This print-out should have 30 questions. Multiple-choice questions may continue on the next column or page – find all choices before answering. V1:1, V2:1, V3:1, V4:1, V5:2.

Please make sure you write your version numbers on your scantron. Good luck!

Strong Acid or Base

22:10, general, multiple choice, < 1 min, fixed.

001 (part 1 of 1) 6 points

Which of

I) HCl II) HF III) LiOH

IV) $HClO_2$ V) HNO_3

are strong acids or strong bases in water?

1. I, III, and V only **correct**

2. I, III, IV, and V only

3. I, II, III, and V only

4. All of the compounds

5. I, II, IV, and V only

Explanation:

Buffer NH3

24:02, general, multiple choice, > 1 min, fixed.

002 (part 1 of 1) 6 points

What is the pH of a solution containing 0.3 M NH_4Cl and 0.6 M NH_3? The pK_a of the ammonium ion is 9.25.

1. 9.55 **correct**

2. 8.95

3. 5.05

4. 4.45

5. 12.25

Explanation:

Buffer Prep 01

24:02, general, multiple choice, > 1 min, fixed.

003 (part 1 of 1) 6 points

Which of the following solutions will produce a buffer?

I) 20 mL of 0.5 M $(CH_3)_3NHCl$ + 50 mL of 0.1 M $(CH_3)_3N$

II) 20 mL of 0.5 M HNO_2 + 50 mL of 0.1 M NaOH

III) 20 mL of 0.5 M HCl + 50 mL of 0.1 M NH_3

IV) 20 mL of 0.5 M $HClO_2$ + 50 mL of 0.1 M CH_3COOH

V) 20 mL of 0.5 M NH_4Cl + 50 mL of 0.1 M NaOH

1. I, II, and V only **correct**

2. I, II, IV, and V only

3. I, II, III, and V only

4. II and IV only

5. II only

Explanation:

Msci 18 0412

22:07, general, multiple choice, > 1 min, fixed.

004 (part 1 of 1) 6 points

Assume that five weak acids, identified only by numbers (1, 2, 3, 4 and 5), have the following ionization constants.

Acid	Ionization Constant K_a value
1	1.0×10^{-3}
2	3.0×10^{-5}
3	2.6×10^{-7}
4	4.0×10^{-9}
5	7.3×10^{-11}

The anion of which acid is the weakest base?

1. 1 **correct**

2. 2

3. 3

4. 4

5. 5

Explanation:

$$HA \rightleftharpoons H^+ + A^-$$

$$K_a = \frac{[H^+]\,[A^-]}{[H]\,[A]}$$

The 'anion of an acid' is another way of saying 'conjugate base,' and a weak conjugate base corresponds to a strong acid. So really what we're looking for is which acid is strongest (has the lowest pH).

A low pH means that the $[H^+]$ concentration is low. (Remember that values greater than 7 are basic!) The larger values of K_a means that there is more $[H^+]$ so you would expect these solutions to be more acidic; *i.e.*, have smaller pH's. The smaller K_a values mean less $[H^+]$ in solution, so higher pH's. The acid with the largest K_a (#1) will have the lowest pH; *i.e.*, highest $[H^+]$ concentration

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Buffer Capacity 01

24:04, general, multiple choice, > 1 min, fixed.

005 (part 1 of 1) 6 points

What is the buffer capacity of 50 mL of 0.3 M HNO_2 and 100 mL of 0.5 M $NaNO_2$?

1. 0.015 mol of OH^- and 0.05 mol of H^+ **correct**

2. 0.05 mol of OH^- and 0.015 mol of H^+

3. 0.3 mol of OH^- and 0.5 mol of H^+

4. 0.5 mol of OH^- and 0.3 mol of H^+

5. 0.15 mol of OH^- and 0.5 mol of H^+

Explanation:

Buffer Stress

24:04, general, multiple choice, > 1 min, fixed.

006 (part 1 of 1) 6 points

What is the final pH of a solution containing 100 mL of 0.2 M $HClO_2$ and 300 mL of 0.1 M $NaClO_2$ after 0.01 mol of NaOH is added? The pK_a is 2.00.

