**GRADE: 4**  
**SUBJECT: NATURAL SCIENCES AND TECHNOLOGY**  
**TERM ONE**  
**FORMAL ASSESSMENT TASK (FAT) 1**

Name: ________________________________________________________  
Class: ______________________ Date: ___________________________  
School: ______________________ Teacher: _______________________

<table>
<thead>
<tr>
<th>FAT</th>
<th>Activity/Form</th>
<th>Learner's mark</th>
<th>Learner's %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Practical</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>30</td>
<td></td>
</tr>
</tbody>
</table>
Instructions

1. You will complete the practical activity in class under supervision
2. Complete all instructions in your NST exercise book
3. Label all sections the same as on this instruction sheet
4. Use a pen for writing
5. All sketches must be done in pencil

Major Process and Design Skills:
* Access information * Recall information * Observe * Compare * Measure * Sort * Classify * Identify problems * Raise questions * Predict * Hypothesising * Plan investigations * Do investigation * Record information * Interpret information * Communication (Plot a bar graph, Draw a table, observations) * Evaluate (Suggest ONE way in which you could improve the investigation to get more accurate results)

Background information
Seeds germinate when provided with the following:
- Water
- Air
- The right temperature
- Light
  NOTE: (most) seeds do not need light to germinate.
- Exposing germinating seed to sunlight will increase the vitamin content of the seedlings.
- The seed is an important part of a seed plant’s life cycle.
- The most important nutrient for initiating germination in all seeds is water.

NOTE: SAFETY:
- This investigation should be done under the supervision of your teacher.
  Ensure that learners:
- Work cooperatively with group members.
- Understand and adhere to safe laboratory practices when performing any activity in the classroom or lab.
- Should not put their fingers into their mouths during these activities.
- Should wash and dry their hands after each activity.
- Should handle all equipment and materials correctly and responsibly to complete the activities.
- Share scissors and pens (markers) if necessary.
- Wear correct protective clothing such as safety glasses or goggles, gloves, and aprons when appropriate.
- Dispose of waste responsibly.
- Maintain clean stations and always wipe up spills immediately
- Support by collecting basic equipment from home e.g., containers (clear and or transparent plastic containers or glass bottles of equal size, such as jam jars, baby food bottles, mayonnaise jars, canning jars, etc.

**TO DO: (in a group)**

1. **To Investigate the structure of a bean seed (Optional activity)**

**List of Material / Equipment**
- Bean seeds
- Water
- Forceps
- Container in which to soak the seeds (e.g. clear and or transparent plastic containers or glass bottles
- Saucer or white tile
- Magnifying glass
- Paper towel

**Method**

**Instructions for the learners**
- In your groups:
- Soak enough bean seeds for the group overnight at room temperature
- Remove the soaked bean seed from water in the morning and dry them on a paper towel.
- Examine and compare outside and inside parts of a bean seed.
- Use the diagram below to help you locate the parts of the bean seed.

- Identify an oval scar on the side of the seed. It is called a **hilum**.
- Identify a tiny dot directly below the hilum. It is called the **Micropyle**.
- Use forceps to remove the outer covering of the seed. It is called the **seed coat**.
- Explain why the outer skin of a bean seed is so important? **It helps to protect the inside parts of the seed from drying out.**
- Split the seed in half. What is each half of a bean seed called?
- Use a magnifying glass to examine the inside of the seed. Explain and write down your observations.
- Draw and label the main parts of a seed you have observed.
- Display the drawings on the classroom walls and discuss them in groups.
- Bean seeds sprouts. What does the word sprouts means? **Begin to grow.**
Investigation
• Conditions necessary for seeds to germinate.

TO DO: (in a group)

2. AIM:
• What do you want to find out by doing this investigation?

TO DO: (individual)

Question
(a) What is the aim of this investigation? (2)
(b) What does the word "germinate" mean?
(c) What conditions trigger seeds to germinate?

