

# Chapter 19. Electric Circuit

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- 19.1 Circuit components
- 19.2 Combinations of resistors
- 19.3 Electrical safety

## New word list:

### 4.3 Electric circuits

#### 4.3.1 Circuit diagrams and circuit components

##### Core

- 1 Draw and interpret circuit diagrams containing cells, batteries, power supplies, generators, potential dividers, switches, resistors (fixed and variable), heaters, thermistors (NTC only), light-dependent resistors (LDRs), lamps, motors, ammeters, voltmeters, magnetising coils, transformers, fuses and relays, and know how these components behave in the circuit

##### Supplement

- 2 Draw and interpret circuit diagrams containing diodes and light-emitting diodes (LEDs), and know how these components behave in the circuit

#### 4.3.2 Series and parallel circuits

##### Core

- 1 Know that the current at every point in a series circuit is the same

##### Supplement

- 8 Recall and use in calculations, the fact that:
  - (a) the sum of the currents entering a junction in a parallel circuit is equal to the sum of the currents that leave the junction
  - (b) the total p.d. across the components in a series circuit is equal to the sum of the individual p.d.s across each component
  - (c) the p.d. across an arrangement of parallel resistances is the same as the p.d. across one branch in the arrangement of the parallel resistances

- 2 Know how to construct and use series and parallel circuits
- 3 Calculate the combined e.m.f. of several sources in series
- 4 Calculate the combined resistance of two or more resistors in series
- 5 State that, for a parallel circuit, the current from the source is larger than the current in each branch
- 6 State that the combined resistance of two resistors in parallel is less than that of either resistor by itself
- 7 State the advantages of connecting lamps in parallel in a lighting circuit
- 9 Explain that the sum of the currents into a junction is the same as the sum of the currents out of the junction
- 10 Calculate the combined resistance of two resistors in parallel

### 4.3 Electric circuits continued

#### 4.3.3 Action and use of circuit components

##### Core

- 1 Know that the p.d. across an electrical conductor increases as its resistance increases for a constant current

##### Supplement

- 2 Describe the action of a variable potential divider
- 3 Recall and use the equation for two resistors used as a potential divider

