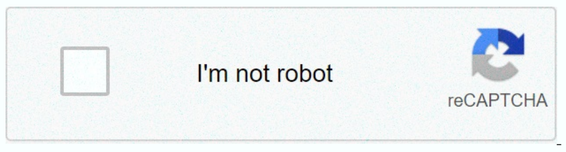

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Ohm's law power practice problems worksheet answers

Ohm's law problems worksheet answers.

Ohm’s law relates the resistance of a component to its voltage and current. Applying circuit rules for current and voltage with Ohm’s Law allows us to formulate rules to determine total resistance. Ohm's law states that the voltage V across a conductor of resistance R is proportional to the current I passing through the resistor (see circuit below). The relationship is written as.V = R I Which can also be written asI = V / R and R = V / I.The units are in Volts (V) for the voltage V, Amperes (A) for the current I and Ohms (Ω) for the resistance of R. Use Ohm's Law to Solve Simple Circuits ProblemsExample 1Find the current I through a resistor of resistance R = 2 Ω if the voltage across the resistor is 6 V.Solution to Example 1Substitute R by 2 and V by 6 in Ohm's law V = R I.6 = 2 ISolve for II = 6 / 2 = 3 AExample 2In the circuit below resistors R1 and R2 are in series and have resistances of 5 Ω and 10 Ω, respectively. The voltage across resistor R1 is equal to 4 V. Find the current passing through resistor R2 and the voltage across the same resistor.

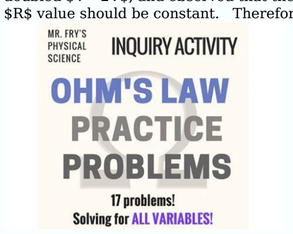
Solution to Example 2We use Ohm's law V = R I to find the current I1 passing through R1.4 = 5 I1Solve for I1I1 = 4 / 5 = 0.8 AThe two resistors are in series and therefore the same current passes through them. Hence the current I2 through R2 is equal to 0.8 A.We now use Ohm's law to find the voltage V2 across resistor R2.V2 = R2 I2 = 10 (0.8) = 8 VExample 3In the circuit below resistors R1 and R2 are in parallel and have resistances of 8 Ω and 4 Ω, respectively. The current passing through R1 is 0.2 A. Find the voltage across resistor R2 and the current passing through the same resistor. Solution to Example 3Use Ohm's law V = R I to find the voltage V1 across resistor R1.V1 = 8 (0.2) = 1.6 VThe voltage across resistor R1 and the voltage across resistor R2 are the same because R1 and R2 are in parallel.We now use Ohm's law to find current I2 passing through resistor R2.1.6 = 4 I2Solve for I2I2 = 1.6 / 4 = 0.4 AExample 4The current passing through a resistor in a circuit is 0.01 A when the voltage across the same resistor is 5 V. What current passes through this resistor when the voltage across it is 7.5 V?Solution to Example 4Use Ohm's law V = R I to find the resistor R in this circuit.5 = R (0.01)Solve for RR = 5 / 0.01 = 500 ΩWe now use Ohm's law V = R I and the value of R to find the current when the voltage is 7.5.7.5 = 500 ISolve for II = 7.5 / 500 = 0.015 AExample 5The graph below represents the voltage V across a resistor against the current I passing through the same resistor. What is the resistance of the resistor in the circuit? Solution to Example 5Ohm's law V = R I is similar to equation of lines of the form y = m x and we know that m is the slope of the line y = m x. Hence in the graph of V against I given above, the slope of the graph is the resistance.We need two points from the graph to find the slope.

Points (0,0) and (1,10) form the graph may be used to find the slope and hence the resistor R.R = (10 - 0) / (1 - 0) = 10 ΩMore References and LinksOhm's Law and Power Calculator Ohm's law In order to continue enjoying our site, we ask that you confirm your identity as a human. Thank you very much for your cooperation. In the following, some simple questions and answers about Ohm's law are provided with detailed explanations. All problems are suitable for a high school student. Ohm's Law Practice Problems: Problem (1): An electronic device has a resistance of 20 ohms, and a current of 15 A passes through it. What is the voltage across the device?

