



# Science: Year 6

## I. CHEMISTRY: MATTER AND CHANGE

### A. ATOMS, MOLECULES, AND COMPOUNDS

- Basics of atomic structure: nucleus, protons (positive charge), neutrons (neutral), electrons (negative charge)
- Atoms are constantly in motion, electrons move around the nucleus in paths called shells (or energy levels).
- Atoms may join together to form molecules or compounds.
- Common compounds and their formulas:
  - Water H<sub>2</sub>O
  - Salt NaCl
  - Carbon Dioxide CO<sub>2</sub>

### B. ELEMENTS

- Elements have atoms of only one kind, having the same number of protons. There are a little more than 100 different elements.
- The periodic table: organises elements with common properties
  - Atomic symbol and atomic number
- Some well-known elements and their symbols
  - Hydrogen H
  - Helium He
  - Carbon C
  - Nitrogen N
  - Oxygen O
  - Sodium Na
  - Aluminium Al
  - Silicon Si
  - Chlorine Cl
  - Iron Fe
  - Copper Cu
  - Silver Ag
  - Gold Au
- Two important categories of elements: metals and non-metals
  - Metals comprise about 2/3 of the known elements
  - Properties of metals: most are shiny, ductile, malleable, conductive

### C. CHEMICAL AND PHYSICAL CHANGE

- Chemical change changes what a molecule is made up of and results in a new substance with a new molecular structure. Examples of chemical change: rusting of iron, burning of wood, milk turning sour
- Physical change changes only the properties or appearance of the substance, but does not change what the substance is made up of. Examples of physical change: cutting wood or paper, breaking glass, freezing water

## II. CLASSIFYING LIVING THINGS

**Teachers:** As the children study animal classifications, discuss: why do we classify? How does classification help us understand the natural world?

- Scientists have divided living things into five large groups called kingdoms, as follows:
  - Plant
  - Animal
  - Fungus (Mushrooms, yeast, mould, mildew)
  - Protist (algae, protozoans, amoeba, euglena)
  - Prokaryote (blue-green algae, bacteria)
- Each Kingdom is divided into smaller groupings as follows:
  - Kingdom
  - Phylum
  - Class
  - Order
  - Family
  - Genus
  - Species
  - Variety
- When classifying living things, scientists use special names made up of Latin words (or words made to sound like Latin words), which help scientists around the world understand each other and ensure that they are using the same names for the same living things
  - *Homo Sapiens*: the scientific name for the species to which human beings belong to (genus: *Homo*, species: *Sapiens*)
  - Taxonomists: biologists who specialise in classification
- Different classes of vertebrates and major characteristics: fish, amphibians, reptiles, birds, mammals (review from Year 4)

### CELLS: STRUCTURES AND PROCESSES

- All living things are made up of cells
- Structure of cells (both plant and animal)
  - Cell membrane: selectively allows substances in and out
  - Nucleus: surrounded by nuclear membrane, contains genetic material, divides for reproduction
  - Cytoplasm contains organelles, small structure that carry out the chemical activities of the cell, including mitochondria (which produce the cell's energy) and vacuoles (which store food, water, or wastes)
- Plant cells, unlike animal cells, have cell walls and chloroplasts.
- Cells without nuclei: monerans (bacteria)
- Some organisms consist of only a single cell: for example, amoeba, protozoans, some algae.
- Cells are shaped differently in order to perform different functions.
- Organisation of cells into tissues, organs, and systems:
  - In complex organisms, groups of cells form tissues (for example: in animals, skin tissue or muscle tissue; in plants, the skin of an onion or the bark of a tree).
  - Tissues with similar functions form organs (for example: in some animals, the heart, stomach, or brain; in some plants, the root or flower).
  - In complex organisms, organs work together in a system (recall, for example, from earlier studies of the human body, the digestive, circulatory, and respiratory systems).

