Unit 1 Cycle 1

Beginnings: Where is it?

LESSON TARGET IDEAS

To accurately describe the position of an object we need a reference point (starting position), and the object's distance and direction from that starting point.

COMMON MISCONCEPTIONS

- *The reference point used can be vague.* (The door, desk, window etc.)
- *Distances can be given in vague terms.* (Next to, close to, a short distance from, etc.)
- *Distances can be given in vague units that may vary with the observer.* (Steps, paces, strides etc.)
- *A good way to give directions is relative to other objects.* (Behind, to the left of, above, etc.)

WHAT TO FOCUS ON

This activity is the first of the Cycle. As such we want as many different ideas to emerge as possible. Do not try to impose "correct terms" or definitions on students at this point. We want them to express themselves in ways that make sense to them. The sequence of activities, with appropriate teacher guidance, will allow good ideas to emerge above poor ones.

In this activity, students write directions for someone else to find an object. It is likely that most students will not be able to find the target object just using the written directions, and that's okay. After students finish trying to locate the objects, the teacher should focus students on the aspects of the written directions that helped them find the object, and the aspects that did not help or made it difficult to find the object. Students should identify that directions that did not work lacked a starting point, had vague measures of distance (e.g., "go forward"), and/or had vague terms for direction (e.g., "look near a bookcase").

Students may comment that directions are easy to follow if you just describe what is around the object. In this case, the teacher should remind students that directions of this nature would not be as helpful to a person who is not familiar with the classroom.

MATERIALS NEEDED FOR THIS LESSON

Material	Quantity
Small mystery object	1 per student group
Small blank sticker	1 per student group
Marking pen	1 per student group

Purpose

Clearly explain the key question, and emphasize that *only* the description of the object's position may be used (i.e., the students should not describe the object itself). We want someone who enters the room (and who is unfamiliar with the room layout) to be able to find a small object that is not obvious, but also not deliberately hidden.

What do we think?

Choose four or five objects or places around the room. Try to make at least one of them something that not everyone can see from where they are.

Write one description for each object on the board. As you write students' descriptions, already be thinking of ways they could be confusing, ambiguous, or misleading.

Now act out the descriptions. Wherever possible, misinterpret, or get turned around so the descriptions don't work correctly. As each one is acted out ask students what is good or problematic about it.

Ask students what the good things about their descriptions were, and where improvement is needed. Make a list of things students think a good description of a position needs.

NOTE: We are aiming for "specific starting point," "direction," and "distance", but if any/all of these do not come up, don't worry; they will emerge later. Let the students decide what is needed – don't tell them!

Unit 1 Cycle 1

Beginnings: Where is it?

Purpose

Sarah says she cannot find her school bag, but Joe says he saw it somewhere in another classroom. How could Joe describe where the bag is, in order to help Sarah find it quickly, before her next class starts?

When someone tells us where an object is, they are telling us about its location, also known as its ***position***. In this activity you will be thinking about some good ways to describe the position of various objects, such that they could be easily found. The 'big' question we are trying to answer in this *Beginnings* activity is:

What is needed to accurately describe the position of an object?

What do we think?

Your teacher will name some objects in the room. Imagine someone needs to come into the room and find those objects quickly, using only a description of its position that you will give them. Discuss with your group how you would describe these positions.

Your teacher will make a note of some descriptions suggested by the class for these objects and try to follow them.

Your teacher will lead a class discussion about what is needed to make a good description of an object's position.

Activity

An even number of groups works best so you may need some groups of three to make this work.

 Alternative activity: If this activity cannot be easily carried out (e.g., a second room is not available), the teacher may modify the activity as follows:

Identify a set of distinctive objects (globe, calendar, etc.) in the classroom (one for each pair of students) and mark these with a small sticker before the lesson starts. Write the names of these objects (but not descriptions of their locations) on slips of paper and distribute one to each pair of students. Be sure to instruct students not to reveal their "secret object." Then, have students write descriptions of their secret object's position and carry out the rest of the activity as described.

Activity: Step 2

 The other room could be the hallway. If necessary, just split your room in half. Make sure students do not deliberately hide objects - they are supposed to be in plain view for anyone who gets to the right place.

 Let students use their own terms and descriptions. Do not limit them at this point.

