You measure the capacitance C_1 of a capacitor by doing the following: First connect capacitors C_1 and C_2 in series to a power supply that provides a voltage V that can be varied. The capacitance of C_2 is known to be 3.00 μF. Then vary the applied voltage V, and for each value of V measure the voltage V_2 across C_2. After plotting your data as V_2 versus V, you find that the data fall close to a straight line that has slope 0.650.

Part A

What is the capacitance C_1?

Express your answer with the appropriate units.

C_1 = Value Units

Submit Request Answer

Review | Constants

For the system of capacitors shown in (Figure 1), a potential difference of 25.0 V is maintained across ab.

For related problem-solving tips and strategies, you may want to view a Video Tutor Solution of Capacitors in series and in parallel.

Part A

What is the equivalent capacitance of this system between a and b?

Express your answer in nanofarads.

C = nF

Submit Request Answer

Part B

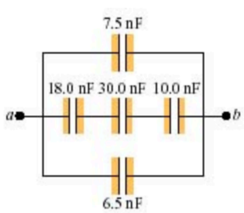
How much charge is stored by this system?

Express your answer in nanocoulombs.

Q = nC

Figure

1 of 1



Part C

How much charge does the 6.50 nF capacitor store?

Express your answer in nanocoulombs.

Q = nC

Submit Request Answer

Part D

What is the potential difference across the 7.50 nF capacitor?

Express your answer in volts.

V = V

Submit Request Answer

Problem 24.64

Review | Constants

A parallel-plate capacitor is made from two plates 12.0 cm on each side and 4.50 mm apart. Half of the space between these plates contains only air, but the other half is filled with Plexiglas of dielectric constant 3.40 (Figure 1). An 18.0 V battery is connected across the plates.

Figure

1 of 1

Part A

What is the capacitance of this combination?

Express your answer with the appropriate units.

C = Value Units

Submit Request Answer

Part B

How much energy is stored in the capacitor?

Express your answer with the appropriate units.

U = Value Units

Part C

If we remove the Plexiglas, but change nothing else, how much energy will be stored in the capacitor?

Express your answer with the appropriate units.

U = Value Units

Submit Request Answer

Exercise 25.11

A metal wire has a circular cross section with radius 0.800 mm. You measure the resistivity of the wire in the following way: you connect one end of the wire to one terminal of a battery that has emf 12.0 V and negligible internal resistance. To the other terminal of the battery you connect a point along the wire so that the length of wire between the battery terminals is d. You measure the current in the wire as a function of d. The currents are small, so the temperature change of the wire is very small.

Review | Constants

Part A

You plot your results as I versus $1/d$ and find that the data lie close to a straight line that has slope 600 $\mathrm{A \cdot m}$. What is the resistivity of the material of which the wire is made?

Express your answer in ohm-meters.

ρ = $\Omega \cdot \mathrm{m}$

Submit Request Answer

Provide Feedback

Next

Exercise 25.20 - Enhanced - with Feedback

Review | Constants

Part A

What diameter must a copper wire have if its resistance is to be the same as that of an equal length of aluminum wire with diameter 2.34 mm?

Express your answer with the appropriate units.

d = Value Units

Submit Request Answer

Provide Feedback

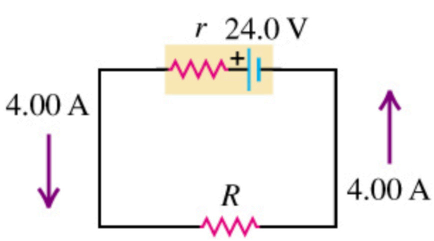
Next

Review | Constants

Consider the circuit shown in the figure. The terminal voltage of the 24.0 V battery is 21.2 V. The current in the circuit is 4.00 A. (Figure 1)

Figure

1 of 1



Part A

What is the internal resistance r of the battery?

Express your answer with the appropriate units.

r = Value Units

Submit Request Answer

Part B

What is the resistance R of the circuit resistor?

Express your answer with the appropriate units.

