Key Terms | Definitions
--- | ---
Adaptation | Something which helps an organism to survive in their environment, e.g., humps for storing water
Habitat | The environment that an organism lives in
Competition | When animals or plants compete for limited resources
Intraspecific competition | Competition between individuals of the same species
Interspecific competition | Competition between individuals of different species

**Adaptation**
- An animal must be able to find food, breed and navigate its way around its habitat if it is to survive.
- Every animal has evolved gradually over millions of years to become well suited, or adapted, to its habitat.
- These adaptations are specific to the environment of the animal and are essential for survival.
- Here are some examples:

**Snow Leopard**
- Big paws to evenly spread weight and help with walking through snow
- Thick fur for insulation

**Siamang Gibbon**
- Long arms and fingers for swinging through trees and gripping branches
- Forward facing eyes for judging distances

**Bactrian Camel**
- Fat stored in humps to convert to water
- Wide feet to even spread weight and prevent sinking into the sand

**Humboldt Penguin**
- Streamlined bodies to help with swimming
- Serrated beaks to help with catching and swallowing slippery fish

**Competition**
- Animals and plants have to compete for the limited resources available to them
- The animals that are best adapted will win and survive
- There are two types of competition
  - Interspecific – between individuals of different species
  - Intraspecific – between individuals of the same species

**Competition in animals**
- Animals compete for:
  - Food
  - Water
  - Space
  - Mates
Year 8 Biology Knowledge Organiser
Topic 4: Adaptations

KPI 1: Describe the factors effecting the abundance and distribution of organisms

Competition in plants
- Plants compete for:
  - Nutrients
  - Water
  - Space
  - Sunlight

Predator-prey relationships
- Numbers of predators and prey are interdependent on each other
- If the numbers of prey drop then the numbers of predators will also drop after a while

KPI 2: Explain how characteristics can be inherited by individuals

Causes of variation
- The differences between living things of the same species is known as variation.
- Variation can be caused by differences in genes (inherited variation) e.g. eye colour, or differences in the environment e.g. language.
- Some variation is caused by a mixture of both genes and environment (e.g. weight and height).

Types of variation
- Continuous variation is variation that can take any value (e.g. height or weight)
- Continuous variation should always be shown on a line graph
- Discontinuous variation is variation that can only take set values (e.g. shoe size or blood group)
- Discontinuous variation should always be shown on a bar chart

<table>
<thead>
<tr>
<th>Key Terms</th>
<th>Definitions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interdependent species</td>
<td>If the number of one species changes it will affect the numbers of the other species</td>
</tr>
<tr>
<td>Variation</td>
<td>Differences between living organisms of the same species</td>
</tr>
<tr>
<td>Continuous variation</td>
<td>Differences that can take any value, e.g. height</td>
</tr>
<tr>
<td>Discontinuous variation</td>
<td>Differences that can only take set values, e.g. blood groups</td>
</tr>
<tr>
<td>Inherited variation</td>
<td>Variation in an individual that is caused by genetics</td>
</tr>
<tr>
<td>Environmental variation</td>
<td>Variation in an individual that is caused by the environment</td>
</tr>
</tbody>
</table>
**Year 8 Biology Knowledge Organiser**  
**Topic 4: Adaptations**

**KPI 2: Explain how characteristics can be inherited by individuals**

### DNA
- DNA contains all the instructions needed to make an organism
- Everybody has unique DNA (apart from identical twins)
- DNA is found in the nucleus of every cell
- The DNA molecules are twisted and folded into tiny structures called chromosomes
- DNA has a double helix structure – this means it is twisted twice
- A short length of chromosome which codes for a characteristic is called a gene
- Genes contain the information to produce proteins
- DNA and therefore genes are passed on from parents to their offspring
- Alleles are different forms of the same gene

### Key Terms | Definitions
| DNA | The molecule containing all the instructions to make an organism |
| Chromosome | A structure containing DNA found inside the nucleus of a cell |
| Gene | A section of DNA coding for a characteristic |
| Allele | A form of a gene |
| Dominant | An allele that is always expressed (capital letter) |
| Recessive | An allele that is only expressed if there is no dominant allele present (lower case letter) |

