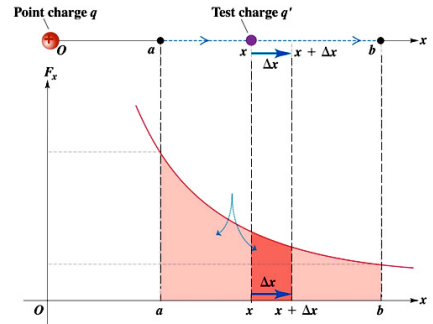


Circle your answer or put your answer in the box provided.

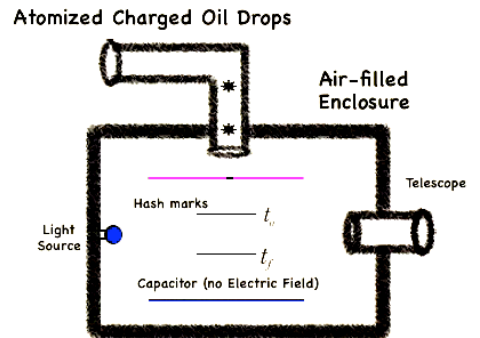
1) The area under the curve represents the \_\_\_\_\_ done in moving the charge. The curve represents \_\_\_\_\_ on the particle. As the charge moves to the left the force \_\_\_\_\_ between the charges. (5pts)

- a) Force, work, increases
- b) work, Force, increases
- c) work, Force, decreases
- d) Force, work, decreases
- e) work, energy, increases



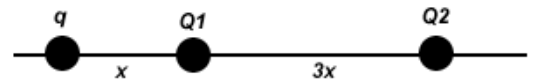
2) What were the forces on the charged oil drop in Millikan's Oil Drop experiment? Why did he run the experiment with the electric field on and then off? (5 pts)

- a) The electric force, gravitational force and magnetic force / he needed to obtain two velocities to help solve for the fundamental charge of the electron.
- b) The electric force, viscous force and magnetic force / he needed to obtain two velocities to help solve for the fundamental mass of the electron.
- c) The electric force, gravitational force and viscous force / he needed to obtain two velocities to help solve for the fundamental mass of the electron.
- d) The electric force, gravitational force and viscous force / he needed to obtain two velocities to help solve for the fundamental charge of the electron.



3) Three equal point charges are held in place. If  $F_1$  is the force on  $q$  due to  $Q_1$  and  $F_2$  is the force on  $q$  due to  $Q_2$  how do  $F_1$  and  $F_2$  compare? (5pts)

- A.  $F_2=16/1$    B.  $F_2=1/16$    C.  $F_2=1/4$    D.  $F_2=1/9$



4) At what distance would the repulsive force between two protons have a magnitude of 5.56 N? (5 pts)

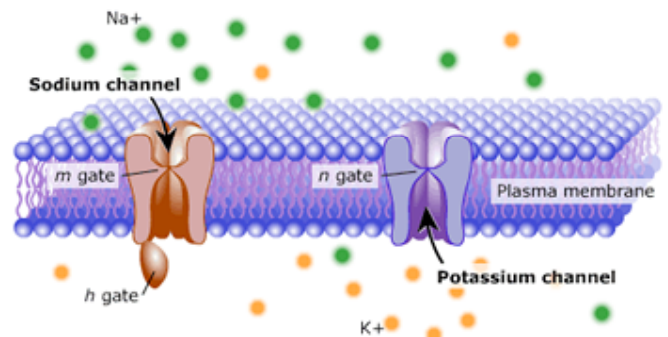
5) The platypus senses prey with its snout. How does it seem to do this? Why is this ability found in water-dwelling creatures? (One or two words will suffice.) (10 pts)

6a) What is the sequence of the Action Potential? (5 pts)

- a) 3,5,2,1,4
- b) 5,2,3,1,4
- c) 2,5,3,4,1
- d) 3,2,5,4,1
- e) 3,5,2,4,1

- 1) Hyperpolarization (potassium flows out of the cell past  $-70\text{mV}$  but soon returns to  $-70\text{mV}$ )
- 2) Depolarization (trigger region reacts. . .Sodium flows into the cell  $-70\text{ mV}$  to  $+0\text{ mV}$ )
- 3) Resting (all active channels closed)
- 4) Repolarization (Potassium flows out of the cell  $+30\text{ mV}$  to  $-70\text{ mV}$ )
- 5) Depolarization (Sodium flow slows into the cell  $0\text{ mV}$  to  $+30\text{ mV}$ )

