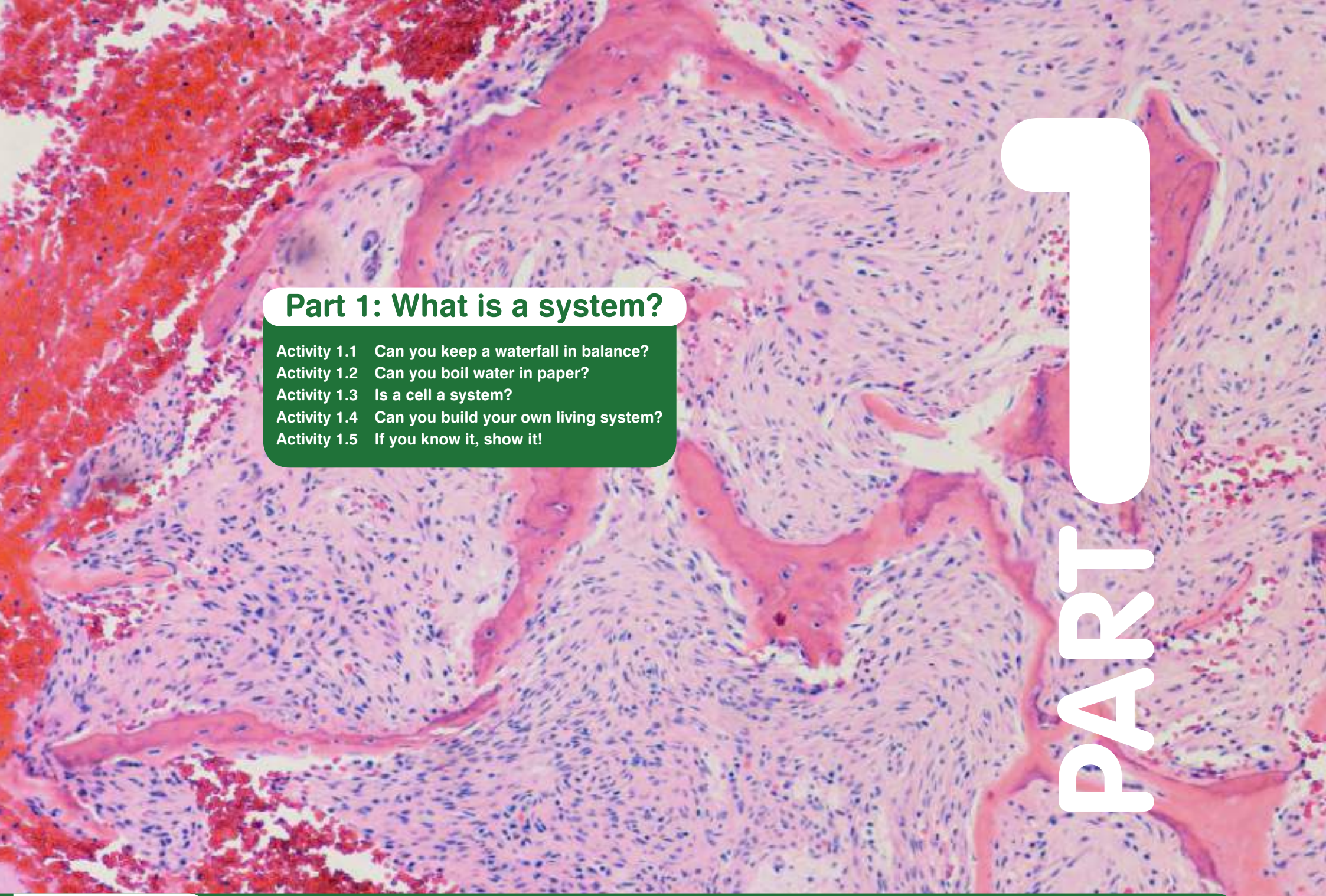


PART 1

Part 1: What is a system?

Activity 1.1 Can you keep a waterfall in balance?

Activity type

DOWNLOAD e-NOTEBOOK

Maintaining balance

What to use:

Each GROUP will require:

- two 1 m lengths of plastic tubing
- 2 tubing clamps
- 2 large containers or laundry buckets
- 4 medium fold back binder clips
- 1 L beaker
- duct tape
- 1 table and chair or steps at 2 heights
- water.

Each STUDENT will require:

- *Science by Doing* ***Notebook.***
- graph paper.

What to do:

Step 1
Set up the system as shown in the diagram.

Step 2
Getting ready for the challenge.

