AP® Chemistry
2003 Sample Student Responses

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(c) The absorbance of the unknown solution is 0.275. What is the concentration of the solution?

(d) Beer's Law is an expression that includes three factors that determine the amount of light that passes through a solution. Identify two of these factors.

(e) The student handles the sample container (e.g., test tube or cuvette) that holds the unknown solution and leaves fingerprints in the path of the light beam. How will this affect the calculated concentration of the unknown? Explain your answer.

(f) Why is this method of determining the concentration of $CoCl_2$ solution appropriate, whereas using the same method for measuring the concentration of NaCl solution would not be appropriate?

a) $M_{conc}V_{conc} = M_{dil}V_{dil}$

$(0.10)(V_{conc}) = (0.020)(.100L)$

$V_{conc} = \frac{0.02(0.1)}{0.1}$

$= 0.02L$

Pipet 0.020L or 20mL of the 0.10M solution into the volumetric flask. Add distilled water to the 100 mL mark on the volumetric flask to obtain 100 mL of 0.020 M solution

b) The optimum wavelength is at the peak of the absorbance graph. The wavelength is about 510 nm.

c) From the graph of concentration vs. absorbance, the absorbance of 0.275 matches with a concentration of about 0.050 M.

d) One factor is the length of the path that the light has to travel. Another factor is the concentration of the solution; less light passes through more concentrated solutions. less light passes through the solution if the path length is longer.

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ADDITIONAL PAGE FOR ANSWERING QUESTION 5.

e) Leaving smudges on the cuvette would cause the calculated concentration to be too high. The fingerprints allow less light than normal to pass through so the reading for transmittance is too low/ the reading for absorbance is too high. The concentration would be too high.

f) $CoCl_2$ solutions have color that varies with the concentration of the solution, so this method is appropriate for determining $CoCl_2$ concentrations. However, NaCl in solution is colorless, so the concentration of a NaCl solution cannot be determined w/ this method.

(c) The absorbance of the unknown solution is 0.275. What is the concentration of the solution?

(d) Beer's Law is an expression that includes three factors that determine the amount of light that passes through a solution. Identify two of these factors.

(e) The student handles the sample container (e.g., test tube or cuvette) that holds the unknown solution and leaves fingerprints in the path of the light beam. How will this affect the calculated concentration of the unknown? Explain your answer.

(f) Why is this method of determining the concentration of $CoCl_2$ solution appropriate, whereas using the same method for measuring the concentration of NaCl solution would not be appropriate?

.02L of

(a) Put the .10M solution of $CoCl_2$ in the 100mL volumetric flask add distilled water to the flask with a pipet until the solution reaches the 100mL mark on the flask.

(b) The optimum wavelength for analysis is 500nm.

(c) The concentration of the unknown solution is approximately .05 M.

(d) The concentration of a solution and

(e) The fingerprints will make the spectrometer show that there is less absorbance of light because the fingerprints will be blocking some of the light. If the absorbance is decreased then the calculated concentration would also be lower than the actual value

(f) This method is only appropriate for colored solutions. A solution of NaCl is colorless.

(c) The absorbance of the unknown solution is 0.275. What is the concentration of the solution?

(d) Beer's Law is an expression that includes three factors that determine the amount of light that passes through a solution. Identify two of these factors.

(e) The student handles the sample container (e.g., test tube or cuvette) that holds the unknown solution and leaves fingerprints in the path of the light beam. How will this affect the calculated concentration of the unknown? Explain your answer.

(f) Why is this method of determining the concentration of $CoCl_2$ solution appropriate, whereas using the same method for measuring the concentration of NaCl solution would not be appropriate?

(A) 1. ADD 20.0 mL OF THE .10M $CoCl_2$ INTO THE 100mL FLASK USING THE PIPET

2. ADD 80.0 mL OF WATER TO THE FLASK WITH THE PIPET

(B) THE OPTIMUM WAVELENGTH WOULD BE 510 nm, CONSIDERING THE GRAPHS ARE AT THEIR HIGHEST OR LOWEST POINTS (DEPENDING ON THE GRAPH → HIGH: ABSORBANCE VS. WAVELENGTH LOW: PERCENT TRANSMITTANCE VS. WAVELENGTH)

(C) $M = \frac{mol}{L}$ THE GRAPH SHOWS THAT THE CONCENTRATION AT .275 ABSORBANCE IS .050M

(D) [redacted] $E_n = \frac{-2.178 \times 10^{-18}}{n^2}$ JOULES

E ENERGY OF THE LIGHT (CHANGE IN ENERGY, THAT IS)

(E) IT WILL MAKE IT LARGER, BECAUSE THE FINGERPRINTS WILL ABSORB SOME EXTRA LIGHT, AND MORE ABSORPTION MEANS HIGHER MOLARITY (CONCENTRATION), ACCORDING TO THE GRAPH.

(F) NaCl DISSOLVES COMPLETELY IN WATER, SO THERE WOULD BE A VERY SMALL ABSORBANCE