1. 2.60 **correct**

2. 1.40

3. 1.70

4. 2.00

5. 11.40

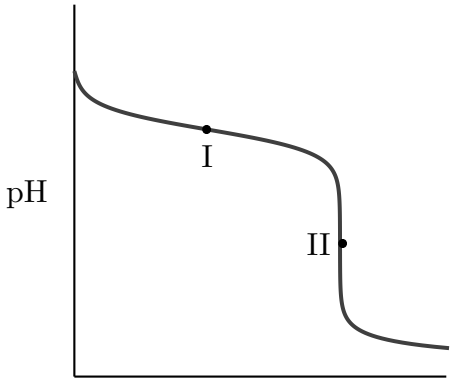
Explanation:

Titration Curve 02

24:06, general, multiple choice, < 1 min, fixed.

007 (part 1 of 1) 6 points

Consider the titration curve of a weak base with a strong acid



The pOH at point I is equal to the ___ and the pH at point II is ___ pH 7.

1. pK_b of the base, less than **correct**

2. pK_b of the base, greater than

3. pH of the base, greater than

4. pH of the base, less than

5. pK_b of the base, equal to

Explanation:

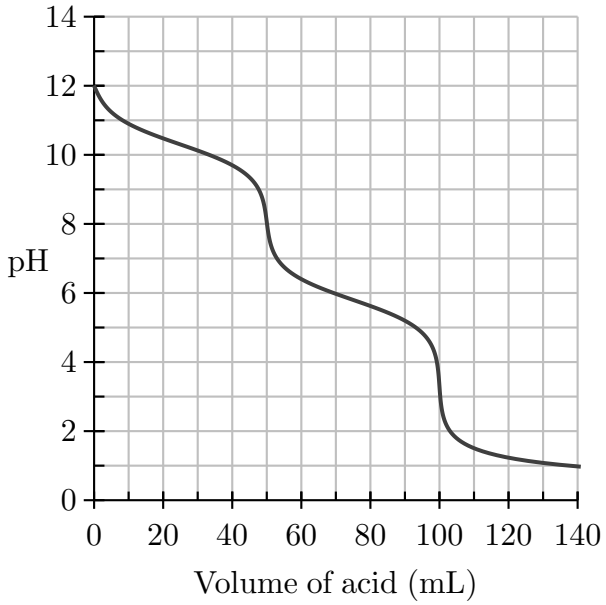
ChemPrin3e T11 64

24:06, general, multiple choice, < 1 min,

wording-variable.

008 (part 1 of 1) 6 points

The titration curve for the titration of 0.5 M Na_2CO_3(aq) with 0.5 M $HClO_4$(aq) is given below.



What are the main species in the solution after the addition of 35 mL of $HClO_4$?

1. CO_3^{2-}, HCO_3-, Na^+, and ClO_4^-. **correct**

2. HCO_3^-, H_2 CO_3, Na^+, and ClO_4^-.

3. CO_3^{2-}, Na^+, and ClO_4^-.

4. H_2 CO_3, Na^+, and ClO_4^-.

5. HCO_3^-, Na^+, and ClO_4^-.

Explanation:

Titration Excess Acid

24:06, general, multiple choice, > 1 min, fixed.

009 (part 1 of 1) 6 points

What is the pH of a solution containing 50 mL of 0.5 M HNO_3 and 150 mL of 0.1 M NaOH?

1. 1.30 **correct**

2. 0.30

3. 7.00

4. 0.70

5. 2.00

Explanation:

Titration End Pt 01

24:06, general, multiple choice, > 1 min, fixed.

010 (part 1 of 1) 6 points

What is the pH of a solution containing 100 mL of 0.3 M $HClO_3$ and 150 mL of 0.1 M $Ba(OH)_2$?

1. 7.00 **correct**

2. 0.52

3. 13.48

4. 5.39

5. 9.60

Explanation:

Titration Partial NH3

24:06, basic, multiple choice, > 1 min, fixed.

011 (part 1 of 1) 6 points

What is the pH of a solution containing 100 mL of 0.5 M NH_3 and 200 mL of 0.1 M HCl? The pK_b of ammonia is 4.75.

1. 9.43 **correct**

2. 9.95

3. 9.65

4. 8.72

5. 9.15

Explanation:

Titration End Pt NH3

24:06, general, multiple choice, > 1 min, fixed.

012 (part 1 of 1) 6 points

What is the pH of a solution containing 100 mL of 0.5 M NH_3 and 250 mL of 0.2 M HCl? The pK_b of ammonia is 4.75.

