|  |  |  |  |
| --- | --- | --- | --- |
| ***Lesson Topic*** | **Minimally Meeting** | **Fully Meeting** | **Exceeding** |
| *Static Charge* | describe types of static electrical charge (positive, negative) and no charge (neutral)  explain, with  illustrations, how static charges are separated because of transfer between various materials  use an electrostatic series to determine the charges on materials | describe types of static electrical charge (positive, negative) and no charge (neutral) with reference to atomic theory  use an electrostatic series to predict the charges on materials and relate to loss/gain of electrons | use known charges to create an electrostatic series  define a Coloumb and relates static charge |
| *Electric Force* | demonstrate an understanding of static force and how it is impacted by types of charge, size or charge and distance between charges | explain and illustrate how an electroscope is charged by conduction and induction |  |
| *Current Electricity* | relate the charge on electrons to electron flow in a circuit (i.e., from negative to positive)  define current in terms of the amount of electric charge that passes a point in a given time interval | distinguish between conventional current and electron flow |  |
| *Voltage* | distinguish between - potential and kinetic energy - static electricity and electric current  conduct experiments to - measure voltage and current, using appropriate equipment and units (e.g., volts, amperes) |  |  |
| *Resistance* | define resistance  determine resistance, using current and voltage data  perform calculations using Ohm’s Law |  |  |
| *Series and Parallel Circuits* | for a fixed supply voltage, differentiate qualitatively between series and parallel circuits in terms of  - current (may change from resistor to resistor in parallel; remains the same in series)  - voltage (may change from resistor to resistor in series; remains the same in parallel) | for a fixed supply voltage, differentiate qualitatively  - total resistance (increases with the number of resistors in series; decreases in parallel) |  |
| *Circuit Diagrams* | draw circuit diagrams using appropriate symbols that are properly placed | draw and use circuit diagrams to determine current, resistance and voltage from given values |  |
| *Power* | define electrical energy and power ‰  calculate the following: power—using voltage and current data  energy consumption—given the power rating of a device and duration of use | find the measurement of power using resistance and current or voltage |  |

**Static Charge**

**Topic 1**

Complete the following sentences using the following terms. Each term may be used more than once.

**attracts repels positive neutral negative**

1. A negative charged is repelled by a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ charge.
2. A positive charge \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_a negative charge.
3. A charged object \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_a neutral object.
4. A negative object attracts an unknown object. The unknown object could be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ or \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
5. A positive object \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ a positive object.

**Topic 2**

Using the electrostatic series on page 276 in Science Probe 9 answer the following questions

1. When rubbed together which of items in each pair would lose electrons

|  |  |  |  |
| --- | --- | --- | --- |
|  | Item 1 | Item 2 | Loses electrons |
| a | vinyl | wool |  |
| b | Human hair | amber |  |
| c | balloon | Cat fur |  |

1. When rubbed together which of items in each pair would become positively charged

|  |  |  |  |
| --- | --- | --- | --- |
|  | Item 1 | Item 2 | Becomes more positive |
| a | Sealing wax | Plastic wrap |  |
| b | wood | Rabbit fur |  |
| c | cotton | nylon |  |

1. When rubbed together which of items in each pair would becomes negatively charged

|  |  |  |  |
| --- | --- | --- | --- |
|  | Item 1 | Item 2 | Becomes more negaive |
| a | cotton | wood |  |
| b | Plastic wrap | amber |  |
| c | Sealing wax | nylon |  |

**Electric Force**

**Topic 3**

Using the list of words below, complete the following sentences. Each word may be used more than once.

**negative*,* negatively, positive, positively, opposite, closer, stronger**

(a) \_\_\_\_\_\_\_\_\_\_\_\_\_ charges are unlike charges.

(b) Two like charges are either both \_\_\_\_\_\_\_\_\_\_\_\_ or both \_\_\_\_\_\_\_\_\_\_\_\_\_\_.

(c) If two \_\_\_\_\_\_\_\_\_\_\_\_ charges are brought together, they will be attracted.

(d) If a \_\_\_\_\_\_\_\_\_\_\_\_ charged object is brought near a positively charged electroscope, the leaves will separate.

(e) If a \_\_\_\_\_\_\_\_\_\_\_\_\_ charged balloon is brought near a positively charged rod, the balloon is attracted to the rod.

(f) The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ two objects are from each other, the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the force.

The diagram below shows two charged pith balls hanging on thin threads. One ball in each diagram is shown with either a positive (+) or a negative (-) charge. The arrows indicate whether the two balls are attracted or repelled. On the diagram, indicate the charge on the blank balls.

|  |  |  |
| --- | --- | --- |
| (a) | (b) | (c) |

**Current Electricity and Voltage**

**Lesson 4**

Respond in point form.

1. Electrons travel from \_\_\_\_ terminal to the \_\_\_\_ in a battery.
2. Define current.
3. How is electron flow different from conventional flow?
4. How is kinetic energy different from potential energy?
5. Define voltage.

**Resistance**

Respond in point form. For calculations, please show all your work.

1. Define resistance.
2. What is Ohm’s Law?
3. If a circuit has a current of 0.05 A and a resistance of 200 Ω, what is the voltage in V? What is the voltage in mV?
4. Calculate the resistance of a circuit in Ω if it has a current of 100 mA and 20 V?

**Series and Parallel**

**Lesson 6**

Circle the best term in the parentheses to correctly complete each statement.

1. A series circuit has (more than one, only one) path for current to travel.
2. In a series circuit, the current at one location in the circuit is (equalto*,* differentfrom) the

current at another location in the circuit.

1. If two different resistors are connected in series, the voltage across one resistor will be

(equalto*,* differentfrom) the voltage across the second resistor.

1. By adding a resistor in series with an original resistor, the total resistance of the circuit

(increases*,* decreases).

1. The sum of the voltages across each of the resistors in a series circuit is (equalto*,* different from) the voltage supplied by the battery.
2. A parallel circuit has (only one, more than one) path for current to travel.
3. Two different resistors are connected in parallel. The current through one of the resistors will be (equal to, different from) the current through the other resistor.
4. If two different resistors are connected in parallel, the voltage across one resistor will be (equal to, different from) the voltage across the second resistor.
5. By adding a resistor in parallel with an original resistor, the total resistance of the circuit (increases, decreases).
6. The total current entering the junction of a parallel circuit must be (equal to, different from) the sum of the currents through each branch of the parallel circuit.

**Lesson 7**

**Drawing Circuit Diagrams**

Draw a diagram of each of the following circuits in the spaces provided. Use a ruler.

|  |  |
| --- | --- |
| Description | Diagram |
| 1. A series circuit consisting of:  · 12 V electrical source  · open switch  · two light bulbs  · 10 W resistor | 1. |
| 2. A parallel circuit consisting of:  · 9.0 V electrical source  · open switch  · three 5.0 W resistors | 2. |
| 3. A circuit consisting of:  · three 1.5 V cells connected in parallel  · open switch  · two light bulbs connected in series  · two 15 W resistors connected in parallel | 3. |

**Power**

**Lesson 9**

Show all your work for calculations.

1. What is the equation for power?
2. A current of 5.0 A flows through a flashlight bulb when it is connected to 6.0 V. What is the power of this bulb?
3. A 600 W electric heater is connected to a 120 V source. What current flows through the heater?
4. A 2.5 A current flows through a 100 W lamp. What is the voltage across the lamp?
5. What is the equation for energy consumption?
6. How much energy (J) is consumed by a 120 W light bulb if it is left on for 15 minutes?
7. How much energy (J) is consumed by a 200 W stereo if it is left on for 4.0 hours?