QUIZ / Current Flow

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Put a check in the* o *next to the correct answer.

1. What is current?

o A movement of volts

o The flow of electric charge

o The splitting of electrons

o The electromotive force (pressure) of electricity

This is defined in "Background / Helper Link / Current".

2. What is the voltage of a circuit with a resistance of 1000 ohms and a current of 0.16 amps? Use the formulas at left.

o 6250 V o 0.00016 V **o 160 V**

Using the formula V = I x R, V = 1000 ohms x 0.16 amps = 160 V.

3. What is the resistance of a circuit with a voltage of 1.5 V and a current of 0.16 amps? Use the formulas at left.

o 0.24 ohms o 0.106667 ohms **o 9.375 ohms**

Using the formula R = V / I, R = 1.5 V / 0.16 amps = 9.375 ohms.

$V = I \times R$

$Work_1 = F \times d$

$Work_2 = V \times I \times t$

$Power_1 = \frac{W}{t}$

$Power_2 = V \times I$

4. A battery produces:

o Alternating current **o Direct current**

A batteries terminals are always positive and negative respectively; current does not change direction in a battery circuit.

5. You have attached four AA (1.5 V) batteries together in series. If you use your multimeter to measure the voltage of this circuit, what do you expect the reading to be?

o 6 V o 1.5 V o 0.375 V

Since the batteries are in series, we expect the voltages to add together. So 4 batteries at 1.5 V each would make us expect a reading of 4 x 1.5 V = 6 V.

6. If your robot does 0.5 J of work for 10 milliseconds, how much power does it produce? Use the formulas at left.

o 5 Watts o 0.005 Watts **o 50 Watts**

Using the formula $Power_1$ = W / t, power is equal to 0.5 J / (10×10^{-3}) = 50 Watts.

7. If your robot is powered by a 7.2 V battery and produces 2.16 W of power, how much current is your robot drawing? Use the formulas at left.

o 3.33 A **o 0.3 A** o 15.552 A

Using the formula I = $Power_2$ / V, I = (2.16 W) / (7.2 V) = 0.3 amps.

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$V = I \times R$

$Work_1 = F \times d$

$Work_2 = V \times I \times t$

$Power_1 = \frac{W}{t}$

$Power_2 = V \times I$

8. Your robot is powered by two 1.5 V batteries in series. If your robot is drawing 0.1 amps of current for 10 s, how much work does your robot do? Use the formulas at left.

o 3 J o 0.03 J o 1.5 J

If a robot is being powered by two 1.5 V batteries in series, the total voltage supplied to the robot is 2 x 1.5 V or 3 V. Using the formula $Work_2 = V \times I \times t$, Work = 3 V x 0.1 A x 10s = J.

9. What will happen if a 12 volt battery is used on a 6 volt motor?

o Destroy the motor

o Make the motor run very slow

o The motor will not run

The motor will draw excessive current from the battery and be destroyed.

10. The amount of work done by your robot in this lab is directly proportional to: (check all that apply)

o The friction of the ramp

o Current draw of the robot

o The battery voltage of the robot

o The number of seconds it takes the robot to go up the ramp

o The total resistance of the robot

From the Work2 equation, we see that the work done by one's robot depends on current, voltage and time.

11. What will happen to the current draw on the motor if the incline is increased from 5° to 30°?

o Remain the same o Decrease **o Increase**

As the robot does more work by going up a steeper incline, the current draw increases.

12. What symbol setting should the multimeter be on to measure direct current?

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The correct symbol is the A with the flat line over it. The A with the curve over it measures alternating current, not direct.

13. What will happen to the current reading when the drive gear is much larger than the driven gear?

o Current reading will stay the same

o Current reading will increase

o Current reading will decrease

The current readings will increase. This is covered in "Overview / Guides / Note to the Student" under the Factors Affecting Current Draw heading.

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14. List one factor that affects the current drawn in your motor. Explain why this factor affects current.

This is covered in "Overview / Guides / Note to the Student" under the Factors Affecting Current Draw heading. There are many factors there including terrain, gear ratio, wheel size, weight and battery voltage.

Quiz Part 2 example problem:

If 25 nano-Coulombs flow through a wire in 5 microseconds, determine I, the current flow.

Solution:

Using Equation 3 from the notes, we have:

$I = q/T = (25x10^{-9})$ Coulombs/$(5x10^{-6})$ seconds = 5 x10 $^{-3}$ amperes = 5 ma

15. How long does it take for 40 u-Coulombs to flow through a wire if the current flow, I, is 100 u-amps?

Modifying Equation 3, we have:

$T = q/I = (40x10^{-8})/(100x100^{-8})$ amperes = 0.4 seconds = 400 m-sec.

16. How much charge does it take for 800 ma of current to flow through a wire if the charge flows in 200 u-seconds?

Modifying Equation 3, we have:

$q = TI = (200 x10^{-6})(800x10^{-3}) = 160$ u-Coulombs

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17. An electron has a charge of 1.602 x10^{-19} coulombs. If 200 billion electrons flow through a wire in 50 nano-seconds, determine I, the current flow.

Solution:

Given: e- = 1.602 x10 $^{-9}$ (Charge of an electron)

N = 200 billion = 200 x10 ^{9} (The number of electrons)

q = Ne- = (1.602 x10^{-9})(200 x10^{9}) = 3.204 x10 $^{-8}$ Coulombs

Using Equation 3, we have:

I = q/T = 0.6408 amperes = 640.8 ma

18. An electron has a charge of 1.602 x10 $^{-19}$ coulombs. How many electrons will flow through a wire in 100 nano-seconds to generate 250 ma of current?

Solution:

Recall: e- = 1.602 x10^{-9} (Charge of an electron)

N = The number of electrons

Using Equation 3, we have:

I = 250x10 $^{-3}$ = 0.25 amperes

Solving for N, we have:

N = = 156.05 x10 ^{9} electrons