1. 5.05 **correct**

2. 5.28

3. 4.94

4. 10.10

5. 9.75

Explanation:

Solubility Order

25:01, general, multiple choice, < 1 min, fixed.

013 (part 1 of 1) 6 points

Arrange the compounds

I) CuS $K_{sp} = 1.3 \times 10^{-36}$
II) $PbCl_2$ $K_{sp} = 1.6 \times 10^{-5}$
III) FeS $K_{sp} = 6.3 \times 10^{-18}$
IV) Hg_2Cl_2 $K_{sp} = 2.6 \times 10^{-18}$
V) Cu_2S $K_{sp} = 2.0 \times 10^{-47}$

in increasing order of solubility.

1. I, V, III, IV, II **correct**

2. II, IV, III, V, I

3. II, III, IV, I, V

4. V, I, IV, III, II

5. I, II, III, IV, V

Explanation:

Molar Sol Ag2S

25:01, general, multiple choice, > 1 min, fixed.

014 (part 1 of 1) 6 points

What is the molar solubility of 0.5 M Ag_2S? The K_{sp} is 6.3×10^{-51}.

1. 1.16×10^{-17} **correct**

2. 7.94×10^{-26}

3. 2.82×10^{-13}

4. 5.8×10^{-18}

5. 6.37×10^{-15}

Explanation:

Molar Sol CuBr in NaBr

25:01, general, multiple choice, > 1 min, fixed.

015 (part 1 of 1) 6 points

What is the molar solubility of 0.1 M CuBr in 0.5 M NaBr? The K_{sp} is 4.2×10^{-8}.

1. 8.40×10^{-8} **correct**

2. 2.05×10^{-4}

3. 4.20×10^{-7}

4. 3.48×10^{-3}

5. 4.20×10^{-8}

Explanation:

Weak Acid Assumptions

23:01, general, multiple choice, < 1 min, fixed.

016 (part 1 of 1) 6 points

The weak acid equation $[H^+] = (K_a\, C_a)^{1/2}$ can be derived from

$$[H^+]^3 + K_a\,[H^+]^2 - (K_w + K_a\, C_a)[H^+] - K_a\, K_w = 0$$

if

1. K values are far apart, K_w is negligible and C_a is significantly larger than $[H^+]$. **correct**

2. K values are far apart, K_w is negligible and C_a is significantly smaller than $[H^+]$.

3. K_w is negligible and C_a is significantly larger than $[H^+]$.

4. K_w is negligible and C_a is significantly smaller than $[H^+]$.

5. K_a is negligible and C_a is significantly larger than $[H^+]$.

Explanation:

Triprotic pH

23:03, general, multiple choice, > 1 min, fixed.

017 (part 1 of 1) 6 points

What is the pH of a solution containing 0.2 M RbH_2PO_4? The pK_{a1} is 2.12, the pK_{a2} is 7.21, and the pK_{a3} is 12.68.

1. 4.67 **correct**

2. 7.40

3. 9.95

4. 1.41

5. 3.95

Explanation:

Sys Treat Equil 02

25:03, general, multiple choice, > 1 min, fixed.

018 (part 1 of 1) 6 points

$NaHCO_3$, NaCl, and HBr are dissolved in water. How many equations are needed to describe this system?

1. 8 **correct**

2. 7

3. 6

4. 5

5. 4

Explanation:

The species Na^+, H_2CO_3, HCO_3^-, CO_3^{2-}, Cl^-, Br^-, H^+, and OH^- will be present in the water.

Mass Balance Equation

25:03, general, multiple choice, < 1 min, fixed.

019 (part 1 of 1) 6 points

0.5 M of HCOOH is dissolved in water. Which equation describes a possible mass balance equation for this system?

1. $C_{HCOOH} = [HCOOH] + [HCOO^-]$ **correct**

2. $C_{HCOOH} = [HCOO^-]$

3. $C_{HCOOH} = [HCOOH]$

4. $C_{HCOOH} = [HCOOH] + [HCOO^-] + [H^+]$

5. $C_{HCOOH} = [HCOO^-] + [H^+]$

Explanation:

Equil Expression

23:03, general, multiple choice, < 1 min, fixed.

