1032_1st Exam_1040325(A)

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

1) In the reaction $C_4H_9Cl(aq) + H_2O(l) \rightarrow C_4H_9OH(aq) + HCl(aq)$ the concentration of the reactant changes from 0.0562 M to 0.0431 M in 85 sec. What is the average rate of decomposition over this interval?

A) 1.54×10^{-4} M/s
B) 0.0154 M
C) 1.54×10^{-4} moles/s
D) 1.54×10^{-4} moles
E) 0.0154 M/s

Answer: A

2) Which of the following statements is incorrect?

A) The slowest step of a mechanism controls the overall rate of the reaction.
B) The concentration of species involved in the mechanism after the slow step will not affect the reaction rate.
C) The sum of the elementary steps in a mechanism gives the net overall reaction.
D) The rate equation for an elementary step contains the reactants raised to the exponent which is the coefficient of that species.
E) The rate equation for a reaction contains all the species in the balanced overall equation.

Answer: E

3) Initial rate data were obtained for the following reaction:

$$2\,A\,(g) + 3\,B\,(g) \rightarrow 2\,C\,(g)$$

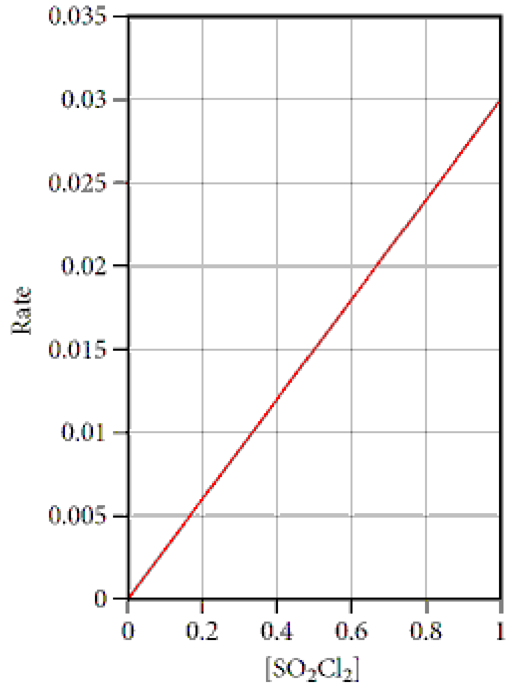
Experiment	Initial [A], Mol/L	Initial [B], Mol/L	Initial Rate
1	0.10	0.10	1.4×10^{2}
2	0.20	0.10	2.8×10^{2}
3	0.20	0.20	5.6×10^{2}

What is the rate law for the reaction?

A) rate = k [A][B]
B) rate = k $[A][B]^2$
C) rate = k $[A]^2[B]^2$
D) rate = k [A]
E) rate = k $[A]^2[B]$

Answer: A

4) This plot shows the rate of the decomposition of SO_2Cl_2 into SO_2 and Cl_2 as a function of the concentration of SO_2Cl_2 . What is the order of the reaction ?



A) first order
B) zero order
C) second order
D) Order cannot be determined without more information.

Answer: A

5) Define rate law.

A) An experimentally determined equation that describes how the rate of reaction depends on the concentration of reactants.
B) An experimentally determined equation that describes how the rate of reaction depends on temperature, orientation and number of collisions.
C) A theoretical equation that describes how the rate of reaction depends on the concentration of reactants.
D) A statement that describes how the ratio of reaction depends on concentration of reactants developed from the balanced equation.
E) A theoretical equation that describes how the rate of reaction depends on temperature, orientation and number of collisions.

