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5.5-010

Which of the following statements is not valid concerning a reaction with $\Delta G < 0$?

- (a) It is thermodynamically favorable.
- (b) It is spontaneous as written.
- (c) It will proceed rapidly from left to right.
- (d) The products are more stable than the reactants.

5.5-120

Which of the following is not a correct expression for the rate of the reaction $A + B \rightarrow C + D$?

(a) $\frac{\Delta[A]}{\Delta t}$

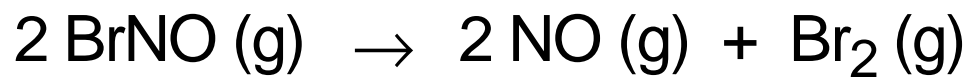
(b) $-\frac{\Delta[B]}{\Delta t}$

(c) $\frac{\Delta[C]}{\Delta t}$

(d) $\frac{\Delta[D]}{\Delta t}$

5.5-130

For the reaction



$d[\text{Br}_2]/dt =$

- (a) $(1/2) d[\text{BrNO}]/dt$
- (b) $2 d[\text{BrNO}]/dt$
- (c) $-(1/2) d[\text{BrNO}]/dt$
- (d) $-2 d[\text{BrNO}]/dt$

5.5-140

Which of the following is true for the reaction
 $a A + b B \rightarrow c C + d D$?

(a) $a \frac{\Delta[A]}{\Delta t} = b \frac{\Delta[B]}{\Delta t} = c \frac{\Delta[C]}{\Delta t} = d \frac{\Delta[D]}{\Delta t}$

(b) $a \frac{\Delta[A]}{\Delta t} = b \frac{\Delta[B]}{\Delta t} = -c \frac{\Delta[C]}{\Delta t} = -d \frac{\Delta[D]}{\Delta t}$

(c) $\frac{1}{a} \frac{\Delta[A]}{\Delta t} = \frac{1}{b} \frac{\Delta[B]}{\Delta t} = \frac{1}{c} \frac{\Delta[C]}{\Delta t} = \frac{1}{d} \frac{\Delta[D]}{\Delta t}$

(d) $\frac{1}{a} \frac{\Delta[A]}{\Delta t} = \frac{1}{b} \frac{\Delta[B]}{\Delta t} = -\frac{1}{c} \frac{\Delta[C]}{\Delta t} = -\frac{1}{d} \frac{\Delta[D]}{\Delta t}$

5.5-150

Which of the following is the rate expression for a reaction that is second order in A and third order overall?

(a) $\text{rate} = k[A]^2[B]$

(b) $\text{rate} = k\frac{[A]^2}{[B]}$

(c) $\text{rate} = k[A]^3$

(d) $\text{rate} = k[A]^2$

5.5-155

What is the overall order of a reaction with

$$\text{rate} = k \frac{[A]^2}{[B]^{1/2}} \quad ?$$

(a) -2.5

(b) 1.5

(c) -1.5

(d) 2.5

What is the order with respect to B?

(a) 0.5

(b) 2.5

(c) -0.5

(d) 1.5

5.5-160

Which units would be appropriate for the rate constant in the rate expression for a third order reaction?

(a) $\text{mol}^2 \text{L}^{-2} \text{s}^{-1}$

(b) $\text{mol}^3 \text{L}^{-3} \text{s}^{-1}$

(c) $\text{L}^2 \text{mol}^{-2} \text{s}^{-1}$

(d) $\text{L}^3 \text{mol}^{-3} \text{s}^{-1}$

5.5-190

The rate law for dimerization of NO_2 to form N_2O_4 is $-\text{d}[\text{NO}_2]/\text{dt} = k [\text{NO}_2]^2$. Which of the following will change the value of k ?

- (a) doubling the total pressure
- (b) adding more NO_2
- (c) running the reaction in CCl_4 instead of in the gas phase
- (d) none of the above

5.5-210

Which of the following graphs would generally be expected to be linear?

