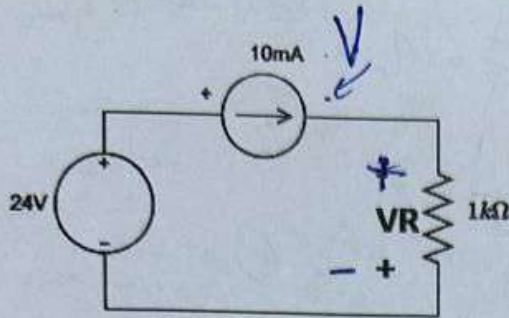


- Answer Questions (1-5).
- Choose the correct answer for each question.

$$10^1 \times 10^{-3} = 10^{-2}$$

$$1.0$$

$$0.01$$



$$V_R = \frac{24 \times 10^3}{(1 \times 10^3 + 1 \times 10^{-2})}$$

$$V_R = \frac{24 \times 10^3}{1000.01}$$

Figure 1: Single-loop circuit for Questions 1-5.

$$V_R = 24$$

Q1. Find V_R in Fig. 1.

- (A) +10V (B) -10V (C) +24V (D) -24V (E) 0V

Q2. Power in 1 kΩ:

- (A) 100mW (B) -100mW (C) 240mW (D) 10mW (E) -10mW

$$P_{1k\Omega} = \frac{(V_R)^2}{1 \times 10^3}$$

$$P_{1k\Omega} = \frac{576}{1 \times 10^3}$$

Q3. Voltage across 10mA:

- (A) +14V (B) -14V (C) +34V (D) -34V (E) +10V

kill source
24V

$$V = IR = 0.01 \times 1000 = 10V$$

$$P_{10mA} = 0.576 W$$

$$P_{10mA} = I^2 R$$

Q4. Power of 24V:

- (A) +240mW (B) -240mW (C) +100mW (D) -100mW (E) +140mW

↑ deliver

$$P_{24V} =$$

Q5. Power of 10mA:

- (A) +140mW (B) -140mW (C) +240mW (D) -240mW (E) +100mW

Absorb

source
P = IV
0.01 * 10 = 0.1W

~~$$+24 + 0.01(R) = 24 = 0$$~~

~~$$V_{10mA} = 24 \times 2400$$~~

~~$$-24 + 2400$$~~

$$100 mW$$

$$P_{24V} = IV = 0.01 \times 24 = 0.24W = 240 mW$$

Use Figure 2 to answer questions (6-15)

Nodal

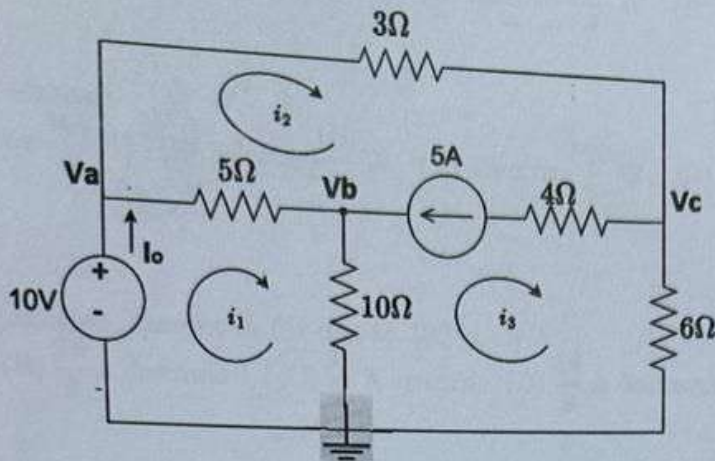


Figure 2: Circuit for Questions 6-15.

Q6. Power absorbed by 4Ω :

- (A) 20 W (B) 25 W (C) 100 W (D) 125 W (E) 200 W

Q7. Final nodal equation at b:

- (A) $3V_b - 70 = 0$ (B) $3V_b + 70 = 0$ (C) $2V_b - 70 = 0$ (D) $3V_b - 50 = 0$ (E) $V_b - 70 = 0$

Q8. Final nodal equation at c:

- (A) $3V_c + 10 = 0$ (B) $3V_c - 10 = 0$ (C) $2V_c + 10 = 0$ (D) $3V_c + 30 = 0$ (E) $V_c + 10 = 0$

Q9. Final supermesh equation (in terms of i_1, i_2):