Answer: A

6) If a reaction has a rate equation of rate = k[A][B][C] then it is:

A) overall third order
B) zero order in A
C) overall first order
D) overall second order
E) second order in B

Answer: A

7) The rate of a specific chemical reaction is independent of the concentrations of the reactants. Thus the reaction is:

A) second order
B) first order in A
C) first order in the product
D) catalyzed
E) overall zero order

Answer: E

8) If increasing the concentration of A in a chemical reaction causes no increase in the rate of the reaction, then we may say:

A) the reaction rate is zero order in A
B) A is not involved in the reaction
C) the reaction rate is first order in [A]
D) the reaction rate is zero order in [A]
E) A is a catalyst

Answer: D

9) The reaction A + B → C + D is second order in A and zero order in B. The value of k is 0.012 M^{-1} min^{-1}. What is the rate of this reaction when [A] = 0.125 M and [B] = 0.435 M?

A) 3.4×10^{-3} M min^{-1}
B) 1.3 M min^{-1}
C) 5×10^{-4} M min^{-1}
D) 1.9×10^{-4} M min^{-1}
E) 1.5×10^{-3} M min^{-1}

Answer: D

10) Calculate rate constant k for a first order reaction with a half-life of 75.0 min.

A) 2.67×10^{-2} min^{-1}
B) 1.54×10^{-4} min^{-1}
C) 1.33×10^{-2} min^{-1}
D) 9.24×10^{-3} min^{-1}
E) 52.0 min^{-1}

Answer: D

11) Which of the following statements is INCORRECT?

A) In a zero order reaction the rate remains constant throughout the reaction.
B) Radioactive decay is a first order reaction.
C) In gaseous reactions [A] can be expressed as concentration or as pressure.
D) For a first order reaction $\ln [A]_t/[A]_o = kt$.
E) Half-life in a first order reaction is constant.

Answer: D

12) In the first order reaction A → products, [A] = 0.400 M initially and 0.250 M after 15.0 min, what will [A] be after 175 min?

A) 3.70×10^{-2} M
B) 1.04×10^{-3} M
C) 1.67×10^{-3} M
D) 2.31×10^{-1} M
E) 6.024×10^{-3} M

Answer: C

13) The rate constant for a reaction at 25.0 °C is 0.010 s^{-1} , and its activation energy is 35.8 kJ. Find the rate constant at 50.0 °C.

A) 0.021 s^{-1} B) 0.0033 s^{-1} C) 0.031 s^{-1} D) 0.010 s^{-1}

Answer: C

14) In the reaction, A → Products, the initial rate of reaction is 3.6×10^{-4} M · s^{-1} when the initial concentration of A is 0.583 M. What will [A] be at t = 25 s?

A) 0.146 B) 0.009 C) 0.574 D) 0.344 E) 0.462

Answer: C

15) Activation energy is:

A) minimum kinetic energy that molecules must bring to their collisions for a chemical reaction to occur
B) energy at the bottom of the reaction curve
C) the kinetic energy of solution stirring that brings the reaction to start
D) the heat energy in Joules required to break the bonds in one reactant
E) an energy that a catalyst brings to the system to activate one of the reactants

Answer: A

16) Choose the INCORRECT answer. The rate of a chemical reaction:

A) describes the change in concentration of a reactant or product with time
B) usually is increased when the concentration of one of the reactants is increased
C) may be increased by certain catalytic agents
D) is dependent on temperature
E) will be very rapid if the activation energy is large

Answer: E

17) Which of the following has no effect on the rate of a reaction?

A) presence of a catalyst
B) value of $\Delta H°$
C) temperature of reactants
D) concentrations of reactants
E) activation energy

Answer: B

18) Which of the following statements is correct?

A) The orientation of a collision does not affect the rate constant.
B) The number of collisions has no effect on the rate constant.
C) A reaction rate cannot be calculated from the collision frequency alone.
D) The activated complex is a chemical species that can be isolated and analysed.
E) A zero order reaction depends on the concentration of reactants.

Answer: C

19) Which statement is INCORRECT?
A) The activated complex will be the highest on the energy profile.
B) If the forward reaction is endothermic, the reverse will be exothermic.
C) Activation energy is the same for forward and reverse reaction.
D) An activated complex has higher energy than any molecule contributing to it.
E) In an endothermic reaction, activation energy is usually greater than the enthalpy.

