

SCIENCE

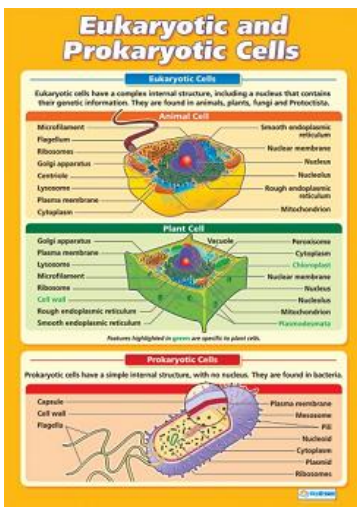
Posters

The posters are colourful and informative. Using the posters in the classroom, noticeboards and corridors makes learning fun and interesting and teaching becomes easy and effective too. The large A1 size makes the bright and informative chart highly readable from a distance, complementing every learning environment.

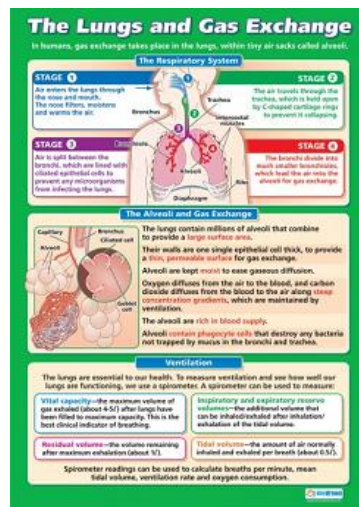
Reasons for using posters

1. About one third of students in an average classroom are visual learners.
2. Visual learners respond well to **colour**.
3. Images, photographs and diagrams are helpful learning aids for visual learners.
4. Words linked to pictures help visual learners grasp and remember new concepts.
5. Posters help reinforce important concepts and can be referred to regularly.
6. Posters can act as reference for students instead of asking the teachers.
7. Posters can keep your classroom/school fresh and **stimulating**.

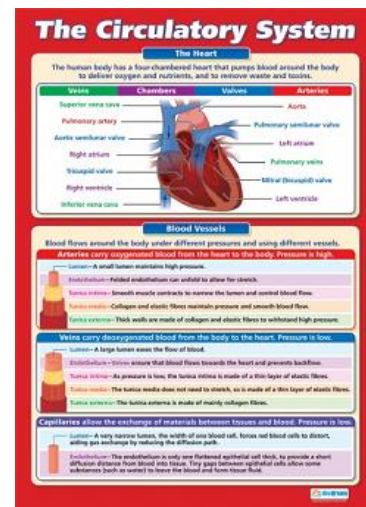
Posters – Biology



Eukaryotic and Prokaryotic Cells
Code: SAL 01 (A1 size)



The Lungs and Gas Exchange
Code: SAL 02 (A1 size)



The Circulatory System (A1 size)
Code: SAL 03

CMN Enterprise

19 Soo Chow View Singapore 575411

Tel: 90600089 Fax : 65199196, Email: cmn@live.com.sg

Posters – Biology

The Immune System

The immune system is a system of organs, cells and tissues that protects the body against pathogens and disease.

Attacking

The immune system attacks organisms and substances that invade the body in a process called the immune response. The body can be invaded by:

Parasites
Organisms such as fleas and head lice, that live in another organism and cause harm by taking nutrition from their host.

Pathogens
Organisms that cause harm and disease by taking nutrition from their host and causing damage in the process. Examples include types of bacteria, viruses (e.g. HIV and measles), fungi and protozoa.

Defending

All cells have a chemical marker on their surfaces known as an antigen. The body recognises its own antigens, but other antigens stimulate an immune response.

The body's defences include:

Physical defences

- Skin
- Nose (lysozymes, mucus)
- Cilia
- Mucus membranes

Chemical defences

- Tears (contain lysozymes)
- Wax (antimicrobial properties)
- Stomach acid
- Harmless bacteria in stomach, vagina and urethra
- Sweat (acidic and contains enzymes)

Cellular Defences

The blood is the body's first defence. It contains many types of white blood cells, including:

Neutrophils

Function: Neutrophils are the most common type of white blood cell. They function as phagocytes. As they ingest and destroy foreign and infected particles and cells, primarily of bacteria.

