Physics 5B Unit Exam 1 Tuesday, March 1st, 2016

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INSTRUCTIONS:

This examination consists of 6 multiple choice questions, a ranking task, and 3 workout problems. To earn full credit on workout problems, you must ***show all your work***.

You may use a non-graphing calculator for the exam.

Do not write below this line

Multiple Choice	(30 pts)	13
Ranking Task 1	(15 pts)	15
Work Out 1	(15 pts)	8
Work Out 2	(15 pts)	14
Work Out 3	(25 pts)	1
TOTAL	(100 pts)	51 → 70

1. Two charges $q_1=2x10^{-10}$ C and $q_2=8x10^{-10}$ C are separated by a distance of 30 cm. Which of the following statements is true?

a) The magnitude of the force on q_2 is four times larger than the force on q_1

b) The magnitude of the force on q_2 is four times smaller than the force on q_1

c) The magnitude of the force on q_2 is twice as large as the force on q_1

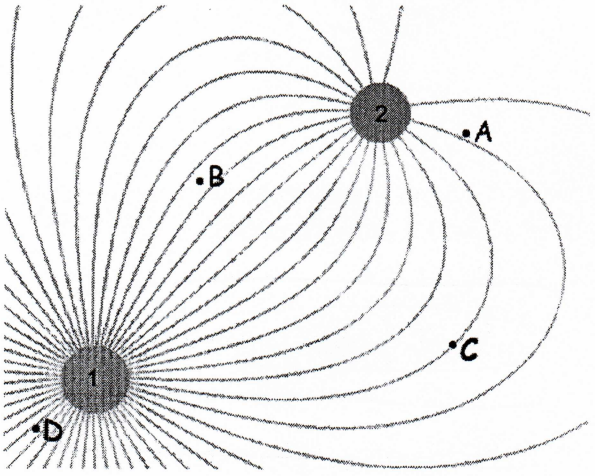
d) The magnitude of the force on q_2 is half as large as the force on q_1

e) The magnitude of the force on q_2 is the same as the force on q_1

Newton Law 2

Same force equal & opp

2. The image to the right shows two point charges and the electric field lines created by them. At which point is the electric field the strongest?



a) Point A

b) Point B

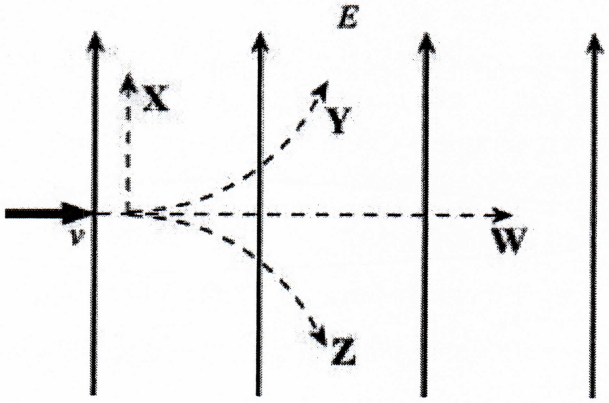
c) Point C

d) Point D

e) All points have the same strength electric field

(+)

3. A proton is fired (with initial velocity to the right) into a region with a uniform electric field (directed upward), as shown. Which path best describes the path followed by the proton?



a) Path W

b) Path X

c) Path Y

d) Path Z

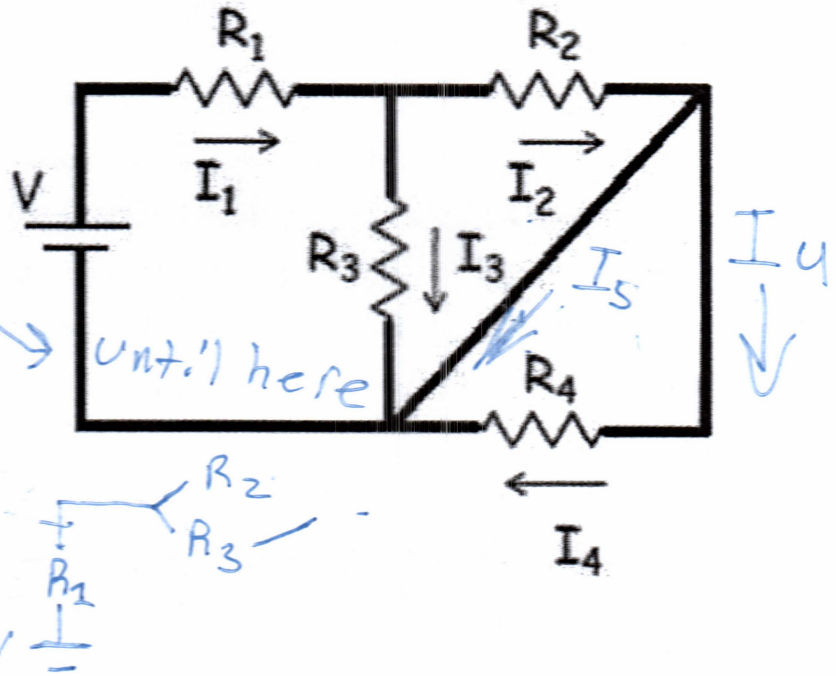
4. In the circuit pictured, all four resistors have the same resistance. Which of the following statements regarding this circuit are true? (Circle all that apply, there may be more than one correct answer)