Organise your group so that:

- one student is in charge of the clamp on the upper tube
- one student is in charge of the clamp on the lower tube

Challenge: While the water is flowing can you maintain the water level in the beaker at 500 mL?

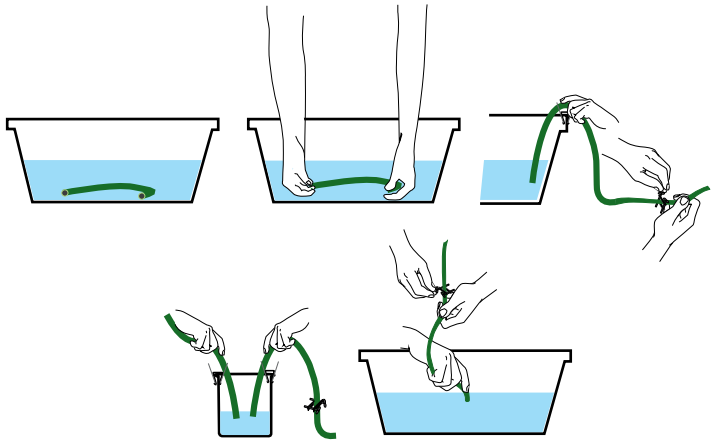
- one student is in charge of recording the water level in the beaker every 10 seconds and then telling the other students. This student could use a table like the following:

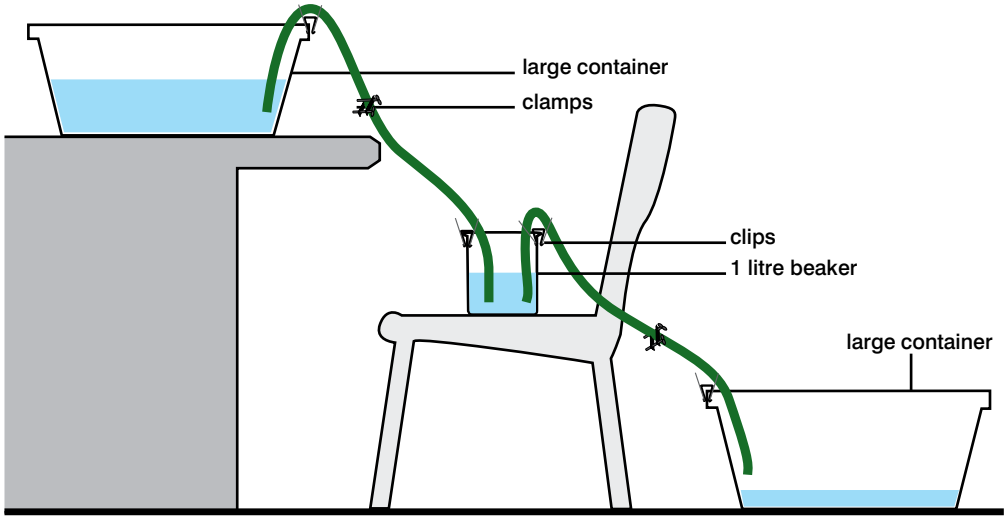
Time (in seconds)	Water volume in beaker (mL)

Step 3
Completing the challenge.

While water is constantly flowing, maintain the water level in the centre beaker at the 500 mL level until the top plastic container is empty.

Step 4
Graph the data collected by your group.





KEEP GOING

How will you communicate with each other to be successful in this challenge?

Discussion:

1. Describe what the members of your group had to do to keep your waterfall system in balance.
2. Compare your graph with other student groups. Which group was the most successful in maintaining the balance in their waterfall system? Explain your answer.

What must be happening for this waterfall system to be in balance?

Science frequently involves thinking in terms of systems in order to understand and explain phenomena. Systems involve separate components working together as an integrated whole. We define the boundaries of the system and identify its inputs and outputs. Systems may have feedback mechanisms that keep the system in balance. Examples of systems include the digestive system, solar system, climate system and ecosystem.

Activity 1.2 Can you boil water in paper?

Activity type

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PREDICT

What do you think will happen when the Bunsen burner is lit and why?

OBSERVE

What did you observe when the lit Bunsen burner was put underneath?

