# 1022_2nd Exam_1030416

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

1) Which of the following species is amphoteric?
   A) $CO_3^{2-}$
   B) $HPO_4^{2-}$
   C) $NH_4^+$
   D) HF
   E) None of the above are amphoteric.

   Answer: B

2) What is the conjugate base of $H_2PO_4^-$?

   A) $H_3PO_4$ B) $PO_4^{3-}$ C) $HPO_4^{2-}$ D) $OH^-$ E) $H_3O^+$

   Answer: C

3) Identify the weak diprotic acid.

   A) $HClO_4$ B) $HNO_3$ C) $H_3PO_4$ D) $H_2SO_3$ E) $H_2SO_4$

   Answer: D

4) Which of the following statements is TRUE?
   A) The conjugate base of a very weak acid is stronger than the conjugate base of a strong acid.
   B) A weak base is composed of a cation and an anion with a very weak attraction between them.
   C) A strong acid is composed of a proton and an anion that have a very strong attraction for one another.
   D) A strong acid has a strong conjugate base.
   E) None of the above statements are true.

   Answer: A

5) Determine the pH of a 0.00598 M $HClO_4$ solution.

   A) 11.777 B) 6.434 C) 3.558 D) 2.223 E) 7.566

   Answer: D

6) Calculate the pOH of a solution that contains $7.8 \times 10^{-6}$ M $OH^-$ at 25°C.

   A) 5.11 B) 9.64 C) 12.72 D) 8.89 E) 1.28

   Answer: A

7) Acid rain consists primarily of _____.
   A) benzoic acid
   B) nitric and sulfuric acids
   C) nitric acid
   D) sulfuric acid
   E) acetic acid

   Answer: B

8) Determine the pH of a 0.62 M $NH_4NO_3$ solution at 25°C. The $K_b$ for $NH_3$ is $1.76 \times 10^{-5}$.

   A) 9.45 B) 4.73 C) 9.27 D) 11.52 E) 2.48

   Answer: B

9) Place the following in order of increasing acid strength.

$HBrO_2$ $HBrO_3$ $HBrO$ $HBrO_4$

A) $HBrO_2 < HBrO_4 < HBrO < HBrO_3$
B) $HBrO < HBrO_4 < HBrO_3 < HBrO_2$
C) $HBrO_2 < HBrO_3 < HBrO_4 < HBrO$
D) $HBrO_4 < HBrO_2 < HBrO_3 < HBrO$
E) $HBrO < HBrO_2 < HBrO_3 < HBrO_4$

Answer: E

10) What is the $K_w$ of pure water at 50.0°C, if the pH is 6.630?

A) $2.13 \times 10^{-14}$
B) $2.34 \times 10^{-7}$
C) $1.00 \times 10^{-14}$
D) $5.50 \times 10^{-14}$
E) There is not enough information to calculate the $K_w$.

Answer: D

11) Which of the following bases is the STRONGEST? The base is followed by its $K_b$.

A) $C_5H_5N$, $1.7 \times 10^{-9}$
B) $CH_3NH_2$, $4.4 \times 10^{-4}$
C) $(CH_3CH_2)_2NH$, $8.6 \times 10^{-4}$
D) $NH_3$, $1.76 \times 10^{-5}$
E) $C_6H_5NH_2$, $4.0 \times 10^{-10}$

Answer: C

12) Which one of the following will form a basic solution in water?

A) LiBrO
B) $NaC_2H_3O_2$
C) LiCN
D) $KClO_2$
E) All of the above will form basic solutions.

Answer: B, C

13) Determine the pH of a solution that is 0.15 M $HClO_2$ ($K_a = 1.1 \times 10^{-2}$) and 0.15 M HClO ($K_a = 2.9 \times 10^{-8}$).

A) 12.55 B) 4.18 C) 1.39 D) 3.55 E) 9.82

Answer: C

14) Determine the $[OH^-]$ concentration in a 0.169 M $Ca(OH)_2$ solution.

A) 0.338 M
B) 0.298 M
C) 0.169 M
D) $5.92 \times 10^{-14}$ M
E) $2.96 \times 10^{-14}$ M

Answer: A

15) Determine the $K_a$ of an acid whose 0.294 M solution has a pH of 2.80.

A) 2.7 B) $5.4 \times 10^{-3}$ C) $4.9 \times 10^{-7}$ D) $8.5 \times 10^{-6}$ E) $1.2 \times 10^{-5}$

Answer: D

16) Find the percent ionization of a 0.337 M HF solution. The $K_a$ for HF is $3.5 \times 10^{-4}$.

A) $3.5 \times 10^{-2}$ % B) $1.2 \times 10^{-2}$ % C) 1.1 % D) 4.7 % E) 3.2 %

Answer: E

17) Identify a good buffer.