Activity: Can you find it?

You will work with a partner for this activity. Each pair will need:

- Small object
- One small blank sticker

STEP 1:

- Choose a small object, such as a pencil, eraser, or something of a similar size.

- Mark an 'X' on the small sticker and stick it to your chosen object.

Your teacher will then take half of the pairs, with their objects, to another room.

STEP 2: Now work with your partner to complete this step.

- Place your marked object somewhere in the room. (It should NOT be hidden so well that other objects have to be moved to find it, but it could be behind, or under, another object.) Make sure the 'X' can be seen by someone close to it, without moving the object.

Suppose one of your classmates in the other room wanted to find your object. One way to help them is to describe its position in the room.

Write a description of your object's position, so that other people coming into the room (the 'Seekers') could find it. ***Do NOT say what the object actually is!***

Activity: Step 3

Students who wrote the directions may want to give hints to the "seekers" as they try to follow the directions; the teacher should encourage students to try to use the written directions first, and only allow hints when students are not able to find the target object. Make sure everyone eventually finds their object.

 Groups should discuss both good and poor aspects of their own, and each other's, descriptions. Monitor discussions to make sure they are constructive. Prompt students to identify what made some descriptions good and what made other descriptions problematic, referring back to the "evidence" (in this case, the evidence is what is in the description) whenever possible. The teacher will likely need to model what it means to use evidence to identify what was good or problematic about a description.

Making Sense Questions

Question 1: We are still aiming for "specific starting point," "direction," and "distance." If any of these still do not come up the teacher should prompt and probe for them by asking about what was most helpful for finding their object, but should not just tell the answers. Make a list and try to get the consensus of the class that the list is complete. The words students use may not be exactly the same, but as long as the meaning is clear, that's OK. Use their words if possible.

STEP 3: Your teacher will arrange for you to switch descriptions with a pair who placed their object in the other room.

- Use the description given to you to find the other pair's object. (Remember it will be marked with an 'X'.)
- If you can find it, take the object from its location and bring it back to your classroom (if you are not there already). If you cannot find it, ask the pair who wrote the description for more help.

When the other pair has also found your object, discuss both your descriptions with them.

Were the descriptions you wrote good, or were there any problems with them? How about the description the other pair wrote? If there were any problems describe below how you could fix them.

Making Sense

Your teacher will lead a class discussion about what information is needed when describing the position of an object, so that someone else can easily find it. Write answers to the following questions after each one is discussed by the class.

1. What important pieces of information are needed when describing the position of an object?

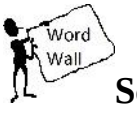
Making Sense Questions

Question 2: This should be pretty self-evident. So much so that students may have trouble expressing it. Basically it's so we know where to start from. Discuss how specifically this point needs to be defined. Bring up any problems that occurred earlier because they were not specific enough with their starting points.

Question 3: Allow students to bring up any directional terms they want to. Help them to see that general terms like left, right, up, down, etc., are typically better to use when giving directions than location specific descriptions like "toward the window," and "away from the teacher's desk." Have students draw on their own experiences in the activity to support this conclusion.

Question 4: Allow students to bring up any distance terms they want to. Help them to see that general units like, meters, feet, miles, are typically better to use when giving directions than location-specific descriptions like "floor tiles," "halfway across the room." Have students draw on their own experiences in the activity to support this conclusion.

Summarize the important ideas of the activity. There are three important pieces of information that are needed to accurately describe the position of an object. They are "specific starting point," "direction," and "distance."



Science Vocabulary

The term "**position**" is introduced in this lesson. If students can demonstrate an understanding of what the "**position**" of an object means, then it would be appropriate to add this term to the word wall.

2. Why is it important to have a starting point (often also called a *reference point*) for a description of the position of an object?

3. What are some good ways to describe what direction an object lies in from the reference point? Why are these ways better than some others?

4. What are some good ways to describe the distance an object is from the reference point? Why are these ways better than some others?

Unit 1 Cycle 1

Exploration #1: Here it is!

LESSON TARGET IDEAS

Standard measures of distance and direction are more generally useful than non-standard measures.

COMMON MISCONCEPTIONS

Directions that depend on observer orientation (left, right, forward, backward, etc.) will work under all circumstances.

