Assignment 1(Spring 2020)

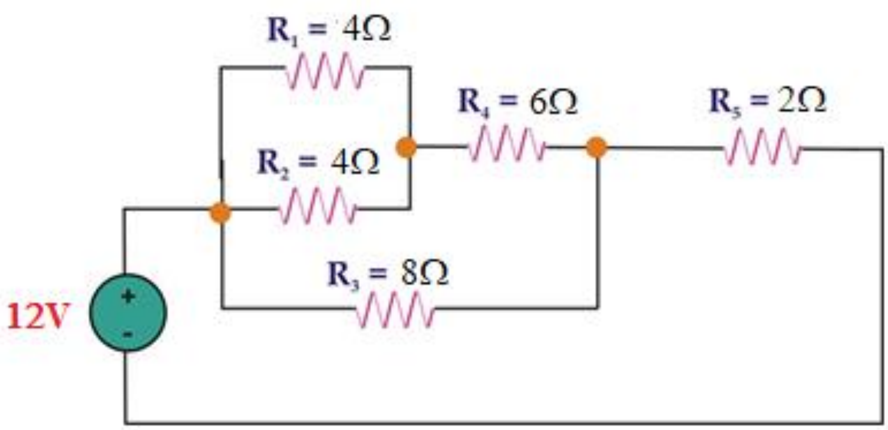
Circuit Theory (Phy301)

Marks: 25

Due Date: May 29, 2020

Q: 1:

For the given below circuit, Calculate the Equivalent resistance and current of the circuit.



Sol:

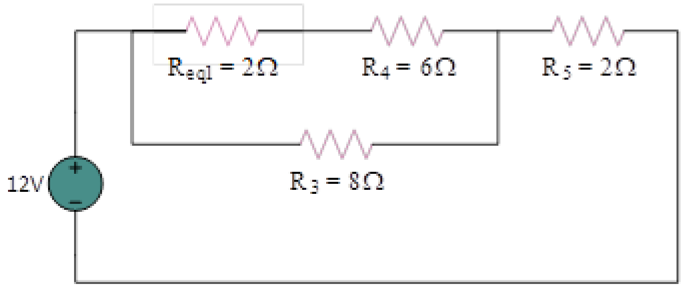
Calculating the Equivalent resistance

Reduce the circuit to one equivalent resistance value.

R_1 and R_2 are connected directly in parallel and can be replaced with an equivalent resistor,

R_1 is parallel with R_2, $= \frac{(R_1 * R_2)}{(R_1 + R_2)}$

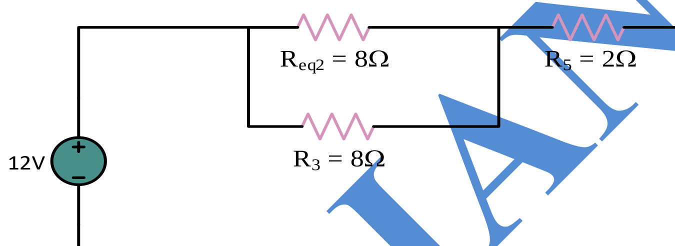
$$R_{eq1} = \frac{(4\Omega *\ 4\Omega)}{(4\Omega +\ 4\Omega)} = \frac{16\Omega}{8\Omega} = 2\Omega$$



R_{eq1} is in series with R_4,

Hence

$$R_{eq2} = R_{eq1} + R_4 = 2\Omega + 6\Omega = 8\Omega$$

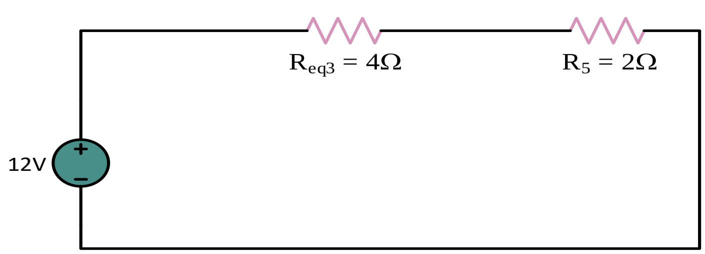


R_{eq2} is parallel with R_3, i.e. $R_{eq2} \| R_3$

So

$$R_{eq3} = \frac{(R_{eq2} * R_3)}{(R_{eq2} + R_3)}$$

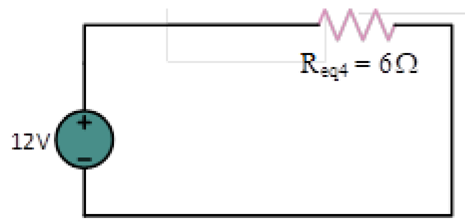
$$R_{eq3} = \frac{(8\Omega * 8\Omega)}{(8\Omega + 8\Omega)} = \frac{64\Omega}{16\Omega} = 4\Omega$$



