

FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA

COURSE- CHM 111

BY CLEVER-B TEAM

1. A chemical reaction is said to be at equilibrium at. **A: Minimal degree of freedom and maximum entropy** B: Minimal degree of freedom and minimal entropy C: Maximum degree of freedom and maximum entropy
2. Predict the spontaneity of a chemical process if $\Delta G^\circ = 141.7$ and $K = 1.4 \times 10^{-25}$ at 298K. A: Spontaneous process **B: Non spontaneous** C: An equilibrium process
3. Estimate the boiling point of water given $\Delta H^\circ = 44.01 \text{ kJ mol}^{-1}$ and $\Delta S^\circ = 118.3 \text{ J/K mol}^{-1}$. A: 100°C B: 93.7°C **C: 97.3°C**
4. Which of the following statements is true for the effect of catalyst on equilibrium. **A: affects the rates of the reactions** B: alter the equilibrium position C: no effect on rates and equilibrium position
5. Which of the following principles is used in predicting changes in equilibrium concentrations? **A: Le Chateliers** B: Zeroth C: Boyles
6. The following reaction is at equilibrium. $\text{C}_2\text{I}_2(\text{g}) + 3\text{F}_2(\text{g}) \rightleftharpoons 2\text{CIF}_3(\text{g})$ How will the system respond if the volume is increased at constant temperature? A: The reaction will shift to the right. B: There will be no change to the equilibrium position **C: The reaction will shift to the left**
7. The following reaction is at equilibrium. $\text{CF}_2\text{Br}_2(\text{g}) \rightleftharpoons \text{CF}_2(\text{g}) + 2\text{Br}(\text{g})$ $\Delta H = 424 \text{ kJ mol}^{-1}$ How will the system respond if the temperature is decreased? **A: The reaction will shift to the left.** B: The reaction will shift to the right. C: reaction stops
8. Consider this equation: $2\text{CO}(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{CO}_2(\text{g})$ Suppose the equation is rewritten as $\text{CO}(\text{g}) + \frac{1}{2}\text{O}_2(\text{g}) \rightleftharpoons \text{CO}_2(\text{g})$ with an equilibrium constant K_c' . What is the relationship between K_c and K_c' ? A: $K_c = K_c'$ **B: $K_c = (K_c')^2$** C: $K_c = \frac{1}{2}(K_c')$
9. Identify the INCORRECT statement below regarding chemical equilibrium. A: All chemical reactions are, in principle, reversible. B: Equilibrium is achieved when the concentrations of species become constant. **C: Equilibrium is achieved when reactant and product concentrations are equal.**
10. In which of the following reactions will the point of equilibrium shift to the left when the pressure on the system is increased? A: $\text{C}(\text{s}) + \text{O}_2(\text{g}) \rightleftharpoons \text{CO}_2(\text{g})$ **B: $\text{CaCO}_3(\text{s}) \rightleftharpoons \text{CaO}(\text{s}) + \text{CO}_2(\text{g})$** C: $2\text{Mg}(\text{s}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{MgO}(\text{s})$
11. What happens when a catalyst is added to a system at equilibrium? **A: The reaction follows an alternative pathway of lower activation energy.** B: The heat of reaction decreases. C: The potential energy of the reactants decreases.

