Practice Exam

1. An alpha particle (mass = 6.7 x 10^{-27} kg, charge = 3.2 x 10^{-19} C) is accelerated from rest through a potential difference of 100 kV. Find the final speed of the alpha particle in m/s.

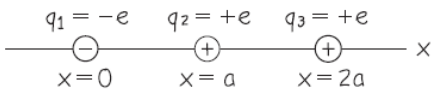
A) 2.5×10^7
B) 3.1×10^6
C) 4.8×10^7
D) 3.9×10^2
E) 9.3×10^3

2. A charge of 1.4 nC is uniformly distributed on the surface of a metal sphere with radius of 0.75 m. The potential outside, at a point 0.25 m from the *center* of the sphere is:

A) 36.6 V
B) 16.8 V
C) 1.2 V
D) 12.6 V
E) 23.3 V

3. Three point charges are located on the x-axis: $q_1 = -e$ at x = 0, $q_2 = +e$ at x = a, and $q_3 = +e$ at x = 2a. Calculate the potential energy of the system of three charges.

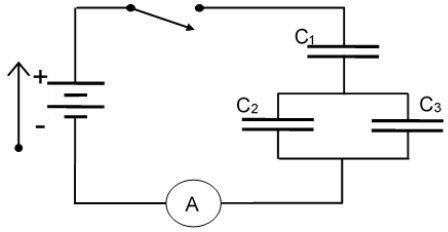
A) $+k\frac{e^2}{a}$
B) $-k\frac{e^2}{2a}$
C) $-k\frac{e^2}{a}$
D) $+k\frac{e^2}{2a}$
E) $-k\frac{e^2}{a^2}$



Practice Exam

4. A 12-Volt battery is connected to a combination of three capacitors with C_1 = 1.0 nF, C_2 = 2.0 nF and C_3 = 3.0 nF. The capacitors are initially uncharged. Find the total charge in nC which will pass through the meter A (i.e. the total charge taken from the battery) until the capacitors get fully charged.

A) 2
B) 4
C) 6
D) 8
E) 10



5. For the previous problem, find the final voltage on capacitor C_2 .

A) 1 V
B) 2 V
C) 3 V
D) 4 V
E) 5 V

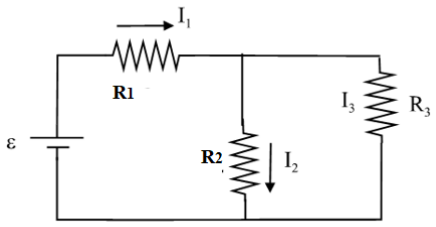
6. A wire made of a certain material has length L and resistance R. The wire is then stretched to a new length 4L without losing any mass. Find the new resistance.

A) R
B) 2R
C) 4R
D) 8R
E) 16R

Practice Exam

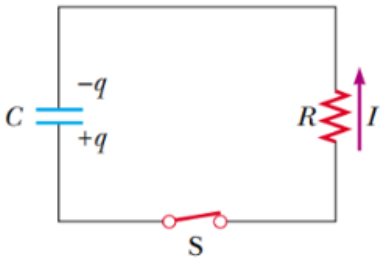
7. In the circuit below a 12 Volt battery is connected to a combination of 3 resistors with $R_1 = 1.0\ \Omega$, $R_2 = 2.0\ \Omega$ and $R_3 = 3.0\ \Omega$. Find the power (in Watts) supplied by the battery.

A) 21.1
B) 32.2
C) 43.3
D) 54.4
E) 65.5



8. Consider a capacitor of capacitance C that is being discharged through a resistor of resistance R, as shown in the figure below. The energy stored in the capacitor decreases with time as the capacitor discharges. After how many time constants is this stored energy one-third its initial value?

A) 0.549τ
B) 0.693τ
C) 0.346τ
D) 0.805τ
E) 2.197τ



9. At room temperature, what is the strength of the electric field in a copper wire (diameter 2.05 mm) that is needed to cause a 2.45 A current to flow? Use the resistivity at room temperature for copper $\rho = 1.72\times10^{-8}$ Ω·m.

A) 2.55×10^{-2} V/m
B) 1.28×10^{-2} V/m
C) 5.10×10^{-2} V/m
D) 1.28×10^{-4} V/m
E) 1.28×10^{2} V/m

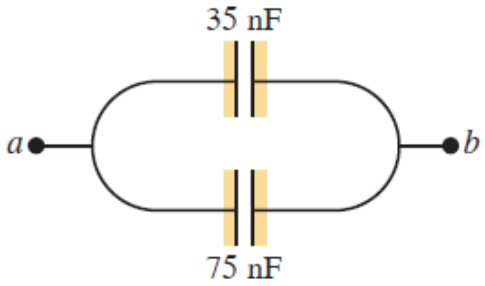
Practice Exam

10. A parallel plate capacitor with capacitance C = 11.3 μF is charged fully by a 48 volt battery, which is then disconnected. The space between the plates is now filled with a slab of certain dielectric with dielectric constant κ=9.6 . What is the magnitude of the final potential difference across the plates?

