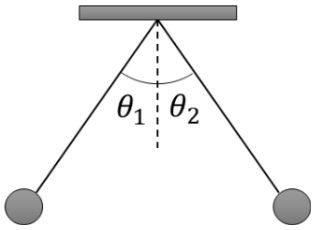
Name: _____ UW NetID: _____

(last) (first)

Practice Final Exam 1

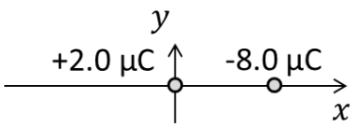
All questions on the test are multiple choice.

1) As shown, two identical spheres are hanging from two identical insulating strings attached to a point on the ceiling. The two spheres carry the same amount of charge and are repelled from each other. At equilibrium, $\theta_1 = \theta_2$. What happens if the charge carried by the right sphere increases?



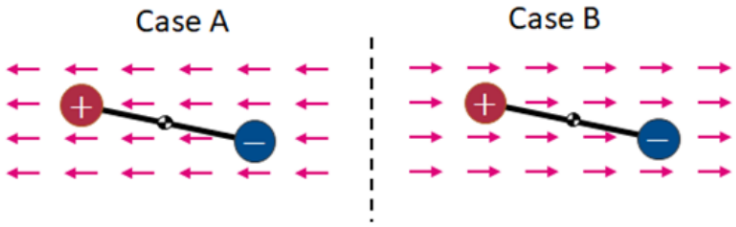
A. Both θ_1 and θ_2 increase.
B. Both θ_1 and θ_2 remain the same
C. θ_1 increases and θ_2 remains the same.
D. θ_2 increases and θ_1 remains the same.
E. More information is required.

2) A particle with $+2.0 \times 10^{-6}$ C is placed at the origin and a particle with charge -8.0×10^{-6} C is placed along the x-axis at $x = 0.60$ m. At which one of the following locations along the x-axis is the electric field zero?



A. $x = 0.10$ m
B. $x = 0.20$ m
C. $x = -0.60$ m
D. $x = -1.20$ m
E. There are no locations along the x-axis where the electric field is zero.

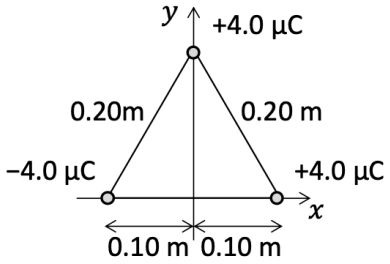
3) Consider two different cases where an identical dipole is placed at rest in identical uniform electric fields, except in case A the electric field points to the left, and in case B the electric field points to the right, as shown. **Compare the magnitude of the net torque** acting on the dipole in these cases.



A. $\tau_A > \tau_B$
B. $\tau_A = \tau_B$
C. $\tau_A < \tau_B$
D. Not enough information

Name: _____ UW NetID: _____
(last) (first)

Three particles are placed 0.20 m away from each other and they have charges as shown in the diagram at right. Note that 1 μC = $+1.0 \times 10^{-6}$ C.



4) What is the electrical force on the particle at the top ($x = 0, y = 0.17$ m)?

A. $-7.2\vec{\imath} - 29\vec{\jmath}$ N
B. $-3.6\vec{\imath}$ N
C. $-6.2\vec{\imath}$ N
D. $-7.2\vec{\imath}$ N
E. $-29\vec{\jmath}$ N

5) What is the electrical potential at the origin? Note that the electrical potential at infinity is zero.

A. 9.3×10^5 V
B. 7.2×10^5 V
C. 3.6×10^5 V
D. 2.1×10^5 V
E. 1.8×10^5 V

6) A parallel-plate capacitor is fully charged by a battery. The positive plate has a charge $+q$ and the negative plate has a charge $-q$. What happens to the charge and the electric field between the plates when the separation between plates is halved while the **battery is still connected**?

A. q halves and E remains the same.
B. q doubles and E doubles.
C. q doubles and E remains the same.
D. q remains the same and E doubles.
E. q remains the same and E remains the same.

7) Due to a potential difference, electrons in an electron gun are accelerated from rest and emerge with a speed v. The electrons then enter a region with a uniform external magnetic field and follow a circular path. By what factor does the radius of the circular path increase if we decrease the potential difference by a factor of 4?

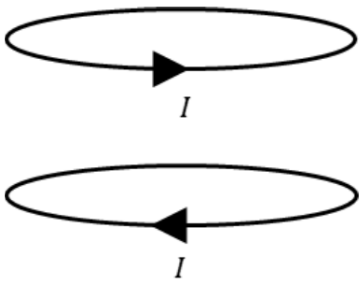
A. Remains the same
B. 2
C. 4
D. ½
E. ¼

Name: _____ UW NetID: _____
(last) (first)

8) A solenoid with a radius of 0.35 m has 30000 windings over a length of 1.4 m. The magnetic field inside the solenoid is 0.27 T. What is the current in the windings?