R = Value Units

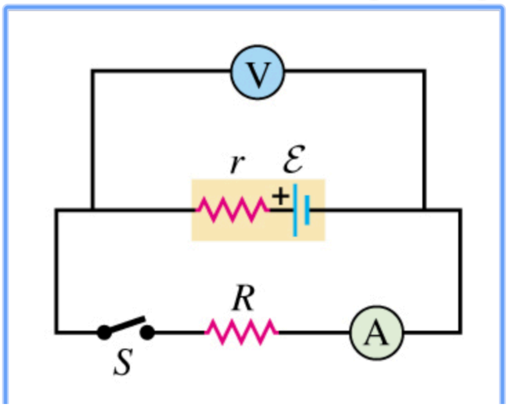
Review | Constants

When switch S in (Figure 1) is open, the voltmeter V of the battery reads 3.08 V. When the switch is closed, the voltmeter reading drops to 2.97 V, and the ammeter A reads 1.68 A. Assume that the two meters are ideal, so they don't affect the circuit.

For related problemsolving tips and strategies, you may want to view a Video Tutor Solution of A source with a short circuit.

Figure

1 of 1



Part A

Find the emf.

Express your answer in volts.

$\mathcal{E}$ = V

Submit Request Answer

Part B

Find the internal resistance of the battery.

Express your answer in ohms.

r = Ω

Part C

Find the circuit resistance R.

Express your answer in ohms.

R = Ω

Submit

Request Answer

Exercise 25.42 - Enhanced - with Feedback

Complete

The battery for a certain cell phone is rated at 3.70 V. According to the manufacturer it can produce 3.10×10^4 J of electrical energy, enough for 7.00 h of operation, before needing to be recharged.

Review | Constants

Part A

Find the average current that this cell phone draws when turned on.

Express your answer with the appropriate units.

I = 0.332 A

Exercise 25.49 - Enhanced - with Feedback

Pure silicon contains approximately 1.0×10^{16} free electrons per cubic meter.

Review | Constants

Referring to Table 25.1 in the textbook, calculate the mean free time τ for silicon at room temperature.

Express your answer with the appropriate units.

τ = Value Units

Submit Request Answer

Part B

Your answer in the previous part is much greater than the mean free time for copper given in the textbook. Why, then, does pure silicon have such a high resistivity compared to copper?

- The number of free electrons in copper is much smaller than in pure silicon. Thus, the density of free electrons in silicon is larger. A smaller density of current carriers means a higher resistivity.
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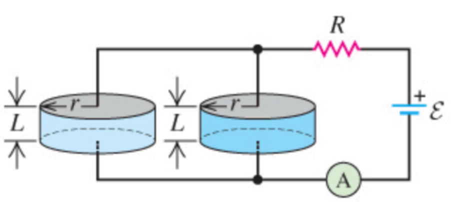
Review | Constants

Two cylindrical cans with insulating sides and conducting end caps are filled with water, attached to the circuitry shown in (Figure 1), and used to determine salinity levels. The cans are identical, with radius $r = 5.10$ cm and length $L = 3.50$ cm. The battery supplies a potential of 10.0 V, has a negligible internal resistance, and is connected in series with a resistor $R = 16.0\ \Omega$. The left cylinder is filled with pure distilled water, which has infinite resistivity. The right cylinder is filled with a saltwater solution. It is known that the resistivity of the saltwater solution is determined by the relationship $\rho = (s_0/s)\ \Omega \cdot \mathrm{m}$, where s is the salinity in parts per thousand (ppt) and $s_0 = 6.30$ ppt.

Figure

1 of 1



Part A

The ammeter registers a current of 484 mA. What is the salinity of the saltwater solution?

Express your answer in parts per thousand to three significant figures.

s = ppt

Submit Request Answer

Part B

The left cylinder acts as a capacitor. Usethe equation $C = \epsilon \frac{A}{d}$ for its capacitance. How much charge is present on its upper plate? Note that pure water has a dielectric constant of 80.4.

Express your answer to three significant figures and include the appropriate units.

q = Value Units

Part C

At what rate is energy dissipated by the saltwater?

Express your answer to three significant figures and include the appropriate units.

P = Value Units

Submit Request Answer

Part D

For what salinity level would the 16.0 Ω resistor dissipate half the power supplied by the battery?

Express your answer in parts per thousand.

s = ppt

Submit Request Answer