992_1st_Exam_1000316

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

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

   Answer: C

2) In the equilibrium system described by: $PO_4^{3-}(aq) + H_2O(l) \rightleftharpoons HPO_4^{2-}(aq) + OH^-(aq)$ Brønsted-Lowry theory would designate:
   A) PO_4^{3-} and H_2O as the bases
   B) HPO_4^{2-} and OH^- as the acids
   C) PO_4^{3-} as amphiprotic
   D) H_2O and OH^- as a conjugate pair
   E) HPO_4^{2-} and H_2O as a conjugate pair

   Answer: D

3) Given the following:

   I) $N_2O_{(g)} + 1/2\ O_{2(g)} \rightleftharpoons 2NO_{(g)}$ $\quad K_c = 1.7 \times 10^{-13}$

   II) $N_{2(g)} + O_{2(g)} \rightleftharpoons 2NO_{(g)}$ $\quad K_c = 4.1 \times 10^{-31}$

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

   Answer: B

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

   Answer: E

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

   Answer: B

6) Consider the reaction:

$CH_{4(g)} + 4\ Cl_{2(g)} \rightleftharpoons CCl_{4(l)} + 4\ HCl_{(g)}\ \Delta H°$ -398 kJ/mol

The equilibrium is displaced to the right if:

A) some hydrogen chloride is added
B) the temperature is raised
C) the pressure is lowered
D) some carbon tetrachloride is removed
E) some chlorine gas is removed

Answer: D

7) Given that the equilibrium concentrations of $[N_2] = 0.035$ M, $[C_2H_2] = 0.057$ M, and $[HCN] = 6.8 \times 10^{-4}$ M, find the value of the equilibrium constant expression for the reaction:

$N_{2(g)} + C_2H_{2(g)} \rightleftharpoons 2\ HCN$

A) 3.4×10^{-1} B) 6.8×10^{-1} C) 4300 D) 2.9 E) 2.3×10^{-4}

Answer: E

8) 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) $H_2O_{(l)}$ is added
C) temperature is lowered
D) catalyst is added
E) $MnO_{2\ (s)}$ is added

Answer: B

9) 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 heat energy in Joules required to break the bonds in one reactant
D) an energy that a catalyst brings to the system to activate one of the reactants
E) the kinetic energy of solution stirring that brings the reaction to start

Answer: A

10) Proton acceptor is an abbreviated definition of:

A) Brønsted-Lowry acid
B) Brønsted-Lowry base
C) Lewis base
D) Lewis acid
E) Arrhenius acid

Answer: B

11) Choose the Brønsted-Lowry acids and bases in the following equation:

$NH_4^+ + OH^- \rightleftharpoons H_2O + NH_3$

A) acids OH^-, H_2O bases NH_3, NH_4^+

B) acids NH_4^+, OH^- bases H_2O, NH_3

C) acids NH_4^+, H_2O bases OH^-, NH_3

D) acids NH_4^+, OH^- bases NH_4^+, H_2O

E) acids NH_4^+, NH_3 bases OH^-, H_2O

Answer: C

12) Which of the following is the strongest base?

A) NO_3^- B) F^- C) Cl^- D) ClO_4^- E) H_2O

Answer: B

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

A) concentrations of reactants

B) presence of a catalyst

C) activation energy

D) value of $\Delta H°$

E) temperature of reactants

Answer: D

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

A) removing product

B) removing reactant

C) raising the temperature

D) addition of a catalyst

E) increase in mixing rate

Answer: C

15) Consider the reaction:

$HC_2H_3O_2 + H_2O \rightleftharpoons H_3O^+ + C_2H_3O_2^-$

Choose the pair of substances that are both bases in the reaction.

A) $HC_2H_3O_2$ and $C_2H_3O_2^-$

B) H_3O^+ and $HC_2H_3O_2$

C) H_2O and $C_2H_3O_2^-$

D) $HC_2H_3O_2$ and H_3O^+

E) H_2O and H_3O^+

Answer: C

16) Which of the following are Brønsted-Lowry acid?