020 (part 1 of 1) 6 points

Which of the equilibrium expressions for a triprotic acid H_3A would be involved in the calculation to find the pH of a solution found from LiCaA and Na_2HA? Assume the K values are far apart and K_w is not involved in the calculation.

1. K_{a3} **correct**

2. K_{a2} and K_{a3}

3. K_{a1}, K_{a2}, and K_{a3}

4. K_{a1} and K_{a2}

5. K_{a1}

6. K_{a2}

Explanation:

Dilute Sol 01

23:10, general, multiple choice, > 1 min, fixed.

021 (part 1 of 1) 6 points

What is the pH of a solution containing 10^{-9} M $HClO_4$?

1. 6.996 **correct**

2. 9.000

3. 8.768

4. 5.000

5. 5.232

Explanation:

Equation Setup

23:03, general, multiple choice, > 1 min, fixed.

022 (part 1 of 1) 6 points

Which of the following is a correct expression to use to solve for $x = [SO_4^{2-}]$ in a 0.2 M H_2SO_4 solution?

1. $x\,\dfrac{0.2 + x}{0.2 - x} = 1.1 \times 10^{-2}$ **correct**

2. $x\,\dfrac{0.2}{0.2 - x} = 1.1 \times 10^{-2}$

3. $\dfrac{x^2}{0.2 - x} = 1.1 \times 10^{-2}$

4. $x\,\dfrac{2}{x} = 1.1 \times 10^{-2}$

5. $x = 1.1 \times 10^{-2}$

Explanation:

Triprotic pH 01

23:03, general, multiple choice, > 1 min, fixed.

023 (part 1 of 1) 6 points

What is the pH of 1 M Na_3A if $pK_{a1} = 2$, $pK_{a2} = 6$, and $pK_{a3} = 10$ for the triprotic acid H_3A?

1. 12 **correct**

2. 2

3. 8

4. 10

5. 11

Explanation:

Redox Bal 01a

26:01, general, multiple choice, < 1 min, wording-variable.

024 (part 1 of 1) 6 points

When the equation

$$FeCl_3 + Au(s) \rightleftharpoons Fe(s) + AuCl$$

is correctly balanced, what is the coefficient of $FeCl_3$?

1. 1 **correct**

2. 3

3. 2

4. 4

5. 5

Explanation:

The balanced equation is

$$FeCl_3 + 3\,Au(s) \rightleftharpoons Fe(s) + 3\,AuCl$$

Bal Redox in Acid

26:01, general, multiple choice, > 1 min, fixed.

025 (part 1 of 1) 6 points

For a reaction in acid involving the following two half reactions,

$$Fe^{3+} + e^- \rightleftharpoons Fe^{2+}$$

$$Cr_2O_7^{2-} + 6\,e^- \rightleftharpoons 2\,Cr^{3+}$$

what is the coefficient for H^+ in the balanced reaction?

1. 14 **correct**

2. 7

3. 6

4. 1

5. 36

Explanation:

The balanced equation is

$$14\,H^+ + 6\,Fe^{3+} + Cr_2O_7 \rightleftharpoons 6\,Fe^{2+} + 2\,Cr^{3+} + 7\,H_2O$$

Ox Agent Order

26:07, general, multiple choice, > 1 min, fixed.

026 (part 1 of 1) 6 points

Arrange the agents

I) $Fe^{3+} + e^- \rightarrow Fe^{2+}$ $\quad E^\circ_{red} = +0.77$

II) $Cu^{2+} + e^- \rightarrow Fe^{+}$ $\quad E^\circ_{red} = +0.15$

III) $S + 2\,e^- \rightarrow S^{2-}$ $\quad E^\circ_{red} = -0.48$

IV) $Mn^{3+} + e^- \rightarrow Mn^{2+}$ $\quad E^\circ_{red} = +1.51$

V) $Ca^{2+} + 2\,e^- \rightarrow Fe$ $\quad E^\circ_{red} = -2.87$

in increasing order of oxidizing agent strength.

1. V, III, II, I, IV **correct**

2. IV, I, II, III, V

3. I, II, III, IV, V

4. V, IV, III, II, I

5. III, V, IV, I, II

Explanation:

Lyon 49740 e5 q20

26:07, general, multiple choice, > 1 min, fixed.

