Coordination and response in plants and animals

Lesson plan and teacher's notes · Form 1 Biology · 1 period of 40 minutes

School	(write school name)	**Teacher**	(write name)
Date	(date)	**Class**	Form 1
Subject	Biology	**Enrolment**	Boys ___ Girls ___ Total ___
Time	40 minutes	**Topic**	Coordination and response in plants and animals

Learners identify stimuli and responses, tell a tropism in plants from a taxis in animals, and plan a simple seedling investigation. The lesson uses the maize seedling and animals the learners know from home.

Specific outcomes

By the end of the lesson, learners should be able to:

1. Define stimulus, response and coordination with an example each
2. Name phototropism, geotropism, hydrotropism and thigmotropism and say what each responds to
3. Say whether a response is positive or negative
4. Tell a tropism from a taxis and give examples of phototaxis, chemotaxis and hydrotaxis

Prior knowledge

- Living things are sensitive to changes around them
- Plants make food by photosynthesis and take in water through roots
- Parts of a plant: shoot, root, leaf

Teaching and learning materials

- chalk and board
- a potted or planted maize or bean seedling if one is available
- a cardboard box with a hole cut in one side, for the demonstration
- exercise books

References

Ministry of Education (CDC) Form 1 Biology syllabus and module; 25Schools learners' note: Coordination and response in plants and animals.

Lesson development

Stage and time	Teacher activities	Learner activities
Introduction **5 min**	Touch a warm cup or ask a learner to pull their hand back from a hot pot in the story you tell. Ask: what changed, and what did the body do? Write the words stimulus and response on the board beside the answers.	Answer in pairs, naming the change and the reaction.
Development: stimulus and response **8 min**	List stimuli on the board: light, water, touch, gravity, temperature, smell. For each, ask for a response from a plant or an animal. Define coordination as the parts of the organism working together so it can detect a stimulus and respond.	Match stimuli to responses from their own surroundings and copy the three definitions.
Development: tropisms **10 min**	Draw the table of tropisms on the board. Explain that a tropism is a growth movement of part of a plant and that its direction depends on the stimulus. Show positive as towards the stimulus and negative as away. Describe the box with a side hole: the seedling bends towards the hole.	Copy the table. Predict which way a shoot and a root grow for each stimulus and say positive or negative.
Development: taxes **10 min**	Contrast a tropism with a taxis: a taxis is the movement of the whole animal towards or away from a stimulus. Use moths to a lamp, houseflies to rotting food and woodlice to damp places. Ask which is positive and which is negative.	Sort the examples into phototaxis, chemotaxis and hydrotaxis, and say positive or negative for each.
Conclusion **7 min**	Ask three learners to give one tropism and one taxis in their own words. Set up the seedling investigation as homework and ask what must be kept the same for both seedlings.	State one tropism and one taxis. Copy the homework.

Teacher's content notes

Read these before the lesson. They are what you need to know, not what to copy onto the board.

Stimulus, response and coordination

A stimulus is a change in the surroundings that an organism can detect, such as light, water, touch, gravity or a smell. The response is what the organism does. Coordination is the working together of the parts of the organism so that it can detect the stimulus and respond.

Tropism

A tropism is a growth movement of part of a plant whose direction depends on the direction of the stimulus. It is positive if the part grows towards the stimulus and negative if it grows away. Plant tropisms are controlled by hormones, which are chemicals made in one part of the plant that control growth in another.

How phototropism works

In phototropism a hormone collects on the shaded side of the shoot and makes the cells there grow longer than the cells on the lit side. The shoot then bends towards the light. This is the idea to give learners who ask why the shoot bends.

Taxis

A taxis is the movement of the whole animal towards or away from a stimulus. It is named after the stimulus: phototaxis for light, chemotaxis for a chemical and hydrotaxis for water or moisture. Moths flying to a lamp show positive phototaxis; earthworms and woodlice moving away from light show negative phototaxis.

Why responses help

Shoots growing towards light get more light for photosynthesis. Roots growing downwards hold the plant in the soil, and roots growing towards water take in the water and mineral salts the plant needs. Animals gain by moving towards food and away from danger.

