CHEM 102 Final Test - 061

Determination of the reaction rate:

1. The kinetic study for the reaction of hydrogen peroxide, H_2O_2, with potassium iodide, KI, the following solutions has to be prepared and then mixed:

   Solution A: $0.3\ M$ KI $+ 0.02\ M$ $Na_2S_2O_3$ + Starch
   Solution B: $0.1\ M$ H_2O_2

   How would the appearance of the solution change if
   A. the $Na_2S_2O_3$ solution was omitted from the experiment?
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   B. the starch solution was omitted from the experiment?
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2. The rate low of a reaction is
$$\text{rate} = k[A]^p[B]^q$$
   to determine the reaction order p
   A. What is the numerical value of the y-intercept?
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   B. What is the kinetic interpretation of the value for the y-intercept?
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   C. What does its value equal according to the equation given above?
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3. State the effect on the following reaction rate
$$\text{rate} = k'[H_2O_2]^p[KI]^q$$
   (Assume no volume change for any of the concentration changes.)
   A. An increase in the H_2O_2 concentration.
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   B. An increase in the $Na_2S_2O_3$ concentration.
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   C. The substitution of a 0.5% starch solution for one at 0.2%.
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4. If 0.2 M KI replaced the 0.3 M KI in this experiment,

   Solution A: $0.3\ M$ KI $+ 0.02\ M$ $Na_2S_2O_3$ + Starch
   Solution B: $0.1\ M$ H_2O_2

   how would this affect the following?
   A. The rate of the reaction.
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   B. The slopes of the graphs used to determine p and q.
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   C. The value of the reaction rate constant.
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5. The temperature of the warm water bath is recorded too high. How will this technique error affect the reported activation energy for the reaction … too high or too low? Explain.
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An Equilibrium constant

6. Fingerprint smudge are present on the cuvet containing the solution placed into the spectrophotometer for analysis.

   A. How does this technique error affect the absorbance reading for $FeNCS^{2+}$ in the analysis?

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   B. Will the equilibrium concentration of $FeNCS^{2+}$ be recorded as being too high or too low?

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   C. Will the equilibrium concentration of SCN^- be too high, too low, or unaffected by the technique error?

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   D. Will the K_C for the equilibrium be too high, too low or unaffected by the technique error?

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7. For the preparation of solution,

   $$0.002\ M\ Fe(NO_3)_3 + 0.002\ M\ NaSCN + 0.1\ M\ HNO_3$$

   if the 0.1 M HNO_3 is omitted.

   A. How does this technique error affect the absorbance reading for $FeNCS^{2+}$?

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   B. Will the K_c for the equilibrium be too high, too low or unaffected by the technique error?

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8. The equation,

   $$A = a \bullet b \bullet c$$

   becomes nonlinear at high concentrations of the absorbing substance. Suppose you prepare a solution with a very high absorbance that is suspect in not following the linear relationship. How might you still use the sample for your analysis, rather than discarding the sample and the data?

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9. Glass cuvets, used for precision absorbance measurements in a spectrophotometer, are marked so that they always have the same orientation in the sample compartment. What error does this minimize and why?

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Antacid Analysis

10. The antacid tablet for analysis was not finely pulverized before its reaction with hydrochloric acid. How might this technique error affect the reported amount of antacid in the sample?

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11. In the antacid analysis, all of the CO_2 is not removed by gentle boiling after the addition of HC1. Will the reported amount of antacid in the sample be too high, too low, or unaffected?

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12. An air bubble was initially trapped in the buret but was dispensed during the back titration of the excess HC1 As a result of this technique error, will the reported amount of antacid in the sample be too high or too low?

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13. The bromophenol blue endpoint is surpassed in the back titration of the excess HC1 with the sodium hydroxide titrant. As a result of this technique error, will the reported amount of antacid in the sample be too high or too low?

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14. A few of the "newer" antacids contain sodium citrate, $Na_3C_6H_5O_7$, as the effective, but milder antacid ingredient.

   A. Write a balanced equation representing the antacid effect of the citrate ion, $C_6H_5O_7^{3-}$.

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   B. Will 500 mg of $Na_3C_6H_5O_7$ (258.1 g/mol) or 500 mg of $CaCO_3$ (100.1 g/mol) neutralize more moles of hydronium ion? Show calculations. Assume that both the $C_6H_5O_7^{3-}$ and the CO_3^{2-} ions become fully protonated.

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Vitamin C Analysis

15. The KIO_3 sample was not sufficiently dried. Will the reported molar concentration of the $Na_2S_2O_3$ solution be too high, too low, or unaffected?

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16. The mass used to prepare the $Na_2S_2O_3$ solution was enormously calculated correctly too low. Will the reported molar concentration of the $Na_2S_2O_3$ be too high, too low, or unaffected?

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17. The mass used to prepare the $Na_2S_2O_3$ solution was calculated correctly, the calculation was based on the availability $Na_2S_2O_3.5H_2O$. only anhydrous $Na_2S_2O_3$ is available. If the calculated mass is used to measure the mass of $Na_2S_2O_3$ instead of $Na_2S_2O_3.5H_2O$ for the preparation of the solution, will the molar concentration of the $Na_2S_2O_3$ be higher or lower than expected?

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18. A. What is the purpose of adding sodium bicarbonate to the ascorbic acid sample? Write a balanced equation for its reaction.

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    B. The $NaHCO_3$ solution is omitted in an analysis of a sample. Will the reported amount of ascorbic acid in the sample be too high, too low, or unaffected?

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19. In the Vitamin C analysis Experiment, after adding the standard solution of KIO_3, the KI, H_2SO_4, and $NaHCO_3$ solutions, the sample solution remains colorless! What modification of the Experimental Procedure can be made to correct for this unexpected observation in order to complete the analysis?

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20. In the reaction of standard KIO_3, the KI, H_2SO_4, and $NaHCO_3$ solutions and after adding starch, the deep-blue color of the I_2-starch complex does not appear! What next? Should you continue titrating with the standard $Na_2S_2O_3$ solution or discard the sample? Why?

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21. In the analysis of Vitamin C, the final buret reading is read and recorded as 27.43 mL instead of the correct 28.43 mL. Will the reported amount of ascorbic acid in the sample be too high or too low? Explain.

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