Year 7 Science: Key Concepts Walkthrough

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

Unit 1: Cells, Tissues, Organs, and Organ Systems

1. Plant Cell vs. Animal Cell

All cells have a **cell membrane, cytoplasm, and a nucleus**. The key differences are:

Feature	Plant Cell	Animal Cell
Cell Wall	✅ Yes (made of cellulose, provides rigid support)	❌ No
Chloroplasts	✅ Yes (contain chlorophyll for photosynthesis)	❌ No
Vacuole	Large, permanent (stores cell sap)	Small, temporary (stores food/wa

2. Levels of Organisation

- **Cell:** The basic unit of life.
- **Tissue:** A group of **similar cells** working together to perform a function (e.g., muscle tissue).
- **Organ:** A structure made of **different tissues** working together (e.g., the heart, made of muscle, nerve, and blood tissue).
- **Organ System:** A group of **organs** working together (e.g., the digestive system).
- **Organism:** A complete living thing.

3. Multi-cellular vs. Uni-cellular

- **Uni-cellular:** An organism made of **only one cell** (e.g., bacteria, amoeba, yeast). This one cell carries out all life functions.

- **Multi-cellular:** An organism made of **many cells** (e.g., humans, trees, cats). Cells are specialised to perform specific jobs.

4. Respiration

- **Definition:** The chemical process that takes place in **every living cell** to release energy from food (glucose).
- **Where it happens:** The reaction begins in the **cytoplasm** and is completed in the **mitochondria**.
- **Word Equation:**
  Glucose + Oxygen → Carbon Dioxide + Water (+ Energy)
    - *This is why all organisms need food and oxygen. The energy released is used for everything: moving, growing, and keeping warm.*

5. Specialised Cells

Cells have unique shapes and features (**adaptations**) to help them do their job.

- **Animal Cells:**
    - **Neuron (Nerve Cell):** Long, thin fibres to carry electrical signals quickly around the body.
    - **Ciliated Cell:** Has tiny hair-like structures (cilia) that waft mucus and dirt out of the airways.
    - **Red Blood Cell:** Has a biconcave shape for a large surface area and contains **haemoglobin** to carry oxygen. **No nucleus** to make more space.
- **Plant Cells:**
    - **Palisade Cell:** Packed with **chloroplasts** to absorb maximum light for photosynthesis.
    - **Root Hair Cell:** Long, thin 'hair' that extends from the root, giving it a huge surface area to absorb water and minerals from the soil.

Unit 4: Grouping and Identifying Organisms

1. Species

- **Definition:** A group of similar organisms that can **interbreed to produce fertile offspring**.

2. Variation

- **Definition:** The differences that exist **between individuals of the same species**. These can be due to genetics (e.g., eye colour) or the environment (e.g., a scar).

3. Hybrids (Non-Species Examples)

- **What is a hybrid?** The offspring resulting from the cross-breeding of two **different species**.
- **Why are they not a new species?** Hybrids are almost always **infertile** (cannot produce their own offspring).
- **Examples:**
    - **Mule:** Cross between a male donkey and a female horse. **Infertile.**
    - **Liger / Tigon:** Cross between a lion and a tiger. **Usually infertile.**

4. Dichotomous Keys

- **Definition:** A tool used by scientists to identify unknown organisms based on a series of choices.
- **Why are they used?** To classify and identify organisms in a logical, step-by-step way.
- **Styles:**
    - **Question Style:** "Does the organism have wings?"
    - **Statement Style:** "1a. Has wings.....Go to 2" and "1b. Does not have wings.....Go to 3"

- **Constructing a Key:** You use observable, contrasting physical characteristics (e.g., wings/no wings, number of legs, shape of leaves) to split the group into smaller and smaller groups until each organism is identified.

Unit 7: Microorganisms in the Environment

1. Types of Microorganisms

Tiny living things, often visible only under a microscope.

- **Bacteria:** Single-celled, some cause disease, many are useful (e.g., in decay).
- **Fungi:** Includes mushrooms, mould, and yeast. They are decomposers.
- **Algae:** Mostly aquatic, can make their own food via photosynthesis (e.g., seaweed).
- **Protozoa:** Single-celled animal-like organisms (e.g., amoeba).

2. Food Chains and Webs

- **Producer:** An organism that makes its own food (usually by **photosynthesis**), e.g., plants, algae.
- **Consumer:** An organism that gets energy by **eating** other organisms.
    - **Primary Consumer:** Eats producers (herbivore).
    - **Secondary Consumer:** Eats primary consumers (carnivore/omnivore).
    - **Tertiary Consumer:** Eats secondary consumers (top carnivore).
- **Predator:** An animal that hunts and eats other animals (**prey**).
- **Prey:** An animal that is hunted and eaten by a **predator**.