Macrophages

Function: Macrophages are phagocytes of larger particles, such as old red blood cells. They ingest and destroy foreign and infected particles and cells before getting to the tissues.

Lymphocytes

Function: Lymphocytes produce B lymphocytes and T lymphocytes. B lymphocytes produce antibodies. T lymphocytes destroy infected cells.

The Immune System
Code: SAL 04 (A1 size)

The Liver

The liver is the body's chemical factory; it deals with many different chemicals and processes, and performs an estimated 500 functions.

The Liver

The Lobule – The Liver's functional unit

The Main Functions of the Liver

The liver breaks down excess amino acids from proteins to form urea using two processes:

Deamination
Amino acids are converted into a keto acid which is used in respiration, and highly toxic ammonia.

Urea Cycle
Ammonia must not build up inside the body. It is quickly converted into urea by combining it with carbon dioxide.

Detoxification of Alcohol
The liver is responsible for detoxification, which occurs in the hepatocytes. (detoxifies many compounds, including alcohol)

Other Important Processes

- Metabolism of carbohydrates to produce such as glycogen and gluconeogenesis
- Regulation of blood levels of key substances such as glucose, lipids and amino acids
- Synthesis of compounds such as proteins (e.g. albumin), lipids (e.g. cholesterol) and bile
- Storage of substances such as glucose, vitamin A, B6 and B12, and minerals, such as iron

The Liver (A1 size)
Code: SAL 05

The Kidneys & Urine Production

The kidney's job is to remove waste from our bodies. Blood enters the kidney via the renal artery and leaves via the renal vein. Once inside the kidney, waste is removed and urine is formed in the nephrons.

Kidney Structure

Nephron Structure

- Ultrafiltration**
The glomerulus, a ball of capillaries, filters the blood through the basement membrane. The afferent arteriole, which brings blood into the glomerulus, is wider than the efferent arteriole, which takes blood away from the glomerulus. This path creates a high pressure that forces fluid out of the blood and into the Bowman's capsule.
- Selective Reabsorption**
The filtrate is transported to the proximal convoluted tubule (PCT), the longest, widest part of the nephron. The PCT uses active transport and facilitated diffusion to reabsorb useful substances, such as Na⁺ and Cl⁻ ions, and glucose, back into the blood.
- Reabsorption of water**
Water is absorbed back into the blood in the loop of Henle. There is a high concentration of Na⁺ and Cl⁻ ions in the tissue surrounding the descending limb of the loop. This is a result of ions being pumped out of the fluid in the ascending limb, which is impermeable to water, by active transport. These Na⁺ and Cl⁻ ions in the tissue become hypertonic in comparison to the filtrate. This lower water potential causes water to travel along the concentration gradient, out of the filtrate and into the tissue fluid, by osmosis and active transport in a countercurrent multiplier.
- Controlling Water Content**
The fluid passes along the distal convoluted tubule, where the concentration of salts are adjusted by active transport, to the collecting duct. The walls of the collecting duct are permeable to water. The PCT uses active transport to control how much water is absorbed. The hypothalamus (in the brain) detects that the blood is becoming hypertonic in comparison to the filtrate. The posterior pituitary gland releases ADH, making the collecting duct's walls more permeable to water. The fluid is then transported along the centre by the bladder for urination.

The Kidneys & Urine Production
Code: SAL 06 (A1 size)

Posters – Chemistry

Atomic Structure

Atoms are made up of three fundamental particles: protons, neutrons and electrons.

Orbitals, Subshells and Shells

Orbitals vary in shape, but each one can only hold two electrons.

The same type of orbital combine to form subshells. For example, the p subshell contains three orbitals.

Subshells combine to form shells.

The principal quantum number indicates what an element's electronic energy, and thus, the overall energy of the orbital.

Filling the Shells

Every orbital holds two electrons, each with opposite spins.

When electrons fill the subshell, they first fill each orbital singly and then pair up.

