

**DIAGNOSTIC TEST IN GENERAL CHEMISTRY 2**  
**SY 2022-2023**

**Instructions:** Read each question carefully and shade the correct answer in the answer sheet provided to you. Do not write anything on this test questionnaire.

1. Jane forgot her water bottle in the freezer and when she took it out, the water already hardens and turned to ice. Considering the kinetic molecular model, what should Jane do to turn her water back into liquid state?
  - A. shake the bottle vigorously
  - B. put the bottle back in the freezer
  - C. put the bottle back but not in the freezer but in the refrigerator
  - D. place the bottle in an area with higher temperature than the refrigerator
  
2. Which of the following statement best describes about intermolecular forces?
  - A. weak forces
  - B. influence the boiling and melting point
  - C. attraction between two polar molecules
  - D. forces that hold solids and liquid together
  
3. What property of liquid that measure the fluid's resistance to flow?
  - A. Viscosity
  - B. Boiling Point
  - C. Vapor Pressure
  - D. Surface Tension
  
4. Which of the following refers to the pressure at which equilibrium occurs between the gaseous phase and the liquid phase of water molecules, in a closed container?
  - A. Vapor Pressure
  - B. Capillary Action
  - C. Surface Tension
  - D. Molar Heat of Vaporization
  
5. What is shapeless mean?
  - A. Amorphous
  - B. Anisotropic
  - C. Crystalline
  - D. Molecule

6. Referring to the phase diagram of water in Figure 1, predict the physical form of a sample of water at  $-0.0050^{\circ}\text{C}$  as the pressure is gradually increased from 1.0 mmHg to 218 atm.

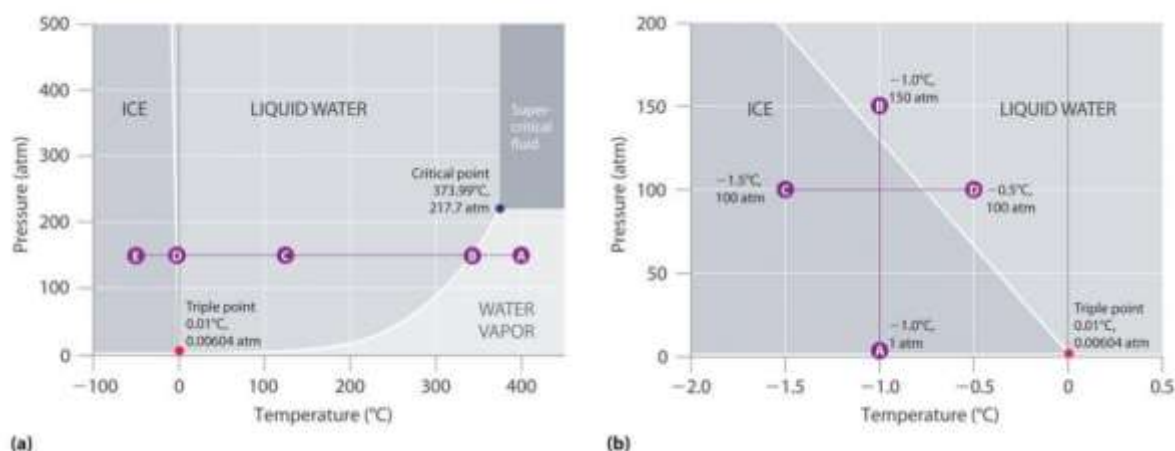
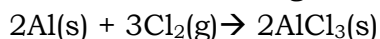


Figure 1. Two Versions of the Phase Diagram of Water.

Source: [https://chem.libretexts.org/Bookshelves/General\\_Chemistry](https://chem.libretexts.org/Bookshelves/General_Chemistry)

- A. The sample is initially a gas, condenses to a solid as the pressure increases and then melts when the pressure is increased further to a liquid.
  - B. The sample is initially a solid then as the pressure increased it melted into a liquid and as pressure further increased, it evaporated into a gas.
  - C. The sample is initially a liquid, as the pressure increases, it turned into solid, and as the pressure further increases, it condenses into a gas.
  - D. The sample is initially a gas, evaporated to liquid as the pressure increases and then hardens and became solid when the pressure further increased.
7. What will be the melting point of a point of a substance when the temperature of heat is being added and the substance is changing from a solid to a liquid?
- A. Increases
  - B. Decreases
  - C. Cease to exist
  - D. Remains constant
8. A solution is prepared by mixing 20g of sodium chloride in 80g of water. What are the concentrations of the solute and the solvent in % by mass?
- A. Solute: 80%, Solvent:20%
  - B. Solute: 20%, Solvent:80%
  - C. Solute: 90%, Solvent:10%
  - D. Solute: 10%, Solvent:90%

9. What is the maximum number of moles of  $\text{AlCl}_3$  that can be produced from 5.0 moles of aluminum and 6.0 moles of chlorine gas?



