

Name \_\_\_\_\_

48 minutes

- closed book & notes
- calculator permitted

score

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potentially useful equations

$$F=ma \quad E=\frac{kq}{R^2} \quad F=qE$$

$$V=\frac{kq}{R} \quad EPE=qV \quad \Delta V=Ed$$

$$Q=CV \quad U=\frac{1}{2}QV \quad V=IR \quad P=IV$$

$$C=\frac{K\epsilon_0 A}{d} \quad R=\frac{\rho L}{A}$$

$$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} \quad R_s = R_1 + R_2$$

T	$10^{12}$
G	$10^9$
M	$10^6$
k	$10^3$
c	$10^2$
m	$10^{-3}$
$\mu$	$10^{-6}$
n	$10^{-9}$
p	$10^{-12}$

$$F = qvB \sin\theta = ILB \sin\theta = \frac{mv^2}{R} \quad \tau = NIAB \sin\theta$$

$$B_{\text{wire}} = \frac{\mu_0 I}{2\pi R} \quad B_{\text{loop}} = \frac{\mu_0 I}{2R} \quad B_{\text{solenoid}} = \mu_0 n I$$

$$e = 1.6 \times 10^{-19} \text{ C}$$

$$k = 9 \times 10^9 \text{ N m}^2/\text{C}^2$$

$$\epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2/\text{N m}^2$$

$$\mu_0 = 4\pi \times 10^{-7} \text{ Tm/A}$$

$$m_e = 9.11 \times 10^{-31} \text{ kg}$$

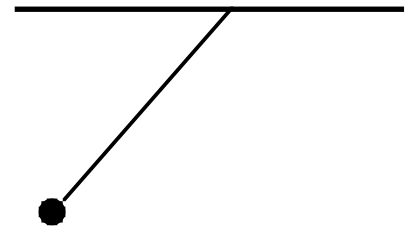
$$m_p = 1.67 \times 10^{-27} \text{ kg}$$

Name \_\_\_\_\_

multiple choice -- circle the letter of the best answer

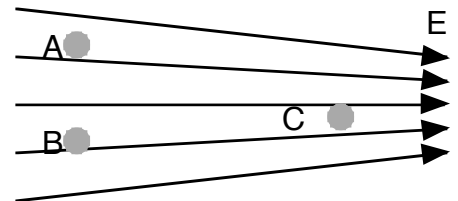
MC.1) [5] A negative charge hangs from a string at an angle due to a horizontal electric field. What is the direction of the electric field?

- a) to the left
- b) to the right
- c) to either the left or the right
- d) to neither the left nor the right
- e) to both the left and the right



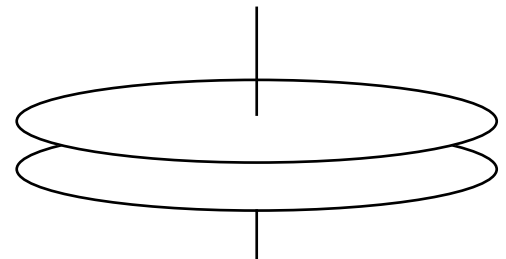
MC.2) [5] Compare the magnitudes of the electric fields at the spots A, B and C.

- a)  $A = B = C$
- b)  $A = B < C$
- c)  $A = B > C$
- d)  $A > B > C$
- e)  $A < B < C$



MC.3) [5] A capacitor is made of two large circular plates. Which of the following would cut the capacitance of the capacitor in half?

- a) inserting a material of dielectric constant = 2 between the plates
- b) cutting the diameter of the plates in half
- c) cutting the distance between the plates in half
- d) each of the above would cut the capacitance in half
- e) none of the above would cut the capacitance in half



MC.4) [5] If the diameter of a wire is cut in half, then the resistance of the wire is \_\_\_\_\_ the original resistance.

- a) the same as
- b) twice
- c) half
- d) four times
- e) one fourth

Name \_\_\_\_\_

multiple choice -- circle the letter of the best answer

MC.5) [5] A circuit-breaker is a safety device that turns off the current if it goes above a specific value. This prevents the wires from overheating and causing a fire. How many 100 W light bulbs can be connected in parallel to each other on a circuit controlled by a 15 A, 110 V circuit-breaker?

