Question 1

Question 2

Knowing that a human eye has an osmotic pressure of 7.97 atm at 37.0 C, an eye-drop solution with the same osmotic pressure and temperature is prepared by adding 0.242 g of NaCl in 25.0 mL water. Calculate the van't Hoff factor for NaCl in this solution. Assume the density of the solution to be 1.00 g/mL.

Question 4

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Question 6

Consider the following reaction

$$H_2S(g) + I_2(s) \rightleftharpoons 2HI(g) + S(s) \qquad K_p = 1.34 \times 10^{-5} \text{ at } 60\ ^\circ C$$

2.00 g solid iodine (I_2)

A 5.00 L reactor contains the following initial mixture at 60 C

Question 7

a. Indicate whether the following statements are true of false

	True	False
i. The solubility of a gas in water decreases with increasing temperature	☐	☐
ii. The presence of a non-volatile solute in a solvent lowers the vapor pressure of the solution	☐	☐
iii. Henry's law states that the amount of a gas dissolved in a solution is directly proportional to the pressure of the gas above the solution	☐	☐
iv. A liquid-liquid solution that obeys Raoult's law is called an "ideal solution"	☐	☐
v. Colligative properties are based on the number of particles in solution, whatever the "size" of the particle.	☐	☐
vi. The addition of an ionic compound to any solvent will cause a boiling point depression.	☐	☐

b. The gas Arsine, AsH_3 decomposes as follows:

$$2AsH_3(g) \rightleftharpoons 2As(s) + 3H_2(g) \qquad \Delta H = +122.8 \text{ kJ}$$

Question 9

a. Order the following from the strongest to the weakest base

i. H_2O
ii. CH_3NH_2
iii. ClO_4^-

_____ _____ _____
strongest base *weakest base*

b. Arrange the following aqueous solutions in order from most acidic to most basic.

i. 0.1M KF
ii. 0.1M KNO_3
iii. 0.1M NH_4Cl

_____ _____ _____
most acidic *most basic*

Question 10

Calculate the mass of KNO

Question 11

A 20.0 mL sample of 0.10 M formic acid ($HCOOH$) was titrated with 5.0×10^{-2} M $Ba(OH)_2$.

K_a for $HCOOH$ is 1.8×10^{-4}.

a. Calculate the pH of the solution upon the addition of 15.0 mL of $Ba(OH)_2$ to the sample.

Question 11 (cont.)

b. What volume of $Ba(OH)_2$ is needed to reach the equivalence point? *2 marks*

c. Calculate the pH of the solution at the equivalence point. *3 marks*

Answers

b. volume at equivalence point :	*c. pH at equivalence point :*

Question 12

Solid NaI is slowly added to a solution that contains both $Pb(NO_3$

Question 13

a. Predict the sign of ΔS of the system for each of the following processes

		$\Delta S < 0$	$\Delta S > 0$
i.	A liquid that boils	☐	☐
ii.	Sugar that crystallized out from a supersaturated sugar solution	☐	☐
iii.	Iron rusts (formation of Fe_2O_3 from pure Fe and O_2)	☐	☐
iv.	A-B(g) + C-D(s) $\longrightarrow$ A-B-C(g) + D(s)	☐	☐
v.	$N_2O_4(g) \longrightarrow 2NO_2(g)$	☐	☐
vi.	$NaCl(s) \longrightarrow Na^+(aq) + Cl^-(aq)$ H_{sol} = +4.0 kJ/mol	☐	☐

b. For mercury (Hg), the enthalpy of vaporization is 58.51 kJ/mol and the entropy of vaporization is 92.92 J/K.mol. What is the normal boiling point of mercury?

Answer

b. T_b *:*

Question 14

Consider the following reaction

$$N_2O_4(g) \longrightarrow 2NO_2(g)$$

Will the reaction be spontaneous at each of the following temperatures? Show your work.
(assume that ΔH° and ΔS° do not change very much within the given temperature range)

a. 25.0 C
b. 60.0 C

Answers

Question 15

Complete the “experiment 2” laboratory data sheet and find the molar mass of the unknown no 3. *6 marks*

The solid unknown added is a non-ionic compound, completely soluble in cyclohexane.

COLLIGATIVE PROPERTIES
DATA SHEET

cyclohexane = 20.2 C.kg.mol^{-1} cyclohexane = 6.55 C

Data for the Unknown Solute/Cyclohexane Solution

Unknown Number: _____

Mass of empty test tube, stopper, beaker	g	1[illegible].223[illegible]
Mass of test tube, stopper, beaker, & cyclohexane	g	204.[illegible]3
Mass of test tube, stopper, beaker, & unknown solute/cyclohexane solution	g	204. 4
Mass of cyclohexane	g	
Mass of unknown solute	g	
Freezing Temperature of unknown solute/cyclohexane solution	C	4.2
Molar mass of unknown solute	g·mol^{-1}	

Sample calculation.