

Part B True-False

11. NT 13. AT
12. ST 14. AT

Part C Matching

15. d 17. b 19. e
16. f 18. a 20. c

Part D Questions

21. This diagram represents a reaction that takes place in two elementary steps. The reaction is exothermic. Points A and C represent the energy level of the activated complexes. Point B represents the energy level of the intermediate product. Point D represents the energy level of the final product.

Practice Problems 18

Section 18.1

1. Rates of chemical reactions can usually be increased by (1) increasing the temperature, (2) increasing the concentration of the reactants, (3) decreasing the reactant particle size, and (4) using of a catalyst.
2. $2 \text{ mol}/4 \text{ h} = 0.5 \text{ mol}/\text{h}$
3. a. decrease the rate
b. increase the rate
4. increase the rate

Section 18.2

1.
$$K_{\text{eq}} = \frac{[\text{NO}_2]^4 \times [\text{O}_2]}{[\text{N}_2\text{O}_5]^2}$$
2.
$$K_{\text{eq}} = \frac{[0.80]^4 \times [0.20]}{[0.50]^2}$$
$$= 0.33$$
3. a. shift left
b. shift right
4.
$$\frac{[\text{N}_2\text{O}_4]}{[\text{NO}_2]^2} = 5.6$$
$$[\text{NO}_2]^2 = \frac{[\text{N}_2\text{O}_4]}{5.6}$$
$$[\text{NO}_2]^2 = \sqrt{\frac{0.66}{5.6}} = 0.3$$

5. a.
$$K_{\text{eq}} = \frac{[\text{N}_2\text{O}_4]^2}{[\text{NO}]^4 \times [\text{O}_2]^2}$$

b.
$$K_{\text{eq}} = \frac{[\text{NOBr}]^2}{[\text{NO}]^2 \times [\text{Br}_2]}$$

c.
$$K_{\text{eq}} = \frac{[\text{CH}_3\text{OH}]}{[\text{CO}] \times [\text{H}_2]^2}$$

d.
$$K_{\text{eq}} = \frac{[\text{SO}_3] \times [\text{NO}]}{[\text{SO}_2] \times [\text{NO}_2]}$$

6. a. shift right
b. shift right
c. shift right
d. no shift

7. $K_{\text{eq}} = 1 \times 10^{12}$

8.
$$K_{\text{eq}} = \frac{[\text{H}_2]^2 \times [\text{S}_2]}{[\text{H}_2\text{S}]^2}$$

$$K_{\text{eq}} = \frac{(0.014)^2 \times (0.035)}{(0.18)^2} = 2.1 \times 10^{-4}$$

Section 18.3