Physics 200 Electricity Practice Test (25-26)

Name: ______________________________

Info:

Coulomb's Law Constant = $8.99 \times 10^9 Nm^2/C^2$

Charge of 1 electron = $-1.6 \times 10^{-19}C$

Charge of 1 proton = $1.6 \times 10^{-19}C$

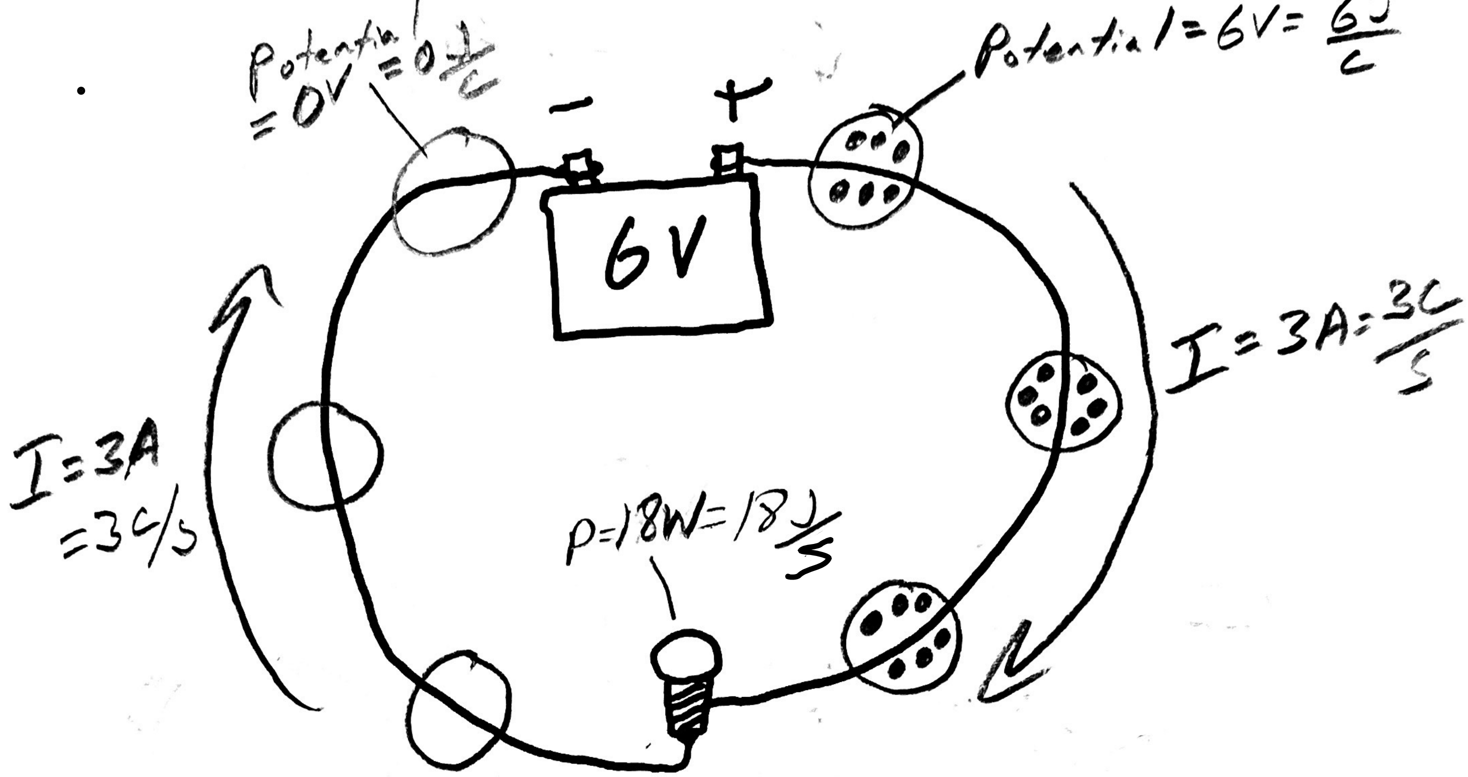
Multiple Choice

1. **Joules:**
   Current Power Voltage Resistance Potential Energy Charge Electric Field
2. **Joules per Coulomb:**
   Current Power Voltage Resistance Potential Energy Charge Electric Field
3. **Change in Joules per Coulomb:**
   Current Power Voltage Resistance Potential Energy Charge Electric Field
4. **Coulombs per second:**
   Current Power Voltage Resistance Potential Energy Charge Electric Field
5. **Together, they determine the amount of current flowing through a circuit (pick 2).**
   Current Power Voltage Resistance Potential Energy Charge Electric Field
6. **Joules per second:**
   Current Power Voltage Resistance Potential Energy Charge Electric Field
7. **Volts per meter or Newtons per Coulomb:**
   Current Power Voltage Resistance Potential Energy Charge Electric Field
8. **I:**
   Current Power Voltage Resistance Potential Energy Charge Electric Field
9. **Coulombs:**
   Current Power Voltage Resistance Potential Energy Charge Electric Field
10. **Amperes:**
    Current Power Voltage Resistance Potential Energy Charge Electric Field
11. **Ohms:**
    Current Power Voltage Resistance Potential Energy Charge Electric Field
12. **A map showing forces that would be experienced by a positive charge in various locations:**
    Current Power Voltage Resistance Potential Energy Charge Electric Field
13. **Watts:**
    Current Power Voltage Resistance Potential Energy Charge Electric Field
14. **In the water model for circuits, the pressure that pushes water through the pipes represents:**
    Current Power Voltage Resistance Potential Energy Charge Electric Field
15. **In the water model for circuits, Mr. Stapleton's hairballs in pipes represent:**
