Question 1 (12 Points)

Are the following salts expected to be soluble or insoluble in water?

1.	FeF_3	Soluble	Insoluble	4.	$Ba(NO_3)_2$	Soluble	Insoluble
2.	Na_3PO_4	Soluble	Insoluble	5.	$FeCO_3$	Soluble	Insoluble
3.	NH_4OH	Soluble	Insoluble	6.	BaS	Soluble	Insoluble

Question 2 (12 Points)

Classify each of the following substances:

1.	HF	B	A) Strong Acid
2.	NaI	E	B) Weak Acid
3.	NH_3	D	C) Strong Base
4.	HCl	A	D) Weak Base
5.	NaOH	C	E) Soluble Salt
6.	$Cr_3(PO_4)_2$	F	F) Insoluble Salt

Question 3 (6 Points)

1. The formula for the conjugate base of HCN: CN^-
2. The formula for the conjugate acid of CO_3^{2-} HCO_3^-

Question 4 (8 Points)

The $[H^+]$ in an aqueous solution is found to be $5.43x10^{-2}$M.

1. The pH of this solution is: 1.265
2. The $[OH^-]$ of this solution is: $1.84x10^{-13}$
3. The pOH of this solution is: 12.735
4. The solution is (circle one) Basic Acidic Neutral

Question 5 (6 Points)

What is the expected pH of an aqueous solution of 0.302M hydrocyanic acid (HCN) at 25^0C?

$[H^+] = \{Ka[Acid]\}^{\frac{1}{2}}$

$[H^+] = \{4x10^{-10}(0.302)\}^{\frac{1}{2}}$

$[H^+] = 1.10x10^{-5}$

pH = 4.96

Question 6
4 Points

How would the pH of a 0.302M aqueous hydrochloric acid solution compare to the 0.302M aqueous HCN solution at the same temperature.

1. pH HCl(aq) > pH HCN(aq)
2. pH HCl(aq) < pH HCN(aq)
3. pH HCl(aq) = pH HCN(aq)

Question 7
6 Points

Give the net ionic equation for the following reactions:

1. $NaOH(aq) + HNO_2(aq)$ — $OH^- + HNO_2(aq) = NO_2^- + H_2O(l)$
2. $NH_3(aq) + HCl(aq)$ — $NH_3(aq) + H^+ = NH_4^+$
3. $HI(aq) + LiOH(aq)$ — $H^+ + OH^- = H_2O(l)$

Question 8
6 Points

A 1L buffer solution contains 0.112M KF and 0.396M HF. Calculate the expected pH of this solution?

$[H^+] = Ka\{[Weak Acid]/[Conjugate Base]\}$
$[H^+] = 7.2x10^{-4}\{0.396/0.112\}$

$[H^+] = 2.54x10^{-3}$

pH = 2.59

Question 9
14 Points

The addition of 0.012 moles of HBr to the buffer described in question 8 would result in:

1.	pH	Increase	Decrease	No Change
2.	$[H_3O^+]$	Increase	Decrease	No Change
3.	$[OH^-]$	Increase	Decrease	No Change
4.	$[F^-]$	Increase	Decrease	No Change
5.	[HF]	Increase	Decrease	No Change
6.	$[HF]/[F^-]$	Increase	Decrease	No Change

7. The maximum amount of HCl that this buffer could withstand? ~0.112 moles

Question 10 — 10 Points

The reaction $H_2(g) + I_2(g) \Leftrightarrow 2HI(g)$ has a K_c = 55.6 and a DH^0=-10 kJ/mol at 696K.

The production of HI(g) is favor by:

1.	Decreasing the temperature.	True	False
2.	Increasing the pressure by changing the volume.	True	False
3.	Decreasing the volume.	True	False
4.	Adding I_2	True	False
5.	Removing HI	True	False

Question 11 — 8 Points

An aqueous solution of **potassium hydroxide** is standardized by titration with a **0.369** M solution of **hydrobromic acid**.

If **30.5** mL of base are required to neutralize **13.4** mL of the acid, what is the molarity of the **potassium hydroxide** solution?

$KOH + HBr = KBr + H_2O$

$0.369 \times 0.0305 = 1.12\text{x}10^{-2}$ mol KOH

$1.12\text{x}10^{-2}$ mol KOK x (1 HBr/1 KOH) = $1.12\text{x}10^{-2}$ mol HBr

M = $1.12\text{x}10^{-2}/0.0134 = 0.839$M

0.839M

Question 12 — 8 Points

How many grams of solid **calcium hydroxide** are needed to exactly neutralize **27.6** mL of a **1.68** M **hydrochloric acid** solution ? Assume that the volume remains constant.

$Ca(OH)_2 + 2HCl = CaCl_2 + 2H_2O$

$1.68 \times 0.0276 = 4.63\text{x}10^{-2}$ mol HCl

$4.63\text{x}10^{-2}$ mol HCl x (1 $Ca(OH)_2$ / 2 HCl) = $2.31\text{x}10^{-2}$ mol $Ca(OH)_2$

$2.31\text{x}10^{-2}$ mol $Ca(OH)_2$ x (74.1g/1 mol) = 1.72g $Ca(OH)_2$

1.72g