$$\frac{R_1}{R_2} = \frac{V_1}{V_2}$$

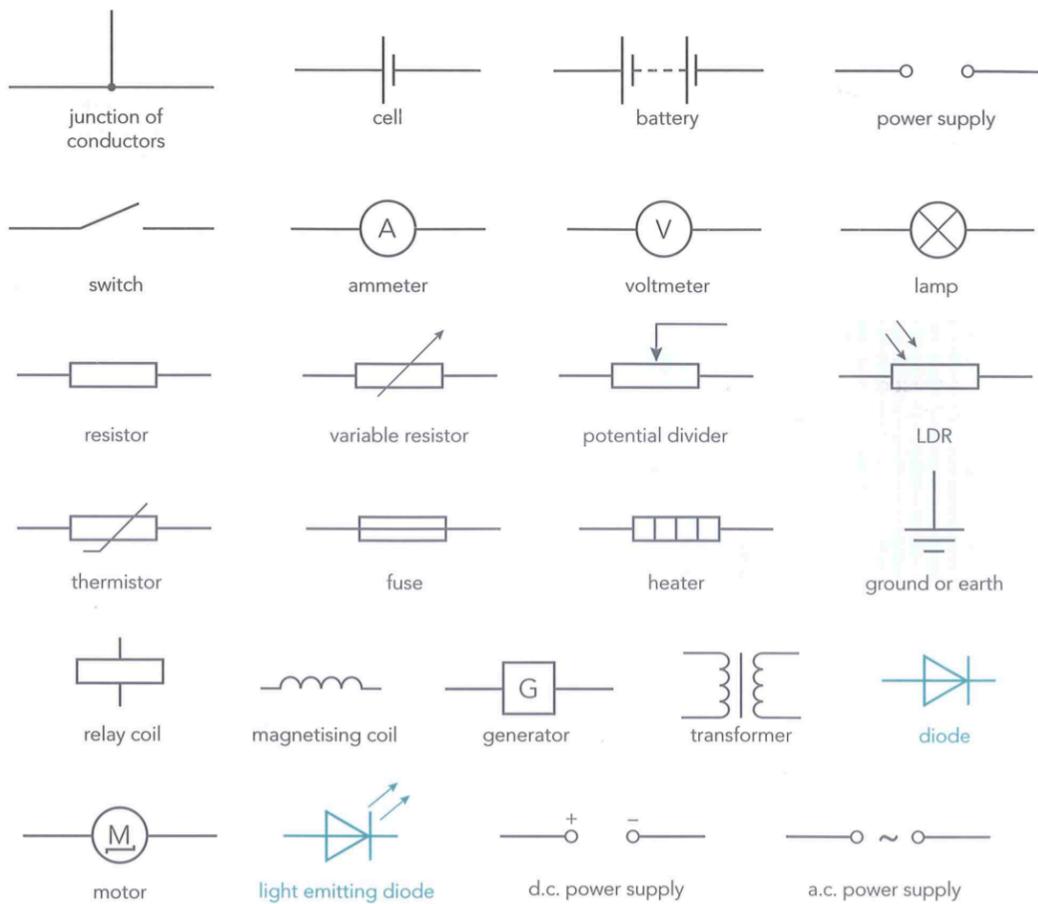
### 4.4 Electrical safety

##### Core

- 1 State the hazards of:
  - (a) damaged insulation
  - (b) overheating cables
  - (c) damp conditions
  - (d) excess current from overloading of plugs, extension leads, single and multiple sockets when using a mains supply
- 2 Know that a mains circuit consists of a live wire (line wire), a neutral wire and an earth wire and explain why a switch must be connected to the live wire for the circuit to be switched off safely
- 3 Explain the use and operation of trip switches and fuses and choose appropriate fuse ratings and trip switch settings
- 4 Explain why the outer casing of an electrical appliance must be either non-conducting (double-insulated) or earthed
- 5 State that a fuse without an earth wire protects the circuit and the cabling for a double-insulated appliance

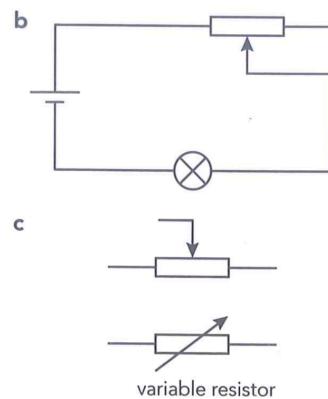
##### Supplement

## 19.1 Circuit components

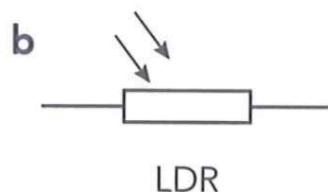
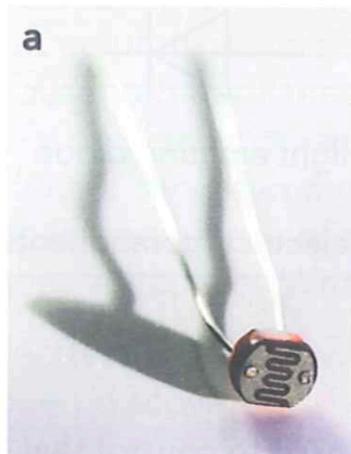


### resistors & variable resistor

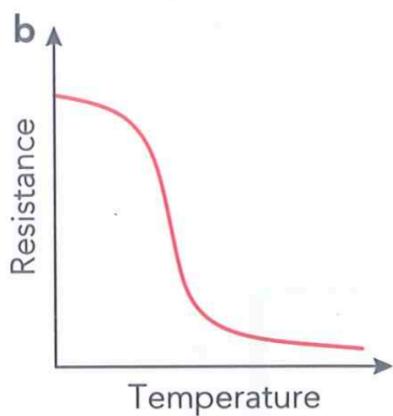
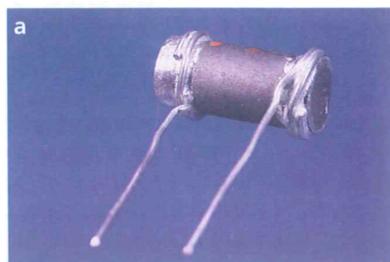