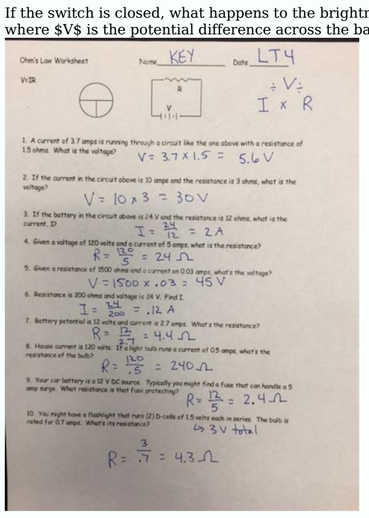
Solution: Resistance, current, and voltage are related together by Ohm's law as $V=IR$. Thus, the voltage of the device is given by \begin{align*}V&=IR\\&=15\times 20\\&=300\quad {\rm V}\end{align*} Problem (2): A $3-{\rm V}$ potential difference is applied across a $6\,{\rm \Omega}$ resistor. What is the current that flows into the resistor?

Solution: Ohm's law states the potential difference across a resistor is resistance times current, so we get \begin{align*} I&=\frac VR\\&=\frac {3}{6}\\&=0.5\quad {\rm A}\end{align*} Problem (3): An electric device is connected to a $120-\rm V$ outlet and draws $6\,\rm A$ of current. How much heat will this device produce in 3 minutes?

Solution: To solve this simple question, we must combine three fundamental equations as follows: \begin{gather*} \text{Ohm's law}: \, I=\frac{V}{R}\\\\ \text{Power}: P=\frac{E}{t} \\\\ \text{Electric power}: P=V\times I \end{gather*} where E is energy. Recall from heat problems that heat is energy. Combining these equations yields \begin{align*} E&=Pt \\\\ &=VIt\\\\ &=(120)(6)(3\times 60\,\rm s) \\\\ &=129600\,\rm J\end{align*} or in scientific notation as \[E=1.29\times 10^5\,\rm J\] Problem (4): In the circuit shown below, how much current does the ammeter show? Solution: A lightbulb is an electronic component with high resistance. In the figure, the voltage across it is the same as that across a battery of $V=20\,{\rm V}$. The current that passes through it relates to the resistance and voltage drop using Ohm's law. \begin{align*} I&=\frac VR\\&=\frac{20}{8}\\&=1.25\quad {\rm A}\end{align*} Problem (5): In a circuit, a $10\,{\rm \Omega}$ resistor is removed and replaced by a $20\,{\rm \Omega}$ resistor. What happens to the current in the circuit? Solution: Since nothing is said about the voltage drop across the circuit, we assume it is constant, say $V=120\,{\rm V}$. Therefore, using Ohm's law formula, $I=\frac VR$, current $I=\frac{120}{10}=12\,{\rm A}$ flows through the $10\,{\rm \Omega}$ resistor, and $I=\frac{120}{20}=6\,{\rm A}$ through the $20\,{\rm \Omega}$ resistor. We can see that for the same voltage, doubling the resistances results in decreasing, or more precisely, halving, the currents. Question: A circuit consists of a battery and a resistor. The resistor dissipates $2\,\rm W$. Now the resistor is replaced with one that has twice the resistance of the original. What power does the new resistor dissipate? Solution: The power dissipated (or consumed) by a resistor is determined by one of the following formulas: \[P=V\times I=\frac{V^2}{R}=RI^2\] where V is the potential drop across the resistor. Ohm's law tells us that the current through a resistor is inversely proportional to its resistance, i.e., $I\propto \frac 1R$. In this problem, the new resistor has twice the resistance of the original resistor, i.e., $R'=2R$ whereas it is connected across the same battery, $V'=V$. Thus, the current flowing through this new resistor is related to the old one as below: \begin{align*} \frac{i'}{i}&=\frac{R}{R'} \\\\ &=\frac{R}{2R} \\\\ \Rightarrow i'&=\frac 12 i\end{align*} Given the current in the replaced resistor, substitute it into one of the above power formulas, say $P'=V'i'$. \begin{align*} P'&=V'i' \\\\ &=V(\frac 12 i) \\\\ &=\frac 12 \underbrace{Vi}_{P} \\\\ &=\frac 12 \times 2 \\\\ \Rightarrow \quad P'&=\boxed{1\,\rm W} \end{align*} Therefore, the new resistor would dissipate $1\,\rm W$ of electric power. Question: A hair dryer is plugged into a $240\,\rm V$ outlet and draws a current of $3.6\,\rm A$. (a) If the voltage drops by 25% and nothing else changes, how much will the current be? (b) Assuming that the resistance of the device was reduced by 25%, what current would be drawn at $240\,\rm V$? Solution: This type of Ohm's law question typically appears in AP Physics classes. (a) We are told that the voltage is reduced by 25% of the original voltage, meaning that \[V_2=V_1-(0.25)V_1=0.75V_1\] In addition, it is assumed that the resistance of the device has not changed, i.e., $R_2=R_1$. Applying Ohm's law formula on both sides of this relation and solving for the unknown current I_2 gives us \begin{align*} R_2&=R_1 \\\\ \frac{V_2}{I_2}&=\frac{V_1}{I_1} \\\\ \Rightarrow I_2&=I_1\left(\frac{V_2}{V_1}\right) \\\\ &=(3.6)\left(\frac{0.75V_1}{V_1}\right) \\\\ &=\boxed{2.7\,\rm A} \end{align*} With a 25% reduction in the original voltage, the current drawn by the device is also reduced by as much as $2.7\,\rm A$. (b) Now, the resistance varies and reduces by 25% of the original resistance, i.e., \[R_2=R_1-0.25R_1=0.75 R_1\] The voltage across the device is held constant, i.e., $V_2=V_1$. As above, applying Ohm's law formula gives us \begin{align*} V_2&=V_1 \\\\ I_2R_2&=I_1 R_1 \\\\ \Rightarrow I_2&=I_1 \left(\frac{R_1}{R_2}\right) \\\\&=(3.6)\left(\frac{R_1}{0.75R_1}\right) \\\\ &=\boxed{4.8\,\rm A} \end{align*} Ohm's Law: Conceptual Questions Here are some simple conceptual questions about Ohm's Law. Question: When you double the voltage across a conducting wire, you observe that the current increases by a factor of 4. What can you conclude about this experiment? Solution: The resistance of a conducting wire is defined as the ratio of the voltage drop across it to the current that passes through it, $R=\frac{\Delta V}{I}$. This relationship is commonly referred to as Ohm's law. For ohmic materials, the resistance, R, is always constant and does not change, either by changing voltage or current. In this question, the voltage was doubled $V'=2V$, and observed that the current was quadrupled, $I'=4I$. Applying Ohm's law gives \begin{align*} R' &=\frac{V'}{I'} \\\\ &=\frac{2V}{4I} \\\\ &=\left(\frac 12\right) \frac VI \\\\ \Rightarrow R' &=\frac 12 R \end{align*} As you can see, the new resistance is halved, and this contradicts the assumption that for an ohmic material, the R value should be constant. Therefore, we conclude that this conducting wire does not obey Ohm's law. Question: All lamps are identical in the circuit shown.



If the switch is closed, what happens to the brightness of bulb A? Solution: The amount of current passing through a lamp determines its brightness. Let's consider the case when the switch is open and bulb B is out of the circuit (bulb B is off). In this case, the current passing through bulb A is found using Ohm's law formula \[I_A=\frac{V}{R}\] where V is the potential difference across the battery and R is the resistance of lamp A. Just after closing the switch, the current is established in the branch where lamp B is located, and thus it lights up. Each lamp can be considered a resistor with resistances of R_A and R_B.


Ohm's Law Worksheet Name KEY Date LT4

V=IR

÷ V ÷
I x R

1. A current of 3.7 amps is running through a circuit like the one above with a resistance of 1.5 ohms. What is the voltage? V = 3.7 x 1.5 = 5.6 V

2. If the current in the circuit above is 10 amps and the resistance is 3 ohms, what is the voltage? V = 10 x 3 = 30 V

3. If the battery in the circuit above is 24 V and the resistance is 12 ohms, what is the current, I? I = 24/12 = 2 A

4. Given a voltage of 120 volts and a current of 5 amps, what is the resistance? R = 120/5 = 24 Ω

5. Given a resistance of 1500 ohms and a current on 0.03 amps, what's the voltage? V = 1500 x .03 = 45 V

6. Resistance is 200 ohms and voltage is 24 V. Find I. I = 24/200 = .12 A

7. Battery potential is 12 volts and current is 2.7 amps. What's the resistance? R = 12/2.7 = 4.4 Ω

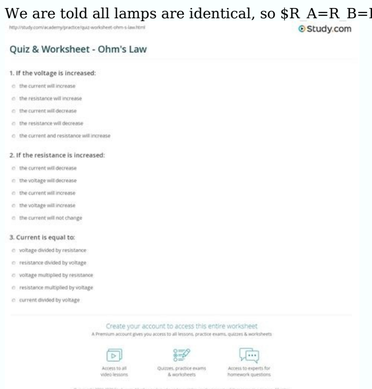
8. House current is 120 volts. If a light bulb runs a current of 0.5 amps, what's the resistance of the bulb? R = 120/.5 = 240 Ω

9. Your car battery is a 12 V DC source. Typically you might find a fuse that can handle a 5 amp surge. What resistance is that fuse protecting? R = 12/5 = 2.4 Ω

10. You might have a flashlight that runs (2) D-cells of 1.5 volts each in series. The bulb is rated for 0.7 amps. What's its resistance? ↳ 3 V total

R = 3/.7 = 4.3 Ω

We are told all lamps are identical, so $R_A=R_B=R$. After lamp B is entered into the circuit, it is in parallel with bulb A.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Quiz & Worksheet - Ohm's Law

1. If the voltage is increased:
- the current will increase
- the resistance will increase
- the current will decrease
- the resistance will decrease
- the current and resistance will increase

2. If the resistance is increased:
- the current will decrease
- the voltage will decrease
- the current will increase
- the voltage will increase
- the current will not change

3. Current is equal to:
- voltage divided by resistance
- resistance divided by voltage
- voltage multiplied by resistance
- resistance multiplied by voltage
- current divided by voltage

