Year 8 Science: Key Concepts Walkthrough

A streamlined guide to the essential knowledge for Units 1, 4, and 7.

Unit 1: Respiration, Gas Exchange, and Circulation

1. Aerobic Respiration

- **Definition:** The chemical process in cells where glucose is broken down using oxygen to release energy.
- **Word Equation:**
  Glucose + Oxygen → Carbon Dioxide + Water (+ Energy)
    - *Remember: This happens in the **mitochondria** of your cells.*

2. The Breathing System & Gas Exchange

- **Pathway of Air:** Air enters through the **mouth/nose** → **Trachea** (windpipe) → **Bronchus** (into each lung) → **Bronchioles** (smaller branches) → **Alveoli** (tiny air sacs).
- **Gas Exchange in the Alveoli:**
    - **Diffusion:** The movement of particles from an area of **high concentration** to an area of **low concentration**.
    - **Process:** Oxygen diffuses from the air in the alveoli (high O_2) into the blood (low O_2). Carbon dioxide diffuses from the blood (high CO_2) into the alveoli (low CO_2) to be breathed out.

3. The Mechanism of Breathing

This is all about changing pressure in your lungs to draw air in or push it out.

Action	Diaphragm	Rib Cage	Lung Volume	Pressure	Air Flow
Inhalation	Contracts & flattens	Moves up and out	Increases	Decreases	**In**
Exhalation	Relaxes & domes up	Moves down and in	Decreases	Increases	**Out**

- **Key Relationship:** When volume **increases**, pressure **decreases** (and vice versa). Air always moves from high-pressure areas to low-pressure areas.

4. Blood Composition

- **Red Blood Cells:** Contain **haemoglobin**, which carries **oxygen**.
- **White Blood Cells:** Defend against pathogens by producing antibodies and engulfing microbes.
- **Platelets:** Small cell fragments that clump together to form blood **clots**.
- **Plasma:** The yellow liquid part of blood that carries everything (cells, nutrients, hormones, waste).

5. Blood Vessels

- **Arteries:** Carry blood **away from the heart** (usually oxygenated). Thick, muscular walls to withstand high pressure.
- **Veins:** Carry blood **towards the heart** (usually deoxygenated). Thinner walls and have **valves** to prevent backflow.
- **Capillaries:** Microscopic, thin-walled vessels that connect arteries and veins. This is where **gas and nutrient exchange** with body tissues occurs.

Unit 4: Ecosystems and Interactions

1. Ecosystems

- **Definition:** A community of interacting **biotic** (living) and **abiotic** (non-living) components in a specific area.

2. Adaptations

- **Definition:** Features or behaviours that help an organism survive in its environment.
- **Example: The Saguaro Cactus (Desert)**
    - **Thick, waxy skin:** Reduces water loss.
    - **Spines:** Minimise surface area for transpiration and protect from herbivores.
    - **Shallow, wide roots:** Quickly absorb rainwater.
    - **Expandable stem:** Stores vast amounts of water.

3. Invasive Species

- **Native Species:** Naturally belong to an ecosystem.
- **Invasive Species:** A non-native species introduced (often by humans) that causes ecological or economic harm.
- **Effects:** Outcompete natives for resources, introduce disease, alter habitats, and reduce **biodiversity**.

4. Bioaccumulation & Biomagnification

- **Pesticide:** A chemical used to kill pests.
- **Persistent Chemical:** A chemical that does **not break down easily** in the environment.
- **Bioaccumulation:** The build-up of a chemical in the tissues of a **single organism** over its lifetime.
- **Biomagnification:** The **increase in concentration** of a chemical at each successive **trophic level** in a food chain. Top predators are most at risk.