### Inheritance
- Alleles can be dominant or recessive
- Dominant alleles will always be expressed (the characteristic they code for will be seen in the individual), they are given a capital letter
- Recessive alleles will only be expressed if the dominant allele is not present (the characteristic they code for will only be seen if the dominant characteristic is not present), they are given a lower case letter
- Punnet squares can be used to show how alleles are inherited:

```
<table>
<thead>
<tr>
<th></th>
<th>Genes from mother</th>
<th>Genes from father</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>B</td>
<td>B</td>
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<td>b</td>
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<td>B</td>
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</tbody>
</table>
```
- B is the dominant allele for brown eyes
- B is the recessive allele for blue eyes
- Offspring BB and Bb would have brown eyes as they have the dominant allele
- Offspring bb would have blue eyes as there is no dominant allele
- There is a 1 in 4 chance of the offspring having blue eyes
- There is a 3 in 4 chance of the offspring having brown eyes
**Evolution**
- The theory of evolution states that all living organisms evolved from simple life forms.
- These first simple life forms developed over three billion years ago.
- The process that leads to evolution is called natural selection.

**Natural selection**
- Within a population there are variations between individuals leading to adaptations.
- Individuals with the adaptation have an advantage and are more likely to survive than those without.
- The individuals that survive will reproduce and have offspring.
- The offspring will inherit the genes for the best adaptations from their parents.
- Over time the population will change towards individuals with the advantageous adaptation – it will evolve.

**Extinction**
- If all the individuals of a species die then the species would become extinct.
- We know that species have become extinct because of fossil records of species that no longer exist.
- Extinction can be caused by many things including:
  - New diseases
  - New predators
  - Climate change
  - Competition

**Conservation**
- Conservation is anything that is done to try to stop an endangered species becoming extinct.
- Examples of endangered species include the Leatherback Sea Turtle, Ivory Billed Woodpecker and the Amur Leopard.
- Conservation work can include:
  - Captive breeding
  - Seed banks
  - Conservation areas
  - Nature reserves

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**Key Terms**

<table>
<thead>
<tr>
<th>Key Terms</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Evolution</td>
<td>The changes in organisms seen over long periods of time</td>
</tr>
<tr>
<td>Natural selection</td>
<td>The process that leads to evolution</td>
</tr>
<tr>
<td>Extinction</td>
<td>When no individuals of a species survive</td>
</tr>
<tr>
<td>Endangered</td>
<td>When only small numbers of individuals of a species remain and there is a risk the species might become extinct</td>
</tr>
<tr>
<td>Conservation</td>
<td>Work done to try to ensure that a species does not become extinct</td>
</tr>
</tbody>
</table>
Pure Substances
If you could see the particles in pure water, you would only see water particles. There would be no other particles. Pure substances can be elements or compounds. Examples of pure substances include gold, oxygen and pure water.

Impure Substances
Impure materials may be mixtures of elements, mixtures of compounds, or mixtures of elements and compounds. For example, even the most pure water will contain dissolved gases from the air. Impurities in a substance will affect its properties. For example, they may change its boiling point.

Mixtures
A mixture contains different substances that are not chemically joined to each other. For example, a packet of sweets may contain a mixture of different coloured sweets. The sweets are not joined to each other, so they can be picked out and put into separate piles.

Key Terms
<table>
<thead>
<tr>
<th>Key Terms</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Pure</td>
<td>A material that is composed of only one type of particle.</td>
</tr>
<tr>
<td>Impure</td>
<td>A material that is composed of more than one type of particle.</td>
</tr>
<tr>
<td>Evaporation</td>
<td>A change of state involving a liquid changing to a gas</td>
</tr>
<tr>
<td>Distillation</td>
<td>A process for separating the parts of a liquid solution. The solvent is heated and the gas is collected and cooled.</td>
</tr>
<tr>
<td>Filtration</td>
<td>The act of pouring a mixture through a mesh, in attempts to separate the components of the mixture.</td>
</tr>
<tr>
<td>Mixture</td>
<td>A material made up of at least two different pure substances.</td>
</tr>
<tr>
<td>Chromatography</td>
<td>A technique used to separate mixtures of coloured compounds.</td>
</tr>
</tbody>
</table>

Elements
Elements are made up of one type of atom. All the elements are found listed in the periodic table – there are currently 118 of them.

Compounds
Compounds are formed by chemical reactions. Compounds contain two or more elements that are chemically joined to each other. In order to separate the elements in a compound you would need to carry out another chemical reaction. Examples of compounds are:

- Carbon dioxide (CO₂)
- Water (H₂O)
**Distillation**
This is good for separating a liquid from a solution. For example, water can be separated from salty water by simple distillation. This method works because the water evaporates from the solution, but is then cooled and condensed into a separate container. The salt does not evaporate and so it stays behind. Distillation can also be used to separate two liquids that have different boiling points.