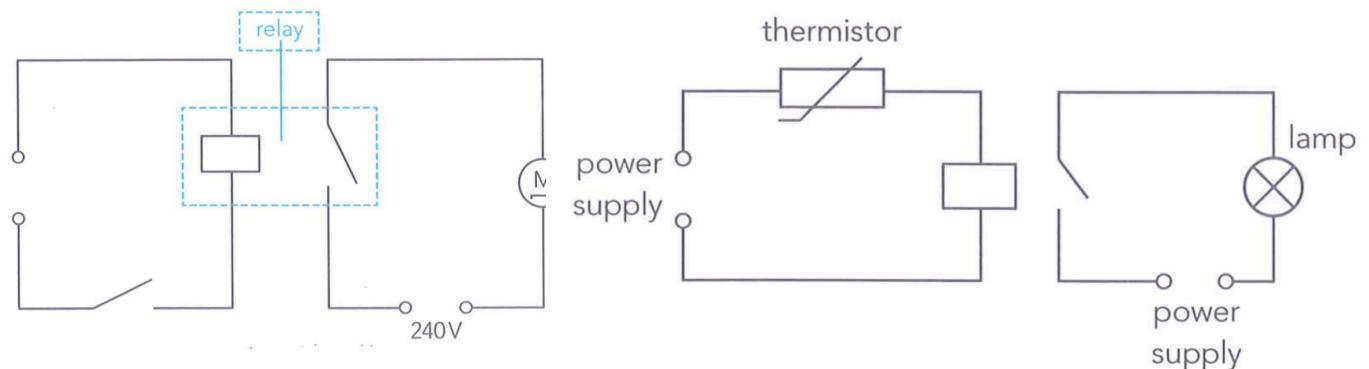
light-dependent resistor (LDR)



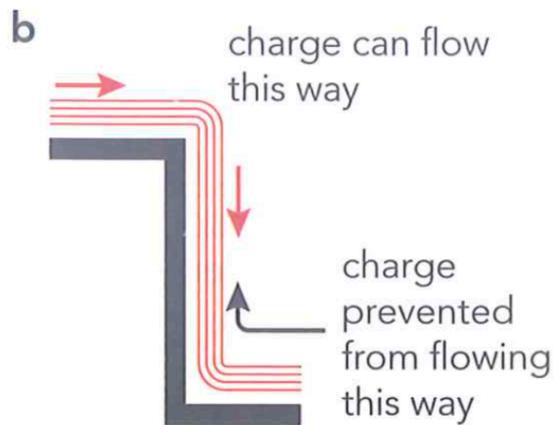
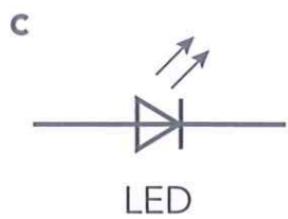
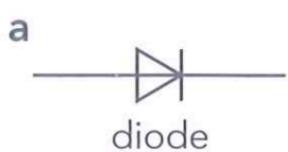
Thermistor



relay



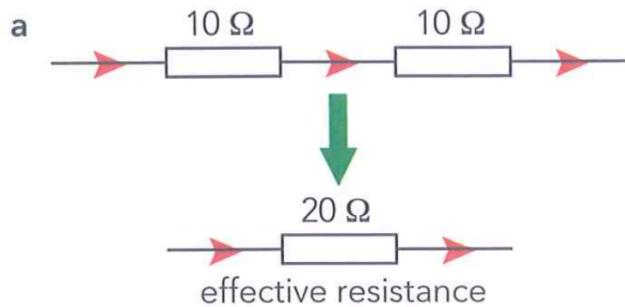
Diode & light-emitting diode (LED)