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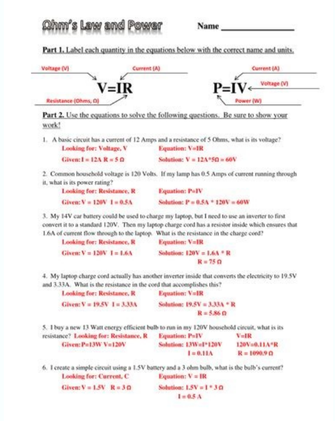
Therefore, the equivalent resistance is \begin{align*} \frac{1}{R_{eq}}&=\frac{1}{R_A}+\frac{1}{R_B} \\\\ &=\frac 1R+\frac 1R \\\\ \Rightarrow R_{eq}&=\frac R2\end{align*} The current through the battery, in this case, is given by \begin{align*} I_{tot}&=\frac{V}{R_{eq}} \\\\ &=\frac{V}{R/2} \\\\ \Rightarrow I_{tot}&=2\frac{V}{R}\end{align*} In other words, the current provided by the battery, in this case, is \[I_{tot}=2I_A\] Recall from Kirchhoff's junction rule problems that the current through each bulb is the same and adds up to $2I_A$. Therefore, lamp A draws the same current as before when lamp B was out of the circuit. As a result, adding bulb B to the circuit does not affect the brightness of bulb A. Question: In the circuit illustrated, rank each branch of the circuits, from greatest to least, according to (a) The voltage drop across each (b) The current through each Solution: We want to solve this question without any mathematical calculation. (a) All three branches are in parallel with each other, so the potential drop of each is the same and equal to the voltage of the battery. \[V_C=V_A=V_B\] (b) Assuming an ideal battery (without internal resistance), the top branch has two resistors, the middle branch has one, and the third branch has none. The top branch is therefore more resistant than the other branches. On the other hand, they are all the same voltage. Ohm's law states that any branch with more resistance draws less current as a result. As a result, we have \[I_C>I_B>I_A\] Question: In the circuit illustrated, compare the brightness of each identical bulb. (a) Which bulbs draw the most current? (b) What will happen if lamp A is burned out? or if lamp C is unscrewed? Solution: The light bulb's brightness intensity is determined by the wattage using (power) of that bulb. The power, also, is found using one of the following formulas \[P=VI=\frac{V^2}{R}=RI^2\] The more power the bulb dissipates, the brighter it shines. The terminals of bulb C are connected directly to the battery, so the voltage across bulb C is the same as that of the battery. The three bulbs are identical, so the equivalent resistance This circuit is made up of two parallel branches. There is more resistance in the upper branch of the circuit, so according to Ohm's law $I=\frac VR$, less current passes through this branch than in the lower branch, including one resistor (bulb).


Ohm's Law and Power Name _____

Part 1. Label each quantity in the equations below with the correct name and units.

V=IR: Voltage (V), Current (A), Resistance (Ohms, Ω)

P=IV: Current (A), Voltage (V), Power (W)

Part 2. Use the equations to solve the following questions. Be sure to show your work!

1. A basic circuit has a current of 12 Amps and a resistance of 5 Ohms, what is its voltage?
Looking for: Voltage, V — Equation: V=IR
Given: I = 12A R = 5 Ω — Solution: V = 12A*5Ω = 60V

2. Common household voltage is 120 Volts. If my lamp has 0.5 Amps of current running through it, what is its power rating?
Looking for: Resistance, R — Equation: P=IV
Given: V = 120V I = 0.5A — Solution: P = 0.5A * 120V = 60W

3. My 14V car battery could be used to charge my laptop, but I need to use an inverter to first convert it to a standard 120V. Then my laptop charge cord has a resistor inside which ensures that 1.6A of current flow through to the laptop. What is the resistance in the charge cord?
Looking for: Resistance, R — Equation: V=IR
Given: V = 120V I = 1.6A — Solution: 120V = 1.6A * R
R = 75 Ω

4. My laptop charge cord actually has another inverter inside that converts the electricity to 19.5V and 3.33A. What is the resistance in the cord that accomplishes this?
Looking for: Resistance, R — Equation: V=IR
Given: V = 19.5V I = 3.33A — Solution: 19.5V = 3.33A * R
R = 5.86 Ω

5. I buy a new 13 Watt energy efficient bulb to run in my 120V household circuit, what is its resistance? Looking for: Resistance, R — Equation: P=IV — V=IR
Given: P=13W V=120V — Solution: 13W=I*120V — 120V=0.11A*R
I = 0.11A — R = 1090.9 Ω

6. I create a simple circuit using a 1.5V battery and a 3 ohm bulb, what is the bulb's current?
Looking for: Current, C — Equation: V = IR
Given: V = 1.5V R = 3 Ω — Solution: 1.5V = I * 3 Ω
I = 0.5 A

\[i_{AB}As a result, you can see that, if the bulbs are identical, the current in the parallel case is four times that in the series combination. (b) The amount of power dissipation by a battery determines how quickly it drains, which is given by the following power formula \[P_{diss}=VI_{tot}\] where V is the voltage across the battery. As you can see above, connecting two identical bulbs in parallel will draw more current from the battery than connecting them in series. Consequently, the more current is drawn from the battery, the more power is dissipated by it. \begin{gather*} I_{parallel} > I_{series} \\\\ P_{parallel} > P_{series} \end{gather*} Question: In the following circuits shown, all bulbs are identical. In each circuit, a voltmeter is connected across a single bulb to measure the voltage difference across it. Rank the voltage readings from greatest to least. Solution: The voltage drop across each bulb is found using Ohm's law: $\Delta V=I\times R$. Assume that every lightbulb has a resistance of R.

Ohm's Law worksheet **Name_____ Per:____**

1. The rate of electron flow is measured in (a) amperes (b) volts (c) ohms.
2. Potential difference is measurement of _____ and is symbolized in the ohms law equation as the letter (__) and the unit symbol (__). The rate of electron flow is called _____ and is measured in amps (A). The symbol for the flow of electrons in an equation is (__). The _____ (R) is measured in ohms (__).
3. Voltage = _____ times _____.
4. According to Ohm's Law, what effect will decreasing the resistance have on the current?
5. In a circuit, voltage and current are (a) directly proportional, (b) inversely proportional, (c) not proportional.
6. Rearrange Ohm's Law to answer the following: Current equals _____ divided by _____.
7. If the power source is set at 6V and R is 2 ohms, the current =_____
8. V=5volts, R= 10 ohms, I= _____.
9. If the voltage stays the same and the resistance is ¼ of its original, what will happen to the current?
10. If the current in the circuit is 7 amps and the resistance is 2 ohms the voltage =_____.
11. R= 30 ohms, I= 3A, V=_____
12. Resistance = _____ divided by _____.
13. If the power source is 12 V and the flow of electrons is 3A, what is the resistance?
14. V= 6V, I= 18A, R=_____

Extension Questions:

15. A _____ is the electric pressure required to produce one ampere of current in a circuit having one _____ of resistance.
16. One amp is one _____ per second. A coulomb is _____ electrons.

Ohm's Law worksheet **Name_____ Per:____**

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The only thing left to do is determine the current flowing through each bulb. Keep in mind that in each circuit, the voltmeter is connected in parallel to the lightbulb. For circuit (A), the voltage drop across the only bulb of the circuit is simply determined as \[\Delta V=\Delta V_A=I_A\times R\] where I_A is the current through the bulb, which in this case, is also the same current as in the battery. ΔV is also the voltage difference across the battery. In the case of B, the two identical bulbs are connected in series. Therefore, according to the rules of series combination, the same current flows through each bulb, and the voltage drop in each bulb adds up to the voltage of the battery. The equivalent resistance of this combination is $R_{eq}=R+R=2R$, and the total current through the battery (which is the same current as each bulb) is \begin{align*} I&=\frac{\Delta V}{2R} \\\\ &=\frac 12 \frac{\Delta V}{R} \\\\ &=\frac 12 I_A\end{align*} Hence, the voltage drop across the bulb shown is \[\Delta V_B=I_B\times R = \boxed{\frac 12 I_A \times R}\] In the third circuit, only another identical bulb is added to the circuit.