- A. 2.0 mol
  - B. 4.0 mol
  - C. 5.0 mol
  - D. 6.0 mol
10. Supposed you have the number of moles of a reactant or product in a reaction and you want to calculate for the mass of another product or reactant, what process will you going to follow?
- A. Mass to mole
  - B. Mole to mole
  - C. Mass to mass
  - D. Mole to mass
11. Which of the following statement explained what changes and what stays the same when 1.00 L of a solution of  $\text{NaCl}$  is diluted to 1.80 L?
- A. The number of moles changes abruptly.
  - B. The number of moles constitutes the whole solution.
  - C. The number of moles varies when diluted in a solution.
  - D. The number of moles always stays the same in a dilution.
12. What is an osmotic pressure?
- A. The process applied in the purification of water.
  - B. This is the pressure needed to prevent osmosis
  - C. It is the minimum pressure that should be applied to a certain solution.
  - D. The pressure applied to the less concentrated solution for the solvent to flow.
13. Salt solution has high degree of vapour pressure lowering compared to sugar solution. Which colligative properties support this example?
- I. Number of solutes present in electrolytes is less compared to nonelectrolytes.
  - II. Number of solutes present in electrolytes is high compared to nonelectrolytes.
  - III. The effect of electrolytes on colligative properties is very high.
  - IV. The colligative properties are not considerably changed.
- A. I only
  - B. II only
  - C. II and III
  - D. I, III and IV

14. Solve the freezing point of the solution formed?
- A. 0.142 0C
  - B. 0.152 0C
  - C. -0.142 0C
  - D. -0.152 0C
15. When a solute is added to a pure solvent, the solute takes up the space at the surface decreasing the tendency of the solvent to escape from the liquid phase to gaseous phase. Based on the figure below, what colligative property of solution is demonstrated?

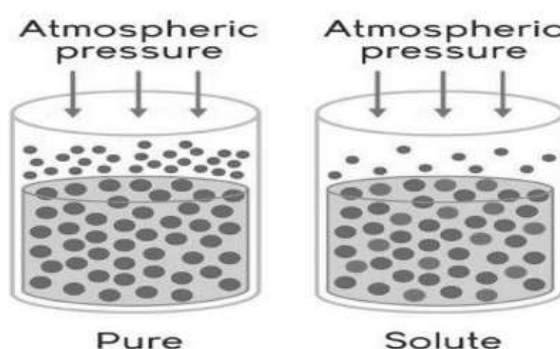


Figure 2. Phase Diagram of Solvent and Solution

(Source: Colligative Properties - Definition, Types, Examples, Raoult's Law (byjus.com))

- A. osmotic pressure
  - B. boiling point elevation
  - C. vapor pressure lowering
  - D. freezing point depression
16. Calculate the molality of a solution prepared from 29.22 grams of NaCl in 2.00kg of water.
- A. 0.25 mol
  - B. 0.50 mol
  - C. 0.75 mol
  - D. 1.00 mol
17. A laboratory experiment where a solution of known concentration is reacted with a solution of unknown concentration to determine its molarity.
- A. Neutralization
  - B. Recombination
  - C. Standardization
  - D. Titration

18. Which of the following processes is an example of exothermic reaction?
- I. photosynthesis
  - II. dew formation
  - III. melting of ice
  - IV. digestion of food
- A. I and II
  - B. III and IV
  - C. I and III
  - D. II and IV
19. Given the hypothetical thermochemical equation:  $A + B \rightarrow C + D$   $\Delta H = -430$  kJ. Which among the following statements is correct about this reaction?
- A. The reaction is endothermic.
  - B. The equation may be written as  $A + B + 430 \text{ kJ} \rightarrow C + D$
  - C. The heat content of A and B is greater than the heat content of C and D
  - D. The heat content of C and D is greater than the heat content of A and B.
20. The thermochemical equation showing the formation of ammonia,  $\text{NH}_3$  from its elements is:
- $$\text{N}_2 (\text{g}) + 3\text{H}_2 (\text{g}) \rightarrow 2\text{NH}_3 (\text{g}) \quad \Delta H = -92 \text{ kJ}$$
- The equation shows that 92 kJ of heat is \_\_\_\_\_.
- A. lost to the surrounding when one mole of hydrogen is used up in the reaction.
  - B. absorbed from the surrounding when one mole of nitrogen reacts.
  - C. absorbed from the surrounding when one mole of ammonia is formed.
  - D. lost to the surrounding when 2 moles of ammonia is formed.
21. As the temperature of a reaction is increased, the rate of the reaction increases because the \_\_\_\_\_.
- A. activation energy is lowered
  - B. reactant molecules collide less frequently
  - C. reactant molecules collide less frequently and with greater energy per collision
  - D. reactant molecules collide more frequently and with greater energy per Collision
22. Using the following data, which is the correct rate law of the sample reaction?
- A.  $R = k[A]^2[B]^1[C]^1$
  - B.  $R = k[A]^4[B]^2[C]^1$
  - C.  $R = k[A]^2[B]^1[C]^0$
  - D.  $R = k[A]^1[B]^2[C]^0$

23. Which of the following statements explain why not all collisions between reactant molecules lead to reaction?
- Solids cannot react with gases.
  - Molecules cannot react with each other unless a catalyst is present.
  - Molecules that are improperly oriented during collision will not react.
  - The total energy of two colliding molecules is less than some minimum amount of energy.
- A. I and II  
B. II and III  
C. II and IV  
D. III and IV
24. If the activation energy in the forward direction of an elementary step is 52 kJ and the activation energy in the reverse direction is 74 kJ, what is the energy of reaction  $\Delta E$  for this step?
- A. 52 kJ  
B. 22 kJ  
C. -22 kJ  
D. -52 kJ
25. Hydrogen peroxide will decompose into water and oxygen gas. Two molecules of hydrogen peroxide will produce two molecules of water and one molecule of oxygen. A catalyst of potassium permanganate can be used to speed up this process. Develop a chemical equation from the given statement.
- A.  $\text{H}_2\text{O}_2 \xrightarrow{\text{KMnO}_4} \text{H}_2\text{O} + \text{O}_2$   
B.  $\text{H}_2\text{O}_2 + \text{H}_2\text{O} \xrightarrow{\text{KMnO}_4} \text{O}_2$   
C.  $\text{KMnO}_4 \xrightarrow{\text{H}_2\text{O}_2} \text{H}_2\text{O} + \text{O}_2$   
D.  $\text{H}_2\text{O}_2 \longrightarrow \text{H}_2\text{O} + \text{O}_2$
26. Which of the following is the process in which reactants or products itself act as catalyst?
- A. catalysis  
B. auto-catalysis  
C. positive catalysis.  
D. negative catalysis
27. Which of the following does not apply the concept of entropy?
- A. black hair turning grey  
B. cooling of a hot flat iron  
C. straightening curly hair  
D. drop of ink dispersing in water

28. One rainy day, your mom prepared a hot coffee for you and you did not drink it within few minutes. After some time, the coffee cooled down. Based on your evaluation, which of the following clearly be the reason of the cooled-coffee, considering the concept of entropy?
- A. The coffee loses its heat due to external forces acting on it.
  - B. The coffee directly absorbed coldness from the surrounding.
  - C. The coffee loses its heat as it releases heat into the environment.
  - D. The coffee became cold as the glass absorbed the cold from the surrounding.
29. What is the characteristics of reaction if the calculated delta G is negative?
- A. The reaction is spontaneous at high temperature.
  - B. The reaction is nonspontaneous at high temperature.
  - C. The reaction is always spontaneous at all temperature.
  - D. The reaction is always nonspontaneous at all temperature.
30. Evaluate the following statements. Select the option that does not follow the concept of chemical equilibrium
- A. If a stress (changes in reaction conditions) is applied to a system in equilibrium, then the systems adjusts in order to reduce the cause of the stress applied.
  - B. If a stress (changes in reaction conditions) is applied to a system in equilibrium, then the system adjusts in order to reduce the effect of the stress applied.
  - C. If a stress (changes in reaction conditions) is applied to a system in equilibrium, then the system adjusts in order to increase the cause of the stress applied.
  - D. If a stress (changes in reaction conditions) is applied to a system in equilibrium, then the system adjusts in order to increase the effect of the stress applied.