Electrons fill the subshell in the order: s, p, d and f – away the subshell furthest from the nucleus begins to fill the next shell.

Box notation is used to represent an atom's arrangement of electrons, or electronic configuration. Electrons are represented using up and down arrows to demonstrate their opposite facing spins.

Electron configurations are written like this: $1s^2 2s^2 2p^6 3s^2 3p^4$

Atomic Structure (A1 size)
Code: SAL 07

Chemical Bonding

Chemical bonds are the attractive forces that hold molecules together. Chemical bonding can be described in terms of the following types:

- 1. Ionic Bonding**
An ionic bond is formed when electrons transfer from one atom to another. This results in the formation of oppositely charged ions, which are held together by electrostatic attraction.
- 2. Covalent Bonding**
A covalent bond is formed when two atoms share their outer electrons. This results in the formation of a shared pair of electrons, which is held together by electrostatic attraction.
- 3. Dative Covalent (Coordinate) Bonding**
A dative covalent bond is formed when two atoms share a pair of electrons from one of the atoms (the donor) with the other atom (the acceptor).

Remember: Ion – A positively or negatively charged atom or compound formed molecule.
Cation – A positively charged ion. Anion – A negatively charged ion.

Chemical Bonding (A1 size)
Code: SAL 08

The Five Types of Solid Structures

Materials are classified into five types of solid structures based on their structure and bonding.

- 1. Giant Ionic**
This structure is formed by oppositely charged ions held together by strong electrostatic forces. It has a high melting point and is brittle.
- 2. Giant Covalent**
This structure is formed by atoms held together by strong covalent bonds. It has a high melting point and is very hard.
- 3. Simple Molecular**
This structure is formed by small molecules held together by weak intermolecular forces. It has a low melting point and is soft.
- 4. Simple Atomic**
This structure is formed by atoms held together by weak intermolecular forces. It has a low melting point and is soft.
- 5. Giant Metallic**
This structure is formed by metal ions held together by strong electrostatic forces. It has a high melting point and is malleable.

Five Types of Solid Structures
Code: SAL 09 (A1 size)

Organic Chemistry

All organic molecules contain carbon. Carbon atoms can:

- form single, double or even triple bonds with other carbon atoms
- form chains with other elements, such as hydrogen, oxygen, nitrogen and the halogens

Naming Organic Molecules

To name organic molecules, you need to know three things:

- 1. Length of Carbon Chain**
Carbon compounds are named after their longest, unbranched carbon chain, the parent chain. The longer the chain, the stronger the van der Waals forces between molecules, which increase the melting point, boiling point and viscosity.
- 2. Branches**
Some molecules have additional carbon atoms attached to the parent chain. These additional atoms form branches.
- 3. Functional Groups**
Every organic compound has a distinctive functional group that dictates its properties.

For Example: 2-Methylpentan-3-ol

Organic Chemistry (A1 size)
Code: SAL 10

Analytical Chemistry

There are many techniques used to determine the composition and structure of chemical compounds, including:

- Infrared Spectroscopy
- Mass Spectrometry
- High-Resolution Mass Spectrometry
- Elemental Analysis
- Titrimetry
- Chromatography
- Electrochemistry
- Atomic Absorption Spectroscopy
- Atomic Fluorescence Spectroscopy
- Fluorescence Spectroscopy
- UV-Visible Spectroscopy
- Nuclear Magnetic Resonance (NMR)
- Electron Spin Resonance (ESR)
- Radioisotopes
- Radioactive Tracers
- Radioimmunoassay (RIA)
- Radioactive Dating
- Radioactive Labelled Compounds
- Radioactive Tracers in Medicine
- Radioactive Tracers in Agriculture
- Radioactive Tracers in Industry
- Radioactive Tracers in Environmental Science
- Radioactive Tracers in Archaeology
- Radioactive Tracers in Geology
- Radioactive Tracers in Cosmology
- Radioactive Tracers in Astrophysics
- Radioactive Tracers in Planetary Science
- Radioactive Tracers in Oceanography
- Radioactive Tracers in Meteorology
- Radioactive Tracers in Climatology
- Radioactive Tracers in Environmental Chemistry
- Radioactive Tracers in Environmental Physics
- Radioactive Tracers in Environmental Biology
- Radioactive Tracers in Environmental Geology
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- Radioactive Tracers in Environmental Communication
- Radioactive Tracers in Environmental Research
- Radioactive Tracers in Environmental Science

Analytical Chemistry (A1 size)
Code: SAL 11

Enthalpy

Enthalpy (H) is the energy content that is stored in a thermal system. It is measured by the amount of energy usually heat, that is absorbed or released during a thermal change.

