

TSOKOS READING ACTIVITY

Section 5-2

1. Essential Idea: One of the earliest uses for electricity was to produce light and heat. This technology continues to have a major impact on the lives of people around the world.
2. Nature Of Science:
 - a. Peer review: Although Ohm and Barlow published their findings on the nature of electric current around the same time, little credence was given to Ohm. Barlow's incorrect law was not initially criticized or investigated further. This is a reflection of the nature of academia of the time, with physics in Germany being largely non-mathematical and Barlow held in high respect in England. It indicates the need for the publication and peer review of research findings in recognized scientific journals.
3. International-Mindedness: A set of universal symbols is needed so that physicists in different cultures can readily communicate ideas in science and engineering.
4. Theory Of Knowledge:
 - a. Sense perception in early electrical investigations was key to classifying the effect of various power sources; however, this is fraught with possible irreversible consequences for the scientists involved.
 - b. Can we still ethically and safely use sense perception in science research?
5. Understandings:
 - a. Circuit diagrams
 - b. Kirchhoff's circuit laws
 - c. Heating effect of current and its consequences
 - d. Resistance expressed as $R I = V$
 - e. Ohm's law
 - f. Resistivity
 - g. Power dissipation
6. Applications And Skills:
 - a. Drawing and interpreting circuit diagrams
 - b. Identifying ohmic and non-ohmic conductors through a consideration of the V/I characteristic graph
 - c. Solving problems involving potential difference, current, charge, Kirchhoff's circuit laws, power, resistance and resistivity
 - d. Investigating combinations of resistors in parallel and series circuits
 - e. Describing ideal and non-ideal ammeters and voltmeters

- f. Describing practical uses of potential divider circuits, including the advantages of a potential divider over a series resistor in controlling a simple circuit
 - g. Investigating one or more of the factors that affect resistance experimentally
7. Guidance:
- a. The filament lamp should be described as a non-ohmic device; a metal wire at a constant temperature is an ohmic device
 - b. The use of non-ideal voltmeters is confined to voltmeters with a constant but finite resistance
 - c. The use of non-ideal ammeters is confined to ammeters with a constant but non-zero resistance
 - d. Application of Kirchhoff's circuit laws will be limited to circuits with a maximum number of two source-carrying loops
8. Data Booklet Reference:
- a. *Kirchoff's circuit laws:*
 - i. $\Sigma V = 0$ (loop)
 - ii. $\Sigma I = 0$ (junction)
 - b. $R = \frac{V}{I}$
 - c. $P = VI = I^2R = \frac{V^2}{R}$
 - d. $R_{total} = R_1 + R_2 + \dots$
 - e. $\frac{1}{R_{total}} = \frac{1}{R_1} + \frac{1}{R_2} + \dots$
 - f. $\rho = \frac{RA}{L}$
 - g. *Refer to electrical symbols on page 4 of the physics data booklet*
9. Utilization:
- a. Although there are nearly limitless ways that we use electrical circuits, heating and lighting are two of the most widespread
 - b. Sensitive devices can employ detectors capable of measuring small variations in potential difference and/or current, requiring carefully planned circuits and high precision components
10. Aims:
- a. Aim 2: electrical theory and its approach to macro and micro effects characterizes much of the physical approach taken in the analysis of the universe
 - b. Aim 3: electrical techniques, both practical and theoretical, provide a relatively simple opportunity for students to develop a feeling for the arguments of physics
 - c. Aim 6: experiments could include (but are not limited to): use of a hot-wire ammeter as an historically important device; comparison of resistivity of a variety of conductors such as a wire at constant temperature, a filament lamp, or a graphite pencil; determination of thickness of a pencil mark on paper; investigation of ohmic and non-ohmic conductor characteristics; using a resistive wire wound and taped around the reservoir of a thermometer to relate wire resistance to current in the wire and temperature of wire

- d. Aim 7: there are many software and online options for constructing simple and complex circuits quickly to investigate the effect of using different components within a circuit
11. Read lesson 5-5, pg. 207-225, Heating Effect of Electric Currents, in your textbook.
12. Write a definition for each of the terms listed below:
- a. electric resistance _____

 - b. resistors _____

 - c. Ohm's Law _____

 - d. non-ohmic device _____

 - e. resistivity _____

 - f. voltage _____

 - g. electric power _____

 - h. EMF _____

 - i. resistors in series _____

 - j. resistors in parallel _____

 - k. Kirchhoff's current law (Kirchhoff's first law) _____

- l. Kirchhoff's loop law (Kirchhoff's second law) _____

- m. ammeter _____

- n. ideal ammeter _____

- o. voltmeter _____

- p. ideal voltmeter _____

- q. Potential Divider _____

13. Answers may be typed or neatly printed. Drawings may be freehand, but try to make use of the 'Shapes' or 'Insert Clipart' functions of MS Word. If you submit this assignment electronically to ManageBac, the filename must be in the following format, "LastnameFirstinitialPerXReadActX-X".