Questions to ask during the lesson

Question	Expected answer
A boy touches a hot cooking pot at his grandmother's kitchen in the village and pulls his hand away at once. (a) Name the stimulus. (b) Name the response. (c) Say what coordination means here.	(a) Heat. (b) Pulling the hand away. (c) The parts of the body acting together to detect the heat and respond.
A bean plant in a garden winds its stem round a stick pushed into the ground next to it. (a) Name the stimulus. (b) Name the tropism. (c) Say whether it is positive or negative.	(a) Touch. (b) Thigmotropism. (c) Positive, because the stem grows towards the support.
Houseflies gather around a pile of rotting food behind a market stall. (a) What is the stimulus? (b) Name the response. (c) Is it a positive or a negative response?	(a) A chemical, the smell of the food. (b) Chemotaxis. (c) Positive, because the flies move towards it.
A learner buries a germinating maize grain and, after some days, sees the root grow downwards while the shoot grows up. (a) Name the stimulus that makes the root grow down. (b) Name the tropism. (c) Say why it helps the plant.	(a) Gravity. (b) Geotropism, positive for the root. (c) The root holds the plant firmly in the soil.

Worked examples for the board

Example 1: a seedling by a window

A maize seedling on a windowsill bends towards the glass. The stimulus is light from one side, so the response is phototropism. The shoot grows towards the stimulus, so it is a positive response.

Example 2: a moth at a lamp

A moth flies towards a lamp at night. The stimulus is light, and the whole animal moves, so it is a taxis: phototaxis. The movement is towards the stimulus, so it is positive.

Example 3: a woodlouse under a log

A woodlouse moves away from light and hides under a log. The stimulus is light and the animal moves away from it, so it is negative phototaxis, not a tropism.

Board plan

Write the title. Left: the definitions of stimulus, response and coordination. Centre: the table of tropisms with the columns tropism, stimulus and plant part. Right: three animal examples under the heading taxis, each with positive or negative. Keep the box and seedling sketch for the bottom corner.

Tropism	Stimulus	Usual response
Phototropism	Light	Shoot grows towards light
Geotropism	Gravity	Root grows downwards
Hydrotropism	Water	Root grows towards water
Thigmotropism	Touch	Climbing stem winds round a support

Plant tropisms as the teacher writes them on the board

Mistakes to expect

Learners often think	Put it right
Plants do not respond to anything because they cannot move.	Show the bending seedling. A plant responds by growing a part of itself towards or away from a stimulus, which is a tropism.
A tropism and a taxis are the same thing.	Ask what part moves. A tropism is a growth movement of part of a plant; a taxis is the whole animal moving.
Positive means good and negative means bad.	Positive means towards the stimulus and negative means away from it, whether or not it helps the organism.

Differentiation

Learners who struggle

Give learners the four tropism names with the stimulus already written and ask only for the direction of growth. Use real objects such as a seedling or a leaf on the windowsill.

Learners who finish early

Ask learners who finish early to design a fair test to show geotropism in a germinating bean, saying what they keep the same and what they change.

Hearing or visual impairment

For learners with hearing impairment, write each key word on the board and face the class when speaking. For learners with visual impairment, let them feel a bent seedling and a straight one, and describe each drawing aloud while pointing to the table.

No projector, no printing

Everything is drawn on the board. The box demonstration needs only a cardboard box and a seedling from the school garden, and the animal examples come from what learners see at home.

If time is short

Keep the stimulus and response definitions and the tropism table. Move the taxis examples to the next lesson and set the seedling investigation as homework.

Evaluation

Question or task	A correct answer shows
A learner places a maize seedling on a windowsill in the classroom and after three days its shoot bends towards the window. (a) Name the stimulus. (b) Name the response and say whether it is positive or negative. (c) Say why this helps the plant.	(a) Light. (b) Phototropism, positive. (c) The shoot gets more light for photosynthesis, which is how the plant makes food.
After rain a farmer lifts a log and finds woodlice that run away from the light and hide in the damp soil under it. (a) Name the stimulus the woodlice respond to first. (b) Say whether it is a positive or negative response. (c) Say whether this is a tropism or a taxis, and why.	(a) Light. (b) Negative phototaxis. (c) A taxis, because the whole animal moves.
A learner grows two seedlings, one in a box with a hole in one side and one in the open, and keeps everything else the same. (a) What is the stimulus in the box? (b) What will the seedling in the box do? (c) Why must everything else be kept the same?	(a) Light from one direction. (b) Bend towards the hole. (c) So that only the light direction can explain the difference.

Homework

A learner in Feira sets up two maize seedlings, one in a box with a hole cut in one side and one in the open. (a) Predict what each will look like after a week. (b) Name the tropism shown. (c) List two things that must be the same for both seedlings.

Extra practice with answers

Question	Answer

1. A farmer notices that the roots of a young tree near a stream grow towards the water while the shoot grows up towards the sun. (a) Name the tropism of the roots. (b) Name the tropism of the shoot. (c) Say why each helps the tree.	(a) Hydrotropism. (b) Phototropism. (c) Roots take in water and mineral salts; the shoot gets light for photosynthesis.
2. At night at a school hostel, moths and flying insects crowd around the lamp outside the door and earthworms come out on the wet ground. (a) Name the response of the moths. (b) Say whether it is a tropism or a taxis. (c) Say why it is positive.	(a) Phototaxis. (b) A taxis, because the whole animal moves. (c) The moths move towards the stimulus, the light.
3. A learner puts a pot of maize on its side in a dark cupboard and a week later the shoot has turned upwards. (a) Name the stimulus. (b) Name the tropism. (c) Say whether the shoot's response is positive or negative.	(a) Gravity. (b) Geotropism. (c) Negative, because the shoot grows away from gravity.
4. A class lays out two trays of soil, one dry and one damp, and releases ten woodlice in the middle of each, and most gather in the damp part. (a) Name the stimulus. (b) Name the response. (c) Say whether it is positive or negative.	(a) Water or moisture. (b) Hydrotaxis. (c) Positive, because they move towards moisture.
5. A learner says that a climbing bean plant must be able to move because it wraps itself round a pole, so she calls it a taxis. (a) What does the plant respond to? (b) What is the correct word for the response? (c) Explain her mistake.	(a) Touch. (b) Thigmotropism. (c) A taxis is the movement of a whole animal; the plant only grows a part of itself.
6. A learner shines a torch from one side onto a seedling every day and covers the other seedling with a box open on all sides. (a) What does the first seedling do? (b) What does the second seedling do? (c) What do the results show?	(a) Its shoot bends towards the torch. (b) It grows straight up. (c) A shoot grows towards light from one direction: phototropism.

Answers to the learners' check-yourself questions

1. Define a stimulus and give two examples.
   A stimulus is a change in the surroundings that an organism can detect. Examples: light, gravity, water, touch, temperature or a chemical.
2. What is the difference between a tropism and a taxis?
   A tropism is a growth movement of part of a plant in response to a stimulus. A taxis is a movement of the whole animal towards or away from a stimulus.
3. A maize seedling is placed near a window and its shoot bends towards the window. Name the tropism and say whether it is positive or negative.
   Phototropism. It is positive because the shoot grows towards the light.
4. Describe how the shoot and the root of a germinating bean seed respond to gravity.
   The shoot shows negative geotropism and grows upwards. The root shows positive geotropism and grows downwards.

5. Why is it useful for a plant root to show positive hydrotropism?
   The root grows towards water, so the plant can take in the water and mineral salts it needs.
6. A bean plant has stems that coil round a stake. Name this tropism and state the stimulus.
   Thigmotropism. The stimulus is touch (contact with the stake).
7. Flying termites gather round a lamp at night. Name the type of taxis and say whether it is positive or negative.
   Phototaxis. It is positive because the termites move towards the light.
8. Woodlice are found under a damp rotting log. Name the taxis that explains this and say why it helps them.
   Hydrotaxis (positive). A woodlouse loses water quickly in dry air and can dry out and die, so staying in a damp place keeps it alive.

Teacher's reflection

What went well:

What I will change next time:

Learners who need follow-up: