

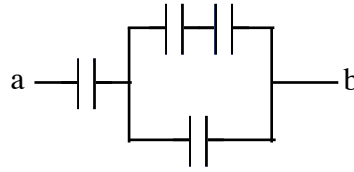
HOMEWORK #2

- *This homework is due by the beginning of class on September 24. It covers material in chapters 17 and 18.*
- *You will need a calculator and lots of scrap paper.*
- *Answers are to be recorded on a scantron that you will turn in. You may keep the questions (i.e., these sheets).*
- *You may (should) use your book. You may even work with other students. However, you should not copy the answers of other students. Since the exams are multiple choice, the homeworks are also exam prep, and so you need to be able to work these problems yourself. If you do not apply yourself to the homework and do your own work, you are not likely to perform well on the exams.*

1. The unit of capacitance, the farad, is dimensionally equivalent to which of the following?
 - a. V/C
 - b. V·C
 - c. J/V
 - d. C/V
2. A parallel-plate capacitor has a capacitance of $20\ \mu\text{F}$. What potential difference across the plates is required to store $7.2 \times 10^{-4}\ \text{C}$ on this capacitor?
 - a. 36 V
 - b. $2.2 \times 10^{-2}\ \text{V}$
 - c. $1.4 \times 10^{-8}\ \text{V}$
 - d. 68 V
3. Three capacitors of 1.0, 1.5, and $2.0\ \mu\text{F}$ are connected in series. Find the combined capacitance.
 - a. $4.5\ \mu\text{F}$
 - b. $4.0\ \mu\text{F}$
 - c. $2.2\ \mu\text{F}$
 - d. $0.46\ \mu\text{F}$

4. What is the equivalent capacitance between points a and b? All capacitors are $1.0\ \mu\text{F}$.

- a. $4.0\ \mu\text{F}$
- b. $1.7\ \mu\text{F}$
- c. $0.60\ \mu\text{F}$
- d. $0.25\ \mu\text{F}$



5. A $0.25\text{-}\mu\text{F}$ capacitor is connected to a 400-V battery. What potential energy is stored in the capacitor?

- a. $1.2 \times 10^{-12}\ \text{J}$
- b. $1.0 \times 10^{-4}\ \text{J}$
- c. $0.040\ \text{J}$
- d. $0.020\ \text{J}$

6. A pair of parallel plates, forming a capacitor, are charged. The plates are pulled apart to double the original separation, the charges on the plates remaining the same. What is the ratio of the final energy stored to the original energy stored?

- a. 4
- b. 2
- c. 1
- d. $1/2$

7. A wire carries a steady current of $0.1\ \text{A}$ over a period of $20\ \text{s}$. What total charge passes through the wire in this time interval?

- a. $200\ \text{C}$
- b. $20\ \text{C}$
- c. $2\ \text{C}$
- d. $0.005\ \text{C}$

8. If a metallic wire of cross sectional area $3.0 \times 10^{-6}\ \text{m}^2$ carries a current of $6.0\ \text{A}$ and has a mobile charge density of $4.24 \times 10^{28}\ \text{carriers/m}^3$, what is the average drift velocity of the mobile charge carriers? (charge value = $1.6 \times 10^{-19}\ \text{C}$)

- a. $3.4 \times 10^3\ \text{m/s}$
- b. $1.7 \times 10^3\ \text{m/s}$
- c. $1.5 \times 10^{-4}\ \text{m/s}$
- d. $2.9 \times 10^{-4}\ \text{m/s}$

9. The unit of electric resistance, the ohm, is equivalent to which of the following?

- a. V/A
- b. $\text{V}\cdot\text{m}$
- c. A/s
- d. A/m

10. Replacing a wire resistor with another of the same material and length but with three times the diameter will have the effect of changing the resistance by what factor?

- a. $1/3$
- b. $1/9$
- c. 3
- d. 9

11. Number 10 copper wire (radius = 1.3 mm) is commonly used for electrical installations in homes. What is the voltage drop in 40 m of #10 copper wire if it carries a current of 10 A? (The resistivity of copper is $1.7 \times 10^{-8} \Omega \cdot \text{m}$.)

