PRACTICE TEST QUESTIONS: SCIENCE 9 CURRENT ELECTRICITY

Here are practice questions to help you prepare for the upcoming test. Recommended target times for each question are in brackets. Actual times may vary depending on the amount of work you are showing for calculations.

Current Calculations (more on worksheet)

1) Convert the following (1 minute each)
   a. 28 mA to A (0.028 A)
   b. 9 V to mV (9 000 mV)
   c. 189 A to mA (189 000 mA)
   d. 15.3 mA to A (0.0153 A)
2) Calculate the current in a circuit where 24 C of charge passes by in 10s. (2 minutes) (2.4 A)
3) Calculate how much charge passes through a lightbulb in 5 minutes if the current through the lightbulb is 100 mA. (3 minutes) (30 C)

Circuit Diagrams

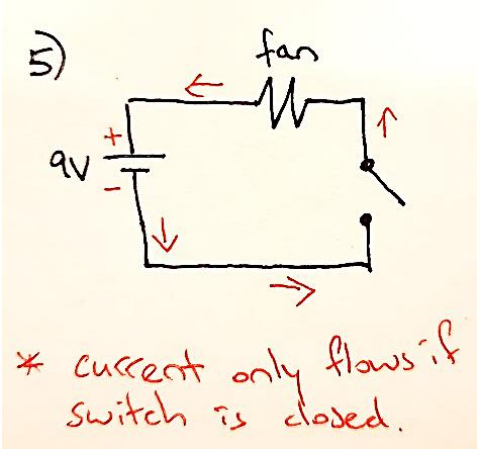
4) A circuit requires three key components: a source, load, and wire. Define these terms in your own words and give examples of sources and loads. (5 minutes)

   (Source: provides electrical potential energy. Example: battery, cell, wall outlet.

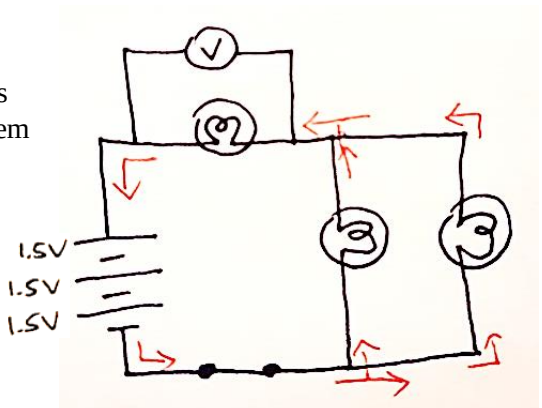
   Load: converts electrical energy into some other kind of energy (e.g. heat, light). Example: lightbulb, toaster

   Wire: made of conductor; connects source and wire (makes a path for electrons to flow). Example: copper wire.)

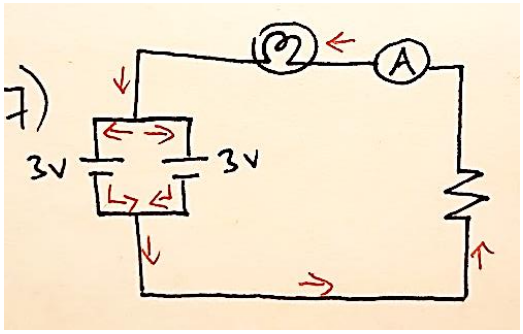
5) (5 minutes)
   a. Draw a circuit diagram with: one 9V battery in series with a fan and an open switch.
   b. Label the positive and negative terminals of the battery.
   c. Draw arrows to indicate the path and direction of electric current in this circuit.
   d. The resistance of the fan is 110 Ω. Calculate the current in this circuit. (0.082 A)



6) (5 minutes)
   a. Draw a circuit diagram with: three 1.5V cells and a lightbulb in series, and two lightbulbs in parallel.
   b. Add a single switch that will control all the lightbulbs in the circuit (i.e. will turn all of them on, or all of them off).
   c. Add a voltmeter that will measure the voltage across the lightbulb that is in series.
   d. Draw arrows to indicate the path and direction of electric current in this circuit.



7) (10 minutes)



a. Draw a circuit diagram with: two 3V cells in parallel, and a lightbulb, an ammeter, and a resistor in series.

b. Draw arrows to indicate the path and direction of electric current in this circuit.

c. What is the total voltage gain of the circuit? (3 V)

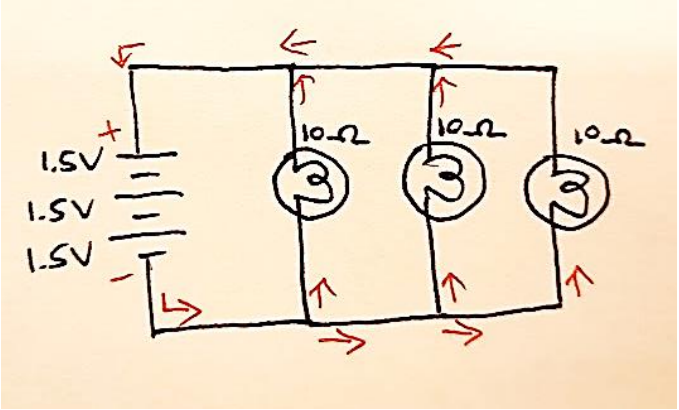
d. If the voltage drop across the resistor is 1V, what is the voltage drop across the lightbulb? (2 V)

e. The ammeter measures a current of 5A. What is the total resistance of the circuit? (0.6 Ω)

f. How much charge flows through a single 3V cell in the circuit in ten minutes? (1500 C)

(Explanation for 7f: Half the current will go through each cell, so I=2.5A. $Q = I \times t = 2.5 \times 10 \times 60 = 1500C$)

8) (10 minutes)



a. Draw a circuit diagram with: a battery made of three 1.5V cells in series, and three identical 10Ω lightbulbs in parallel.