    Current Power Voltage Resistance Potential Energy Charge Electric Field
16. **In the energy distribution model, the number of delivery trucks per day represents:**
    Current Power Voltage Resistance Potential Energy Charge Electric Field
17. **In the energy distribution model, the number of packages per truck represents:**
    Current Power Voltage Resistance Potential Energy Charge Electric Field
18. **In the energy distribution model, the number of packages delivered per day represents:**
    Current Power Voltage Resistance Potential Energy Charge Electric Field

# of packages dropped off each truck at a stop.

19. In a simple circuit, a 6 volt battery powers an 18W light bulb. On the diagram show what is happening in the circuit during each second. For each wire segment...

a. Draw a circle to represent each Coulomb of charge.
b. Draw a dot to represent each Joule of energy.
c. Label a charge with its potential. Use traditional units for potential and alternative units.
d. Label the light bulb with its power consumption in traditional units (18W) and alternative units.
e. Use an arrow to indicate the current. Label the arrow with the symbol for current and the magnitude of the current in both traditional and alternative units.



f. How many electrons pass through the bulb each second?

$$I = 3A = \frac{3C}{s}\left(\frac{1e}{1.6\times10^{-19}C}\right) = 1.88\times10^{19}\text{ electrons}$$

g. What is the resistance of the light bulb?

$$R = \frac{V}{I} = \frac{6V}{3A} = 2\,\Omega$$

h. At an energy rate of \$0.21 per kWh, how much would it cost to power the bulb for 1,000 hours?

One way to do this...

$$18W\,(1000\text{ hours}) = 18{,}000\,Wh = 18k\,Wh \Rightarrow 18\,kWh\left(\frac{\$0.21}{kWh}\right) = \$3.78$$

20. Suppose we obtain another 6V battery and we connect a plain wire to both of its electrodes. The wire is 2m long and homogeneous (constant thickness and material).

a. The wire will probably burn up, but before it burns up, what is the magnitude of the electric field in the wire?