- (a) [product] vs. time
- (b) [reactant] vs. time
- (c) rate vs. [reactant]
- (d) $\ln(\text{rate})$ vs. $\ln([\text{reactant}])$

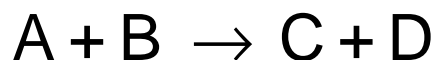
5.5-240

The rate of the reaction $A + B \rightarrow C + D$ increases 9-fold when A is tripled and 2-fold when B is doubled. The order of the reaction is

- (a) 9 in A and 2 in B
- (b) 3 in A and 2 in B
- (c) 2 in A and 2 in B
- (d) 2 in A and 1 in B

5.5-250

For the reaction



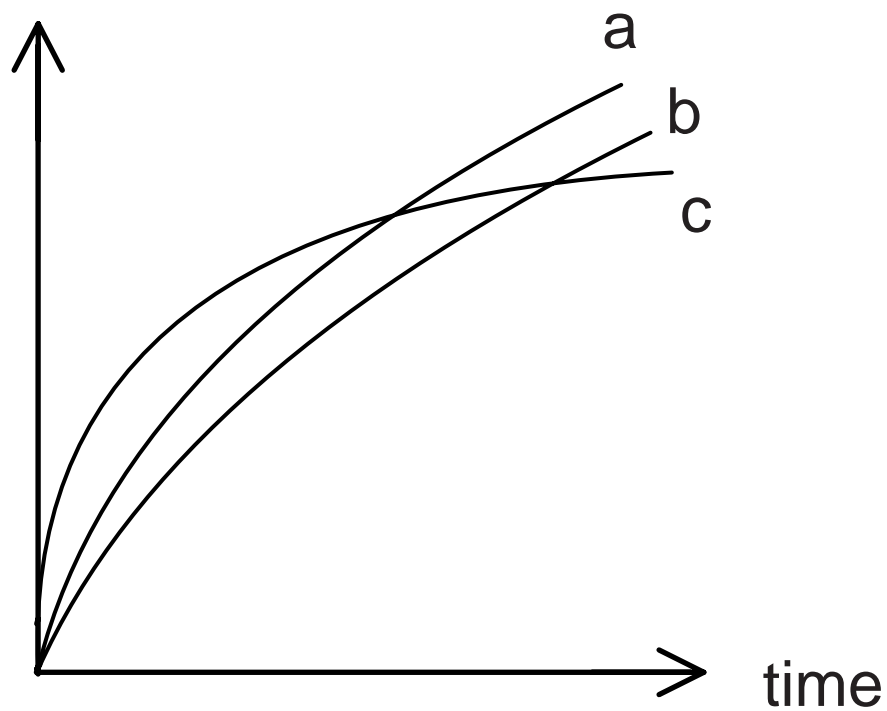
it is found that doubling the concentrations of both reactants simultaneously increases the rate of the reaction by a factor of 8 while doubling the concentration of A alone doubles the rate. The order of this reaction with respect to B is

- (a) 0 (b) 1 (c) 2 (d) 1/4

5.5-290

In which experiment is the initial rate greatest ?

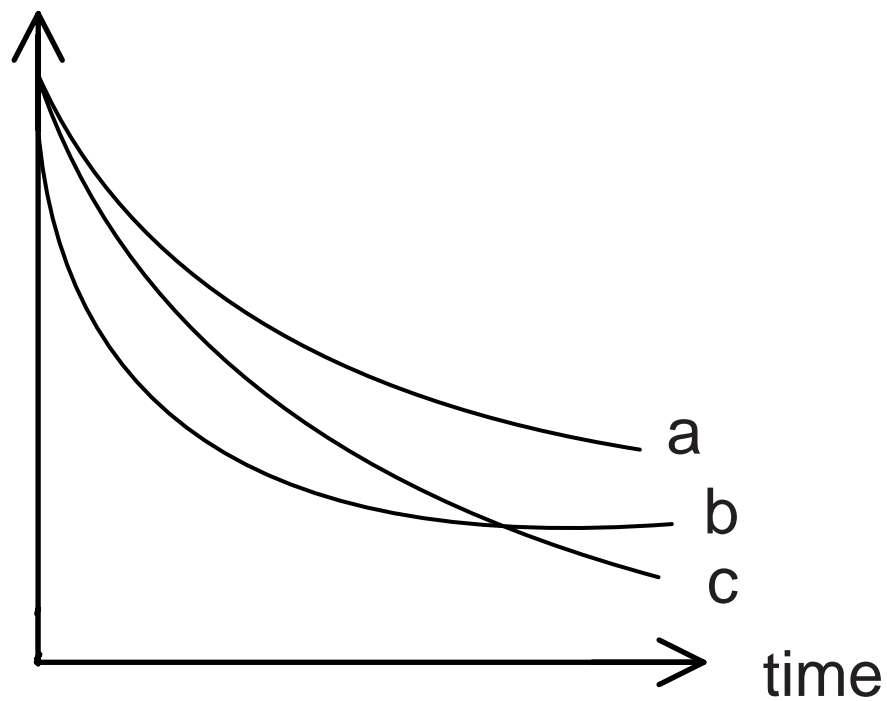
[product]



