Grade 9

Haa Latseen

SCIENCE

AS AN INQUIRY PROCESS

A-1 • UNITS 1-3

Based on the Alaska Science Standards SA1.1, SA1.2, SA2.1




FOR THE

Juneau-Douglas High School

Sealaska Heritage Institute

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Integrating Culturally Responsive, Place-Based Content with Language Skills Development for Curriculum Enrichment

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INTRODUCTION

Over the years, much has been written about the successes and failures of students in schools. There is no end to the solutions offered, particularly for those students who are struggling with academics. There have been efforts to bring local cultures into the classroom, thus providing the students with familiar points of departure for learning. However, most often such instruction has been limited to segregated activities such as arts and crafts or Native dancing rather than integrating Native culture into the overall learning process. Two core cultural values, *Haa Aaní,* the reference for and usage of the land, and *Haa Shagóon,* the tying of the present with the past and future, are known by both students and parents, and can be included in a curriculum that simultaneously provides a basis for self-identity and cultural pride, within the educational setting. This will provide a valuable foundation for improved academic achievement.

While the inclusion of Native concepts, values, and traditions into a curriculum provides a valuable foundation for self-identity and cultural pride, it may not, on its own, fully address improved *academic* achievement.

This program is designed to meet the academic realities, faced by high school students every day, using a developmental process that integrates *culture* with *skills* development. The values of *Haa Aaní* and *Haa Shagóon* are reinforced through the various activities in the program.

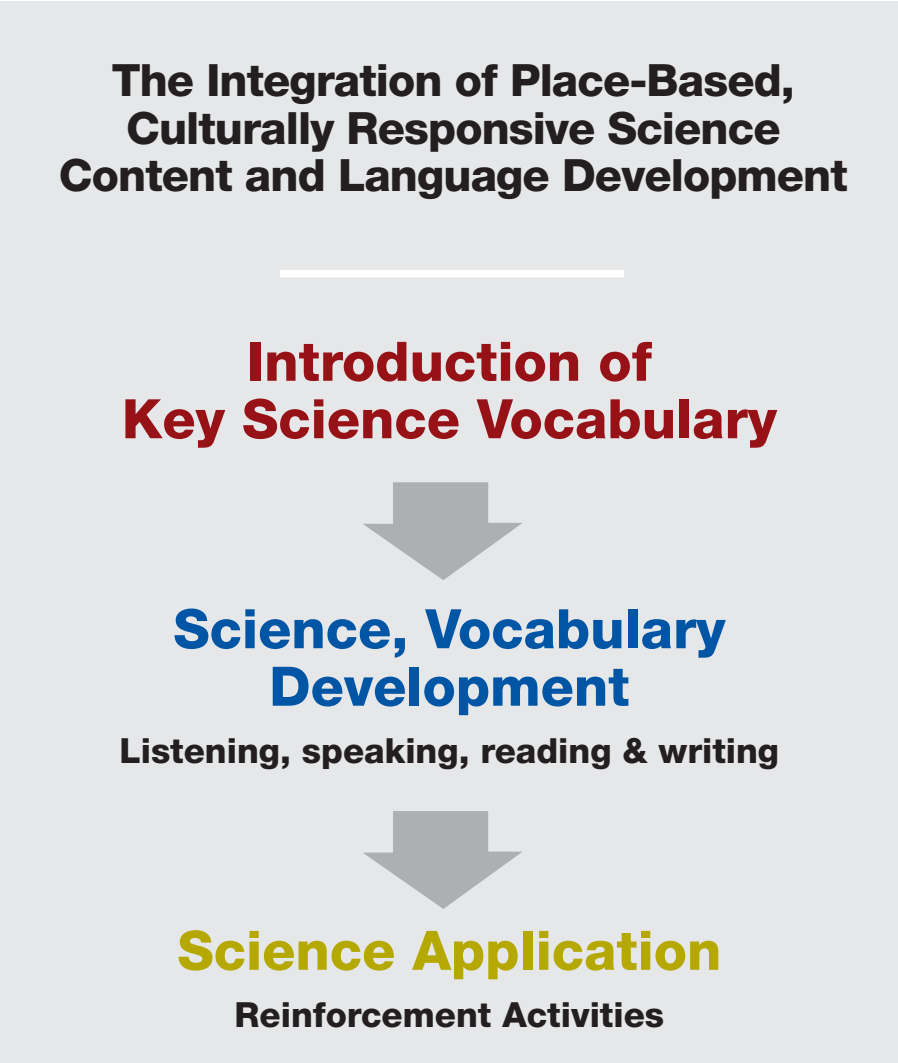
During science lessons, the students are exposed to new information and to key vocabulary that represent that information. While the students may acquire, through various processes, the scientific information, the vocabulary is often left at an exposure level and not internalized by them. Over time, this leads to *language-delay* that impacts negatively on a student's on-going academic achievement.

Due to *language delay*, many Native Alaskan high school students struggle with texts that are beyond their comprehension levels and writing assignments that call for language they do not have.

To this end, in this resource program, each key vocabulary word in science is viewed as a *concept*. The words are introduced concretely, using place-based information and contexts. Whenever possible, the concepts are viewed through the Native heritage cultural perspectives, thus reinforcing the value of *Haa Shagóon* and Haa Aaní. Using this approach, the students have the opportunity to acquire new information in manageable chunks; the sum total of which, represent the body of information to be learned in the science program.

When the key vocabulary/concepts have been introduced, the students are then taken through a sequence of listening, speaking, reading, and writing activities, designed to instill the vocabulary into their long term memories.

Finally, at the end of each unit, the students will participate in enrichment activities based on recognized and research-based *best practices*. By this time, the science information and vocabulary will be familiar, adding to the students' feelings of confidence and success. These activities will include *place-based* and *heritage culture* perspectives of the information learned.



The Developmental Language Process

The Developmental Language Process is designed to instill language into long term memory. The origin of the Process is rooted in the struggles faced by language-delayed students, particularly when they first enter school.

The Process takes the students/children through developmental steps that reflect the natural acquisition of language in the home and community. Initially, once key language items have been introduced concretely to the students, the vocabulary are used in the first of the language skills, Basic Listening. This stage in the process represents *input* and is a critical venue for language acquisition and retention. A baby hears many different things in the home, gradually the baby begins to *listen* to what he/she hears. As a result of the *input* provided through Basic Listening, the baby tries to repeat some of the language heard – this is represented by the second phase of the Process, Basic Speaking - the oral *output* stage of language acquisition.

As more language goes into a child's long-term memory, he/she begins to understand simple commands and phrases. This is a higher level of listening represented by the stage, Listening Comprehension. With the increase in vocabulary and sentence development, the child begins to explore the use of language through the next stage in the Process, Creative Speaking. All of these steps in the Process reflect the natural sequence of language development.

The listening and speaking skill areas represent *true* language skills; most cultures, including Alaska Native cultures, never went beyond them to develop written forms. Oral traditions are inherent in the listening and speaking skills.

However, English does have abstract forms of language in reading and writing. Many Native children entering kindergarten come from homes where language is used differently than in classic Western homes. This is not a value judgment of child rearing practices but a definite cross-cultural reality. Therefore, it is critical that the Native child be introduced to the concepts of reading and writing before ever dealing with them as skills areas. It is vital for the children to understand that reading and writing are *talk in print*.

The Developmental Language Process integrates the *real* language skills of listening and speaking with the related skills of reading and writing. At this stage in the Process, the students are introduced to the printed words for the first time. These abstract representations are now familiar, through the listening and speaking activities, and the relationship is formed between the words and language, beginning with Basic Reading.

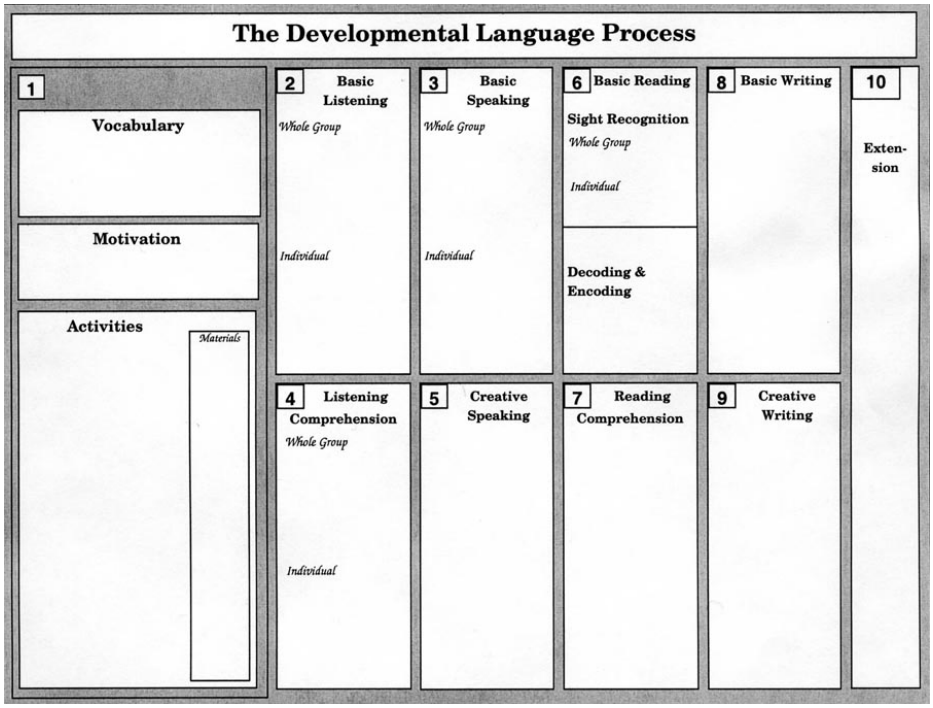
As more language goes into the children's long-term memories, they begin to comprehend more of what they read, in Reading Comprehension.

Many Alaskan school attics are filled with reading programs that didn't work – in reality, any of the programs would have worked had they been implemented through a language development process. For many Native children, the printed word creates angst, particularly if they are struggling with the reading process. Often, children are asked to read language they have never heard.

Next in the Process is Basic Writing, where the students are asked to write the key words. Finally, the most difficult of all the language skills, Creative Writing, asks the students to write sentences of their own, using the key words and language from their long-term memories. This high level skill area calls upon the students to not only retrieve language, but to put the words in their correct order within the sentences, to spell the words correctly and to sequence their thoughts in the narrative.

A student's ability to comprehend well in listening and reading, and to be creatively expressive in speaking and writing, is dependent upon how much language he/she has in long-term memory.

The Developmental Language Process is represented in this chart:



It should be understood that these materials are not a *curriculum* - rather, they are resource materials designed to encourage academic achievement through intensive language development in the content areas.

These resource materials are *culturally responsive* in that they utilize teaching and learning styles effective with Native students. As the students progress through the steps of the Process, they move from a concrete introduction of the key vocabulary, to a symbolic representation of the vocabulary, and finally, to their abstract forms - reading and writing. This provides a format for the students to develop language and skills that ultimately lead to improved academic performance.

Alaska Content Standards for Science

A. Science as Inquiry and Process

A student should understand and be able to apply the processes and applications of scientific inquiry. A student who meets the content standard should

1. develop an understanding of the processes of science used to investigate problems, design and conduct repeatable scientific investigations, and defend scientific arguments;
2. develop an understanding that the processes of science require integrity, logical reasoning, skepticism, openness, communication, and peer review; and
3. develop an understanding that culture, local knowledge, history, and interaction with the environment contribute to the development of scientific knowledge, and local applications provide opportunity for understanding scientific concepts and global issues.

B. Concepts of Physical Science

A student should understand and be able to apply the concepts, models, theories, universal principals, and facts that explain the physical world. A student who meets the content standard should:

1. develop an understanding of the characteristic properties of matter and the relationship of these properties to their structure and behavior;
2. develop an understand that energy appears in different forms, can be transformed from one form to another, can be transferred or moved from one place or system to another, may be unavailable for use, and is ultimately conserved;
3. develop an understanding of the interactions between matter and energy, including physical, chemical, and nuclear changes, and the effects of these interactions on physical systems; and
4. develop an understanding of motions, forces, their characteristics and relationships, and natural forces and their effects.

C. Concepts of Life Science

A student should understand and be able to apply the concepts, models, theories, facts, evidence, systems, and processes of life science. A student who meets the content standard should:

1. develop an understanding of how science explains changes in life forms over time, including genetics, heredity, the process of natural selection, and biological evolution;
2. develop an understanding of the structure, function, behavior, development, life cycles, and diversity of living organisms; and
3. develop an understanding that all organisms are linked to each other and their physical environments through the transfer and transformation of matter and energy.

D. Concepts of Earth Science
A student should understand and be able to apply the concepts, processes, theories, models, evidence, and systems of earth and space sciences. A student who meets the content standard should:

1. develop an understanding of Earth's geochemical cycles;
2. develop an understanding of the origins, ongoing processes, and forces that shape the structure, composition, and physical history of the Earth;
3. develop an understanding of the cyclical changes controlled by energy from the sun and by Earth's position and motion in our solar system; and
4. develop an understanding of the theories regarding the origin and evolution of the universe.

E. Science and Technology
A student should understand the relationships among science, technology, and society. A student who meets the content standard should:

1. develop an understanding of how scientific knowledge and technology are used in making decisions about issues, innovations, and responses to problems and everyday events;
2. develop an understanding that solving problems involves different ways of thinking, perspectives, and curiosity that lead to the exploration of multiple paths that are analyzed using scientific, technological, and social merits; and
3. develop an understanding of how scientific discoveries and technological innovations affect and are affected by our lives and cultures.

F. Cultural, Social, Personal Perspectives and Sciences
A student should understand the dynamic relationships among scientific, cultural, social, and personal perspectives. A student who meets the content standard should:

1. develop an understanding of the interrelationships among individuals, cultures, societies, science, and technology;
2. develop an understanding that some individuals, cultures, and societies use other beliefs and methods in addition to scientific methods to describe and understand the world; and
3. develop an understanding of the importance of recording and validating cultural knowledge.

G. History and Nature of Science
A student should understand the history and nature of science. A student who meets the content standard should:

1. develop an understanding that historical perspectives of scientific explanations demonstrate that scientific knowledge changes over time, building on prior knowledge;
2. develop an understanding that the advancement of scientific knowledge embraces innovation and requires empirical evidence, repeatable investigations, logical arguments, and critical review in striving for the best possible explanations of the natural world;
3. develop an understanding that scientific knowledge is ongoing and subject to change as new evidence becomes available through experimental and/or observational confirmation(s); and
4. develop an understanding that advancements in science depend on curiosity, creativity, imagination, and a broad knowledge base.

http://www.educ.state.ak.us/ContentStandards/Science.html

UNIT 1

Sealaska Heritage Institute

INTRODUCTION OF

Key Vocabulary

Culturally Responsive & Place-based Introduction of Science Vocabulary

Process

PLACED-BASED PERSPECTIVE	HERITAGE CULTURAL PERSPECTIVE
Show the students a can of fish. Have them suggest the *processes* that led to the fish being canned. Relate this to a science *process*. Repeat this with other *processed* items.	Show the students a sample of dry fish. Have the students suggest the *process* of producing dry fish. Relate this to other traditional *processes*.

Predict

PLACED-BASED PERSPECTIVE	HERITAGE CULTURAL PERSPECTIVE
Show the students the picture from this unit. Encourage them to suggest how the groundhog helps to *predict* weather. Have the students suggest other *predictions* that might be made in the community.	Traditionally, native peoples of the SE would use natural phenomena to predict weather. Have the students suggest what weather predictions this might lead to: .. squirrels frantically gathering food .. (long winter)

Classify

PLACED-BASED PERSPECTIVE	HERITAGE CULTURAL PERSPECTIVE
Show the students the *classified* section of a newspaper. Use it to introduce the concept of classifying. Have the students suggest other things that are *classified*.	Review the concept of the Clan structure with the students (Eagle: Killer Whale, Wolf, Bear, Shark, Thunderbird) and (Raven: Whale, Frog, Sockeye, Coho, Humpy, Land Otter). Show the students the picture from the vocabulary illustrations; using the Clan system to introduce *classifying* to the students.

Culturally Responsive & Place-based Introduction of Science Vocabulary

Generalize

PLACED-BASED PERSPECTIVE

Show the students pictures of two different types of cars - have the students identify which car they would buy and why.

Use this to introduce *generalize* - i.e,, the students made their decisions based on information about the cars.

HERITAGE CULTURAL PERSPECTIVE

Discuss a bear attack to the students. Call upon them to imagine *why* there might be a rash of bear attacks.

Lead the students to suggest that a bad berrry and/or fish season can lead to more bear/human encounters. Use this to introdjce *generalize* to the students.

Infer

PLACED-BASED PERSPECTIVE

Prepare an overhead of the vocabulary picture, from this Unit. Have the students look at the picture of the woman; they should then tell as much as they can about her, merely by her appearance, expression, etc.

Use this to introduce *inferring* - making decisions based on information provided.

HERITAGE CULTURAL PERSPECTIVE

Show the students the picture, from the vocabulary illustrations, that shows clouds hanging over a mountain. Have the students *infer* the meaning of this phenomenon - lead them to suggest that the clouds indicate that the winds may be from the south and that it will be rainy.

Observation

PLACED-BASED PERSPECTIVE

Show the students a pair of binolculars, a magnifying glass, and/or a microscope. Lead the students to suggest what is common to all of the items - they are all used for *observation* and research.

HERITAGE CULTURAL PERSPECTIVE

Show the students the picture, from the vocabulary illustrations, that shows salmon spawning. Lead the students to understand that when male salmon were *observed* coming back to a river to make nests for the females, the females were soon to follow. Have the students suggest other elements of the environment that would have been *observed*.

Culturally Responsive & Place-based Introduction of Science Vocabulary

Qualitative

PLACED-BASED PERSPECTIVE

Show the students a tray of soil - have them suggest the best method for studying the soil - lead them to suggest that studying the soil in its natural habitat would be the most effective method of study. Use this to introduce *qualitative* studies to the students.