027 (part 1 of 1) 6 points

Consider the standard reduction potentials

$Cu^{2+} + 2\,e^- \rightarrow Cu$ $\quad E^0 = 0.337$ V

$Ag^+ + 1\,e^- \rightarrow Ag$ $\quad E^0 = 0.7994$ V

$Au^+ + 1\,e^- \rightarrow Au$ $\quad E^0 = 1.68$ V

Which of the following statements about oxidizing strengths of Group IB metal ions is true?

1. Ag^+ is a stronger oxidizing agent than Cu^{2+}. **correct**

2. Cu^{2+} is a stronger oxidizing agent than Ag^+.

3. Cu^{2+} is a stronger oxidizing agent than Au^+.

4. Ag^+ is a stronger oxidizing agent than Au^+.

5. Nothing can be predicted about oxidizing strengths from the data given.

Explanation:

Cell Type 01

26:05, general, multiple choice, < 1 min, fixed.

028 (part 1 of 1) 6 points

The cathode in

$$Ag(s) \mid Ag^+(aq) \,||\, Fe^{2+}(aq) \mid Fe(s)$$

$Ag^+ + e^- \rightarrow Ag$ $\quad E^\circ_{red} = +0.80$

$Fe^{2+} + 2\,e^- \rightarrow Fe$ $\quad E^\circ_{red} = -0.44$

is ___. This cell is ___.

1. $Fe^{2+}(aq) \mid Fe(s)$; an electrolysis cell **correct**

2. $Fe^{2+}(aq) \mid Fe(s)$; a battery

3. $Ag(s) \mid Ag^+(aq)$; an electrolysis cell

4. $Ag(s) \mid Ag^+(aq)$; a battery

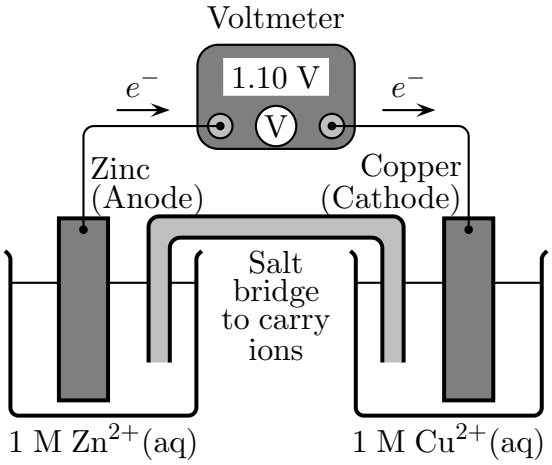
5. Not enough information is provided.

Explanation:

CIC T08 09

26:05, general, multiple choice, < 1 min, fixed.

029 (part 1 of 1) 6 points



In this electrochemical cell, what is the reduction half reaction?

1. $Cu^{2+}(aq) + 2\,e^- \rightarrow Cu(s)$ **correct**

2. $Zn(s) \rightarrow Zn^{2+}(aq) + 2\,e^-$

3. $Cu(s) \rightarrow Cu^{2+}(aq) + 2\,e^-$

4. $Zn^{2+}(aq) + 2\,e^- \rightarrow Zn(s)$

Explanation:

$$Zn(s) + Cu^{2+}(aq) \rightarrow Zn^{2+}(aq) + Cu(s)$$

Reduction occurs at the cathode. In this cell the reduction half reaction is

$$Cu^{2+}(aq) + 2\,e \rightarrow Cu(s)$$

Cu^{2+} cations are attracted to the solid Cu electrode where they are reduced to Cu(s).

Std Cell Potential

26:07, general, multiple choice, < 1 min, fixed.

030 (part 1 of 1) 6 points

What is the E°_{cell} of

$$\text{Zn(s)} \mid \text{Zn}^{2+}\text{(aq)} \parallel \text{Ce}^{4+}\text{(aq)} \mid \text{Ce}^{3+}\text{(aq)}$$

$\text{Zn}^{2+} + 2\,e^- \rightarrow \text{Zn}$ $\quad E^\circ_{\text{red}} = -0.76$

$\text{Ce}^{4+} + e^- \rightarrow \text{Ce}^{3+}$ $\quad E^\circ_{\text{red}} = +1.61$

1. $+2.37$ **correct**

2. -2.37

3. $+0.85$

4. -0.85

5. $+1.61$

Explanation: