

Brain Electricity “*Frequency Counts*”

GOAL

Quantitative descriptors describe things numerically.
 Qualitative descriptors describe things by their qualities ie. color, shape or relative rate.
 Frequency is the number of events over time.
 Frequency can be represented by wave patterns.
 Electrical activity in the brain corresponds to our state of consciousness.



Set-up:

- Brain wave chart
- Drum
- Handout for study of frequency



PROCEDURE

Engage (15 minutes)

- Draw or show unlabeled poster of representative brain waves for the different states of consciousness.

or

- Show projection (video or computer) of EEG machine waves.
- Explain that the wave patterns with lots of wave crests, close together represent a lot of electrical activity, and low activity is represented by the patterns with few crests.
- Explain that we can represent that electrical activity on the drum.

Explore (15 minutes)

- Choose student to come to the front of the class.
- Explain that we are going to use the drum as an EEG. Explain EEG if necessary. (EEG is short for electroencephalogram!)
- An EEG machine measures electrical activity in the brain.
- Make sure students understand that the instructor (or a student volunteer) cannot play as fast as the actual EEG!
- Connect the student to the drum with yarn, with one end taped to the student's forehead and the other tied to the drum.
- Ask the student to do something requiring concentration.
- Play a fast beat on the drum.



PROCEDURE

Explain (10 minutes)

- Ask class for descriptions of the rhythm.
- Lead discussion to qualitative vs. quantitative descriptions
- Emphasize that scientists often take measurements, and rely on specific quantitative information in their tests.
- Ask how we could get quantitative descriptions of rhythm.
- Pull counting beats over time from class.
- Introduce and explain the term frequency. Begin with the root word “frequent”. Take examples. Consider what these examples have in common. (e.g.: Do the examples all refer to an amount of time or using a unit of measurement?)
- Students compose and record definitions for new terms.
- Webster’s International Dictionary defines Frequency as “The number of periodic waves per unit of time usually expressed in cycles per second.” Hertz is defined as: “ A unit of frequency equal to one cycle per second.)

Expand (10 minutes)

- Choose another student to come to the front of the class.
- Connect the student to the drum with yarn, one end taped to the student's forehead with the other end tied to the drum.
- Ask student to just stare at the wall, unfocused.
- Play slow rhythm on drum for 10 seconds, while students count the number of drum beats played.
- Ask for the beat numbers recorded by several students and write them on the board.
- Discuss concept of averaging and have class calculate, as a group, the average number of beats recorded from those provided by the previously polled students.
- Draw a wave pattern representation of the average number of beats recorded for the 10 second interval and have students draw this wave pattern on the back of their handout. Divide by 10 and calculate the frequency (beats per second).
- Students should also record the activity of the "EEG subject"
- Repeat this process several times as time allows, having student volunteers concentrate or pretend to be tired and unfocused.

Evaluate (homework)

- Students complete the handout
- The handout evaluates the students' grasp of mathematical skills, the concept of frequency and the idea that relative levels of electrical activity in the brain are dependent on the state of consciousness of the individual.



A student and instructor play slow and fast beats, representing the rhythms of the EEG machine.

- **Key Cognitive Skills:**
 - Comparison
 - Systems thinking
 - Models and explanation
 - Graphing
 - Recording
 - Data collection
 - Interpreting results
- **Vocabulary Terms:**
 - qualitative
 - quantitative
 - frequency
 - wave crest
 - amplitude
- **Specific Outcomes:**
 - During dreams there is high frequency electrical activity in the brain and this occurs 4-5 times over an 8 hour period of sleep.
 - There is usually 90 minutes between each dream with low frequency electrical activity in the brain during the time between dreams.

PROJECT 2061 BENCHMARKS FOR SCIENTIFIC LITERACY

1A Nature of Science: Scientific Inquiry.

Scientific investigations..can be focused on physical and biological questions. Students collect and analyze data on frequency of events over time and create graphic representations of that data.

2B Nature of Mathematics:

Patterns and Relationships and Mathematical Inquiry.

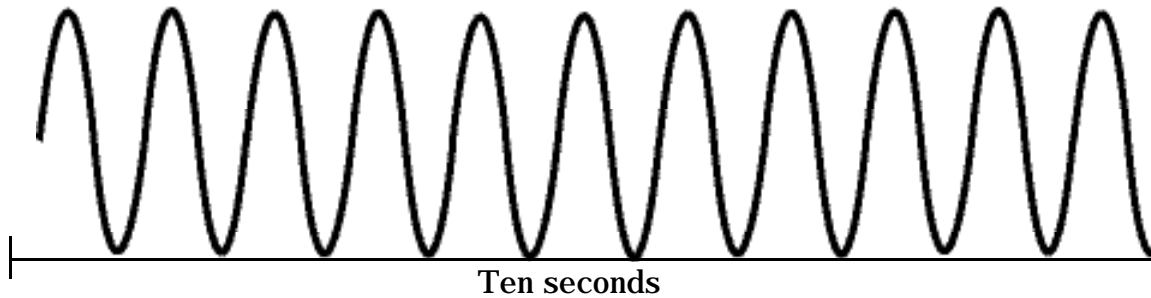
Students are asked to determine frequency involving addition of events divided by time over which events occur.

6C The Human Organism: Basic Functions

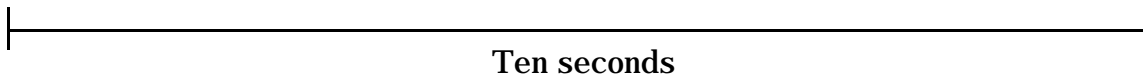
At this level, children can begin to view the body as a system in which parts do things for other parts, and for the organism as a whole. (Students learn that different states of consciousness correspond to different patterns of electrical activity in the

Name _____

Date: _____



1. Count the beats and calculate the frequency. _____ beats /sec.



2. Create your own frequency. Draw in the beats above (you choose how many) and calculate the frequency. Use all 10 seconds and don't forget to include units.

The rhythm has a frequency of _____

3. 28 beats are counted over 10 seconds

Frequency = 28 beats divided by 10 seconds or _____ beats per second

4. Why is time important when calculating a rhythm's frequency?
(hint: Think of the definition of rhythm frequency.)

5. Describe the difference between the frequencies of a concentrating brain versus a tired and unfocused brain.