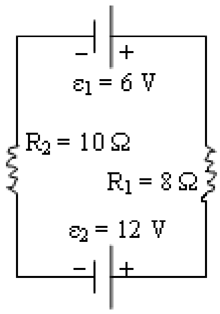
KFUPM – Physics Department

PHYS102 – Chapter 27 (Instructor: Dr. Al–Shukri)

Q1. A single loop circuit contains two external resistors and two emf sources as shown in the **Figure**. Assume the emf sources are ideal, what is the power dissipation across resistor R_1.



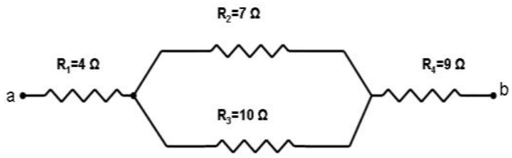
a. 0.9 W b. 0.7 W c. 18 W
d. 0.5 W e. 8.0 W

Q2. A capacitor of capacitance 5.0 μF is discharging through a 4.0 MΩ resistor. At what time will the energy stored in the capacitor be half of its initial value?

a. 7 s b. 9 s c. 5 s d. 8 s e. 4 s

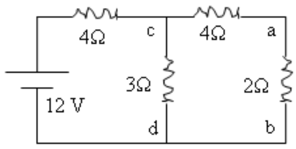
Q3. Four resistors are connected as shown in the **Figure**. What is the current through R_1, when a potential difference of 30.0 V is applied between points a and b?

a. 1.75 A
b. 1.50 A
c. 1.65 A
d. 2.75 A
e. 2.00 A

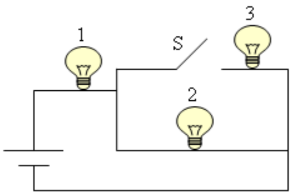


Q4. In the **Figure**, if $V_a - V_b = 3.2$ V, what is $V_d - V_c$?

a. –9.6 V b. +9.6 V
c. +3.6 V d. –3.6 V
e. –12 V

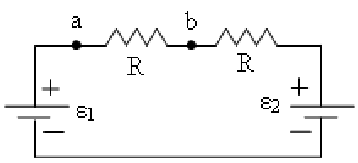


Q5. The **Figure** shows 3 identical light bulbs connected to a battery. What happens to the power of light bulb 1 when the switch S is closed?



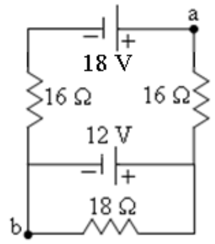
a. The power increases.
b. The power will increase momentarily then returns to its initial value.
c. The power will decrease momentarily then returns to its previous value.
d. The power remains the same.
e. The power decreases.

Q6. The **Figure** shows two resistors, each of the resistance R, connected to two ideal batteries of emf ε_1 and ε_2 ($\varepsilon_1 > \varepsilon_2$). The potential difference $V_a - V_b$ is equal to $\varepsilon_1/5$. What is the ratio $\varepsilon_2/\varepsilon_1$?



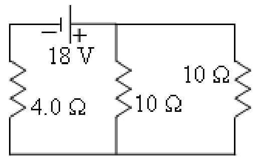
a. 3/5 b. 2/5 c. 1/5 d. 4/5 e. 1

Q7. Three resistors and two batteries are connected as shown in the **Figure**. What is the potential difference $V_a - V_b$?



a. 15 V b. 5 V c. 12 V
d. -12 V e. 0 V

Q8. Determine the power dissipated by the 4.0 Ω resistor in the **Figure**.



a. 16 W b. 4.0 W c. 2.0 W
d. 8.0 W e. 18 W

Q9. A capacitor of capacitance C takes 2 s to reach 63 % of its maximum charge when connected in series to a resistance R and a battery of emf ε. How long does it take for this capacitor to reach 95 % of its maximum charge (from zero initial charge)?

a. 6 s b. 7 s c. 5 s d. 3 s e. 4 s

Q10. Two resistors have resistances R_1 and R_2, such that $R_1 < R_2$. If R_1 and R_2 connected in …

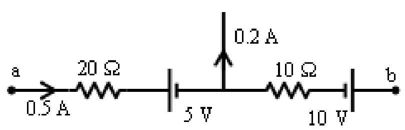
a. parallel, then $R_{eq} < R_1$ and $R_{eq} < R_2$
b. parallel, then $R_{eq} > R_1$ and $R_{eq} < R_2$
c. parallel, then $R_{eq} > R_1$ and $R_{eq} > R_2$
d. series, then $R_{eq} > R_1$ and $R_{eq} < R_2$
e. series, then $R_{eq} < R_1$ and $R_{eq} < R_2$

Q11. A battery is connected across a series combination of two identical resistors. If the potential difference across the terminals is V and the current in the battery is i, then

a. the potential difference across each resistor is V/2 and the current in each resistor is i.
b. the potential difference across each resistor is V and the current in each resistor is i.
c. the potential difference across each resistor is V/2 and the current in each resistor is i/2.
d. the potential difference across each resistor is V and the current in each resistor is i/2.
e. the potential difference across each resistor is V and the current in each resistor is 2×i.

