## Answers to Exercises in Chapter 1

1.1 The prefixes are:

| | |
|---|---|
| $10^{-12}$ | p |
| $10^{-9}$ | n |
| $10^{-6}$ | μ |
| $10^{-3}$ | m |
| $10^{3}$ | k |
| $10^{6}$ | M |
| $10^{9}$ | G |
| $10^{12}$ | T |

1.2 1 ms is 1 millisecond, 1 m/s is 1 metre per second and 1mS is 1 milliSiemen (the meaning of Siemens will be covered later – but these are clearly not seconds!).

1.3 1 mΩ is 1 milliohm ($10^{-3}$ ohms) and 1 MΩ is 1 megohm ($10^{6}$ ohms).

1.4 Direct current describes the situation where the current in a conductor always flows in the same direction. Alternating current describes the situation where the direction of the current periodically changes.

1.5 The unit of measurement of resistance is the ohm (Ω).

1.6 The unit of measurement of capacitance is the farad (F).

1.7 The unit of measurement of inductance is the henry (H).

1.8 From Kirchoff's current law, the currents flowing into any note must sum to zero, so here $I_1 + I_2 + I_3 = 0$, which gives $5\text{A} + 3\text{A} + I_3 = 0$. So $I_3 = -8\text{A}$.

1.9 From Kirchoff's voltage law, the voltages around the loop must sum to zero, so here $E - V_1 - V_2 + V_3 = 0$, which gives $12\text{V} - 8\text{V} - 5\text{V} + V_3 = 0$. So $V_3 = 1\text{V}$.

1.10 By Ohm's law, $I = V/R = 5/10^3 = 5$ mA.

1.11 By Ohm's law, $R = V/I = 9/(1.5 \times 10^{-3}) = 6$ kΩ.

1.12 $P = V^2/R = 25^2/25 = 25$ W.

1.13 $P = I^2R = (5 \times 10^{-6})^2 \times 400 = 10$ nW.

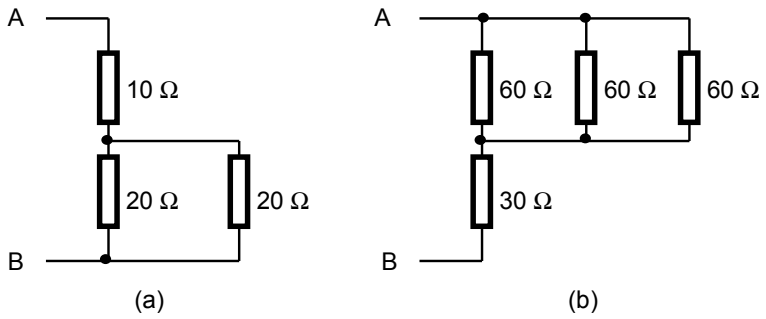
1.14 $R = R_1 + R_2 = 20\ \Omega + 30\ \Omega = 50\ \Omega$.

1.15 $1/R = 1/R_1 + 1/R_2$. Therefore, $R = 1/(1/20 + 1/30) = 12\ \Omega$.

1.16 $R = R_1 + R_2 + R_3 = 1\text{k}\Omega + 2.2\ \text{k}\Omega + 4.7\ \text{k}\Omega = 7.9\ \text{k}\Omega$.

1.17 $1/R = 1/R_1 + 1/R_2 + 1/R_3$. Therefore, $R = 1/(1/1\text{k}\Omega + 1/2.2\text{k}\Omega + 1/4.7\text{k}\Omega) = 584\ \Omega$.

