# KEY

## Earth Science Baseline Cornerstone Assessment: Part A. Scientific Investigation

*Directions:* Read the paragraph below and then respond to the questions.

Sam spent the summer as a lifeguard at the beach and observed that the sand was hotter than the water. He wondered how the absorption of heat was affected by different types of materials. He decided to perform an experiment for the science fair. Sam decides to test water, sand and potting soil.

1a. What is the **independent variable**? MATERIAL – OR SAND, SOIL AND WATER (ALL 3)

1b. Why did you choose this answer?

THIS IS THE VARIABLE THAT IS BEING MANIPULATED OR CHANGED BY THE EXPERIMENTER

2a. What is the **dependent variable**? TEMPERATURE

2b. Why did you choose this answer?

THIS IS THE VARIABLE THAT RESPONDS TO THE CHANGES OR THE VARIABLE. IT IS THE MEASUREABLE VALUE/VARIABLE.

Design a science experiment to determine which material gets the hottest throughout a 30 minute time period. You may use some or all of the following materials:

- Sand
- Potting Soil
- Water
- Heat lamp
- Timer
- Q-Tips
- Ruler
- stirring rod
- thermometers
- balance
- paper and pencil to record data
- Pyrex beakers
- Salt
- Balloons

3a. What is your **hypothesis**?

THIS CAN HAVE VARIOUS REPONSES BUT SHOULD INCLUDE THE INDEPENDENT VARIABLE AND D EPEND ENT VARIABLE AND / OR WRITTE N IN AN IF… THEN STATEM ENT.

3b. What is the logical reasoning behind your **hypothesis**?

THIS CAN HAVE VARIOUS RESPONSES BUT SHOULD LINK PRIOR KNOWLEDGE/EXPERIENCE AND THE CURRENT TOPIC.

4a. List three variables you need to hold **constant** in your experiment? LIGHT SOURCE, AMOUNT OF MATERIAL, TIME OF DAY, CONTAINER, THERMOMETERS, LOCATION, TIMER, DISTANCE TO LIGHT SOURCE

4b. Explain why they should be held **constant.**

THIS CAN HAVE VARIOUS RESPONSES BUT SHOULD MENTION THAT ACCURACY COMES WITH CHANGING ONLY ONE VARIABLE (VALIDITY).

5. Identify the **materials** you would use in your experiment.

SAND, WATER, POTTING SOIL, HEAT LAMP, TIMER, THERMOMETER, PAPER AND PENCILS TO RECORD DATA, RULER AND PYREX BEAKERS.

6. Describe the **steps** you would take to conduct your experiment.

STEP:

1. FILL 3 OF THE BEAKERS WITH A DIFFERENT TYPE OF MATERIAL (SAND, SOIL AND WATER). THE VOLUME MUST BE THE SAME FOR EACH CONTAINER.

2. PLACE A THERMOMETER IN EACH BEAKER. MAKE SURE THAT THE THERMOMETER IS AT THE SAME DEPTH FOR ALL THE BEAKERS.

3. PLACE THE 3 BEAKERS AT THE SAME DISTANCE FROM THE LIGHT SOURCE.

4. RECORD THE INITIAL TEMPERATURES FOR EACH MATERIAL.

5. TURN ON THE HEAT LAMP AND START THE TIMER.

6. AFTER (X) MINUTES RECORD THE TEMPERATURE OF EACH MATERIAL (STUDENT SHOULD IDENTIFY A CONSISTENT TIME INTERVAL). CONTINUE GATHERING AND RECORDING DATA FOR 30 MINUTES.

7. Set up a data table for this experiment. Include labels for each row and column (you do not need to include data).

SHADED AREAS ARE WHAT THE STUDENTS SHOULD INCLUDE.

| | TEMPERAURE OVER TIME (degree Celcius) | | | |
|---|---|---|---|---|
| | 0 MINUTES | 10 MINUTES | 20 MINUTES | 30 MINUTES |
| MATERIALS | | | | |
| SOIL | | | | |
| SAND | | | | |
| WATER | | | | |

## Earth Science Baseline Cornerstone Assessment: Part B. Data Analysis and Interpretation and Scientific Reasoning

*Directions:* Read the paragraph below and review the data table. Then, answer the questions that follow.

