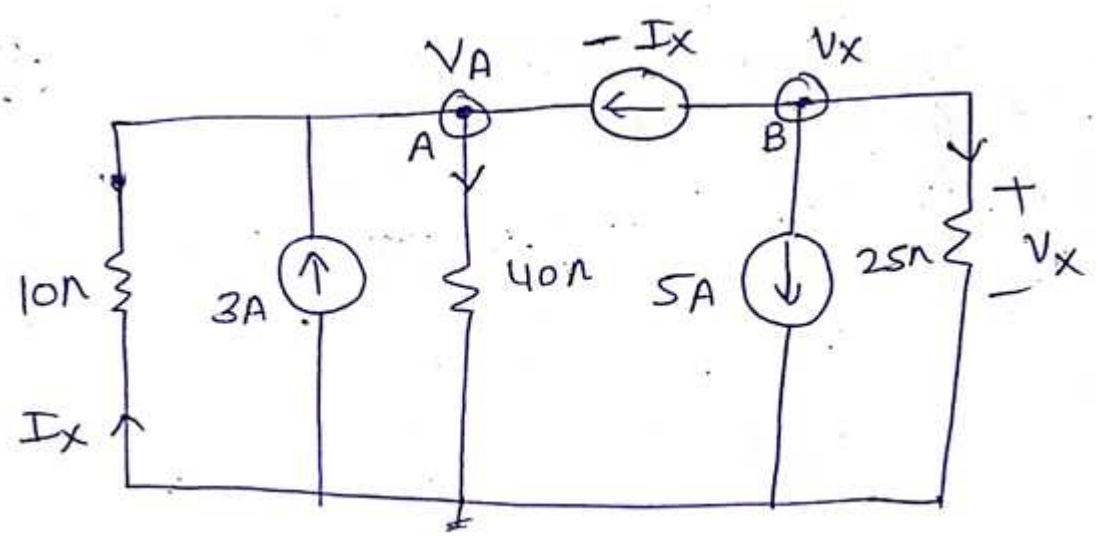
## Answer

(a)

The labelled circuit diagram is:




The KCL equation at node 'A':

$$\frac{V_A}{10} + \frac{V_A}{40} = 3 - I_X$$

$$4V_A + V_A = 120 - 40I_X$$

$$5V_A + 40I_X = 120 \ldots\ldots (1)$$

The voltage across 10-ohm resistor:

$$V_A = -10I_X \ldots. (2)$$

Put the value of equation (2) into (1)

$$5(-10I_X) + 40I_X = 120$$

$$-10I_X = 120$$

$$I_X = -12\ A$$

The KCL equation at node 'B':

$$-I_X + 5 + \frac{V_X}{25} = 0$$

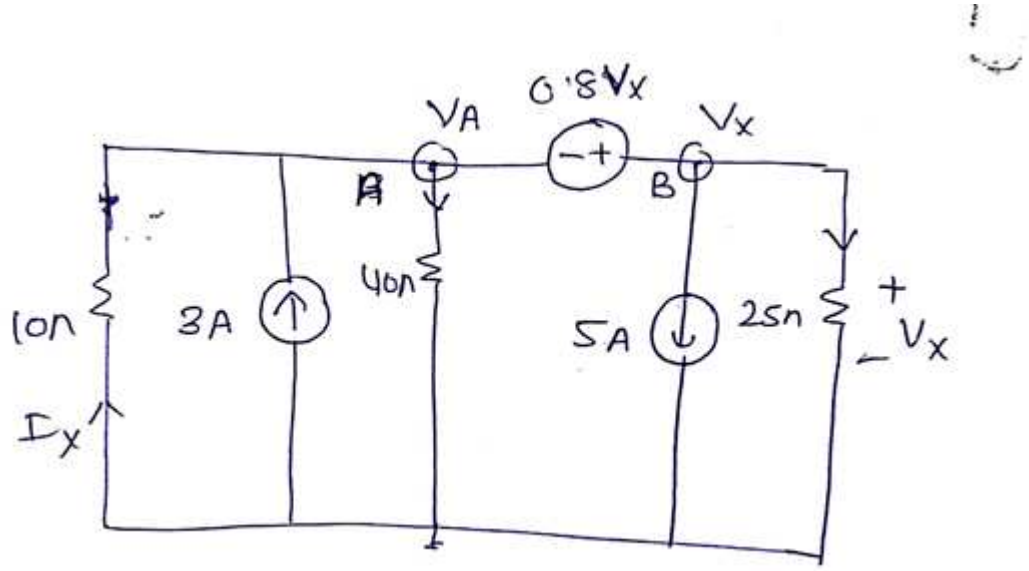
$$V_X = 25 \times (I_X - 5)$$

$$V_X = 25 \times (-12 - 5) = -425\ V$$

$$\boldsymbol{V_X = -425\ V}$$

(B)

The labelled circuit diagram is:




The KCL equation at node 'A':

$$\frac{V_A}{10} + \frac{V_A}{40} + \frac{V_X}{25} + 5 = 3$$

$$20V_A + 5V_A + 8V_X + 1000 = 600$$

$$25V_A + 8V_X = -400 \ldots\ldots (3)$$

The voltage difference between node 'A' and node 'B':

$$V_A + 0.8V_X = V_X$$

$$V_A = 0.2V_X \ldots\ldots\ldots\ldots (4)$$

Put the equation (4) into equation (3)

