Year 10 Science Work-booklet

Biology: Cell Division – Mitosis

Understanding Cell Division

All living organisms grow and repair themselves by making new cells. This process is called **cell division**. The main type of cell division in body cells is **mitosis**. Mitosis is very important because it makes two new cells that are genetically identical to the original cell. This means that the new cells have exactly the same number of chromosomes and the same type of genetic material.

Organisms need mitosis for growth, to repair damaged tissues, and to replace old or dead cells. For example, when you cut your skin, mitosis produces new skin cells to heal the wound.

The Cell Cycle

Before mitosis happens, the cell goes through a cycle called the **cell cycle**. Most of the time the cell is in a stage called **interphase**, when it is growing, carrying out normal functions, and copying its DNA. When the cell is ready, it enters mitosis, where the nucleus divides. After mitosis comes **cytokinesis**, when the cell finally splits into two.

The Stages of Mitosis

Mitosis is divided into clear stages:

1. **Prophase** – The chromosomes in the nucleus become visible under a microscope. They shorten and thicken. The nuclear membrane starts to break down and spindle fibres form in the cell.
2. **Metaphase** – The chromosomes line up across the centre of the cell. Spindle fibres attach to the chromosomes.
3. **Anaphase** – The chromosomes are pulled apart and move towards opposite ends (poles) of the cell.
4. **Telophase** – New nuclear membranes form around each set of chromosomes, creating two separate nuclei.
5. **Cytokinesis** – The cytoplasm divides, leaving two identical cells.

Biology Glossary

- **Mitosis** – Cell division that makes two identical cells.
- **Chromosome** – A structure made of DNA carrying genetic information.

- **Interphase** – Stage of the cell cycle when the cell grows and copies DNA.
- **Cytokinesis** – The splitting of the cytoplasm to form two cells.
- **Spindle fibres** – Structures that help separate chromosomes during mitosis.

Biology Tasks

1. In your own words, explain why mitosis is important.
2. Describe what happens in metaphase and anaphase.
3. A body cell has 46 chromosomes. After mitosis, how many chromosomes will each new cell contain? Explain why.
4. Draw and label the stages of mitosis.

Physics: Heat Transfer

What is Heat Transfer?

Heat energy always moves from a hot place to a cooler place. The movement of heat can happen in different ways: **conduction, convection, and radiation**. These processes explain how objects heat up and cool down in our everyday lives.

Conduction

Conduction happens mainly in solids. The particles in a solid are packed closely together. When one part of the solid is heated, its particles vibrate faster. These vibrations are passed along to neighbouring particles, transferring the heat through the solid. Metals are very good conductors because their free electrons also carry energy quickly. Materials like wood and plastic are poor conductors (called **insulators**), which is why they are often used for handles on pans.

Convection

Convection takes place in liquids and gases. When a part of a fluid is heated, the particles gain energy, move faster, and spread apart. This makes the warm fluid less dense, so it rises. Cooler fluid is denser, so it sinks. This creates a continuous circulation called a **convection current**. Convection explains why hot air balloons rise and why radiators warm up a whole room.

Radiation

Radiation does not need particles at all – it transfers heat by **infrared waves**. These waves can travel through a vacuum, which is how the Sun's energy reaches the Earth. Dark, matte surfaces absorb radiation well, while light, shiny surfaces reflect it. This is

why car dashboards are often black (to absorb heat), while emergency blankets are shiny (to reflect heat and keep a person warm).

Physics Glossary

- **Conduction** – Transfer of heat through solids by vibrating particles.
- **Convection** – Transfer of heat in fluids (liquids or gases) due to rising and sinking currents.
- **Radiation** – Transfer of heat by infrared waves, which can travel through space.
- **Convection current** – A circular flow caused by rising warm fluid and sinking cooler fluid.
- **Insulator** – A material that does not allow heat to pass through easily.

Physics Tasks

1. Explain why saucepans are made of metal but have plastic handles.
2. Draw and label convection currents in a room heated by a radiator.
3. A black car and a white car are left in the sun. Which gets hotter and why?
4. Exam Question: Explain how heat is transferred when you warm your hands near (but not touching) a fire.

Chemistry: The Periodic Table

The Structure of the Periodic Table

The **Periodic Table** is a chart that organises all the known chemical elements. The elements are arranged in order of **increasing atomic number**, which tells us how many protons are in the nucleus of an atom. Elements are grouped into columns (called **groups**) and rows (called **periods**).

Elements in the same group have similar properties because they have the same number of **electrons in their outer shell**. This means they react in similar ways. For example, all Group 1 elements (the alkali metals) are very reactive and react strongly with water.

Metals and Non-metals

Most elements in the table are metals, which are shiny, conduct heat and electricity well, and can be bent or shaped. Non-metals are found on the right-hand side. They are often brittle, poor conductors, and have lower melting and boiling points.

Groups to Know

- **Group 1 (Alkali Metals):** These include lithium, sodium, and potassium. They are very reactive, and reactivity increases as you go down the group. They always form +1 ions.
- **Group 7 (Halogens):** These include chlorine, bromine, and iodine. They are reactive non-metals, and their reactivity decreases as you go down the group. They form –1 ions.
- **Group 0 (Noble Gases):** These include helium, neon, and argon. They are very unreactive because their outer shells are full of electrons, making them stable.

Chemistry Glossary

- **Atomic number** – The number of protons in an atom's nucleus.
- **Group** – A column in the periodic table, showing elements with similar properties.
- **Period** – A row in the periodic table.
- **Reactivity** – How easily an element reacts with others.
- **Noble gas** – An element from Group 0 that is unreactive.

Chemistry Tasks

1. Explain why elements in the same group react in similar ways.
2. Compare the reactivity of lithium, sodium, and potassium.
3. Why are noble gases unreactive?
4. Draw and label the periodic table, colouring Groups 1, 7, and 0.
5. Challenge Question: Write the word equation for sodium reacting with chlorine.

End-of-Booklet Review Questions

1. Describe the stages of mitosis in full sentences and explain why it is important.
2. Compare conduction, convection, and radiation, using examples for each.
3. Explain how the structure of the periodic table helps us predict the properties of elements.