A) 1 V
B) 2 V
C) 3 V
D) 4 V
E) 5 V

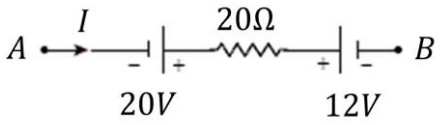
11. For the capacitor network shown in figure, the potential difference across *ab* is 220 V. Find the total energy stored in this network.

A) 1.5 mJ
B) 0.45 mJ
C) 4.8 mJ
D) 2.7 mJ
E) 0.9 mJ



12. What is the potential difference $V_B - V_A$ when the I = 1.5 A in the circuit segment below?

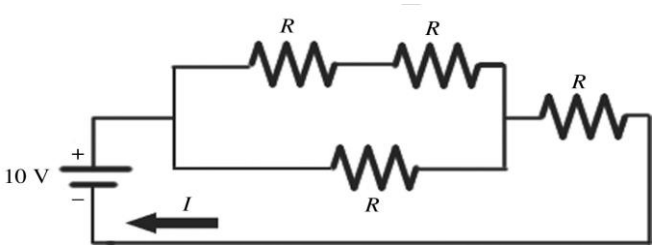
A) $+22V$
B) $-22V$
C) $-38V$
D) $+38V$
E) $+2.0V$



Practice Exam

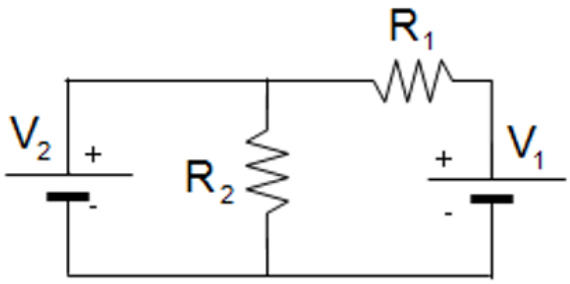
13. When four identical resistors are connected to an ideal battery of voltage V = 10 V as shown in the figure, the current I is equal to 0.20 A. What is the value of the resistance R of the resistors?

A) 20 Ω
B) 40 Ω
C) 30 Ω
D) 50 Ω
E) 60 Ω



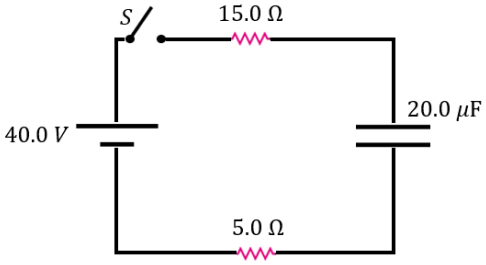
14. In the figure below the battery V_1 on the right is 10 volt and the battery V_2 on the left is 20 volt. The resistances are R_1=15.0 Ohm and R_2=30.0 Ohm. Find the current (in amps) through the battery V_2.

A) 0.23
B) 0.42
C) 0.65
D) 0.86
E) 1.33



15. For the circuit shown in the figure, the capacitor is initially uncharged, the connecting leads have no resistance, the battery has no appreciable internal resistance. Determine the time it takes for the capacitor to be charged to 75% of its capacity? (Hint: first find the equivalent resistance)

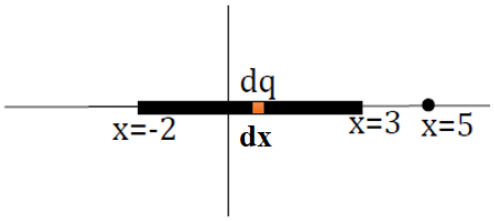
A) 2.55×10^{-2} s
B) 1.28×10^{-2} s
C) 5.10×10^{-2} s
D) 5.6×10^{-4} s
E) 1.28×10^{2} s



Practice Exam

16. A charge of 10 nC is distributed uniformly along the x axis from $x = -2m$ to $x = 3m$. Which of the following integrals is correct for the electric potential in volt (relative to infinity) at the point $x = +5$ on the x axis?

A) $\int_{-2}^{3} \frac{90dx}{x+5}$
B) $\int_{-2}^{3} \frac{18dx}{5-x}$
C) $\int_{-2}^{3} \frac{90dx}{x}$
D) $\int_{-2}^{3} \frac{90dx}{5-x}$
E) $\int_{-2}^{3} \frac{18dx}{x}$



Answer Key

1. B
2. D
3. B
4. E
5. B
6. E
7. E
8. A
9. B
10. E
11. D
12. B
13. C
14. E
15. D
16. B