## TAXONOMIES

**Teachers:** Introduce an example of how an animal is classified, in order for students to become familiar with the system of classification, not to memorise specific names. For example, a collie dog is classified as follows:

- Kingdom: Animalia
- Phylum: Chordata (Subphylum: Vertebrata)
- Class: Mammalia (mammal)
- Order: Carnivora (eats meat)
- Family: Canidae (a group with doglike characteristics)
- Genus: *Canis* (a coyote, wolf, or dog)
- Species: *Familiaris* (a domestic dog)
- Variety: Collie (a breed of dog)

## IV. PLANT STRUCTURES AND PROCESSES

### A. STRUCTURE: NON-VASCULAR AND VASCULAR PLANTS

- Non-vascular plants (for example: algae)
- Vascular plants
  - Vascular plants have tube-like structures that allow water and dissolved nutrients to move through the plant
  - Parts and functions of vascular plants: roots, stems and buds, leaves

### B. PHOTOSYNTHESIS

- Photosynthesis is an important life process that occurs in plant cells, but not animal cells (photo = light; synthesis = putting together). Unlike animals, plants make their own food, through the process of photosynthesis.
- Role in photosynthesis of: energy from sunlight, chlorophyll, carbon dioxide and water, xylem and phloem, stomata, oxygen, sugar (glucose)

## V. LIFE CYCLES AND REPRODUCTION

### A. THE LIFE CYCLE AND REPRODUCTION

- Life cycle: development of an organism from birth to growth, reproduction, death
  - Example: Growth stages of a human: embryo, foetus, newborn, infancy, childhood, adolescence, adulthood, old age
- All living things reproduce themselves. Reproduction may be asexual or sexual.
  - Examples of asexual reproduction: fission (splitting) of bacteria, spores from mildews, moulds, and mushrooms, budding of yeast cells, regeneration and cloning
  - Sexual reproduction requires the joining of special male and female cells, called gametes, to form a fertilised egg.

### B. SEXUAL REPRODUCTION IN ANIMALS

- Reproductive organs: testes (sperm) and ovaries (eggs)
- External fertilisation: spawning
- Internal fertilisation: birds, mammals
- Development of the embryo: egg, zygote, embryo, growth in uterus, foetus, newborn

### C. REPRODUCTION IN PLANTS

- Asexual reproduction
  - Example of algae

- Vegetative reproduction: runners (for example: strawberries) and bulbs (for example: onions), growing plants from eyes, buds, leaves, roots, and stems
- Sexual reproduction by spore bearing plants (for example: mosses and ferns)
- Sexual reproduction of non-flowering seed plants: conifers (for example: pines), male and female cones, wind pollination
- Sexual reproduction of flowering plants (for example: peas)
  - Functions of sepals and petals, stamen (male), anther, pistil (female), ovary (or ovule)
  - Process of seed and fruit production: pollen, wind, insect and bird pollination, fertilisation, growth of ovary, mature fruit
  - Seed germination and plant growth: seed coat, embryo and endosperm, germination (sprouting of new plant), monocots (for example: corn) and dicots (for example: beans)

## VI. THE HUMAN BODY: HORMONES AND REPRODUCTION

### A. HUMAN GROWTH STAGES

- Puberty
  - Glands and hormones (see below, Endocrine System), growth spurt, hair growth, breasts, voice change

### B. THE REPRODUCTIVE SYSTEM

- Females: ovaries, fallopian tubes, uterus, vagina, menstruation
- Males: testes, scrotum, penis, urethra, semen
- Sexual reproduction: intercourse, fertilisation, zygote, implantation of zygote in the uterus, pregnancy, embryo, foetus, newborn

### C THE ENDOCRINE SYSTEM

- The human body has two types of glands: duct glands (such as the salivary glands), and ductless glands, also known as the endocrine glands.
- Endocrine glands secrete (give off) chemicals called hormones. Different hormones control different body processes.
- Pituitary gland: located at the bottom of the brain; secretes hormones that control other glands, and hormones that regulate growth
- Thyroid gland: located below the voice box; secretes a hormone that controls the rate at which the body burns and uses food
- Pancreas: both a duct and a ductless gland; secretes a hormone called insulin that regulates how the body uses and stores sugar; when the pancreas does not produce enough insulin, a person has a sickness called diabetes (which can be controlled).
- Adrenal glands: secrete a hormone called adrenaline, especially when a person is frightened or angry, causing rapid heartbeat and breathing.

## VII. SCIENCE BIOGRAPHIES

- Tim Burners-Lee (inventor of the World Wide Web)
- Humphry Davy (chemist and inventor; discovered alkaline earth metals, chlorine and iodine)
- Dorothy Hodgkin (British chemist, confirmed the structures of penicillin and vitamin B<sub>12</sub>)
- Carl Linnaeus (botanist and 'Father of taxonomy' who standardised the classification system)