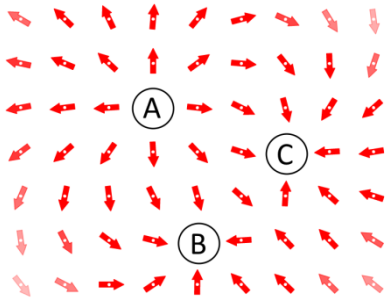
Phys 2426: University Physics II **Name:** _____

Fall 2019 **Exam 1 – Practice**

1. (0 Points) What course is this?
   a. PHYS 1401 b. PHYS 1402 c. PHYS 2425 d. PHYS 2426
2. (0 Points) What exam is this?
   a. Exam 1 b. Exam 2 c. Final Exam
3. (0 Points) What version of the exam is this?
   a. Version A b. Version B c. Version C d. Version D
4. In the figure to the right, the red arrows indicate the direction of the electric field. Determine the signs of each of the three charges.
   a. All three charges are positive.
   b. All three charges are negative.
   c. A is negative, while B and C are positive.
   d. A is positive, while B and C are negative.
   e. A and B are positive, while C is negative.



(Questions 5–7) A charge of 4.0 nC is at the origin. There are no other charges in the universe.

Consider a point P located 1.5 m away, along the $+x$ axis.

5. What is the direction of the electric field at point P?
   a. $+x$
   b. $-x$
   c. $+y$
   d. $-y$
   e. It is zero.
6. What is the magnitude of the electric field at point P?
   a. 2.6 N/C
   b. 6 N/C
   c. 16 N/C
   d. 24 N/C
   e. 64 N/C
7. If a (−5.0 nC) charge is now placed at point P, what is the direction of the force on this new charge?
   a. $+x$
   b. $-x$
   c. $+y$
   d. $-y$
   e. It is zero.

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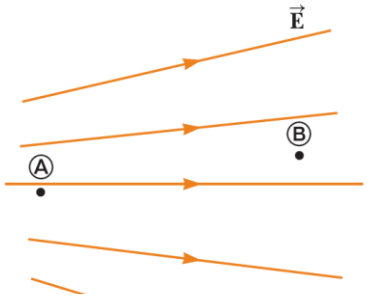
8. A balloon is rubbed against a cotton or wool shirt, and the balloon becomes negatively charged. What is the most likely physical change that occurred to caused this charge?
   a. Some of the balloon's electrons were destroyed.
   b. The rubbing process created some extra electrons.
   c. The balloon lost some electrons to the shirt.
   d. The balloon picked up some extra electrons from the shirt.
   e. The balloon lost some protons to the shirt.

9. In the figure to the right, two points, A and B, are located within a region in which an electric field points toward the right. How would you describe the relationship between their electric potentials V_A and V_B?
   a. V_A is a higher potential.
   b. V_B is a higher potential.
   c. The points are at the same potential.
   d. It depends on what kind of charge is placed in the region.
   e. Impossible to determine from the information given.



10. How many protons does it take to form a coulomb of charge?
    a. 6.25×10^{18} protons
    b. 1.6×10^{-19} protons
    c. 9.1×10^{-31} protons
    d. 1.6×10^{18} protons
    e. 1.1×10^{30} protons
11. A 0.5 F capacitor is charged up to a potential difference of 10 V. What is the charge of just the positive plate of the capacitor?
    a. 0.05 C
    b. 5.0 C
    c. 10.0 C
    d. 20.0 C
    e. 0.0 C
12. A 0.5 F capacitor is charged up to a potential difference of 10 V. What is the total charge of the capacitor, including both plates?
    a. 0.05 C
    b. 5.0 C
    c. 10.0 C
    d. 20.0 C
    e. 0.0 C
13. In a DC circuit, when a capacitor is fully charged, the current entering and leaving the capitor is…
    a. zero.
    b. at its maximum value.
    c. less than the current in a resistor in series with the capacitor.
    d. greater than the current in a resistor in series with the capacitor.
    e. equal to half of its maximum value.
14. In a working electrical circuit, the electric current has this behavior:
    a. It is emitted by the battery and absorbed by the load.
    b. It is emitted by the load and absorbed by the battery.
    c. It flows in the air around the wires, in a direction determined by the right-hand rule.
    d. It circulates around the circuit like blood flowing around our cardiovascular system.
    (Note: The "load" is the device using the electricity, such as a light bulb, motor, or resistor.)
15. If an electron beam is pointed northward, what is the direction of the electric current formed by the beam?
    a. North
    b. South
    c. Upward
    d. Downward
    e. Clockwise, as viewed from the top.

16. If a circuit consists of an ideal battery, an appropriate light bulb, and an ideal voltmeter, all in series,
    a. The bulb will be lit, but the voltmeter will display zero.
    b. The bulb will be lit, and the voltmeter will display half of the battery's EMF.
    c. The bulb will be lit, and the voltmeter will display the battery's EMF.
    d. The bulb will be off, and the voltmeter will display zero.
    e. The bulb will be off, and the voltmeter will display the battery's EMF.
17. A 7.0 Ω resistor is connected to a 5.0 V adjustable power supply. If the voltage is doubled, what happens to the resistance?
    a. The resistance increases 4×.
    b. The resistance doubles.
    c. The resistance stays the same.
    d. The resistance is cut in half.
    e. The resistance decreases 4×.

(Questions 18 and 19) A 13.6-g piece of Styrofoam carries a net charge of −0.69 μC and is suspended in equilibrium above the center of a large, horizontal sheet of plastic that has a uniform charge density on its surface.