12. The reaction $A \rightleftharpoons B$ has an equilibrium constant of $K = 10^{-4}$. Which of the following statements is always correct? A: The reaction will have 50% product B and 50% reactant A at equilibrium. B: The reaction is very favourable and will have mostly product B at equilibrium. **C: The reaction is unfavourable and will not have very much product B at equilibrium.**
13. Which of the following statements most accurately relates the properties of a liquid at room temperature with its vapour pressure? **A: liquid low vapour pressure will probably have a high surface tension and a high boiling point.** B: liquid low vapour pressure will probably have a low surface tension and a high boiling point. C: liquid high vapour pressure will probably have a low surface tension and a high boiling point.
14. For a reversible reaction, the equilibrium lies to the. A: Left **B: Right** C: middle
15. Which of the following is true for the composition of equilibrium mixture. If $\Delta G = 0$ and $K = 1$ the mixture is. A: Mostly products B: Mostly reactants **C: Neither reactants nor products are favoured**
16. Calculate the value of K at 298K for the following reaction $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$ Given $\Delta G = -32.96 \text{ kJ mol}^{-1}$. **A: 5.97×10^5** B: 13.3 C: -13.3
17. Of the following reactions, which of the reaction process is only spontaneous at high temperatures? A: $\Delta H +$, $\Delta S -$ **B: $\Delta H +$, $\Delta S +$** C: $\Delta H -$, $\Delta S -$
18. The incomplete combustion of carbon is described by the following equation $2C(s) + O_2(g) \rightleftharpoons 2CO(g)$ How does the spontaneity of this process depend upon temperature? **A: spontaneous ($\Delta G < 0$) at all temperatures.** B: Spontaneous process at high temperature C: Non spontaneous process
19. A condition of a predation process describes an endothermic process with an increase in system entropy, ΔG will be negative if. **A: $T\Delta S$ is greater than ΔH** B: $T\Delta S$ is less than ΔH C: $T\Delta S = 0$
20. At 25°C, a reaction has a Gibbs free energy change of +45 kJ. If the enthalpy change of the reaction is +35 kJ, what is the entropy change of the reaction? A: -400 J/K **B: -33.6 J/K** C: 33.6 J/K
21. Energy can neither be created nor destroyed but can be converted from one form to other is inferred from. A: zeroth law of thermodynamic **B: first law of thermodynamics** C: second law to thermodynamics
22. From the equation $2NO_2(g) \rightleftharpoons N_2O_4(g)$ When the value of the reaction quotient before any reaction occurs is zero (0) at 25 °C, the concentration changes so that at equilibrium, $[NO_2] = 0.016 \text{ M}$ and $[N_2O_4] = 0.042 \text{ M}$. What is the value of the equilibrium constant for the reaction? **A: 1.6×10^2** B: -1.6×10^5 C: 0.016
23. For the reaction, $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$ the concentrations at equilibrium are $[SO_2] = 0.90 \text{ M}$, $[O_2] = 0.35 \text{ M}$, and $[SO_3] = 1.1 \text{ M}$. What is the value of the equilibrium constant, K_c ? A: $K_c = 3.4$ B: $K_c = 6.9$ **C: $K_c = 4.3$**
24. A 1.00-L flask containing 0.0500 mol of $NO(g)$, 0.0155 mol of $Cl_2(g)$, and 0.500 mol of $NOCl$ $2NO(g) + Cl_2(g) \rightleftharpoons 2NOCl(g)$ $K_c = 4.6 \times 10^4$

Calculate the reaction quotient and determine the direction of the equilibrium shift. A:

$Q_c = 1.9 \times 10^{-7}$, shift left **B: $Q_c = 6.45 \times 10^{-3}$, shift right** C: $Q_c = 4.6 \times 10^{-4}$, none is favoured

25. Which of the statements defines the activity of a substance. A: degree of randomness of a system **B: a measure of its effective concentration under specified conditions.** C: a measure of heat content of a substance
26. A system in which reactants and products are found in two or more phases is a. A: Phase equilibrium B: chemical equilibrium **C: Heterogeneous equilibrium**
27. One of the following is an example of heterogeneous equilibria. A: $C_2(g) + H_2(g) \rightleftharpoons C_2H_4(g) + H_2O(g)$ B: $CO(g) + H_2O(g) \rightleftharpoons CO_2(g) + H_2(g)$ **C: $PbCl_2(s) \rightleftharpoons Pb^{2+}(aq) + 2Cl^{-}(aq)$**
28. A chemical reaction is said to be at equilibrium at. **A: Minimal degree of freedom and maximum entropy** B: Minimal degree of freedom and minimal entropy C: Minimal entropy and minimal degree of freedom
29. Predict the spontaneity of a chemical process if $\Delta G^\circ = 141.7$ and $K = 1.4 \times 10^{-25}$ at 298K. A: Spontaneous process **B: Non spontaneous** C: An equilibrium process
30. Estimate the boiling point of water given $\Delta H^\circ = 44.01 \text{ kJ mol}^{-1}$ and $\Delta S^\circ = 118.3 \text{ J K mol}^{-1}$. A: 93.7°C **B: 97.3°C** C: 97.3 kJ/mol
31. Which of the following statements is true for the effect of catalyst on equilibrium. **A: affects the rates of the reactions** B: alter the equilibrium position C: catalyst remains in the reactants
32. Which of the following principles is used in predicting changes in equilibrium concentrations? A: Fritz Haber **B: Le Chateliers** C: Zeroth
33. The following reaction is at equilibrium. $C_2H_2(g) + 3F_2(g) \rightleftharpoons 2CF_3(g)$ How will the system respond if the volume is increased at constant temperature? A: The reaction will shift to the right. B: There will be no change to the equilibrium position **C: The reaction will shift to the left**
34. The following reaction is at equilibrium. $CF_2Br_2(g) \rightleftharpoons CF_2(g) + 2Br(g)$ $\Delta H = 424 \text{ kJ mol}^{-1}$ How will the system respond if the temperature is decreased? **A: The reaction will shift to the left.** B: The reaction will shift to the right. C: reaction stops
35. Consider this equation: $2CO(g) + O_2(g) \rightleftharpoons 2CO_2(g)$ Suppose the equation is rewritten as $CO(g) + \frac{1}{2}O_2(g) \rightleftharpoons CO_2(g)$ with an equilibrium constant K_c' . What is the relationship between K_c and K_c' ? A: $K_c = K_c'$ **B: $K_c = (K_c')^2$** C: $K_c = \frac{1}{2}(K_c')$
36. Identify the INCORRECT statement below regarding chemical equilibrium. A: All chemical reactions are, in principle, reversible. B: Equilibrium is achieved when the concentrations of species become constant. **C: Equilibrium is achieved when reactant and product concentrations are equal.**
37. In which of the following reactions will the point of equilibrium shift to the left when the pressure on the system is increased? A: $C(s) + O_2(g) \rightleftharpoons CO_2(g)$

