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kinetics multiple choice Practice

____ 1. A catalyst increases the rate of a chemical reaction by

a. decreasing the potential energy of the reactants

c. increasing the frequency of collisions between reactant molecules

b. decreasing the potential energy of the activated complex

d. increasing the standard free energy of formation of the products

Consider the reaction and its rate law given below:

$$2A_{(g)} + B_{(g)} \Rightarrow C_{(g)}$$

$$\text{Rate} = k[A]^2[B]$$

At the beginning of one trial this reaction, [A] = 4.0 and [B] = 1.0. The observed rate was 0.048 mol /L sec

____ 2. Which of the following describes how the rate for this trial of the reaction, at constant temperature, changes as [B] approaches 0.4 M?

a. The rate decreases because the concentration of the products increases.

d. The rate remains the same because the energy of activation remains the same

b. The rate decreases because the concentration of the reactants decreases.

e. The rate remains the same because the temperature remains the same.

c. The rate remains the same because the rate constant remains the same.

____ 3. Which applies to this system when its temperature is increased at constant volume?

I. [A] decreases at a greater rate. yes

II. The value for k, the rate constant, remains the same. No, Temp dependent

a. I only

c. Both I and II

b. II only

d. Neither I or II

____ 4. When a catalyst is added to a reaction system, the potential energy of the activated complex.

a. increases and the heat of reaction increases

d. decreases and the heat of reaction remains the same ΔH

b. decreases and the heat of reaction decreases

e. remains the same and the hear of reaction increases

c. remains the same and the heat of reaction decreases

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Geometry

____ 5. Which statement is false?
a. The slowest reaction mechanism determines the rate of the overall reaction
b. A catalyst provides a new reaction path with different energy
c. Optimum collision geometry plays an important part in effective collisions
d. A reaction occurs each time two particles collide if they possess activation energy
e. Enzymes are catalysts which generally specific to one particular reaction.

____ 6. A match does not ignite spontaneously with Oxygen in air because
a. The reaction is exothermic
b. it needs a catalyst
c. the molecules are not spontaneous
d. too few molecules possess activation energy to ignite.

____ 7. Consider the following hypothetical reaction

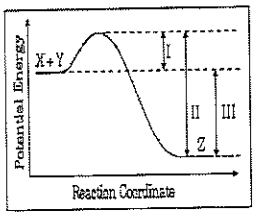
$X_{(g)} + 2Y_{(g)} \Rightarrow XY_{2(g)}$ $\Delta[Y]/\Delta t = -5.0E\text{-}2$ mol/L s

What is the rate of formation of $XY_{2(g)}$?

Stoich Ratio

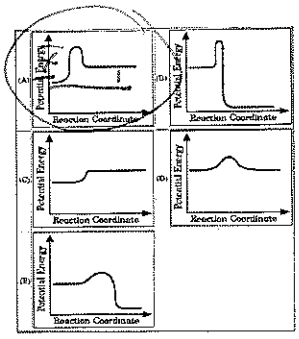
a. –5.0 E-2 b. –2.5 E-2 c. 2.5 E-2 d. 5.0 E-2

____ 8.



The energy diagram for the reaction $X + Y \Rightarrow Z$ is shown above. The addition of a catalyst to this reaction would cause a change in which of the indicated energy differences?
a. I only b. II only c. III only d. I and II only

____ 9.



(99-48)Which of the following is a graph that describes the pathway of reaction that is endothermic and has high activation energy?
a. above
b. above
c. above
d. above
e. above

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Step I $O_3(g) + NO(g) \Rightarrow NO_2(g) + O_2(g)$ (Slow)

Step II $NO_2(g) + O(g) \Rightarrow NO(g) + O_2(g)$ (Fast)

The overall reaction is $O_3(g) + O(g) \Rightarrow 2O_2(g)$

____ 10. Identify the Catalyst
a. O_3 b. NO c. O_2 d. NO_2

____ 11. Identify the intermediate
a. O_3 b. NO c. O_2 d. NO_2

____ 12. Increasing the temperature of a reaction increases all of the following EXCEPT. Identify exception.
a. rate of forward and reverse reactions
b. Activation energy
c. the average velocity of colliding molecules
d. the number of effective collisions
e. the translational energy of molecules

____ 13.

$$X_2 + Y_2 \rightarrow X_2Y_2$$

$$\text{rate} = k[X_2]$$

Mechanism 1	Mechanism 2
$X_2 \rightarrow 2\,X$ (*slow*)	$X_2 \rightarrow 2\,X$ (*slow*)
$X + Y_2 \rightarrow XY_2$ (*fast*)	$X + Y_2 \rightarrow XY + Y$ (*fast*)
$X + XY_2 \rightarrow X_2Y_2$ (*fast*)	$X + XY \rightarrow X_2Y$ (*fast*)
	$X_2Y + Y \rightarrow X_2Y_2$ (*fast*)

a. Only mechanism 1 is consistent with the rate law.
b. Only mechanism 2 is consistent with the rate law.
c. Both mechanism 1 and mechanism 2 are consistent with the rate law.
d. Neither mechanism 1 nor mechanism 2 is consistent with the rate law.

