Topic 2: Homeostasis in Living Things

**Homeostasis** is the internal stability that all organisms maintain. Biochemical processes occur in living things and are essential for their survival.

**Energy Storing Process:** Photosynthesis

Equation in words: **water** + **carbon dioxide** $\xrightarrow{\text{sun}}$ **glucose** + **oxygen**

Equation in chemical symbols: $\text{H}_2\text{O} + \text{CO}_2 \xrightarrow{\text{sun}} \text{C}_6\text{H}_{12}\text{O}_6 + \text{O}_2$

*Happens in the **chloroplasts** of plant cells (chlorophyll is the pigment needed)

*Light energy from the sun is converted into chemical energy

**Stomata** - holes on the bottoms of leaves that open and close

- let $\text{CO}_2$ (when open)
- conserve **water** (when closed)
- special cells called **guard cells** control the opening or closing of the holes.

![Guard Cells and Stomata](image)

**Energy Releasing Process:** Cellular Respiration

Equation in words: **glucose** + **oxygen** $\rightarrow$ **water** + **carbon dioxide** + **ATP**

Equation in chemical symbols: $\text{C}_6\text{H}_{12}\text{O}_6 + \text{O}_2 \rightarrow \text{H}_2\text{O} + \text{CO}_2 + \text{ATP}$

*Happens in the **mitochondria** of all cells

*Chemical energy from **glucose** is converted into **ATP** which is a form of energy used by cells.
Organism- All systems working together to maintain life and homeostasis

- **Digestive system** - digest and absorb nutrients
- **Respiratory System** - Gas exchange (oxygen & carbon dioxide)
- **Immune System** - protects the body from viruses and bacteria (pathogens/antigens)
  - **Pathogens** - disease causing organisms (virus, bacteria, fungus, microorganisms, protists)
  - **Antigens** - are like protein name tags that have a special shape to fit the white blood cells can recognize the name tags to
  - **White Blood Cells** - produce antibodies that have a special shapes to fit into or recognize the bad pathogens/antigens and destroy them or label them for destruction (immune response).
  - **Vaccines** - dead/weakened pathogen injected into your body so the WBC can "practice" making antibodies for it...makes a person IMMUNE to the pathogen.
  - **Antibiotics** - medications given to fight bacterial infections.
  - **Allergy** - body makes antibodies to harmless antigens (pollen, dust, peanut butter)
  - **AIDS** - H.I.V. destroys WBC's...no immunity
- **Nervous System** - used for fast communication between cells to maintain homeostasis.
- **Endocrine System** - Hormones - (chemical message) is sent through the blood to a target cell/organ that has the correct shaped receptors.
  - **Feedback Mechanisms** - maintain homeostasis by regulating the amount of sugar, water, calcium in your body/blood
  - Ex. If blood sugar is too high, insulin is released from the pancreas to bring it back to normal levels.
- **Excretory System** - removes wastes from the body (kidneys, skin, lungs)
- **Skeletal Muscular System** - Locomotion
Dynamic Equilibrium - the constant small corrections that must occur to maintain homeostasis.

Enzymes - Specially shaped proteins that digest or synthesize large molecules. They are needed for most metabolic activities (homeostasis/equilibrium).

- Enzymes are specific in their action and their substrate (what they digest or synthesize). Substrate "fits" into the substrate.

Ex. Protease digests proteins. Lipase digests lipids.

- Enzymes are catalysts (increase the rate of the reaction).

Ex. Starch will eventually breakdown into simple sugars but... enzymes make the reaction happen 100 times faster.

- If you change the shape of an enzyme (denature), you change the speed of it or make it stop functioning.

Factors affecting enzyme activity:

- Temperature and pH (acidic/basic) and amount of enzyme or substrate affect the rate at which enzymes work. Every enzyme has an optimal (best) temperature and pH that it can work the fastest (highest rate).

The optimum temperature is $40^\circ C$. 
1. Which process is represented by the arrow in the diagram below?

- Energy Stored in Food → Energy Available for Use by Living Organisms

- 1. growth
- 2. respiration
- 3. regulation
- 4. excretion

2. In photosynthesis, chlorophyll functions in changing
- 1. glucose molecules to starch
- 2. water and carbon dioxide to sugar
- 3. light energy to chemical bond energy
- 4. hydrogen bonds to water

3. The basic inorganic materials used during photosynthesis are
- 1. H₂O and C₆H₁₂O₆
- 2. O₂ and CO₂
- 3. H₂O and CO₂
- 4. C₆H₁₂O₆ and CO₂

4. Bromthymol blue turns to bromthymol yellow in the presence of carbon dioxide. When the carbon dioxide is removed, the solution will return to a blue color. Two green water plants were placed in separate test tubes, each containing water and bromthymol yellow. Both test tubes were corked. One tube was placed in the light, the other in the dark. After several days, the liquid in the tube exposed to the light turned blue.

This demonstration illustrates that, during photosynthesis, green plants

- 1. take in carbon dioxide
- 2. need bromthymol blue
- 3. give off oxygen gas
- 4. form ATP molecules

5. Most of the oxygen in the atmosphere results from the process of

- 1. fermentation
- 2. photosynthesis
- 3. regulation
- 4. respiration

6. Most of the food and oxygen in the environment is produced by the action of

- 1. saprophytic bacteria
- 2. heterotrophic organisms
- 3. aerobic protozoans
- 4. autotrophic organisms

7. Photosynthesis transforms molecules of water and carbon dioxide into molecules of

- 1. carbohydrate and oxygen
- 2. carbohydrate and nitrogen
- 3. polypeptide and oxygen
- 4. polypeptide and nitrogen

8. If the leaves of a geranium plant receive an adequate supply of raw materials, which graph shows how the rate of photosynthesis is related to increasing light intensity received by the plant?