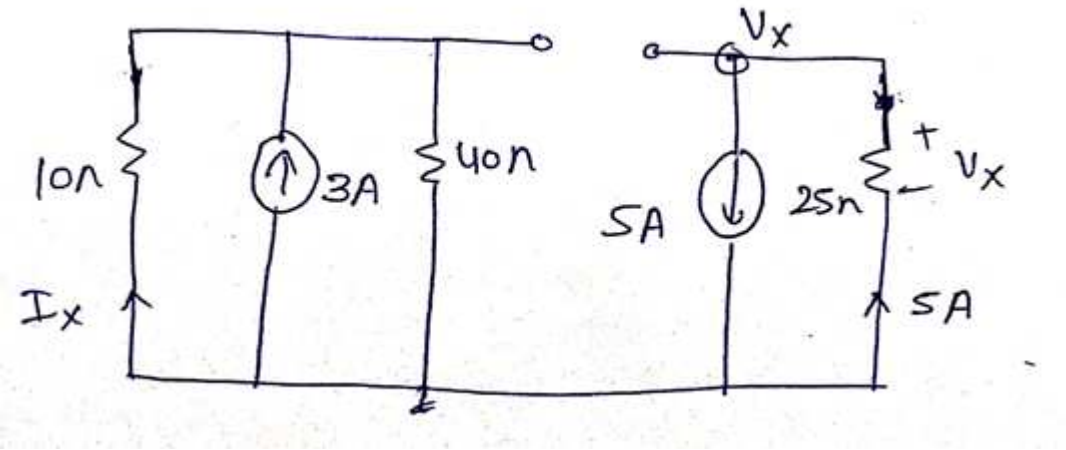
$$25(0.2V_X) + 8V_X = -400$$

$$V_X = \frac{-400}{13} = -30.77\,V$$

$$\boldsymbol{V_X = -30.77\,V}$$

(c)

When the element A is open circuit then The labelled circuit diagram is:



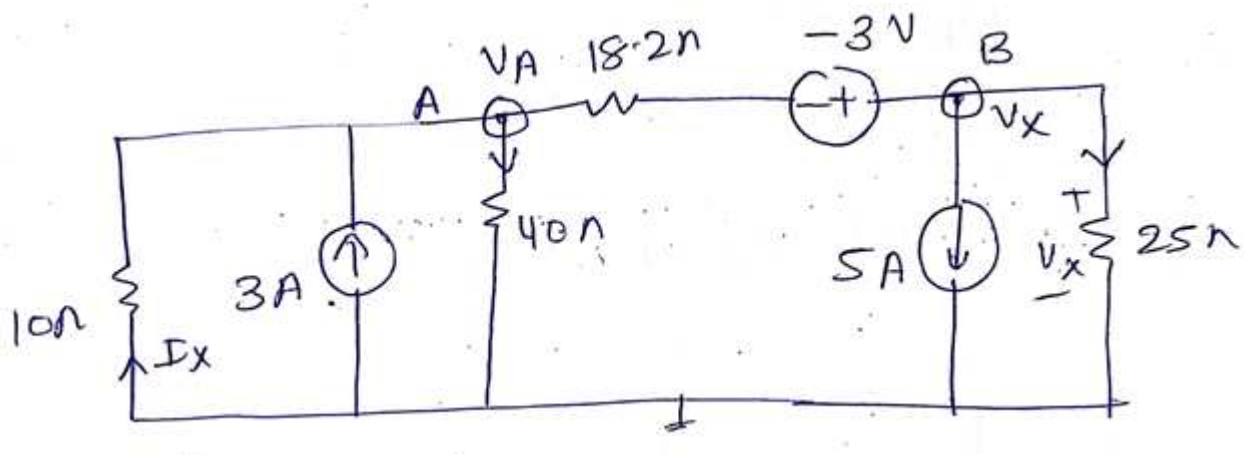

The voltage $V_X$ is:

$$V_X = 25 \times (-5) = -125\,V$$

$$\boldsymbol{V_X = -125\,V}$$

**(d)**

The labelled circuit diagram is:



The KCL equation at node 'A':

$$\frac{V_A}{10}+\frac{V_A}{40}+\frac{V_A+(-3)-V_X}{18.2}=3$$

$$\frac{V_A}{10}+\frac{V_A}{40}+\frac{V_A-3-V_X}{18.2}=3$$

$$0.1V_A+0.025V_A+0.055V_A-0.165-0.055V_X=3$$

$$0.18V_A-0.055V_X=3.165\ldots\ldots(5)$$

$$0.18V_A=3.165+0.055V_X$$

$$V_A=17.58+0.31V_X\ldots\ldots..(7)$$

The KCL equation at node 'B':

$$\frac{V_X}{25}+5+\frac{V_X-(-3)-V_A}{18.2}=0$$

$$0.04V_X+5+0.0549\,V_X+0.165-0.0549V_A=0$$

$$0.0949V_X-0.0549V_A=-5.165\ldots\ldots.(8)$$

Put the equation (7) into (8)

$$0.0949V_X-0.0549(17.58+0.31V_X)=-5.165$$

$$0.0949V_X-0.965-0.0170V_X=-5.165$$

$$0.0779V_X=-4.2$$

$$\boldsymbol{V_X=-53.92\,V}$$

**Likes: 2** **Dislikes: 0**