WHAT TO FOCUS ON

This activity builds on the more useful terms/measures that students identified at the end of the previous activity. As such, it gives students practice using ideas the students themselves have decided are useful. In this activity, students use standard distance measures (meters or centimeters) and directions (left, right, forward, backward, up, down) when writing directions. Students should find that written directions that include these specifics (rather than the number of steps or terms like "pretty far") are more likely to allow a "seeker" to find the target object. However, they will probably also find that not all of the written directions allow the object to be found, most likely because the standards terms for direction that they use do not always work as they require a starting orientation (e.g., facing the white board). This finding sets up the next activity that introduces the use of compass directions as a way to indicate direction that always works.

MATERIALS NEEDED FOR THIS LESSON

Material	Quantity
Small mystery object	1 per student group
Small blank sticker	1 per student group
Marking pen	1 per student group
Meter stick	1 per student group

Purpose

Tell students that in this activity they will again be writing descriptions of position but they will be allowed to use only certain specific directions and distance measures. The teacher may want to put these on a board for everyone to see.

Activity

 Again, an even number of groups works best so the teacher may need some groups of three to make this work.

Before starting, you may wish to review centimeters and meters and how to measure in a combination of both.

This activity is nearly identical to the activity in the previous lesson, *except* that in this one, the teacher should require students to use specific direction and distance measures in their descriptions.

Activity: Step 1

 The other room could be the hallway. If necessary, just split your room in half. Make sure students do not deliberately hide objects; they are supposed to be in plain view for anyone who gets to the right place.

Exploration #1: Here it is!

Purpose

In the *Beginnings* section of this Cycle, the class decided on what important pieces of information need to be included when describing the position of an object. You also decided what would be some good ways to give this information that would be useful in any situation. In this *Exploration*, you will practice writing instructions that describe the position of an object using these useful ways.

The 'big' question we are trying to answer in this *Exploration* activity is:

How can we describe the position of an object so someone else can easily find it?

Activity: Follow My Lead

You will work with a partner for this activity. Each pair will need:

- Small object
- Meter rule
- One small blank sticker

STEP 1:

- Choose a different small object than the one you used in the previous activity.

- Mark an 'X' on the small sticker and stick it to your chosen object.

Your teacher will then take half the class, with their objects, to another room.

Activity: Step 3

 Make sure students understand that they can use only the specified terms/measures.

 Monitor groups to ensure they are using only the specified terms/measures.

STEP 2:

- Place your marked object somewhere in the room. (It should NOT be hidden so well that other objects have to be moved to find it, but it could be behind, or under, another object.) Make sure the 'X' can be seen by someone close to it, without moving the object.

STEP 3: Suppose one of your classmates in the other room wanted to find your object. You will again write a description of its position but this time you will only be allowed to use some of the more common standard terms and measures for directions and distances.

- For directions you can use only the following:
  LEFT and **RIGHT**
  FORWARD and **BACKWARD**
  UP and **DOWN**

- For distances, you can use only the following:
  METERS (m) and **CENTIMETERS (cm)**

Note: When using only these terms you may have to include several steps in your description of an object's position. For example, the position of a book under a chair might be:

"Start at the sink. Forward 4 meters. Left 2 meters and 50 centimeters. Up 20 centimeters."

Now write a description of your object's position using only these terms and measures, so that other people coming into the room (the 'Seekers') could find it.

Activity: Step 4

 If any groups cannot find their object, allow them to talk to the original writers of the description they are using. Make sure everyone eventually finds their object.

 Groups should discuss both good and problematic aspects of their own and each other's descriptions. Monitor discussions to make sure they are constructive. Prompt students to identify what made some descriptions good and what made other descriptions problematic, referring back to the "evidence" (in this case, the evidence is what is in the description and what happened when the description was used) whenever possible. The teacher will likely need to model what it means to use evidence to identify what was good or problematic about a description.

STEP 4: Your teacher will arrange for you to switch descriptions with a pair who placed their object in the other room.

- Use the description given to you to find the other pair's object. (Remember it will be marked with an 'X'.)

- Take the object from its location and bring it back to your classroom (if you are not there already).

Once the other pair has also found your object, discuss both your descriptions with them.

Were your descriptions good, or were there any problems with them? If there were any problems describe below how you could fix them.

