

*Important Concepts . . .*

# **Preview Review**



***Science***

***Grade 9***

***W3 - Lesson 3A: Genes and Cell Division***

***W3 - Lesson 3B: Organisms and Matter in  
their Environment***

## Important Concepts of Grade 9 Science

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## Materials Required

Textbook:  
*Science in Action 9*

Science Grade 9

Version 5

Preview/Review W3 - Lesson 3

Publisher: Alberta Distance Learning Centre

Author: Nicole Bondarchuk

In-House Reviewer: Barb Philips

Project Coordinator: Dennis McCarthy

Preview/Review Publishing Coordinating Team: Nina Johnson,

Laura Renkema, and Donna Silgard



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# Preview/Review Concepts for Grade Nine Science



***W3 - Lesson 3A:  
Genes and Cell Division***

# OUTLINE

By the end of this lesson, you should

- explain chromosomes, genes, and DNA
- explain the difference between mitosis and meiosis

## GLOSSARY

**chromosome** - a structure in which DNA is arranged and along which genes are located

**DNA** - deoxyribonucleic acid; genetic material found mainly in the nuclei of cells of living things

**meiosis** - a type of cell division that produces four sex cells from

one parent cell; each sex cell contains half the genetic material of the original cell

**mitosis** - a type of cell division that produces two identical daughter cells from one parent cell

**organelles** - structure in cells that perform a certain function

## W3 - Lesson 3A: Genes and Cell Division

Do you ever get the comment that you look like or have the same traits as your mother or father? Family resemblance has to do with the genetic information found in your cells that has been passed from your mother and father. This lesson introduces genes, chromosomes, DNA, and cell division.

### Cell Division

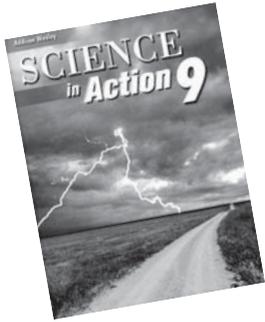
Humans are multicellular organisms. We are made of cells that are specialized and perform certain functions. Although our cells are specialized (i.e., skin cells), each cell contains the same genetic blueprint in its nucleus. Our cells are constantly undergoing cell division to grow and replace existing cells and tissue. For example, every three months we have a totally new red blood cell supply. This occurs by the process of mitosis.

**Mitosis** is an asexual reproductive process. One cell eventually forms two new cells that are identical to the parent cell. For this to happen, everything inside the cell (including all the cell organelles and chromosomes) must double in quantity. The cell then splits in two. In humans, mitosis repairs damage and increases the size of the body.

Humans are also capable of undergoing sexual reproduction by the process of meiosis. Remember that the main purpose of sexual reproduction is to produce variation in offspring. In humans, sperm and eggs are formed that contain half the genetic information of the cell.

**Meiosis** produces four cells with half the number of chromosomes from every parent cell. For this to happen, everything inside the cell (cell organelles and chromosomes) must double in quantity. Two cell divisions then follow. The gametes (egg and sperm) that are produced by meiosis are then able to join in the process of fertilization to produce a whole new different baby with the correct amount of genetic information.

Read pages 46-47 of *Science in Action 9*.



1. Identify two differences between mitosis and meiosis.

mitosis

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meiosis

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2. If a human cell contains 46 chromosomes, how many chromosomes will a cell produced by mitosis contain? How many will a cell produced by meiosis have ?

mitosis \_\_\_\_\_

meiosis \_\_\_\_\_

3. Identify the main purpose of mitosis and meiosis in humans.

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## DNA, Chromosomes, and Genes

Traits such as eye colour and curly hair are passed to children from their parents. This information is carried by the genetic blueprint they receive when the egg and sperm, produced by meiosis, unite. What is that genetic blueprint and where is it found?

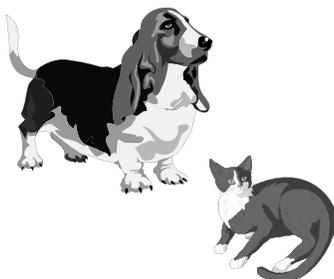
Our genetic blueprint is basically a set of instructions. The instructions are written in code in the form of **DNA**. DNA stands for deoxyribonucleic acid. It is found in the nucleus of almost every cell in a body.

We can compare the structure of DNA to a twisted ladder. The sides of the ladder are alternating deoxyribose sugar and phosphate groups. The rungs of the ladder are sequences of nitrogen bases that are paired. The nitrogen bases that make up the rungs are adenine, guanine, cytosine, and thymine. Adenine (A) always pairs with thymine (T). Cytosine (C) always pairs with guanine (G).

Look at Figure 3.4 on page 41 of *Science in Action 9*. DNA in your cells is estimated to be made up of 26 million nitrogen base pairs. The various combinations of these base pairs is what makes you!