3. Microorganisms and Decay

- **Decomposers:** Microorganisms (especially bacteria and fungi) that break down dead material and waste.

- **Useful:** They recycle nutrients (like carbon and nitrogen) back into the soil for plants to use. This is essential for all ecosystems.
- **Harmful:** Some microorganisms cause decay in our food (making it mouldy), or cause diseases in plants, animals, and humans.

4. Microorganisms and Food Webs

Microorganisms are the **ultimate recyclers**. In any food web, when a producer or consumer dies, it is the decomposers that break down its body. This means that **all energy and matter eventually flow through microorganisms** back to the environment.

Real-World Examples

Example of a Dichotomous Key: Identifying Pond Creatures

Imagine you find these organisms in a pond: a Mayfly Nymph, a Dragonfly Nymph, and a Water Louse.

A Simple Dichotomous Key:

1. a) Has a long, slender body ..... Go to 2
   b) Has a wide, flat body ..... **Water Louse**
2. a) Has three long "tails" at the end of its body .... **Mayfly Nymph**
   b) Does not have three tails, body ends in a point ... **Dragonfly Nymph**

Example of Microorganisms as Decomposers: A Fallen Log in a Forest

- **Scenario:** A large tree falls in the forest.
- **Process:**
    1. **Fungi** (like mushrooms and mould) grow on the log, secreting enzymes to break down the tough wood.
    2. **Bacteria** join in, breaking down the material further.

- **Useful Effect:** Over time, the hard wood is broken down into rich, dark **humus** (soil). The nutrients (like carbon and minerals) that were locked in the tree are released back into the soil, fertilising it for new plants to grow. This is nature's recycling system!

Example of a Specialised Cell: The Root Hair Cell

- **Location:** On the surface of plant roots.
- **Specialisation:** It has a long, thin extension (the root hair) that massively increases its **surface area**.
- **Function:** This large surface area allows the cell to absorb water and dissolved minerals from the soil much more efficiently, which is essential for the plant's survival.

Scientific Skills: Identifying Variables

In a fair test, we change one thing and measure its effect, while keeping everything else the same.

- **Independent Variable:** The one **you change** on purpose.
    - *Example: "Investigating how light affects plant growth."*
    - **Independent Variable:** The amount of light the plant receives.
- **Dependent Variable:** The one **you measure** as a result.
    - *Example: "Investigating how light affects plant growth."*
    - **Dependent Variable:** The height of the plant (in cm).
- **Control Variables:** The things **you keep the same** to make it a fair test.
    - *Example: "Investigating how light affects plant growth."*

    - **Control Variables:** The type of plant, the amount of water, the type of soil, the temperature.

Another Example:

- **Question:** Does the temperature of water affect how quickly sugar dissolves?
- **Independent Variable:** Temperature of the water.
- **Dependent Variable:** Time it takes for the sugar to dissolve.
- **Control Variables:** Amount of water, amount of sugar, type of sugar, no stirring.

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

Practice Questions

Unit 1: Cells, Tissues, Organs, and Organ Systems

1. **List** three structures found in both plant and animal cells.
2. **State** the main function of the chloroplast in a plant cell.
3. A student looks at a cell under a microscope. It has a cell wall and a large permanent vacuole. **Identify** whether it is a plant or animal cell. **Justify** your answer.
4. **Place** the following terms in order from the simplest to the most complex: Organ, Cell, Organ System, Tissue, Organism.
5. **Define** the term 'organ' and give one example.
6. **Compare** unicellular and multicellular organisms. Give one example of each.
7. **State** the word equation for aerobic respiration.
8. **Explain** why red blood cells do not have a nucleus.
9. **Describe** one adaptation of a root hair cell and explain how it helps the plant.
10. A neuron (nerve cell) is long and thin. **Explain** how this shape is an adaptation for its function.

Unit 4: Grouping and Identifying Organisms

11. **Define** the term 'species'.
12. **Explain** why a mule (a cross between a horse and a donkey) is not considered a new species.
13. A student finds an insect with 6 legs and wings. **State** one more observation they could make to help identify it using a key.
14. **Construct** a simple two-step dichotomous key to distinguish between a fish, a frog, and a snake. (Hint: Think about legs and body covering).

Unit 7: Microorganisms in the Environment

15. **List** the four main types of microorganisms.
16. In a food chain: Grass → Grasshopper → Frog → Hawk, **identify** the primary consumer and the tertiary consumer.
17. **Explain** why decomposers, like bacteria and fungi, are essential for an ecosystem.
18. **Describe** the role of algae in a pond food web.
19. Give **one** useful and **one** harmful effect of microorganisms.

Scientific Skills

20. An investigation is set up to see if fertiliser affects the growth of tomato plants.

- **What is the independent variable?**
- **What is the dependent variable?**
- **Name two control variables** you would need to keep the same.

