**Science 9 – Voltage (Current Electricity Notes 3)**

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| **C:\Documents and Settings\gill_narinder\Local Settings\Temporary Internet Files\Content.IE5\D6CEZ9YH\MC900434731[1].pngEnergy is Required to do Work*** In science, energy is measured in **“Joules” (J)**
* Your phone battery holds ~ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of energy‼!
* Fun fact: a food “Calorie” is equal to 4184 J, so an egg holds \_\_\_\_\_\_\_\_\_\_\_\_\_\_ of energy!
* Energy is required to do work (e.g. lighting up a bulb, heating up a stove).
* Energy sources provide electrons with energy to do \_\_\_\_\_\_\_\_\_\_ (e.g. lighting up a bulb, heating up a stove).
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| **Understanding Potential Energy****Voltage Gain*** Batteries give electrons a certain amount of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, also known as \_\_\_\_\_\_\_\_\_\_\_\_\_ (V).
* E.g. an AA or AAA battery has a potential energy difference of 1.5 V between its two terminals, so we call it a 1.5 V battery.

**Voltage Drop*** When electrons go through a \_\_\_\_\_\_\_\_\_\_\_\_ (e.g. resistor, light bulb), they \_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Some loads may use more energy than others.
* On its journey around the circuit, an electron must use \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ before it returns to the positive terminal of the battery.
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| **Measuring Changes in Potential Energy** |
| The voltage difference between two points on a circuit can be measured using a voltmeter. * Voltmeter symbol in circuit diagrams:
* A voltmeter is always connected across the device, in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
 | *Add a voltmeter to this circuit diagram to show how you would measure the voltage of the battery.*   |

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| **https://images.squarespace-cdn.com/content/v1/5c5aed8434c4e20e953d6011/1603295342267-574BA5R64X49DJ3ERJBX/energy+charge+voltage+triangle.jpgVoltage Calculations*** Voltage is measured in volts (V).
* The voltage of a battery is the amount of Energy (J) carried by 1 Coulomb of electrons in a circuit.

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| $$V=\frac{E}{Q}$$ | V = voltage in Volts (V)E = energy in Joules (J)Q = charge in Coulombs (C) |

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| **Example 1)**A light bulb is powered by 3 AA batteries. How much energy is delivered to the bulb if 20 C of charge is used? | **Example 2)**A car battery is 12 V and sends out 28 kJ of energy. How much electric charge does the battery hold? |

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| **Series and Parallel Combinations of Cells*** When cells are connected in **series**, we can find the total amount of voltage by just adding them together.
* VT = V1 + V2 + …
 | https://www.schoolphysics.co.uk/age14-16/Electricity%20and%20magnetism/Current%20electricity/text/Series_and_parallel_components/images/4.pngExample: Calculate the total voltage of this battery made of three, 2-volt cells connected in series. Draw the voltmeter set-up that could measure this total voltage change. |
| * When cells are combined in **parallel**, the voltage does not increase but the amount of charge (current) does.
* Advantages: greater current or longer battery life
* VT = V1 = V2 = V3
 | https://www.schoolphysics.co.uk/age14-16/Electricity%20and%20magnetism/Current%20electricity/text/Series_and_parallel_components/images/4.pngExample: Calculate the total voltage of this battery made of three, 2-volt cells connected in parallel. Draw the voltmeter set-up that could measure this total voltage change.  |
| **Loads Connected in Series*** Rule: The total voltage gained from the battery is equal to the total voltage drop from all the loads combined.
* VT = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
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| Example:What is $V\_{T}$? |

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| **Loads Connected in Parallel** V1V2V3VT* When electrons go through devices in parallel, they split at junction points.
* Each load in parallel will receive the same amount of energy/Voltage.
* VT = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
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| Example: If V1=10V, Calculate VT, V2 and V3. V1V2V3VT |