Series and parallel circuits

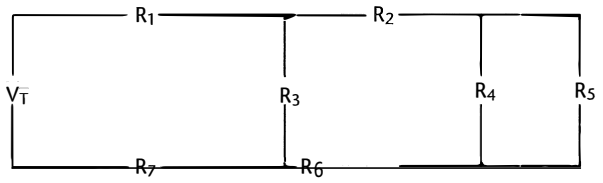
Usually circuits are a combination of series and parallel parts. To find out the characteristics of the components, the circuit has to be dealt with in sections or strings. The basic rules for parallel circuits are followed in those sections so:

P.D. = P.D.1 = P.D.2 = P.D.3 $\qquad$ I = I1 + I2 + I3 $\qquad$ $\frac{1}{R} = \frac{1}{R1} + \frac{1}{R2} + \frac{1}{R3}$

Similarly, the rules for series circuits are followed in those sections where:

P.D. = P.D.1 + P.D.2 + P.D.3 $\qquad$ I = I1 = I2 = I3 $\qquad$ R = R1 + R2 + R3

Ohm's law ($V = IR$) is used to find potential difference (P.D.) and current for each component and the circuit. The first step is to simplify the parallel sections so that the circuit becomes a series of resistances, then combine these resistances to find the total resistance of the circuit (R_T). The electro motive force (emf) of supply (V_T) is usually known so the total current (I_T) can be found. The resistances in the circuit below are simply numbered against values in the table with other characteristics to be built up as the exercise proceeds.



	R1	R2	R3	R4	R5	R6	R7	*T*
R	50	8	20	16	16	4	60	
I								
V								240
P								

where R = resistance (ohms),
I = current (amps),
V = P.D. or e.m.f. (volts),
P = power (watts).

1 Draw the circuit and put in the resistance values. Now simplify the parallel section for R4 and R5 and call the new resistance R9.

2 Draw the new simplified circuit. There is now a series section involving resistances R2, R9 and R6. Calculate the resistance (R17) of this section.

3 The circuit you now draw should have R3 and R17 in parallel. Simplify these two resistances and call the resulting value R20.

4 This is the final circuit with R1, R20 and R7 in series. Find the total resistance (R_T) and the total current (I_T) for the final column of the table.
Work from the last diagram to the first, putting in the currents for each section and then each resistance, before filling in the current row in the table.

6 Find the P.D. of each component and put the values in the table.

7 Calculate the power for each resistance and the circuit using $P = IV$.

© Peter Faulkner and Emerald City Books 2000. This sheet may be photocopied for non-commercial classroom use.