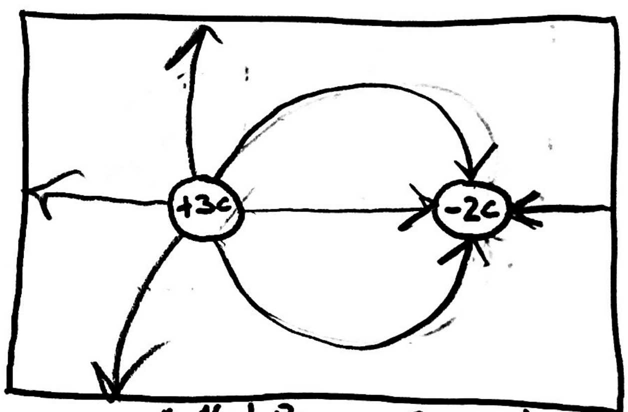
$$E = \frac{\Delta V}{d} = \frac{6V}{2m} = 3\frac{V}{m} = 3\frac{N}{C}$$

Both units for electric field

b. How much force would that electric field exert on 2C of positive charge in that wire? In which direction?

$$E = \frac{F_E}{q} \quad 3\frac{N}{C} = \frac{F_E}{2C} \Rightarrow F_E = 6N$$

21. One of the particles on the right has a charge of +3C. The other particle's charge is -2C. They are separated by a distance of 10m. [The diagram is NOT drawn to scale.]



a. Find the magnitudes of the forces the charges exert on one another and describe the directions of those forces.

$$F_E = k\frac{q_1 q_2}{r^2}$$

$$= 8.99\times10^9 \frac{Nm^2}{C^2}\left(\frac{(3C)(2C)}{(10m)^2}\right) = 5.39\times10^8 N$$

b. Draw electric field lines for the area inside the box. Assume that the two charges are the only charges affecting the electric field.

22-24: Circuit Solving:

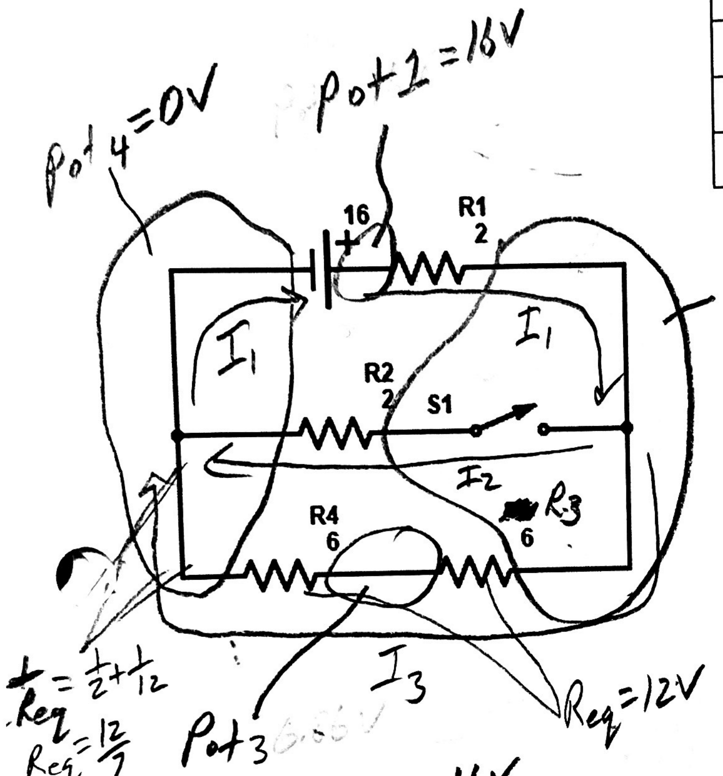
1) "Circle" and label the areas of equal potential.

2) Label the distinct currents.

3) Enter the data into the tables.

S1 is Open

	V	I	R	P
Source	16	1.14	14	18.3
R_1	2.29	1.14	2	2.62
R_2	16/7	0	2	0
R_3	6.86	1.14	6	7.84
R_4	6.86	1.14	6	7.84



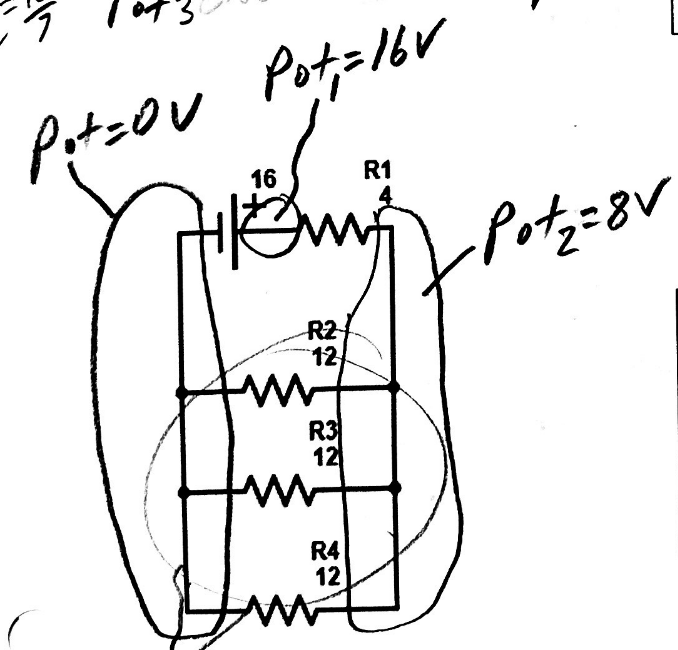
16-8.62

S1 is Closed

26/7

	V	I	R	P
Source	16	4.31	3.71	68.9
R_1	8.62	4.31	2	37.1
R_2	7.38	3.69	2	27.2
R_3	3.72	0.62	6	2.31
R_4	3.72	0.62	6	2.31

4.31-3.69



	V	I	R	P
Source	16	2	8	32
R_1	8	2	4	16
R_2	8	2/3	12	16/3
R_3	8	2/3	12	16/3
R_4	8	2/3	12	16/3

$$\frac{1}{R_{eq}} = \frac{1}{12} + \frac{1}{12} + \frac{1}{12} \Rightarrow R_{eq} = 4\Omega$$

Applying Kirchoff's Rules:

25. For each of the items below, choose the correct direction of current flow (conventional current) and give the magnitude of the current.

Item	Magnitude of Current (A)	In which direction does current (conventional current) flow through this item? Circle the Correct answer.
Resistor 1	0.45A	Upward **Downward**
Resistor 3	0.2A	**Leftward** Rightward
9V Battery	0.25A	**Upward** Downward

Jct Rule

$I_1 + I_3 = I_2$

Big loop, CW:

$12V - 10I_1 - 9V - 5I_1 = 0$

$3V = 15I_1$

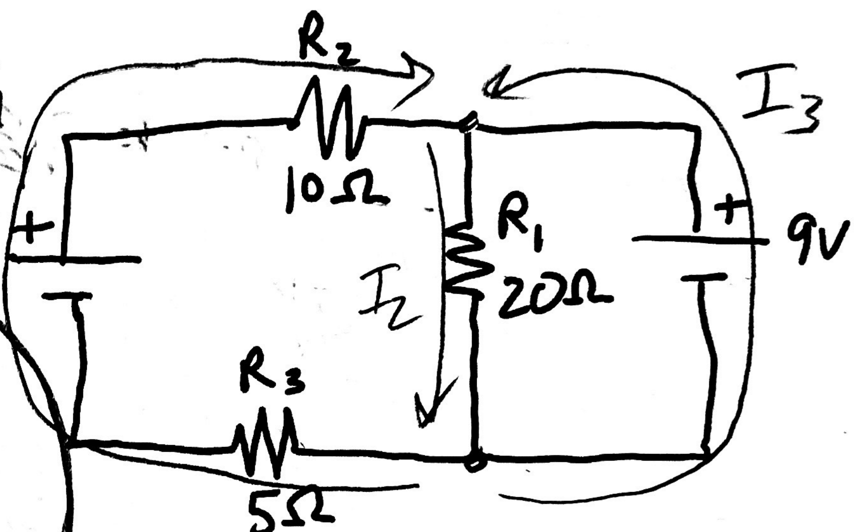
$I_1 = 0.2A$

Right Loop, CCW:

$9V - 20I_2 = 0$

$9V = 20I_2$

$I_2 = 0.45A$



$0.2A + I_3 = 0.45A$

$I_3 = 0.25A$