Name ______________________________ **Student ID Number** ____________

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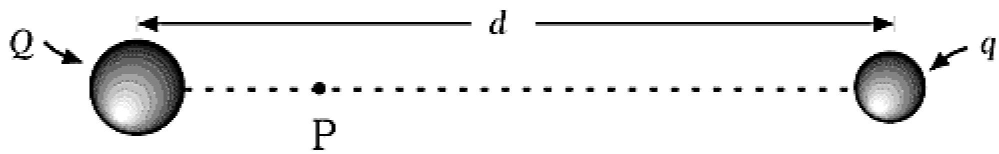
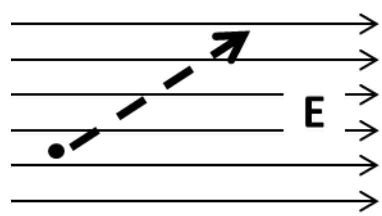


1. (4 pts.) Charges Q and q (Q > q), separated by a distance d, produce a potential $V_P = 0$ at point P. This means that

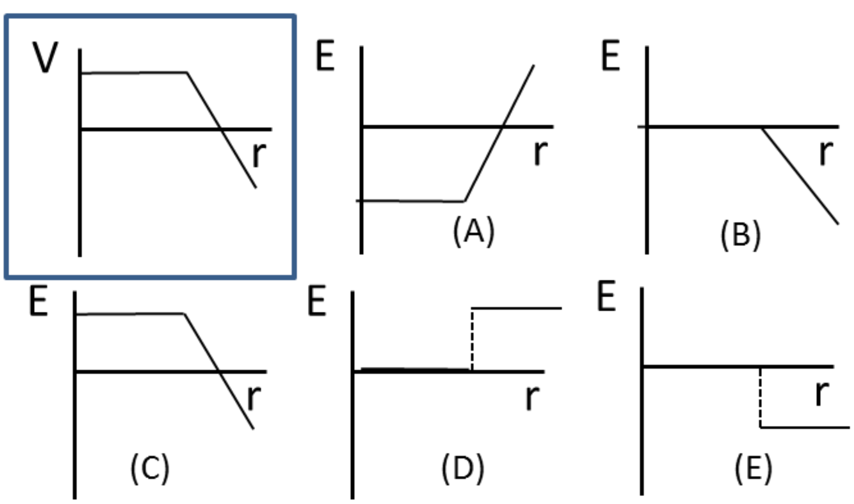
A) no force is acting on a test charge placed at point P.
B) Q and q must have the same sign.
C) the electric field must be zero at point P.
D) the net work in bringing Q to distance d from q is zero.
E) the net work needed to bring a charge from infinity to point P is zero.

2. (4 pts.) A charge of 5.0 μC is located in a uniform electric field of intensity 3.5×10^5 N/C. How much work is required to move this charge at constant speed 50 cm along a path making an angle of 33° with respect to the electric field direction?



A) 0.16 J
B) 0.27 J
C) 0.54 J
D) 0.73 J
E) 7.3 mJ

3. (4 pts.) Which graph below best shows the electric field E(r) corresponding to the potential V(r) shown in upper left graph?



Choose: (A) (B) (C) (D) (E)

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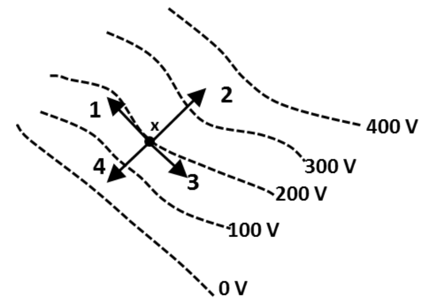
4. (3 pts.) The vector that best represents the direction of the electric field at point **x** on the 200 V equipotential line is



A) 1
B) 2
C) 3
D) 4
E) None of these is correct.

5. (3 pts.) Three charges are brought from infinity and placed at the corners of an equilateral triangle. Which of the following statements is <u>true</u>?