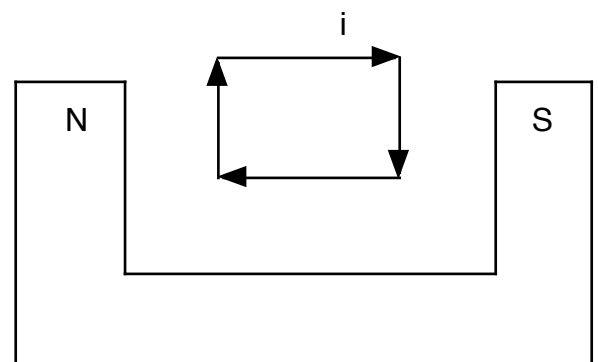
- a) 1
- b) 15
- c) 16
- d) 110
- e) any number; the power decreases as more bulbs are added

MC.6) [5] A charge travels in a circle in a magnetic field. If the magnetic field strength is decreased, the diameter of the circle will...

- a) stay the same
- b) decrease
- c) increase
- d) increase if the charge is positive, decrease if the charge is negative
- e) can't tell without knowing the sign of the charge

MC.7) [5] A rectangular loop of wire is placed between the poles of a horseshoe magnet, as shown in the diagram, but is free to move. A current travels through the loop in the direction shown. The magnetic field acting on the loop will cause the loop in the diagram to...

- a) move up
- b) move down
- c) rotate counterclockwise as seen from above
- d) rotate clockwise as seen from above
- e) experience neither force nor torque

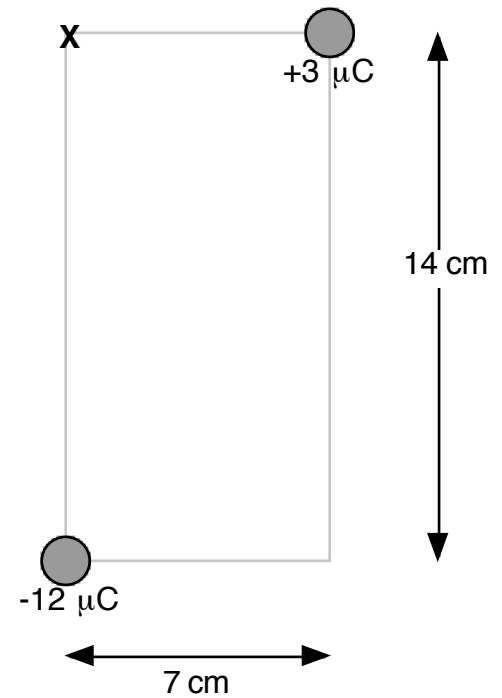


Name \_\_\_\_\_

Barrett      Burdette      Gibbons  
Modoran      Park      Williams

show your work -- write neatly -- specify units and directions as appropriate

- 1) Two charges are located at corners of a rectangle.  
1.1) [10] What is the magnitude of the electric field at X ?



- 1.2) [10] What is the work needed to move a  $+0.10 \mu\text{C}$  charge from X to an infinite distance away and give it 0.020 J of kinetic energy?

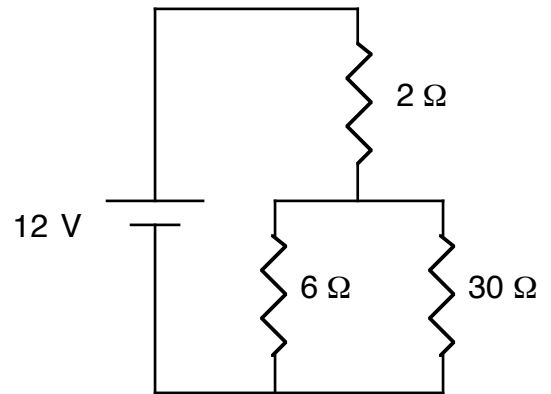
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2) A circuit consists of three resistors connected to a battery as shown.

2.1) [8] What is the equivalent resistance of the three resistors?



2.2) [6] What is the current flowing through the 2 Ω resistor?

2.3) [6] What is the potential difference across the 6 Ω resistor?