

Exercise 6.14 – Physical equilibrium

Q614-01 Which statement(s) is/are true for a mixture of ice and water at equilibrium?

- I The rates of freezing and melting are equal
- II The amounts of ice and water are equal
- III The same position of equilibrium can be reached by cooling water and heating ice.

- A. I only
 - B. I and III only
 - C. II only
 - D. III only
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Q614-02 An equimolar mixture of propan-1-ol (bp=97.4°C) and propan-2-ol (bp=82.4°C) is boiled in a flask to which a distillation column is attached. What is true about the first sample of the vapour that enters the distillation column?

- A. It is pure propan-1-ol
 - B. It is pure propan-2-ol
 - C. It contains a higher fraction of propan-1-ol than propan-2-ol
 - D. It contains a higher fraction of propan-2-ol than propan-1-ol
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Q614-03 10.0cm³ of liquid bromine is placed in an empty 100cm³ bottle, which is then sealed and left to reach equilibrium at room temperature. What happens first?

- A. The rate of evaporation is greater than the rate of condensation
 - B. The rate of condensation is greater than the rate of evaporation
 - C. The rate of evaporation is equal to the rate of condensation
 - D. There is no evaporation or condensation
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Q614-04 Which of the factors below affect the equilibrium vapour pressure of a liquid in a container?

- I temperature
- II surface area of the liquid
- III volume of the container

- A. I only
 - B. I and II only
 - C. II and III only
 - D. I, II and III
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Q614-05 A liquid and its vapour are at equilibrium inside a sealed container. Which change would alter the equilibrium vapour pressure of the liquid inside the container?

- A. Adding more liquid
 - B. Adding more vapour
 - C. Decreasing the volume of the container
 - D. Decreasing the temperature
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Q614-06 Which statement(s) is/are true for a mixture of ice and water at equilibrium?

- I The rates of freezing and melting are equal
- II The amounts of ice and water are equal
- III The same position of equilibrium can be reached by cooling water and heating ice.

- A. I only
- B. I and III only
- C. II only
- D. III only

Q614-07 A sealed container is half full of water (optimist or pessimist?). The temperature of the container is increased and left for equilibrium to re-establish. Which statement is correct when the equilibrium is re-established at the higher temperature?

- A. The rate of vaporisation is greater than the rate of condensation.
- B. The amount of water vapour is greater than the amount of liquid water.
- C. The amount of water vapour is greater than it is at the lower temperature
- D. The rate of condensation is greater than the rate of vaporisation.

Q614-08 As a volatile liquid in an isolated container evaporates its temperature drops. Account for this observation in terms of the behaviour of the molecules.

Q614-09 A small amount of a volatile liquid is added to a 50.0cm^3 evacuated container. Twice the amount of the same liquid is added to a second 50.0cm^3 evacuated container and separately to a 100cm^3 container. The three systems are allowed to reach equilibrium at the same temperature and some liquid remains in each flask. Compare the pressure due to the vapour in the three containers and explain your answer.

Q614-10 When a small amount of iodine is shaken with trichloromethane and water containing dissolved potassium iodide, a purple trichloromethane and a brown aqueous layer are obtained. Suppose more solid potassium iodide were dissolved in the water and the system again allowed to come to equilibrium. What change or changes, if any, would you expect to see in the colours of the two layers?

- A. The brown colour of the aqueous layer becomes paler, but the purple colour of the trichloromethane layer does not change.
 - B. The brown colour of the aqueous layer becomes more intense, but the purple colour of the trichloromethane layer becomes paler.
 - C. The brown colour of the aqueous layer becomes paler in colour, and the purple colour of the trichloromethane layer intensifies.
 - D. Neither the purple colour of the trichloromethane layer, nor the brown colour of the aqueous layer changes in any way.
 - E. Both the layers become paler in colour
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