Answer: C

20) Pick the single-step reaction that, according to collision theory, has the smallest orientation factor.
A) $I + HI \rightarrow I_2 + H$
B) $H_2 + H_2C{=}CH_2 \rightarrow H_3C{-}CH_3$
C) All of these reactions have the same orientation factor.
D) $H + H \rightarrow H_2$

Answer: B

21) In the Arrhenius equation, $\ln k = -E_a/RT + \ln A$, the symbol A denotes:
A) the activation energy
B) the absolute temperature
C) the rate constant
D) a constant that represents the frequency of collisions with the proper orientation and other steric conditions favorable for a reaction
E) the initial concentration of A

Answer: D

22) A catalyst alters the rate of a chemical reaction by:
A) always providing a surface on which molecules react
B) changing the products formed in the reaction
C) increasing the number of collisions of molecules
D) inducing an alternate pathway for the reaction with generally lower activation energy
E) changing the frequency of collisions between molecules

Answer: D

23) Which of the following situations involves a heterogeneous catalysis?
A) The reactants and products are different phases of matter in a catalyzed reaction.
B) The catalyst is present in a different phase of matter than are the reactants and products.
C) The catalyst changes phases during the reaction.
D) The catalyst, reactants, and products are all different phases of matter.
E) The catalyst is in two different phases of matter.

Answer: B

24) The reaction $2H_2 + NO \rightarrow H_2O + 1/2N_2$ is first order in H_2 and second order in NO. The rate law is ________.
A) $k[H_2]^2[NO]$
B) $k[H_2][NO]^{-2}$
C) $k[H_2]$
D) $k[H_2][NO]$
E) $k[H_2][NO]^2$

Answer: E

25) If the half-life of a reactant is independent of its initial concentration, the reaction order is ________.

A) 0 B) 3 C) 0.5 D) 1 E) 2

Answer: D

26) A chemical system is at equilibrium

A) when the rates of the forward reaction and the reverse reaction are both zero.
B) when the concentration of reactants and products are equal.
C) when all of the reactants have been used up.
D) when the rates of the forward reaction and the reverse reaction are equal.
E) when the rate of the forward reaction becomes zero.

Answer: D

27) What is the correct expression for the equilibrium constant (K_c) for the reaction between carbon and hydrogen gas to form methane shown here?

$$C(s) + 2\ H_2(g) \rightleftharpoons CH_4(g)$$

A) $Kc = \frac{[CH_4]}{[C][H_2]}$ B) $Kc = \frac{[CH_4]}{[H_2]}$ C) $Kc = \frac{[CH_4]}{[H_2]^2}$ D) $Kc = \frac{[CH_4]}{[C][H_2]^2}$

Answer: C

28) The value of K_c is changed when

A) a catalyst is added.
B) the concentration of reactants are changed.
C) the pressure of the system is changed.
D) the temperature of the system is changed.
E) the volume of the system is changed.

Answer: D

29) If the equilibrium concentrations found in the reaction:

$$2\ A\ (g)\ +\ B\ (g) \Leftrightarrow 2\ C\ (g),$$

are [A] = 0.30 M, [B] = 0.10 M, and [C] = 0.20 M, calculate the value of K_c.

A) 4.4 B) 0.23 C) 6.7 D) 3.3 E) 0.21

Answer: A

30) Given the following:

I) $N_2O(g) + 1/2\ O_2(g) \rightleftharpoons 2NO(g)$ $K_c = 1.7 \times 10^{-13}$

II) $N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$ $K_c = 4.1 \times 10^{-31}$

Find the value of the equilibrium constant for the following equilibrium reaction:

$N_2(g) + 1/2\ O_2(g) \rightleftharpoons N_2O(g)$

A) 4.2×10^{17} B) 1.6×10^{-9} C) 2.4×10^{-18} D) 7.0×10^{-44} E) 2.6×10^{-22}

Answer: C

31) Consider the reaction of A to form B:

$$2\ A(g) \rightleftharpoons B(g) \quad K_c = 1.8 \times 10^{-5} \quad \text{(at 298 K)}$$

A reaction mixture at 298 K initially contains [A] = 0.50 M. What is the concentration of B when the reaction reaches equilibrium ?