Enthalpy Change

The enthalpy change (ΔH) of a reaction can be calculated by finding the difference between the enthalpy of the products and the enthalpy of the reactants. According to the conservation of energy law, the amount of heat produced within the reaction is equal to the amount of energy released into the surroundings.

$\Delta H = H_{\text{products}} - H_{\text{reactants}}$

Enthalpy profile diagrams are used to show enthalpy change.

Exothermic Reactions

In exothermic reactions, the enthalpy of the products is greater than that of the reactants. Thus, heat is given out to the surroundings.

Exothermic reactions are always exothermic because the enthalpy of the products is less than the enthalpy of the reactants.

Examples include oxidation of fuels.

Endothermic Reactions

In endothermic reactions, the enthalpy of the products is less than that of the reactants. Thus, heat is absorbed from the surroundings.

Endothermic reactions are always endothermic because the enthalpy of the products is greater than the enthalpy of the reactants.

Examples include the thermal decomposition of limestone and photosynthesis.

Standard Enthalpy Change

Enthalpy values vary with conditions, so we use standard enthalpy changes (ΔH°), measured under standard conditions:

- Pressure: 100 kPa (1 atmosphere)
- Concentration: the reactions using aqueous solutions – "mol dm⁻³"
- Temperature: Usually 298 K (25°C)
- State: A substance must be in its standard physical state

These conditions are applied to measure enthalpy change for different types of reactions, including standard enthalpy change of formation (ΔH°_f), standard enthalpy change of reaction (ΔH°_r), and standard enthalpy change of combustion (ΔH°_c).

Hess's Law

The total enthalpy change for a chemical reaction is independent of the route by which the reaction is achieved.

Hess's law makes it possible to find enthalpy changes that cannot be measured directly, using existing enthalpy change values and enthalpy cycle diagrams.

For example, find enthalpy change of formation.

We can use values for enthalpy change of combustion.

Route 1: C + 2H₂ → CH₄ + 2H₂O
Route 2: C + O₂ → CO₂
Route 3: 2H₂ + O₂ → 2H₂O

We can use values for ΔH°_c to determine a value for ΔH°_f.

Enthalpy (A1 size)
Code: SAL 12

E-mail cmn@live.com.sg for enquiries

Visit <http://cmnsg.weebly.com/> for more information

Snap Frames

Snapframes are designed for quick and hassle free changeover of posters. They are sold fully assembled and ready to use, with clear PVC cover sheet to protect your poster. The frames are light enough to wall-mount with 4 screws.



All four sides of the Snap Frames can be easily snapped open. Just lift up four sides of frame by hand, insert your poster, place protective sheet on top and then snap frames to close without tools, as easy as 1-2-3!

Features & Benefits of Snap Frame

- Simple - access on all sides of the frame, simply flip open and change posters!
- Good visibility - clear and non-reflective PVC cover
- Durable - made of lightweight yet strong aluminium
- Instant - requires no assembly and arrives ready to use.
- Quick - Change poster from the front, no tools required!
- Eye catching - attracts attention of customers walking past
- Stable - Easy and quick wall mount with use of screws or poster hooks

E-mail cmn@live.com.sg for enquiries

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SAL 02	The Lungs and Gas Exchange	31.00		
SAL 03	The Circulatory System	31.00		
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SAL 18	Capacitors	31.00		
SF1	Snap Frame (A1 size, silver matt)	85.00		
	Lamination service (A1 size)	20.00		
	Frame Mounting Service (min 5 pcs)	10.00		
	Delivery(for orders < \$150)	15.00		
Grand Total				

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