R_{eq3} is in series with R_5,

So equivalent resistance is

$$R_{eq4} = R_{eq3} + R_5 = 4\Omega + 2\Omega$$
$$= \mathbf{6\Omega}$$



<u>Finding total current</u>

We know from ohm's law

$$V = IR$$

We have

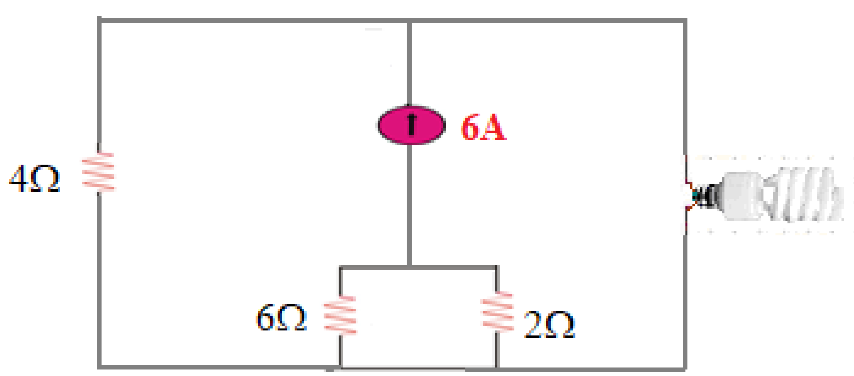
V = 12V and R = 6Ω,

So total current flowing through circuit is

$$I = \frac{V}{R} = \frac{12}{6}$$
$$= \mathbf{2A}$$

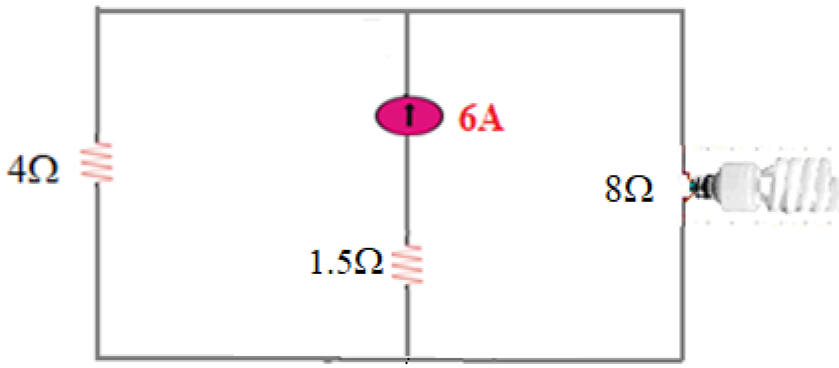
Q: 2:

Find power dissipated through energy saver having resistance 8Ω, in given below network.



Sol;

Since 6Ω and 2Ω are in parallel so their equivalent resistance is 6x2/6+2=1.5Ω. Circuit can be redrawn as



We see that 6A and 1.5Ω are in series so same current will pass through 1.5Ω resistance; however, 6A current is divided to 4Ω and energy saver of 8Ω resistance.

Since we have to find power dissipation in 8Ω energy saver, that can be calculated by formula $P=I^2R$ So first we find current flowing through 8Ω resistance by current divider rule as

$$I = \frac{iXR4}{Rt} = \frac{6X4}{4+8}$$

=**2A**

So, power dissipation through 8Ω energy saver is calculated as

$P=I^2R$

$=(2)^2 8$

=32W

Q: 3:

(I) What causes positive and negative charge?

(II) How the electrons in last orbit of an atom responsible for stability of an atom.

Answer:

(I) An atom is generally considered neutral having equal no of electrons and protons. When an atom loses electron(s) it becomes positively charged and when an atom gains electron(s), it becomes negatively charged. In other words, deficiency of electron causes positive (+) charge and addition of electron causes negative (-) charge.

(II) Electrons in outer orbit, also called valence electrons are loosely bound to its nucleus and can share to nearby outer orbit electrons of another atom. The atom is considered unstable as they share electrons to another atom. An atom of tightly bound electrons is more stable.