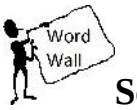
Making Sense Questions

Question 1: The key idea is that everyone should have a common language that always means the same thing, and can be used in almost any situation. Try to get students to make this point first and recognize that their success using standard terms provides evidence for this view! When possible, encourage students to refer back to examples from their written descriptions.

Question 2: "Compass directions" is the obvious one. Give students time to propose it first. If it doesn't emerge, prompt with situations like being outside with no obvious landmarks (except the reference point), or trying to drive to another town when there are no road signs. Ask what observations or experiences led to their responses.

Question 3: Other standard measures of distance such as feet, yards, miles, kilometers etc. should come up. Again, ask what observations or experiences led to their responses.

Summarize the important ideas of the activity: that there are standard terms/measures that people find useful to use to describe the position of objects. These terms/measures give us a common language that everyone can use and understand.



Science Vocabulary

If students can demonstrate an understanding of what the "**position**" of an object means, then it would be appropriate to add this term to the word wall.

Making Sense

Your teacher will lead a discussion on this way of describing the position of an object. Write answers to the following questions after each one is discussed by the class.

1. What are some good things about giving the position of an object using standard directions and measures?

2. What are some other common ways of giving the direction to an object that would work for any situation?

3. What are some other common ways of giving the distance to an object that would work for any situation?

Unit 1 Cycle 1

Exploration #2: Find the treasure!

LESSON TARGET IDEAS

Compass directions are a useful way to give directions that work under any circumstances because they do not change depending on observer orientation.

COMMON MISCONCEPTIONS

Compass directions are different depending on observer orientation. (This idea may be due to not understanding how to use a compass – it is the needle that defines North, not how the case is held!)

WHAT TO FOCUS ON

This activity builds on the idea that compass directions can be used to specify direction when describing a position. This idea should have emerged at the end of the previous activity as a result of terms for direction such as "left" and "right" not always working without a starting orientation (e.g., facing the white board). In the first steps of this activity, students use compass directions and a distance scale to find landmarks on a map using provided descriptions. In the latter steps of this activity, students use each other's descriptions to locate a secret destination. Students should find that, unlike using "left" or "right," compass points (i.e., North, South, East and West) specify a particular direction that is independent of an observer's orientation. Students should also find that following the descriptions (i.e., starting from a specified point and moving the specified distance in each specified direction) allows them to reach the target destinations.

MATERIALS NEEDED FOR THIS LESSON

Material	Quantity
Treasure map (last page of activity)	1 per student
Ruler with centimeter increments	1 per student
Marking pen	1 per student

Purpose

Tell students that in this activity they will be writing descriptions of an object's position using a map and compass directions.

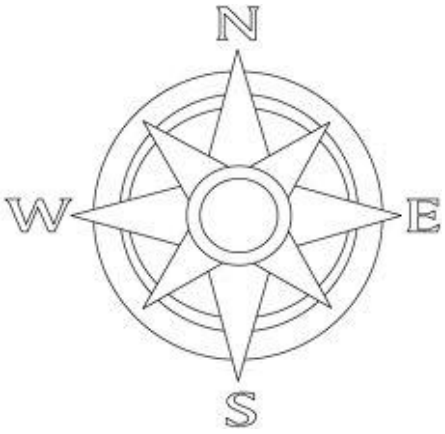
Unit 1 Cycle 1

Exploration #2: Find the treasure!

Purpose

In the first *Explorations* activity of this Cycle, you looked at some of the standard directions and measures used to give the position of an object, like LEFT/RIGHT, and FORWARD/BACKWARD. These are useful when you are giving the position of an object to other people in a room, but they can be confusing sometimes. This is because when two people start out facing in different directions, then telling them to move forward, backward, left, or right, will take them in different directions also. (Your teacher will demonstrate this.)

Another way to specify directions is using the points of a compass, NORTH, SOUTH, EAST, and WEST. These refer to directions defined on the surface of the Earth, and so do not depend on which way a person is facing. Very often you will find these compass directions represented on a map, as shown here. (This type of picture is called a "compass rose" because it looks a little like a flower.)



In this activity you will practice writing, and following, instructions on a map using these compass directions.

The "big" question we are trying to answer in this *Exploration* activity is:

How can we use a map and compass directions to describe the position of an object?