TO DO: (in a group)
• Describe how you will carry out a fair test for this investigation. You may use a headings similar to the following:
  o We will do this___________________________________________
  o We will change this one condition____________________________
  o We will keep these conditions the same________________________
  o We will measure___________________________________________
  o We think this will happen____________________________________

3. Prediction

TO DO: (individual)
1. Predict what will happen if you:
(a) Don't water the soil. What changes, if any would you expect in your observations, and why? (2)
(b) Put the container in a dark place after you have planted the seeds. What changes, if any would you expect in your observations, and why? (2)
(c) Put a lid on a container after planting the seeds. What changes, if any would you expect in your observations, and why? (2)
(d) Put the container in a cold place after you have planted the seeds. What changes, if any would you expect in your observations, and why? (2)

TO DO: (in a group)

4. Hypothesis – (guess answer)
• Discuss and decide in pairs on a suitable hypothesis

TO DO: (individual)
• Formulate a suitable hypothesis for this investigation. (3)
  Include “If . . . then . . .”
5. Plan an investigation

List of Material / Equipment
- Containers in which to plant the seeds (e.g. clear and or transparent plastic containers or glass bottles of equal size, such as jam jars, baby food bottles, mayonnaise jars, canning jars, etc. which will allow learners to observe root growth). Alternatively, you could use clear zip lock sandwich bags.
- Potting soil / paper towel / cotton wool
- Water
- Spoons
- Newspapers to cover the work areas
- Bean seeds or any other seed that do not take long to germinate, for example; pea, grain, etc.
- Piece of string / wool 30 cm long
- Ruler calibrated in millimeters
- Spray bottle or an extra bottle to use to water the seeds.
- Markers or pens and pencils
- Scissors
- Stickers or adhesive tape

Method
Instructions for the teacher
- Prepare a place/ stations in the classroom where the learners will work in groups to put their planted seeds.
- Divide the learners into groups with two to four learners in a group.
- Set out materials and equipment in different stations according to the number of groups.
- Assign each group TWO conditions they should use to germinate the seeds as follows:

<table>
<thead>
<tr>
<th>The assigned conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>All groups</strong></td>
</tr>
<tr>
<td>Condition A</td>
</tr>
<tr>
<td>No water + air + correct temperature</td>
</tr>
<tr>
<td>Leave soil dry (without water). Place in a sunny spot</td>
</tr>
</tbody>
</table>

NOTE: Learners can use other suitable methods for germinating seeds.
- Remind learners about safety measures they should follow during the investigation.
TO DO: (in a group)

Steps for conduct an investigation:
- Work in a group assigned by your teacher.
- Soak enough bean seeds for the group overnight at room temperature.
- Remove the soaked bean seed from water in the morning and dry them on a paper towel.

**NOTE:** Do not leave seeds covered by water for more than 24 hours because they may begin to rot.
- Fill containers nearly full of potting soil and level off the top of the soil. (A level top helps with successful watering).

**NOTE:** Each group should use identical containers.
- Use a pencil to make a planting hole in the potting soil on each side of the containers. Make the hole so that the bean seed will be pressed against the side of the container.
- Plant **three to four seeds** in **one container** not much deeper than the thickness of the seed, nearer to the top of the soil. See illustration below.

- Gently water the soil so it is wet, but not soaking.
- Leave soil dry (without water) for Conditions A.
- Watch the potting soil to be certain it does not dry out.
- Write labels on the containers as suggested below:
Each group should put the containers in a suitable place according to the assigned conditions as indicated above. Observe the containers each day for changes to the seeds. Compare your seeds with illustrations below:

7. Communicate

TO DO: (individual)
Record Observations

- Complete and record all the observations.
- Use the tables below to record the daily observations.
- My seed was exposed to (choose the relevant boxes)

<table>
<thead>
<tr>
<th>Condition</th>
<th>Day 2</th>
<th>Day 3</th>
<th>Day 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>No water + air + correct temperature</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leave soil dry (without water). Place in a sunny spot</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>water + air + correct temperature</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sunny and warm spot</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>water + air + without light</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In a dark cupboard</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>water + without the correct temperature</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In in the refrigerator (e.g. staff room one)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
(a) What is the first part of the seedling that grows out of the seed?

(b) What happened to the seed coat?

(c) What happens to the seed leaves?

(d) What happens to the leaves?

