Unit 14 – AP Review **Name _____**

2023 FRQ #5 **Period _____**

5. HCl is a molecular gas as a pure substance but acts as an acid in aqueous solution.

a) A sample of $HCl_{(g)}$ is stored in a rigid 6.00 L container at 7.45 atm and 296 K.

(i) Calculate the number of moles of $HCl_{(g)}$ in the container.

(ii) The rigid 6.00 L container of $HCl_{(g)}$ is cooled to a temperature of 271 K. Calculate the new pressure, in atm, of the $HCl_{(g)}$.

b) When HCl ionizes in aqueous solution, $Cl^-_{(aq)}$ ions are formed. In the following box, draw <u>three</u> water molecules with proper orientation around the $Cl^-_{(aq)}$ ion. Use  to represent water molecules.

Acid (HA)	Anion (A^-)	K_a Value
HNO_2	NO_2^-	5.6×10^{-4}
HCl	Cl^-	2.0×10^{7}
$HClO_4$	ClO_4^-	1.6×10^{15}

The K_a values for three acids are shown in the preceding table.

c) The following particulate diagram represents the ionization of one of the acids in the data table. Water molecules have been omitted for clarity. Which acid (NHO_2, HCl, or $HClO_4$) is represented in the diagram? Justify your answer using the information in the table.