I) CH_3COOH

II) $[Cu(H_2O)_4]^{2+}$

III) H_2O

IV) CH_3NH_2

V) H_3O^+

A) II), III), and IV)
B) I), II) and III)
C) I), II), III), and V)
D) I), II), III) and IV)
E) II), III) and V)

Answer: C

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

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

Answer: E

18) Define activation energy.

A) the difference between the energy of the products and reactants
B) the minimum total kinetic energy that molecules must bring to their collisions for a chemical reaction to occur
C) the total kinetic energy of molecules in a system
D) the total kinetic energy of molecules in collisions
E) the energy difference between the maximum energy of reaction and the energy of the products

Answer: B

19) 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) catalyzed
D) overall zero order
E) first order in the product

Answer: D

20) 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) $k[H_2]$
B) $k[H_2][NO]^2$
C) $k[H_2][NO]^{-2}$
D) $k[H_2][NO]$
E) $k[H_2]^2[NO]$

Answer: B

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

Answer: C

22) pOH = 3.14 is equivalent to:

A) pH = 11.
B) $[OH^-] = 3.14 \times 10^{-7}$ M
C) $[OH^-] = 7.2 \times 10^{-4}$ M
D) $[H^+] = 1.4 \times 10^{-10}$ M
E) $[H^+] = 7.0 \times 10^{-4}$ M

Answer: C

23) For the reaction: $C_2H_4Br_2 + 3\ KI \rightarrow C_2H_4 + 2\ KBr + KI_3$, when the rate of reaction is 2.0×10^{-5}, what is the rate of disappearance of KI?

A) -0.67×10^{-5} B) -1.0×10^{-5} C) -4.0×10^{-5} D) -6.0×10^{-5} E) -2.0×10^{-5}

Answer: D

24) Choose the correct statement about a container in which the chemical equilibrium is established:

$2\ SO_{2(g)} + O_{2(g)} \rightleftharpoons 2\ SO_{3(g)}$ + heat

A) A decrease in the volume will decrease the amount of SO_2 present.
B) An increase in amount of O_2 will increase the amount of SO_2 present.
C) A decrease in temperature will increase the amount of SO_2 present.
D) A decrease in the amount of SO_3 present will increase the amount of SO_2 present.
E) A decrease in amount of O_2 will decrease the amount of SO_2 present.

Answer: A

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

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

Answer: B

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

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

Answer: A

27) 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) 0.0154 M
B) 1.54×10^{-4} M/s
C) 1.54×10^{-4} moles/s
D) 1.54×10^{-4} moles
E) 0.0154 M/s

Answer: B

28) In a second order reaction:

I) the sum of the exponents in the rate law is equal to two.
II) at least one of the exponents in the rate law is a two.
III) the half-life is not constant.
IV) the half-life is constant.
V) *k* can be expressed as $M^{-2}s^{-1}$ or $M^{-2}min^{-1}$.

A) II and III B) I and IV C) II and IV D) I, III, and V E) I and III

Answer: E

29) Choose the strongest acid.

A) $HC_2H_3O_2$ B) H_2CO_3 C) $HClO_4$ D) HCN E) HF

Answer: C

30) 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) 1.67×10^{-3} M
B) 1.04×10^{-3} M
C) 3.70×10^{-2} M
D) 6.024×10^{-3} M
E) 2.31×10^{-1} M

Answer: A

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

Answer: C

32) Which of the following situations involves a heterogeneous catalysis?

A) The catalyst, reactants, and products are all different phases of matter.
B) The catalyst is present in a different phase of matter than are the reactants and products.
C) The reactants and products are different phases of matter in a catalyzed reaction.
D) The catalyst changes phases during the reaction.
E) The catalyst is in two different phases of matter.

Answer: B

33) At 25°C, the pH of pure water is:

A) 0 B) 14 C) >0, <7 D) 7 E) >7, <14

Answer: D

34) Which of the following statements is correct ?