a) I_1 is the greatest of the labeled currents

b) I_2 and I_3 are equal

c) I_4 is zero

d) $I_2 + I_3 = I_1$



5. An engineer wants to create a device that has as little resistance as possible. If the device must use three resistors, how should the engineer combine them?

a) Put the resistors in series

b) Put the resistors in parallel

c) It depends on the resistances of the resistors

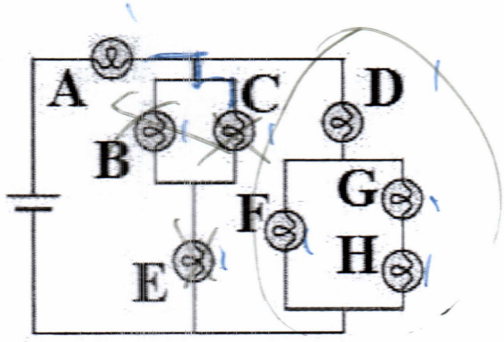
d) It doesn't matter, the same resistors will give the same resistance no matter how they are connected

6. In the circuit pictured, all eight light bulbs have the same resistance. Which of the following statements regarding this circuit are true? (Circle all that apply, there may be more than one correct answer)

a) If bulb A burns out, all the bulbs go out

b) If bulb B burns out, all the other bulbs stay on

c) If bulb E burns out, all the other bulbs stay on



Same material?

$R = \frac{\rho L}{A}$

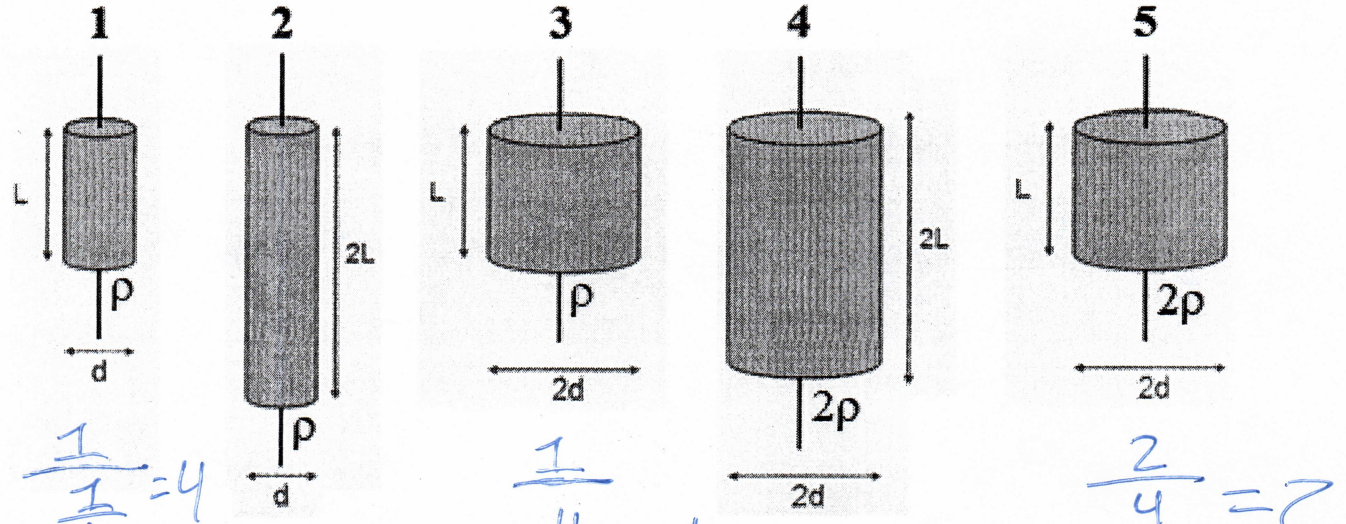
$r = \frac{D}{2}$

$A = \pi r^2 \rightarrow \pi \frac{D^2}{2^2} \Rightarrow A = \pi D^2 \frac{1}{4}$

Ranking Task 1

Consider the resistors pictured below. Each resistor is labeled with a length and a diameter and a resistivity.

$R = \frac{\rho L}{A}$ π - Constant



$\frac{1}{\frac{1}{4}} = 4$ $\frac{2}{\frac{1}{4}} = 8$ $\frac{1}{\frac{4}{4}} = 1$ $\frac{4}{\frac{4}{4}} = 4$ $\frac{2}{\frac{4}{4}} = 2$

Rank the five resistors on the basis of their resistance.

Greatest 2 (1 = 4) 5 3 **Least**

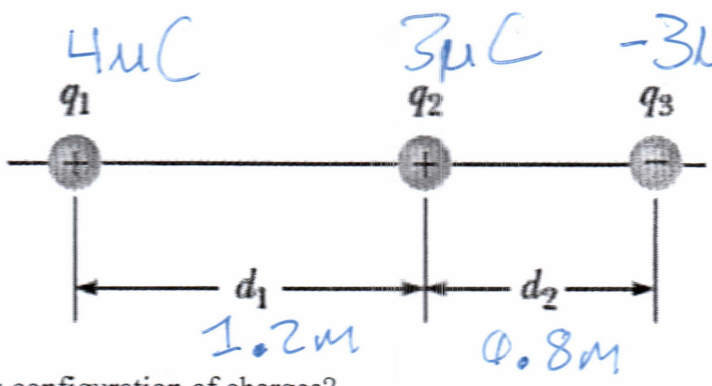
Explain.

$U = 1q^{-6}$

Work Out 1

Three charges are arranged along a line as shown in the image.

The labeled values are: $q_1 = 4\ \mu C$, $q_2 = 3\ \mu C$, $q_3 = -3\ \mu C$, $d_1 = 1.2$ m, and $d_2 = 0.8$ m.



What is the total electric potential energy of this configuration of charges?

$U = \frac{k q_1 q_2}{r}$ ✓ $\quad k = 9 \times 10^9$

$\frac{k q_1 q_2}{1.2m}$ | $\frac{(3 \cdot 10^{-6})(-3 \cdot 10^{-6})}{(9 \cdot 10^9)(9 \cdot 10^{-6})^{-12}}$

$\frac{9 \cdot 10^9 | (4 \cdot 10^{-6})(3 \cdot 10^{-6})|}{1.2}$ $\quad \frac{}{0.8}$

$\frac{0.108000}{1.2} + \frac{81000}{0.8}$

$90000 + 101250$

$U_{123} = ?$

191250 (5)