- a. 1.3 V
- b. 0.77 V
- c. 0.50 V
- d. 0.13 V

12. If a 500-W heater carries a current of 4.00 A, what is the resistance of the heating element?

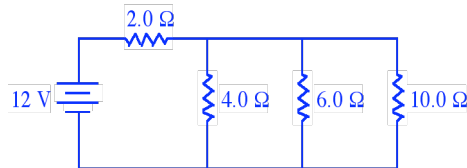
- a. 85.7Ω
- b. 42.8Ω
- c. 31.3Ω
- d. 11.2Ω

13. The internal resistances of an ideal voltmeter and an ideal ammeter are respectively (*ideal* meaning the behavior of the system is not changed when using the meter):

- a. zero and zero.
- b. infinite and infinite.
- c. zero and infinite.
- d. infinite and zero.

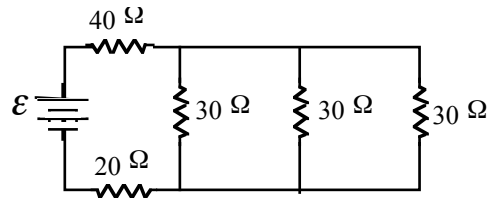
14. Three resistors connected in parallel have individual values of 4.0, 6.0 and 10.0Ω , respectively. If this combination is connected in series with a 12-V battery and a $2.0\text{-}\Omega$ resistor, what is the current in the $10\text{-}\Omega$ resistor?

- a. 0.59 A
- b. 1.0 A
- c. 11 A
- d. 16 A



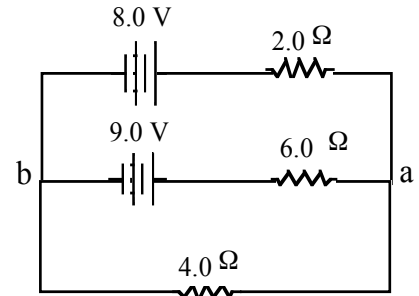
15. If $\mathcal{E} = 20 \text{ V}$, at what rate is thermal energy being generated in the $20\text{-}\Omega$ resistor?

- a. 6.5 W
- b. 1.6 W
- c. 15 W
- d. 26 W



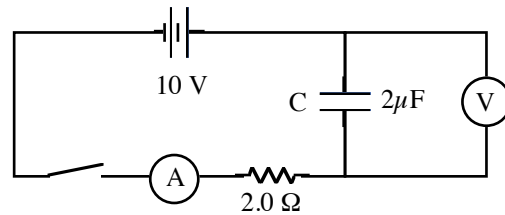
16. What is the current through the $2\text{-}\Omega$ resistor?

- a. 1.0 A
- b. 0.50 A
- c. 1.5 A
- d. 2.0 A



17. A 10-V -emf battery is connected in series with the following: a $2\text{-}\mu\text{F}$ capacitor, a $2\text{-}\Omega$ resistor, an ammeter, and a switch, initially open; a voltmeter is connected in parallel across the capacitor. At the instant the switch is closed, what are the current and capacitor voltage readings, respectively?

- a. zero A, 10 V
- b. zero A, zero V
- c. 5 A , zero V
- d. 5 A , 10 V



18. A 1 000-V battery, a $3\text{ 000-}\Omega$ resistor and a $0.50\text{-}\mu\text{F}$ capacitor are connected in series with a switch. The time constant for such a circuit, designated by the Greek letter, τ , is defined as the time required to charge the capacitor to 63% of its capacity after the switch is closed. What is the value of τ for this circuit?

- a. $6.0 \times 10^9\text{ s}$
- b. $1.7 \times 10^{-10}\text{ s}$
- c. $1.7 \times 10^{-7}\text{ s}$
- d. $1.5 \times 10^{-3}\text{ s}$