- Measure the length of your seedling every second day as follows:
- Use the piece of string / wool to carefully mark off the seedling.
- Use the ruler to determine the length of growth.
- Record the length of the stem growing out of the seed in a table below in millimeters.
- Record the number of seedlings that sprout daily.

<table>
<thead>
<tr>
<th>Record</th>
<th>The assigned conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No water + air + correct temperature</td>
</tr>
<tr>
<td></td>
<td>Leave soil dry (without water). Place in a sunny spot</td>
</tr>
</tbody>
</table>

The date of planting the seed in containers

The date the plant appeared above the surface of the soil.

How many days did it take for the seed to germinate? (Day 1)

The date the first leaf appears above the surface of the soil.

Day 3 (length of Seedling)
Day 5 (length of Seedling)
Day 7 (length of Seedling)
Day 9 (length of Seedling)
Day 11 (length of Seedling)
Day 13 (length of Seedling)

- Make drawings that show the major stages of germination of the seedling.
- Label the key structures.
- Explain how the key structures help the plant with the life process of germination and growth.
- Draw a bar graph to represent your data.
NOTE: Remember that when you construct your graph, the time (days) is placed along the x-axis (Horizontal) and the plant growth is placed along the y-axis (vertical) for example Plant height is the measured effect. You always place the factor that will happen, even if you do not do the investigation, on the x-axis. The factor that will change (why you are doing the investigation) is placed on the Y-axis.

8. Evaluation

TO DO: (individual)
Interpret Observation
- Describe your observations during the investigation. (2)
- Interpret your observation
- Accept or reject the chosen hypothesis by stating an overall conclusion that you can draw from the investigation. (2)

9. Conclusion and Improvement

TO DO: (individual)
(a) Suggest ONE way in which you could improve the investigation to get more accurate results. (2)
(b) A learner placed some seeds on a moist paper towel in a glass jar. Another glass jar was filled with water and seeds. The glass jars were covered and exposed to identical experimental conditions. After several days, the learner noticed that the seeds submerged in water did not germinate, but those on the paper towel did. What best explanation can you give for these results?
(c) If 5 seeds germinated out of 10 seeds, what percentage of the seeds has germinated?

Self-Assessment Checklist

<table>
<thead>
<tr>
<th>Features specified</th>
<th>Achieved? Yes/No</th>
<th>Improvements which I could make</th>
</tr>
</thead>
<tbody>
<tr>
<td>All instructions were carefully followed.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All questions have been completed in my exercise book.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tables, graphs and diagrams have been drawn, labelled correctly and completed.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I worked neatly and the work station was clean when I left.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The work in my exercise book is neat and up to date.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I answered all the questions.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Formal Assessment Rubric

<table>
<thead>
<tr>
<th>Criteria:</th>
<th>Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aim of this investigation correctly stated</td>
<td>/1</td>
</tr>
<tr>
<td>The word “germinate” defined.</td>
<td>/1</td>
</tr>
<tr>
<td>Conditions that trigger seeds to germinate given</td>
<td>/1</td>
</tr>
<tr>
<td>At least TWO predictions accurately made</td>
<td>/2</td>
</tr>
<tr>
<td>A suitable hypothesis formulated / stated</td>
<td>/2</td>
</tr>
<tr>
<td>A bar graph accurately plotted to represent data.</td>
<td>/6</td>
</tr>
<tr>
<td>Observations / data accurately recorded on a table</td>
<td>/3</td>
</tr>
<tr>
<td>Observations in the investigation accurately described.</td>
<td></td>
</tr>
<tr>
<td>The first part of the seedling that grows out of the seed identified.</td>
<td>/1</td>
</tr>
<tr>
<td>Explanation of what happened to the seed coat given</td>
<td>/1</td>
</tr>
<tr>
<td>Explanation of what happens to the seed leaves given</td>
<td>/1</td>
</tr>
<tr>
<td>Explanation of what happens to the leaves given</td>
<td>/1</td>
</tr>
<tr>
<td>Drawings that show the major stages of germination of the seedling with labels of the key structures.</td>
<td>/4</td>
</tr>
<tr>
<td>How key structures help the plant with the life process of germination and growth clearly defined.</td>
<td>/1</td>
</tr>
<tr>
<td>The chosen hypothesis accepted or rejected by stating an overall conclusion that can be drawn from the investigation.</td>
<td>/1</td>
</tr>
<tr>
<td>A reason for making observations accurately suggested.</td>
<td>/1</td>
</tr>
<tr>
<td>ONE way in which the investigation could be improved to get more accurate results</td>
<td>/1</td>
</tr>
<tr>
<td>Correct reason given why seeds submerged in water did not germinate</td>
<td>/1</td>
</tr>
<tr>
<td>Calculations of % of seeds that germinated correctly made.</td>
<td>/1</td>
</tr>
<tr>
<td>Comment:</td>
<td></td>
</tr>
</tbody>
</table>

Signature: Teacher_________________                                      Date: ___________________

Mark:  /30
TEACHERS’ NOTES

- Seeds germinate when provided with the following: water, air, the right temperature and light.
  **NOTE:** (most) seeds do not need light to germinate.
- Exposing germinating seed to sunlight will increase the vitamin content of the seedlings.
- The seed is an important part of a seed plant’s life cycle.
- The most important nutrient for initiating germination in all seeds is water.
- During its early stages of growth, the seedling relies upon the food supplies stored in the seed until it is large enough for its own leaves to begin making food through photosynthesis.

- Explain to the learners to work like scientists. They should work carefully with the seeds so as not to damage them or affect how they germinate.
- Although learners will work in groups to germinate the seeds, each learner will be assessed separately when testing the following process skills, i.e. observing, measuring and recording, evaluation, conclusion and improvement. Therefore each learner must complete their work individually where it has been clearly stated.
- As an alternative to growing seeds in soil, seeds can be placed on a wet cotton wool or paper towel and put into a sealable transparent plastic bags or glass bottles of equal size which will allow learners to observe root growth. This could also be used as an option for learners who would like to test if soil is necessary for growing plants. However the seeds should be soaked overnight at room temperature. Make sure that the learners do not pull the seeds apart when removed from soaked water. Learners will also need to use a medicine dropper or pipette or spray bottle to moisten paper towel or cotton wool.
  **NOTE:** Do not leave seeds covered by water for more than 24 hours because they may begin to rot.
- Remind learners to add labels to their containers as suggested below:

<table>
<thead>
<tr>
<th>Germinating bean seeds investigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>The assigned conditions:</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Date:</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Names of group members:</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

**NOTE:** Plant pots from each of the different seed types need to experience conditions as similar as is possible. For each variable you need to keep the others as constant as possible. For instance – all the 10 pots within the light experiment should be in the same light receiving area, e.g. all on the same window sill. They should all be watered at the same time and with the same amount of water and kept in similar temperature conditions. Where water is the variable, plants should all be kept in similar light and temperature conditions; where temperature is the variable – you should water consistently and try to keep as much similarity in light conditions as possible (obviously this is not always be possible, e.g. it is dark in a fridge but not outdoors).
List of Material / Equipment
- Containers in which to plant the seeds (e.g. clear plastic or glass bottles of equal size which will allow learners to observe root growth). Small jam jars, baby food bottles and clear zip lock sandwich bags will be handy to use for this investigation.
- Potting soil / wet cotton wool or paper towel
- Newspapers to cover the work areas
- Seeds: e.g.; pea, bean, grain, etc.
- Piece of string / wool 30 cm long
- Ruler calibrated in millimeters
- Water
- Spoons
- Markers or pens and pencils
- Spray bottle or medicine dripper or pipette or an extra bottle to use to water the seeds.
- Stickers or adhesive tape

Method
Instructions for the teacher
- Prepare a place/ stations in the classroom where the learners will work in groups to put their planted seeds.
- Divide the learners into groups with two to four learners in a group.
- Set out materials and equipment in different stations according to the number of groups.
- Assign each group TWO conditions they should use to germinate the seeds as follows:

<table>
<thead>
<tr>
<th>The assigned conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>No water + air + correct temperature</td>
</tr>
<tr>
<td>Leave soil dry (without water). Place in a sunny spot</td>
</tr>
</tbody>
</table>

NOTE: Learners can use other suitable methods for germinating seeds.

