

USING OHM'S LAW TO DETERMINE RESISTANCE IN WIRE

Performance Standard 6D.J

This task uses electrical resistance in a wire as a context for finding the constant of proportionality and applying it to a new situation using electrical resistance in a wire:

- *Mathematical knowledge*: determine the constant of proportionality.
- *Strategic knowledge*: set up the variation equation and apply the constant.
- *Explanation*: explain what was done and why it was done.

Procedures

1. *In order to solve problems using comparison of quantities, ratios, proportions and percents (6D)*, provide students with sufficient learning opportunities to develop the following:
 - Set up and solve proportions for direct, inverse and compound variations of quantities involving powers and multiple variables.
Many agriculture related occupations involve an understanding of electricity and Ohm's Law and the relationship ohms, volts and amps have to each other. Volts = Amps x Ohms. The ability to utilize this mathematical equation is important.
2. Students are given a copy of the task to complete and submit. It is assumed that students have studied direct and inverse variation in single and compound situations. Use Ohm's Law to determine amps, ohms, or volts if any two of the variables are given.
3. Evaluate the students' work using the mathematics rubric:
 - A 4 in mathematical knowledge would require a correct answer of $k = 3.056124683 \times 10^{-5}$ and $d = 0.0986$ inch.
 - A 4 in strategic knowledge would require a correct set up of the variation equation in Part A and correct application of the constant in Part B.
 - A 4 in explanation would require a complete explanation of the process used and the reason for each step.

Examples of Student Work

- [Meets](#)
- [Exceeds](#)

Time Requirements

- One class period

Resources

- Copies of the "Resistance in Wire" task sheet
- Access to a scientific calculator
- Mathematics Rubric

NAME _____ DATE _____

RESISTANCE IN WIRE

Student Task Sheet

Resistance of a wire carrying an electrical current is directly proportional to the length and inversely proportional to its cross-sectional area.



wire

If a copper wire has a diameter of 0.0246 inch, length 100 feet and resistance of 6.43 ohms, find

- A) the constant of proportionality (in scientific notation).
- B) the diameter of a 15-foot wire with resistance 0.06 ohms using the constant of proportionality from Part A (to the nearest 0.001 inch).
- C) Using Ohm's Law, determine the amperage in a conductor that is in a 120 volt system that has a resistance of 6.43 ohms. Determine amperage to the nearest .01 amp.
- D) Write in words how you solved each problem and why you did each step.

MATHEMATICS RUBRIC

NAME _____ DATE _____

- Exceeds standard (must receive a 4 in each area)
- Meets standard (must receive all 3's or a combination of 3's and 4's)
- Approaches standard (must receive all 2's or any combination which may include a 3 or a 4)
- Begins standard (has no 3's or 4's but not all 1's)
- Absent (has all 1's and 0's)

	Mathematical Knowledge	Strategic Knowledge	Explanation
4	<ul style="list-style-type: none"> • Wrote the right answer. • Used math words correctly to show understanding of how math works. • Worked it out with no mistakes. • Used the right math words and labeled the answers. 	<ul style="list-style-type: none"> • Identified all the important parts of the problem, and knew how they went together. • Showed all the steps used to solve the problem. 	<ul style="list-style-type: none"> • Wrote what was done and why it was done. • If a drawing was used, all of it was explained in writing.
3	<ul style="list-style-type: none"> • Knew how to do the problem, but made small mistakes. 	<ul style="list-style-type: none"> • Identified most of the important parts of the problem. • Showed most of the steps used to solve the problem. 	<ul style="list-style-type: none"> • Wrote mostly about what was done. • Wrote a little about why it was done. • If a drawing was used most of it was explained in writing.
2	<ul style="list-style-type: none"> • Understood a little, but made a lot of big mistakes. 	<ul style="list-style-type: none"> • Identified some of the important parts of the problem. • Showed some of the steps used to solve the problem. 	<ul style="list-style-type: none"> • Wrote some about what was done or why it was done but not both. • If a drawing was used, some of it was explained in writing.
1	<ul style="list-style-type: none"> • Tried to do the problem, but didn't understand it. 	<ul style="list-style-type: none"> • Identified almost no important parts of the problem. • Showed almost none of the steps used to solve the problem. 	<ul style="list-style-type: none"> • Wrote or drew something that didn't go with the answer. • Wrote an answer that was not clear.
0	<ul style="list-style-type: none"> • No answer attempted. 	<ul style="list-style-type: none"> • No strategy shown. 	<ul style="list-style-type: none"> • No written explanation.
Score			