A. The work required to assemble the charges is always positive.
B. The electrostatic potential energy of the system is always positive.
C. The electrostatic potential energy does not depend on the order the charges are placed at the corners.
D. The work required to assemble the charges depends on which charge is placed at which corner.
E. The electrostatic potential energy depends on which charge is placed at which corner.

6. (4 pts.) If you increase the charge on a parallel-plate capacitor from 3 μC to 9 μC and increase the plate separation from 1 mm to 3 mm, the energy stored in the capacitor changes by a factor of

A) 27
B) 9
C) 8
D) 3
E) 1/3

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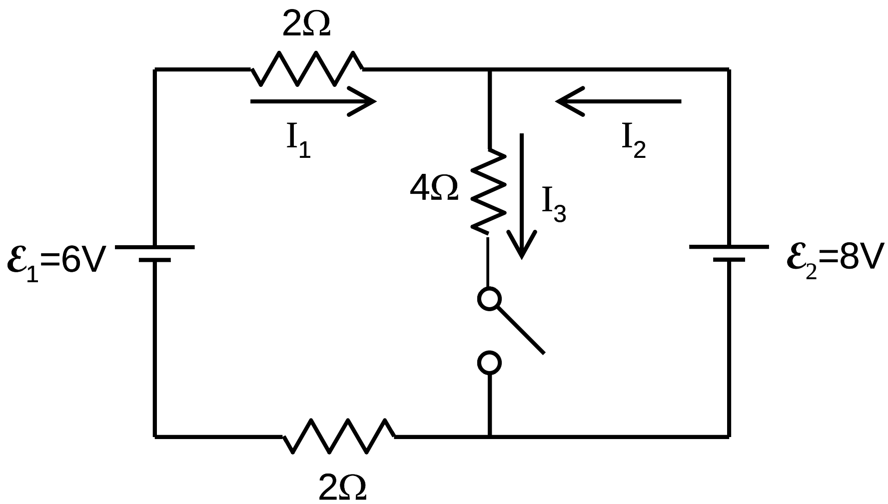
The next three questions pertain to the following circuit.



7. (4 pts.) With the switch open as shown, what is the current I_1?

(A) $I_1 = -7/2$ A
(B) $I_1 = -1/2$ A
(C) $I_1 = 1/2$ A
(D) $I_1 = 3/2$ A
(E) $I_1 = 7/2$ A

For the next two questions the switch is closed.

8. (4 pts.) What is the voltage across the 4 ohm resistor?

(A) 2 V
(B) 6 V
(C) 7 V
(D) 8 V
(E) 14 V

9. (3 pts.) Which of the currents have changed in magnitude after the switch is closed?

(A) Only I_3 has changed in magnitude.
(B) Only I_2 and I_3 have changed in magnitude.
(C) I_1, I_2, and I_3 have all changed in magnitude.
(D) No currents have changed in magnitude.

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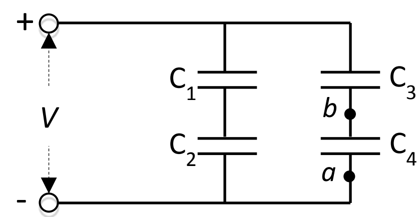
The next three questions pertain to the following situation.



Four capacitors are connected as shown in the figure below. The gaps between the plates of all three capacitors are filled with air (κ = 1.0); the values of the capacitances are:

$C_1 = 2\ \mu F$
$C_2 = 3\ \mu F$
$C_3 = 8\ \mu F$
$C_4 = 6\ \mu F$

A constant potential difference, ***V* = 12 V**, is maintained across the circuit, as shown.

10. (4 pts.) What is C_{tot}, the total equivalent capacitance of the four capacitors?

A) 0.89 μF
B) 3.68 μF
C) 4.63 μF
D) 4.75 μF
E) 19.0 μF

11. (5 pts.) What is $V_b - V_a$, the potential difference between points *b* and *a* (*i.e.*, the voltage across capacitor C_4)?

A) 5.14 V
B) 6.00 V
C) 6.86 V
D) 9.00 V
E) 16.00 V

12. (3 pts.) If capacitors C_1 and C_2 are removed from the circuit, how will the energy stored in C_4 change?

A) Increase
B) No change
C) Decrease