HERITAGE CULTURAL PERSPECTIVE

Show the students the picture of the Chilkat blanket, from the vocabulary illustrations. Have the students suggest *how* the quality of the blanket might be determined (its weave, symmetry, the story it tells). Use this to introduce *qualitative* observations; have the students suggest other *qualitative* observations that can be made in their area.

Quantitative

PLACED-BASED PERSPECTIVE

Show the students a road map. Have them tell the characteristics of a map - i.e., the information that it provides. Lead the students to suggest that distances, among other things, are represented on the map. In addition, size of urban areas may be represented by the markers on the map, etc.

HERITAGE CULTURAL PERSPECTIVE

Have the students imagine what might happen to salmon eggs, if there is a freeze-up with no snow. Lead them to understand that the number of salmon hatched may be much less. Use this as an example of *quantitative* research. Have the students suggest other *quantitative* observations that can be made.

Communicate

PLACED-BASED PERSPECTIVE

Show a phone book and a letter envelope. Have the students suggest the commonality of the two items - lead them to realize that both represent forms in which people can *communicate*.

Have the students suggest other forms of *communication*.

HERITAGE CULTURAL PERSPECTIVE

Show the students a miniature totem pole or the picture, from the vocabulary illustrations. Lead the students to sugges *what* the parts of the pole represent - the poles may tell stories, histories, etc. Use this to indicate one way the Tlingit, Haida, and Tsimshian peoples *communicated* information. Introduce the concept of the *oral tradition* as another *communication* form.

Culturally Responsive & Place-based Introduction of Science Vocabulary

Data

PLACED-BASED PERSPECTIVE

Show the students the picture of a tagged animal, from **Appendix D**, at the back of this Unit. Have the students suggest why animals are tagged; use this to introduce the gathering of information (*data*) that then has to be *interpreted.* Have the students suggest other information in their area that can provide *data* to be *interpreted*.

HERITAGE CULTURAL PERSPECTIVE

Show the students the potlach picture, from the vocabulary illustrations. Have the students determine the types of organizing necessary to have a potluck. Lead this into the necessary *data* - how many skins, blankets, would be necessary, etc. Have the students suggest other situations in which the collection of *data* would have been critical.

Conclusion

PLACED-BASED PERSPECTIVE

Show the students a glass. Have the students imagine how the glass might have been used to solve a crime - lead them to suggest that fingerprints might have been found on the glass - leading the investigators to a *conclusion* related to the crime - once again, have the students suggest the *conclusions* that might have been reached.

HERITAGE CULTURAL PERSPECTIVE

Show the picture of pollution, from the vocabulary illustrations. Use the picture to come to *conclusions* regarding the state of the environment.

Have the students suggest other *conclusions* that might be reached about elements of the environment.

Interpret

PLACED-BASED PERSPECTIVE

Show the students the vocabulary picture from this unit. Have the students tell you what it is that the man is doing (interpreting data).

Have the students suggest things that they might *interpret* in their community - weather and water conditions, clouds, etc.

HERITAGE CULTURAL PERSPECTIVE

Show the students the picture, from the vocabulary illustrations, that shows red northern lights. Have them imagine what this might have signified traditionally to Tlingit, Haida, and Tsimshian peoples. Lead them to understand that red northern lights that seemed close, indicated misfortune to an individual or his/her family.

Language Skills

Language & Skills Development

LISTENING

Use the activity pages from the Student Support Materials.

Illustration Bingo

Provide each student with a copy of the mini-illustration activity page from the student support materials. The students should cut out the illustrations. Each student should turn his/her illustrations face-down on the desk. Then, each student should turn ONE illustration face up. Say a vocabulary word. Any student or students who have the illustration for the vocabulary word you said face up on their desks, should show their illustrations. Those illustrations should then be put to the side and the students should turn over another illustration. The first student or students to have no illustrations left on their desks, win the round. The illustrations may be collected, mixed, and re-distributed to the students for the different rounds of the activity.

SPEAKING

One To Six

Provide each student with two blank flashcards. Each student should then write a number on each of his flashcards, between one and six - one number per card. When the students' number cards are ready, toss two dice and call the numbers showing. Any student or students who have those two numbers must then identify a vocabulary illustration you show. The students may exchange number cards periodically during this activity.

READING

Use the activity pages from the Student Support Materials.

Right or Wrong?

Mount the sight words on the chalkboard. Point to one of the sight words and name it. The students should repeat the sight word. However, when you point to a sight word and say the wrong word for it, the students should remain silent. Repeat this process until the students have responded accurately to all of the sight words a number of times.

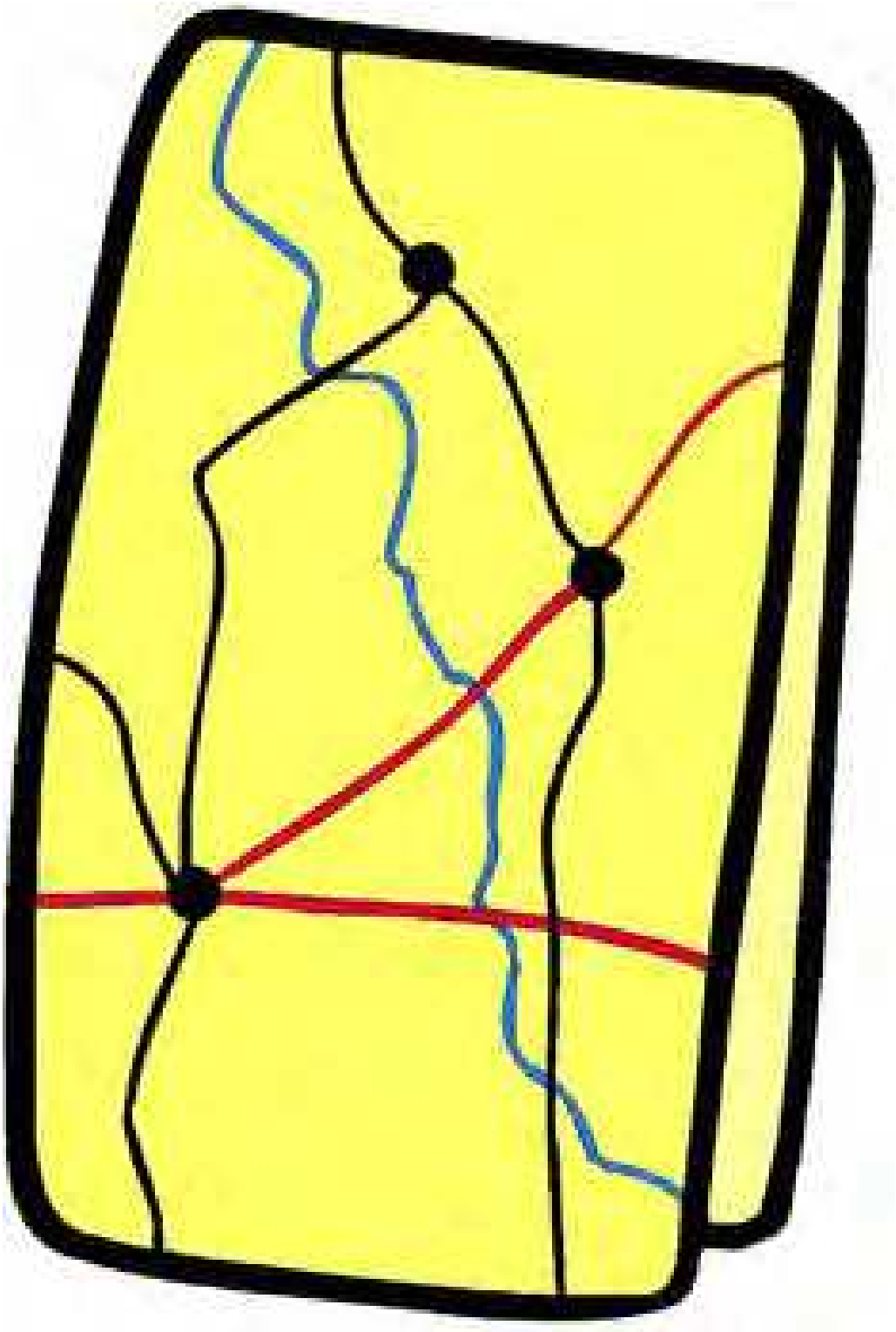
WRITING

Use the activity pages from the Student Support Materials.

Mirror Writing

Group the students into two teams. Have the first player from each team stand in front of the chalkboard. Give each of the two players a small, unbreakable mirror. Stand some distance behind the two players with illustrations for the sight words. Hold up one of the illustrations. When you say "Go," the players with the mirrors must look over their shoulders to see the illustration you are holding. When a player sees the illustration, he/she must write the sight word for that illustration on the chalkboard. The first player to do this correctly wins the round. Repeat this process until all players in each team have an opportunity to respond.

Vocabulary Images

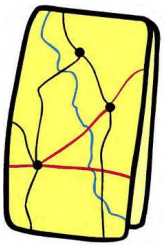


STUDENT SUPPORT MATERIALS

Listening

"Write the numbers of the words under their pictures - 1. process, 2. predict, 3. generalize, 4. infer, 5. observation, 6. qualitative, 7. quantitative, 8. communicate, 9. data, 10. conclusion 11. interpret, 12. classify."

cut along this line



True Or False?

Read the following sentences to the students. The students should write "true" or "false" for each of the sentences.

1. *"A process is data that leads to a qualitative conclusion."*

2. *"Today, weather prediction is made easier due to radar and other devices."*

3. *"Animals can be classified based on data collected."*

4. *"It is easy to generalize information when little or no data is available."*

5. *"We can infer information based on something we see."*

6. *"Observations relate to information that has never been gathered, using available data."*

7. *"Qualitative data is data that does not include quantities."*

8. *"Quantitative data often involves measurements, of one form or another."*

9. *"To communicate with another person is to prepare data that is not shared."*

10. *"Interpreting data involves understanding the information provided."*

11. *"Data is the different forms of communication available in a quantitative study."*

12. *"A conclusion should always be reached when little or no data is available."*

13. *"We can formulate opinions based on data that we interpret."*

STUDENT SUPPORT MATERIALS

Sight Words

process

predict

classify

generalize

infer

observations

qualitative

quantitative

communicate

interpret

data

conclusion

STUDENT SUPPORT MATERIALS

Reading

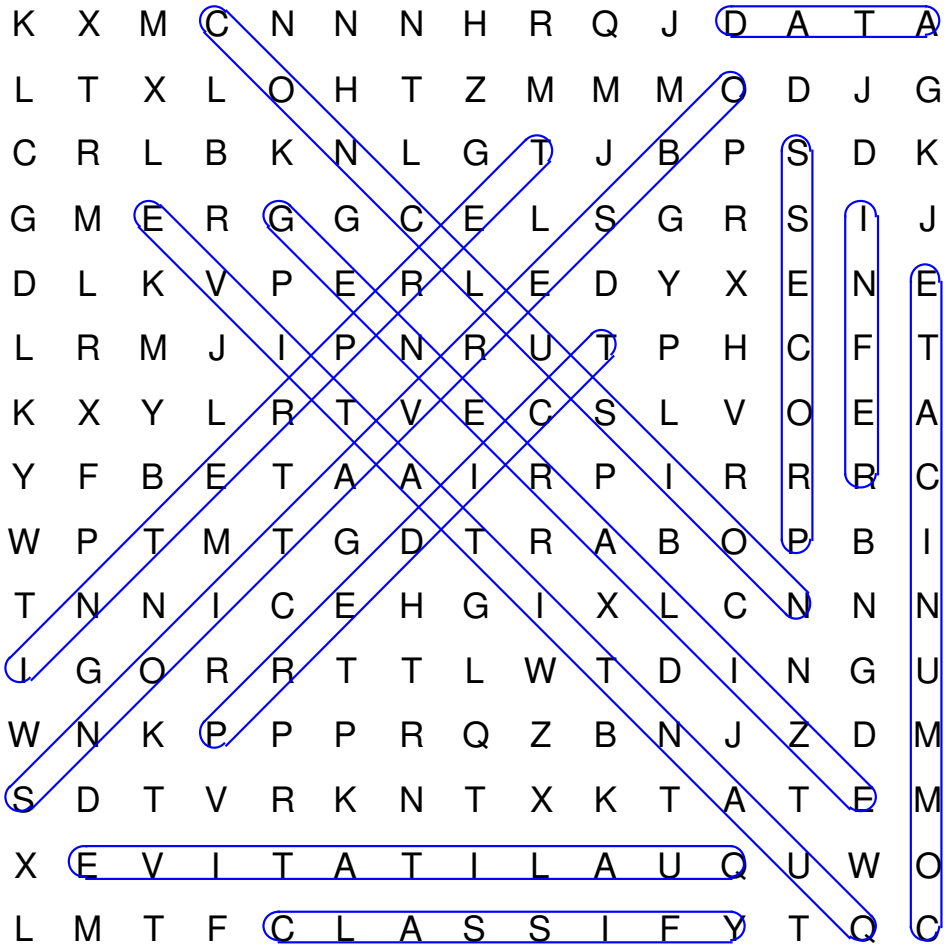
Word Find

Find the words in the grid. Words can go horizontally, vertically and diagonally in all eight directions.

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

Classify
Communicate
Conclusion
Data
Generalize
Infer
Interpret
Observations
Predict
Process
Qualitative
Quantitative

Word Find Solution



Find The Word

process
predict
classify
generalize
infer
observations
qualitative
communicate
quantitative
interpret
data
conclusion
formulate

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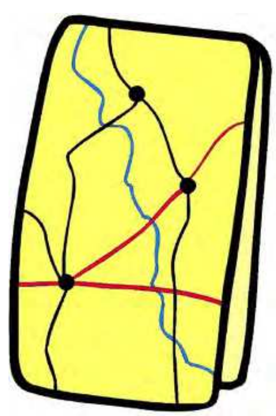

process
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Match The Halves

1	*Tooth decay*	**A**	*recorded.*
2	*We can sometimes predict*	**B**	*we are often explaining it.*
3	*When we wash clothes, we classify*	**C**	*is collected on-site.*
4	*It is possible to generalize*	**D**	*using data.*
5	*When we infer*	**E**	*data with other people.*
6	*Observations can be*	**F**	*which team will win.*
7	*Qualitative data is data that*	**G**	*is a process.*
8	*Quantitative data is data that*	**H**	*them by white and colors.*
9	*We can communicate*	**I**	*involves measurement in some form.*
10	*When we interpret something,*	**J**	*that is collected.*
11	*Data is information*	**K**	*an answer.*
12	*A conclusion is*	**L**	*we are guesssing.*
13		**M**	

Word & Definition Match

Have the students write the word numbers on their matching definitions.

This involves different steps.	*This is telling what will happen.*	*This is grouping things.*	*We can do this based on a few facts.*	*This is a form of guessing.*
This is watching something over time.	*This information does not have measurements.*	*This data has measurements.*	*This is when we deal with others.*	*This is when we understand data.*
This is information.	*This is something we decide.*	*We do this after interpreting data.*		

1. formulate **2. process** **3. conclusion** **4. predict** **5. classify**

6. data **7. interpret** **8. generalize** **9. communicate** **10. infer**

11. quantitative **12. observations** **13. qualitative**

Fill-in the Blanks

1. If you_____ information slowly you will require more time to grasp the reality of the situation.

2. Sometimes it is easy to _____ the outcome of an experiment, especially if you have done the experiment before.

3. When a new organism is discovered, scientists are careful to _____ it appropriately so that the new organisms relationship to other organisms is clear.

4. Sometimes people _____ from their observations too quickly, which can lead to mistakes and prejudice.

5. It is the responsibility of the listener to _____ what the speaker is implying.

6. Science is based not only on _____ but also observations, which employ the senses.

7. If you collect _____ data you are collecting data that cannot be measured, necessarily, with a number, but rather can be measured with a descriptive word.

8. _____ data is based on a number or quantity, such as the length of ones hair.

9. Scientists still use scientific journals to _____ their findings to the broader community, although press conferences and internet sites are used as well.

10. Scientists often argue over the proper way to _____ their observations.

11. Keeping track of your _____ in a lab notebook will pay off when trying to write up your lab report.

12. It is difficult to draw a _____ from an incomplete data set.

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1. process 2. predict 3. classify 4. generalize 5. infer 6. observations
7. qualitative 8. quantitative 9. communicate 10. interpret 11. data
12. conclusion

Which One is Right?

Have the students read the sentences and mark the bullets that go with them.

Multiple Choice

1) **Science is:**
   - (a) A process to explain observations and make predictions;
   - (b) A process that varies according to who is conducting research;
   - (c) A system that generalizes observations of our world.

2) **The effects of global climate change on sea level:**
   - (a) Is a process that all agree are inconsequential;
   - (b) is something that scientists are trying to predict;
   - (c) is being classified by scientists.

3) **People who look for new species are:**
   - (a) Working to classify organisms;
   - (b) Working to collect quantitative data;
   - (c) Inferring new biological laws.

4) **To state that ravens are the most intelligent of the bird is:**
   - (a) To make a prediction about birds in general;
   - (b) A generalization about birds;
   - (c) A statement about the communication abilities of various birds.

5) **Although it was not known how information was passed from parents to offspring,**
   - (a) The presence of something that did that was classified when children showed characteristics of both parents;
   - (b) The presence of something that did that was processed when children showed characteristics of both parents;
   - (c) The presence of something that did that was inferred when children showed characteristics of both parents.

6) **When a scientist works to identify the individual components of a compound:**
   - (a) they are performing a quantitative analysis;
   - (b) they are performing a qualititative analysis;
   - (c) they are performing a communicative analysis.

7) **When a scientist works to identify the exact amounts of individual components of a compound:**
   - (a) they are performing a quantitative analysis;
   - (b) they are performing a qualititative analysis;
   - (c) they are performing a communicative analysis

8) **The reporting of findings by scientists:**
   - (a) Is an important part of the interpretive process;
   - (b) Is necessary for any conclusions to be drawn;
   - (c) Is an important aspect of the communication process between scientists.

