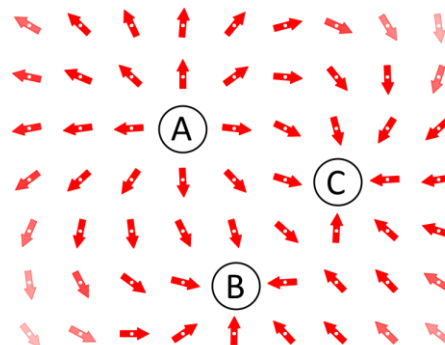


- (0 Points) What course is this?
 - PHYS 1401
 - PHYS 1402
 - PHYS 2425
 - PHYS 2426
- (0 Points) What exam is this?
 - Exam 1
 - Exam 2
 - Final Exam
- (0 Points) What version of the exam is this?
 - Version A
 - Version B
 - Version C
 - Version D
- In the figure to the right, the red arrows indicate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

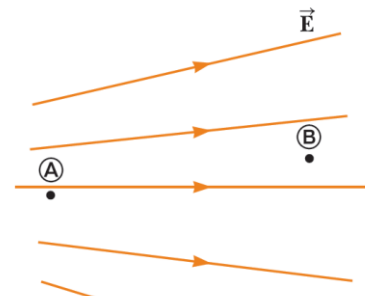


(Questions 5–7) A charge of 4.0 nC is at the origin. There are no other charges in the universe.

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

- What is the direction of the electric field at point P ?
 - $+x$
 - $-x$
 - $+y$
 - $-y$
 - It is zero.
 - What is the magnitude of the electric field at point P ?
 - 2.6 N/C
 - 6 N/C
 - 16 N/C
 - 24 N/C
 - 64 N/C
 - If a (-5.0 nC) charge is now placed at point P , what is the direction of the force on this new charge?
 - $+x$
 - $-x$
 - $+y$
 - $-y$
 - It is zero.
-
- 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?
 - Some of the balloon's electrons were destroyed.
 - The rubbing process created some extra electrons.
 - The balloon lost some electrons to the shirt.
 - The balloon picked up some extra electrons from the shirt.
 - 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 ?
- V_A is a higher potential.
 - V_B is a higher potential.
 - The points are at the same potential.
 - It depends on what kind of charge is placed in the region.
 - Impossible to determine from the information given.



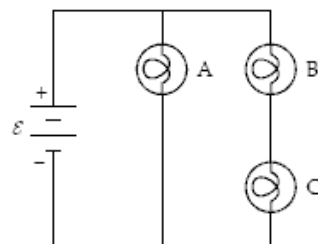
10. How many protons does it take to form a coulomb of charge?
- 6.25×10^{18} protons
 - 1.6×10^{-19} protons
 - 9.1×10^{-31} protons
 - 1.6×10^{18} protons
 - 1.1×10^{30} protons
11. A 0.5 F capacitor is charged up to a potential difference of 10 V. What is the charge of just the positive plate of the capacitor?
- 0.05 C
 - 5.0 C
 - 10.0 C
 - 20.0 C
 - 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?
- 0.05 C
 - 5.0 C
 - 10.0 C
 - 20.0 C
 - 0.0 C
13. In an RC circuit, when a capacitor is fully charged, the current passing through the resistor is...
- zero.
 - at its maximum value.
 - equal to half of its maximum value.
14. In a working electrical circuit, the electric current has this behavior:
- It is emitted by the battery and absorbed by the load.
 - It is emitted by the load and absorbed by the battery.
 - It flows in the air around the wires, in a direction determined by the right-hand rule.
 - 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?
- North
 - South
 - Upward
 - Downward
 - 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,
- The bulb will be lit, but the voltmeter will display zero.
 - The bulb will be lit, and the voltmeter will display half of the battery's EMF.
 - The bulb will be lit, and the voltmeter will display the battery's EMF.
 - The bulb will be off, and the voltmeter will display zero.
 - The bulb will be off, and the voltmeter will display the battery's EMF.
17. A cylindrical wire has a radius r and a length ℓ . If ℓ and r are both doubled, the resistance of the wire...
- Increases.
 - Decreases.
 - Remains the same.
 - It depends on which of r and ℓ is larger.
 - Becomes negative.
18. A 7.0Ω resistor is connected to a 5.0 V adjustable power supply. If the voltage is doubled, what happens to the resistance?
- The resistance increases $4\times$.
 - The resistance doubles.
 - The resistance stays the same.
 - The resistance is cut in half.
 - The resistance decreases $4\times$.

(Questions 19 and 20) A proton is levitated using only an electric field.