B: $\text{CaCO}_3(\text{s}) \rightleftharpoons \text{CaO}(\text{s}) + \text{CO}_2(\text{g})$ C: $2\text{Mg}(\text{s}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{MgO}(\text{s})$

38. What happens when a catalyst is added to a system at equilibrium? **A: The reaction follows an alternative pathway of lower activation energy.** B: The heat of reaction decreases. C: The potential energy of the reactants decreases.
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45. The incomplete combustion of carbon is described by the following equation $2\text{C}(\text{s}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{CO}(\text{g})$ How does the spontaneity of this process depend upon temperature? **A: spontaneous ($\Delta G < 0$) at all temperatures.** B: Spontaneous process at high temperature C: Non spontaneous process
46. If ΔH is negative and ΔS is positive, this condition describes. A: Spontaneous process at low temperature B: Non spontaneous process **C: Spontaneous process at all temperatures**
47. A condition of a predation process describes an endothermic process with an increase in system entropy, ΔG will be negative if. **A: $T\Delta S$ is greater than ΔH** B: $T\Delta S$ is less than ΔH C: $T\Delta S = 0$
48. At 25°C, a reaction has a Gibbs free energy change of +45kJ. If the enthalpy change of the reaction is +35kJ, what is the entropy change of the reaction? A: -400JK **B: -33.6JK** C: 33.6JK
49. Energy can neither be created nor destroyed but can be converted from one form to other is inferred from. A: zeroth law of thermodynamic **B: first law of thermodynamics** C: second law of thermodynamics
50. From the equation $2\text{NO}_2(\text{g}) \rightleftharpoons \text{N}_2\text{O}_4(\text{g})$ When the value of the reaction quotient before any reaction occurs is zero (0) at 25 °C, the concentration changes so that at equilibrium, $[\text{NO}_2] = 0.016 \text{ M}$ and

$[N_2O_4] = 0.042 \text{ M}$. What is the value of the equilibrium constant for the reaction? **A: 1.6×10^2** B: -1.6×10^5 C: 0.016

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52. A 1.00-L flask containing 0.0500 mol of $NO(g)$, 0.0155 mol of $Cl_2(g)$, and 0.500 mol of $NOCl$ $2NO(g) + Cl_2(g) \rightleftharpoons 2NOCl(g)$ $K_c = 4.6 \times 10^4$ Calculate the reaction quotient and determine the direction of the equilibrium shift. A: $Q_c = 0$, shifts right B: $Q_c = 1.9 \times 10^{-7}$, shift left **C: $Q_c = 6.45 \times 10^3$, shift right**
53. Which of the statements defines the activity of a substance. A: degree of randomness of a system **B: a measure of its effective concentration under specified conditions.** C: a measure of heat content of a substance
54. A system in which reactants and products are found in two or more phases is a. A: Phase equilibrium B: chemical equilibrium **C: Heterogeneous equilibrium**
55. The following factors affects the position of an equilibrium EXCEPT. A: Temperature B: Pressure **C: Catalyst**
56. Which one of the following statements regarding energy is false? A: The total energy in a chemical universe (a system and its surroundings) is constant B: Energy can be converted from one form to another **C: The energy stored in chemical bonds is referred to as kinetic energy**
57. First law of thermodynamics furnishes the relationship between. A: heat and work **B: heat, work and properties of the system** C: various properties of the system
58. In which direction does the transfer of energy as heat happen spontaneously? A: From cold to hot **B: From hot to cold** C: No changes occurs
59. Which one of the following statements best describes the enthalpy change of a reaction? A: The energy released when chemical bonds are formed during a chemical reaction B: The energy consumed when chemical bonds are broken during a chemical reaction **C: The difference between the energy released by bond formation and the energy consumed by bond cleavage during a chemical reaction**
60. Enthalpy is represented by which of the following symbols? **A: H** B: K C: S
61. Which of the following terms describes a reaction in which there is a net transfer of energy from a system to its surroundings? **A: Exothermic** B: Endothermic C: Spontaneous
62. Which of the following statements regarding the Gibbs free energy change for a reaction is false? **A: The Gibbs free energy change is the proportion of the enthalpy change of a reaction that is used to increase the entropy.** B: If the Gibbs free energy change for a reaction is negative, the reaction happens spontaneously. C: The Gibbs free energy is represented by the symbol G
63. Energy is measured in which of the following units? A: Kelvin **B: Joule** C: Pascal
64. The formation of a chemical bond releases energy. True or false? **A: True** B: False C: All of the above
65. In case of spontaneous reaction, the reaction process favoured is. **A: Forward** B: Both direction C: Reverse