18. What is the charge per unit area on the plastic sheet?
    a. 1.7 mC/m^2
    b. 3.4 mC/m^2
    c. 1.7 μC/m^2
    d. 3.4 μC/m^2
    e. 0
19. What is the sign of the charge on the plastic sheet?
    a. Positive.
    b. Negative.
    c. Either positive or negative will work.
    d. The sign of the charge varies.
    e. Impossible to determine.

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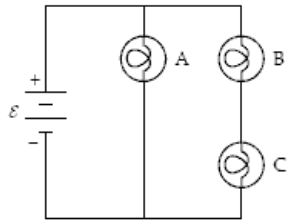
20. A light bulb that uses LED technology currently costs $8. Using it reduces electric power usage by about 50 W. If electricity costs $0.12/kWh, how long would it take (in continuous operation) to recoup the costs of buying the bulb? (Reminders: 1 kWh = 1 kW × 1 hour, 1 day = 24 hours)
    a. 1 week (approx 7 days)
    b. 1 month (approx 30 days)
    c. 2 months (approx 60 days)
    d. 1 year (approx 365 days)
    e. 2 years (approx 730 days)
21. A cheap USB charging cable only has 28 AWG wires. (28 AWG wire has a cross-sectional area of 0.0810 mm^2 and copper has a resistivity of 1.7×10^{-8} Ω m.) If you are charging a tablet with 2.0 A of current, how much voltage is lost in a 2.0 m length of this cheap wire?
    a. 0.0008 V
    b. 0.1 V
    c. 0.4 V
    d. 0.8 V
    e. 2 V

22. In the circuit to the right, which bulb(s) is(are) the brightest?



a. A b. B c. C
d. B and C
e. All three are equally bright.

(Questions 23 and 24) A 50 μF capacitor's initial voltage is 20 V. At $t = 0$, a 4.0 kΩ resistor is connected across it.

23. What is the initial charge of the capacitor?
a. 240 μC
b. 360 μC
c. 400 μC
d. 600 μC
e. 1000 μC

24. What is the charge on the capacitor at the instant when I = 2 mA?
a. 240 μC
b. 360 μC
c. 400 μC
d. 600 μC
e. 1000 μC

25. In an RC circuit, how many time constants must elapse if an initially uncharged capacitor to reach 80% of its final voltage?
a. 0.22
b. 1.6
c. 1.9
d. 3.0
e. 5.0

26. A cell phone which is 7 cm × 14 cm is placed on a metal table. There is a metal plate in the entire back of the phone which is now 1 mm away from the table. If this system acts like a parallel-plate capacitor with a dielectric constant of 1, what is the capacitance between the phone and the table? (Note: 1 pF = 10^{-12} F)
a. 8.7 pF
b. 87 pF
c. 8.7 nF
d. 87 nF
e. 8.7 μF

27. How much electric flux is generated by a single proton? (Volt-meter (V·m) is the SI unit of electric flux.)
a. 1.6×10^{-19} V·m
b. 8.85×10^{-12} V·m
c. 1.8×10^{-8} V·m
d. 1.0 V·m
e. 5.5×10^{7} V·m

28. A 8.0 nC charge is placed at the center of a thick spherical metal shell. The net charge on the shell is −5.0 nC. If the outside radius of the shell is 6 cm, what is the electric field just outside the shell?
a. 7.5 kN/C, pointing outward
b. 12.5 kN/C, pointing inward
c. 20 kN/C, pointing outward
d. 53 N/C, pointing clockwise
e. 0 N/C

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Kirchoff's Laws

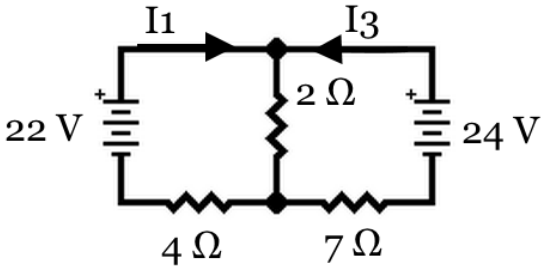

Figure: (Questions 29 thru 32) Two batteries are connected into a network as shown, with two currents already labeled.

29. Which of the following is a valid Kirchoff's Voltage Law equation for the circuit (in SI units)?
    a. $22 - 24 + 7I_3 - 4I_1 = 0$
    b. $22 - 24 - 7I_3 + 4I_1 = 0$
    c. $22 - 24 - 2(I_1 + I_3) = 0$
    d. $22 + 24 - 7I_3 - 4I_1 = 0$
    e. $22 + 24 + 7I_3 + 4I_1 = 0$
30. If the Kirchoff's Current Law equation is: $I_1 + I_3 = I_2$, where should I_2 be labeled?
    a. Pointing toward the left in the 4 Ω resistor.
    b. Pointing toward the right in the 4 Ω resistor.
    c. Pointing upward through the 2 Ω resistor.
    d. Pointing downward through the 2 Ω resistor.
    e. Pointing toward the left in the 2 Ω resistor.
31. What is the magnitude of the current in the 2 Ω resistor? (Choose the closest answer.)
    a. 1 A
    b. 2 A
    c. 3 A
    d. 5 A
    e. 10 A
32. What is the direction of the current in the 2 Ω resistar? (The conventional current, not the direction of the electron flow.)
    a. Upward
    b. Downward
    c. Leftward
    d. Rightward
    e. Cannot be determined.
33. In the circuit to the right, the three resistors each has the same value $R_1 = R_2 = R_3 = 20.0\ \Omega$. If an ammeter is placed in parallel with R_3, what will the reading on the ammeter be?
    a. 2.0 A
    b. 3.0 A
    c. 4.0 A
    d. 6.0 A
    e. 12.0 A