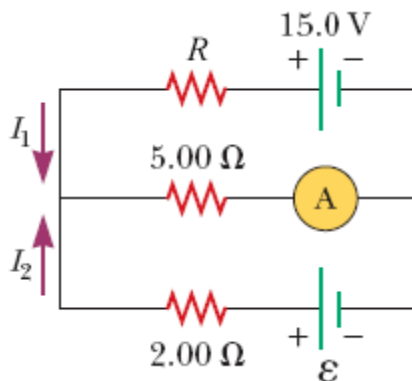
19. What electric field strength is required to support the weight of the proton?
- $1.6 \times 10^{-19} \text{ N/C}$
 - $5.6 \times 10^{-11} \text{ N/C}$
 - $1.02 \times 10^{-7} \text{ N/C}$
 - $9.4 \times 10^8 \text{ N/C}$
 - $9.8 \times 10^6 \text{ N/C}$
20. What is the direction of the required electric field?
- North
 - South
 - Up
 - Down
 - Away from the proton.

21. A light bulb that uses LED technology currently costs \$8. Using it reduces electric power usage by about 50 W . If electricity costs $\$0.12/\text{kWh}$, how long would it take (in continuous operation) to recoup the costs of buying the bulb? (Reminders: $1 \text{ kWh} = 1 \text{ kW} \times 1 \text{ hour}$, $1 \text{ day} = 24 \text{ hours}$)
- 1 week (approx. 7 days)
 - 1 month (approx. 30 days)
 - 2 months (approx. 60 days)
 - 1 year (approx. 365 days)
 - 2 years (approx. 730 days)
22. In the circuit to the right, which bulb is the brightest?
- A
 - B
 - C
 - B and C
 - All three are equally bright.



23. 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 $1.7 \times 10^{-8} \Omega \cdot \text{m}$.) 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?
- 0.0008 V
 - 0.1 V
 - 0.4 V
 - 0.8 V
 - 2 V
24. In an RC circuit, how many time constants must elapse if an initially charged capacitor to reach 50% of its initial voltage?
- 0.5
 - 0.6
 - 0.7
 - 1.0
 - 1.6
25. A cell phone which is $7 \text{ cm} \times 14 \text{ cm}$ 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: $1 \text{ pF} = 10^{-12} \text{ F}$)
- 8.7 pF
 - 87 pF
 - 8.7 nF
 - 87 nF
 - $8.7 \mu\text{F}$
26. How much electric flux is generated by a single proton? (Volt-meter ($\text{V} \cdot \text{m}$) is the SI unit of electric flux.)
- $1.6 \times 10^{-19} \text{ V} \cdot \text{m}$
 - $8.85 \times 10^{-12} \text{ V} \cdot \text{m}$
 - $1.8 \times 10^{-8} \text{ V} \cdot \text{m}$
 - $1.0 \text{ V} \cdot \text{m}$
 - $5.5 \times 10^7 \text{ V} \cdot \text{m}$
27. If a 10Ω , a 15Ω , and a 30Ω resistor are placed in parallel, what is their combined equivalent resistance?
- 0.2Ω
 - 5Ω
 - 15Ω
 - 20Ω
 - 55Ω
28. Which of the following statements about the electric field of a single isolated charge is not correct?
- The magnitude of the field depends on the distance from the charge.
 - The magnitude of the field depends on the magnitude of the charge.
 - The magnitude of the field depends on the sign of the charge.
 - The direction of the field depends on the position relative to the charge.
 - The direction of the field depends on the sign of the charge.

Kirchoff's Laws



In the figure above, $R = 6.75 \Omega$ and the ammeter reads 1.85 A.
 (In this section, as always, choose the closest answer.)

29. What is the current I_2 in the lower branch of the circuit?

- a. 0.1 A
- b. 0.4 A
- c. 0.7 A
- d. 1.0 A
- e. 1.3 A

30. What is the voltage ϵ of the unknown battery?

- a. 7 V
- b. 11 V
- c. 15 V
- d. 19 V
- e. 23 V

31. In the circuit to the right, the voltmeter reads 4.0 V.

What is the voltage across R_2 ?

- a. 0.0 V
- b. 4.0 V
- c. 8.0 V
- d. 12.0 V
- e. 16.0 V

32. In the circuit to the right, what is the current passing through R_1 ?

- a. 0.0 A
- b. 0.5 A
- c. 0.86 A
- d. 1.2 A
- e. 2.0 A

33. In the circuit to the right, what is the value of R_2 ?

- a. 6.0 Ω
- b. 8.0 Ω
- c. 12 Ω
- d. 24 Ω
- e. 32 Ω