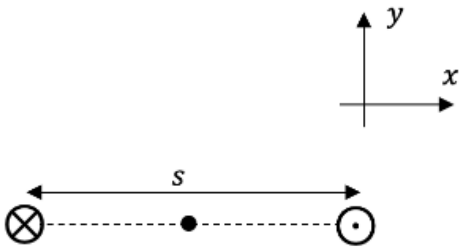
A. 0 A
B. 2.5 A
C. 5.0 A
D. 7.2 A
E. 10 A

9) Two circular loops carry a current I as shown in the figure. They are placed on top of each other with the same orientation. Which statement is true?



A. There is an attractive force between the loops.
B. There is a repulsive force between the loops.
C. There is no force between the loops.
D. Cannot be determined with the information provided.
E. None of the above.

10) Two long thin wires separated by distance s carry equal currents perpendicular to the plane of the page, as shown. The current in each wire is 3.4A and the net magnetic field midway between the wires is 1.8μT.



What is the distance s?

A. 0.50 m
B. 0.75 m
C. 1.5 m
D. 3.0 m
E. 6.0 m

11) A proton moves along the x-axis with $v_x = 1.0 \times 10^7$m/s. As it passes the origin, what are the strength and direction of the magnetic field on the y-axis at $y = 1$cm?

A. 0 T
B. $1.6 \times 10^{-17}\hat{j}$ T
C. $1.6 \times 10^{-17}\hat{k}$ T
D. $1.6 \times 10^{-15}\hat{j}$ T
E. $1.6 \times 10^{-15}\hat{k}$ T

12) In an RC circuit, the charge, Q, stored on the capacitor is described by $Q(t)$, where Q is in

Name: _____ UW NetID: _____

(last) (first)

Coulombs, and t is in seconds:

$$Q(t) = Q_o \sin(60\text{Hz} * t + \frac{\pi}{2})$$

Which of the following statements are **TRUE**?

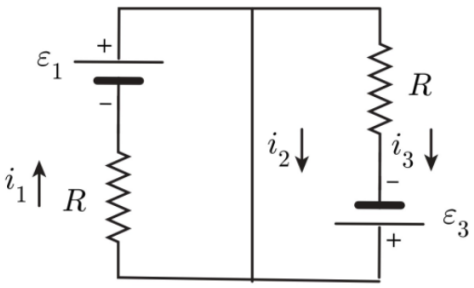
A. At t=0 the capacitor is fully charged.

B. At t=0 the capacitor is completely discharged.

C. At t=0 the current is instantaneously zero through the resistor.

D. The amount of current flowing through the resistor is largest at t=0.

Consider the following multi-loop circuit for the next two questions.



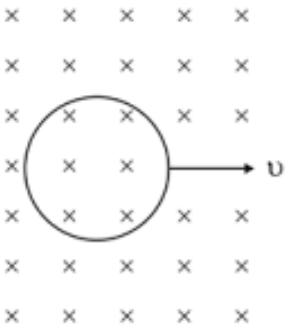
13) **Which equation correctly applies the junction rule?**

A. $i_1 = i_2 + i_3$
B. $i_2 = i_3 + i_1$
C. $i_3 = i_1 + i_2$
D. $i_1 + i_2 + i_3 = 0$

14) **For what EMFs is the current i_2 zero?**

A. $\mathcal{E}_1 = R$
B. $\mathcal{E}_1 = \mathcal{E}_3$
C. $\mathcal{E}_1 = -\mathcal{E}_3$
D. i_2 is zero irrespective of the EMFs.
E. It is impossible for i_2 to be zero.

15) A conducting loop is moved through a region of uniform magnetic field, as shown in the figure. Loop 1 has a radius r_o, and is moved at a speed v_o. Next a second loop is moved through the same magnetic field. Loop 2 has a radius $\frac{1}{2}r_o$ and is moved at speed of $3v_o$ How do their induced emf, ε, compare?

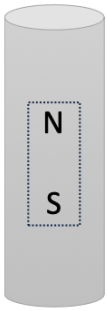


A. $\varepsilon_2 = \frac{3}{2}\varepsilon_1$
B. $\varepsilon_2 = \frac{4}{3}\varepsilon_1$
C. $\varepsilon_2 = \frac{2}{3}\varepsilon_1$
D. $\varepsilon_2 = \varepsilon_1$
E. $\varepsilon_2 = \frac{3}{4}\varepsilon_1$

Name: _____ UW NetID: _____

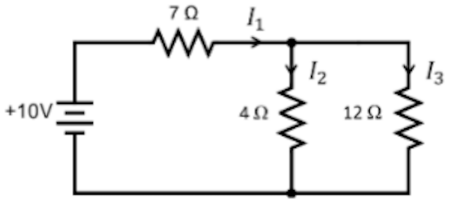
(last) (first)

16) Consider a magnet falling inside a conducting copper pipe. As viewed from above what is the direction of the current in the pipe?