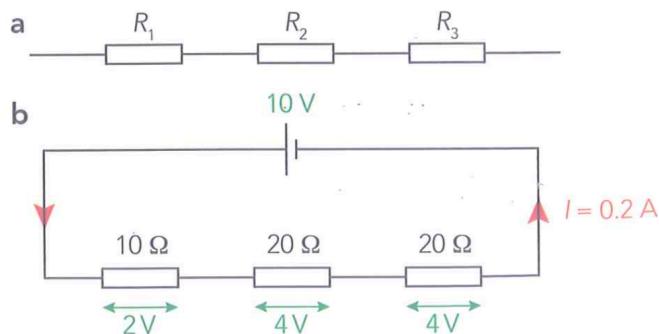
## 19.2 Combinations of resistors

Effective resistance:

**Resistors in series:**



Proof:

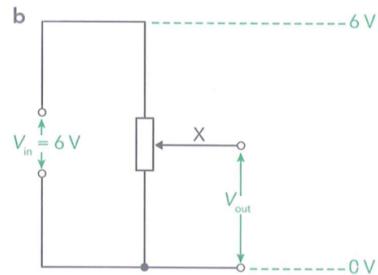
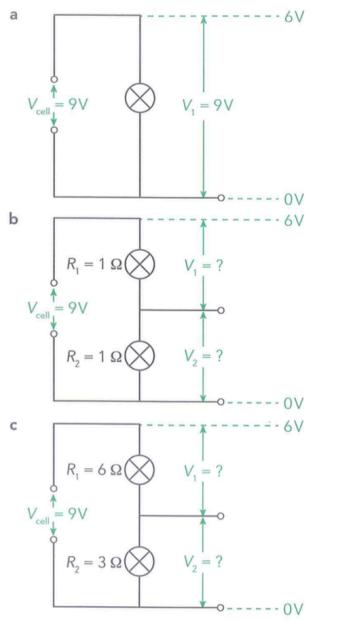


**Exercise:**

One  $4\ \text{ohms}$  resistor and one  $6\ \text{ohms}$  resistor are connected in a series circuit with a  $6\ \text{V}$  power supply. Calculate:

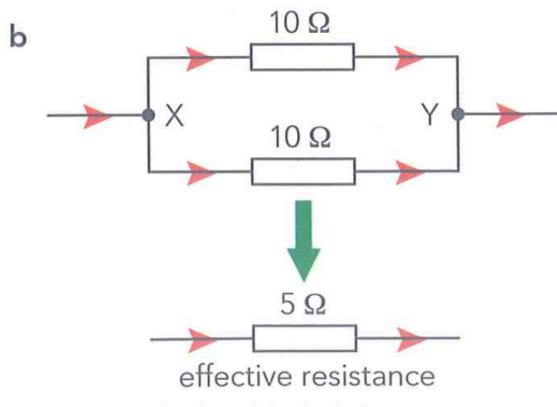
- 1, The combined resistance of the two resistors
- 2, The current that flows in the circuit
- 3, The p.d. across each resistor

## Potential divider circuit

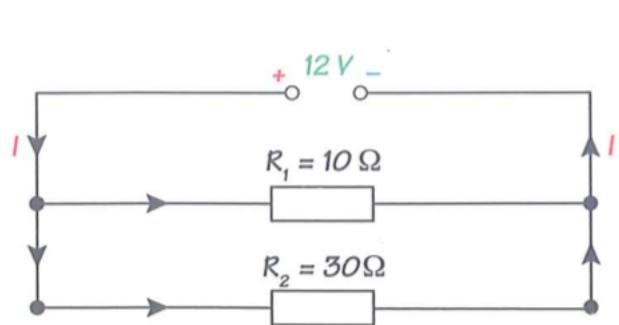


### Exercise:

A potential divider circuit is required to produce an output voltage of 8V across a resistor, R<sub>1</sub>, of 600 ohms. The supply voltage is 12V. What is the required value of the series resistor, R<sub>2</sub>?

