

Measuring: Science by Keith Kelly

AGE: Teenagers

LEVEL: Intermediate

TIME NEEDED: Approx. 90 minutes

OBJECTIVES: to learn about the conditions necessary for plant germination; to prepare seeds for germination; to hypothesize about seedling growth under variable conditions; to observe and measure seedling growth; to record and present measurements in tabular form; to make conclusions based on hypothesis; to write up an experiment.

KEY SKILLS: reading, practical work, observation, note taking, writing

MATERIALS: one copy of the worksheet per student; one copy of *Conditions for germination*, *Measuring seedling growth* and *Comparing seedling growth* per student; enough materials for germinating seedlings in pairs (per pair: two glasses or jars, four kidney beans, paper, water); a bean and a germinating kidney bean;

Note: students need to be able to use a dark place and a sunlit place for 20 days.

Content focus Measuring seedling growth

Warm-up: 5 minutes

Activity 1: 10 minutes

Activity 2: 10 minutes

Activity 3: 10 minutes

Activity 4: recording measurements over 20 days

Activity 5: 20 minutes

WARM-UP

Show the class a kidney bean and a newly germinating kidney bean seedling or use the image included in the handout *Conditions for germination*. Ask the class what happens for the bean to become a seedling. Accept all suggestions but don't give any help at this stage. Just get the students interested in the topic.

ACTIVITY 1

Divide the students into groups of four to discuss what conditions a seed needs to grow into a plant. Walk

around the room and facilitate discussions. Ask students to write down any ideas they have.

After 5 minutes, write up any suggestions the students make on the board but don't give any help at this stage. They may suggest nutrients, water, the right temperature, oxygen, sunlight.

Get the students to read the text *Conditions for germination* on their own and check their ideas. Did they find anything else to add to the list?

ACTIVITY 2

Get students to discuss in their groups how they could test different conditions and their effect on seedling growth.

Discuss as a class and take suggestions from around the room. Ask students which variable would be the easiest to test in the class and direct the discussion towards the variable 'light'.

ACTIVITY 3

Tell students that they are going to work in their groups to test how light affects the growth of a seedling. Hand out *Measuring seedling growth* and tell the groups to read the instructions carefully. Next they should collect their equipment and prepare their experiment as a group.

ACTIVITY 4

This activity takes 20 days to complete, so get the students to think about how they will first collect their data, and how they will present their data using the handout *Comparing seedling growth*.

Dedicate 10 minutes every two days for students to collect their measurements and record them in their report sheets. If you don't see the students that frequently, arrange for them to visit their experiment to take measurements.

ACTIVITY 5

Get individuals to write up their report using their measurements and the handout *Comparing seedling growth*. Tell students to use full sentences in their write-up of the results, using the key words as a starting point.

Direct students to [Your CLIL: Measuring](#) and [Your CLIL: Comparisons](#) for more ideas.

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Language focus
Measuring

- Activity 1: 5 minutes
- Activity 2: 15 minutes
- Activity 3: 20 minutes

ACTIVITY 1

Get students to look at the adjectives for describing size, distance and shape and match the opposites.

Key _____
1. b; 2. h; 3. d; 4. f; 5. g; 6. a; 7. e; 8. c

ACTIVITY 2

Ask students to form nouns from the measurement adjectives by adding suffixes (-th, -ness, -ment). Remind students that the spelling of some of the adjectives might need to be changed. Let them use a dictionary if necessary. Then ask students to complete the wordsearch to find the nouns.