9) **Data refers to:**
   - (a) Any observations made by scientists while conducting work;
   - (b) A prediction made by a scientist;
   - (c) A scientific theory.

10) **The most important part of any scientific work is the:**
   - (a) Hypothesis that is being examined;
   - (b) The observations that are gathered during the work;
   - (c) The conclusions that can be made based on the analysis of data.

Which One Belongs

1. Preparing for the National Ocean Sciences Bowl competition was a long prediction/process.

2. Scientists often make observations/predictions about the future based on models that they construct.

3. Those scientists who work with classifying/interpreting organisms, study their characteristics on an easily seen, and not easily seen (like the cell) level. (Classify)

4. To say that those who go to college are most successful is to interpret/generalize about a segment of the population.

5. Sally was able to classify/infer the kingdom that the grasshopper belonged to based on the presence of its eyes.

6. Many many observations/conclusions support the Theory of Evolution.

7. Determining the exact kind of chemical in a solution is a qualitative/quantitative analysis.

8. Determining the exact amount of a chemical substance in a solution is a qualitative/quantitative analysis.

9. Steve was unable to interpret/communicate with his hunting partner because his radio wouldn't turn on.

10. The question of whether a virus is alive is often based on the interpretation/conclusion of what life itself constitutes.

11. The infer/data clearly showed that the accused had, in fact, committed the crime.

12. The investigator reached the generalization/conclusion only after much deliberation of the evidence had occurred.

---

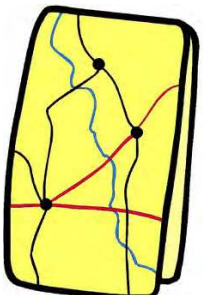
1. process, 2. prediction, 3. classify, 4. generalize, 5. infer, 6. observations, 7. qualitative 8. quantitative, 9. communicate 10, interpretation, 11. data, 12. conclusion

STUDENT SUPPORT MATERIALS

Writing

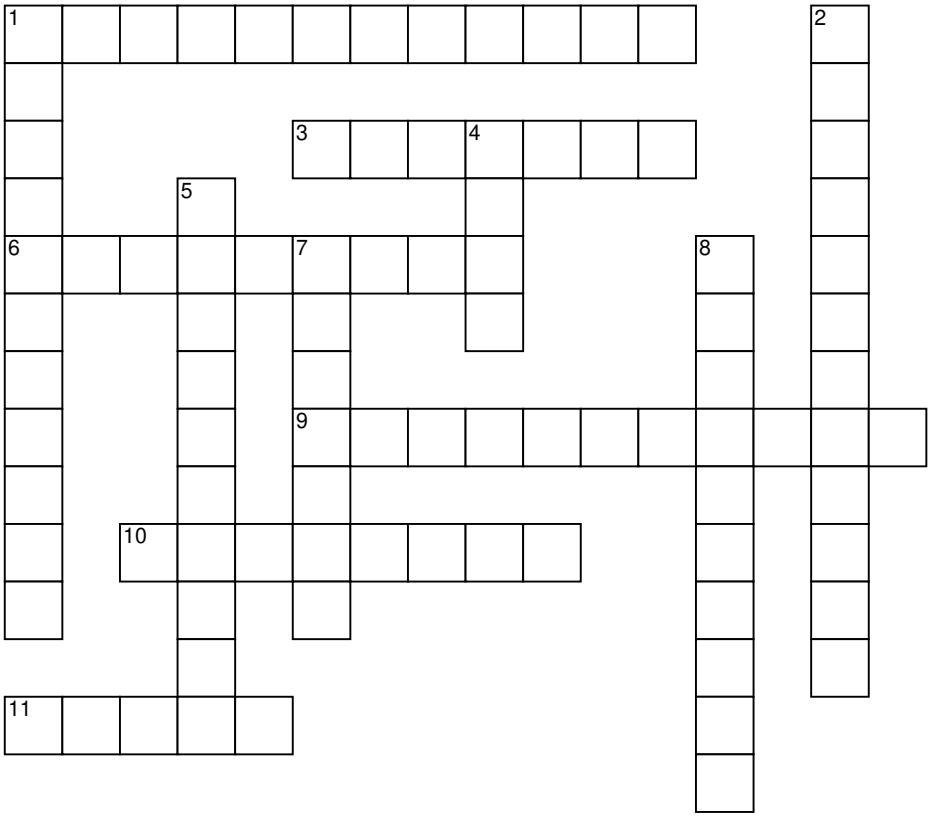
Write the Words

Write the Words



9th A-1: Science as Inquiry and Process

Unit 1



www.CrosswordWeaver.com

ACROSS

1 a measurement based on some quantity or number rather than one on some quality.
3 is a guess about something that will happen in the future.
6 to explain or tell the meaning of; to expound; to decipher; to define.
9 is the successful transmission of information set of symbols , signs, behavior, speech, writing or signals.
10 to identify by or divide into classes; to categorize.
11 to draw a conclusion (by reasoning).

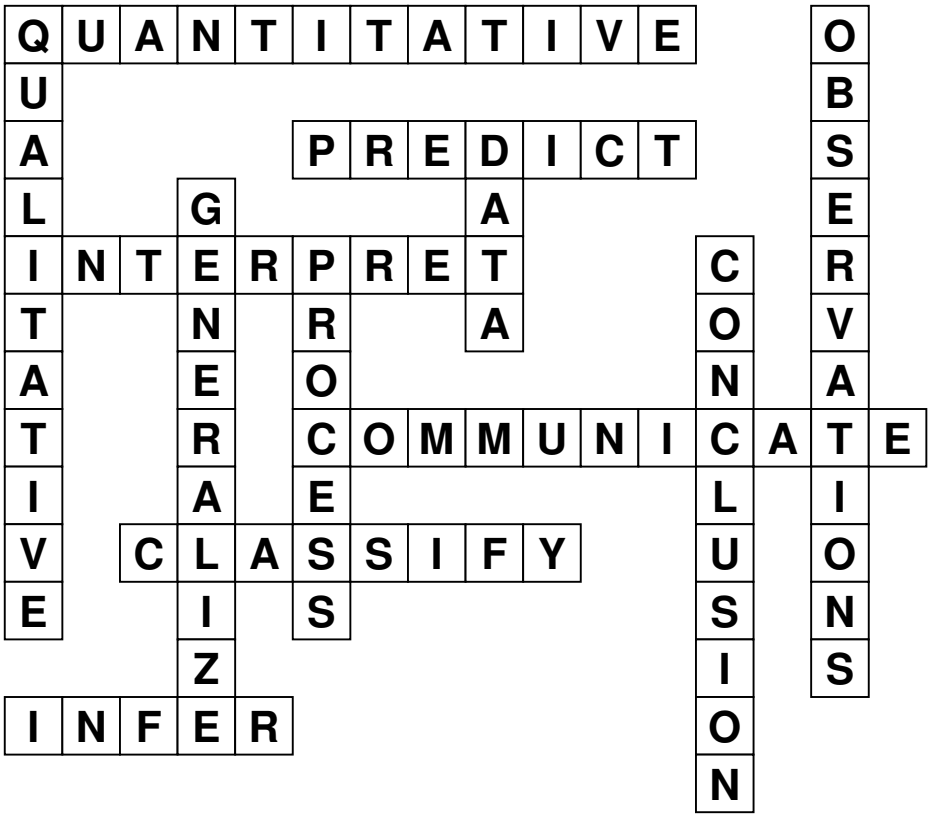
DOWN

1 of a form of analysis that yields the identity of a compound.
2 means to watch carefully the way something happens or to watch how someone does something in ofer to learn more about it.
4 is factual information (measurements or statistics) used as a basis for reasoning, discussion, or calculation.
5 to speak in generalities, or in vague terms.
7 is the action taking place. It is the output of the program or command.
8 the end, finish, close or last part of something.

9th A-1: Science as Inquiry and Process

Unit 1

Solution:



Finish the Sentences

Have the students write the key words in the blanks.

1. If you_____ information slowly you will require more time to grasp the reality of the situation.

2. Sometimes it is easy to _____ the outcome of an experiment, especially if you have done the experiment before.

3. When a new organism is discovered, scientists are careful to _____ it appropriately so that the new organisms relationship to other organisms is clear.

4. Sometimes people _____ from their observations too quickly, which can lead to mistakes and prejudice.

5. It is the responsibility of the listener to _____ what the speaker is implying.

6. Science is based not only on _____ but also observations, which employ the senses.

7. If you collect _____ data you are collecting data that cannot be measured, necessarily, with a number, but rather can be measured with a descriptive word.

8. _____ data is based on a number or quantity, such as the length of ones hair.

9. Scientists still use scientific journals to _____ their findings to the broader community, although press conferences and internet sites are used as well.

10. Scientists often argue over the proper way to _____ their observations.

11. Keeping track of your _____ in a lab notebook will pay off when trying to write up your lab report.

12. It is difficult to draw a _____ from an incomplete data set.

---

1. process 2. predict 3. classify 4. generalize 5. infer 6. observations
7. qualitative 8. quantitative 9. communicate 10. interpret 11. data
12. conclusion

Creative Writing Activity Page

Have the students write sentences of their own, using the key words from this unit. When the students' sentences are finished, have them take turns reading their sentences orally. The students should say "Blank," for the key words; the other students must name the "missing" words. You may wish to have the students write the "definitions" for the key words.

process

predict

classify

generalize

infer

observations

qualitative

quantitative

communicate

Creative Writing Activity Page

Have the students write sentences of their own, using the key words from this unit. When the students' sentences are finished, have them take turns reading their sentences orally. The students should say "Blank," for the key words; the other students must name the "missing" words. You may wish to have the students write the "definitions" for the key words.

interpret

---

data

---

conclusion

---

formulate

Creative Writing Activity Page

Have the students write sentences of their own, based on the picture below. When finished, have each student read his/her sentences to the others.

STUDENT SUPPORT MATERIALS

Reinforcement Activities

Students can participate in a mini-science fair in which they investigate an original question and then present their findings in posterboard form to the class during a class-wide science fair. PowerPoint presentations and/or written reports could also be a part of this open inquiry.

Before the experiment begins, ask the students to predict what will happen if you put a bag of milk in a bag of ice water. Communicate to them that this experiment will be a process that the students need to follow precisely. Have them perform the experiment below and make careful observations.

Materials

1/2 cup milk
1/2 cup whipping cream (heavy cream)
1/4 cup sugar
1/4 teaspoon vanilla, almond, strawberry, banana extracts
1/2 to 3/4 cup sodium chloride (NaCl) as table salt or rock salt
2 cups ice
1-quart ZiplocTM bag
1-gallon ZiplocTM bag
thermometer
measuring cups and spoons
cups and spoons for eating your treat!

Procedure

1. Add 1/4 cup sugar, 1/2 cup milk, 1/2 cup whipping cream, and 1/4 teaspoon extract to the quart ziplocTM bag. Seal the bag securely.
2. Put 2 cups of ice into the gallon Ziploc bag.
3. Use a thermometer to measure and record the temperature of the ice in the gallon bag.
4. Add 1/2 to 3/4 cup salt (sodium chloride) to the bag of ice.
5. Place the sealed quart bag inside the gallon bag of ice and salt. Seal the gallon bag securely.
6. Gently rock the gallon bag from side to side. It's best to hold it by the top seal or to have gloves or a cloth between the bag and your hands because the bag will be cold enough to damage your skin.
7. Continue to rock the bag for 10-15 minutes or until the contents of the quart bag have solidified into ice cream.
8. Open the gallon bag and use the thermometer to measure and record the temperature of the ice/salt mixture.
9. Remove the quart bag, open it, serve the contents into cups with spoons and ENJOY!

Follow-up

Have the students classify the ice creams by flavor. Discuss how the taste of the ice cream is qualitative data, whereas the temperatures measured are quantitative data. Have the students write a conclusion for the project about why the cream turned to ice cream.

Invite a resource person to demonstrate the making of a Chilkat blanket. Arrange for sample materials to be used to enhance the presentation.

Unit Assessment

Unit 1 Quiz

A-1 Unit 1 Quiz

Science as Inquiry and Process

Name: _____
Date: _____

1) which of the following demonstrates a process?

   a) a silkworm spinning fibers into cloth

   b) a spawned out salmon

   c) a basketball going through a hoop

   d) a book report

2) When I identify fish by their appearance, I am...

   a) naming them.

   b) culling them.

   c) classifying them.

   d) selecting them.

3) Choose the best definition below for the term, OBSERVATION when referring to scientific activities.

   a) an act of stating an opinion about something

   b) an act of seeing something from a new point of view

   c) an act of paying attention to a custom or tradition

   d) an act of gathering information by paying attention to facts or occurrences

4) Based on the gallon of berries my aunt picked yesterday, I _____ I will find berries to pick today.

5) Scientist believe that qualitative research is more important to science than quantitative.

   a) True

   b) False

6) When can you infer that something has happened?

   a) when you don't have all of the facts but need to take action

   b) when you're tired of waiting for the results and need to make a decision

   c) when you can form an opinion due to information and evidence

   d) none of the above

7) When I saw the cane by the door, the false teeth on the counter, the older model car in front of the house, I could_____that I was in the home of an older person.

a) generalize

b) communicate

c) estimate

d) generate

8) Do you remember the illustrations used for words Qualitative? Draw the illustration for Qualitative. Give a short written explanation of a qualitative study or research based on your illustration. What does it mean?

9) Facts that we collect from observation and experiments are also called _____.

10) The words infer and generalize mean almost the same thing.

a) True

b) False

11) Draw an illustration for the word COMMUNICATE. Then write a brief definition.

A-1 Unit 1 Quiz

Science as Inquiry and Process

READ TO THE STUDENTS

1) which of the following demonstrates a process?

   a) **a silkworm spinning fibers into cloth**

   b) a spawned out salmon

   c) a basketball going through a hoop

   d) a book report

2) When I identify fish by their appearance, I am...

   a) naming them.

   b) culling them.

   c) **classifying them.**

   d) selecting them.

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b) when you're tired of waiting for the results and need to make a decision

c) **when you can form an opinion due to information and evidence**

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10) The words infer and generalize mean almost the same thing.

a) **True**

b) False

11) Draw an illustration for the word COMMUNICATE. Then write a brief definition.

UNIT 2

Sealaska Heritage Institute

INTRODUCTION OF

Key Vocabulary

Culturally Responsive & Place-based Introduction of Science Vocabulary

Formulate

PLACED-BASED PERSPECTIVE

Show students diagrams of small groups of animals. Have students write the number of animals on the board. Add the animals up to create a simple formula.

Use this to introduce formulate – putting information into a definite statement or expression

HERITAGE CULTURAL PERSPECTIVE

Traditionally, Heritage Cultures fomulated plans for a variety of activities. This included the building of the long houses as well as the making of canoes.

Evidence

PLACED-BASED PERSPECTIVE

Discuss with students what observations they could make in the classroom would support the assertion that it is a classroom. Limit descriptions only to observable facts. Discuss how this evidence supports the original assertion.

HERITAGE CULTURAL PERSPECTIVE

When the coastal people travelled to trade with the inland tribes, they would return with songs, language and cultural processes as evidence of their travels.

Inquire

PLACED-BASED PERSPECTIVE

Have students count off to make pairs (preferably outside their social circle) and have them interview each other for two minutes about what they did last weekend. Use this to introduce inquiry – asking questions that you do not know the answers.

HERITAGE CULTURAL PERSPECTIVE

When a Native person from the southeast introduces himself/herself, he/she establishes who they are by clan affiliation. In this way, any inquiries into a person's family connections would be answered.

Culturally Responsive & Place-based Introduction of Science Vocabulary

Scientific

PLACED-BASED PERSPECTIVE

Define science- The systematic study of the natural world through observation and repeated experimentation. Provide students examples of different occupations and have them state whether or not they are based in science and therefore scientific. Have them support their reasoning.

HERITAGE CULTURAL PERSPECTIVE

Southeast Natives observed many scientific processes in their environment. For example, they knew that where spring water entered the ocean, there was more oxygen in the water and therefore, more salmon would gather in that area. The Natives also knew the cycles of the salmon.

Application

PLACED-BASED PERSPECTIVE

Have students match pictures of tools with applications: a fishing rod with fishing or a dabber for bingo.

HERITAGE CULTURAL PERSPECTIVE

One aspect of *application* used by Native peoples in the southeast was the making of the Chilkat blankets. Goat wool had to be made into yarn, dyes had to be made to decorate the blankets and the blankets had to be woven. In this way, Native peoples applied their knowledge that was handed down to them.

Investigate

PLACED-BASED PERSPECTIVE

Have students work in pairs and examine each others hands for similarities and differences (lines on their palms, rings, scars, etc.) and write down their observations.

Use this to introduce – investigate as an inquiry or examination.

HERITAGE CULTURAL PERSPECTIVE

In the story, *Raven Went Down the Bull Kelp,* the raven went under the ocean to investigate why the people who were living along the coast were starving.

Culturally Responsive & Place-based Introduction of Science Vocabulary

Logical

PLACED-BASED PERSPECTIVE

Prepare a set a statements for students to decide if they may be supported by valid repeatable proof or experiential knowledge (i.e. the sun will rise tomorrow) or can not be supported with valid repeatable proof (i.e. UFO's). Use this to introduce that the use of logic is part of the formal scientific method.

HERITAGE CULTURAL PERSPECTIVE

Even in traditional times, the Native peoples of the southeast knew that the world rotated. This knowledge was reflected in traditional songs. They knew the *logical* relationship of the moon and tides. This knowledge affected travel for the Native peoples of the southeast.

Reasoning

PLACED-BASED PERSPECTIVE

Have students write down what they want to do after high school. Then have them explain their decision using their beliefs and feelings as to why they chose their post-secondary path. Discuss with the students that reasoning is the thought process that led them to their decision, not the decision itself.

HERITAGE CULTURAL PERSPECTIVE

In a Migration Story, two older women reasoned that they should be the ones to test a risky travelling route. They made this decision based on the reasoning that they were older had already had children and could no longer contribute to the population of the clan. The two women travelled through dangerous situations to locate a safe travel route.