- (A) $15i_1 - 24i_2 + 80 = 0$ (B) $15i_1 - 24i_2 - 80 = 0$ (C) $15i_1 + 24i_2 - 80 = 0$
 (D) $15i_1 - 8i_2 + 80 = 0$ (E) $5i_1 - 24i_2 + 80 = 0$

Q10. Determine I_0 :

- (A) $\frac{8}{3}$ A (B) $-\frac{8}{3}$ A (C) 5 A (D) $\frac{10}{3}$ A (E) $\frac{16}{9}$ A

Q11. The 5 A source:

- (A) absorbs $\frac{590}{3}$ W (B) delivers $\frac{590}{3}$ W (C) absorbs $\frac{160}{9}$ W (D) delivers $\frac{160}{9}$ W (E) delivers 233 W

$$P = IV = 5 * (V_c - V_b) = 5/$$

Q12. The 10 V source:

- (A) absorbs $\frac{160}{9}$ W (B) delivers $\frac{160}{9}$ W (C) absorbs $\frac{590}{3}$ W (D) delivers $\frac{590}{3}$ W (E) absorbs 100 W

$$I = (10)$$

Q13. By superposition, current in 6Ω due to 10 V only:

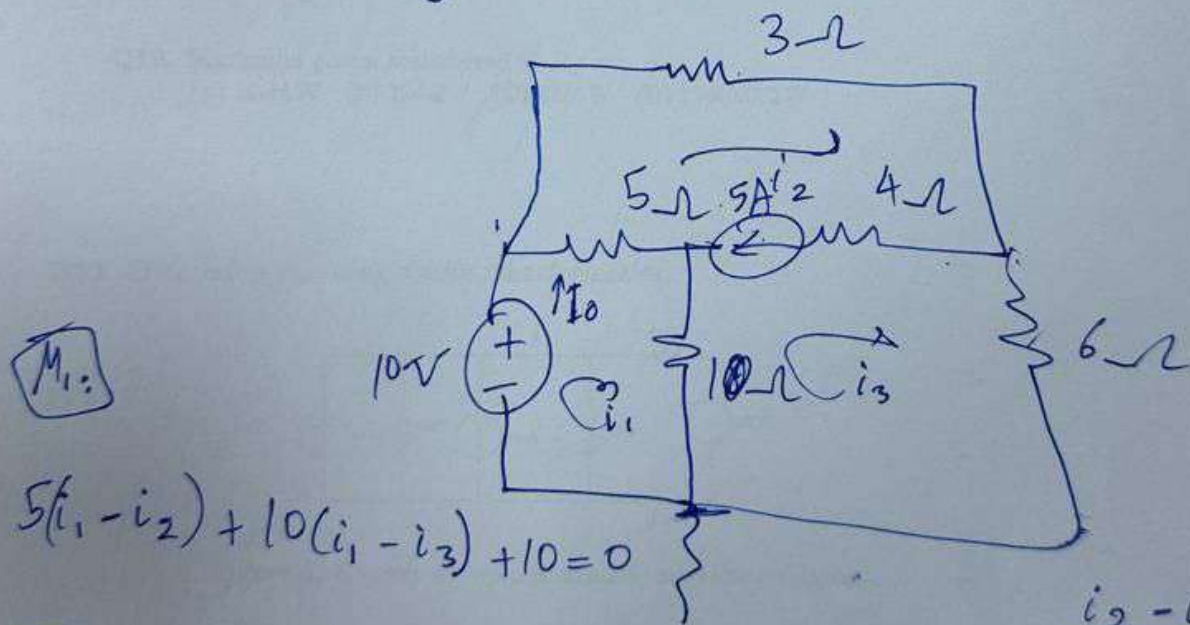
- (A) 0 A (B) $\frac{10}{9}$ A downward (C) $\frac{10}{9}$ A upward (D) $\frac{16}{9}$ A downward (E) $\frac{5}{3}$ A downward

Q14. By superposition, current in 6Ω due to 5 A only:

- (A) 0 A (B) $\frac{5}{3}$ A downward (C) $\frac{5}{3}$ A upward (D) $\frac{10}{9}$ A upward (E) $\frac{5}{9}$ A upward

Q15. Total current in 6Ω :

- (A) $\frac{10}{9}$ A downward (B) $\frac{5}{3}$ A upward (C) $\frac{5}{9}$ A upward (D) $\frac{5}{9}$ A downward (E) 0 A



