#  Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

# Chapter 9.1 – Series and Parallel Circuits

### After you have completed this unit you will able to:

1. Differentiate between series and parallel circuits in terms of current, voltage, and resistance.
2. Define electrical energy and power.
3. Calculate power using voltage and current.
4. Determine energy consumption given the power rating of a device and duration of use.

## Section 9.1 – Series & Parallel Circuits

There are two types of circuits used in electronics: \_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_.

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| Define **series circuit**: |  |
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In a series circuit, the total voltage is equal to the \_\_\_\_\_\_\_\_\_\_\_ of voltages lost at each \_\_\_\_\_\_\_\_\_\_\_\_. This is because each \_\_\_\_\_\_\_\_ uses some of the voltage to power itself.

Most electrons flowing in a circuit remain evenly spread apart. In a series circuit, the current in each part of the series is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

What happens to current when resistors are added to a series circuit? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

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| **Example of a Series Circuit** | Macintosh HD:Users:Jason:Documents:School:Curriculum Material:Jason's Course Material:Science 9:BC Science 9 Resources:Images:Unit 3 - Physics:images_ch_09:bc9_u3c9_p307_1.jpg |
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| Define **parallel circuit**: |  |
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When **loads** a placed in **parallel** the voltage across each load \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ . That is each load will be supplied with the same voltage.

In a parallel circuit, the total current entering a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ must equal the sum of the current leaving the junction point. A pathway with less \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ will be able to have more electrons travel on it and therefore will have a greater \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ than the pathway with more \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

If you add a resistor in a parallel circuit to an existing resistor, what happens to the total resistance in the circuit? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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| **Example of a Parallel Circuit** | Macintosh HD:Users:Jason:Documents:School:Curriculum Material:Jason's Course Material:Science 9:BC Science 9 Resources:Images:Unit 3 - Physics:images_ch_09:bc9_u3c9_p307_b.jpg |
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A comparison of series and parallel circuits.



**Practice drawing parallel circuits.**

1. A single cell with 2 lamps in parallel.
2. 4 cells in series, 2 lamps in parallel .
3. The same as above, but add an open switch in series with the battery.
4. Will the lamps be lit? Explain.
5. The same as question 2, but add an open switch to one of the circuits with a bulb.
6. Will the bulbs be lit? Explain.

## Section 9.2 – The Power of Electricity

Electricity is important because it allows us to make something happen, whether it be turning on a light bulb, listening to music, or powering a vehicle. When something happens we say \_\_\_\_\_\_\_\_\_\_\_\_ has been done, or \_\_\_\_\_\_\_\_\_\_\_\_ has been used.

With **electricity** we want to know the \_\_\_\_\_\_\_\_\_ at which **electrical** **energy** is being used or consumed. The **rate** at which electrical energy is being consumed is called \_\_\_\_\_\_\_\_\_\_\_(\_\_).

The unit for measuring **energy** is called the \_\_\_\_\_\_\_\_\_\_ (\_\_) named after British scientist \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. **Power** is how many **Joules** of **energy** are being transformed every \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and we use the unit the \_\_\_\_\_\_\_\_\_\_\_ (\_\_) after \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ a Scottish inventor.

For example a 60 W light bulb uses 60 J of electrical energy every second to produce 60 J of heat and light energy.

Another unit used to measure **power** is the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, which is equal to the \_\_\_\_ W that James Watt used to help boost sales of his steam engines.

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| We can calculate **power** any electrical device; however, we use \_\_\_\_\_\_\_\_\_\_\_and \_\_\_\_\_\_\_\_\_ instead of **energy** and **time**. The relationship to calculate is: | **Formula for Power** |
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### Example

If a 6.0 V battery supplies a current of 2.0 A, what is the power output of the battery?

### Problems

1. A toaster draws 5A of current from a 120V circuit. What is the power of the toaster?
2. A 100W light bulb is operating on 1.2 amperes of current. What is the voltage?
3. A potential difference of 120 volts is operating on a 500 Watt microwave oven. What current is being used?
4. If a computer has a resistance of 100 ohms and runs on normal household electricity (120 V), what is the computer’s electrical power rating? (Hint: you will need Ohm’s law also)
5. What is the resistance of a kettle if it uses 4800 W of power on normal household electricity?

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| Many **electronic** **devices** are labeled with a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. A **power rating** is a measurement of how much **electrical** **energy** an electrical device \_\_\_\_\_\_\_\_\_\_\_\_\_\_ for every **second** it is in use. We can use the **electrical power rating** and the amount \_\_\_\_\_\_\_\_\_\_ to calculate the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ a particular electrical device consumes. | **Formula for Power Rating** |
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### Example

How much electrical energy does a 1200 W hair dryer if it is used for 5.0 min consume?

### Exercise

Convert the following times into seconds. Remember 1 minute = 60 seconds and 1 hour = 60 minutes. Show your work.

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| --- | --- | --- |
| 1. 6.0 minutes
 | 1. 20 minutes
 | 1. 2 hours
 |

### Problems

1. How much electrical energy is consumed by a 60 W light bulb if it is left on for 25 minutes?
2. A 1600 W kettle is turned on for 3.0 minutes. How much electrical energy does the kettle use in this time?
3. How much electrical energy does a 100 W light bulb consume if left on for 4.0 hours?

Since the energy consumed by most electrical devices is often quite **large** a special unit is used called the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (\_\_\_\_\_). There are \_\_\_\_\_\_ **W** in a **kW** and \_\_\_\_\_\_\_ **seconds** (**s**) in an **hour** (**h**). The power companies **charge** users a fee for every **kilowatt-hour** a customer uses. To calculate the cost of energy used we use the following formula:

## Problems

1. How much kWh of electricity is consumed by a 1000 W light bulb that burns for three hours?
2. A 3000 W toaster is used for 15 minutes. How many kWh of electricity did it consume?
3. A 10,000 W space heater runs for 2 days. If electricity costs $0.05/kWh, what did it cost to run the heater this long?
4. A microwave oven operates on 5 amps of current on a 110 V circuit for 1 hour. How much would it cost to run the microwave if the cost of energy is $0.10/kWh?
5. The meter reading on June 1 was 84502 kW\*h. On July 1, the meter read 87498 kW\*h. If the cost of electricity in the area was 12¢ per kW\*h, what was the electric bill for the month of June?