2. Conduct an investigation
Steps for conduct an investigation:
- Work in a group assigned by your teacher.
- Soak enough bean seeds for the group overnight at room temperature
- Remove the soaked bean seed from water in the morning and dry them on a paper towel.
  NOTE: Do not leave seeds covered by water for more than 24 hours because they may begin to rot.
- Fill containers nearly full of potting soil and level off the top of the soil. (A level top helps with successful watering).
  NOTE: Each group should use identical containers.
- Use a pencil to make a planting hole in the potting soil on each side of the containers. Make the hole so that the bean seed will be pressed against the side of the container.
- Plant **three to four seeds** in **one container** not much deeper than the thickness of the seed, nearer to the top of the soil.
• Gently water the soil so it is wet, but not soaking.
• Leave soil dry (without water) for Conditions A.
• Watch the potting soil to be certain it does not dry out.
• Write labels to the containers as suggested above.

NOTE: SAFETY:
• This investigation should be done under the supervision of your teacher. Ensure that learners:
  • Work cooperatively with group members.
  • Understand and adhere to safe laboratory practices when performing any activity in the classroom or lab.
  • Should not put their fingers into their mouths during these activities.
  • Should wash and dry their hands after each activity.
  • Should handle all equipment and materials correctly and responsibly to complete the activities.
  • Share scissors and pens (markers) if necessary.
  • Wear correct protective clothing such as safety glasses or goggles, gloves, and aprons when appropriate.
  • Dispose of waste responsibly.
  • Maintain clean stations and always wipe up spills immediately.
  • Support by collecting basic equipment from home, e.g., containers (clear and or transparent plastic containers or glass bottles of equal size, such as jam jars, baby food bottles, mayonnaise jars, canning jars, etc. Clear zip lock sandwich bags will also be handy to use for this investigation.

Give learners time to:
• Make predictions and to complete the necessary information.
• Draw and complete a table.
• Draw and label a graph and seedlings.
• Complete all the questions.

Suggested Marking Guidelines
Question
• What is the aim of this investigation?
  To find out whether a seed needs water, warmth or light, to germinate and grow ✓

• What does the word "germinate" mean?
  To germinate means to start to grow ✓

• What conditions trigger seed germination?
  In order for germination to begin seeds must absorb an adequate amount of water. ✓
**Prediction**

Predict what will happen if you:

(a) Don’t water the soil. What changes, if any would you expect in your observations, and why?
The seeds will just stay dormant, not growing. If they are watered later, they will sprout.

(b) Put the container in a dark place after you have planted the seeds. What changes, if any would you expect in your observations, and why?
Some seeds need light to germinate, while others need darkness. Some seeds germinate well in either light or dark conditions.

(c) Put a lid on a container after planting the seeds. What changes, if any would you expect in your observations, and why?
Oxygen availability will be greatly reduced and germination may fail to be completed.

(d) Put the container in a cold place after you have planted the seeds. What changes, if any would you expect in your observations, and why?
The number of seeds that will germinate and rate of seedling growth will reduce.

**Hypothesis – (guess answer)**

- Formulate a suitable hypothesis for this investigation.

Hypothesis:
- E.g. If planted bean seeds are placed in the sunny and warm spot, in the shade, in a dark cupboard and in a fridge, then the germinating seeds placed in the sunny and warm spot will germinate, have the greatest height, and produce the most leaves.
- Read carefully the hypothesis the learner has written based on the conditions they were given.

7. Communicate

**TO DO: (individual)**

**Record Observations**

- Complete and record all the observations.
- Use the tables below to record the daily observations.
- My seed was exposed to *(choose the relevant boxes)*

**Rubric to be used when assessing the table:**

<table>
<thead>
<tr>
<th></th>
<th>3 Marks</th>
<th>2 Marks</th>
<th>1 Marks</th>
<th>0 Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Collecting data by measuring</strong></td>
<td>Learner measure accurately with attention to detail</td>
<td>Learner is able to measure without assistance</td>
<td>Learner need fulltime assistance in measuring</td>
<td>Learner does not participate</td>
</tr>
<tr>
<td><strong>Recording data in the table</strong></td>
<td>All relevant data is clearly and accurately recorded.</td>
<td>Most relevant data recorded accurately. Records are clear enough to be useful.</td>
<td>Less than half the data recorded. Many inaccuracies. Not clearly recorded (too messy to be useful)</td>
<td>Learner does not submit any records.</td>
</tr>
</tbody>
</table>
(e) What is the first part of the seedling that grows out of the seed?  
   The root. ✓

(f) What happened to the seed coat?  
   It stays behind in the soil or is dropped onto the surface of the potting soil ✓.