Key _____
1. depth; 2. length; 3. width; 4. hardness; 5. softness;
6. thickness; 7. thinness; 8. loudness; 9. heaviness;
10. lightness

I	S	L	H	G	P	S	P	D	G	W	R	I	B	J	Y
L	O	I	O	A	X	A	O	E	E	C	S	F	L	G	O
O	F	E	D	P	D	C	G	P	H	P	I	N	U	R	C
Q	S	S	E	Q	S	L	L	T	R	H	A	R	A	Z	E
H	V	Z	L	Q	T	I	E	H	E	B	A	L	V	X	V
I	A	T	O	N	H	G	N	H	H	R	E	S	O	O	O
L	O	R	U	L	I	H	G	E	A	L	E	E	N	S	W
E	Q	W	D	R	N	T	T	A	L	R	C	C	B	O	E
N	L	L	N	N	N	N	H	V	O	E	S	I	F	I	X
D	H	O	E	E	E	E	F	I	O	J	O	L	S	E	J
R	I	O	S	J	S	S	C	N	C	G	F	H	E	A	U
O	E	X	S	S	S	S	S	E	I	K	T	F	S	I	I
E	C	C	S	G	F	G	V	S	A	D	N	N	O	N	R
N	E	P	F	H	O	E	V	S	I	X	E	E	A	N	E
P	S	H	T	R	S	W	U	W	N	S	S	E	S	C	O
A	J	R	O	F	O	T	H	C	O	J	S	R	B	S	Z

ACTIVITY 3

Ask students to complete the crossword by filling in the measurement words for quantity, scope and degree.

Key _____
Across: 3. speed, 4. level, 6. average, 9. height
Down: 1. observe, 2. length, 3. size, 5. stage, 7. amount, 8. steps

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Content focus Measuring seedling growth

ACTIVITY 1

Look at the seedling. In groups of four, discuss:

- What conditions does a seed need in order to grow into a plant?

Now read *Conditions for germination* on your own and check your ideas. Did you find anything else?

ACTIVITY 2

In your groups, discuss:

- How could you test these conditions on seedling growth?
- Which condition would be the easiest to test in class?

ACTIVITY 3

You are going to carry out an experiment to compare how seedlings grow in different light conditions. In your groups, collect your equipment from your teacher and prepare your experiment using the handout *Measuring seedling growth*.

ACTIVITY 4

Use the handout *Comparing seedling growth* to record your measurements over 20 days.

ACTIVITY 5

Write up your report using your measurements and the handout *Comparing seedling growth*. Use the language prompts to help you and make sure you use full sentences in writing up your results.

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Language focus
Measuring

ACTIVITY 1

Look at the list of adjectives for describing size, distance and shape, and match the opposites.

- | | |
|------------|-----------|
| 1. near | a. deep |
| 2. thin | b. far |
| 3. light | c. low |
| 4. long | d. heavy |
| 5. broad | e. slow |
| 6. shallow | f. short |
| 7. fast | g. narrow |
| 8. high | h. thick |

ACTIVITY 2

Form nouns from the measurement adjectives by adding suffixes (-th, -ness, -ment). Use a dictionary if you need to. Then, complete the wordsearch to find the nouns formed from the adjectives.

- deep _____
- long _____
- wide _____
- hard _____
- soft _____
- thick _____
- thin _____
- loud _____
- heavy _____
- light _____

I	S	L	H	G	P	S	P	D	G	W	R	I	B	J	Y
L	O	I	O	A	X	A	O	E	E	C	S	F	L	G	O
O	F	E	D	P	D	C	G	P	H	P	I	N	U	R	C
Q	S	S	E	Q	S	L	L	T	R	H	A	R	A	Z	E
H	V	Z	L	Q	T	I	E	H	E	B	A	L	V	X	V
I	A	T	O	N	H	G	N	H	H	R	E	S	O	O	O
L	O	R	U	L	I	H	G	E	A	L	E	E	N	S	W
E	Q	W	D	R	N	T	T	A	L	R	C	C	B	O	E
N	L	L	N	N	N	N	H	V	O	E	S	I	F	I	X
D	H	O	E	E	E	E	F	I	O	J	O	L	S	E	J
R	I	O	S	J	S	S	C	N	C	G	F	H	E	A	U
O	E	X	S	S	S	S	S	E	I	K	T	F	S	I	I
E	C	C	S	G	F	G	V	S	A	D	N	N	O	N	R
N	E	P	F	H	O	E	V	S	I	X	E	E	A	N	E
P	S	H	T	R	S	W	U	W	N	S	S	E	S	C	O
A	J	R	O	F	O	T	H	C	O	J	S	R	B	S	Z