Because DNA is such a long complex molecule, it does not fit into the nucleus of your cells in the form that it is in. **Chromosomes** are DNA that is wound around proteins. Chromosomes in humans basically resemble an X shape. Look at Figure 3.6 on page 43 in *Science in Action 9* to see a picture of a chromosome.

One of the things that scientists have found, with the help of microscopes is that chromosomes have banding patterns. These banding patterns are called genes. A **gene** is a segment of DNA that contains coded instructions for the production of a person's traits. For example, one gene codes for a person's skin colour. You need to remember that genes (like chromosomes) are found in pairs. In humans, one gene for a specific trait (such as hair colour) comes from the father and one comes from the mother. The interaction of the two genes produces hair colour. An **allele** is one of the possible forms of a gene that exist for a specific trait.



Read pages 39-45 of *Science in Action 9*.

- Humans have 46 chromosomes that are basically 23 pairs. How many chromosomes do dogs and cats have?

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- 5. How long would a DNA molecule be if it was stretched out? With this information, explain why it is important that DNA is wound into chromosomes.

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- 6. Humans have 46 chromosomes in their cells. Sometimes, mistakes occur during meiosis and a person can have 47 chromosomes. If our genetic blueprint (our set of instructions) is found on 46 chromosomes, what do you think is the effect of adding one more chromosome to a cell?

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### Websites



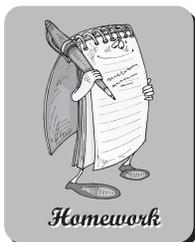
The addresses for the websites below were valid at the time of printing.

<http://www.icnet.uk/kids/cellsrus/cellsrus.html>

<http://www.cellsalive.com/mitosis.htm>



### Homework



- 7. Do some research on the genetic disorder *Down's syndrome*. How many chromosomes does a person with Down's syndrome have? What are some symptoms of this syndrome?

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# Preview/Review Concepts for Grade Nine Science



***W3 - Lesson 3B:  
Organisms and Matter  
in their Environment***

# OUTLINE

By the end of this lesson, you should

- explain the difference between organic and inorganic compounds
- identify the compounds that are necessary for the growth of organisms
- identify and describe the different types of nutrients
- identify how nutrient compounds are taken into organisms

## GLOSSARY

**active transport** - process in which plant and animal cells use energy to move nutrient molecules from areas of lower concentration to areas of higher concentration

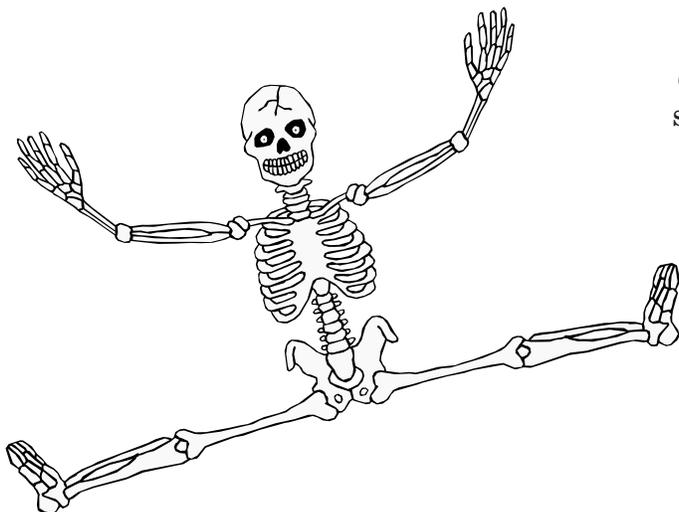
**carbohydrates** - organic molecules made of atoms of carbon, hydrogen, and oxygen; can form

simple molecules such as sugar, or large complex molecules such as starch, cellulose, and glycogen

**ingestion** - process by which food is taken into a body

**macronutrients** - nutrients that organisms need in relatively large amounts

## W3 - Lesson 3B: Organisms and Matter in their Environment



Did you know that your bones need calcium, phosphorus, and magnesium to be solid and healthy? These elements are part of inorganic and organic compounds in our environment. This lesson looks at the lessons we need these elements in our body and how we take them into our body.

### Macronutrients

All organisms need certain nutrients to live and maintain their body structures. Humans are no different. We need a combination of inorganic and organic compounds to survive.

An **organic compound** is a complex molecule that contains carbon. An example is glucose ( $C_6H_{12}O_6$ ), which is required for the process of cellular respiration in our bodies.

An **inorganic compound** is a simpler molecule that usually does not contain carbon. Oxygen ( $O_2$ ) is inorganic and necessary for the process of cellular respiration as well.

A **macronutrient** is a nutrient that an organism needs in large amounts. Here are some examples of macronutrients we need in our bodies.

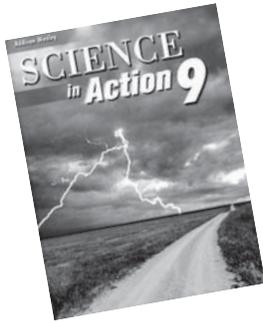


**Nitrogen (N)** is a component of proteins and DNA found in all cells.

**Phosphorus (P)** is a component of bones, teeth, and DNA.

**Potassium (K)** is needed for muscle contraction and nerve impulse.

**Calcium (Ca)** is needed for blood clotting and the building of bones and teeth.



Read pages 196-198 of *Science in Action 9*.

1. A macronutrient is a nutrient that an organism needs in large amounts. What is a micronutrient? Give an example.

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2. Why do plants need phosphorus and calcium?

phosphorus \_\_\_\_\_

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calcium \_\_\_\_\_

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3. Give an example of an organic and inorganic compound not previously mentioned.

organic \_\_\_\_\_

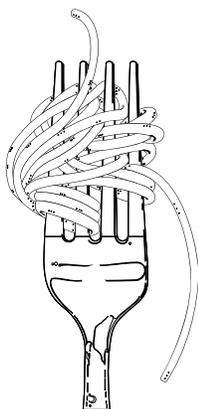
inorganic \_\_\_\_\_



## Types of Organic Molecules

Plants and animals require certain nutrients to live. They can either produce the nutrients themselves or take in the nutrients from another source. The four main classes of nutrients are carbohydrates, lipids, proteins, and nucleic acids.

**Carbohydrates** are complex organic molecules needed in humans to provide a source of energy. An example of a carbohydrate is spaghetti. Carbohydrates break down in the human body into glucose, which is necessary for the process of cellular respiration. Plants are the only organisms capable of producing carbohydrates through the process of photosynthesis.



**Lipids** are basically fats, oils, and waxes. Lipids are necessary for the structure of cell membranes. Both plants and animals produce lipids. Peanuts contain large amounts of oil.

**Proteins** are the building blocks of all cells and tissues. Proteins are made of individual amino acids joined together. We can obtain proteins from both plant (for example, nuts) and animal (for example, meat) sources.

**Nucleic acids** are necessary for the genetic blueprint of an organism. There are two kinds of nucleic acids: DNA and RNA. DNA stores the genetic code for an organism in the nucleus of a cell whereas RNA (ribonucleic acid) is necessary to make proteins. We obtain nucleic acids from plant and animal foods.



Read pages 199-203 of *Science in Action 9*.

4. Classify the following substances by identifying the main nutrient they contain.

- a. rice \_\_\_\_\_
- b. butter \_\_\_\_\_
- c. RNA \_\_\_\_\_
- d. fish \_\_\_\_\_
- e. corn \_\_\_\_\_
- f. eggs \_\_\_\_\_

5. Identify and explain a component of the human body that forms proteins.

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### How Organisms take in Substances



Lunchtime! I have an apple as part of my lunch today. How does the food that is required for our body get to our cells?

The first step in this process is to eat the apple or **ingest** it. The apple then travels through our digestive system and is broken into tiny units (in this case, glucose). Mechanical digestion breaks the apple with our teeth. Chemical digestion, with the help of **enzymes**, causes hydrolysis.

**Hydrolysis** occurs by breaking substances further with the use of water (H<sub>2</sub>O). The smallest units of food are then absorbed into our bloodstream where they are carried to individual cells.

Small substances can enter cells in three ways. The processes are diffusion, osmosis, and active transport.

**Diffusion** is the movement of molecules from an area of **high** concentration to an area of **low** concentration. No extra energy is required for this movement.

**Osmosis** is the movement of water molecules from a **high** concentration to a **low** concentration. No extra energy is required for this movement.

**Active Transport** is the movement of molecules from a **low** concentration to a **high** concentration. This process requires a carrier molecule and the addition of energy.

Read pages 204-206 of *Science in Action 9*.

6. Give an example of a substance that a plant actively transports into itself.

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7. Identify a substance that moves into cells by diffusion.

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8. What are two differences between osmosis and active transport?

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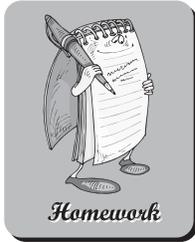
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### Internet Websites

The address for the website below was valid at the time of printing.



[http://kidshealth.org/kid/stay\\_healthy/food/protein\\_carb\\_fat.html](http://kidshealth.org/kid/stay_healthy/food/protein_carb_fat.html)



### Homework

- 9. Place a drop of food colour into a glass of water. Describe what happens. This is an example of diffusion bringing materials into your cells.

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- 10. Here is a second small experiment. Fill a tall clear glass half full with water. Add 1 tablespoon of red or blue food colour into the glass. Place a celery stalk (with leaves) in the water. Leave the experiment for 24 hours. Describe your results. What type of transport do you think is occurring in the celery stalk?

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