Answers

1. Cell membrane, cytoplasm, nucleus.
2. To absorb light energy for photosynthesis.
3. Plant cell. Justification: Animal cells do not have a cell wall or a large permanent vacuole.
4. Cell → Tissue → Organ → Organ System → Organism.
5. An organ is a structure made of different tissues working together to perform a specific function. Example: The heart, stomach, or leaf.
6. Unicellular organisms are made of one cell (e.g., bacteria, amoeba) and carry out all life functions in that one cell. Multicellular organisms are made of many cells (e.g., humans, trees) which are often specialised for specific jobs.
7. Glucose + Oxygen → Carbon Dioxide + Water (+ Energy)
8. The lack of a nucleus creates more space to pack in haemoglobin, allowing the cell to carry more oxygen.
9. Adaptation: It has a long, thin 'root hair' extension. Explanation: This gives it a large surface area, which helps it absorb water and minerals from the soil more efficiently.
10. Its long, thin shape allows it to carry electrical signals over long distances around the body quickly.
11. A group of similar organisms that can interbreed to produce fertile offspring.
12. Mules are almost always infertile and cannot produce their own offspring.
13. Observe the number of wings, the shape of the wings, or the presence/absence of antennae.
14. **Example Key:**
    1a. Has legs ..... Go to 2
    1b. Has no legs ..... Snake
    2a. Has wet skin ..... Frog
    2b. Has scales and fins ..... Fish
15. Bacteria, Fungi, Algae, Protozoa.
16. Primary consumer: Grasshopper. Tertiary consumer: Hawk.

17. They break down dead material and waste, recycling nutrients like carbon and nitrogen back into the soil for plants to use. Without them, nutrients would remain locked in dead matter.
18. Algae are producers. They use photosynthesis to make their own food, providing energy and nutrients for primary consumers in the pond.
19. Useful: Decomposers recycle nutrients / Yeast is used in baking bread. Harmful: Some cause food to go mouldy / Some cause diseases.
20. Independent variable: The presence (or amount) of fertiliser.

    Dependent variable: The growth of the tomato plants (e.g., height, number of leaves).

    Control variables: Type of tomato plant, amount of water, amount of sunlight, temperature, type/size of pot.

Diagram Practice (Animal Vs. Plant)

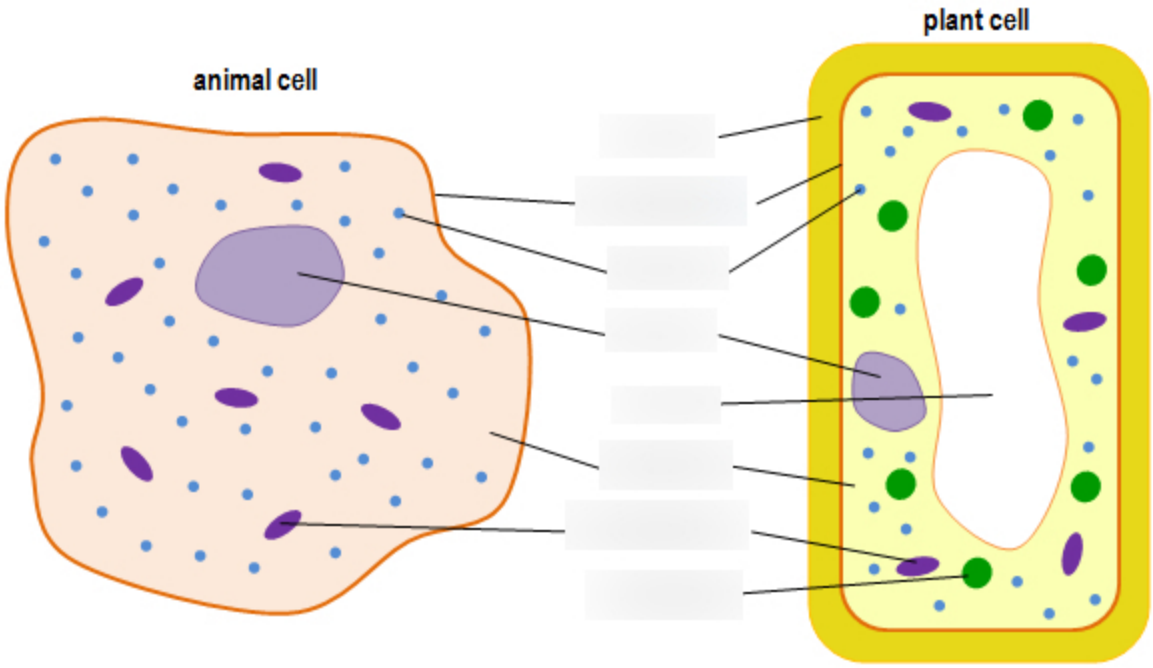

Diagram Practice (Animal Vs. Plant) Answer