- 1. 
- 2. 
- 3. 
- 4. 

9. The graph below represents the absorption spectrum of chlorophyll.

- Percent of Absorption
- Wavelength of Light

The graph indicates that the energy used in photosynthesis is most likely obtained from which regions of the spectrum?

- 1. yellow and orange red
- 2. violet blue and green
- 3. orange red and violet blue
- 4. green and yellow
10. Anaerobic respiration is considered to be less efficient than aerobic respiration because
   1) less lactic acid is formed during anaerobic respiration than aerobic respiration
   2) anaerobic respiration requires more oxygen than aerobic respiration
   3) the net gain of ATP molecules is less in anaerobic respiration than in aerobic respiration
   4) less energy is required during anaerobic respiration than aerobic respiration

11. Which word equation represents a type of fermentation?
   1) glucose → lactic acid + energy
   2) glucose + oxygen → carbon dioxide + water + energy
   3) starch + water → simple sugars
   4) carbon dioxide + water → glucose + oxygen + water

12. The products produced by yeast cells as a result of anaerobic respiration include ATP and
   1) alcohol and oxygen
   2) alcohol and carbon dioxide
   3) water and oxygen
   4) water and carbon dioxide

13. In a green plant cell, oxygen is used primarily for the process of
   1) dehydration synthesis
   2) photosynthesis
   3) respiration
   4) capillary action

14. In animals, the organelles in which aerobic cellular respiration occurs are known as
   1) ribosomes
   2) chloroplasts
   3) nuclear membranes
   4) mitochondria

15. Which substance is represented by X in the word equation below?
   glucose + X → enzymes → water + carbon dioxide + ATP
   1) alcohol
   2) chlorophyll
   3) oxygen
   4) lactic acid

16. In humans, what happens when the breathing rate increases?
   1) Additional oxygen will diffuse into the blood as carbon dioxide diffuses out of the blood in the lungs.
   2) Additional carbon dioxide will diffuse into the blood as oxygen diffuses out of the blood in the lungs.
   3) Oxygen from body cells will diffuse more rapidly into red blood cells.
   4) Increased oxygen dissolved in the blood will stimulate the cerebrum to slow the breathing rate.
Base your answers to questions 17 through 20 on the diagrams below of organ systems and on your knowledge of biology.

18. Tendonitis is a condition that would most directly involve which two systems?
   1) A and B
   2) C and D
   3) E and F
   4) A and G

19. Cardiovascular diseases interfere most directly with the normal functioning of system
   1) E
   2) G
   3) C
   4) D

20. Polio is a disease caused by a virus that directly destroys cells in system
   1) A
   2) B
   3) C
   4) D

17. Which disorder would most directly involve an organ in system F?
   1) anemia
   2) constipation
   3) bronchitis
   4) meningitis
Homework Topic 2

21. Base your answer to the following question on the reading passage below and on your knowledge of biology.

Polio Vaccines

Polio is a disease that results in the destruction of nerve cells. The first vaccine against polio was developed by Jonas Salk and was made from polio viruses that were killed using the chemical formalin. In 1953, Salk tested the vaccine on himself, his wife, and his three sons. The vaccine was found to be safe and seemed to work. In 1954, more than 1.8 million schoolchildren were part of a trial to test the vaccine, and in April 1955, the vaccine was declared to be safe and effective.

Albert Sabin also developed a vaccine against polio. The vaccine developed by Sabin was made from weakened polio viruses. While the Salk vaccine had to be injected, the Sabin vaccine was administered orally on a cube of sugar.

Both vaccines were found to be effective in protecting people against polio because these vaccines stimulate immune responses involving antibody production. However, the Sabin vaccine is effective over a longer period of time and is easier to administer. Together, these vaccines have nearly eliminated polio in many parts of the world.

Which statement about the Salk vaccine is correct?
1) Dead viruses are injected.
2) Antibodies are injected.
3) Antibodies are administered orally.
4) Sugar cubes are administered orally.

22. People who receive organ transplants sometimes produce antibodies in response to foreign proteins present in the organ of the donor. This reaction is an example of
1) regeneration
2) clotting
3) rejection
4) deamination

23. An individual who has had chicken pox rarely gets this disease again. This situation is an example of
1) biological control
2) negative feedback
3) active immunity
4) passive immunity

Base your answers to questions 24 through 26 on the diagram of the human heart below and on your knowledge of biology.

24. Oxygenated blood from the left lung is returned to the heart through a structure labeled
1) A
2) E
3) C
4) D

25. Which sequence correctly represents the flow of blood through the heart?
1) 4 → 3 and 2 → 1
2) 2 → 1 and 3 → 4
3) 1 → 2 and 3 → 4
4) 1 → 2 and 4 → 3
Homework Topic 2

26. In the ventricles, deoxygenated blood is prevented from mixing with oxygenated blood by the structure labeled

1) A
2) B
3) C
4) D

27. Which statement best describes enzymes?
1) They slow down the rate of breathing.
2) They are the building blocks of polymers.
3) They speed up the conduction of impulses along a nerve cell.
4) They influence the rate of chemical reactions.

28. A similarity between the nervous system and the endocrine system in humans is that they both
1) are composed of neurons
2) are composed of glands
3) maintain homeostasis
4) secrete chemicals across synapses

29. Some pituitary hormones cause the ovaries to secrete hormones. These ovarian hormones then influence the production of the pituitary hormones. This type of control mechanism is known as
1) ovulation
2) negative feedback
3) gametogenesis
4) a menstrual cycle