18.12 (a) rate = $k[A][B]$
(b) rate = $k[A]$
(c) rate = $k[A]^2$
(d) rate = $k[A][B][C]$
(e) rate = $k[A][B]^2$

18.13 (a) A $\longrightarrow$ products
(b) 2A $\longrightarrow$ products
(c) A + B $\longrightarrow$ products
(d) 2A + B $\longrightarrow$ products
(e) A + B + C $\longrightarrow$ products

termolecular reactions are the least likely to happen.

18.15 false, it depends on mechanism.

18.19 rate $\propto [O_2]$ & rate $\propto [NO]^2$ so rate = $k[NO]^2[O_2]$

$$k = \frac{\text{rate}}{[NO_2]^2[O_2]} = \frac{7.11\times10^{-3}\,M s^{-1}}{(1.00\times10^{-2}M)^2(1.00\times10^{-2}M)} = 7.1\times10^3\,M^{-2}s^{-1}$$

18.20 using rate = $7.1\times10^{-3}\,M^{-2}s^{-1}\,[NO]_0^2[O_2]_0$

TRIAL	Rate (Ms^{-1})
1	8.9×10^{-4}
2	1.8×10^{-3}
3	8.52×10^{-2}
4	1.92×10^{-1}

18.44 (a) For reaction 1:

$$k_1(300K) = (10^{13}s^{-1})\exp\left[-\frac{1.00\times10^5\,J\,mol^{-1}}{(8.3145\,J\,mol^{-1}K^{-1})(300K)}\right] = 3.88\times10^{-5}s^{-1}$$

$k_1(1000K) = 5.98\times10^2\,s^{-1}$

For reaction 2:

$k_2(300K) = 7.04\times10^{-6}\,s^{-1}$

$k_2(1000K) = 1.80\times10^{8}\,s^{-1}$

(b) Reaction 1 is faster at 300K.
Reaction 2 is faster at 1000K.

Reaction 1 has a smaller activation energy (which increases rate) but lower "A" (which decreases rate). At lower T, small E_a is more important. At higher T, "A" is more important.