(g) What happens to the seed leaves?  
   They remain attached to the stem and are pulled above the potting soil as the stem grows. As the seedling grows, they shrivel. ✓

(h) What happens to the leaves?  
   They unfold and grow larger. ✓

- Measure the length of your seedling every second day as follows:
  Ensure that learners accurately measure the length of their seedlings every second day. ✓

- Record the length of the stem growing out of the seed in a table below in millimetres.

- Record the number of seedlings that sprout daily.
  Ensure that learners accurately measure the length of their seedlings every second day, keep a record of their measurements and record the number of seedlings that sprout daily. ✓

- Make drawings that show the major stages of germination of the seedling.
- Label the key structures

Criteria for marking a diagram:

<table>
<thead>
<tr>
<th>Criteria for marking a diagram:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Heading</td>
<td>1</td>
</tr>
<tr>
<td>Correct proportion, shape and size</td>
<td>1</td>
</tr>
<tr>
<td>At least TWO labels given</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>4</td>
</tr>
</tbody>
</table>
• Explain how the key structures help the plant with the life process of germination and growth.
• Seedling’s roots push down into the soil to anchor the new plant and to absorb water and minerals from the soil.
• Roots also store extra food for future use. ✓ any one
• Stems support the plant.
• They conduct water and nutrients from the roots and food from the leaves to other plant parts. ✓ any one
• Leaves capture sunlight which the plant uses to make food through a process called photosynthesis. ✓
• Draw a bar graph to represent your data.

NOTE: Remember that when you construct your graph, the time (days) is placed along the x-axis (Horizontal) and the plant growth is placed along the y-axis (vertical). For example, Plant height is the measured effect. You always place the factor that will happen, even if you do not do the investigation, on the x-axis. The factor that will change (why you are doing the investigation) is placed on the Y-axis.

Marking a bar graph:
Draw a bar graph of your measurements, showing the growth over the thirteen days.

Rubric to use when assessing the graph:

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Maximum mark</th>
<th>Mark Achieved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bar graph has a correct heading</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Correct label and units for X-axis and Y-axis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Appropriate width and interval of bars</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Appropriate scale for Y-axis</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Drawing of the graphs</td>
<td>1: 1 to 6 bars plotted correctly</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2: all bars plotted correctly</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>

Example of how to draw a bar graph

Length of germinating bean seeds over a period of thirteen (13) days exposed to (e.g. no water, sunlight & warmth and dark cupboard)

- water and fridge
- water and shade
- sunlight, water and warmth
6. **Evaluation**

**TO DO: (individual)**

**Interpret Observation**
- Describe your observations during the investigation.
- Interpret your observation
- Accept or reject the chosen hypothesis by stating an overall conclusion that you can draw from the investigation.
  The chosen hypothesis accepted or rejected by stating an overall conclusion that can be drawn from the investigation ✓

7. **Conclusion and Improvement**

**TO DO: (individual)**

(d) Suggest ONE way in which you could improve the investigation to get more accurate results.
  By repeating the investigation several times, using the same type and quantity of soil, water and seedlings exposed to the same conditions. ✓

(e) A learner placed some seeds on a moist paper towel in a glass jar. Another glass jar was filled with water and seeds. The glass jars were covered and exposed to identical experimental conditions. After several days, the learner noticed that the seeds submerged in water did not germinate, but those on the paper towel did. What best explanation can you give for these results?
  Seeds submerged in water did not receive enough oxygen. ✓

(f) If 5 seeds germinated out of 10 seeds, what percentage of the seeds has germinated?
  \[ \frac{5}{10} \times 100 = 50\% \] ✓