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

Answer: C

35) A catalyst alters the rate of a chemical reaction by:

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

Answer: C

36) In the Arrhenius equation, $\ln k = -E_a/RT + \ln A$, the symbol A denotes:

A) the initial concentration of A
B) a constant that represents the frequency of collisions with the proper orientation and other steric conditions favorable for a reaction
C) the absolute temperature
D) the rate constant
E) the activation energy

Answer: B

37) What is the value for K_C if [CO] = 0.025, $[H_2]$ = 0.013 and $[CH_3OH]$ = 0.0028 for the following reaction?

$$CH_3OH_{(g)} \rightleftharpoons CO_{(g)} + 2\ H_{2(g)}$$

A) 0.12 B) 6.6×10^2 C) 9.1×10^{-7} D) 8.6 E) 1.5×10^{-3}

Answer: E

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

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

Answer: D

39) The reaction has the rate law Rate = $k[A][B]^2$. Which will cause the rate to increase the most?

A) doubling [A]
B) tripling [B]
C) doubling [B]
D) lowering temperature
E) quadrupling [A]

Answer: B

40) 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) Half-life in a first order reaction is constant.
D) In gaseous reactions [A] can be expressed as concentration or as pressure.
E) For a first order reaction $\ln [A]_t/[A]_0 = kt$.

Answer: E

41) For the second order reaction A → products, the following data are obtained:

[A] = 3.024 M, t = 0 min
[A] = 2.935 M, t = 1.0 min
[A] = 2.852 M, t = 2.0 min

What is the rate constant, k?

A) 3.6×10^{-3} M^{-1} min^{-1}
B) 9.7×10^{-3} M^{-1} min^{-1}
C) 1.0×10^{-2} M^{-1} min^{-1}
D) 2.2×10^{-2} M^{-1} min^{-1}
E) 1.4×10^{-2} M^{-1} min^{-1}

Answer: C

42) According to the Arrhenius theory, a neutralization reaction involves:

A) the dissociation of a strong base into hydroxide ions and a cation.
B) the combination of hydrogen ions and hydroxide ions to form water.
C) the dissociation of a strong acid to hydrogen ions and an anion.
D) the combination of an acid with a base to make only water.
E) the addition of water to ammonia to make ammonium hydroxide.

Answer: B

43) Define rate law.

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

Answer: A

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

Answer: B

45) Choose the Brønsted-Lowry acids and bases in the following equation:

$HCN + OH^- \rightleftharpoons H_2O + CN^-$

A) acids CN^-, OH^- bases HCN, H_2O
B) acids HCN, OH^- bases H_2O, CN^-
C) acids HCN, H_2O bases OH^-, CN^-
D) acids HCN, CN^- bases OH^-, H_2O
E) acids OH^-, H_2O bases CN^-, HCN

Answer: C

46) For the reaction: $2N_2O_{5(g)} \rightarrow 4NO_{2(g)} + O_{2(g)}$ at the time when N_2O_5 is being consumed at a rate of -1.2×10^{-4} M/s, what is the rate at which O_2 is being formed?

A) 6.0×10^{-5} M/s
B) 2.4×10^{-4} M/s
C) 1.2×10^{-4} M/s
D) 4.8×10^{-4} M/s
E) 3.0×10^{-5} M/s

Answer: A

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

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

Answer: E

48) Which statement is INCORRECT ?

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

Answer: C

49) The definition of a neutralization reaction as a reaction in which an acid reacts with a base to produce water and a salt is inherent in:

A) both the Brønsted-Lowry and the Lewis theories
B) only the Lewis theory
C) both the Arrhenius and the Brønsted-Lowry theories
D) only the Arrhenius theory
E) only the Brønsted-Lowry theory

Answer: D

50) For the reaction: $CH_{4(g)} + 2H_2O_{(g)} \rightleftharpoons CO_{2(g)} + 4H_{2(g)}$ $\Delta H° = +190$ kJ add $H_{2(g)}$:

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

Answer: C