Electrical Science Tut-3

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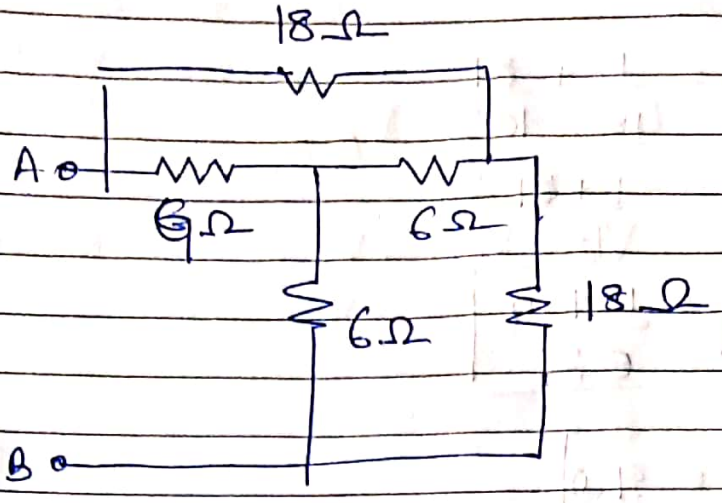
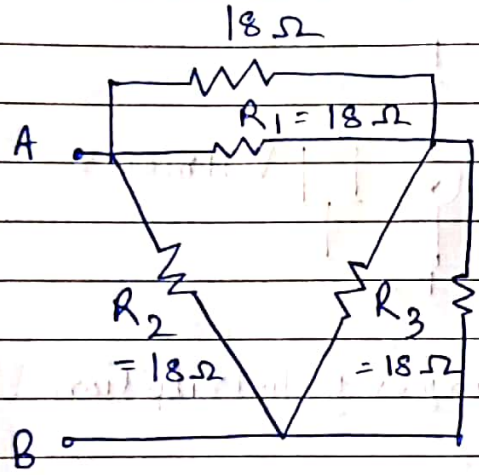
Q1.



Converting star to delta the 3 6Ω resistors



$$R_1 = \frac{6\times6 + 6\times6 + 6\times6}{6}$$

$$R_1 = 18\Omega$$

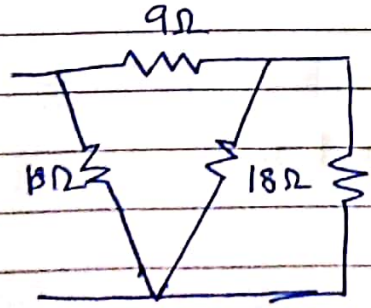
$$R_2 = \frac{6\times6 + 6\times6 + 6\times6}{6}$$

$$R_2 = 18\Omega$$

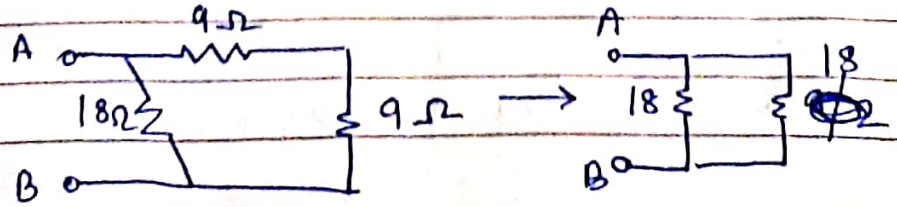
$$R_3 = \frac{6\times6 + 6\times6 + 6\times6}{6}$$

$$R_3 = 18\Omega$$

Top 2 18Ω resistors are in parallel.



The 2 18 Ohm resistors are parallel.