A) significant amounts of both a strong acid and a strong base
B) significant amounts of both a weak acid and a strong acid
C) small amounts of both a strong acid and a strong base
D) small amounts of both a weak acid and its conjugate base
E) significant amounts of both a weak acid and its conjugate base

Answer: E

18) If the pKa of $HCHO_2$ is 3.74 and the pH of an $HCHO_2/NaCHO_2$ solution is 3.11, which of the following is TRUE?

A) $[HCHO_2] << [NaCHO_2]$
B) $[HCHO_2] > [NaCHO_2]$
C) $[HCHO_2] = [NaCHO_2]$
D) $[HCHO_2] < [NaCHO_2]$
E) It is not possible to make a buffer of this pH from $HCHO_2$ and $NaCHO_2$.

Answer: B

19) A solution contains $2.2 \times 10^{-3}$ M in $Cu^{2+}$ and 0.33 M in LiCN. If the $K_f$ for $Cu(CN)_4^{2-}$ is $1.0 \times 10^{25}$, how much copper ion remains at equilibrium?

A) $2.9 \times 10^{-27}$ M
B) $3.8 \times 10^{-24}$ M
C) $6.7 \times 10^{-28}$ M
D) $4.6 \times 10^{-25}$ M
E) $1.9 \times 10^{-26}$ M

Answer: E

20) A solution containing $CaCl_2$ is mixed with a solution of $Li_2C_2O_4$ to form a solution that is $3.5 \times 10^{-4}$ M in calcium ion and $2.33 \times 10^{-4}$ M in oxalate ion. What will happen once these solutions are mixed? $K_{sp}$ ($CaC_2O_4$) = $2.3 \times 10^{-9}$.

A) A precipitate will form since $Q > K_{sp}$ for calcium oxalate.
B) A precipitate will form as calcium oxalate is not soluble to any extent.
C) Nothing will happen $K_{sp} > Q$ for all possible precipitants.
D) Nothing will happen since both calcium chloride and lithium oxalate are soluble compounds.
E) There is not enough information to determine.

Answer: A

21) The molar solubility of $Ag_2S$ is $1.26 \times 10^{-16}$ M in pure water. Calculate the $K_{sp}$ for $Ag_2S$.

A) $1.12 \times 10^{-8}$ B) $3.78 \times 10^{-12}$ C) $8.00 \times 10^{-48}$ D) $1.59 \times 10^{-32}$ E) $6.81 \times 10^{-63}$

Answer: C

22) A 100.0 mL sample of 0.10 M $NH_3$ is titrated with 0.10 M $HNO_3$. Determine the pH of the solution before the addition of any $HNO_3$. The $K_b$ of $NH_3$ is $1.8 \times 10^{-5}$.

A) 9.26 B) 11.13 C) 4.74 D) 12.55 E) 13.00

Answer: B

23) A 100.0 mL sample of 0.10 M $NH_3$ is titrated with 0.10 M $HNO_3$. Determine the pH of the solution after the addition of 100.0 mL of $HNO_3$. The $K_b$ of $NH_3$ is $1.8 \times 10^{-5}$.

A) 10.56 B) 5.28 C) 8.72 D) 3.44 E) 6.58

Answer: B

24) Determine the molar solubility of AgBr in a solution containing 0.200 M NaBr. $K_{sp}$ (AgBr) = $7.7 \times 10^{-13}$.

A) $3.8 \times 10^{-12}$ M
B) $1.54 \times 10^{-13}$ M
C) 0.200 M
D) $8.8 \times 10^{-7}$ M
E) $5.8 \times 10^{-5}$ M

Answer: A

25) Which of the following is TRUE?

A) The equivalence point is where the amount of acid equals the amount of base during any acid-base titration.
B) At the equivalence point, the pH is always 7.
C) A titration curve is a plot of pH vs. the [base]/[acid] ratio.
D) An indicator is not pH sensitive.
E) None of the above are true.

Answer: A

26) Determine the molar solubility of $BaF_2$ in pure water. $K_{sp}$ for $BaF_2$ = $2.45 \times 10^{-5}$.

A) $6.13 \times 10^{-6}$ M
B) $1.83 \times 10^{-2}$ M
C) $1.23 \times 10^{-5}$ M
D) $4.95 \times 10^{-3}$ M
E) $2.90 \times 10^{-2}$ M

Answer: B

27) When titrating a monoprotic strong acid with a weak base at 25°C, the

A) pH will be greater than 7 at the equivalence point.
B) pH will be less than 7 at the equivalence point.
C) titration will require more moles of the base than acid to reach the equivalence point.
D) pH will be 7 at the equivalence point.
E) titration will require more moles of acid than base to reach the equivalence point.