**Chromatography**
Simple chromatography is carried out on paper. A spot of the mixture is placed near the bottom of a piece of chromatography paper and the paper is then placed upright in a suitable solvent, e.g. water. As the solvent soaks up the paper, it carries the mixtures with it. Different components of the mixture will move at different rates. This separates the mixture out.

**Other techniques for separating mixtures**
- If you have a solution for example salt water, you can evaporate the water leaving pure salt.
- If you have two substances where 1 is magnetic and 1 is not, for example iron and sulphur, then a magnet can be used to separate the two substances.
- If you have a mixture of a solid and a liquid then the mixture can be filtered.
KPI 3: Explain the process of dissolving including saturation

**Solutions**
- Salt and sugar are soluble in water, this means they dissolve in water.
- Sand is insoluble in water, this means it does not dissolve in water.
- The solute is the substance that dissolves.
- The solvent is the liquid the solute dissolves in.
- The solution what is produced (the solvent containing the solute)

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Solute</td>
<td>The substance that dissolves</td>
</tr>
<tr>
<td>Solvent</td>
<td>The liquid that the solute dissolves in</td>
</tr>
<tr>
<td>Solution</td>
<td>The solute dissolved in the solvent</td>
</tr>
<tr>
<td>Solubility</td>
<td>How easy it is for a given substance to dissolve</td>
</tr>
<tr>
<td>Saturated solution</td>
<td>When no more solute can be dissolved into a solution it is said to be saturated</td>
</tr>
</tbody>
</table>

**Dissolving**
- During dissolving the solvent particles surround the solute particles and move them away so they are spread out in the solvent.

**Saturated solutions**
- When a solvent is heated it will dissolve more solute.
- When no more solute can be dissolved in the solvent the solution is saturated.
- Mass is always conserved so for example if 5 grams of solute are dissolved in 100 grams of solvent, the mass of the solution will be 100+5= 105 grams.
# Year 8 Physics Knowledge Organiser

## Topic 6: Energy

### KPI 1: describe examples of energy transfers

### KPI 3: apply the law of conservation of energy to situations involving energy transfers

### Energy Stores

Energy can be stored in objects, or when objects are doing something. It is a quantity measured in joules (J). Examples to know:

- Energy is stored in fuels as **chemical potential energy**
- Energy is stored in anything elastic when it is stretched, as **elastic potential energy**
- Energy is stored in any object that has been lifted up, because the object stores **gravitational potential energy**
- Energy is stored in moving objects as **kinetic energy**. (Obviously, if it is cold, it doesn’t store much heat energy!) This is also known as **thermal energy**.

### Energy Transfer

An energy transfer is when energy changes from one store to another. VERY IMPORTANTLY, the **total amount of energy does not change**. Energy cannot be created or destroyed. All that can be changed is how it is stored. This ideas is called **the law of conservation of energy**.

Energy is transferred, so it changes store, in loads of situations. Examples to know:

- When a fuel is burned, the chemical potential energy in the fuel ends up stored as thermal energy in the surroundings;
- When an object falls off a shelf, the gravitational potential energy it stores is transferred (changed) to kinetic energy while it is falling.
- When the object hits the floor, all the gravitational potential energy it had to start with ends up stored as thermal energy in the surroundings.
- When a spring that’s been stretched is released, the elastic potential energy it stored is transferred to kinetic energy then to thermal energy.

### Key Terms

<table>
<thead>
<tr>
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<th>Definitions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy</td>
<td>Energy is a quantity that is stored in many objects and situations. Anything storing energy can do <strong>work</strong>.</td>
</tr>
<tr>
<td>Work</td>
<td>Work is done when energy changes from one store to another.</td>
</tr>
<tr>
<td>Potential energy</td>
<td>Potential energy is energy stored in objects that don’t seem to be doing anything. See the examples.</td>
</tr>
<tr>
<td>Chemical potential energy</td>
<td>Energy stored in fuels (like wood, or the gas we run Bunsen burners on) is called chemical potential energy.</td>
</tr>
<tr>
<td>Elastic potential energy</td>
<td>Elastic objects, like springs or rubber bands, store elastic potential energy when they are stretched.</td>
</tr>
<tr>
<td>Gravitational potential energy</td>
<td>Any object that is not on the ground has gravitational potential energy. This is because they are lifted up in a gravitational field, and could fall down!</td>
</tr>
<tr>
<td>Kinetic energy</td>
<td>Movement energy. Any moving object stores <strong>kinetic energy</strong>.</td>
</tr>
<tr>
<td>Thermal energy</td>
<td>Also known as heat energy. All objects store some thermal energy, because the particles are moving. The higher the temperature of an object, the more thermal energy it stores.</td>
</tr>
<tr>
<td>Conservation of energy</td>
<td>The law that says energy cannot be created or destroyed. It can only change how it is stored.</td>
</tr>
</tbody>
</table>