Skepticism

PLACED-BASED PERSPECTIVE

Give the students a list of scenarios and ask them if they believe you or not (i.e. early out, astronauts never landed on the moon, etc.) Explain to them that their lack of belief and doubt is skepticism.

HERITAGE CULTURAL PERSPECTIVE

When the Native peoples of the southeast first saw rice, they were skeptical about eating it. They felt that the rice looked like maggots.

Culturally Responsive & Place-based Introduction of Science Vocabulary

Openness

PLACED-BASED PERSPECTIVE

Show the students the picture of a tagged animal, from **Appendix D**, at the back of this Unit. Have the students suggest why animals are tagged; use this to introduce the gathering of information (*data*) that then has to be *interpreted.* Have the students suggest other information in their area that can provide *data* to be *interpreted*.

HERITAGE CULTURAL PERSPECTIVE

Show the students the potlach picture, from the vocabulary illustrations. Have the students determine the types of organizing necessary to have a potluck. Lead this into the necessary *data* - how many skins, blankets, would be necessary, etc. Have the students suggest other situations in which the collection of *data* would have been critical.

Peer Review

PLACED-BASED PERSPECTIVE

Show the students a glass. Have the students imagine how the glass might have been used to solve a crime - lead them to suggest that fingerprints might have been found on the glass - leading the investigators to a *conclusion* related to the crime - once again, have the students suggest the *conclusions* that might have been reached.

HERITAGE CULTURAL PERSPECTIVE

Show the picture of pollution, from the vocabulary illustrations. Use the picture to come to *conclusions* regarding the state of the environment.

Have the students suggest other *conclusions* that might be reached about elements of the environment.

Language Skills

Language & Skills Development

LISTENING

Use the activity pages from the Student Support Materials.

Illustration Bingo

Provide each student with a copy of the mini-illustration activity page from the student support materials. The students should cut out the illustrations. Each student should turn his/her illustrations face-down on the desk. Then, each student should turn ONE illustration face up. Say a vocabulary word. Any student or students who have the illustration for the vocabulary word you said face up on their desks, should show their illustrations. Those illustrations should then be put to the side and the students should turn over another illustration. The first student or students to have no illustrations left on their desks, win the round. The illustrations may be collected, mixed, and re-distributed to the students for the different rounds of the activity.

SPEAKING

Roll 'em Again!

Mount the vocabulary illustrations on teh chalkboard. Number each illustera-tion, using the numbers 1 to 6. Give dice to the students. Have each student roll his/her dice. The student should identify a picture with the same number showing on his/her die and then use that word in a sentence.

READING

Use the activity pages from the Student Support Materials.

Sight Word Bingo

Provide each student with a set of sight words from this unit. Each student should place one word on his/her desk, holding the others separately. Show a vocabulary picture. If a student has the word for that picture on his/her desk, he/she should show it to you; the student should then put that word to the side and place another one on the desk. Continue in this way until a student has no words left.

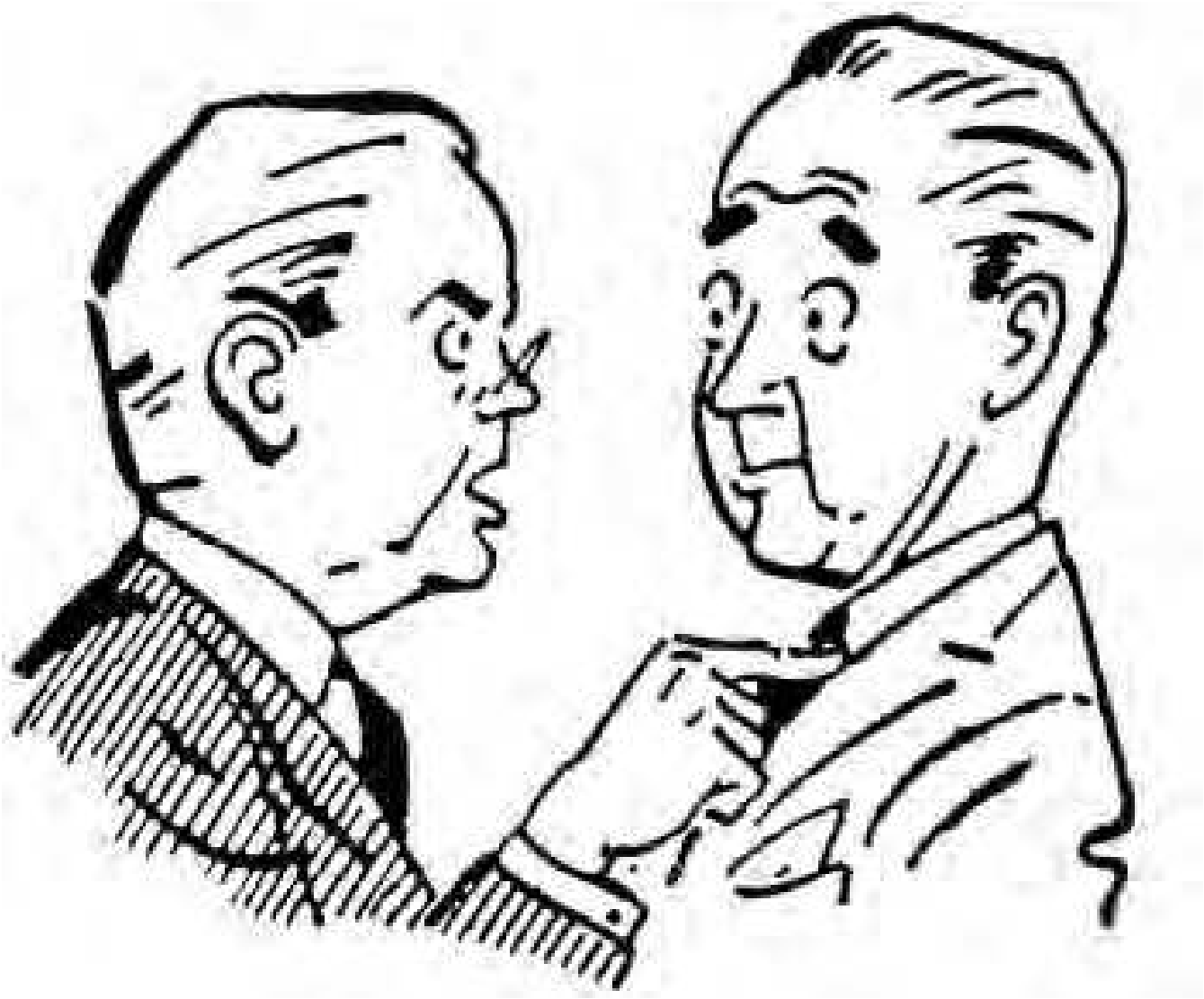
WRITING

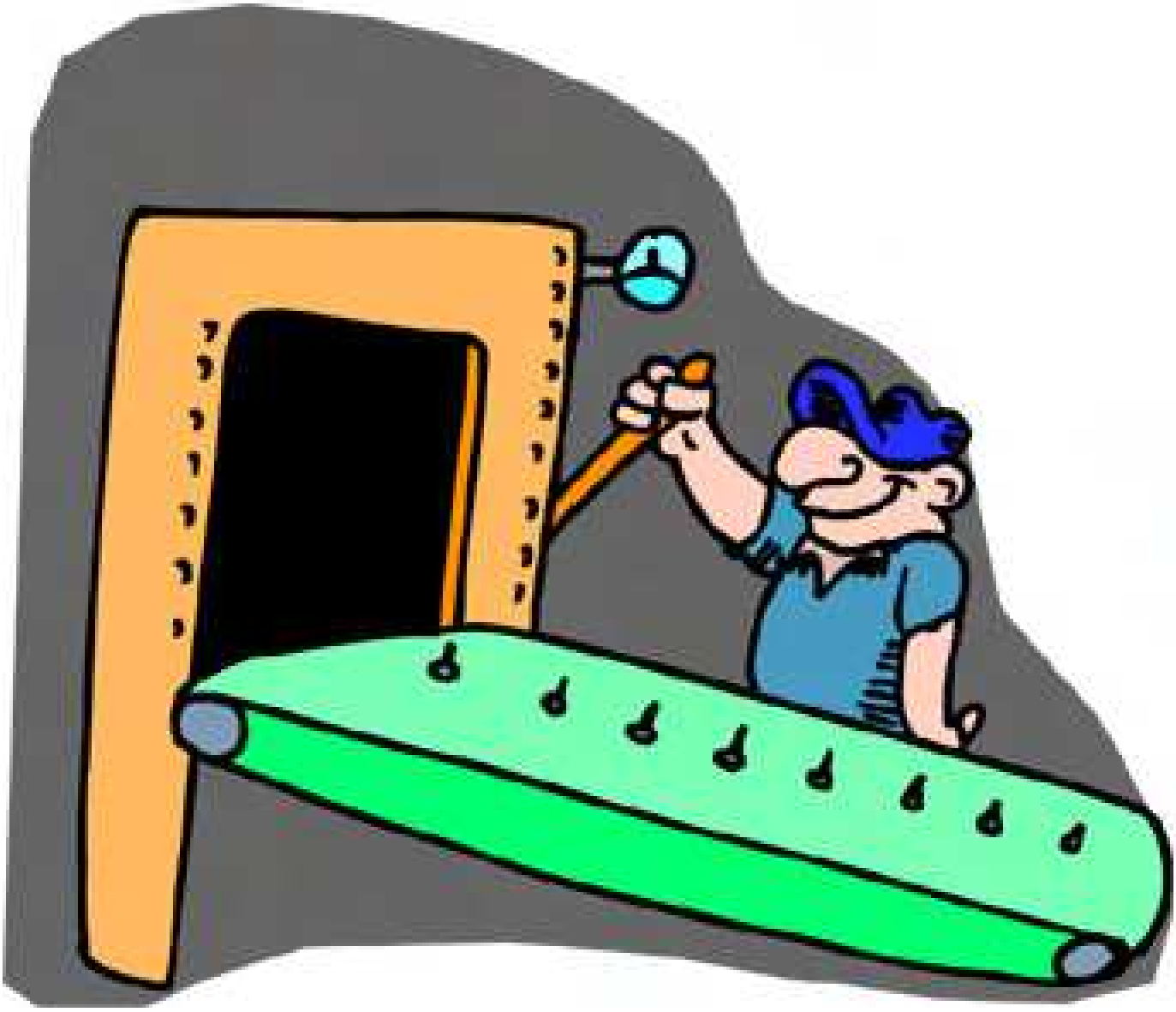
Use the activity pages from the Student Support Materials.

What's Your Letter?

Show one of the vocabulary pictures to the students. Each student should then write ONE letter that is in the word for that picture. Then, check all the students' letters to determine if all of the letters of the word were written. Have the students identify the "missing letters," if there are any.

Vocabulary Images

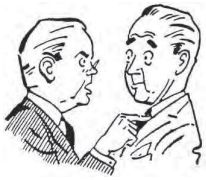




STUDENT SUPPORT MATERIALS

Listening

Say these words to the students - they write the numbers of the words under the pictures.
1. formulate, 2. evidence, 3. inquire, 4. scientific, 5. application, 6. investigate, 7. repeatable, 8. defend, 9. integrity, 10. logical, 11. reasoning, 12. skepticism, 13. openness, 14. peer review








Fill-in the Blanks

Read the sentences to the students. The students should provide the "missing words."

1. The student was asked to _____ an answer to the question.

2. The police collected all of the _____ from the crime scene; it was clear that the accused was guilty.

3. If you are going to _____ about something, be ready to hear the answer.

4. A _____ approach to the question is undoubtedly the most efficient.

5. The _____ of a scientific concept to make something useful for people is called technology.

6. There are many questions that scientists have yet to _____ regarding developing a cure for canver.

7. Many of the experiments done by middle school students are not _____ because they fail to write detailed procedures.

8. It is not possible to _____ a theory when no evidence supports it.

9. The _____ of a science lab depends on the honesty of the scientist doing the work.

10. It was not _____ to conclude that gravity was absent when the ball fell to the earth after it was thrown.

11. _____ is necessary if the data is to be analyzed well.

12. _____ is an attitude of doubt or an unbelieving way of looking at things.

13. In a way, the opposite of skepticism is _____.

14. Having your friends read your essays is a form of _____ .

True or False?

Read the following sentences to the students. The students should write "true" or "false" for each of the sentences.

1. *"Billy formulated a plan for his science fair project."*

2. *"The evidence is clear - evolution occurs.*

3. *"I visited the store to inquire some potato chips."*

4. *"Reading Tom Sawyer* by Mark Twain is a scientific process.

5. *"Using a fork as a toothpick is an improper application of this dining utensil."*

6. *"Matthias went to the shed to investigate whether there were any insects eating the decayed wood.*

7. *"When heat is added to water, the water becomes repeatable*

8. *"if your statement is based on evidence, it is easier to defent.*

9. *""The Korean scientist who faked his results had no integrity.*

10. *"If you open your mouth, you can see your logical in the back of your throat.*

11. *""The reasoning behind using studded snow tires is that the force of friction is increased.*

12. *"Joey showed his skepticism by buying his girfriend some flowers for Valentine's Day.*

13. *"It is important that scientiests show openness to new ideas, even if they don't agree with them.*

14. *"Steve's paper was heavily criticized during peer review - it was not accepted by the Scientific Journal.*

STUDENT SUPPORT MATERIALS

Sight Words

inquire evidence formulate

inquire evidence formulate

investigate

application

scientific

integrity

defend

repeatable

peer review openness

STUDENT SUPPORT MATERIALS

Reading

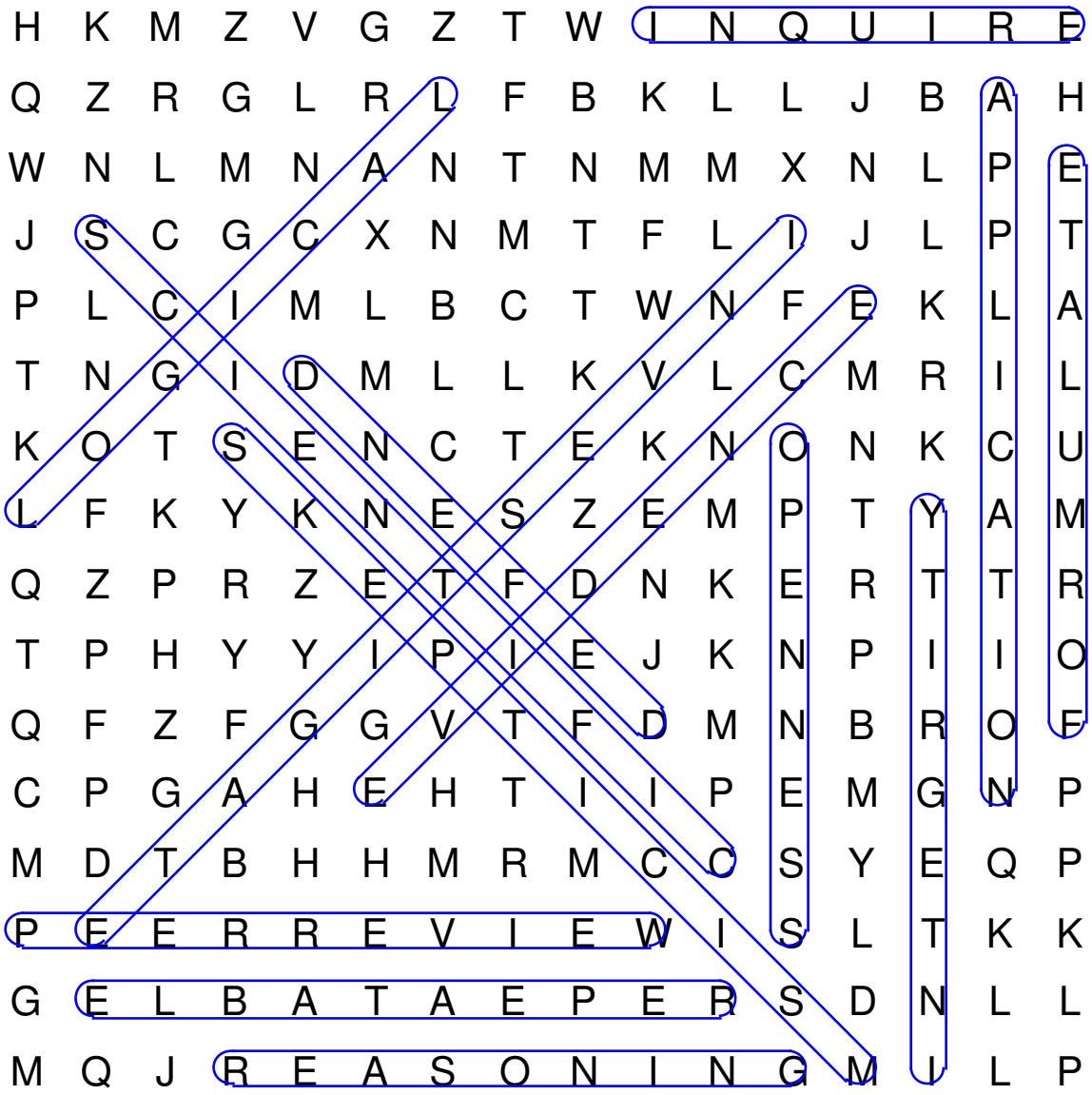
Word Find

Find the words in the grid. Words can go horizontally, vertically and diagonally in all eight directions.

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

Application
Defend
Evidence
Formulate
Inquire
Integrity
Investigate
Logical
Openness
Peerreview
Reasoning
Repeatable
Scientific
Skepticism

Word Find Solution



Find The Word

formulate
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inquire
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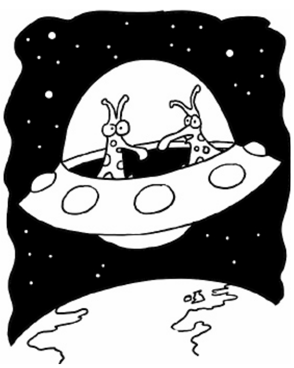

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reasoning
skepticism
openness
peer review

formulate
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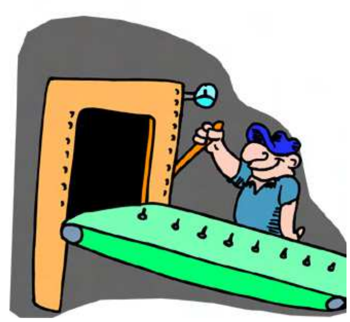

formulate
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Find The Word

formulate
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Match The Halves

Have the students write the numbers/letters for sentence halves that match.

1	*It is possible to formulate*	**A**	*where deer resided near his house during hunting season.*
2	*There is much evidence*	**B**	*characteristic of a good scientist.*
3	*It is difficult to inquire*	**C**	*in the scientific community as to the cause of accelerated global climate change.*
4	*There is currently no debate*	**D**	*they lacked structural integrity.*
5	*The application of a rain gauge*	**E**	*her experiment might be repeatable.*
6	*Dr. Carney wanted to investigate*	**F**	*a plan to accomplish a task.*
7	*If a scientist writes very detailed notes*	**G**	*regarding the crime by examining the evidence in a logical way.*
8	*In order to get a Doctoral Degree*	**H**	*you will need to make some adjustments before your work is published.*
9	*The dikes failed because*	**I**	*his paper was not accepted.*
10	*Sherlock Holmes drew his conclusions*	**J**	*a candidate must defend their research*
11	*Skepticism is an important*	**K**	*supporting evolution.*
12	*openness to new ideas*	**L**	*about something you know nothing about.*
13	*If your research doesn't stand up to peer review*	**M**	*is to determine the amount of precipitation.*
14	*Because of the peer review*	**N**	*is an important part of science.*
15		**O**	

Word & Definition Match

Have the students write the word numbers on their matching definitions.

	These are facts or observations.	*This can involve arguing.*	*This has to do with science.*	*This is the use of something.*
This is being true.	*This is when we doubt something.*	*This is being receptive to new ideas.*	*In science, this is a formal method of thinking.*	*This is when we look for reasons.*
This is to examine something.	*This is when we ask about something.*	*This can relate to the same age group or grade.*	*This can be repeated.*	

1. formulate	2. evidence	3. inquire	4. scientific	5. application
6. investigate	7. repeatable	8. defend	9. integrity	10. logical
11. reasoning	12. skepticism	13. openness	14. peer review	

Sentence Completion

The students should read the sentences and tell you the words that are missing.

1. The student was asked to _____ an answer to the question.

2. The police collected all of the _____ from the crime scene; it was clear that the accused was guilty.

3. If you are going to _____ about something, be ready to hear the answer.

4. A _____ approach to the question is undoubtedly the most efficient.

5. The _____ of a scientific concept tomake something useful for people is called technology

6. There are many questions that scientists have yet to _____ regarding developing a cure for canver.

7. Many of the experiments done by middle school students are not _____ because they fail to write detailed procedures.

8. It is not possible to _____ a theory when no evidence supports it.

9. The _____ of a science lab depends on the honesty of the scientist doing the work.

10. It was not _____ to conclude that gravity was absent when the ball fell to the earth after it was thrown.

11. _____ is necessary if the data is to be analyzed well.

12. _____ is an attitude of doubt or an unbelieving way of looking at things.

13. In a way, the opposite of skepticism is _____.

14. Having your friends read your essays is a form of _____ .

Which Belongs?

Have the students circle the words that belong in the sentences.

1. Johnny **formulated**/**inquired** a method to solve the problem.

2. The **evidence**/**application** of the Prosecutor was called into question during the trial.

3. To **defend**/**inquire** is to ask a question about something.

4. If you have a **openness/scientific** world view, you avoid magical thinking.

5. The **reasoning**/**application** of the Heimlich Maneuver was ineffective, death happened.

6. To **investigate**/**defend** is to examine something.

7. Since there is a healthy dose of skepticism in science, experiments must be **repeatable**/**open** .

8. The girl was able to **defend**/**reasoning** her claim that she was the real winner of the popularity contest.

9. One Presidential candidate has a lot of **integrity**/**reasoning** while the other does not.

10. It is **reasoning**/**logical** to conclude that if you hit your hand with a hammer, it will hurt.

11. Although she was cheering, the cheerleader viewed the efforts of the football team players with **skepticism**/**evidence**.

12. A scientist's work is always **repeatable**/**open** to peer review.

13. Before being published, all written submissions to scientific journals must go through a **peer**/**skepticism** review.

True or False?

Have the students read the following sentences. They should indicate whether the sentences are "true"or "false.

"1. Billy formulated a plan for his science fair project.

2. "Wipe that evidence off your face", said Fransesca to her newborn infant.

3. I visited the store to inquire some potato chips.

4. If you have a scientific mind, you think about what you see and how to explain it.

5. I was happy to hear that my dinner was served by an application at.

6. Matthias went to the shed to investigate whether there were any insects eating the decayed wood.

7. All scientific investigations are repeatable.

8. It defends, do you like your eggs over-easy.

9. The com-link is an integrity part of a storm troopers helmet.

10. The use of random sampling in the study of understory brouse cover was quite logical for Dr. Smith's study.

11. When cooking mouse stew, it is important to add reasoning to cover the gamey taste.

12. Joey showed his skepticism by buying his girlfriend some flowers for Valentines Day.

13. It is important that scientists show openness to new hypotheses even if they threaten their own ideas.

14. Steve's paper was heavily criticized during peer review – it was not accepted by the Scientific Journal. (

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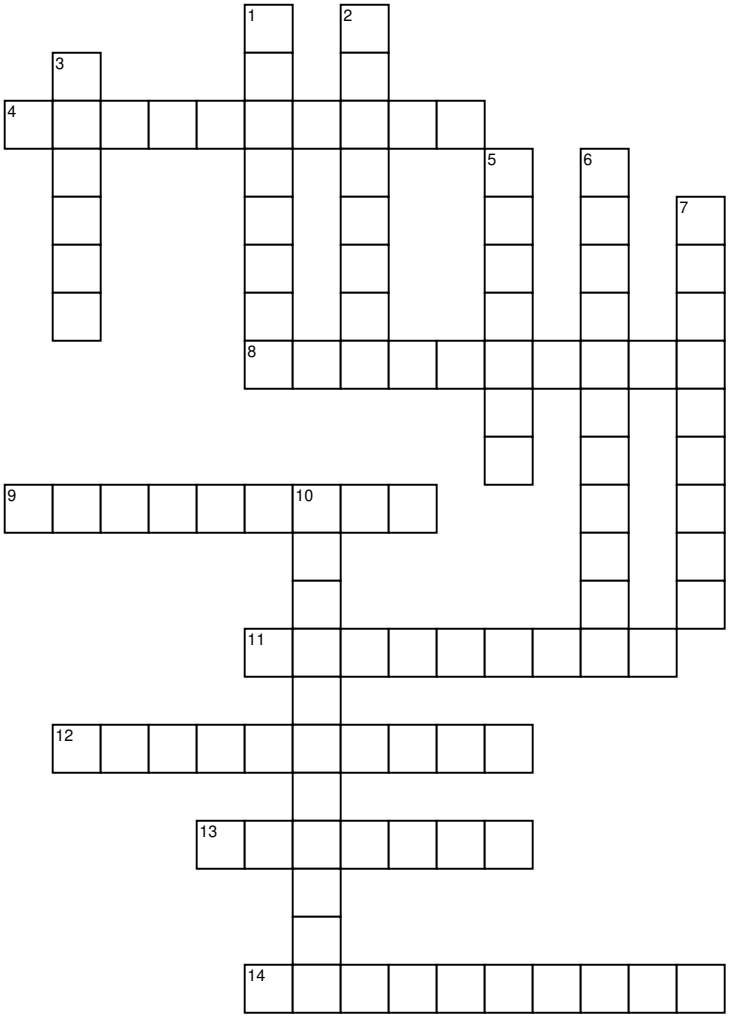
1. T 2. F 3. F 4. T 5. F 6. T 7. T 8. F 9. F 10. T 11. F 12. F 13. T 14. T

STUDENT SUPPORT MATERIALS

Writing

9th A-1 Science as Inquiry and Process

Unit 2



ACROSS

4 a process in which fellow scientists review the findings of a study prior to publication.
8 to look about, to consider an attitude of doubt or disposition to incredulity either in general or toward a particular object.
9 means being true to a purpose or design.
11 is the cognitive process of looking for reasons for beliefs, conclusions, actions or feeling.
12 of, or having to do with science.
13 a formal scientific method of examining or thinking about ideas.
14 able to be repeated

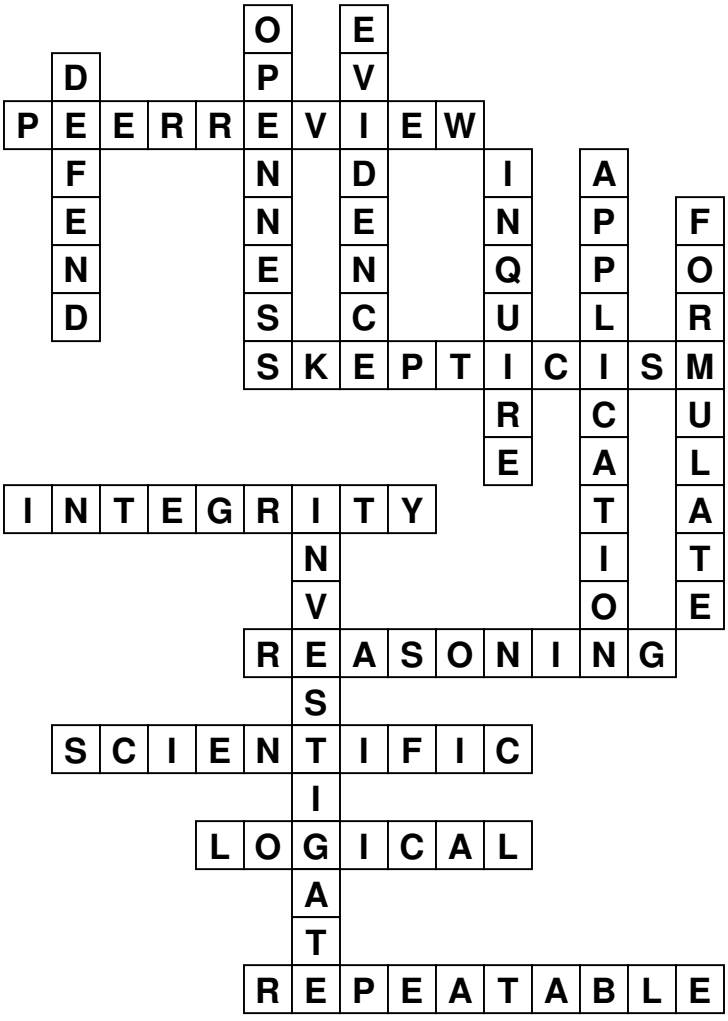
DOWN

1 it is typified by communal management, and open access to the information or material resources needed for projects.
2 facts or observations presented in support of an assertion
3 to maintain by argument, evidence, etc.
5 to ask about something.
6 is another for a particular use of something.
7 to put in a clear and definite form of statement or expression.
10 to inquire into or to examine

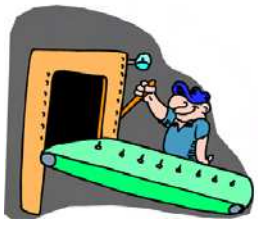
9th A-1 Science as Inquiry and Process

Unit 2

Solution:



Write The Words



Complete The Sentences

The students should write the missing words in the sentences.

1. The student was asked to _____ an answer to the question.

2. The police collected all of the _____ from the crime scene; it was clear that the accused was guilty.

3. If you are going to _____ about something, be ready to hear the answer.

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12. _____ is an attitude of doubt or an unbelieving way of looking at things.

13. In a way, the opposite of skepticism is _____.

14. Having your friends read your essays is a form of _____ .

Creative Writing Activity Page

Have the students write sentences of their own, using the key words from this unit. When the students' sentences are finished, have them take turns reading their sentences orally. The students should say "Blank," for the key words; the other students must name the "missing" words. You may wish to have the students write the "definitions" for the key words.

formulate

evidence

inquire

scientific

application

investigate

repeatable

defend

integrity

Creative Writing Activity Page

Have the students write sentences of their own, using the key words from this unit. When the students' sentences are finished, have them take turns reading their sentences orally. The students should say "Blank," for the key words; the other students must name the "missing" words. You may wish to have the students write the "definitions" for the key words.

logical

reasoning

skepticism

openness

peer review

Creative Writing Activity Page

Have the students write sentences of their own, based on the picture below. When finished, have each student read his/her sentences to the others.

STUDENT SUPPORT MATERIALS

Reinforcement Activities

Have students compile a list of logical fallacies and then read newspaper articles to assess the credibility of the findings presented. This activity could be expanded to incorporate websites, especially sites that have an agenda to promote. Students can present the website to the class and discuss which logical fallacies have been used to promote ideas unfairly.

Prior to beginning the experiment, tell the students that they will be using a lemon, a zinc nail and a copper penny for this experiment. Working in small groups, ask them what type of scientific experiment that they think they can do with these materials.
After discussing some uses, tell them that they will be create a battery with these materials. Ask if there is any skepticism amongst the students.

Have students inquire on the Internet how a "lemon battery" would work. After researching how a lemon battery works, ask the students if their research seemed logical. Have them record their reasoning for their opinion.

Making A Lemon Battery Experiment

You will need:

- A lemon: A large, fresh, "juicy" lemon works best.
- A nail: Galvanized nails are coated in zinc. I used a 2" galvanized common nail.
- A penny: Any copper coin will work.
- A voltmeter: a gauge to record small currents of electricity

Directions

#1 Insert a penny into a cut on one side of the lemon. Push a galvanized nail into the other side of the lemon. The nail and penny must not touch.

#2 After building the lemon battery, connect the voltmeter and test for current (read instructions for your particular voltmeter).

Have the students collect evidence (using the voltmeter). Ask if this experiment is repeatable.

#3 Connect all the groups lemon batteries in series and test the voltage again with the voltmeter.

Ask the students if they can think of an application for a lemon battery.

Bacteria Collection – An Experiment

Based on the work of S. Marino

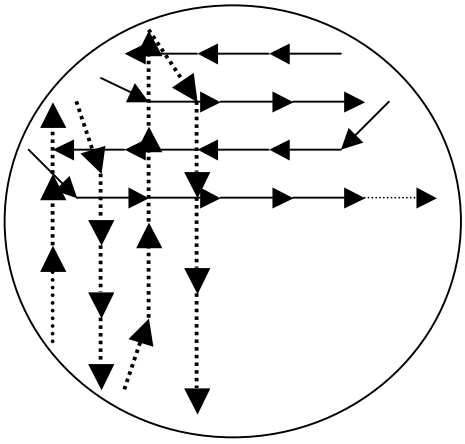
Materials

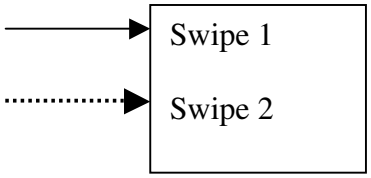
- Distilled Water
- 2 Cotton Swabs
- 2 Plastic Bags
- Masking Tape

Methods

- Wash your hands!
- Wet the cotton swab in distilled water.
- Rub it thoroughly on the surface you will be testing (one dirty, one clean).
- Put the cotton swab in a plastic bag. Label it using the masking tape. Include the following information:
    -
    - Your name
    - Location- be specific!
    - Dirty/Clean
    - Date
-

  Repeat the above steps for your second sample.
- Wash your hands!
- Obtain 2 Petri dishes.
- Gently rub the cotton swab on the surface of the agar in the manner shown below.





  The cotton swab should run in a zig-zag pattern half way down the dish. Rotate the dish ¼ of a turn and repeat that same process.
- Transfer the label from the bag to the Petri dish lid making sure it seals the lid to the bottom.
- Repeat the above steps for the second sample.

- Place the Petri dishes upside down in a warm area that is set aside by your instructor.
- Check the dishes in 48 hours.

Unit Assessment

Unit 2 Quiz

A-1 Unit 2 Quiz

Science as Inquiry and Process

1) _____ to reduce to, or express in a formula
2) _____ facts or observations used to support a belief or assertion
3) _____ of, or having to do with science
4) _____ is another word for a particular use of something
5) _____ to inquire into or to examine
6) _____ be able to do again with the same results
7) _____ to maintain by argument, evidence, etc.
8) _____ means being true to a purpose or design.
9) _____ is a form of scientific thinking about ideas
10) _____ is the cognitive or thought process for examining
11) _____ to look at an idea or issue with a certain degree of doubt, based on reason
12) _____ willingness or readiness to receive new ideas
13) _____ a process in which fellow scientists review the findings of a study prior to publication

a. to formulate
b. evidence
c. scientific
d. application
e. to ask
f. repeatable
g. to defend
h. integrity
i. to be logical
j. reasoning
k. skepticism
l. openness
m. peer review

A1, Unit 2, Science as Inquiry and Process Quiz

1) **a** to reduce to, or express in a formula
2) **b** facts or observations used to support a belief or assertion
3) **c** of, or having to do with science
4) **d** is another word for a particular use of something
5) **e** to inquire into or to examine
6) **f** be able to do again with the same results
7) **g** to maintain by argument, evidence, etc.
8) **h** means being true to a purpose or design.
9) **i** is a form of scientific thinking about ideas
10) **j** is the cognitive or thought process for examining
11) **k** to look at an idea or issue with a certain degree of doubt, based on reason
12) **l** willingness or readiness to receive new ideas
13) **m** a process in which fellow scientists review the findings of a study prior to publication

a. to formulate
b. evidence
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e. to ask
f. repeatable
g. to defend
h. integrity
i. to be logical
j. reasoning
k. skepticism
l. openness
m. peer review

UNIT 3

Sealaska Heritage Institute

INTRODUCTION OF

Key Vocabulary

Culturally Responsive & Place-based Introduction of Science Vocabulary

Hypothesis

PLACED-BASED PERSPECTIVE

Locate an item that is broken. Show it to the students, calling upon them to guess what caused it to break. Use this to introduce the concept of a *hypothesis*.

Show the vocabulary picture from this Unit and have the students tell how it relates to this key science word.

HERITAGE CULTURAL PERSPECTIVE

Traditionally, Tlingit/Haida and Tsimshian peoples would have applied hypotheses to various aspects of the environment. This might include, "how did the large rock move, what broke the tree,"and so on.

Outcome

PLACED-BASED PERSPECTIVE

Give each student a balloon. Ask them what the consequence will be to forcing air into them. Let them try it. Then ask them what the consequence will be to poking the blown up balloon with a pencil. Let them try it. Explain to them that the consequences to their actions were outcomes.

Show the vocabulary picture from this Unit and have the students tell how it relates to this key science word.

HERITAGE CULTURAL PERSPECTIVE

Traditionally and today, nature plays a significant role in daily life. For example, the outcome of high tides would be that it was a good time to travel.

Results

PLACED-BASED PERSPECTIVE

Show the students a food item that is mouldy, dry, over-cooked, etc. Have the students tell why the food item is in that state - use this to introduce *results*.

Show the vocabulary picture from this Unit and have the students tell how it relates to this key science word.

HERITAGE CULTURAL PERSPECTIVE

In order to make good Chilkat blankets and grass baskets, people had to be good in math. In particular, they had to be good at counting. The result of strong math skills led to better quality in the art forms.

Culturally Responsive & Place-based Introduction of Science Vocabulary

Imply

PLACED-BASED PERSPECTIVE

Before the lesson begins, write a fake letter that *implies* that an individual may not be suitable for a job. Use this to introduce *imply*.

Show the vocabulary picture from this Unit and have the students tell how it relates to this key science word.

HERITAGE CULTURAL PERSPECTIVE

If people were seen in ceremonial dress andwith ceremonial regalia, others would imply that a traditional special event was about to occur.

Identify

PLACED-BASED PERSPECTIVE

Mix different socks together - have the students match the pairs. Use this to introduce *identify*.

Show the vocabulary picture from this Unit and have the students tell how it relates to this key science word.

HERITAGE CULTURAL PERSPECTIVE

Traditionally, as well as today, fish were identified and classified by their types. Other forms of wildlife were and are identified in the same manner.

Discuss

PLACED-BASED PERSPECTIVE

Show a picture of a current event in the news. Ask the students questions about the happenings depicted in the picture. Use this to introduce *discuss* with the students.

Show the vocabulary picture from this Unit and have the students tell how it relates to this key science word.

HERITAGE CULTURAL PERSPECTIVE

Before a newborn baby was named, there was much discussion about the name to be given to him/her. This discussion would have included a review of the mother's and father's lineages.

Culturally Responsive & Place-based Introduction of Science Vocabulary

Graph

PLACED-BASED PERSPECTIVE

Access USA Today graphs at

http://www.usatoday.com/snapshot/news/snapndex.htm

to show them different types of graphs and how to read them.

HERITAGE CULTURAL PERSPECTIVE

Traditionally pictographs were used to represent a wide variety of data. In the Klawok area, many pictographs were found in the "Down On Your Knees" caves. The pictographs relate information about, among other things, hunting and fishing.

Mean

PLACED-BASED PERSPECTIVE

Have the students measure the distance between their thumb and pinky to the closest cm. and write the measurement on the board. Have them add up the data at their desks, count the number of students, and divide by the number of students to get the mean width between the thumb and pinky for that class.

Median

PLACED-BASED PERSPECTIVE

Use the data used to calculate the mean and have a student put the data in order on the board in a straight line from least to greatest. Have two students cover numbers one at a time in unison to find the median.

Culturally Responsive & Place-based Introduction of Science Vocabulary

Mode

PLACED-BASED PERSPECTIVE

Collect a number of mini-chocolate bars. Spread them out on a table. Have the students determine which bar appears most in the set. Use this as an analogy for *mode*

Show the vocabulary picture from this Unit and have the students tell how it relates to this key science word.

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Support

PLACED-BASED PERSPECTIVE

Have students recall a recent election (national, local, school, etc.) and discuss what candidates they remember. How do they remember them? TV? Radio?

Use this to introduce the concept of support and promotion of the candidates.

Show the vocabulary picture from this Unit and have the students tell how it relates to this key science word.

HERITAGE CULTURAL PERSPECTIVE

People supported the Heritage laws. This would have included the laws relating to usinganother person's song or story, care for the environment, and so on.

Pseudoscientific

PLACED-BASED PERSPECTIVE

Ask all the students what their zodiac signs are? If they don't know, have a chart available for them to look up their birthdays. Ask how many read their horoscope? Use this as an example of *pseudoscientific.*

Show the vocabulary picture from this Unit and have the students tell how it relates to this key science word.

Culturally Responsive & Place-based Introduction of Science Vocabulary

Illogical

PLACED-BASED PERSPECTIVE

Remind them that logic is supported by valid repeatable proof or experiential knowledge. Tell them that vampires and werewolves are real and discuss why this is an illogical statement.

Show the vocabulary picture from this Unit and have the students tell how it relates to this key science word.

HERITAGE CULTURAL PERSPECTIVE

Relate the story of the bombing of the community of Angoon in 1882 - a good example of illogical behavior. The people of Angoon seized some whaling skiffs to protest the whaling company's refusal to pay for the death of a shaman's nephew, as should have been the custom at the time. The company called in the navy and the navy bombed the community.

Implicit

PLACED-BASED PERSPECTIVE

Lead a discussion about how student behavior is perceived by others as implicit as to who they are. (i.e. if they dress a certain way it implies something different than if they choose another defining style of dress.

Show the vocabulary picture from this Unit and have the students tell how it relates to this key science word.

HERITAGE CULTURAL PERSPECTIVE

Heritage peoples viewed the sharing of the environment by the different forms of wildlife as implicit to their areas.

Dogmatic

PLACED-BASED PERSPECTIVE

Discuss the dogmatic opinions of individuals living in 15th century Europe that were convinced that the Earth was flat. Open the class to any recent or current dogma that they may recognize.

Show the vocabulary picture from this Unit and have the students tell how it relates to this key science word.

HERITAGE CULTURAL PERSPECTIVE

When an uncle trained a nephew, he was often dogmatic in his approach.

Culturally Responsive & Place-based Introduction of Science Vocabulary

Research

PLACED-BASED PERSPECTIVE

In pairs, have students measure each others heights and then measure the distance between each others out stretched arms. Explain that they are researching the hypothesis that a person is as tall as their arms are wide.

Show the vocabulary picture from this Unit and have the students tell how it relates to this key science word.

HERITAGE CULTURAL PERSPECTIVE

Heritage people conducted a variety of research activities, often based on the environment. This would include researching what bears were eating. This would determine whether or not to hunt bears as, bears that are eating berries and roots have better tasting meat than bears that are eating fish.

Language Skills

Language & Skills Development

LISTENING

Use the activity pages from the Student Support Materials.

The Hidden Words

Say a vocabulary word for the students. Tell the students to listen for that vocabulary word as you say a running story. Provide each student with writing paper and a pen. When the students hear the vocabulary word in the running story, they must make a check mark on their papers each time the word occurs. Depending upon the readiness of your students, you may wish to have them listen for two or three words. In this case, have the students make a check mark for one word, and a "X" and an "O" for the other words.

SPEAKING

What's the Date?

Before the activity begins, collect an old calendar or calendars of different years. Say the name of a month to a student. The student should then say a date within that month. Look on the calendar to see which day the date represents. If the date represents a day between Monday and Friday, the students should identify a vocabulary illustration you show or he/she should repeat a sentence you said at the beginning of the round. However, if the date named by the student is a Saturday or Sunday, the student may "pass" to another player. Repeat until many students have responded.

READING

Use the activity pages from the Student Support Materials.

The Lost Syllable

Say a syllable from one of the sight words. Call upon the students to identify the sight word (or words) that contain that syllable. Depending upon the syllable you say, more than one sight word may be the correct answer. This activity may also be done in team form. In this case, lay the sight word cards on the floor. Group the students into two teams. Say a syllable from one of the sight words. When you say "Go," the first player in each team must rush to the sight word cards and find the sight word that contains the syllable you said.

WRITING

Use the activity pages from the Student Support Materials.

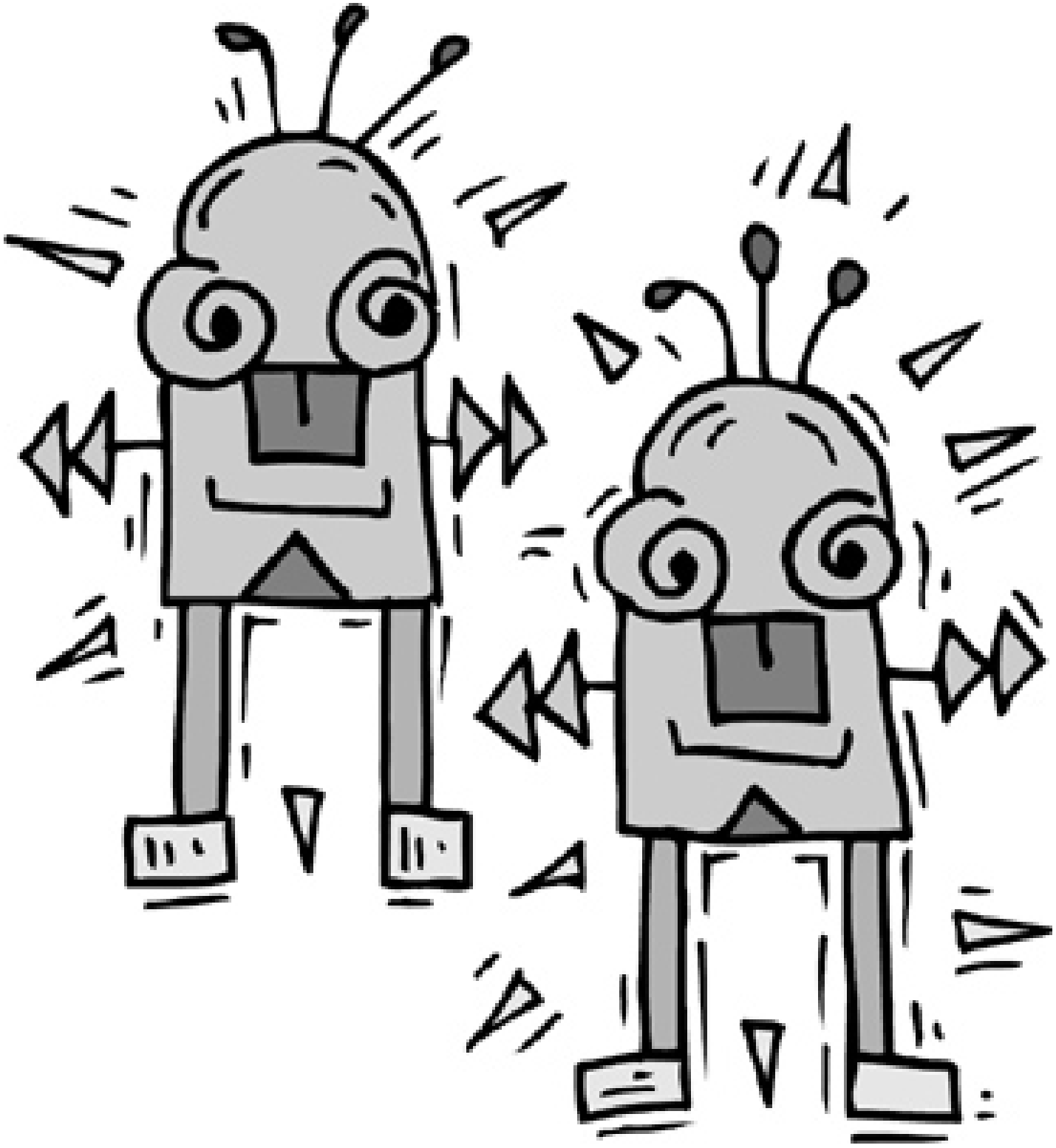
The Other Half

Cut each of the sight words in half. Give each student a sheet of writing paper, a pen and one of the word-halves. Each student should glue the word-half on his/her writing paper and then complete the spelling of the word. You may wish to have enough word-halves prepared so that each student completes more than one word. Afterwards, review the students' responses.

Vocabulary Images


The DISCOVERY of AMERICA by CHRISTOPHER COLUMBUS 1492
SOUTH AMERICA

identify




Report Card
A+
A+
A+
A+


BALLOTS


NO

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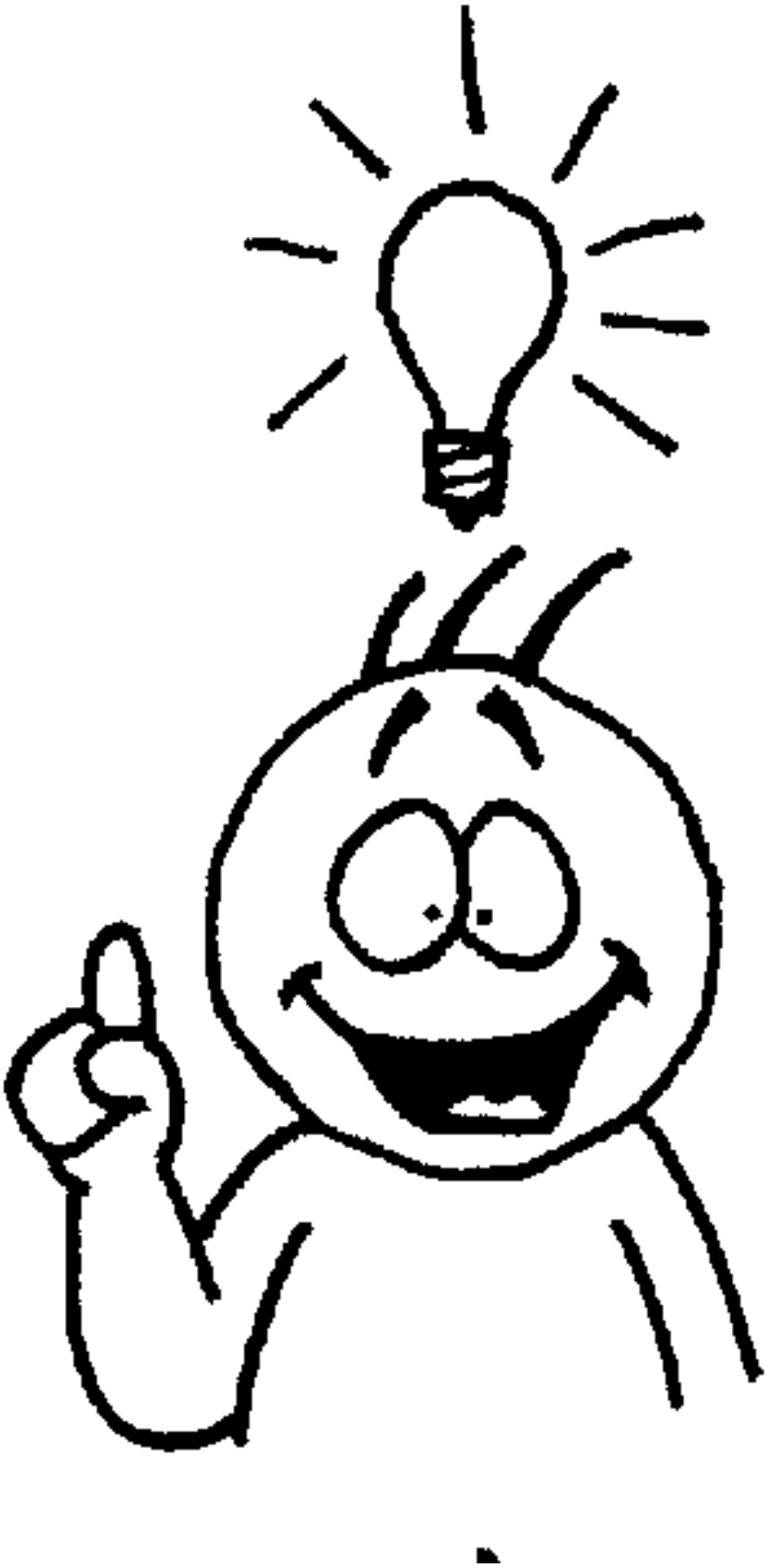
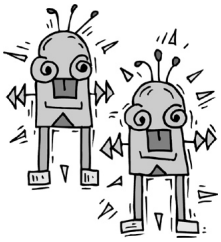


STUDENT SUPPORT MATERIALS

Listening

Say these words to the students - they write the numbers of the words under the pictures. 1. hypothesis, 2. outcome, 3. results, 4. imply, 5. identify, 6. discuss, 7. graph, 8. mean, 9. median, 10.mode, 11. support,12. pseudoscientific, 13. research, 14. illogical, 15. implicit, 16. dogmatic



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Fill-in The Blanks

Read the sentences to the students. The students should name the "missing words."

1. Early in his life Steve developed an incorrect _____ about what pick up lines work well and so stayed single until his mid-forties.
2. The _____ of the embargo was not as beneficial as the collaborating governments expected.
3. The _____ of the experiments needed to be analyzed by a team of scientist before anyone could make heads or tails of them.
4. It is important to not only _____ how you feel in this difficult family situation, but to say it directly.
5. _____ the variables of the experiment is the first step, and figuring out how to control them is the second.
6. I cannot _____ this problem further—let's just make a decision!
7. A good way to illustrate trends or show patterns is to make a _____ of the data.
8. While there are many types of ways to measure average, the _____ of a set of data is what most refer to as the "average".
9. The _____ is the middle number in a set of data, as longs at the data is in order from least to greatest or greatest to least.
10. The most common data value in a set of data is called the _____.
11. One should support ones views with _____ if respect from the scientific community is desired.
12. Intelligent Design is considered by the scientific community as _____ since none of what it says can be tested.
13. It would be _____ to conclude that one will not get wet when chopping wood during a downpour.
14. The use of the dog's favorite bowl was_____ by the placement of the bowl near the list of dog-sitting instructions, even though the note did not mention the bowl directly.
15. Teachers who cover controversial topics without class discussion run the risk of appearing _____.
16. Scientific _____ leads to many discoveries.

1. hypothesis, 2. outcome, 3. results, 4.imply, 5.identifiying, 6. discuss, 7. graph, 8. mean
9. median 10. mode, 11.evidence, 12. pseudoscientific, 13.illogical, 14. implicit,
15. dogmatic, 16. research

True Or False?

Read the following sentences to the students. The students should write "true" or "false" for each of the sentenc-

1. It is possible for a scientist to prove a hypothesis correct.

2. The outcome of a struggle between a clam and a starfish almost always ends in a favorable way for a clam.

3. The result of the atomic test explosion was the wastage of the building it was detonated upon.

4. To not smile upon greeting a well-known person is to imply discontent.

5. The identity of the person was clearly determined when his DNA was found at the scene.

6. The results section of a scientific paper is where findings are discussed.

7. The graph of the data indicated a direct relationship where as the independent variable increased, so did the dependent variable.

8. The mean is the middle value of a set of data.

9. The median is often a better measure of central tendency than the mean as it is the actual middle value(s).

10. When the tally for dinner desserts was complete, the mode was apple pie – hence it was served at the family feast.

11. The purpose of an experiment is to provide support for a the null hypothesis – the hypothesis being tested.

12. One problem with pseudoscientific claims is that many attempt to get them into science text books.

13. Usually, no research is necessary before developing and marketing a new prescription drug.

14. The paper was written in an illogical way and was easy to follow.

15. His findings were implicit and undeniable.

16. Discussing mitigation measures with bureaucrats is often not productive as replies are often dogmatic.

1. F, 2. F. 3. T 4. T, 5. T. 6. F, 7. F. 8. F, 9. T, 10. T, 11. F, 12. T, 13. F, 14. F, 15. T, 16. T

STUDENT SUPPORT MATERIALS

Sight Words

results

outcome

hypothesis

discuss

identify

imply

median

mean

graph

pseudoscientific

support

mode

implicit illogical research dogmatic

STUDENT SUPPORT MATERIALS

Reading

Word Find

Find the words in the grid. Words can go horizontally, vertically and diagonally in all eight directions.

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

Discuss
Dogmatic
Graph
Hypothesis
Identify
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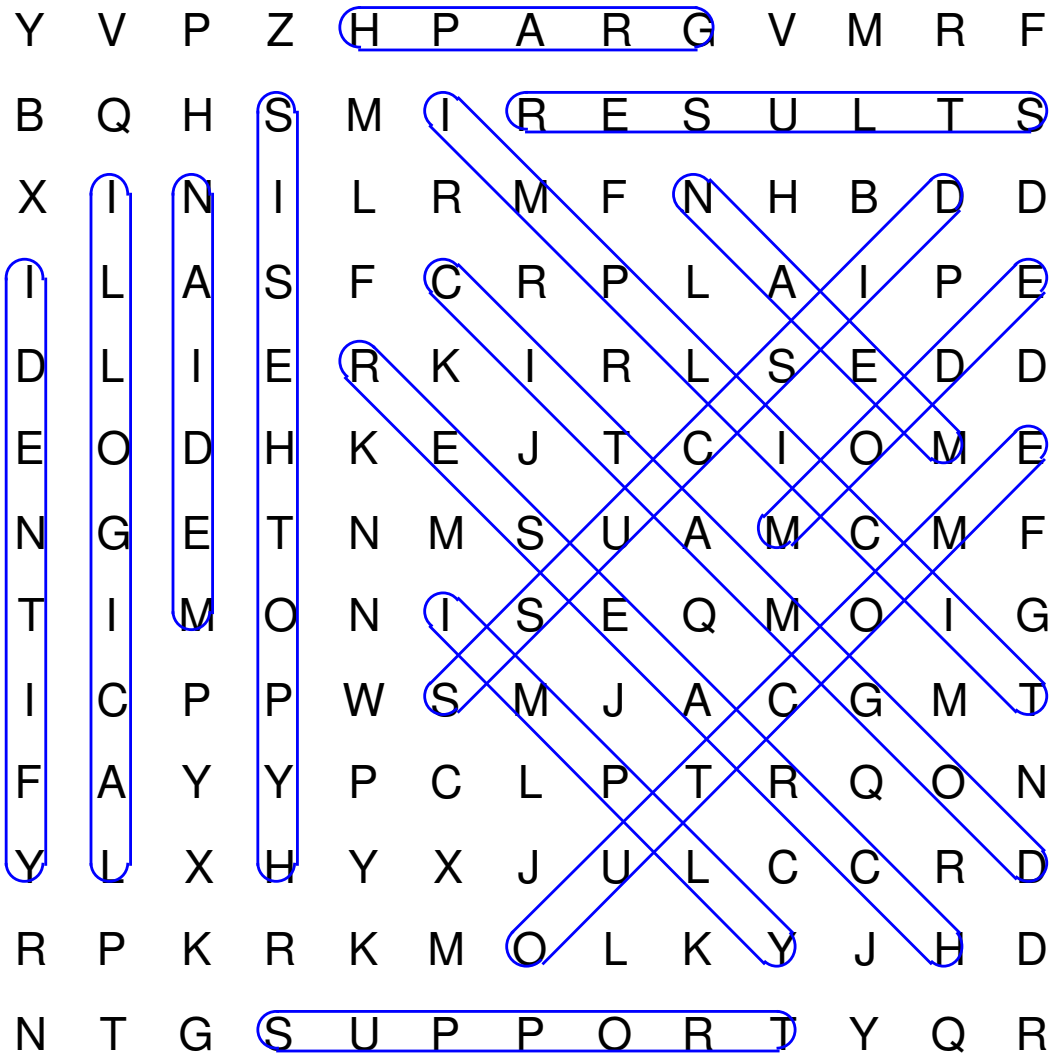
Mean
Median
Mode
Outcome
Research
Results
Support

Word Find Solution



Sight Words Activity Page

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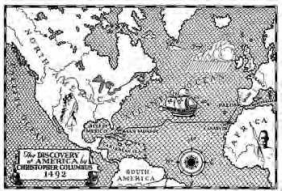

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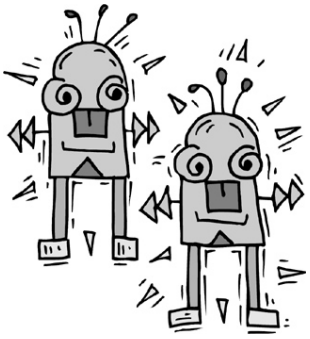

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Sight Words Activity Page

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Reading Comprehension Activity Page

Have the students write the numbers/letters for sentence halves that match.

1. *A hypothesis needs to be testable*
2. *Misbehaving in society often results*
3. *What the next question the scientists would investigate*
4. *When the dog bared its teach*
5. *Successful marriages are based on the premise of discussion,*
6. *A graph is a useful way to portray*
7. *Teachers often calculate the mean*
8. *The median value is determined by*
9. *Although adding ice-cream to pie is a popular dish – called "pie-ala-mode, it does not represent the most common*
10. *The support of the Theory of Evolution*
11. *Psuedoscientific findings are not*
12. *It was illogical to conclude that*
13. *That the villain would shoot the hostage was*
14. *Science teachers present current scientific findings, hence their*

A. *If it is a valid hypothesis.*

B. *In an outcome that involves jail time.*

C. *depended in part on the results of their current research.*

D. *a violent response was implied, and the paperboy didn't put the paper on the porch.*

E. *where the opinions and feelings of both partners are valued.*

F. *complicated mathematical relationships.*

G. *Finding the middle value in a set of data.*

H. *Result in set of data – this is called the mode.*

I. *Is so extensive that it is considered a fact by most scientists.*

J. *publishable in peer reviewed scientific journals.*

K. *the person committed the crime since they were not in the same country it was committed at the time it was committed.*

L. *implicit when the gun was pointed towards the held captive.*

M. *presentations are not dogmatic*

Reading Comprehension Activity Page

Have the students write the word numbers on their matching definitions.

This is when we present for feedback.	*This does not involve direct statement.*	*To be or become the same.*	*These are because of a consequence, effect, or conclusion.*	*This shows information on paper.*
This is the result of something.	*This can be the most common data value.*	*This is a guess.*	*This is the center of a set of math data.*	*This promotes something.*
This is not really scientific.	*This is something understood but not stated.*	*This is the middle value of a set of data.*	*This is collecting information.*	*This does not make sense.*
This involves very strong opinions.				

1. hypothesis
2. outcome
3. results
4. imply
5. identify
6. discuss
7. graph
8. mean
9. median
10. mode
11. support
12. pseudoscientific
13. research
14. illogical
15. implicit
16. dogmatic

Which Belongs?

Have the students circle/identify the word that is correct for each sentence.

1. Ben's hypothesis/outcome about where the deer would be found was incorrect, and he returned without meat in his pack.

2. When the basketball score was tied in the last minute of the game, the outcome/results became uncertain.

3. The outcome/results of the experiment were in; Mr. Morley's hypothesis was not rejected.

4. It was difficult to relate the events of the crash without implying/supporting whose fault it was .

5. The psuedosceintific/identity of the compound was clear – it was uranium.

6. The most important part of any scientific paper is when the authors support/discuss the results.

7. The x-axis of the support/graph represents the independent variable.

8. A measure of the center of data, calculated by dividing the sum of all values by the number of values, is the mean/median.

9. A measure of the center of data, determined by the middle value(s) is the mean/median.

10. The majority of the popular vote of the country is the same as the median/mode of the popular vote.

11. On election day, many people stood on the sidewalk by busy intersections, displaying their support/identify of a particular candidate.

12. Astrology is pseudoscientific/research.

13. The outcome/research supported the findings of Kayla et. al., who were investigating the impacts of ocean acidification on pink salmon.

14. Mr. Spock never acted in a support/illogical manner.

15. The effects of the rising dollar on the ability of household incomes to meet expenses is dogmatic/implicit.

16. The speech by the incumbent senator was dogmatic/illogical, representing party platform only.

---

1. hypothesis, 2. outcome, 3. results, 4. implying, 5.identify, 6. discuss, 7. graph, 8. mean,
9. median, 10. mode, 11. support, 12. pseudoscientific, 13. research, 14. illogical, 15. implicit
16. dogmatic.

What's The Answer?

Have the students read the questions and then select the correct answer for them. They should fill-in the appropriate circles, beside the answers of their choice.

1. If a hypothesis is not testable
- (a) It is still acceptable as long as it is clear and consise
- (b) It is unacceptable
- (c) It is still acceptable as long as it is about something in the natural world.

2. A good outcome in an experiment
- (a) Might disprove the hypothesis
- (b) Will never disprove the hypothesis
- (c) Will always support the hypothesis

3. Sloppy work can result in all of the following except
- (a) Accidental discoveries
- (b) Bad data
- (c) Conclusive results

4. If a student wants to imply that a class is boring they may
- (a) Tell the teacher directly
- (b) Tell a fellow student
- (c) Yawn

5. It is difficult to identify, without a magnifying lens, the various species of
- (a) Shrew
- (b) Elephant
- (c) Primate

6. During a first date it might be considered rude to discuss
- (a) Previous romance
- (b) The weather
- (c) Your favorite movies

7. Which of the following is the most appropriate graph to use to show parts of a whole?
- (a) Scatterplot
- (b) Circle Graph (Pie Chart)
- (c) Bar Graph

8. The mean of a set of data is
- (a) The middle number
- (b) The most common number
- (c) The value that is computed by dividing the sum of a set of data by the number of data

9. The median of a set of data is
- (a) The middle number
- (b) The most common number
- (c) The value that is computed by dividing the sum of a set of data by the number of data

10. The mode of a set of data is
- (a) The middle number
- (b) The most common number
- (c) The value that is computed by dividing the sum of a set of data by the number of data

11. All of the following support weight of the roof of a building except
- (a) the headers over the doors and windows
- (b) the studs
- (c) the doors

12. All of the following are pseudoscience except
- (a) Astrology
- (b) Intelligent Design
- (c) Geology

What's The Answer?

Have the students read the questions and then select the correct answer for them. They should fill-in the appropriate circles, beside the answers of their choice.

13. If my son were crying it would be illogical to conclude that

(a) He is in pain
(b) He got his feelings hurt
(c) He is having fun playing with the bigger kids in the pool.

14. The confidence of the mugger was implicit by

(a) The shaking of his hands
(b) The determined look in his eye
(c) The puddle of urine at his feet

15. Scientists are wise to avoid being _____ in their thinking.

(a) Dogmatic
(b) Flexible
(c) Skeptical

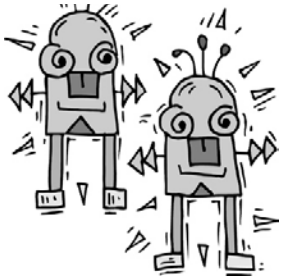
ANSWERS

1. b
2. a
3. c
4. c
5. a
6. a
7. b
8. c
9. a
10. b
11. c
12. c
13. c
14. b
15. a

STUDENT SUPPORT MATERIALS

Writing

Write the Words



Write the Words

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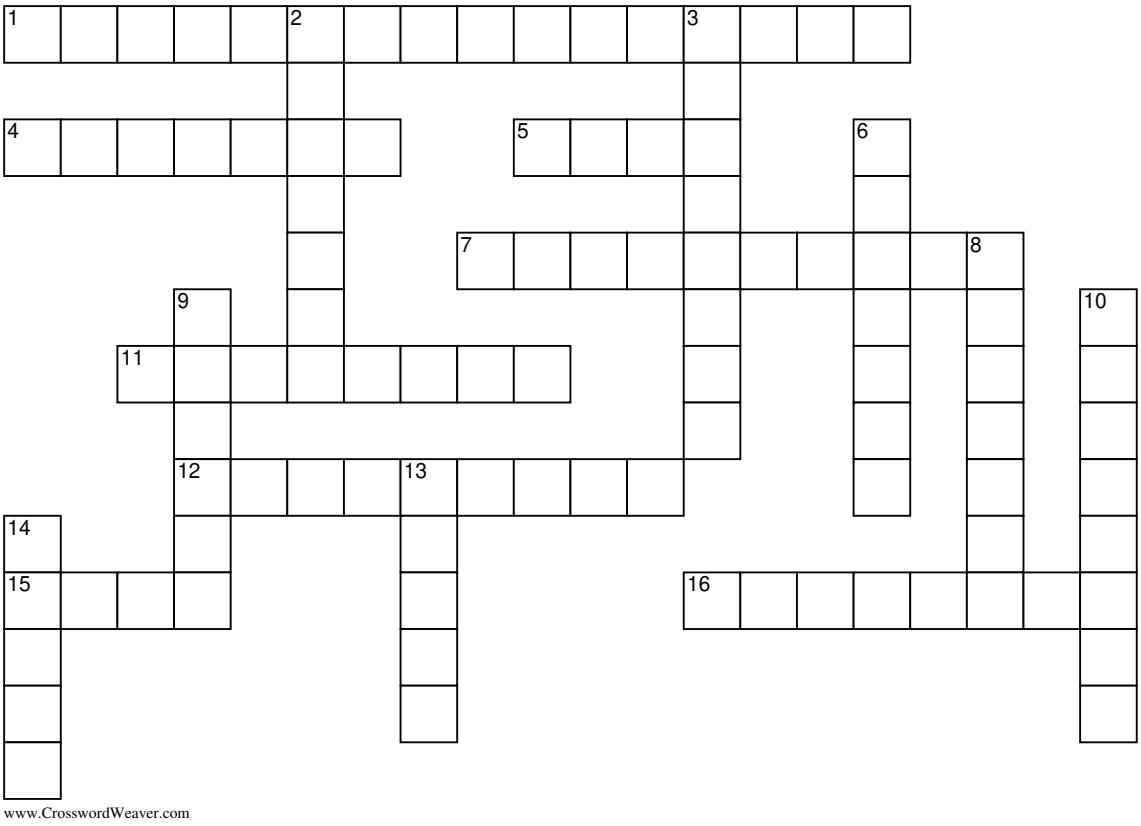
9th A-1 Science as Inquiry and Process

Unit 3



ACROSS

1 a system of theories, assumptions, and methods erroneously regarded as scientific.
4 to proceed or arise as a consequence, effect, or conclusion.
5 is a common way to measure the center of a set of mathematical data.
7 a guess as to why something happens.
11 the collecting of information about a subject is know as research.
12 not observing the principles of logic.
15 is a common way to measure the cneter of a set of mathematical data.
16 characterized by or given to the expression of opinions very strongly or positively as if they were facts.

