

EXPERIMENT 4

ULTRAVIOLET-VISIBLE SPECTROSCOPY

QUANTITATIVE ANALYSIS

15 Very Hard Multiple-Choice Questions

Circle the correct answer. Choose one answer only for each question.

Main Topics	Assessment Style
Transmittance and Absorbance Beer-Lambert Law Calibration Curves Standard Dilutions Deviations from Beer's Law Paracetamol Assay	Conceptual reasoning Numerical calculations Experimental interpretation Dilution analysis Instrumental error analysis

The model answer key is placed at the end of the document.

QUESTIONS

1

A solution transmits 20% of the incident monochromatic light. What is its absorbance?

- A. 0.200
- B. 0.301
- C. 0.699
- D. 1.699

2

The incident light intensity is 80 arbitrary units, while the transmitted intensity is 8 arbitrary units. Which pair is correct?

- A. $T = 0.10$ and $A = 1.00$
- B. $T = 0.90$ and $A = 0.046$
- C. $T = 10$ and $A = -1.00$
- D. $T = 0.01$ and $A = 2.00$

3

A sample has an absorbance of 2.00. Approximately what percentage of the incident light is transmitted?

- A. 0.01%
- B. 0.10%
- C. 1.00%
- D. 10.0%

4

According to the Beer-Lambert law, doubling both the concentration and the cuvette path length, while all other conditions remain constant, should cause the absorbance to:

- A. Double.
- B. Increase fourfold.
- C. Remain unchanged.
- D. Decrease to one-fourth.

5

A calibration curve is described by the equation below, where concentration is expressed in mol/L and a 1 cm cuvette is used. Which statement is most accurate?

$$A = 12500c + 0.002$$

- A. The molar absorptivity is approximately $12500 \text{ L mol}^{-1} \text{ cm}^{-1}$.
- B. The molar absorptivity is $0.002 \text{ L mol}^{-1} \text{ cm}^{-1}$.
- C. The path length is 12500 cm.
- D. The unknown concentration must equal the intercept.

6

Why is the highest-concentration standard used to determine λ_{max} in the practical procedure?

- A. It always has the lowest molar absorptivity.
- B. It usually produces the most detectable absorption peak, facilitating accurate identification of λ_{max} .
- C. Its wavelength is independent of the identity of the absorbing compound.
- D. It prevents all deviations from Beer's law.

7

Stock Solution 1 is prepared by dissolving 100 mg of paracetamol and completing the volume to 100 mL. What is its concentration?

- A. 0.10 mg/mL
- B. 0.50 mg/mL
- C. 1.00 mg/mL
- D. 10.0 mg/mL

8

Five millilitres of Stock Solution 1 are diluted to 100 mL to prepare Stock Solution 2. What is the concentration of Stock Solution 2?

- A. 0.005 mg/mL
- B. 0.050 mg/mL
- C. 0.200 mg/mL
- D. 0.500 mg/mL

9

Which of the following correctly lists the four standard concentrations prepared from Stock Solution 2 in increasing order?

- A. 0.003, 0.005, 0.010 and 0.0125 mg/mL
- B. 0.003, 0.005, 0.0125 and 0.025 mg/mL
- C. 0.005, 0.010, 0.015 and 0.025 mg/mL
- D. 0.015, 0.025, 0.050 and 0.125 mg/mL

10**Which standard dilution has the highest paracetamol concentration?**

- A. Diluting 3 mL of Stock Solution 2 to 50 mL.
- B. Diluting 5 mL of Stock Solution 2 to 50 mL.
- C. Diluting 10 mL of Stock Solution 2 to 50 mL.
- D. Diluting 25 mL of Stock Solution 2 to 100 mL.

11**An unknown sample gives an absorbance of 0.620. Its calibration equation is shown below. What is the concentration of the unknown sample in the units used for the calibration standards?**

$$A = 0.050c + 0.020$$

- A. 0.030
- B. 10.0
- C. 12.0
- D. 12.4

12**Which experimental condition would most directly cause deviation from Beer's law because more than one wavelength reaches the sample?**

- A. Using non-monochromatic light.
- B. Using a correctly prepared blank.
- C. Using a quartz cuvette.
- D. Measuring at λ_{max} .

13**A calibration curve bends downward relative to the ideal straight line at high concentrations. This behavior is classified as:**

- A. Positive deviation.
- B. Negative deviation.
- C. Zero deviation.
- D. Instrumental amplification.

14

In the paracetamol tablet assay, Solution A nominally contains 0.15 g of paracetamol in 200 mL. After two consecutive 10-fold dilutions to prepare Solutions B and C, what is the nominal concentration of Solution C?

- A. 0.00075 mg/mL
- B. 0.0075 mg/mL
- C. 0.075 mg/mL
- D. 0.75 mg/mL

15

Which statement best explains why Beer's law cannot normally be applied directly to suspensions?

- A. Suspended particles may scatter light, so the reduction in transmitted intensity is not caused solely by molecular absorption.
- B. Suspensions always have zero absorbance.
- C. Suspensions transmit all wavelengths equally.
- D. Suspended particles eliminate the effect of concentration on absorbance.

MODEL ANSWER KEY

Use this key only after completing all questions.

Question	Answer	Question	Answer	Question	Answer
1	C	6	B	11	C
2	A	7	C	12	A
3	C	8	B	13	B
4	B	9	A	14	B
5	A	10	D	15	A

Quick Formula Reminder

$$T = I / I_0 \quad | \quad A = -\log(T) \quad | \quad A = \epsilon b c \quad | \quad C_1 V_1 = C_2 V_2$$

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