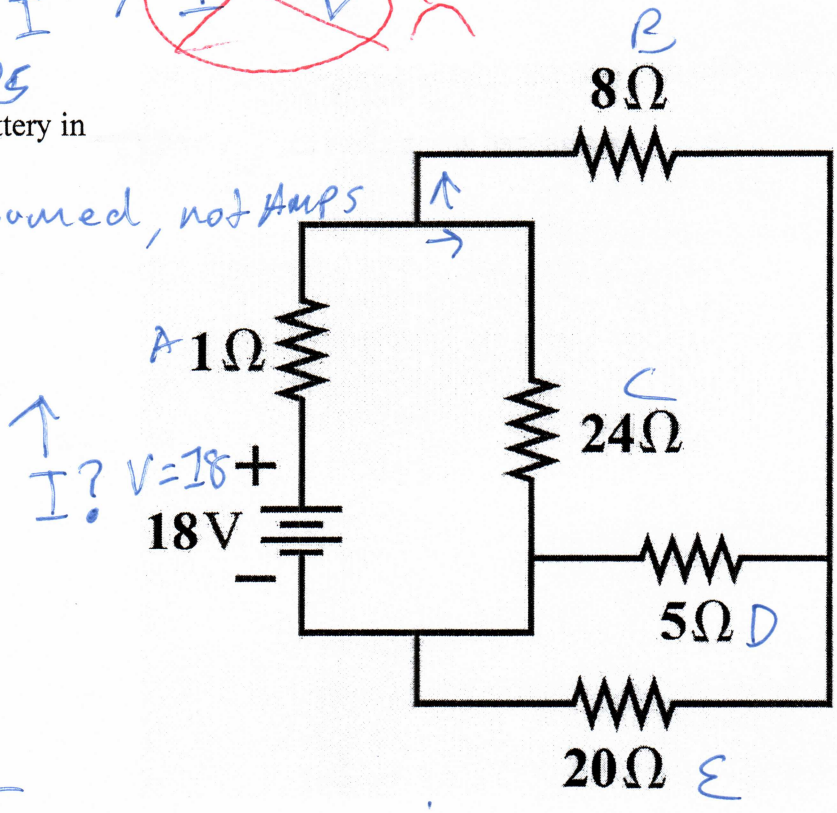
Work Out 2

$V = IR$, $R = \frac{V}{I}$, ~~$I = \frac{R}{V}$~~

current = Amps

How much current flows out of the battery in the pictured circuit?

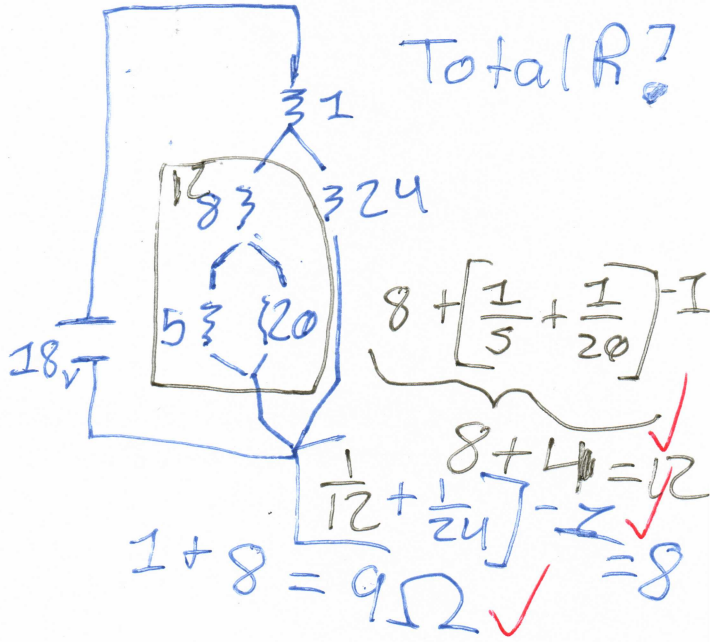
Volts are consumed, not Amps



$R_{Total} = 9\Omega$

$I = \frac{9\Omega}{18V}$

$I = 0.5A$

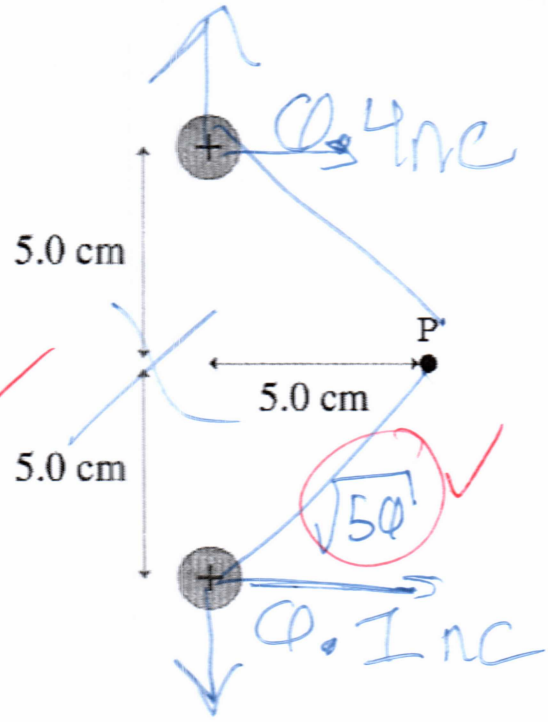


Work Out 3

.05 M

Two positive point charges are separated by a distance of 10 cm, as shown. The top charge has a magnitude of 0.4 nC and the bottom charge has a magnitude of 0.1 nC.

a) What is the total electric field (magnitude and direction) at point P?



b) A 6 μC charge is now placed at point P. What is the net force (magnitude and direction) on this new charge? Hint: you can use your answer from part a to make this easier!