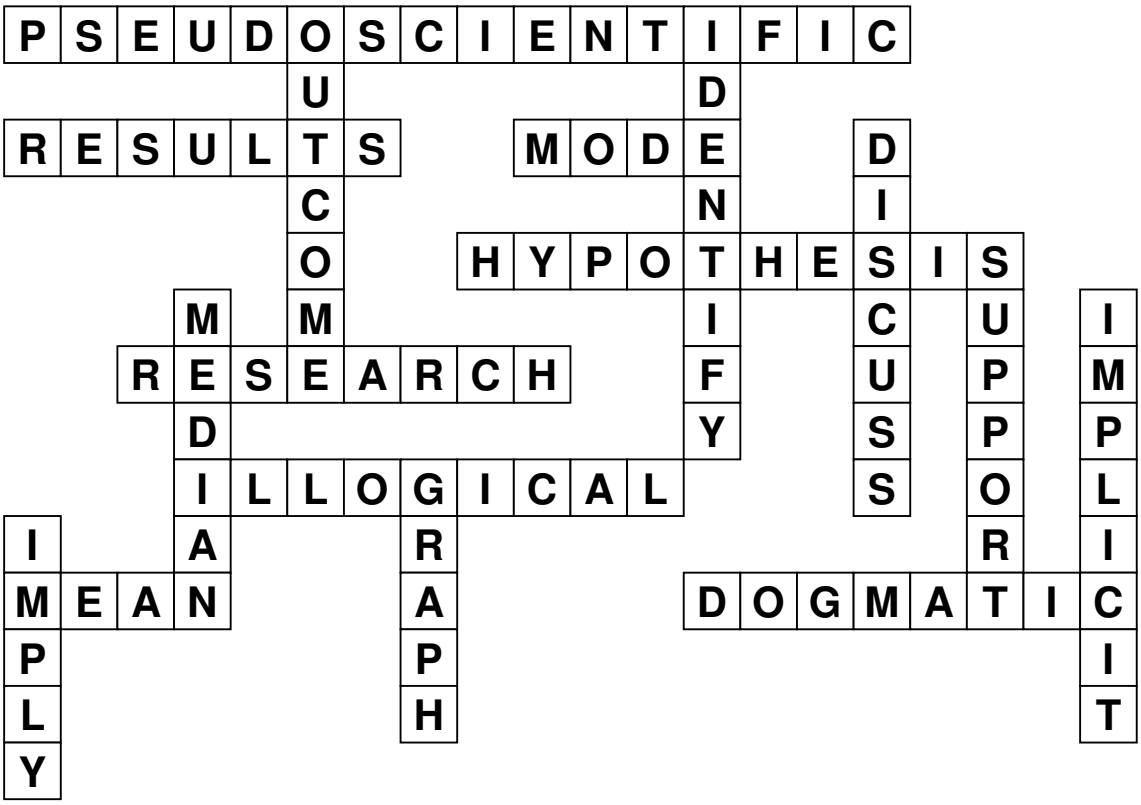
DOWN

2 something that follows as a result or consequence.
3 to be or become the same.
6 to present in detail for examination or consideration.
8 to promote the interests or cause of.
9 is a common way to measure the center of a set of mathematical data.
10 capable of being understood from something else though unexpressed.
13 a representation of an event--on paper.
14 to involve or indicate by inferemce, association, or necessary consequence rather than by direct statement.

9th A-1 Science as Inquiry and Process

Unit 3

Solution:



Complete the Sentence

Have the students write the key words in the blanks.

1. Early in his life Steve developed an incorrect _____ about what pick up lines work well and so stayed single until his mid-forties.

2. The _____ of the embargo was not as beneficial as the collaborating governments expected.

3. The _____ of the experiments needed to be analyzed by a team of scientist before anyone could make heads or tails of them.

4. It is important to not only _____ how you feel in this difficult family situation, but to say it directly.

5. _____ the variables of the experiment is the first step, and figuring out how to control them is the second.

6. I cannot _____ this problem further—let's just make a decision!

7. A good way to illustrate trends or show patterns is to make a _____ of the data.

8. While there are many types of ways to measure average, the _____ of a set of data is what most refer to as the "average".

9. The _____ is the middle number in a set of data, as longs at the data is in order from least to greatest or greatest to least.

10. The most common data value in a set of data is called the _____.

11. One should _____ ones views with evidence if respect from the scientific community is desired.

12. Intelligent Design is considered by the scientific community as_____ since none of its premises are testable.

13. It would be _____ to conclude that one will not get wet when chopping wood during a downpour.

14. The use of the dog's favorite bowl was _____ by the placement of the bowl near the list of dog-sitting instructions, even though the note did not mention the bowl directly.

15. Teachers who cover controversial topics without class discussion run the risk of appearing _____.

---

1. hypothesis	4.imply	7.graph	10.mode	13.illogical
2. outcome	5.Identifying	8.mean	11.support	14.implicit
3.results	6.discuss	9.median	12.pseudoscientific	15.dogmatic

Creative Writing Activity Page

Have the students write sentences of their own, using the key words from this unit. When the students' sentences are finished, have them take turns reading their sentences orally. The students should say "Blank," for the key words; the other students must name the "missing" words. You may wish to have the students write the "definitions" for the key words.

hypothesis

outcome

results

implying

identify

discuss

graph

mean

median

Creative Writing Activity Page

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mode

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support

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pseudoscientific

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research

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illogical

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implicit

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dogmatic

Creative Writing Activity Page

Have the students write sentences of their own, based on the picture below. When finished, have each student read his/her sentences to the others.

STUDENT SUPPORT MATERIALS

Reinforcement Activities

Students can participate in a mini-science fair in which they investigate an original question and then present their findings in posterboard form to the class during a class-wide science fair. PowerPoint presentations and/or written reports could also be a part of this open inquiry.

Another idea would be to have students form a question about student behavior or preferences, develop a hypothesis about their question, develop a survey to be taken by students in the class, and then tally and analyze the results. Students would need to use statistics and numerical analysis to calculate mean, median, and mode and then present their findings to the class. An extension to could be to have students look for correlations among their findings.

Paper plane vs. paper ball

1. Ask students to formulate a hypothesis if they believe a paper airplane will go farther than a paper ball. Explain that this is a pseudoscientific experiment because it is not a repeatable experiment and may not have a consistent outcome.
2. Have students work in groups of two or three.
3. Students should make one paper airplane and one paper ball.
4. Students need to throw the paper airplane and the paper ball in the same direction and then measure the distance in centimeters (cm).
5. Students need to record the results.
6. Have students write their results on the board.
7. After all groups have reported their results, have them calculate the mean, median, mode for the class and graph the results by group.
8. Students need to discuss their results compared to the class.
9. Students need to state whether their hypothesis was supported by the data.

From the work of S. Marino

Purposes:

To reflect upon the idea of *life*.

To incorporate traditional ideas and values on what is life into scientific criteria

Inquiry and Process

☐ **Activities**

• Have students conduct a fast write responding to the question, “What is life?” Be sure they include characteristics they believe distinguish living and nonliving things. Share and reflect on what students have written.

Have the students go on a scavenger hunt to find unique objects that would go under the category of “living.

• Give students an opportunity to share the items they found. Are there items that peers believe are not living and what is their reasoning?

• Display some puzzling nonliving objects that have characteristics of living things. Have students discuss what characteristics these items have in common with living things and why these items are not living.

☐ Materials

• Nonliving objects that have living characteristics (a lighted candle, a stone worn down, a motorized toy car, etc.).

Home-made Agar

Agar is a gel that is used to grow bacteria. Traditionally the gelling agent comes from seaweed called *Agar*, thus the reason for its name. In this version we will be using gelatin to make the gels. Follow the directions below to get your Petri dishes ready for growing bacteria.

Materials

- 80 ml distilled water
- 20 ml low sodium beef broth
- 2 packets of gelatin
- Graduated cylinder
- Sauce pot
- Hot plate
- Petri dish

Method

- Heat the water and beef broth to boiling.
- Stir in the gelatin until it completely dissolves.
- Continue to boil the mixture for another 2 minutes.
- Take the mixture of the heat and allow it to cool for five minutes stirring occasional.
- Pour the mixture into Petri dishes.
- Cover and place the Petri dishes into the refrigerator to cool.

Bacteria Collection – An Experiment

From the work of S. Marino

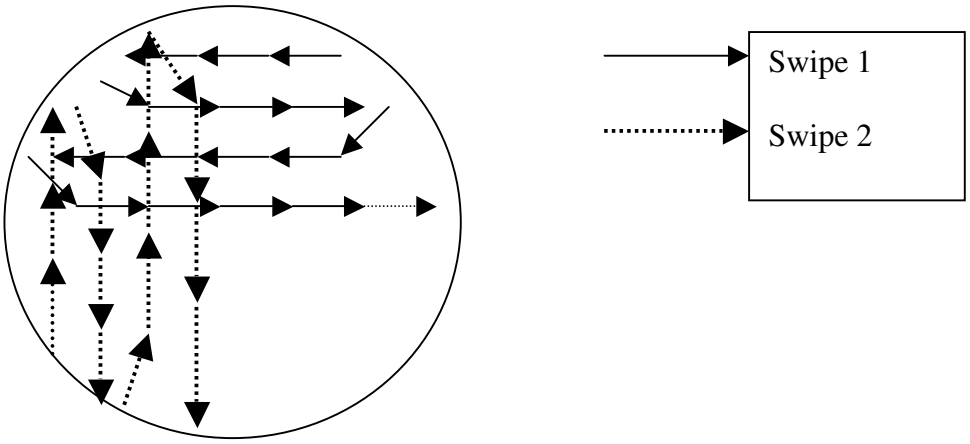
Materials

- Distilled Water
- 2 Cotton Swabs
- 2 Plastic Bags
- Masking Tape

Methods

- Wash your hands!
- Wet the cotton swab in distilled water.
- Rub it thoroughly on the surface you will be testing (one dirty, one clean).
- Put the cotton swab in a plastic bag. Label it using the masking tape. Include the following information:
    -
    - Your name
    - Location- be specific!
    - Dirty/Clean
    - Date
-

  Repeat the above steps for your second sample.
- Wash your hands!
- Obtain 2 Petri dishes.
- Gently rub the cotton swab on the surface of the agar in the manner shown below.



The cotton swab should run in a zig-zag pattern half way down the dish. Rotate the dish ¼ of a turn and repeat that same process.

Bacteria Growth Analysis

Your bacteria have grown for at least 48 hours now. Remember, ***It is extremely important that students <u>never</u> open the Petri dishes. It is impossible to know what kind of bacteria they have grow and in today's age of drug resistant strains you do not want to be exposed to large amounts of bacteria.***

Materials:

- 2 Petri dishes that have been growing bacteria cultures for 48 hours
- Colored pencils

Methods:

- Start with you're Petri dish where you grew the culture from your dirty place. Copy down all of the information you wrote on your label.
- Draw a detailed picture of what you see. Include color.
- Analyze the following information:
    - How much of the Petri dish is covered by the bacteria growth?
    - What shape are the growths?
    - What shape are the edges of the growth (are they smooth or rough)?
    - What color(s) are the growths?
    - Is there liquid where the gelatin has been metabolized (how much)?
- Repeat the same process for the clean Petri dish culture.

Conclusions:

- How do your results confirm or reject your hypothesis?
- What would you do differently if your were to repeat the experiment?

Purposes: Draw conclusions from the results of the bacteria culture designed to test the cleanest and dirtiest place in/near the school.

From the work of S. Marino

Analyzing Petri Dishes

☐ **Activities**

• Have each group of students explain to the class the hypothesis they are testing in regards to the cleanest and dirtiest place in/near the school.

• ** ***It is extremely important that students <u>never</u> open the Petri dishes. It is impossible to know what kind of bacteria they have grow and in today's age of drug resistant strains you/students do not want to be exposed to large amounts of bacteria.***

• Dispose of Petri dishes in heavy duty plastic bag that contains a 10% bleach solution –or- however you school/community recommends.

• Students should respond to the prompt, "How do your results confirm or reject your hypotheses?" and "What would you do differently if you were to repeat the experiment?"

☐ Materials

Bacteria Growth

Heavy duty plastic bags

Unit Assessment

Unit 3 Quiz and Test for Units 1, 2 & 3

A-1 Unit 3 Quiz

Science as Inquiry and Process

Name: _____
Date: _____

1) Scientists like to think about why events happen and ask questions about why they happen so they study the events in a thoughtful way . They will then guess the answer in an attempt to answer the question. When scientists guess it is called

   a) a smart guess

   b) an hypothesis

   c) a scientific answer

   d) scientific belief

2) Our teacher didn't exactly tell us we were going to have a test, but it was _____ in the way he kept reviewing the chapter and asking us questions.

3) When someone says something to you that's not a direct statement, but involves an inference or may be associated with something similar in nature they may be...

   a) lying.

   b) evading.

   c) implying.

   d) misleading.

4) The man had very strong opinions about his beliefs in global warming. He said everything he stated was based on research, but sometimes we thought his beliefs were more opinion than fact. But he expressed himself very strongly as if everything he said were fact. We think he is very...

   a) smart

   b) ostentatious

   c) dogmatic

   d) illustrative

5) A good scientist will only use principles that are..

   a) logical.

   b) illogical.

6) Pretend you are a scientist. Use the word DISCUSS in a sentence that helps help your reader understand how a scientist would use the word.

Match the following words on the left with their correct definition on the right

7) _____ median
8) _____ mean
9) _____ mode

a. it's same as the average of a group of numbers
b. arranging all the observations from lowest value to highest value and picking the middle one
c. the number that occurs most often in the collection of data

10) Graphs are often used in schools to

a) show student progress over time.
b) chart absenteeism during a school year.
c) chart basketball statistics during a season.
d) all of the above.

11) Success is often considered an OUTCOME of hard work.

a) True
b) False

12) In the world of science, when we want to classify a plant or an animal, we examine its characteristics and _____ to which group a specimen belongs.

13) Another word for OUTCOME might be RESULT.

a) True
b) False

14) Scientists might consider astrology to be a pseudoscientific belief.

a) True
b) False

15) When you decide that you aren't going to be in favor of something you are going to give it your SUPPORT.

a) True
b) False

A1, Unit 3, Science as Inquiry and Process Quiz

1) Scientists like to think about why events happen and ask questions about why they happen so they study the events in a thoughtful way . They will then guess the answer in an attempt to answer the question. When scientists guess it is called

a) a smart guess

b) an hypothesis

c) a scientific answer

d) scientific belief

2) Our teacher didn't exactly tell us we were going to have a test, but it was **implicit** in the way he kept reviewing the chapter and asking us questions.

3) When someone says something to you that's not a direct statement, but involves an inference or may be associated with something similar in nature they may be...

a) lying.

b) evading.

c) implying.

d) misleading.

4) The man had very strong opinions about his beliefs in global warming. He said everything he stated was based on research, but sometimes we thought his beliefs were more opinion than fact. But he expressed himself very strongly as if everything he said were fact. We think he is very...

a) smart

b) ostentatious

c) dogmatic

d) illustrative

5) A good scientist will only use principles that are..

a) logical.

b) illogical.

6) Pretend you are a scientist. Use the word DISCUSS in a sentence that helps help your reader understand how a scientist would use the word.

"My name is Dr. Science and I'm going to discuss with you what I have learned about the reasons we're getting so much snow in SE Alaska this winter."

Match the following words on the left with their correct definition on the right

7) **b** median
8) **a** mean
9) **c** mode

a. it's same as the average of a group of numbers
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10) Graphs are often used in schools to

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11) Success is often considered an OUTCOME of hard work.

a) True
b) False

12) In the world of science, when we want to classify a plant or an animal, we examine its characteristics and **identify** to which group a specimen belongs.

13) Another word for OUTCOME might be RESULT.

a) True
b) False

14) Scientists might consider astrology to be a pseudoscientific belief.

a) True
b) False

15) When you decide that you aren't going to be in favor of something you are going to give it your SUPPORT.

a) True
b) False

A1, Units 1, 2, 3, Science as Inquiry and Process Test

Name: _____
Date: _____

Reading Comprehension: Below there is short piece about the scientist, Dr. Maria Solvesit. Fill in the blanks using the words from the word bank. A few of the words will be used more than once.

Word Bank

communicate	conclusions	data
discuss	dogmatic	evidence
evidence	formulated	graphs
hypothesizing	illogical	integrity
integrity	interpret	outcomes
peer	predict	process
qualitative	quantitative	repeatable
research	results	review
skepticism		

1) There was once a brilliant scientist, Dr. Maria Solvesit, who spent a great deal of her life scientifically guessing, or h_____ about new ideas she had f_____ or put into a question. She would start out by using the information she had to p_____ what she thought would happen as a result of her experiments. Whenever she began a new scientific investigation she collected facts or d_____ very carefully, and shared all information with others during the p_____ of her investigation. Most of the information she collected was based on the scientific collection of data that could be counted, measured and quantified. Her data was mostly q_____, not q_____.

She was able to c_____ well, and explain to others what she was finding. She could i_____ or tell others the new information in ways that would make make sense to them. She would report on the o_____ and r_____ and d_____ her r_____ findings using charts and g_____. She tried very hard to present her information so that should would present her information in an intelligent, reasonable manner, not in an i_____, d_____ way, showing only bias and opinion. Her presentations included e_____ of her findings, showed i_____ , true to the purpose of the research. All of her research design, the data and the e_____ and c_____ are always open for p_____ r_____ . She believes that her research is r_____, that is it could be done again with the same results, and she welcomes any s_____ as a means of verifying or proving her findings.

Yes...Dr. Solvesit is indeed a scientist of l_____, with a capital l.

A1, Units 1, 2, 3, Science as Inquiry and Process Test

Name: _____
Date: _____

Reading Comprehension: Below there is short piece about the scientist, Dr. Maria Solvesit. Fill in the blanks using the words from the word bank. A few of the words will be used more than once.

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1) There was once a brilliant scientist, Dr. Maria Solvesit, who spent a great deal of her life scientifically guessing, or h **hypothesizing** about new ideas she had f **formulated** or put into a question. She would start out by using the information she had to p **predict** what she thought would happen as a result of her experiments. Whenever she began a new scientific investigation she collected facts or d **data** very carefully, and shared all information with others during the p **process** of her investigation. Most of the information she collected was based on the scientific collection of data that could be counted, measured and quantified. Her data was mostly q **quantitative** , not q **qualitative** .

She was able to c **communicate** well, and explain to others what she was finding. She could i **interpret** or tell others the new information in ways that would make make sense to them. She would report on the o **outcomes** and r **results** and d **discuss** her r **research** findings using charts and g **graphs** . She tried very hard to present her information so that should would present her information in an intelligent, reasonable manner, not in an i **illogical** , d **dogmatic** way, showing only bias and opinion. Her presentations included e **evidence** of her findings, showed i **integrity** , true to the purpose of the research. All of her research design, the data and the e **evidence** and c **conclusions** are always open for p **peer** r **review** . She believes that her research is r **repeatable** , that is it could be done again with the same results, and she welcomes any s **skepticism** as a means of verifying or proving her findings.

Yes...Dr. Solvesit is indeed a scientist of I **integrity** , with a capital I.

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