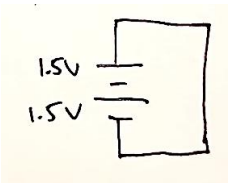
b. Label the negative and positive terminals of the battery.

c. Draw arrows to indicate the path and direction of electric current in this circuit.

d. The current leaving the negative terminal of the battery is 80 mA. Calculate the current that goes through each of the lightbulbs.
(26.7 mA or 0.0267 A. Can ignore resistance of 10Ω in this case because it is not important. What matters most is that the current must split into 3 equal paths…80mA÷3)

e. What is the voltage drop across each of the lightbulbs? (4.5 V)

9) (5-10 minutes depending on depth/length of answers)



a. Draw a circuit diagram with: a battery made of two 1.5V cells, and a wire connecting the negative and positive terminals of the battery.

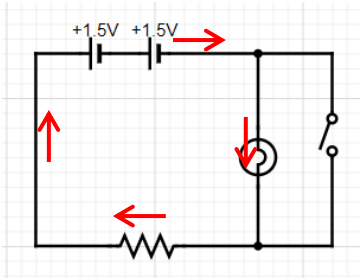
b. This is called a short circuit. Explain briefly what this circuit is missing.
(a load)

c. If the short circuit is allowed to persist, the wire and the battery will both become extremely hot and be a fire hazard. Explain why this is. (Hint: look at the first page of your Notes #4 on Resistance)
(Wire has a tiny amount of resistance. There is no load in the circuit so the wire provides the only resistance. Resistance converts electrical energy into other forms. In this case, the wire will convert all the energy into heat – wasted energy – because there is no other place for the energy to go.)

d. Suppose that you measured the current in your short circuit. Would you expect the current to be high, normal, or low? Explain briefly.
(Very high; low resistance means current will be high according to Ohm's law.)

Circuit Analysis

10) (3-5 minutes depending on depth/length of answers)

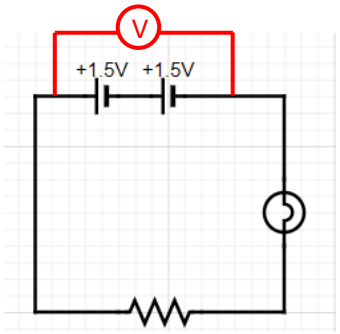


a. Draw arrows to indicate the path and direction of electric current in this circuit. (Hint: will any current go through the *open* switch?)

b. Do you expect the lightbulb to be on or off in this circuit? What will happen to the lightbulb when the switch is closed? Explain briefly in terms of electric current.

(Lightbulb should be on. If switch is closed, lightbulb will turn off because it is 'easier' for electrons to go down a wire with negligible resistance than to do work by going through a lightbulb.)

11) (7 minutes)



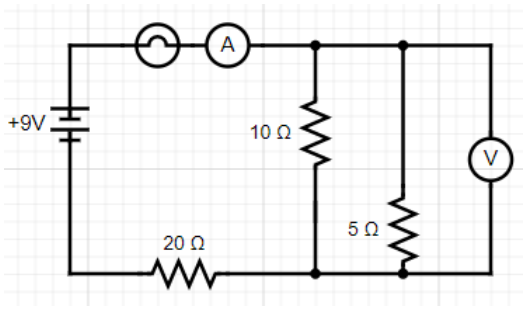
a. What is the total voltage of the battery? (3.0 V)

b. Draw a voltmeter that will measure the total voltage of the battery.

c. Suppose the voltage drop across the lightbulb is 1.2V. What will the voltage drop across the resistor be? (1.8 V)

d. The total resistance of the circuit is 250 Ω. Calculate the current in milliamperes (mA) that is flowing across the resistor. (12 mA)

12) (5-7 minutes depending on depth/length of answers)



a. What voltage will the voltmeter read: greater than 9V, equal to 9V, or less than 9V? Explain briefly.

(Less than 9V because some of the electric potential will be used up by the other two loads (one lightbulb, one 20Ω resistor) in series. What is left will be the voltage measured by that voltmeter. Remember: electrons must use all their electric potential energy before returning to the positive terminal of the battery.)

b. Suppose the ammeter measures a current of 12A. If 4A is going through the 10Ω resistor, how much current is going through the 5Ω resistor? the 20Ω resistor? (8 A; 12 A)

Ohm's Law (more on worksheet)

13) A power saw at the local hardware store boasts of having a 16.7-Amp motor. Determine its resistance when plugged into a 110-Volt outlet. (2 minutes) (6.59 Ω)

14) A coffee cup immersion heater utilizes a heating coil with a resistance of 9.09 Ω. Determine the current through the coil when operated at 110 Volts. (2 minutes) (12.1 A)

15) A typical color television draws about 4000 mA and has a resistance of 30Ω. Determine the voltage of the electrical source. (3 minutes) (120 V)

16) Suppose a circuit has an electric motor that is powered by a 9V battery. 150 Coulombs of charge passes through the electric motor every 10 seconds. Calculate the resistance of the motor. (4 minutes) (0.6 Ω)

Miscellaneous

17) Do you think the appliances in your home are connected in series or in parallel? Explain with evidence.
(Parallel. Explanations may vary, but should have to do with what happens when you turn various appliances on or off…e.g. what happens to the microwave when you turn a light on in a room?)