Unit 7: Health, Diet, and Movement

1. Diet and Nutrients

- **A Balanced Diet:** Contains the right proportions of the seven nutrient groups: **Carbohydrates, Proteins, Fats, Vitamins, Minerals, Water, and Fibre**.
- **Key Components:**
    - **Vitamins & Minerals:** Essential for various body functions (e.g., immune system, bone health).
    - **Fibre:** Aids digestion and prevents constipation.
- **Malnutrition:** The result of an unbalanced diet (too much or too little of specific nutrients).

2. Deficiency Diseases

- **Anaemia:** Caused by lack of **Iron**. Leads to fatigue due to reduced red blood cells.
- **Rickets:** Caused by lack of **Vitamin D or Calcium**. Leads to soft, weak bones.
- **Scurvy:** Caused by lack of **Vitamin C**. Leads to bleeding gums and joint pain.

3. Growth vs. Development

- **Growth:** An increase in **physical size** (e.g., height, mass).
- **Development:** The acquisition of **new skills and abilities** (e.g., learning to walk, puberty).

4. Harmful Effects of Smoking

- **Tar:** A sticky substance that damages the cilia and alveoli, leading to diseases like **bronchitis** and **lung cancer**.
- **Nicotine:** The highly **addictive** stimulant drug that increases heart rate.
- **Carbon Monoxide:** A poisonous gas that binds to haemoglobin in red blood cells, **reducing oxygen transport**.

5. Moving the Body: The Skeletal and Muscular Systems

- **Joint:** A place where two or more bones meet.
- **Types of Joints:**
    - **Hinge Joint:** Allows movement in **one plane** (e.g., elbow, knee).
    - **Ball and Socket Joint:** Allows **rotational** movement (e.g., shoulder, hip).
- **Bones of the Arm & Shoulder:**
    - **Scapula:** Shoulder blade.
    - **Humerus:** Upper arm bone.
    - **Radius & Ulna:** Lower arm bones (radius is on the thumb side).
- **Muscles and Movement:**
    - **Tendons:** Connect **muscle to bone**.
    - **Antagonistic Muscle Pairs:** Muscles work in pairs. As one contracts (the **agonist**), the other relaxes (the **antagonist**).
    - **Example (Bicep & Tricep):**
        - **Bending the arm:** Bicep **contracts** (agonist), Tricep **relaxes** (antagonist).
        - **Straightening the arm:** Tricep **contracts** (agonist), Bicep **relaxes** (antagonist).

Real-World Examples

Example of Bioaccumulation & Biomagnification: The Great Lakes

- **Pollutant:** PCBs (a persistent industrial chemical).
- **Process:**
    1. **Bioaccumulation:** Plankton absorb PCBs from the water.
    2. **Biomagnification:** Small fish eat many plankton, concentrating the PCBs. Large predatory fish (like trout) eat the small fish, further concentrating the toxin. Birds of prey (eagles) that eat the large fish receive a lethal dose.

- **Effect:** Caused population decline in top predators before regulations were enforced.

Example of an Invasive Species: The Cane Toad in Australia

- **Origin:** South and Central America.
- **Introduction:** Brought to Australia in 1935 to control sugarcane beetles.
- **Impact:**
    - **Toxic:** Native predators (quolls, snakes) die when they eat the toads.
    - **Outcompetes:** Reproduces rapidly and consumes food resources of native species.
    - **Result:** Severe decline in native predator populations, disrupting the food web.

Good luck with your studies! Use this guide as a checklist for your revision.

Practice Questions

Unit 1: Respiration, Gas Exchange, and Circulation

1. **State** the word equation for aerobic respiration.
2. Where in the cell does most of the process of aerobic respiration take place?
3. **List** the pathway of air from when it enters the body to the site of gas exchange.
4. **Define** the term 'diffusion'.
5. **Describe** how oxygen and carbon dioxide are exchanged in the alveoli. Use the term 'diffusion' in your answer.
6. During inhalation, does the pressure inside the lungs increase or decrease? **Explain** why this happens.
7. **Compare** the structure and function of arteries and veins.
8. **Explain** why capillaries have walls that are only one cell thick.
9. **Identify** the component of blood that is responsible for fighting infection.
10. What is the function of platelets?

