SUPeR Chemistry
CH 222 Practice Exam

This exam has been designed to help you practice working multiple choice problems over the material that will be covered on the first CH 222 midterm. The actual exams for each section of CH 222 will be different and you should not assume that this practice exam is representative of those exams.

To get the maximum benefit out of this practice exam, treat it like a real exam. Give yourself one hour to take the test and do not use any outside resources except your calculator and a periodic table. Do not stop during the exam to look up answers. When finished, grade yourself using the answer key.

\[ R = 0.0821 \text{ L·atm/mol·K} \]
Multiple Choice: Select the one best answer.

1. Which of the following statements are true of gases?

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<table>
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<tbody>
<tr>
<td>I.</td>
<td>Individual gas molecules are in close contact with each other.</td>
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<tr>
<td>II.</td>
<td>Gases are highly compressible.</td>
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<tr>
<td>III.</td>
<td>The density of gases is greater than that of liquids.</td>
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<td>IV.</td>
<td>Gases take the shape of the container.</td>
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<tr>
<td>V.</td>
<td>Gas molecules experience very weak intermolecular attractions.</td>
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A. I, III, IV and V  
B. I, III and IV  
C. II and IV  
D. II, IV and V  
E. II, III, IV and V

2. A small bubble rises from the bottom of a lake, where the temperature and pressure are 4°C and 3.0 atm, and rises to the water's surface, where the temperature is 25°C and the pressure is 0.95 atm. What is the final volume of the bubble if its initial volume was 2.1 mL?

A. 0.72 mL  
B. 6.2 mL  
C. 7.1 mL  
D. 22 mL  
E. 41 mL

3. Gases are sold in large cylinders for laboratory use. What pressure in atmospheres will be exerted by 2500 g of oxygen gas when stored at 22°C in a 40.0 L cylinder?

A. 3.55 atm  
B. 10.2 atm  
C. 47.3 atm  
D. 1510 atm  
E. 7.56 x 10^4 atm
4. Calculate the density of SF₆ gas at 27°C and 0.500 atm pressure.
   A. 3.38 x 10⁻³ g/L
   B. 2.96 g/L
   C. 22.4 g/L
   D. 32.9 g/L
   E. 3.38 kg/L

5. A mixture of three gases has a total pressure of 1380 mmHg at 298 K. The mixture is analyzed and is found to contain 1.27 mol CO₂, 3.04 mol CO, and 1.50 mol Ar. What is the partial pressure of Ar?
   A. 0.258 atm
   B. 301 mmHg
   C. 356 mmHg
   D. 5350 mmHg
   E. 8020 mmHg

6. A sample of hydrogen gas was collected over water at 21°C and 685.0 mmHg. The volume of the container was 7.80 L. Calculate the mass of H₂(g) collected. (Vapor pressure of water = 18.6 mmHg at 21°C)
   A. 0.283 g
   B. 0.572 g
   C. 0.589 g
   D. 7.14 g
   E. 435 g
7. What volume of oxygen gas at 320 K and 680 torr will react with 2.50 L of NO gas at the same temperature and pressure?

\[ 2\text{NO}(g) + \text{O}_2(g) \rightarrow 2\text{NO}_2(g) \]

A. 1.00 L  B. 1.25 L  C. 2.50 L  D. 3.00 L  E. 5.00 L

8. A ten liter cylinder at 25°C is filled to 1 atm pressure with nitrogen gas. A second identical cylinder contains oxygen gas at the same temperature and pressure. Which of the following statements is true?

A. The nitrogen cylinder contains more moles of gas than the oxygen cylinder.
B. The mass of the nitrogen cylinder is greater than that of the oxygen cylinder.
C. The molecules of the different gases have the same average kinetic energy.
D. The molecules of the different gases have the same average velocity.
E. All of the above statements are true.

9. Under which of the following conditions would a gaseous substance display the greatest deviations from ideal behavior? (Assume the substance remains in the gaseous state under all of the conditions.)

A. 100 °C and 2 atm
B. 0 °C and 2 atm
C. -100 °C and 2 atm
D. -100 °C and 4 atm
E. 100 °C and 4 atm

10. Which of the following indicates the presence of weak intermolecular forces in a liquid?

A. a small heat of vaporization
B. a high critical temperature
C. a low vapor pressure
D. a high boiling point
E. none of the above
11. Each of the following substances is a liquid at -50°C. Place these liquids in order of increasing vapor pressure at that temperature.

   \[ \text{H} - \text{C} - \text{O} - \text{C} - \text{H} \quad \text{dimethyl ether} \]
   \[ \text{H} - \text{C} - \text{C} - \text{H} \quad \text{propane} \]
   \[ \text{H} - \text{C} - \text{O} - \text{H} \quad \text{ethanol} \]

A. ethanol < propane < dimethyl ether
B. ethanol < dimethyl ether < propane
C. propane < dimethyl ether < ethanol
D. dimethyl ether < ethanol < propane
E. propane < ethanol < dimethyl ether

12. Arrange the following in order of increasing boiling point: RbCl, CH₃Cl, CH₃OH, CH₄

A. CH₃OH < CH₃Cl < RbCl < CH₄
B. CH₃OH < CH₄ < CH₃Cl < RbCl
C. RbCl < CH₃Cl < CH₃OH < CH₄
D. CH₄ < CH₃OH < CH₃Cl < RbCl
E. CH₄ < CH₃Cl < CH₃OH < RbCl

13. A liquid boils when its

A. temperature is equal to standard temperature.
B. temperature is equal to, or greater than, room temperature.
C. vapor pressure is equal to standard pressure.
D. vapor pressure is equal to, or greater than, the external pressure pushing on it.
14. How much energy is required to convert 10.0 g of ice at –20.0 °C to liquid water at 60.0°C?

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
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<tbody>
<tr>
<td>Specific heat of ice</td>
<td>2.1 J/g°C</td>
</tr>
<tr>
<td>Specific heat of water</td>
<td>4.18 J/g°C</td>
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<tr>
<td>ΔH_fus</td>
<td>6.0 kJ/mol</td>
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</tbody>
</table>

A. 7.5 J  
B. 420 J  
C. 2.9 kJ  
D. 6.3 kJ  
E. 63 kJ

15. The triple point of iodine is at 0.12 atm and 115°C. This means that liquid I₂

A. is more dense than solid I₂.  
B. cannot exist above 115°C.  
C. is the normal state of iodine at room temperature.  
D. cannot have a vapor pressure less than 0.12 atm.

16. Which of the following factors contributes to a low viscosity for a liquid?

A. low temperature  
B. spherical molecular shape  
C. hydrogen bonding  
D. high molar mass
17. Consider the following phase diagram. Which of the following provides the best molecular description of a substance that has a temperature and pressure at any point along the line A–B?

A. There are equal numbers of molecules in the liquid and gas phases.
B. Molecules are moving from the liquid to gas phase and the gas to liquid phase at the same rate.
C. The concentration of gas phase molecules is increasing and the concentration of liquid phase molecules is decreasing.
D. The concentration of gas phase molecules is decreasing and the concentration of liquid phase molecules is increasing.

18. Refer to the phase diagram above. Which of the following statements is true?

A. Starting at point C and decreasing the pressure while keeping the temperature constant will result in a change of state from solid to gas.
B. Starting at point D and increasing the pressure while keeping the temperature constant will result in a change of state from liquid to gas.
C. Starting at C and decreasing the pressure while keeping the temperature constant will result in a change of state from solid to liquid.
D. Starting at point D and decreasing the temperature while keeping the pressure constant will result in a change of state from liquid to solid.
E. All three phases are in equilibrium at point B.

19. When liquid bromine is cooled to a solid, which of the following types of solid would it form?

A. atomic  
B. metallic  
C. molecular  
D. ionic  
E. covalent network