This shows how energy changes where it is stored twice while you use a light bulb (lamp):

From chemical potential energy to electrical energy to heat (thermal) energy in the surroundings.
**Temperature and Heat**

Temperature and heat are linked, but are not the same thing. The heat of a material depends on the potential energy of the particles AND the kinetic energy of the particles it is made from. What this does mean is that the more heat (thermal energy) a substance stores, the higher its temperature will be. You can increase the heat stored in a substance without increasing its temperature though: just get more of it. This means you have more particles, so there is more thermal energy all together in the substance.

**But do not get confused**, a cup of tea at 80°C has a higher temperature than a swimming pool at 30°C but because there are many more water particles in the swimming pool so the energy is higher.

**Thermal energy transfer**

Thermal energy will always be transferred from hotter objects to cooler objects. This includes hot objects transferring thermal energy to the surroundings (the air, nearby surfaces and so on). You can reduce the amount of thermal energy transferred by insulating the hot object.

**Thermal energy transfer by conduction**

Hot materials can transfer thermal energy to other materials that they are touching. This is called conduction of thermal energy. As the diagram shows, the particles that are heated increase in kinetic energy when they are heated. They bump into neighbouring particles and pass on (transfer) thermal energy. This is why a table feels warm after a hot cup of tea is lifted from it, and the reason why thermal energy can pass through the bottom of a saucepan to cook your dinner.

**Thermal energy transfer by radiation**

All objects give out some infra red radiation, but the hotter they are the more radiation they give out. All objects can also absorb infra red radiation: when they do, they heat up. Radiation can travel through empty space – so this is how the Sun heats up the Earth. The objects don’t have to be touching, unlike in conduction, and there are no particles involved. .
### Year 8 Physics Knowledge Organiser

#### Topic 6: Energy

<table>
<thead>
<tr>
<th>Key Terms</th>
<th>Definitions</th>
</tr>
</thead>
</table>
| **Power** | Power is the rate (or speed) of energy transfer.  
\[
power(W) = \frac{\text{energy transferred (J)}}{\text{time (s)}}
\] |
| **Joule (J)** | The unit for energy |
| **Watt (W)** | The unit for power |
| **Kilowatt (kW)** | 1000 watts |
| **Renewable** | Renewable resources are replenished (replaced) as they are used. |
| **Non-renewable** | Non-renewable resources, like fossil fuels, are NOT replenished (replaced) as they are used. |
| **Environmental impact** | The effects of something on the environment. |

### Energy and power

Energy can be stored in objects or transferred between them. The speed, or rate, at which energy is transferred is called the **power**. Divide the amount of energy transferred by the time it took to transfer it to find the power (see equation).

This means that if the same amount of energy is transferred in half the time, the power is twice as much.

### Fuels as Energy Resources

Fuels store chemical potential energy. Many fuels are used a great deal by humans, including fossil fuels:
- **Oil** – used to make petrol/diesel/aircraft fuel especially
- **Coal** – burned in power stations to generate electricity
- **Natural gas** – used as a fuel for heating homes and for cooking.

These are all very useful fuels, but the problem is that they are **non-renewable** and when they are burned, carbon dioxide is produced. Carbon dioxide contributes to climate change because it is a greenhouse gas.

### Other Energy Resources

We don’t have to use fossil fuels for the uses given above. There are many other energy resources on Earth, including many **renewable resources**. E.g.
- **Sunlight**, which we can use to generate electricity with solar cells
- **Wind**, which can be used to generate electricity using wind turbines
- **The tides**, which can be used to generate electricity
- **Waves in the sea**, which can be used to generate electricity.

### Choosing energy resources

Many things should be considered to choose an energy resource:
- The **reliability** of the energy resource
- The usefulness of the energy resource
- How long the resource lasts, and if it is **renewable**
- The **environmental impact** of the energy resource.