31. What conclusion would you draw from the figure below?

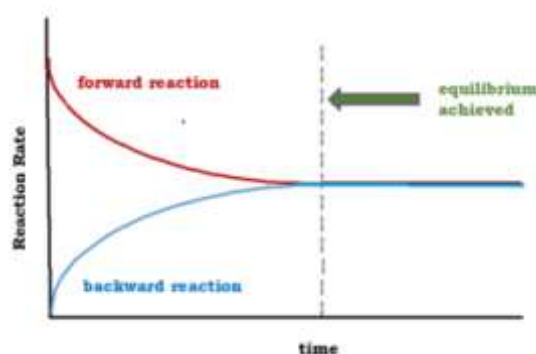


Figure 1. Changes in the rate of forward and backward reactions in a reversible reaction

(Source: <https://www.coursehero.com/sg/general-chemistry/reversible-reactions-and-equilibrium/>)

- A. The forward and backward reactions are equal during the start of the chemical reaction.
  - B. The forward and backward reactions are equal at the end of the chemical reaction.
  - C. When the rates of forward and backward reactions reach the same point, chemical equilibrium is attained.
  - D. When the rates of forward and backward reactions are in the highest and lowest points respectively, the point, chemical equilibrium is attained.
32. Evaluate the figure below. Which of the following situations follow the Le Chatelier's principle?

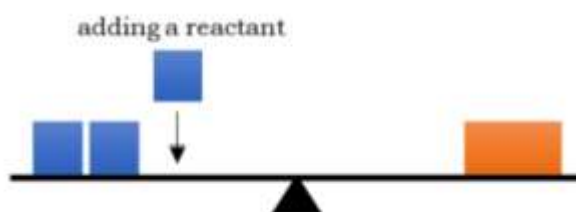


Figure 3. Lever-and-fulcrum analogy of equilibrium shift with (a) addition or (b) removal of a reactant

(Source: <https://opentextbc.ca/chemistry2eopenstax/chapter/shifting-equilibria-le-chateliers-principle/>)

- A. Adding a reactant does not change the concentration.
  - B. Adding a reactant favors the forward reaction.
  - C. Adding a reactant favors the reverse reaction.
  - D. Adding a reactant re-establishes equilibrium.
33. By the Arrhenius definition, a base
- A. Feels slippery on skin.
  - B. Produces an  $H^+$  ion in water.
  - C. Produces an  $OH^-$  ion in water.
  - D. Reacts with a metal to produce  $H_2$ .



34. Water is said to be amphoteric compound. Which of the following best describes amphoteric?
- A. It is a very good strong electrolyte.
  - B. It can either donate or accept a proton.
  - C. A substance that has a high heat capacity.
  - D. The ability to dissolve many polar and ionic substances.
35. Evaluate the pH of the hydronium ion concentration in a solution that has a  $4.57 \times 10^{-9}$  M.
- A. 6.42
  - B. 6.79
  - C. 8.34
  - D. 8.56
36. On what concentration does the pH of the buffer depends upon?
- A. salt
  - B. acid ( $H^+$ ) only
  - C. conjugate base ( $-OH^-$ ) only
  - D. acid ( $H^+$ ) and conjugate base ( $-OH^-$ )
37. For a generic equilibrium  $HA(aq) \rightleftharpoons H^+(aq) + A^-(aq)$ , which of these statements is true?
- A. The equilibrium constant for this reaction changes as the pH changes.
  - B. If you add the soluble salt KA to a solution of HA that is at equilibrium, the pH would increase.
  - C. If you add the soluble salt KA to a solution of HA that is at equilibrium, the concentration of  $A^-$  would decrease.
  - D. If you add the soluble salt KA to a solution of HA that is at equilibrium, the concentration of HA would decrease.
38. To mimic a blood buffer, a scientist prepared 1.00 L buffer containing 0.0025mol carbonic acid,  $H_2CO_3$ , and 0.025 mol hydrogen carbonate ion,  $HCO_3^-$ . What is the pH of the buffer? (The  $K_a$  of carbonic acid is  $4.3 \times 10^{-7}$ )
- A. 6.58
  - B. 7.37
  - C. 8.02
  - D. 8.53
39. Which of the following statement is the proper definition of the term “oxidation”?
- A. The losing of electrons in a redox reactions.
  - B. A chemical reaction consisting of Oxygen only.
  - C. The reactions involving the movement of electrons.
  - D. A chemical reaction pertaining to the electron gains

