

Concentration, separation and absorbance

AP Chemistry · Test answers (mark scheme)

Marking points are given after each answer. Give credit for correct working even if the final answer has a small arithmetic slip, and accept answers within rounding. In explanations, accept equivalent wording.

Level: AP Chemistry · **Curriculum:** AP Chem Unit 3

Question 1 Molarity (3 marks)

$$n = 4.00/40.00 = 0.100 \text{ mol}; M = 0.100/0.2000 = \mathbf{0.500 \text{ mol/L.}}$$

Marking: 1 moles, 1 volume in litres, 1 answer with unit.

Question 2 Dilution (3 marks)

$$V_1 = 1.20 \times 250.0 / 6.00 = \mathbf{50.0 \text{ mL.}}$$

Marking: 1 equation, 1 substitution, 1 answer.

Question 3 Chromatography (2 marks)

$R_f = 3.2/8.0 = \mathbf{0.40}$. It is the ratio of the distances and can be compared with reference values to identify a compound.

Marking: 1 calculation, 1 use.

Question 4 Beer-Lambert calculation (3 marks)

$$\epsilon = A/(bc) = 0.375 / (1.00 \times 2.5 \times 10^{-5}) = \mathbf{1.5 \times 10^4 \text{ L/(mol}\cdot\text{cm)}}.$$

Marking: 1 rearrangement, 1 substitution, 1 answer with unit.

Question 5 Percentage transmittance (2 marks)

$$T = 10^{-0.699} = 0.200, \text{ i.e. } \mathbf{20.0 \text{ percent.}}$$

Marking: 1 method, 1 answer.

Question 6 Calibration line (3 marks)

a. $\mathbf{2.5 \times 10^{-5} \text{ mol/L}}$ ($0.300/0.120 \times 10^{-5}$).

b. A is directly proportional to c.

c. This is beyond the highest standard and the Beer-Lambert relationship fails at high absorbance; dilute the sample.

Marking: 1 + 1 + 1.

Question 7 Separation methods (2 marks)

(i) **Simple distillation.** (ii) **Chromatography.**

Marking: 1 each.

Question 8 Choosing the wavelength (2 marks)

At λ_{max} the absorbance changes most for a given change in concentration, so the **sensitivity is greatest**, and the absorbance changes least with small errors in wavelength, which makes the result more precise.

Marking: 1 sensitivity, 1 reliability.