$M_1:$

$$5(i_1 - i_2) + 10(i_1 - i_3) + 10 = 0$$

$M_2:$

$$3i_2 + 4(i_2 - i_3) + 5(i_2 - i_1) = 0$$

$$3i_2 + 20 + 5(i_2 - i_1) = 0$$

$M_3:$

$$-5(4) + 6i_3 + 10(i_3 - i_1) = 0$$

$$16i_3 - 4i_1 + 8i_2 \quad 9i_1 + 3i_2 + 6i_3 + 10 =$$

$$i_2 - i_3 = 5$$

Use Figure 3 to answer questions (16-19)

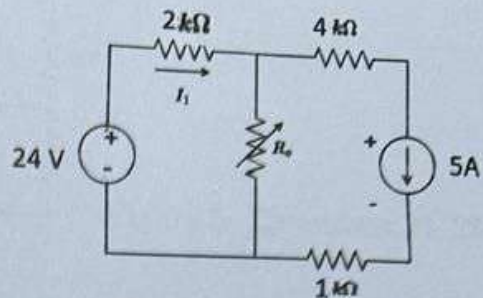


Figure 3: Questions 16-19.

Q16. With R_o removed, $V_{oc} = V_{th}$:
 (A) -9976 V (B) $+9976\text{ V}$ (C) -24 V (D) $+24\text{ V}$

Q17. Voltage across 5 A
 (A) -34976 V (B) $+34976\text{ V}$ (C) -29976 V (D) $+5000\text{ V}$

Q18. R_o for maximum power transfer:
 (A) $1\text{ k}\Omega$ (B) $2\text{ k}\Omega$ (C) $4\text{ k}\Omega$ (D) $6\text{ k}\Omega$

Q19. Maximum power transferred to R_o :
 (A) 12.44 W (B) 124.4 W (C) 1244 W (D) 12440.072 W

Q20. Determine V_{ab} using source transformation.

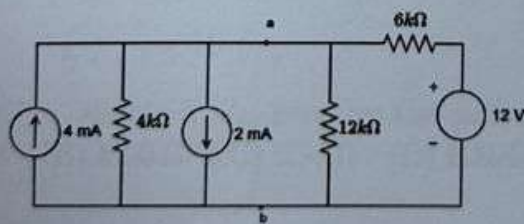


Figure 4: Circuit for source transformation analysis.

(A) 4 V (B) 6 V (C) 8 V (D) 10 V (E) 12 V

Use Figure 5 to answer questions (21-25)

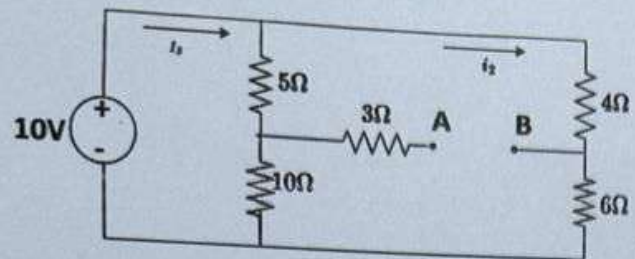
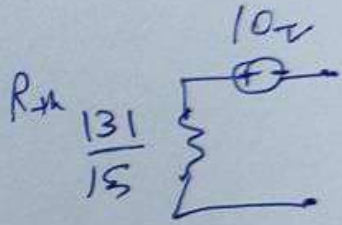


Figure 5: Questions 21-25.

- Q21. R_{eq} seen from A and B .
 (A) $\frac{19}{3} \Omega$ (B) $\frac{12}{5} \Omega$ (C) $\frac{131}{15} \Omega$ (D) 10Ω (E) $\frac{29}{5} \Omega$

Handwritten calculation: $6.33 + \frac{50}{15} + 3 + 2.4$

- Q22. Voltage across 10Ω :
 (A) 3.33 V (B) 6.00 V (C) 6.67 V (D) 10.0 V (E) 4.00 V



- Q23. Current in 4Ω :
 (A) 0.4 A (B) 0.6 A (C) 1.0 A (D) 1.5 A (E) 2.5 A

Handwritten calculation: $\frac{10 \times 10 \times \frac{150}{25}}{10 + 25}$

- Q24. $V_{AB} = V_A - V_B$:
 (A) $-\frac{2}{3} V$ (B) $+\frac{2}{3} V$ (C) $+6 V$ (D) $+\frac{20}{3} V$ (E) $0 V$

Handwritten calculation: $6i_2 + 10i_2$

- Q25. With A and B shorted, R_{eq} seen by the source:
 (A) 4.50Ω (B) 5.00Ω (C) 5.98Ω (D) 6.50Ω (E) 7.20Ω