

Topic 4.

COLLIGATIVE PROPERTIES OF SOLUTIONS

Theoretical QUESTIONS for preparation:

I. Concentration of solute particles

II. Colligative Properties

1. Boiling point
2. Freezing point
3. Vapor pressure
4. Osmotic pressure

TASKS

1. The freezing point of blood serum is -0.56° . Calculate molality of salt in blood taking into account that all salts are binary. $K(\text{H}_2\text{O})=1.86 \text{ kg}\cdot\text{K/mol}$.

GIVEN:

QUESTION: _____

FORMULA:

CALCULATIONS:

ANSWER: _____

2. We add 275 g of ethylene glycol ($\text{C}_2\text{H}_6\text{O}_2$) per 1000 g of water in a car radiator, what will the freezing point of the solution be? $K(\text{H}_2\text{O})=1.86 \text{ kg}\cdot\text{K/mol}$.

GIVEN:

QUESTION: _____

FORMULA:

CALCULATIONS:

ANSWER: _____

3. Vitamin K is involved in the blood clotting mechanism. When 0.500 g is dissolved in 10.0 g of camphor, the freezing point is lowered by 4.43 K. Calculate the molecular weight of vitamin K. $K(\text{solvent})=40 \text{ kg}^{\circ}\text{K/mol}$.

GIVEN:

QUESTION: _____

FORMULA:

CALCULATIONS:

ANSWER: _____

4. Calculate molar mass of a substance 0.94g of which is dissolved into 50g of ethanol. Increasing of the boiling point is 0.232 K. $K(C_2H_5OH) = 1.16 \text{ kg} \cdot \text{K/mol}$.

GIVEN:

QUESTION: _____

FORMULA:

CALCULATIONS:

ANSWER: _____

5. 0.64 g of adrenaline in 36.0 g of CCl_4 produces a boiling point elevation of 0.49 K. What is adrenaline's molecular weight? $K(\text{CCl}_4) = 4.95 \text{ kg}^{\circ}\text{K/mol}$.

GIVEN:

QUESTION: _____

FORMULA:

CALCULATIONS:

ANSWER: _____

6. Seawater is about 3.5% (by weight) dissolved solids, almost all of which is NaCl. Calculate the normal boiling point of seawater. $K(\text{H}_2\text{O})=0.52 \text{ kg}\cdot\text{K/mol}$.

GIVEN:

QUESTION: _____

FORMULA:

CALCULATIONS:

ANSWER: _____

7. Calculate the osmotic pressure of hemoglobin (Hb) solution at 27°C if $V(\text{Hb})=1\text{L}$, $m(\text{Hb})=124\text{g}$, $M(\text{Hb})=68000\text{g/mol}$.

GIVEN:

QUESTION: _____

FORMULA:

CALCULATIONS:

ANSWER: _____

8. Hemolysis of human erythrocytes begins in a solution with $\omega(\text{NaCl})=0.4\%$ and all erythrocytes are being broken in a solution with $\omega(\text{NaCl})=0.34\%$. Calculate the osmotic pressure of these solutions at 37°C ($\rho=1 \text{ g/ml}$).

GIVEN:

QUESTION: _____

FORMULA:

CALCULATIONS:

ANSWER: _____

9. What happens to a red blood cell (RBC) in hypotonic solution? Why? What happens if the cell swells too much? What is this called?