Thus, all calculations are similar to the second circuit, but with only a slight change. \begin{gather*} R_{eq}=R+R+R=3R \\\\ I=\frac{\Delta V}{R_{eq}}=\frac{\Delta V}{3R}=\frac 13 I_A \\\\ \Delta V_C=I_C \times R \\\\ \Delta V_C=\frac 13 I_A R \\\\ \Rightarrow \boxed{\Delta V_C=\frac 13 \Delta V_A} \end{gather*} Consequently, the rank of the voltage drop across each bulb from greatest to least is as follows \[\Delta V_A>\Delta V_B > \Delta V_C\] Question: If the voltage across a circuit increases by five times, then what would the current through the circuit be? Solution: Assuming the circuit is made of a material that obeys Ohm's law, a change in voltage will change the current so that the ratio of $\frac{\Delta V}{I}$ becomes constant. Therefore, the current also increases five times to maintain the resistance of the circuit unchanged. Question: In a certain electric circuit including a cell, connecting wires, and a filament lightbulb, which of the following would cause the lightbulb to shine less brightly? (a) Decrease or increase the resistance of the circuit. (b) Increase or decrease the voltage of the battery. Solution: As long as the current through the filament lightbulb is small, we can assume Ohm's law will be obeyed. (a) Shining less brightly means less current passes through the filament (resistance). According to Ohm's law, the current is inversely proportional to the resistance, so an increase in the resistance will cause a decrease in the current through the filament and consequently a less glow for the lightbulb. (b) The current through the filament is related to the voltage across it by $I=\frac{\Delta V}{R}$. Assuming the resistance of the lightbulb does not change, the current is proportional to the voltage drop. Thus, an increase in voltage causes an increase in the current through the resistor, and as a result, the lightbulb shines brighter. Question: A $12-\rm V$ battery is connected across a lightbulb with variable resistance. As the resistance increases, what happens to each of the following quantities? (a) The current through the lightbulb. (b) The voltage across the lightbulb. (c) The power consumed by the lightbulb. Solution: We have a circuit with a fixed-voltage battery of $12\,\rm V$, and a lightbulb (resistor) with variable resistance. We assume that the filament of the lightbulb is made up of a material that obeys Ohm's law. (a) According to Ohm's law, the current through a resistance is $I=\frac{\Delta V}{R}$. The voltage is assumed to be fixed, and the only alteration is due to the increases in the resistance. Thus, increasing the resistance decreases the current through the lightbulb filament. (b) The voltage across the bulb is held constant by a battery and does not change with a change in circuit resistance. (c) One of the following formulas can be used to calculate the power consumed by resistance in a circuit: \[P=I\Delta V=\frac{\Delta V^2}{R}=RI^2\] If we pick out the first formula, $P=I\Delta V$, as you can see in part (a), an increase in the resistance leads to a decrease in the current, and so does power. Ohm's Law: Homework Problems The following are some homework questions appearing for Ohm's law are provided and answered. Problem (6): In the following circuits, find the unknowns. Solution: In each of the circuits, use Ohm's law $V=IR$ and solve for the unknown. In the left circuit, the current through the resistor is asked for in milliamps. Thus, \begin{align*} I&=\frac VR\\\\&=\frac{120}{100}\\\\&=1.2\quad {\rm A}\end{align*} To convert it to milliamperes, multiply it by 1000, so we get $I=1200\,{\rm mA}$. In the right circuit, the resistance of the light bulb is unknown. As a result, \begin{align*} R&=\frac VI\\&=\frac {24}{600\times 10^{-3}} \\\\&=40\quad {\rm \Omega}\end{align*} Problem (7): In a circuit, the potential drop across the $10\,\rm k\Omega$-resistor is $100\,\rm V$. What is the current through the resistor? Solution: Substitute all known numerical values into Ohm's law equation, $V=IR$. \begin{align*} I&=\frac VR\\\\&=\frac{100\,{\rm V}}{10000\,{\rm \Omega}}\\\\&=0.01\quad {\rm A}\end{align*} Problem (8): The voltage-current curve for an ohmic conductor is plotted as shown in the figure below. What is the resistance of resistors 1 and 2? Solution: Ohm's law tells us that resistance is the slope of the voltage vs.

current curve $R =\frac{\Delta V}{I}$. Recall that the slope m of a straight line between two points $A(x_1,y_1)$ and $B(x_2,y_2)$ is determined as \[m=\frac{\Delta y}{\Delta x}=\frac{y_2-y_1}{x_2-x_1}\] Thus, the slope of the voltage-current curve, which is the resistance, is obtained as below: The points $A(0,0)$ and $B(2,20)$ are on the line (1):\[R_1=\frac{20-0}{2-0}=10\quad{\rm \Omega}\] The points $A(0,0)$ and $B(4,10)$ are on the line (2):\[R_2=\frac{10-0}{4-0}=2.5\quad{\rm \Omega}\]