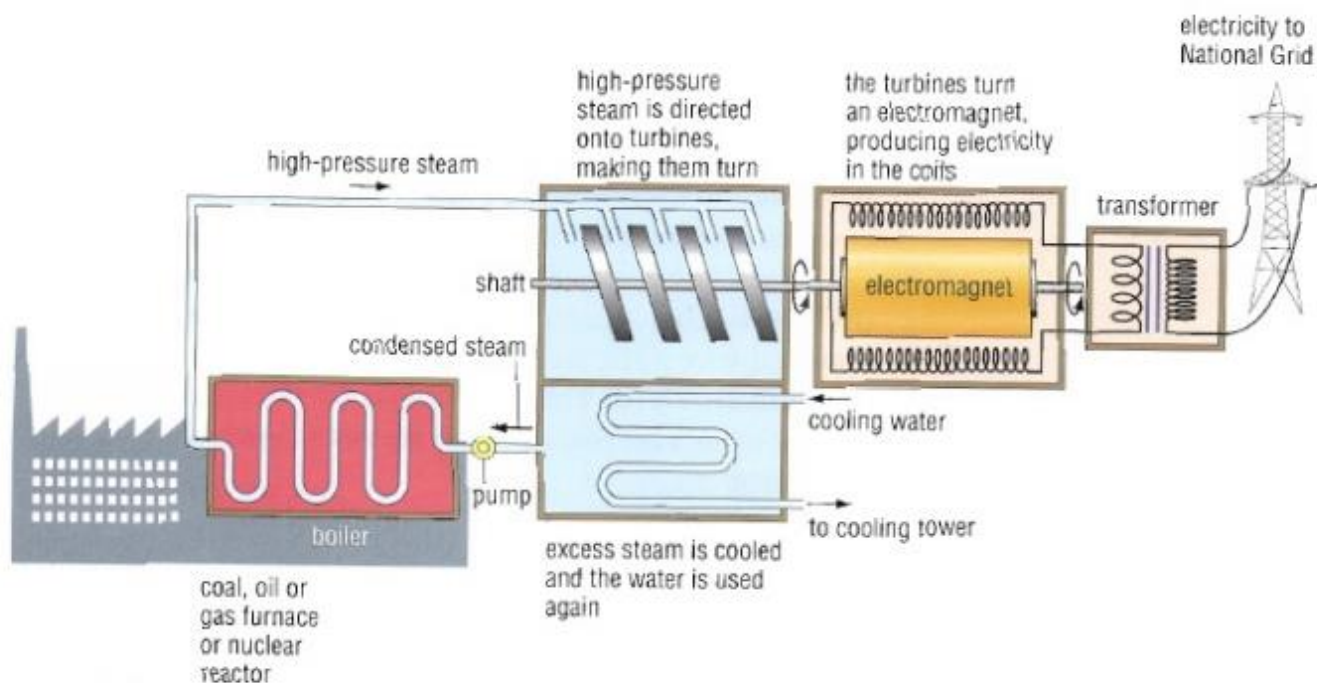


Figure 16.10 The parts of a power station

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Figure 16.11 This turbine assembly for a power station in England is like many others around the world.

Conservation of energy

Imagine that you have a piece of string with a small weight on the end. It can be used as a pendulum. If you held it up in front of you and pulled the weight towards your face until it almost touched your nose, the pendulum would be ready to swing. You might think that when you let go of the weight it would swing away from you and then back again, and perhaps hit your nose. If you were to try this experiment you would find that your nose was safe. The pendulum would not reach your nose when it swung back. In fact, as the weight swung to and fro it would approach your nose less and less, until it stopped.

It would seem that as the pendulum swung back the first time some energy was lost. It is true that pendulums do lose energy as they swing but the energy is not destroyed. As the string and weight move through the air, they rub against the air particles. This rubbing causes heat energy to be released from them, just like the heat energy that is released from your hands when you rub them together. With each swing of the pendulum, more heat energy is lost until all the energy has left the pendulum and it hangs vertically, motionless.

This experiment shows that energy is not destroyed, it just changes form. Just as energy is not destroyed, so it is not created either. The energy used in the body or a machine simply comes from somewhere else in the universe. This discovery about energy led to the law of Conservation of Energy, which says that energy cannot be made or destroyed, can only be changed from one form to another.

Some inventors have tried to defy the Law of Conservation of Energy by designing and even making perpetual motion machines.

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This perpetual motion machine is called an overbalanced wheel, It is believed that someone in India thought of the idea for this machine about 1200 years ago. Since then many people in other parts of the world have worked on the idea but all have failed to make the machine work. The idea behind the machine is that the top of the wheel is given a push to the right. This makes the hammers on the right swing and fall. When they reach the bottom of the wheel, they swing against a peg and push it to the left. If there is enough force in the push, the wheel should turn upwards on the left and this will cause more hammers on line right to fall. When models have been made, they work for a short while and then stop.

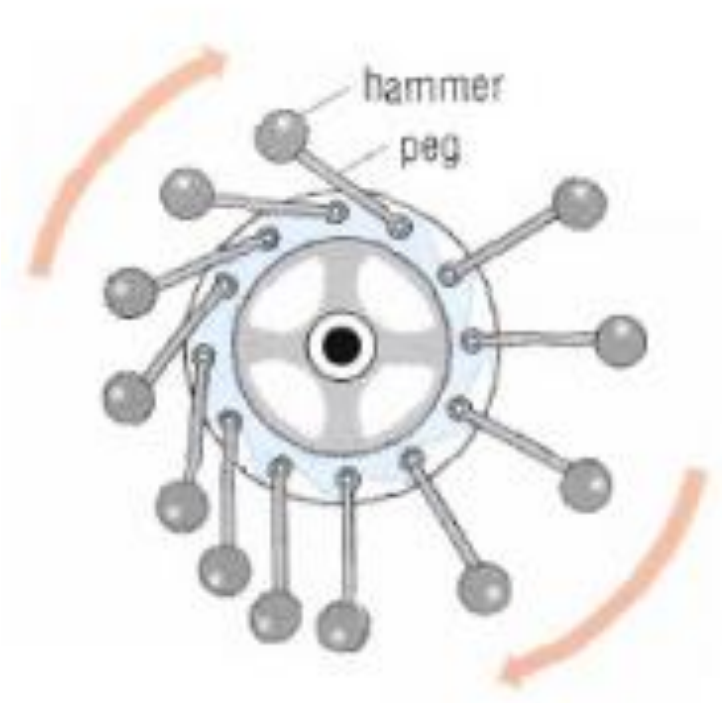


Figure 16.13 Perpetual motion machine

REFERENCE	KEYWORDS	EVALUATION/ASSESSMENT
Cambridge Checkpoint Science - Book 1	<ul style="list-style-type: none">Perpetual motion machineConservationDynamoGeneratorMagnetic field	<ol style="list-style-type: none">How does a bicycle dynamo work?Briefly analyze how a power station generator work.

10. REVISION

Objective: By the end of this class, all students should be able to recall all they have learnt in the term

Duration: 80mins

Week: 10

Entry Behaviour (*How you plan to start your Class*):

11. REVISION

Objective: By the end of this class, all students should be able to recall all they have learnt in the term

Duration: 80mins

Week: 11

Entry Behaviour (*How you plan to start your Class*):