EXPLAIN

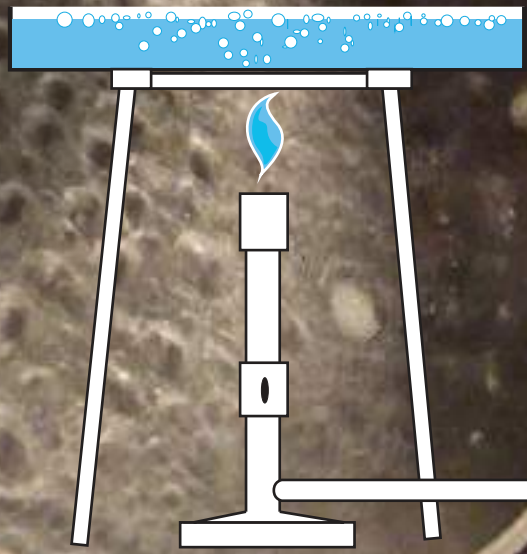
Can you explain your observations?

Boiling water in a paper container

Discussion:

1. What are the parts to this system?
2. What is the input and the output to this system?
3. What is the balance point in this system?
4. What would happen if we kept the Bunsen burner on?

An open saucepan of boiling water is a system in action. What different restoring mechanisms could you use to keep this system in dynamic balance all day?



Activity 1.3 Is a cell a system?

Activity type

DOWNLOAD e-NOTEBOOK

Onion cells bathed in salt solution

What happens to onion cells when in a salt solution?

What to use:

Each GROUP will require:

- compound microscope
- a piece of red onion skin
- microscope slides
- cover slips
- eye dropper/pipette
- water
- 15% salt solution
- probe/toothpick
- forceps and scalpel
- paper towel.

Each STUDENT will require:

- *Science by Doing* ***Notebook.***

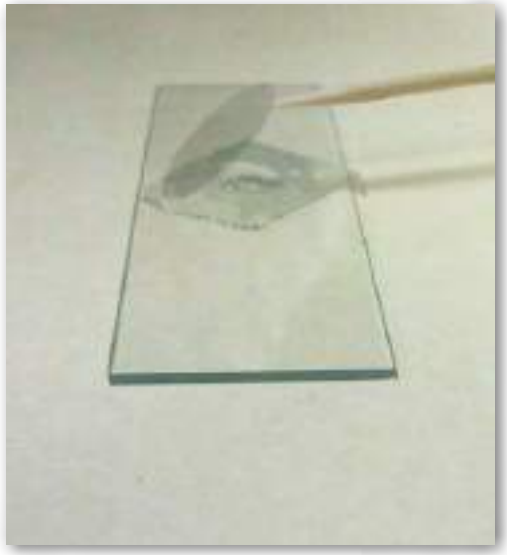
What to do:

Preparing the slide

Step 1
Cut a piece of onion skin (no bigger than the nail on your little finger).

Step 2
Place it as flat as you can in the middle of the microscope slide.

Step 3
Add one drop of water.



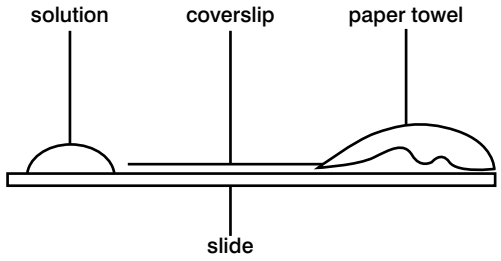
Step 4
Lower the coverslip using a probe or toothpick.

Step 5
Observe the onion cells at 40X magnification and describe and draw what you see in your ***Notebook***.

Step 6
Observe the onion cells at 100X magnification and describe and draw what you see in your ***Notebook***.

Adding the salt solution

Step 7
While observing the onion cells at X100 magnification, pipette 2 drops of salt solution on one side of the cover slip and place a torn piece of paper towel on the opposite side to where the salt solution was placed. The paper towel will draw the salt solution under the coverslip. Describe what you see.



Activity 1.4 Can you build your own living system?

Activity type

CAN YOU BUILD AND SUCCESSFULLY MAINTAIN A BALANCED LIVING SYSTEM?

What parts will make up your system?

What are its inputs?

What will you need to keep it in balance?

Note:

Your teacher will give you special instructions for this activity.

SYSTEMS

Activity 1.5 If you know it, show it!