**FOR EXAMPLE:**

Tidal energy is very reliable, as there are two tides per day. Tidal energy is useful for generating electricity, but you couldn’t use it to run your car! Tidal energy is renewable, which is an advantage, because it cannot be used up. Using tidal energy does not produce polluting gases like carbon dioxide, but building the generators in the sea can damage the habitats of wildlife near the coast.
Recycling of Aluminium

Aluminium extraction is expensive because the process needs a lot of electrical energy. Therefore aluminium is extensively recycled because less energy is needed to produce recycled aluminium than to extract aluminium from its ore.

Recycling preserves limited resources and requires less energy, so it causes less damage to the environment. In addition, the multiple uses of aluminium mean that soon the demand for the recycled aluminium will outweigh the need to extract it and therefore less energy is lost.
Global Warming

The extra carbon dioxide increases the greenhouse effect. More heat is trapped by the atmosphere, causing the planet to become warmer than it would be naturally. The increase in global temperature this causes is called global warming.

Global Warming is beginning to cause big changes in the environment. These include:

- ice melting faster
- the oceans warming up
- changes in where different species of plants and animals can live

Carbon cycle

A series of processes that moves carbon through organisms and the atmosphere.

Photosynthesis

A chemical process that uses energy to produce glucose.

Respiration

A chemical process that releases energy.

Global warming

The gradual increase in global temperatures

The Carbon Cycle

All cells - whether animal, plant or bacteria - contain carbon, because they all contain proteins, fats and carbohydrates. Carbon is passed from the atmosphere, as carbon dioxide, to living things, passed from one organism to the next in complex molecules, and returned to the atmosphere as carbon dioxide again. This is known as the carbon cycle.

• Step 1: Removing carbon dioxide from the atmosphere
  Green plants remove carbon dioxide from the atmosphere by photosynthesis. The carbon becomes part of complex molecules such as proteins, fats and carbohydrates in the plants.

• Step 2: Returning carbon dioxide to the atmosphere
  Organisms return carbon dioxide to the atmosphere by respiration. It is not just animals that respire. Plants and microorganisms do, too.

• Step 3: Passing carbon from one organism to the next
  When an animal eats a plant, carbon from the plant becomes part of the fats and proteins in the animal. Microorganisms and some animals feed on waste material from animals, and the remains of dead animals and plants. The carbon then becomes part of these microorganisms and detritus feeders.

Atmospheric composition

The Earth's atmosphere has remained much the same for the past 200 million years. The pie chart shows the proportions of the main gases in the atmosphere.

- Oxygen: 21%
- Nitrogen: 78%
- Other including: Argon 0.9%, CO₂ 0.037%
**The Reactivity Series**

In a reactivity series, the most reactive element is placed at the top and the least reactive element at the bottom. More reactive metals have a greater tendency to lose electrons and form positive ions.

Observations of the way that these elements react with water, acids and steam enable us to put them into this series.

Metals are very useful. A **metal ore** is a rock containing a metal, or a metal compound, in a high enough concentration to make it economic to extract the metal.

The method used to extract metals from the ore in which they are found depends on their reactivity.

For example, reactive metals such as aluminium are extracted by **electrolysis**, while a less-reactive metal such as iron may be extracted by **reduction** with carbon or carbon monoxide.

Thus the method of extraction of a metal from its ore depends on the metal's position in the reactivity series.

### Key Terms

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Displacement reaction</td>
<td>Reaction where a more reactive substance will take the place of a less reactive substance in a compound</td>
</tr>
<tr>
<td>Electrolysis</td>
<td>The separation of a compound using an electrical current</td>
</tr>
<tr>
<td>Reduction</td>
<td>Reaction where oxygen is removed from a substance. It also means a gain in electrons.</td>
</tr>
</tbody>
</table>

### Testing for different Gases

You need to know the following tests:

- **Hydrogen**
  A lighted wooden splint makes a popping sound in a test tube of hydrogen.

- **Oxygen**
  A glowing wooden splint relights in a test tube of oxygen.

- **Carbon dioxide**
  Bubble the test gas through limewater - calcium hydroxide solution. Carbon dioxide turns limewater cloudy white.

- **Ammonia**
  Ammonia has a characteristic sharp, choking smell. It also makes damp red litmus paper turn blue. Ammonia forms a white smoke of ammonium chloride when hydrogen chloride gas, from concentrated hydrochloric acid, is held near it.

- **Chlorine**
  Chlorine has a characteristic sharp, choking smell. It also makes damp blue litmus paper turn red, and then bleaches it white. Chlorine makes damp starch-iodide paper turn blue-black.