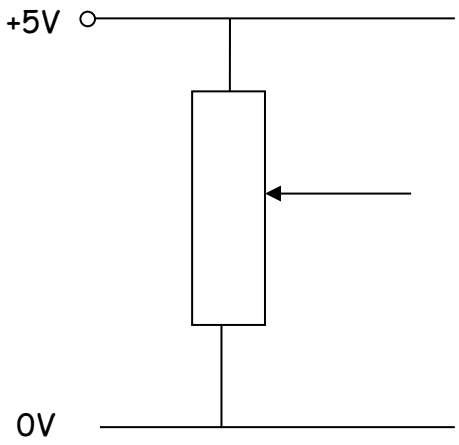
Potentiometers

A potentiometer is a type of VARIABLE RESISTOR where the voltage is divided up!



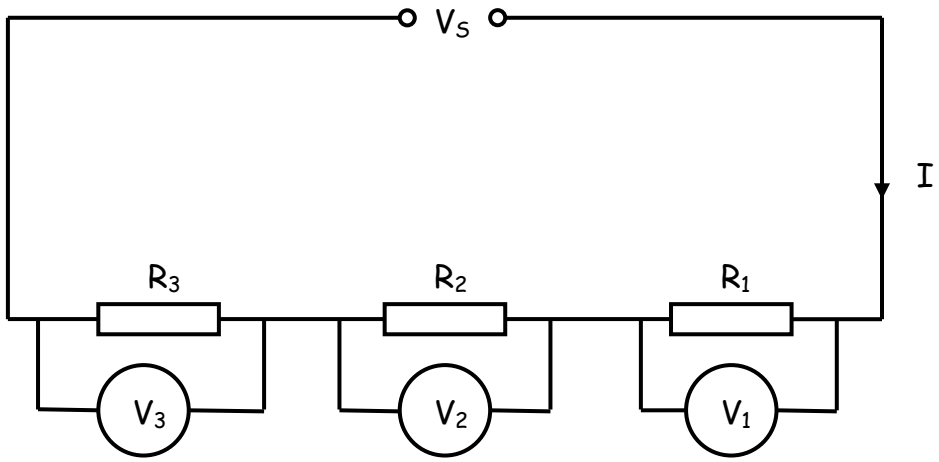
If the Formula for a series circuit

$V_s = V_1 + V_2 + V_3$ etc

$I_T = I_1 = I_2 = I_3$ etc

$V = I \times R$

$R_T = R_1 + R_2 + R_3$ etc



In a SERIES circuit *the current through each resistor is the same. To find the current use the formula:*

$\frac{V_s}{R_T} = I_T$ Where

I_T is the current,

$R_T = R_1 + R_2 + R_3$,

V_s = supply voltage

We already know that I_T is the same as the current going through R_1, R_2, R_3 etc. So to find V_1, V_2, V_3, use:

$$V_s = I_T \times R_T$$

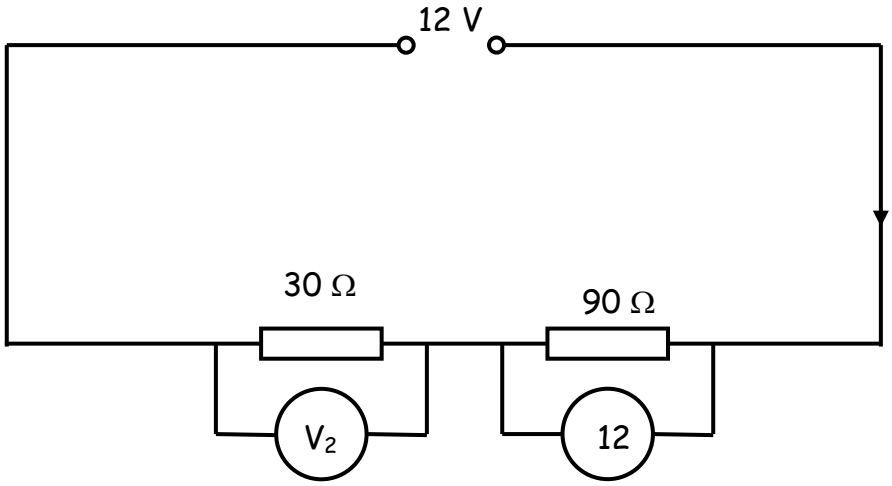
$$V_1 = I_T \times R_1$$
$$V_2 = I_T \times R_2$$
$$V_3 = I_T \times R_3$$

As I_T is the same

$$I_T = \frac{V_1}{R_1} = \frac{V_2}{R_2} = \frac{V_3}{R_3} = \frac{V_s}{R_T}$$

To find the voltage across resistors you do not need to work out the current.

$$I_T = \frac{V_1}{R_1} = \frac{V_2}{R_2} = \frac{V_s}{R_T}$$



Either work out by ratios (quick if you can do it but costly if it goes wrong!)

EITHER:

1. Summarise

   V_S = 12 V, R_1 = 90 Ω, R_2 = 30 Ω
   V_1 = ?, V_2 = ?