5.5-295

In which experiment is the initial rate greatest ?

[reactant]



5.5-310

When an active protein is transferred to denaturing conditions, it unfolds and loses activity with 1st order kinetics. If it loses $1/3$ of its activity in 10 minutes, what fraction of the initial activity is left after a total of 20 minutes?

- (a) $(1/3)(1/3) = 1/9$
- (b) $(1/3)(2/3) = 2/9$
- (c) $(2/3)(2/3) = 4/9$
- (d) $1 - 2(1/3) = 1/3$

5.5-320

X reacts with a very large excess of Y according to pseudo 1st order kinetics. What is the half-life of the reaction if 7/8 of X is reacted in 20 s ?

- (a) $(20 \times 1/8) \text{ s}$
- (b) $(20 \times 1/3) \text{ s}$
- (c) $(20 \times 4/7) \text{ s}$
- (d) $(20 \times 7/8) \text{ s}$

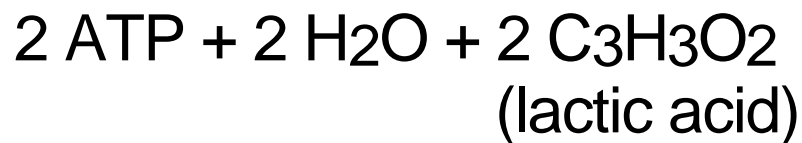
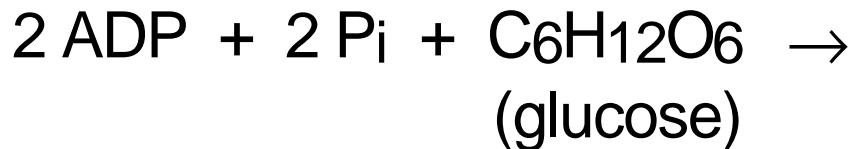
5.5-410

A dimeric protein X-Y is formed by the association of a monomer of X and a monomer of Y. When $[X]=[Y]$ the reaction occurs with pseudo 2nd order kinetics. If 50% of the monomers are gone in 10 s, 75% of the monomers be used up after a total of

- (a) 30 s
- (b) 20 s
- (c) 15 s

5.5-510

The net reaction of glycolysis (the metabolism of glucose in the absence of oxygen -- i.e., our vestigial fermentation) is



If nature had devised to do this in one step, what would the overall reaction order be?

- (a) 3 rd (b) 4 th (c) 5 th (d) 11 th

5.5-530

Glucose (G) is oxidized in the presence of an indicator dye (D) according to the steps



Which reaction will be accelerated first when oxygen is added?

Which form of the dye increases thereby?

- (a) oxidized (b) reduced

Which reaction is accelerated when the oxidized dye accumulates?