Channel Gating during an action potential



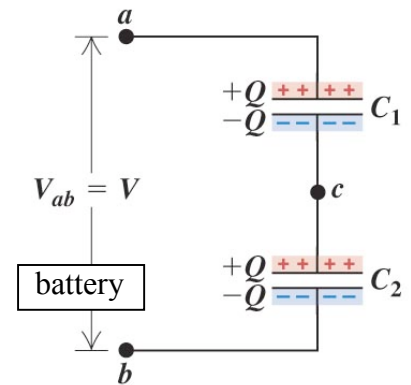
6b) For  $\text{Na}^+$  and  $\text{K}^+$  ions to move between the cell membrane:

The cell membrane acts as a(n) \_\_\_\_\_ with a(n) \_\_\_\_\_ across it.  
 The movement of ions across the membrane would represent a(n) \_\_\_\_\_. (5 pts)

- a) battery, voltage, current
- b) power source, current, voltage
- c) capacitor, voltage, current
- d) voltage, capacitor, current
- e) capacitor, current, voltage

7a) If the voltage is  $24\text{V}$  and  $C_1 = 30\text{nF}$  and  $C_2 = 60\text{nF}$ , what is the charge and voltage on each capacitor? (10 pts)

$V_1$  \_\_\_\_\_  $V_2$  \_\_\_\_\_ and  $Q_1$  \_\_\_\_\_  $Q_2$  \_\_\_\_\_



7b) When the voltage was first applied where did the Charge on the top plate of  $C_1$  come from? (5pts)

- a) the battery
- b) the bottom plate of  $C_2$
- c) the top plate of  $C_2$
- d) the bottom plate of  $C_1$

7c) At the moment the switch is closed what happens? (5 pts)

- a) The current in the circuit is at maximum and the the charge on the plates is at a minimum.
- b) The current in the circuit is at minimum and the the charge on the plates is at a minimum.
- c) The current in the circuit is at minimum and the the charge on the plates is at a maximum.
- d) The current in the circuit is zero and the the charge on the plates is at a zero.

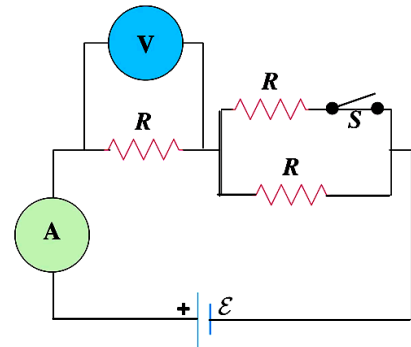
8) A potential difference of 6.73 kV is established between parallel plates in air. If the air becomes ionized (and hence electrically conducting) when the electric field exceeds  $3.00 \times 10^6$  V/m, what is the minimum separation the plates can have without ionizing the air? (10 pts)

9a) When the switch S is closed, the reading of the voltmeter V will (5 pts)

- a) double
- b) decrease
- c) increase
- d) stay the same

9b) The reading on the ammeter will be? (5pts)

- a) lower
- b) the same
- c) higher
- d) zero



10) Resistors are dependent upon temperature. The resistance of a substance \_\_\_\_\_ with increasing temperature. What is  $\alpha$ ? What is  $R_0$ ? (5 pts)

Fill in the blank

$\alpha$  \_\_\_\_\_

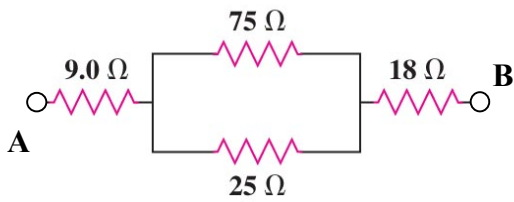
$R_0$  \_\_\_\_\_

11) A battery powered global positioning system receiver operating on 12.5 V draws a current of 0.16 A. a) How much power does it consume? B) How much electrical energy does it consume during 3 hours? (10 pts)

Power

Energy

12) What is the Total Resistance in the circuit? If the voltage between A and B is 123 volts, what is the current thru and the voltage over the 25 ohm resistor? (15 pts)

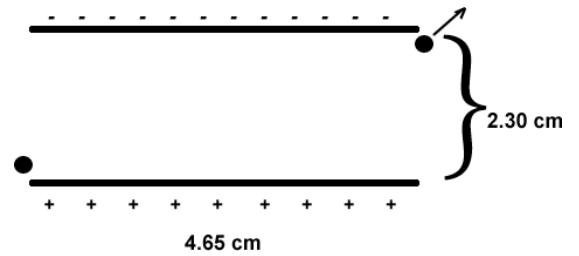


$R_t$

$I_{25}$

$V_{25}$

13) An proton is set thru the capacitor as shown. It just passes the upper edge on the way out of the capacitor. The initial speed of the proton is  $2.75 \times 10^6$  m/s. Find the *magnitude and direction* of the Electric Field between the plates. (15 pts)



magnitude

direction