____ 14. After a certain pesticide compound is applied to crops, its decomposition is a first-order reaction with a half-life of 32.5 days. What is the rate constant, k , for the decomposition reaction?
a. 0.0213 1/day b. 0.0308 1/day c. 32.5 1/day d. 46.9 1/day

$\frac{.693}{32.5} =$

____ 15. The gas-phase reaction $A_2(g)+B_2(g) \Rightarrow 2AB(g)$ is assumed to occur in a single step. Two experiments were done at the same temperature inside rigid containers. The initial partial pressures of A2 and B2 used in experiment 1 were twice the initial pressures used in experiment 2. Which statement provides the best comparison of the initial rate of formation of AB in experiments 1 and 2 ?

a. The initial rate of formation of AB is the same in both experiments because they were done at the same temperature and the frequency and energy of the collisions between A2 and B2 would have been about the same.

(c.) The initial rate of formation of AB is faster in experiment 1 than in experiment 2 because at a higher pressure the collisions between A2 and B2 molecules would have been more frequent, increasing the probability of a successful collision.

b. The initial rate of formation of AB is slower in experiment 1 than in with experiment 2 because at the same temperature, a higher pressure would reduce the volume available for A2 and B2 molecules to achieve the proper orientation for a successful collision.

d. The initial rate of formation of AB is faster in experiment 1 than in experiment 2 because at a higher pressure a larger fraction of the A2 and B2 molecules would have the minimum energy required to overcome the activation energy barrier.

____ 16.

Experiment	$[X]_0$	$[Y]_0$	Initial Rate of Formation of Z (mol L^{-1} sec^{-1})
1	0.40	0.10	R
2	0.20	0.20	?

The table above shows the results from a rate study of the reaction X + Y ? Z. Starting with known concentrations of X and Y in experiment 1, the rate of formation of Z was measured. If the reaction was first order with respect to X and second order with respect to Y, the initial rate of formation of Z in experiment 2 would be

a. R4 b. R/2 c. R (d. 2R)

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7 min short response.

17. (average 2.98/8) In an experiment, all the air in a rigid 2.0 L flask is pumped out. Then some liquid ethanol is injected into the sealed flask, which is held at 35C. The amount of liquid ethanol initially decreases, but after five minutes the amount of liquid ethanol in the flask remains constant. Ethanol has a boiling point of 78.5C and an equilibrium vapor pressure of 100 torr at 35C.

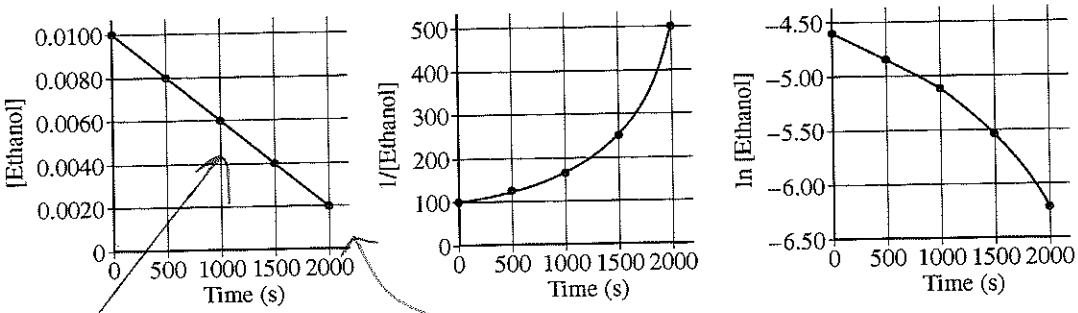
(a) When the amount of liquid ethanol in the flask is constant, is the pressure in the flask greater than, less than, or equal to 100 torr? Justify your answer. 100 torr = Vp

(b) The flask is then heated to 45C, and the pressure in the flask increases. In terms of kinetic molecular theory, provide TWO reasons that the pressure in the flask is greater at 45C and then 35C. speed, # of collisions, force of collision

In a second experiment, which is performed at a much higher temperature, a sample of ethanol gas and a copper catalyst are placed in a rigid, empty 1.0 L flask. The temperature of the flask is held constant, and the initial concentration of the ethanol gas is 0.0100 *M*. The ethanol begins to decompose according to the chemical reaction represented below.

$$CH_3CH_2OH(g) \xrightarrow{Cu} CH_3CHO(g) + H_2(g)$$

The concentration of ethanol gas over time is used to create the three graphs below.



(c) Given that the reaction order is zero, one, or two, use the information in the graphs to respond to the following. straight

(i) Determine the order of the reaction with respect to ethanol. Justify your answer. zero

(ii) Write the rate law for the reaction. Rate = $k[C_2H_5OH]^0$

(iii) ~~Determine~~ the rate constant for the reaction, including units. slope $\frac{.01-.002}{200}$ =

(d) The pressure in the flask at the beginning of the experiment is 0.40 atm. If the ethanol completely decomposes, what is the final pressure in the flask?

use PV=nRT & stoich or → stoich → # particles doubles .4 → .8