Activity: Step 1

 The teacher may want to review compass directions.

The teacher may want to review the idea of scale as applied to a map, which could even be a cross-curricular activity!

Activity: Step 2

 Students should be able to figure out that "Old Shack" is the appropriate answer. If many have trouble with this task, you may want to "walk" them through it – perhaps on a smart board or other common display.

Students should be able to figure out that "Volcano" is the appropriate answer. If students are struggling, assist them in breaking down the description into steps. For this example, have students first identify where 4 miles East of *Palm Beach* is located and put a mark in that spot. Then, have students identify where 15 miles South from that mark is, which should be nearest the "Volcano."

Activity: Where is the treasure buried?

You will work on your own for this activity. You will need:

- Ruler and pencil
- Island map

STEP 1: You will be given a map of an island on which several pirates have buried their treasures, in different places. Each treasure chest is buried near one of the landmarks shown on the map.

Look at the map and note that:

- The compass directions are shown. Using these, directions on the island can be described in a way that everyone can agree on.

- On this map, a distance of one centimeter (cm) represents a distance of one mile on the real island. (This is called the "scale" of the map.)

For example, the position of the *Abandoned Mine* is about 5 miles north of the *Tallest Mountain*. (The distance on the map is about 5 cm, which means that on the island it would be about 5 miles.)

STEP 2: Now use the map to answer these questions.

Captain Jack landed at *Safe Harbor* and buried his treasure chest at a position 10 miles West and 4 miles North from there. Near which landmark did he bury it?

Redbeard landed at *Palm Beach* and buried his treasure chest at a position 4 miles East and 15 miles South from there. Near which landmark did he bury it?

Activity: Step 2

For the location of Redbeard's treasure starting from the *Waterfall*, something like 2 miles North and 5 miles West would be appropriate.

Activity: Step 3

Reinforce the idea that no-one else should yet know where their treasure is buried.

Check student work to insure they are using only North, South, East and West, and not "diagonal" (e.g., Southwest) or "left/right" paths to create their descriptions.

To give specific starting points, tell students to use the dots on the coast of the island that are already on the map.

Let students create their own position descriptions. Do not be tempted to help at this point. Students who understand the concept may wish to write more elaborate and less "efficient" position descriptions. Allowing them to do so is fine, as long as the descriptions are accurate.

Activity: Step 4

It may be better to have students copy their landing point and directions onto another sheet of paper to give to a partner.

After a mutiny, Redbeard's crew come back to the island to recover his treasure. However, this time they land by the *Waterfall*. Starting from here, what is the position of Redbeard's treasure?

STEP 3: Imagine you are a pirate and want to bury your treasure somewhere on the island.

- Choose a position for your treasure and mark it on your own map with a small 'X'. **Do not show it to anyone else, or tell them where it is.**

Choose a point on the shore of the island where you will land. Write down that point here or on a separate sheet of paper (not on the map).

Landing point:

Now write down the position of the place you will bury your treasure (your 'X'), as measured from your chosen landing point. **You should use only the four directions shown on the compass rose, North (N), South (S), East (E), and West (W).**

STEP 4: Your teacher will now arrange for you to swap your paper with one of your classmates. **Do not swap maps!**

- Use your own map to figure out the position on the island where your classmate has buried their treasure. Mark this position with a different colored 'X'.

What is the closest landmark to your classmate's treasure?

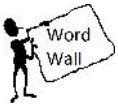
Have students check with each other. If they are not right, they should work together to find out why. Were the directions misleading for some reason, or were they not followed correctly?

Have a class discussion about any common issues that emerge. Take the opportunity to reinforce the elements that all good descriptions had and why these elements make descriptions good or useful.

Making Sense Questions

Question 1: The idea of a common language is appropriate again here. It is also important that the meaning of compass directions never change, unlike terms like "left," "right, "forward, "backward," etc. that change depending on which way a person is facing. The teacher may want to use two or more students facing in different directions to demonstrate this point. In answering this question, prompt students to provide examples (evidence) from the activity that support their responses.

Question 2: Let students suggest ideas (e.g., a ship at sea with no landmarks, hiking in a forest). Make sure they explain how compass directions are involved and why they are helpful.



