

Principles of organisation

4.2.1 · Biology · revision notes

How living things are built up from cells into tissues, organs, organ systems and whole organisms. It is usually tested with short recall questions (defining a tissue or an organ, putting the levels in order, classifying a structure) and as the opening part of longer questions on digestion, the heart or plants.

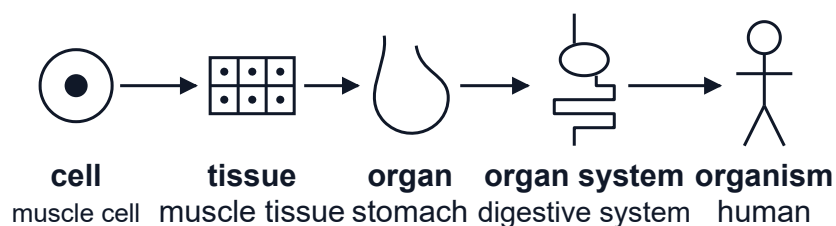
Key facts

- Order: cell → tissue → organ → organ system → organism
- Organ = a group of different tissues working together to perform a specific function
- Stomach tissues: muscular (churns), glandular (makes digestive juice), epithelial (covers)
- Leaf = a plant organ; roots + stem + leaves = the plant transport organ system
- Tissue = a group of cells with a similar structure and function
- Organ system = a group of organs working together to perform a function
- Blood = a tissue; heart = an organ; circulatory system = an organ system

Notes

The levels of organisation

- Cells** are the basic building blocks of all living organisms. In a multicellular organism most cells are specialised for one job.
- A **tissue** is a group of cells with a similar structure and function, e.g. muscular tissue contracts to move things.
- An **organ** is a group of different tissues that work together to perform a specific function, e.g. the stomach, the heart or a leaf.
- An **organ system** is a group of organs that work together to perform a function, e.g. the digestive system digests and absorbs food.
- Organ systems work together to form an **organism**.



Levels of organisation, smallest to largest

Examples to learn

- The stomach contains **muscular tissue** (contracts to churn the food), **glandular tissue** (makes digestive juices containing enzymes and acid) and **epithelial tissue** (covers the inside and outside of the stomach).
- Blood is a tissue. The heart is an organ. The heart, blood vessels and blood together make up the circulatory system, an organ system.
- In plants, a leaf is an organ. It contains epidermal tissue, palisade and spongy mesophyll, xylem and phloem.
- The roots, stem and leaves together form a plant organ system that transports substances around the plant.

How to answer each type of question

Recall: define a level or put the levels in order

1 mark each

Grade 3

1. Learn the exact definitions: 'similar structure and function' for a tissue, 'different tissues working together' for an organ.
2. For ordering questions, always start with the cell and finish with the organism.

Example. (a) What is a tissue?

(b) Put these in order from smallest to largest: organ, cell, organ system, tissue.

Model answer. (a) A group of cells with a similar structure and function (1)

(b) cell → tissue → organ → organ system (1)

Classify structures by level of organisation

1 mark each

Grade 5

1. Ask yourself: is it one cell, a group of similar cells, several different tissues, or several organs?
2. Watch for the traps: blood is a tissue, xylem is a tissue, a leaf is an organ.

Example. Give the level of organisation of each structure. Choose from: cell, tissue, organ, organ system.

(a) the heart

(b) xylem

(c) a root hair cell

(d) the stomach, liver, pancreas and intestines working together

Model answer. (a) organ (1)

(b) tissue (1)

(c) cell (1)

(d) organ system (1)

Don't lose marks

- ✗ Defining a tissue as 'a group of cells' without 'with a similar structure and function'.
- ✗ Saying an organ is 'a group of cells'. It is a group of different tissues.

- ✗ Calling blood an organ or a cell. Blood is a tissue.
- ✗ Calling a leaf a tissue. A leaf is an organ; palisade mesophyll and xylem are tissues.
- ✗ Writing 'they work together' without saying what function they carry out.

More tips

Memory tricks

- Order mnemonic: 'Clever Tigers Often Sleep Outside' = Cell, Tissue, Organ, organ System, Organism.
- Each level is made of several of the level below: similar cells make a tissue, different tissues make an organ, different organs make a system.
- Quick test: if it is a single named body part (heart, stomach, leaf, root), it is an organ.

Exam technique

- In 'explain why X is an organ' questions, name the tissues given in the question to show you have applied your knowledge.
- This subtopic is often the first part of a longer question, so learn which organs belong to which organ system.
- Use the key phrases examiners look for: similar structure and function, work together, specific function.

What each grade needs

What you need to be able to do, from the first marks up to the top grade.

Grade 3

Put the levels of organisation in order

From smallest to largest: cell → tissue → organ → organ system → organism.

Grade 4

Define tissue, organ and organ system

A tissue is a group of cells with a similar structure and function, an organ is a group of tissues working together, and an organ system is a group of organs working together.

Grade 5

Classify a structure by its level

For example, a red blood cell is a cell, blood is a tissue, the heart is an organ and the circulatory system is an organ system.

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