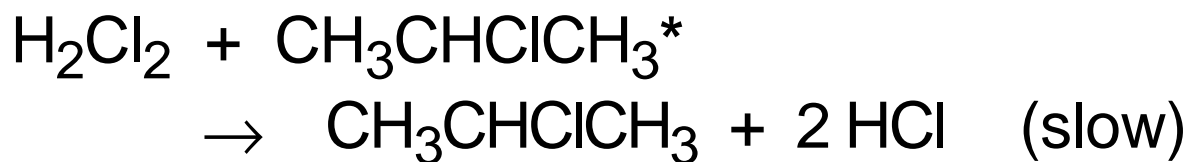
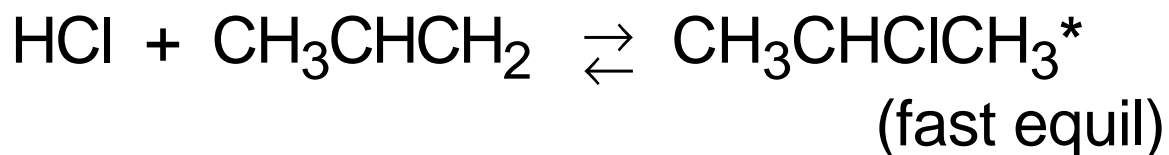
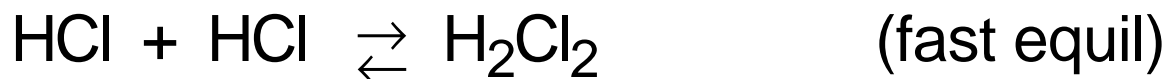
When oxygen is cut off, which reaction will slow down first?

As a result, the level of oxidized indicator will

- (a) increase (b) decrease

5.5-550

For the reaction mechanism

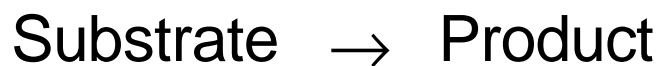


the rate expression is rate =

- (a) $k[\text{HCl}]^2$
- (b) $k[\text{HCl}] [\text{CH}_3\text{CHCH}_2]$
- (c) $k[\text{HCl}]^2[\text{CH}_3\text{CHCH}_2]$
- (d) $k[\text{HCl}]^3[\text{CH}_3\text{CHCH}_2]$

5.5-570

In the presence of Enzyme, the reaction



occurs by three steps



The rate law for this reaction is
rate=

- (a) $k [S]$ (b) $k [E]$ (c) $k [E][S]$

5.5-610

Which of the following graphs for the temperature dependence of a rate constant is expected to be linear?

- (a) k vs. T
- (b) k vs. $\ln T$
- (c) $\ln k$ vs $\ln T$
- (d) $\ln k$ vs. $1/T$

This graph

- (a) must have a positive slope
- (b) must have a negative slope
- (c) can have a positive or negative slope

5.5-630

Consider the forward and reverse directions of a reaction. The activation energy is greater in the direction for which

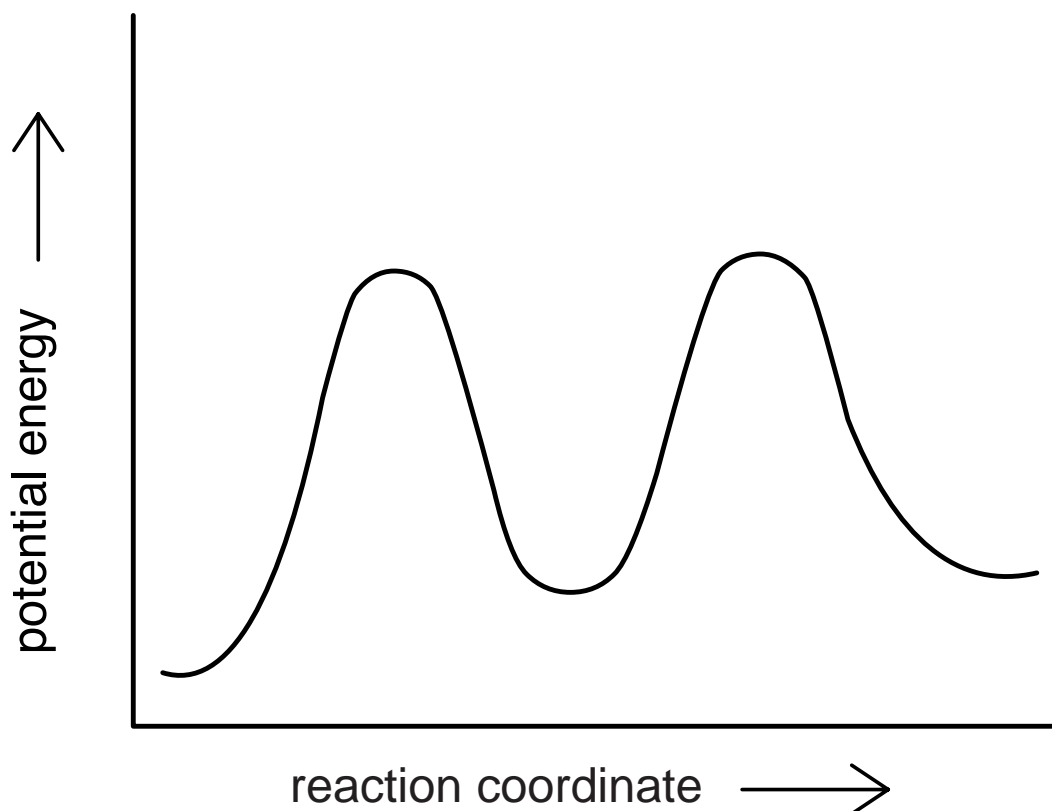
- (a) $\Delta H > 0$ (b) $\Delta H < 0$
(c) $\Delta S > 0$ (d) $\Delta S < 0$