Science Vocabulary

If students can demonstrate an understanding of what the "**position**" of an object means, and it has not already been added to the word wall, then it would be appropriate to add "**position**" to the word wall.

Your teacher will arrange for you to compare results with the classmate who was given your paper.

 Were you successful in finding each other's treasure?

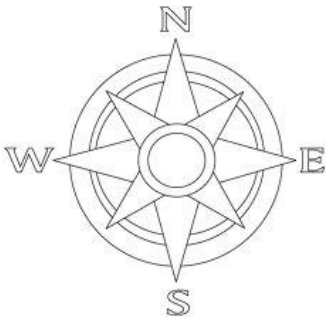
Making Sense

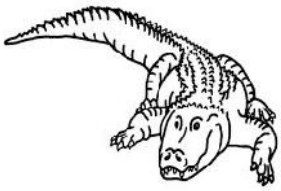
 Your teacher will lead a discussion on using compass directions to describe the position of an object. Write answers to the following questions after each one is discussed.

1. What are some good things about giving the position of an object using compass directions?

2. What are some other situations in which people use compass directions to give the position of something?

Palm Beach



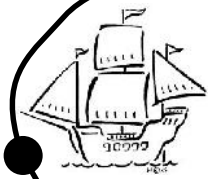


Alligator Swamp

Rocky Shore

Old Shack

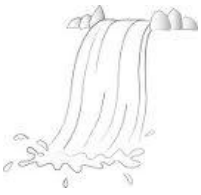
Abandoned Mine



Safe Harbor

Tallest Mountain

Volcano



Waterfall

Scale: 1 cm ≡ 1 mile

Unit 1 Cycle 1

Application: Deliver the pizza

LESSON TARGET IDEAS

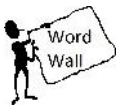
This lesson has no new target ideas.

WHAT TO FOCUS ON

This activity could be used in many ways. For classes who are having trouble with using compass directions and/or map scales, it could be extra practice. It could also be used as an authentic assessment activity, or even be omitted, if the teacher is satisfied that the class has already mastered the ideas. In this activity, students use compass directions and a distance scale to write directions from a pizza restaurant to a delivery location. Students then use each other's directions to identify the delivery location and compare results with their classmate. Similar to the previous activity in which students wrote directions to hidden treasure, students should find that using compass points (North, South, East and West) are useful when describing the position of an object because they specify direction independent of orientation. Students should also find that following descriptions that include a starting point, standard measures of distance, and compass points allows them to reach the target destinations.

MATERIALS NEEDED FOR THIS LESSON

Material	Quantity
Map of houses (last page of activity)	1 per student
Ruler with centimeter increments	1 per student



Science Vocabulary

By now, students should know what the "**position**" of an object means. If "**position**" has not already been added to the word wall, then add it at this time.

Unit 1 Cycle 1

Application: Deliver the pizza

Purpose

You have looked at different ways to describe the position and of an object. In this *Application* activity you will put these ideas together to tell a motorcyclist where to deliver a pizza.

Activity: Deliver the pizza

You will work on your own for this activity. You will need:

- Ruler and pencil
- Map of friends' houses

STEP 1: Imagine you call *Pizza House*, a pizza delivery service in the middle of your town. You want them to deliver a pizza to one of your friends who lives outside of town.

Your teacher will give you a map that shows *Pizza House* and your friends' houses.

Choose which friend you want the pizza delivered to and write their name here.

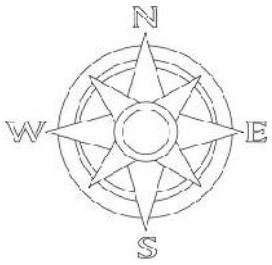
Using only the compass directions and distances, describe the position of your friend's house, as measured from *Pizza House*.

STEP 2: Your teacher will now arrange for you to swap your paper with one of your classmates. **Do not swap maps!**

Use your own map, and your classmate's given description to figure out which friend your classmate chose to get a pizza. Write the name below.

STEP 3: Your teacher will arrange for you compare results with the classmate who was given your paper.

Were you successful in finding out which friend your class mate chose to get the pizza?

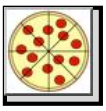


Scale: 1 cm ≡ 1 mile

ROSA

SUE

ZACK



Pizza House

KRIS

ROB

JOSE