Answer: B

28) Give the equation for a supersaturated solution in comparing Q with $K_{sp}$.

A) $Q < K_{sp}$

B) $Q \neq K_{sp}$

C) $Q = K_{sp}$

D) $Q > K_{sp}$

E) none of the above

Answer: D

29) Calculate the pH of a solution formed by mixing 200.0 mL of 0.30 M HClO with 300.0 mL of 0.20 M KClO. The $K_a$ for HClO is $2.9 \times 10^{-8}$.

A) 6.46 B) 8.01 C) 5.99 D) 7.54 E) 7.06

Answer: D

30) A 1.50 L buffer solution is 0.250 M in HF and 0.250 M in NaF. Calculate the pH of the solution after the addition of 0.0500 moles of solid NaOH. Assume no volume change upon the addition of base. The $K_a$ for HF is $3.5 \times 10^{-4}$.

A) 3.57 B) 3.63 C) 3.46 D) 2.89 E) 3.34

Answer: A

31) Define buffer capacity.

A) Buffer capacity is the amount of acid that can be added until all of the base is used up.

B) Buffer capacity is the amount of acid or base that can be added to a buffer without destroying its effectiveness.

C) Buffer capacity is the amount of base that can be added until all of the acid is used up.

D) Buffer capacity is the amount of base that can be added until all of the base is used up.

E) Buffer capacity is the amount of acid that can be added until all of the acid is used up.

Answer: B

32) Choose the electron configuration for $Fe^{3+}$.

A) $[Ar]3d^5$ B) $[Ar]4s^23d^3$ C) $[Ar]4s^23d^9$ D) $[Ar]4s^23d^6$ E) $[Ar]4s^13d^4$

Answer: A

33) Name the following: $Fe[AlF_6]$

A) iron (III) hexafluoroaluminate

B) ironaluminumhexafluoride

C) aluminumhexafluoroferrate

D) iron(II) hexafluoroaluminum

E) iron(I) aluminumhexafluoride

Answer: A

34) Determine the chemical formula for the compound, diamminetetraaquairon(II)chloride.

A) $[Fe(NH_3)_2][(H_2O)_4Cl]$

B) $[Fe(NH_3)_2(H_2O)_4]Cl_2$

C) $[Fe(NH_3)_2(H_2O)_4]Cl_3$

D) $[Fe(NH_3)_2(H_2O)_4Cl]$

E) $[Fe(H_2O)_4][(NH_3)_2Cl]$

Answer: B

35) Identify the isomers that have ligands which coordinates to metal in different ways.
A) geometric isomers
B) coordination isomers.
C) optical isomers
D) linkage isomers
E) stereoisomers.

Answer: D

36) How many unpaired electrons would you expect for the complex ion: $[Cr(CN)_6]^{4-}$?
A) 5 B) 3 C) 2 D) 1 E) 0

Answer: C

37) Name the following: $[Pt(H_2O)_4F_2]Br_2$
A) tetraaquadifluoroplatinum(IV) bromide
B) platinum(III)tetraaquadifluorobromide
C) tetraaquadibromodifluoroplatinate
D) platinum (II) dibromodifluorotetrahydride
E) platinum(II)bromide

Answer: A

38) Which of the following compounds can exhibit fac-mer isomerism?
A) $[Fe(NH_3)_4(H_2O)_2]^{2+}$
B) $[Fe(CO)_3(NH_3)_3]^{3+}$
C) $[Cu(CO)_5Br]^{+}$
D) $[Fe(CO)_5ONO]^{2+}$
E) $[Cr(H_2O)_4Br_2]^{+}$

Answer: B

39) The complex ion, $[Ni(NH_3)_6]^{2+}$, has a maximum absorption near 580 nm. Calculate the crystal field splitting energy (in kJ/mol) for this ion.
A) 485 kJ/mol B) 114 kJ/mol C) 343 kJ/mol D) 206 kJ/mol E) 292 kJ/mol

Answer: D

40) Which of the following pairs of coordination compounds or complex ions are examples of coordination isomers?
A) $[Fe(NH_3)_2(H_2O)_4]Cl_2$ and $[Fe(NH_3)_4(H_2O)_2]Cl_2$
B) $[MnCl_3Br]^{2-}$ and $[MnClBr_3]^{2-}$
C) $[Cu(CO)_5Br]Cl$ and $[Cu(CO)_5Cl]Br$
D) $[Fe(NH_3)_2(H_2O)_4]Cl_2$ and $[Fe(NH_3)_2(H_2O)_4]Br_2$
E) $[Fe(CO)_5NO_2]^{2+}$ and $[Fe(CO)_5ONO]^{2+}$

Answer: C