2. Find RT

   Find $R_T = R_1 + R_2$
   R_T = 90 + 30 = 120 Ω

3. Find V_1

   $\frac{V_s}{R_T} = \frac{V_1}{R_1}$ $\quad\quad$ $\frac{12}{120} = \frac{V_1}{90}$

   $V_1 = \frac{12 \times 90}{120}$ $\quad\quad$ $V_1 = 9V$

4. Find V_2

   $\frac{V_s}{R_T} = \frac{V_2}{R_2}$ $\quad\quad$ $\frac{12}{120} = \frac{V_2}{30}$

   $V_2 = \frac{12 \times 30}{120}$ $\quad\quad$ $V_2 = 3V$

5. Check

   $V_s = V_1 + V_2 = 9 + 3 = 12$ V ☺

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OR:

1. Summarise

   V_S = 12 V, R_1 = 90 Ω, R_2 = 30 Ω
   V_1 = ?, V_2 = ?

2. Find R_T

   Find $R_T = R_1 + R_2$
   R_T = 90 + 30 = 120 Ω

3. Find I_T

   $\frac{V_s}{R_T} = I_T = \frac{12}{120} = 0.1A$

4. Find V_1

   $V_1 = I_T R_1 = 0.1 \times 90 = 9V$

5. Find V_2

   $V_2 = I_T R_2 = 0.1 \times 30 = 3V$

6. Check

   $V_s = V_1 + V_2 = 9 + 3 = 12$ V ☺

See Virtual int 2 or Virtual Higher (old) Physics for practice on this!

OR USE

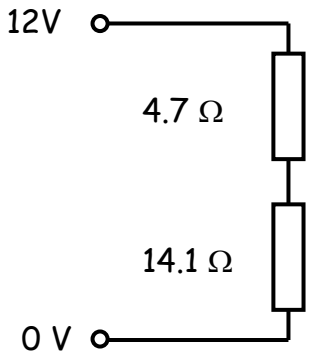
$$V_1 = \frac{R_1}{(R_1 + R_2)} \times V_s$$

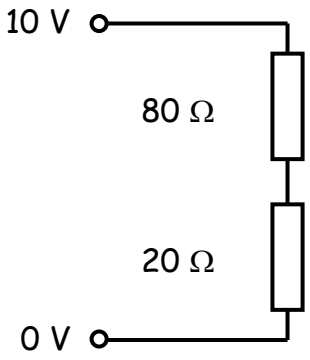
$$V_2 = \frac{R_2}{(R_1 + R_2)} \times V_s$$

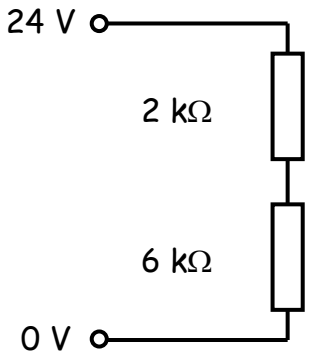
$$V_2 = V_s - V_1$$

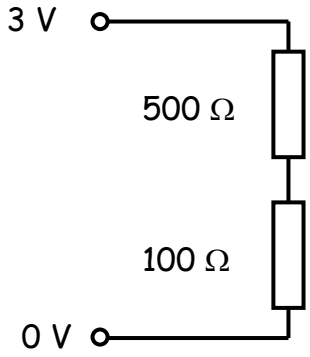
VOLTAGE DIVIDERS

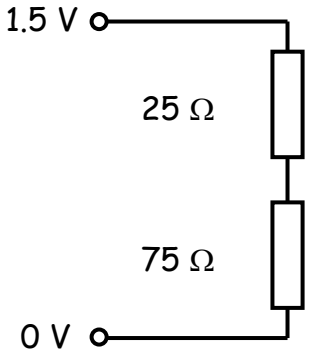
FIND THE VOLTAGE DROP ACROSS BOTH RESISTORS.

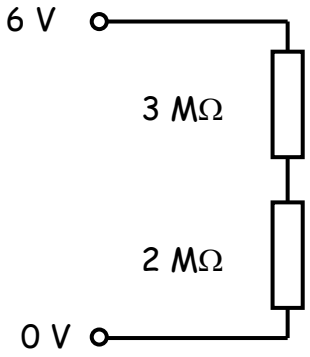


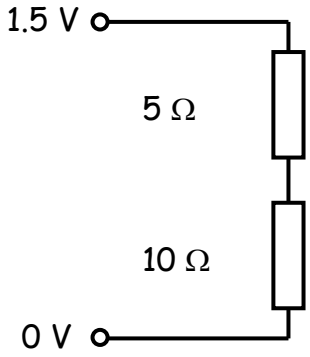


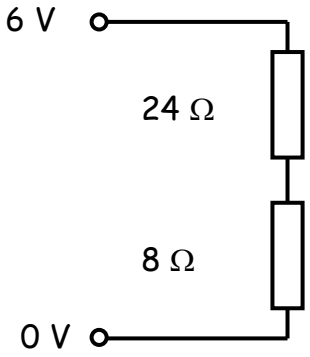


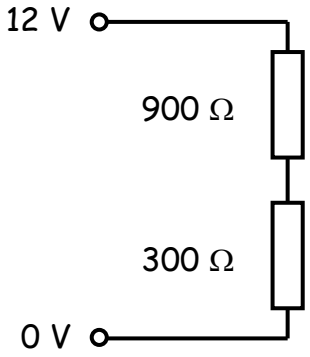












1a) 3V, 9V b) 8V, 2V, c) 6V, 18V
2a) 2.5V, 0.5V b) 0.375V, 1.125V c) 3.6V, 2.4V
3a) 0.5V, 1V b) 4.5V,1.5V c) 9V, 3V