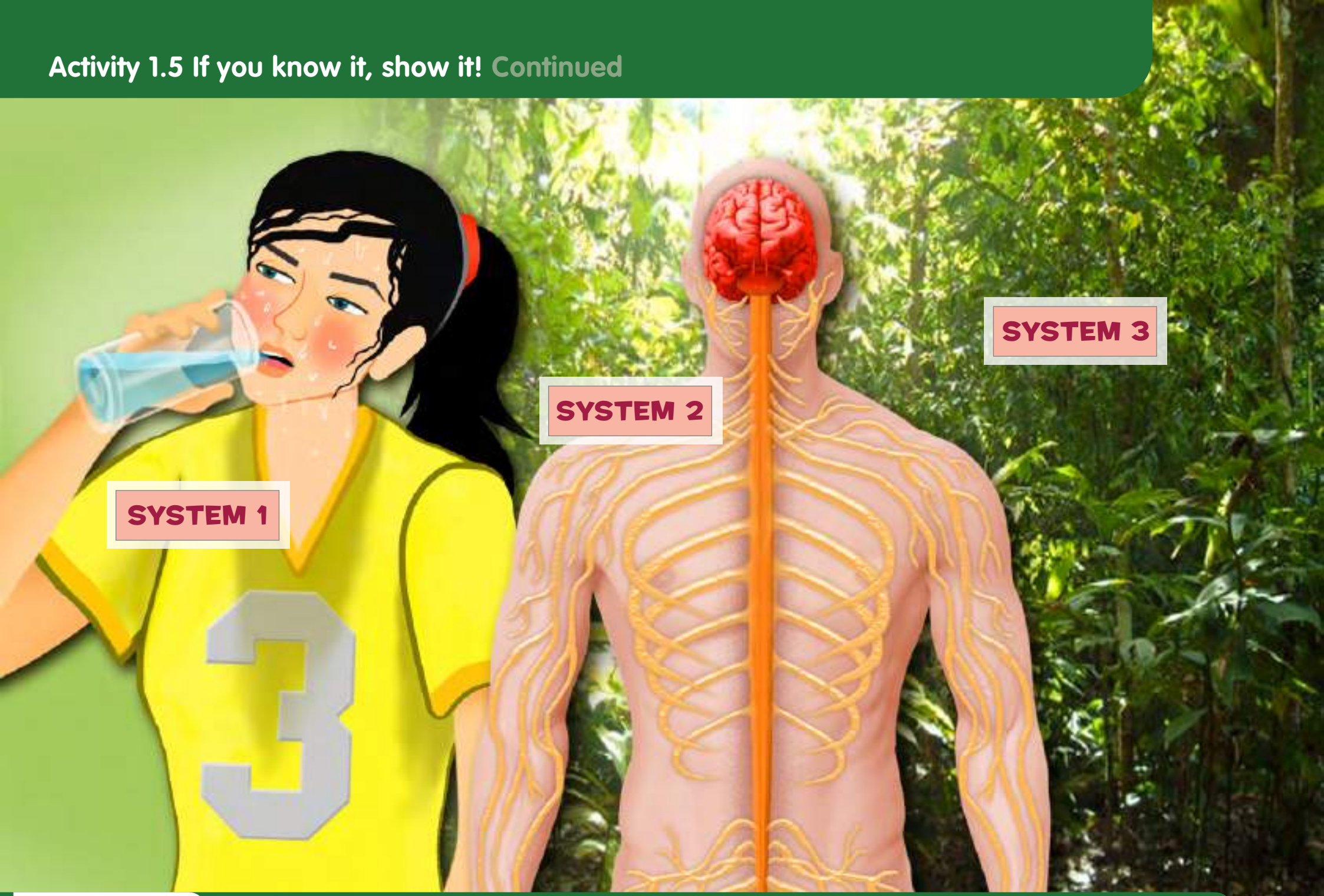
Activity type

DOWNLOAD e-NOTEBOOK

LIVING SYSTEMS

On the next page you can see three living systems. What are they showing? What different parts make up each system? What is happening?

KEEP GOING



Summary

PART 1

Science frequently involves thinking in terms of **systems** in order to understand and explain phenomena. Systems involve separate components working together as an integrated whole. We **define the boundaries** of the system and identify its **inputs** and **outputs**.

When a system is moving around a particular point, it is in **dynamic balance**. The point is called the **set point**. Systems may have **feedback mechanisms** that keep the system maintaining a set point.

When onion cells are bathed in an **isotonic solution** (having the same concentration as the cytoplasm of the cell) there is equal water movement in and out of the cell and the cell remains the same size. Being in an isotonic state is the set point of the cell system.

When a cell is bathed in a stronger salt solution (**hypertonic solution**), water moves by **osmosis** from inside the cell to the outside of the cell and the cell shrinks. The cell system is working to restore the dynamic balance with the solution it is in by moving towards the set point of an isotonic state.

When onion cells are placed in distilled water (**hypotonic solution**) water moves by osmosis from outside to inside the cells and the cells swell. Again, the cell system is working to restore the balance back to an isotonic state.

Examples of systems include the digestive system, solar system, climate system and an ecosystem.

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