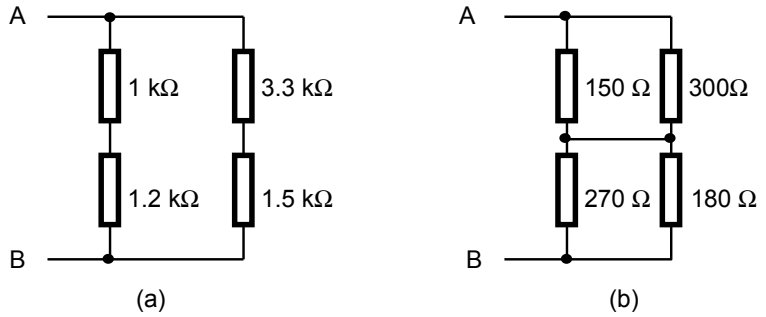
1.18




(a) This is 10 Ω, in series with 20 Ω//20 Ω, which is 10 Ω + 10 Ω = 20 Ω.

(b) This is 30 Ω, in series with 60 Ω//60 Ω//60 Ω = 30 Ω + 20 Ω = 50 Ω.

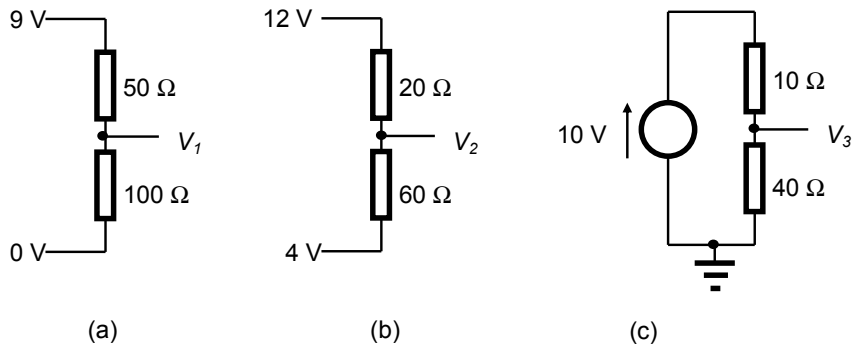
1.19




(a) This is (1kΩ + 1.2 kΩ)//(3.3 kΩ + 1.5 kΩ) = 2.2 kΩ//4.8 kΩ = 1.51 kΩ.

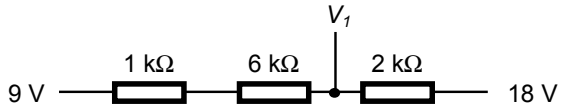
(b) This is (150 Ω//300 Ω) + (270 Ω//180 Ω) = 100 Ω + 108 Ω = 208 Ω.

1.20

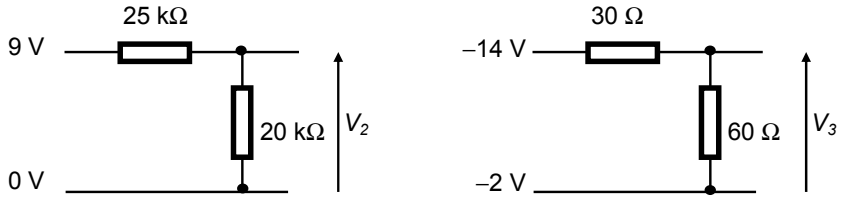



(a) (b) (c)

1.21




(a)




(b) (c)

(a) $V_1 = 9 + (18 - 9)\dfrac{1\text{k}\Omega + 6\text{k}\Omega}{1\text{k}\Omega + 6\text{k}\Omega + 2\text{k}\Omega}$

$= 9 + 9\dfrac{7}{9}$

$= 16\text{ V}$

(b) $V_2 = 9\dfrac{R_2}{R_1 + R_2}$

$= 9\dfrac{20\Omega}{20\Omega + 25\Omega}$

$= 4\text{V}$

(c) $V_3 = (-14 + 2)\dfrac{60\Omega}{60\Omega + 30\Omega}$

$= -12\dfrac{2}{3}$

$= -8\text{V}$

1.22 $T = 1/f = 1/10^3 = 1$ ms.

1.23 $f = 1/T = 1/(20 \times 10^{-6}) = 50$ kHz.