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ACTIVITY 3

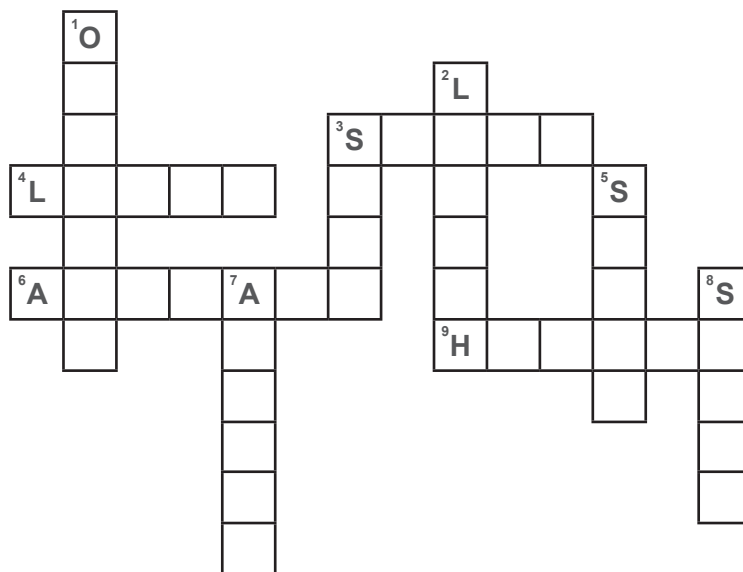
Complete the crossword with measurement words for quantity, scope and degree.

Across

- 3. Catalysts can either _____ up or slow down a reaction.
- 4. Use a marker to mark the water _____ on the outside of the dish.
- 6. Plot a graph of the results for _____ growth against time.
- 9. Record the average _____ of the seedlings on each occasion for 20 days.

Down

- 1. What growth do you _____ between the first and second week?
- 2. Heat the bimetallic strip about one-third of the way along its _____.
- 3. Plot a line graph showing the population _____ against year.
- 5. At what _____ in the water cycle does precipitation occur?
- 7. The _____ of heat energy absorbed depends on colour and surface.
- 8. Follow the _____ in the instructions to set up your experiment.



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Conditions for germination

After seeds are dispersed, they will begin to grow into new plants or seedlings if they are in suitable conditions. This is called germination. Although the embryo has sufficient food to allow germination, there are other conditions that will determine the success of the germination. Seeds not only require nutrients in order to germinate, they also need oxygen, a suitable temperature and water:

- Living things obtain the energy they need for growth from respiration. Seeds respire using oxygen from the air to break down the food inside them. This provides the energy they need for growth.
- The temperature required for germination is not the same for all seeds. Seeds of tropical plants will germinate at a higher temperature than seeds from plants that are found in colder climates. However, there is a maximum and minimum temperature beyond which all seeds are unable to grow. If the temperature is too high, enzymes in the chemical reactions, which are responsible for growth, break down and prevent the seed from germinating. If the temperature is too low, the rate of the reactions slows down, which slows down or stops the germination process.
- Water is vital to germination. During germination water enters the seed via the micropyle. This causes the seed to swell and the pressure eventually bursts open the testa, making it easy for the very fragile young plant (seedling) to grow beyond it. The water is also necessary to provide the medium (liquid) in which all the metabolic reactions needed for growth can happen.