40. Which is an example of a redox half-reaction?
- A.  $\text{MnO}_2 \rightarrow \text{Mn}^{2+}$
  - B.  $2\text{Na} + \text{Cl}_2 \rightarrow 2\text{NaCl}$
  - C.  $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$
  - D.  $\text{MnO}_2 + \text{Cl} \rightarrow \text{Mn}^{2+} + \text{Cl}$
41. In order to balanced the equation  $\text{NaBr} + \text{Cl}_2 \rightarrow \text{NaCl} + \text{Br}_2$ , what should be put in the blank respectively?
- A. 1 and 2
  - B. 2 and 2
  - C. 2 and 3
  - D. 2 and 4
42. Which of the following is true for an electrolytic cell?
- A. It is a type of cell used in electroplating
  - B. It changes electrical energy into chemical energy
  - C. It uses an electric current to make a nonspontaneous reaction to occur
  - D. All of the above
43. What do you call the part of Galvanic cell where reduction takes place?
- A. Anode
  - B. Cathode
  - C. Salt Bridge
  - D. Load
44. Which of the following is the correct definition of a reduction potential?
- A. Refers to the ability of anion solution to become reduced picking up or gaining electrons from its own electrode.
  - B. Refers to the ability of an electrode to become oxidized giving up or losing Electrons.
  - C. Refers to the ability of cation solution to become reduced picking up or gaining electrons from its own electrode.
  - D. Refers to the ability of an electrode to become reduced giving up or losing electrons.
45. What is the correct chemical equation for the oxidation half reaction in Daniel Cell?
- A.  $\text{Zn(s)} \rightarrow \text{Zn}^{2+}(\text{aq}) + 2\text{e}^-$
  - B.  $\text{Zn(aq)} \rightarrow \text{Zn}^{2+}(\text{s}) + 2\text{e}^-$
  - C.  $\text{Zn(s)} \rightarrow \text{Zn}^{2+}(\text{aq}) + \text{e}^-$
  - D.  $\text{Zn(s)} \rightarrow \text{Zn}^{2+}(\text{s}) + 2\text{e}^-$

46. What is the standard cell potential of the following ,  $E^0$  of the reaction:  
 $\text{Zn(s)} + \text{Pb}^{2+}(\text{aq}) \rightarrow \text{Zn}^{2+}(\text{aq}) + \text{Pb(s)}$  given that  $E^0 = -0.13\text{V}$ ;  $E^0 = -0.76\text{V}$ ?
- A.  $E^0 \text{ redox} = 0.63 \text{ V}$
  - B.  $E^0 \text{ redox} = 0.42 \text{ V}$
  - C.  $E^0 \text{ redox} = 0.53 \text{ V}$
  - D.  $E^0 \text{ redox} = 0.33 \text{ V}$
47. Which of the following is used as an anode in a dry cell?
- A. Graphite
  - B. Nickel
  - C. Zinc
  - D. Mercury (II) oxide
48. In an electrochemical reaction, what will happen to the electron during the reduction reaction?
- A. gain
  - B. lost
  - C. A and B
  - D. no change at all
49. During the electrolysis of water ( $\text{H}_2\text{O}$ ) how much hydrogen gas will be produced?
- A. Twice as much hydrogen gas as oxygen gas
  - B. Thrice as much hydrogen gas as oxygen gas
  - C. Twice as much oxygen gas as hydrogen gas
  - D. Thrice as much oxygen gas as hydrogen gas
50. From the electroplating of silver and spoon which is the anode?
- A. Silver
  - B. Spoon
  - C. Silver Nitrate
  - D. Neither A nor B