Sam tried to answer the question: "Which material absorbs heat the fastest?" Here is the data that Sam collected.

| | Temperature over time (degrees Celsius) | | | |
|---|---|---|---|---|
| | 0 minutes | 10 minutes | 20 minutes | 30 minutes |
| Sand | 27 | 31 | 35 | 39 |
| Potting Soil | 27 | 28 | 30 | 32 |
| Water | 27 | 27 | 27 | 28 |

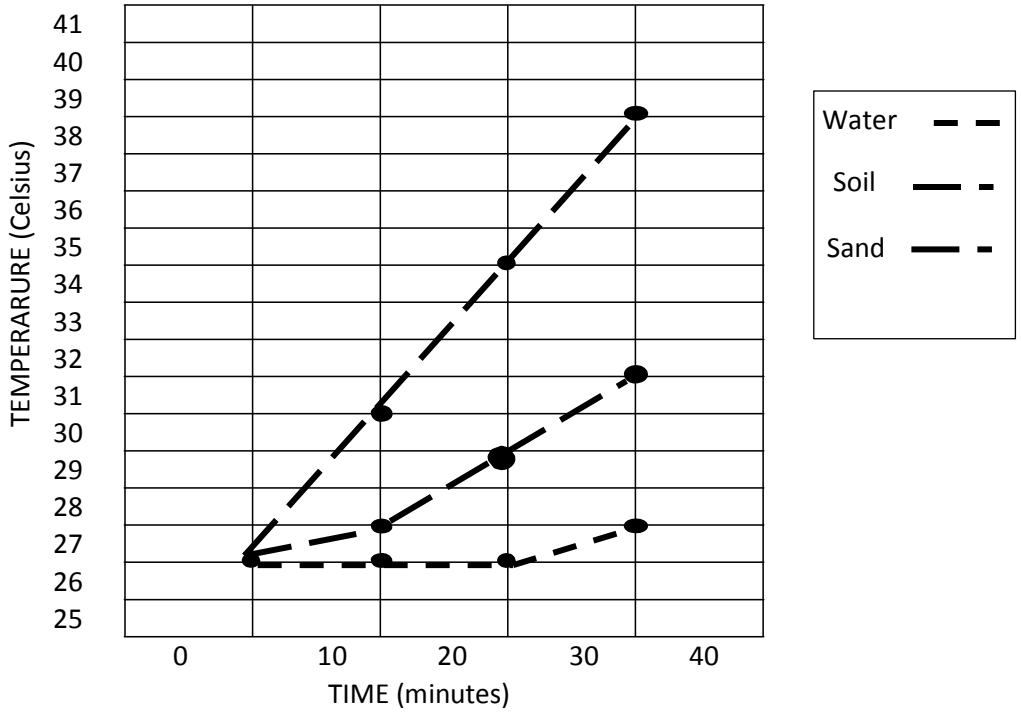
1. Based on the data, predict the temperatures for each of the following substances at 40 minutes.

SHADED AREAS ARE WHAT THE STUDENTS FILL IN.

| | 40 minutes |
|---|---|
| Sand | 43°C ±1°C |
| Potting Soil | 34°C ±1°C |
| Water | 28°C ±1°C |

2. Create a graph to display the data provided for this experiment.

STUDENTS SHOULD INCLUDE A TITLE – MATERIAL VS. TEMPERATURE INCREASE



3. Which material has the greatest rate of change? SAND
4. Based on your graph, draw a conclusion about the absorption of heat and different types of materials.
   BASED ON THE GRAPH, THE ABSORPTION OF HEAT IS AFFECTED BY THE TYPE OF MATERIAL. THE SAND HEATED UP THE FASTEST WHILE WATER HEATED THE SLOWEST.

   STUDENTS MAY WRITE A VARIATION OF THE ABOVE ANSWER BUT SHOULD INCLUDE THIS BASIC INFORMATION.

   *THE DIFFERENCE BETWEEN PRACTITIONER AND EXPERT IS THAT A PRACTIONER WILL GIVE YOU THE ABOVE STATEMENT BUT AN EXPERT WILL PROVIDE EVIDENCE THAT SUPPORTS WHY THE DIFFERENT RATES OF HEAT ABSORPTION OCCUR (HEAT CAPACITY).