

## Basic Principles of Physical Chemistry Sample Questions and answers

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1. If we compress isothermally 20 L of ideal gas from the initial pressure of 1 atm to the final pressure of 5 atm, which will be the final volume assumed by the gas ?  
(a) 2L            (b) 3L            (c) 4L            (d) 5L
2. Which is the meaning of heat capacity ?  
(a) How much heat a material needs to increase its temperature by 1 K.  
(b) How much heat a gas needs to increase his pressure by 1 atm.  
(c) How much heat a solid needs to melt.  
(d) How much heat a liquid needs to boil.
3. Which of the processes below is reversible expansion of a gas ?  
(a) Expansion of a gas in the vacuum.  
(b) Controlled expansion of a gas against a pressure of 1 atm.  
(c) Controlled expansion, with the gas pressure in equilibrium with the external pressure.  
(d) Isothermal expansion of a gas.
4. Which is the standard state of a substance ?  
(a) At a specified temperature is its pure form at 1 bar.  
(b) At a specified temperature is its pure form at 1 atm.  
(c) At a specified pressure is its pure form at 298 K.  
(d) At a specified pressure is its pure form at 300 K.
5. What it means that a process in a system is adiabatic ?  
(a) That it occurs without transfer of heat or matter with the surroundings.  
(b) That it occurs with transfer of heat and matter with the surroundings.  
(c) That it occurs at constant temperature and pressure.  
(d) That it occurs at constant temperature and volume.

6. How many phases are present when  $\text{CaCO}_3(\text{solid})$  decomposes into  $\text{CaO}(\text{solid})$  and  $\text{CO}_2(\text{gas})$  ?
- (a) 1
  - (b) 2
  - (c) 3.
  - (d) 4.
7. Which of the following sentences about colligative properties is true ?
- (a) a solution freezes at higher temperature than the pure solvent.
  - (b) a solution boils at lower temperature than the pure solvent.
  - (c) a solution boils at higher temperature than the pure solvent.
  - (d) the vapor pressure of the solvent in a solution is higher than that of the pure solvent.
8. The following reaction is found to be first order in  $\text{H}_2$  (g) and second order in  $\text{NO}$  (g). The rate law for this reaction is:  $2\text{NO}(\text{g}) + 2\text{H}_2 = \text{N}_2(\text{g}) + 2\text{H}_2\text{O}(\text{g})$
- (a)  $\text{Rate} = k[\text{NO}]^2[\text{H}_2]^2/[\text{N}_2][\text{H}_2\text{O}]^2$
  - (b)  $\text{Rate} = k[\text{NO}][\text{H}_2]^2$
  - (c)  $\text{Rate} = k[\text{NO}]^2[\text{H}_2]^2$
  - (d)  $\text{Rate} = k[\text{NO}]^2[\text{H}_2]$
9. Reaction rates increase with temperature because as the temperature increases:
- (a) The equilibrium constant increases.
  - (b) The activation energy increases.
  - (c) The activation energy decreases.
  - (d) The rate constant increases.
10. a catalyst is a substance which
- (a) increases the equilibrium concentration of the product
  - (b) increases the equilibrium constant of the reaction
  - (c) supplies energy to the reaction
  - (d) shortens the time to reach equilibrium
11. When an atom/molecule absorbs a photon, one of its orbital electrons
- (a) Jumps from a higher to a lower energy level
  - (b) Gains energy to be excited to higher energy level
  - (c) Does not change
  - (d) Turns into gamma radiation

## Physical Chemistry Sample Questions Key

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1. C
2. A
3. C
4. A
5. A
6. C
7. C
8. D
9. D
10. D
11. B