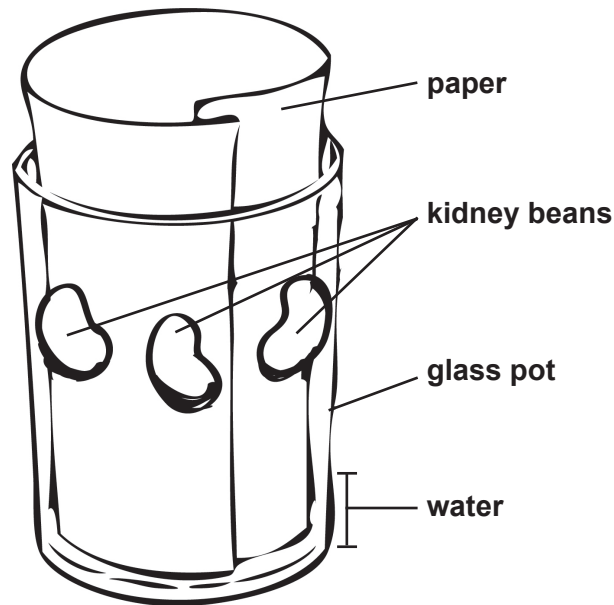


After a seed has germinated, the young seedling uses up the food stored in the cotyledons. After that, the young plant must begin to make its own food by the process of photosynthesis. To do this, it needs sunlight, water and carbon dioxide. It uses the energy from the sunlight to combine carbon dioxide and water to form food, oxygen and energy. Additional nutrients are absorbed from the soil.

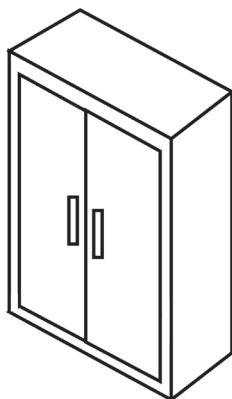
The reading text comes from *CXC Integrated Science* p.31 and the experiment is based on the practical tasks on page 33 and page 34.

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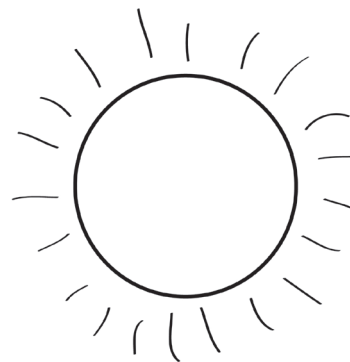
1. Prepare two glass pots or jars. Roll up a piece of newspaper or tissue paper and use it to line the jars.



2. Slowly add water to the jars so that the paper absorbs it and becomes damp. The water remaining at the bottom of the jars will keep the paper moistened during the germination process.
3. In each jar, place four kidney beans between the paper and the jar.
4. Put one jar in a dark place. Put the other jar in a sunlit place.



dark place



sunlit place

Note: Label your jars with your names if you are placing your experiment with those of classmates.

5. Observe the growth of the beans and measure the average height of the four seedlings in centimetres every two days.
6. Use your results to compare the measurements of the growth of the seedlings in the two jars.

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Write up your measurements and comparisons.

Aim (Say what you had to do.)

We had to
grow seedlings / sunlit place / dark place / compare growth / 20 days

Hypothesis (Say what you thought would happen.)

We thought that
seedlings / dark place / sunlit place / grow / more / less than

Materials (Say what you used.)

List your equipment

Procedure (Say what you did.)

We prepared
seeds / pots / placed / dark place / sunlit place / recorded results

Data collection (Say what you measured.)

We measured
seedlings / each jar / two days

Results (Give your results in tabular form.)

Seedling growth in a dark place

Time (days)	0	2	4	6	8	10	12	14	16	18	20
Average growth (cm)											

Seedling growth in a sunlit place

Time (days)	0	2	4	6	8	10	12	14	16	18	20
Average growth (cm)											

Discussion and conclusion (Say what you observed.)

Make sentences referring to specific time periods.

In the first few days / At the end of the first week / After 7 days / 14 days / 20 days

Make sentences about average measurements.

The average growth
the seedlings / sunlight
seedlings / dark place