A) 9.0×10^{-6} M
B) 4.5×10^{-6} M
C) 0.060 M
D) 0.030 M

Answer: B

32) The value of K_p for the reaction $2\ NO_2\ (g) \Leftrightarrow N_2O_4\ (g)$ is 1.52 at 319 K. What is the value of K_p at this temperature for the reaction $N_2O_4\ (g) \Leftrightarrow 2\ NO_2\ (g)$?

A) 1.74×10^{3}
B) 0.658
C) 5.74×10^{-4}
D) 1.23
E) -1.52

Answer: B

33) What is the effect of adding helium gas (at constant volume) to an equilibrium mixture of the reaction:

$$CO(g) + Cl_2(g) \rightleftharpoons COCl_2(g)$$

A) The reaction does not shift in either direction.
B) The reaction slows down.
C) The reaction shifts toward the reactants.
D) The reaction shifts toward the products.

Answer: A

34) For the following chemical equilibrium, $K_p = 4.6 \times 10^{-14}$ at 25°C, find the value of K_c for this reaction at 25°C.

$$2\ Cl_2(g) + 2\ H_2O(g) \rightleftharpoons 4\ HCl(g) + O_2(g)$$

A) $K_c = 1.1 \times 10^{-12}$
B) $K_c = 9.4 \times 10^{-14}$
C) $K_c = 2.2 \times 10^{-14}$
D) $K_c = 4.6 \times 10^{-14}$
E) $K_c = 1.9 \times 10^{-15}$

Answer: E

35) Which factor influences the value of the equilibrium constant for a reversible reaction?

A) removing reactant
B) addition of a catalyst
C) removing product
D) increase in mixing rate
E) raising the temperature

Answer: E

36) For the reaction: $CH_4(g) + 2\ H_2O(g) \rightleftharpoons CO_2(g) + 4\ H_2(g)\ \Delta H° = +190$ kJ when CH_4 is added:

A) the temperature increases
B) the $\Delta H°$ increases
C) the reaction reacts to the left
D) the reaction reacts to the right
E) there is no change in equilibrium position

Answer: D

37) For the reaction: $CH_4(g) + 2\ H_2O(g) \rightleftharpoons CO_2(g) + 4\ H_2(g)$ $\Delta H° = +190$ kJ raise the temperature to 1200 K:

A) the reaction reacts to the left
B) the temperature increases
C) the reaction reacts to the right
D) the $\Delta H°$ increases
E) there is no change in equilibrium position

Answer: C

38) For the reaction: $3\ Fe(s) + 4\ H_2O(g) \rightleftharpoons Fe_3O_4(s) + 4\ H_2(g)$ what is the effect of removing H_2?

A) The K_p is doubled.
B) The reaction shifts to the right.
C) There is no change.
D) The K_p is decreased.
E) The reaction shifts to the left.

Answer: B

39) For the reaction: $3\ Fe(s) + 4\ H_2O(g) \rightleftharpoons Fe_3O_4(s) + 4\ H_2(g)$ what is the effect on equilibrium of increasing temperature of an exothermic reaction?

A) The K_p is decreased.
B) There is no change.
C) The K_p is doubled.
D) The reaction shifts to the right.
E) The reaction shifts to the left.

Answer: E

40) Consider the exothermic reaction:

$$4\ HCl(aq) + MnO_2(s) \rightleftharpoons Cl_2(g) + 2\ H_2O(l) + MnCl_2(aq)$$

The equilibrium is displaced to the left if:

A) pressure is lowered
B) temperature is lowered
C) catalyst is added
D) $H_2O(l)$ is added
E) MnO_2 (s) is added

Answer: D