Q12. What is the electric potential difference $V_b - V_a$?

a. –8 V b. –10 V
c. +8 V d. +10 V
e. +18 V



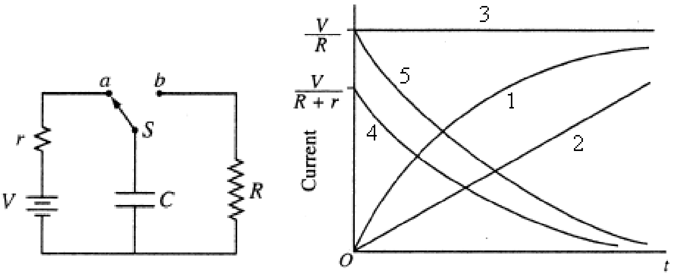
Q13. A 15 Ω resistor is connected in parallel with 30 Ω resistor. The combination is connected to a 10 V battery. Then the power generated in the 15 Ω resistor is:

a. 6.7 W b. 3.3 W c. 5.9 W
d. 10 W e. 15 W

Q14. The emf of a battery is equal to its terminal potential difference

a. only when there is no current in the battery.
b. under all conditions.
c. only when the battery is being charged.
d. only when a large current is in the battery.
e. only when a small current is in the battery.

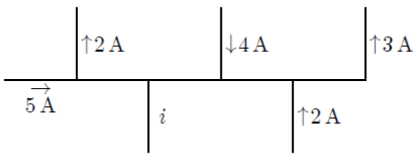
Q15. The capacitor shown in the figure is fully charged by connecting switch S to contact *a*. If switch



S is thrown to contact *b* at time t=0, which of the curves represents the magnitude of the current through the resistor R as a function of time?

a. 5 b. 4 c. 3 d. 2 e. 1

Q16. A portion of a circuit is shown, with the values of the currents given for some branches. What is the direction and value of the current i?



a. 6.0 A, down b. 6.0 A, up c. 2.0 A up
d. 2.0 A, down e. 3.0 A. up

Q17. Nine identical wires, each of diameter d and length L, are connected in parallel. The combination has the same resistance as a single similar wire of length L but whose diameter is:

a. 3d b. 9d c. d/3 d. d/9 e. d/81

Q18. Resistances of 2.0 Ω, 4.0 Ω, and 6.0 Ω and a 24-V emf device are all in parallel. The current in the 2.0 Ω resistor is:

a. 12 A b. 4.0 A c. 2.4 A
d. 2.0 A e. 0.50 A

Q19. Two identical batteries, each with an emf of 18V and an internal resistance of 1.0 Ω are wired in parallel by connecting their positive terminals together and connecting their negative terminals together. The combination is then wired across a 4.0 Ω resistor. The current in each battery is:

a. 2.0 A b. 1.0 A c. 4.0 A d. 3.6 A e. 7.2 A

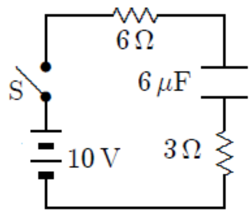
Q20. A 120-V power line is protected by a 10-A fuse. What is the maximum number of “120 V, 100 W" light bulbs that can be operated at full brightness from this line?

a. 12 b. 10 c. 8 d. 6 e. 4

Q21. A certain capacitor, in series with a 720 Ω resistor, is being charged. At the end of 10 ms its charge is half the final value. The capacitance is about:

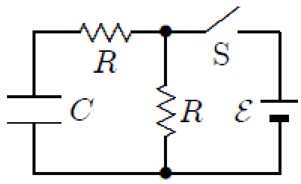
a. 20 μF b. 14 μF c. 9.6 μF
d. 7.2 F e. 10 F

Q22. In the circuit shown, the capacitor is initially uncharged. At time t = 0, switch S is closed. If τ denotes the time constant, the approximate current through the 3 Ω resistor when t = τ /10 is:



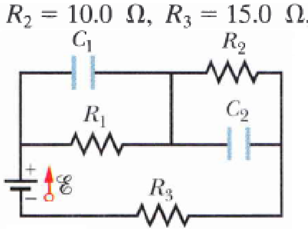
a. 1.0 A b. 0.50 A
c. 0.75 A d. 0.38 A
e. 1.5 A

Q23. In the circuit shown, both resistors have the same value R. Suppose switch S is initially closed. When it is then opened, the circuit has a time constant τ_a. Conversely, suppose S is initially open. When it is then closed, the circuit has a time constant τ_b. The ratio τ_a/τ_b is:



a. 2.0 b. 1.0 c. 0.5
d. 0.67 e. 1.5

Q24. InThe Figure, $R_1 = 5.00\ \Omega$, $R_2 = 10.0\ \Omega$, $R_3 = 15.0\ \Omega$, $C_1 = 5.00\ \mu F$, $C_2 = 10.0\ \mu F$, and the ideal battery has emf $\mathcal{E} = 20.0$ V. Assuming that the circuit is in the steady state, what is the total energy stored in the two capacitors?



a. 2.50×10^{-4} J. b. 5.00×10^{-3} J.
c. 2.20×10^{-4} J. d. 5.50×10^{-3} J.
e. 2.00×10^{-4} J.