**Resistors in parallel:**

Proof:

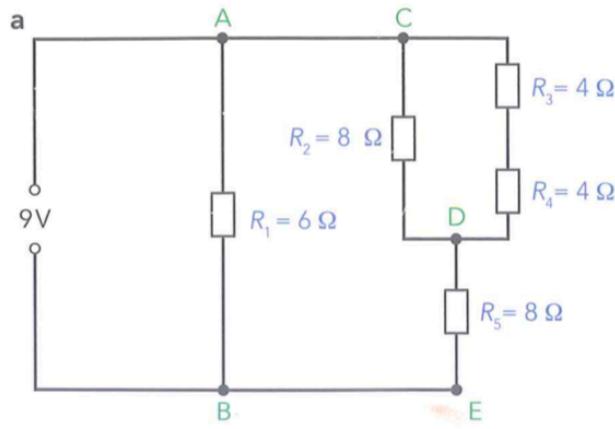


in particular:

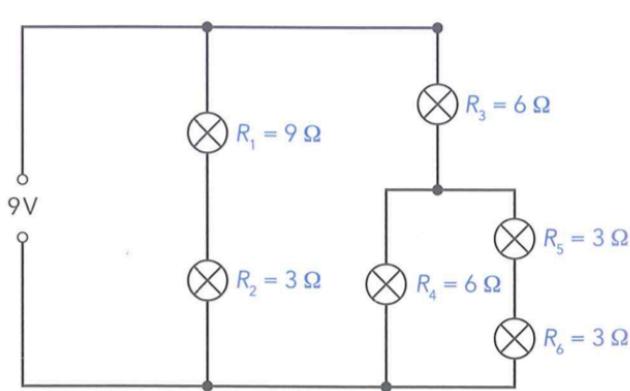
**Putting it all together:**

Work out the current through, and the voltage across, each lamp in the circuit.

Summarize your result in the table below.

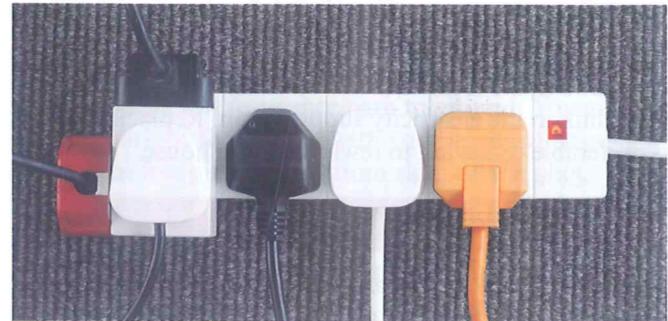
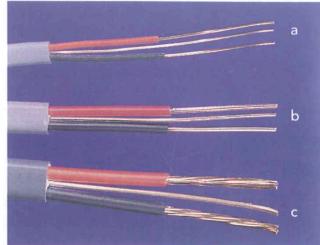


Resistor	Source	1	2	3	4	5
<b>Voltage</b>						
<b>Current</b>						

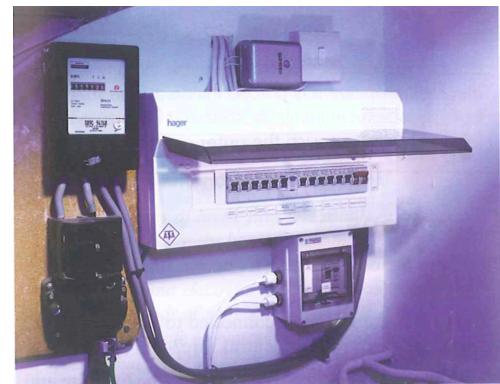
Exercise:

## 19.3 Electrical safety

### Electrical hazards



**Solutions:**



Fuse vs trip switch

Double insulation