5.5-680

For a simple two-step reaction

reactants \rightarrow intermediates \rightarrow products

the energy profile is



Which of the following may be inferred?

- (a) the intermediates accumulate in measurable quantities
- (b) the reactants quickly form intermediates that slowly form products
- (c) the reactants slowly form intermediates that quickly form products
- (d) none of the above

5.5-710

The rate of a certain biochemical reaction at physiological temperature (T) occurs $10^6 = (e^{2.303})^6$ times faster with enzyme than without. The change in the activation energy upon adding enzyme is

- (a) $- 6 RT$ (b) $- 6 (2.303) RT$
(c) $+ 6 RT$ (d) $+ 6 (2.303) RT$

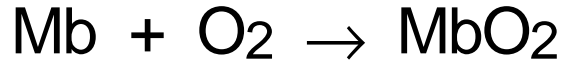
5.5-730

Reactions commonly double in speed for a 10°C increase in T near room T (~ 300 K). This means that activation energies for reactions that occur at moderate rates at room T are typically

- (a) $\sim (\ln 2) R (10 \text{ K})$
- (b) $\sim (\ln 2) R (300 \text{ K})$
- (c) $\sim (\ln 2) R (10 \text{ K})^2 / (300 \text{ K})$
- (d) $\sim (\ln 2) R (300 \text{ K})^2 / (10 \text{ K})$

5.5-910

The binding of oxygen to myoglobin (the oxygen storage protein of muscle)



is a reversible elementary process. If the rate constant for the forward reaction is k_f and the rate constant for the backward reaction is k_b then the reaction rate is

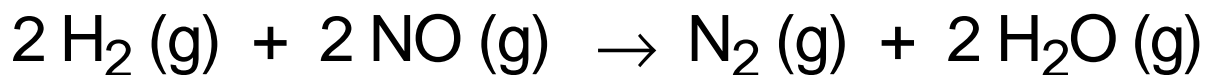
- (a) $+ k_f [\text{Mb}] [\text{O}_2] - k_b [\text{MbO}_2]$
- (b) $- k_f [\text{Mb}] [\text{O}_2] + k_b [\text{MbO}_2]$
- (c) $+ k_b [\text{Mb}] [\text{O}_2] - k_f [\text{MbO}_2]$
- (d) $- k_b [\text{Mb}] [\text{O}_2] + k_f [\text{MbO}_2]$

The equilibrium constant for the reaction is

- (a) $k_f - k_b$
- (b) $k_b - k_f$
- (c) k_f / k_b
- (d) k_b / k_f

5.5-930

For the reaction



the observed rate expression is

$$\text{rate} = k_f[\text{NO}]^2[\text{H}_2]$$

The rate expression for the reverse reaction is rate =

- (a) $k_b[\text{N}_2][\text{H}_2\text{O}]$
- (b) $k_b[\text{N}_2][\text{H}_2\text{O}]^2$
- (c) $k_b[\text{N}_2][\text{H}_2\text{O}]^2[\text{H}_2]$
- (d) $k_b[\text{N}_2][\text{H}_2\text{O}]^2 / [\text{H}_2]$