66. Which of the following is true for a closed system? A: mass entering = mass leaving **B: mass does not enter or leave the system** C: no reaction occur
67. When the value of K is greater than the I, then the reaction is. A: Forward reaction B: Backward reaction **C: Spontaneous**
68. ΔG for spontaneous reaction is. **A: Negative** B: Positive C: zero
69. Describe how matter and/or energy is redistributed when you empty a canister of compressed air into a room. **A: greater and more uniform dispersal of matter** B: much lesser dispersal of matter C: a reversible process
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71. Why do plastic materials tend to persist in the environment? A: Oxidation of plastics is fast and spontaneous B: Plastics are kinetically unstable **C: Oxidation of plastics is slow and spontaneous**
72. Predict the sign of the entropy change for the following processes. $\text{C}_6\text{H}_6(\text{l}) + 15/2 \text{O}_2(\text{g}) \rightarrow 6\text{CO}_2(\text{g}) + 3\text{H}_2\text{O}(\text{l})$.
A: ΔS = positive **B: ΔS = negative** C: ΔS = 0
73. $\text{NaNO}_3(\text{s}) \rightarrow \text{Na}^+(\text{aq}) + \text{NO}_3^-(\text{aq})$. **A: ΔS = positive** B: ΔS = negative C: ΔS = +/-
74. The freezing of liquid water. A: ΔS = positive **B: ΔS = negative** C: ΔS is = 0
75. Will Ice Spontaneously Melt? The entropy change for the process $\text{H}_2\text{O}(\text{s}) \rightarrow \text{H}_2\text{O}(\text{l})$ Given the ΔS of the system and the surrounding as 22.1J/K and requires that the surrounding transfer 6.00kJ of heat to the system. Is the process spontaneous at -10.00 °C? Is it a spontaneous at +10.00 °C? **A: Melting is spontaneous at 10 °C** B: Melting is non spontaneous at 10 °C C: Entropy is equal to 0
76. Determine if liquid water will spontaneously freeze at the same temperatures. $\text{H}_2\text{O}(\text{s}) \rightarrow \text{H}_2\text{O}(\text{l})$ Given the ΔS of the system and the surrounding as 22.1J/K and requires that the surrounding transfer 6.00kJ of heat to the system. Is the process spontaneous at -10.00 °C? Is it a spontaneous at +10.00 °C? **A: Freezing is spontaneous at -10 °C** B: Freezing is spontaneous at 10 °C C: Entropy is equal to 0
77. $S = k \ln \Delta$; $W = k \ln(1) = 0$ The above equation represents. A: First law of thermodynamics B: Second law of thermodynamics **C: Third law of thermodynamics**
78. What is the difference between S° , and ΔS_{298} for a chemical change? A: S° standard enthalpy at 1 bar pressure **B: ΔS_{298} Standard change in entropy at room temperature** C: S° Entropy of a perfect crystal at absolute zero
79. Which of the following options indicates that a chemical reaction is unfavorable? A: ΔH is negative B: ΔG is negative **C: ΔS is negative**
80. Consider the following reaction in a galvanic cell $\text{Zn} + \text{Cu}^{2+} \rightarrow \text{Zn}^{2+} + \text{Cu}$ Which if the following statements about the reaction is false? A: The cell potential is positive B: The equilibrium constant is greater than one **C: Gibbs's free energy is positive**
81. The two ways in which a closed system can share energy with it's surroundings are ----- and ----
-- **A: heat and work** B: exothermic and endothermic C: hot and cold

82. If a system is at equilibrium, what is the relationship between ΔH and ΔS . A: $\Delta S = T\Delta H$ B: $\Delta S = T\Delta H$ **C: $\Delta S = \Delta H/T$**