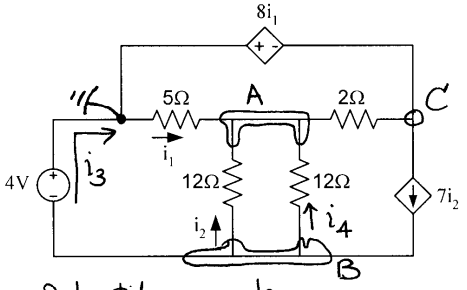
Quiz # 4
EE201-06 (032)

Name KEY
ID# _____

For the following circuit
(a) Identify all the nodes and write nodal equations
(b) Find the power absorbed or supplied by 4V source.



(a)

Step 1 Identify nodes. A, B and C

Step 2 Notice $V_C = -8i_1$

$V_B = -4$

Therefore no need to apply KCL at these nodes.

Step 3 Apply KCL at node A.

$$\frac{V_A}{5} + \frac{V_A - V_B}{12} + \frac{V_A - V_B}{12} + \frac{V_A - V_C}{2} = 0$$

$$\frac{V_A}{5} + \frac{V_A + 4}{12} + \frac{V_A + 4}{12} + \frac{V_A + 8i_1}{2} = 0$$

$$\Rightarrow \frac{V_A}{5} + \frac{V_A + 4}{6} + \frac{V_A + 8i_1}{2} = 0$$

$$\Rightarrow 6V_A + 5V_A + 20 + 10V_A + 80i_1 = 0$$

$$\Rightarrow 21V_A + 80i_1 = -20 \quad \text{—(1)}$$

Step 4 Write equation for the dependent variable i_1

$$i_1 = \frac{0 - V_A}{5} = -\frac{V_A}{5} \quad \text{—(2)}$$

Substitute in (1).

$$21V_A + 80\left(-\frac{V_A}{5}\right) = -20$$

$$21V_A - 16V_A = -20$$

$$\Rightarrow \boxed{V_A = -4V} \;\&\; \boxed{i_1 = \frac{4}{5} = 0.8A}$$

(b) To find power of 4V source, we need current i_3 through it.

We can find it by either applying KCL at ⏚ (ground) or at B node.

Lets apply KCL at node B

$$i_3 + i_2 + i_4 = 7i_2$$

$$i_3 + i_4 = 6i_2$$

$$\Rightarrow i_3 = 6i_2 - i_4$$

$$\Rightarrow i_3 = 6\left(\frac{V_B - V_A}{12}\right) - \left(\frac{V_B - V_A}{12}\right)$$

$$= 5\left(\frac{V_B - V_A}{12}\right)$$

$$= 5\left(\frac{-4 + 4}{12}\right) = 0$$

$$\Rightarrow i_3 = 0$$

$$P_{4V} = 0$$