A. Clockwise above and below the magnet.
B. Counterclockwise above and below the magnet.
C. Clockwise above the magnet and counterclockwise below the magnet.
D. Counterclockwise above the magnet and clockwise below the magnet.
E. Clockwise at the center of the magnet.

17) A circuit contains a 10 V battery and 3 resistors, as shown. Which option below shows the correct ranking for the power dissipated in each resistor?



A. $P_2 < P_1 < P_3$
B. $P_2 < P_3 < P_1$
C. $P_3 < P_1 < P_2$
D. $P_3 < P_2 < P_1$
E. $P_1 < P_2 < P_3$

18) Your team measures the force between two particles six times obtaining the following data: 47.1 N, 50.2 N, 49.8 N, 50.7 N, 49.3 N, and 46.9 N. How should you report your force according to the uncertainty analysis procedure used in PHYS 122?

A. 49.0±1.62 N
B. 49.0±1.6 N
C. 49±1.6 N
D. 49±2 N
E. 50±2 N

Name: UW NetID:

(last) (first)

19) You are exploring how many different types of particles are in your simulation. You spawn five particles and give them all different colors. Then in pairs you place the particles 1 m away from each other and see if the force is attractive (a) or repulsive (r). You obtain the following table.

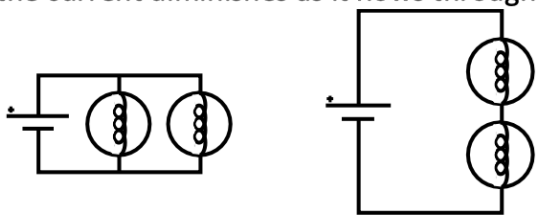
	Blue	Orange	Green	Red	Purple
Blue	-	r	r	a	r
Orange	r	-	r	r	r
Green	r	r	-	r	a
Red	a	r	r	-	r
Purple	r	r	a	r	-

Which of the following conclusions is consistent with your data? **Select all that apply.**

A. Blue and Red particles are the same type.
B. Blue and Orange particles are the same type.
C. Red and Purple particles are the same type.
D. Green and Red particles are the same type.
E. Green and Purple particles are the same type.

20) Consider Model 1 that you tested in Lab B1, and the following two circuits with light bulbs and batteries. Note that the batteries and light bulbs are identical.

Model 1: As current flows through multiple elements connected in series, the first element uses up some of the current, and the second element uses up some of the remaining current etc. So, the current diminishes as it flows through multiple elements in series.



Circuit 1 Circuit 2

Which of the following predictions for the circuits above is consistent with the model **and** useful in testing the model? **Select all that apply.**

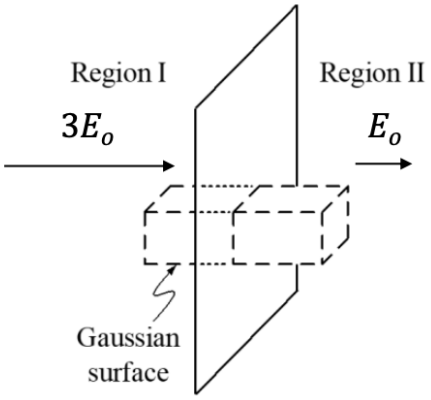
A. The left bulb in Circuit 1 and the top bulb in Circuit 2 have the same brightness.
B. The left bulb in Circuit 1 is dimmer than the top bulb in Circuit 2.
C. In Circuit 1 the two bulbs have the same brightness.
D. In Circuit 2 the two bulbs have the same brightness.
E. In Circuit 2 the bottom bulb is dimmer than the top bulb.

Name: _____ UW NetID: _____
(last) (first)

21) Consider a circuit with a capacitor with capacitance $C = (8.0 \pm 0.3) \times 10^{-3}$ F, a resistor with resistance R, a battery with emf $\mathcal{E}$, and a switch all connected in series. The capacitor is initially uncharged. Your model for the potential difference across the resistor is $V_R(t) = \mathcal{E}e^{-t/RC}$, where t is the time after the switch is closed. You measure V_R at different times and plot $\ln(V_R/\mathcal{E})$ on the vertical axis and t on the horizontal axis. The linear best-fit line to this graph yields a slope of (-0.065 ± 0.001) s^{-1}. Based on this result, what is the best estimate and uncertainty of R according to the rules we use in PHYS 122?

A. $(1.92 \pm 0.03) \times 10^3\ \Omega$
B. $(1.92 \pm 0.07) \times 10^3\ \Omega$
C. $(8.1 \pm 0.3)\ \Omega$
D. $(8.1 \pm 0.6)\ \Omega$
E. $(5.2 \pm 0.2) \times 10^{-4}\ \Omega$

22) A box-shaped Gaussian surface spans two regions of uniform electric field that are separated by a large uniformly charged sheet. In region I, the electric field points to the right and has magnitude $3E_o$. In region II, the electric field points to the right and has magnitude E_o. The area of each square end-surface of the Gaussian surface is A_o. What is the surface charge density of the sheet?

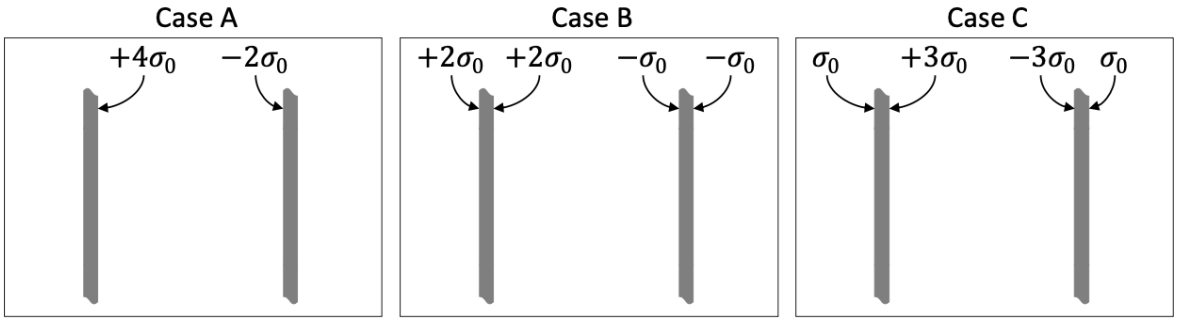


A. $-2E_o\varepsilon_o$
B. $+2E_o\varepsilon_o$
C. $-4E_o\varepsilon_o$
D. $+4E_o\varepsilon_o$
E. Not enough information is given.

Name: UW NetID:

(last) (first)

23) Two conducting plates are placed close together. The left plate is given a positive charge, and the right is given half as much negative charge. The diagrams below show various distributions of the charge on the two surfaces of the plates.



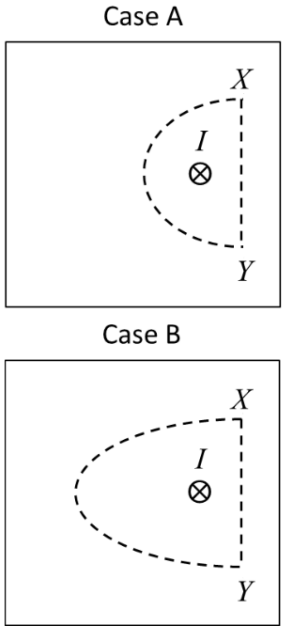
Which arrangement is stable?

A. Case A
B. Case B
C. Case C
D. Not enough information given.

24) Case A: Consider an Ampèrian loop consisting of a straight line and a curved line that surrounds a wire that has current flowing into the page, as shown. $L_A = \left|\int_X^Y \vec{B} \cdot d\vec{l}\right|$ is calculated along the **curved** part of the loop.

Case B: Is identical to case A, except the curved line is further from the wire. $L_B = \left|\int_X^Y \vec{B} \cdot d\vec{l}\right|$ is calculated along the **curved** part of the loop.

How does L_A compare to L_B?

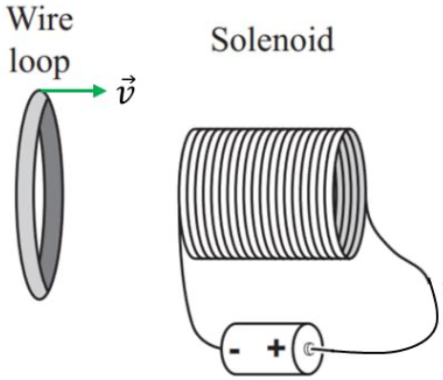


A. $L_A = L_B > 0$
B. $L_A = L_B = 0$
C. $L_A > L_B$
D. $L_A < L_B$

Name: _____ UW NetID: _____

(last) (first)

25) A wire loop is moving toward a solenoid, as shown at right. What is the direction of the net force on the loop due to the solenoid?



A. There is no force on the solenoid.
B. The net force into the page.
C. The net force out of the page.
D. The net force is to the left.
E. The net force is to the right.