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Req

$$\frac{1}{Req} = \frac{1}{12} + \frac{1}{18}$$

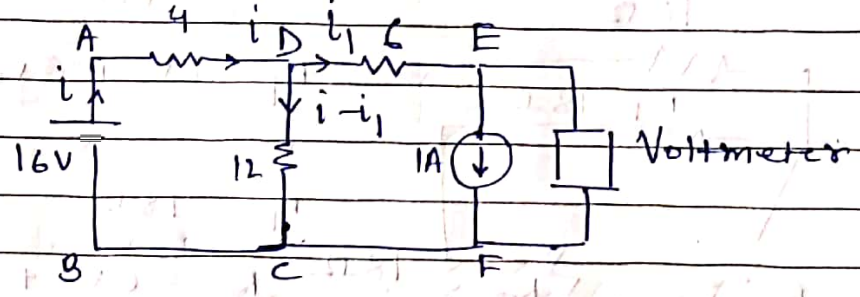
$$= \frac{1+1}{18}$$

$$= \frac{2}{18}$$

$$Req = \frac{18}{2}\ \Omega$$

$$\boxed{Req = 9\ \Omega}$$

Q2



From the above current distribution

$i_1 = 1A$

Now applying Kirchoff's laws in Loop ABCD

$$16 - 4i - 12i + 12i_1 = 0$$

$$16 = 16i - 12i_1$$

$$4 = 4i - 3i_1$$

$$4 = 4i - 3$$

$$i = 7/4$$

$$i - i_1 = 3/4\ A$$

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In the loop DcfE

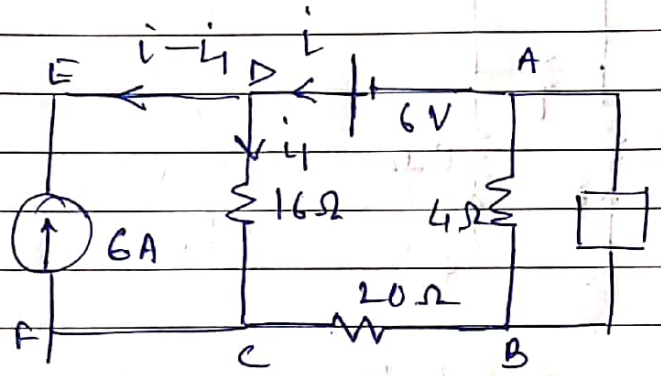
$$6 \times 1 - V_{EF} = 12\left(\frac{3}{4}\right)(i_2 - i_1)$$

$$6 - V_{EF} = 12 \times \frac{3}{4}$$

$$6 - V_{EF} = 9$$

$$\boxed{V_{EF} = -3V}$$

Q3.



From the above circuit diagram.

$$i - i_1 = -6$$

Applying Kirchoff's laws in Loop ABCD

$$6 - 16i_1 - 20i - 4i = 0$$

$$6 - 16i_1 - 24i = 0$$

$$3 = 8i_1 + 12i$$

$$i = i_1 - 6$$

$$3 = 8i_1 + 12i_1 - 72$$

$$72 + 3 = 20i_1$$

$$15\frac{75}{20} = i_1$$

$$4$$

$$i = \frac{15}{4} - 6 = -\frac{9}{4}$$

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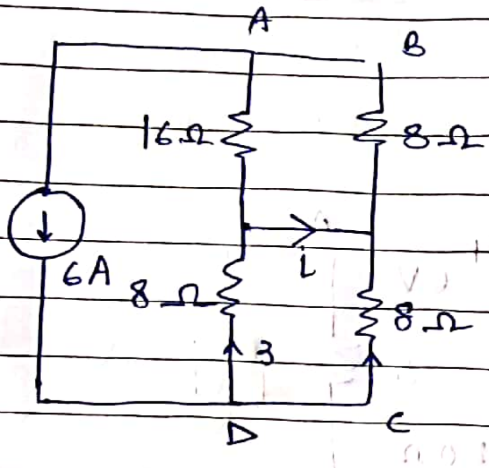
~~$V_B - V_A$~~

$$V_B - 4\left(-\frac{9}{4}\right) = V_A$$

$$\boxed{V_A - V_B = 9V}$$

Q4.



In ABCD:

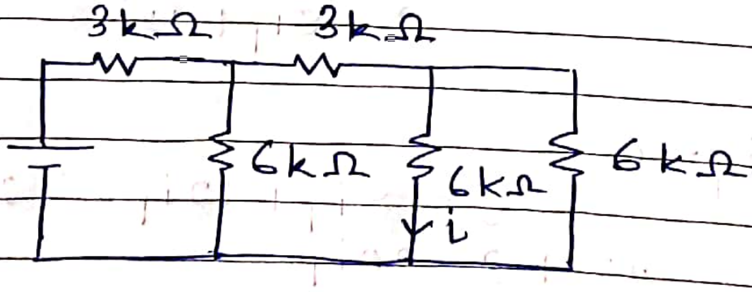
$$8(3+i) = 16(3-i)$$

$$3+i = 6-2i$$

$$3i = 3$$

$$\boxed{i = 1A}$$

Q5



~~$i = \frac{12}{6}$~~

$$i = \frac{12}{6} = 2mA$$

So current in i is

$\boxed{0.5mA}$

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