Unit 4: Ecosystems and Interactions

11. **Define** the term 'ecosystem' and give one example of a biotic and one abiotic component within it.
12. **Describe** two adaptations of a cactus that help it survive in a desert environment.
13. **Explain** why an introduced species can become an invasive species and cause harm.
14. **Distinguish** between *bioaccumulation* and *biomagnification*.
15. In a food chain: Algae → Zooplankton → Small Fish → Osprey (a bird of prey), if a pesticide is sprayed, which organism would have the highest concentration of the chemical in its body? **Explain** why.

Unit 7: Health, Diet, and Movement

16. **List** the seven essential components of a balanced diet.
17. **Name** the deficiency disease caused by a lack of:
    a) Iron
    b) Vitamin C
    c) Vitamin D/Calcium
18. **Distinguish** between **growth** and **development** in humans.
19. **Explain** how carbon monoxide in cigarette smoke affects the blood's ability to transport oxygen.
20. Using the example of the arm, **describe** how an antagonistic muscle pair (bicep and tricep) works to bend and straighten the elbow.

Answers

1. Glucose + Oxygen → Carbon Dioxide + Water (+ Energy)
2. In the mitochondria.
3. Mouth/Nose → Trachea → Bronchi → Bronchioles → Alveoli.
4. The movement of particles from an area of high concentration to an area of low concentration.
5. Oxygen diffuses from the air in the alveoli (high concentration) into the blood (low concentration). Carbon dioxide diffuses from the blood (high concentration) into the alveoli (low concentration) to be exhaled.
6. It decreases. When the diaphragm contracts and the rib cage moves up and out, the volume of the lungs increases, which causes the pressure inside to decrease.
7. **Arteries** carry blood *away* from the heart under high pressure, so they have thick, muscular walls. **Veins** carry blood *towards* the heart under low pressure, so they have thinner walls and contain valves to prevent backflow.
8. This thin wall minimises the diffusion distance, allowing for the rapid exchange of substances (like oxygen and carbon dioxide) between the blood and the body's tissues.
9. White blood cells.
10. They clump together at the site of a wound to form a blood clot, which stops bleeding and prevents pathogens from entering.
11. An ecosystem is a community of interacting living (biotic) and non-living (abiotic) components in an area. Example: A pond ecosystem. Biotic: Fish. Abiotic: Water.
12. Any two from: Thick, waxy skin to reduce water loss; spines to minimise surface area and for protection; shallow, wide roots to quickly absorb water; expandable stem to store water.
13. Without its natural predators, diseases, or competitors from its original home, the introduced species can reproduce rapidly and outcompete native species for resources (food, space), leading to a reduction in biodiversity.
14. **Bioaccumulation** is the build-up of a chemical in the tissues of a *single organism* over time. **Biomagnification** is the *increase in concentration* of a chemical at each successive *trophic level* in a food chain.
15. The Osprey. **Explanation:** The pesticide is persistent and does not break down. It bioaccumulates in each organism and is then biomagnified as it passes up the food chain. The Osprey, as the top predator, consumes many small fish, each containing concentrated pesticide, leading to the highest concentration in its body.
16. Carbohydrates, Proteins, Fats, Vitamins, Minerals, Water, Fibre.

17. a) Anaemia; b) Scurvy; c) Rickets.
18. **Growth** is an increase in physical size (e.g., getting taller). **Development** is the acquisition of new skills and abilities (e.g., learning to talk, undergoing puberty).
19. Carbon monoxide binds to haemoglobin in red blood cells more easily than oxygen does. This reduces the amount of oxygen that can be carried by the blood, leading to oxygen deprivation in the body's cells.
20. To bend the arm (flexion): The bicep contracts and shortens (agonist) while the tricep relaxes and lengthens (antagonist). To straighten the arm (extension): The tricep contracts and shortens (agonist) while the bicep relaxes and lengthens (antagonist).