

DEPARTMENT OF CHEMISTRY
AMBROSE ALLI UNIVERSITY, EKPOMA

Course Code: CHM 101

1. What is the name given to the electrons in the highest occupied energy level of an atom?

- a. orbital electrons
- b. valence electrons
- c. anions
- d. cations

Answer: B

2. How does calcium obey the octet rule when reacting to form compounds?

- a. It gains electrons.
- b. It gives up electrons.
- c. It does not change its number of electrons.
- d. Calcium does not obey the octet rule.

Answer: B

3. What is the charge on the strontium ion?

- a. 2-
- b. 1-
- c. 1+
- d. 2+

Answer: D

4. How many electrons does barium have to give up to achieve a noble-gas electron configuration?

- a. 1
- b. 2
- c. 3
- d. 4

Answer: B

5. What is the formula of the ion formed when potassium achieves noble-gas electron configuration?

- a. K^{2+}
- b. K^+
- c. K^1
- d. K^{2-}

Answer: B

6. Which of the following ions has a pseudo-noble-gas electron configuration?

- a. Fe^{2+}
- b. Mn^{2+}
- c. Cu^+
- d. Ni^+

Answer: C

7. Which of the following elements does NOT form an ion with a charge of $1+$?

- a. fluorine
- b. hydrogen
- c. potassium
- d. sodium

Answer: A

8. What is the charge on the cation in the ionic compound sodium sulfide?

- a. 0
- b. $1+$
- c. $2+$
- d. $3+$

Answer: B

9. Which of the following occurs in an ionic bond?

- a. Oppositely charged ions attract.
- b. Two atoms share two electrons.
- c. Two atoms share more than two electrons.
- d. Like-charged ions attract.

Answer: A

10. What is the net charge of the ionic compound calcium fluoride?

- a. 2–
- b. 1–
- c. 0
- d. 1+

Answer: C

11. How many valence electrons are transferred from the nitrogen atom to potassium in the formation of the compound potassium nitride?

- a. 0
- b. 1
- c. 2
- d. 3

Answer: A

12. How many valence electrons are transferred from the calcium atom to iodine in the formation of the compound calcium iodide?

- a. 0
- b. 1
- c. 2
- d. 3

Answer: C

13. What is the formula unit of sodium nitride?

- a. NaN
- b. Na_2N
- c. Na_3N
- d. NaN_3

Answer: C

14. What is the formula unit of aluminum oxide?

- a. AlO
- b. Al_3O
- c. AlO_3
- d. Al_2O_3

Answer: D

15. What is the name of the ionic compound formed from lithium and bromine?

- a. lithium bromine
- b. lithium bromide
- c. lithium bromium
- d. lithium bromate

Answer: B

16. What is the formula for sodium sulfate?

- a. NaSO_4
- b. Na_2SO_4
- c. $\text{Na}(\text{SO}_4)_2$
- d. $\text{Na}_2(\text{SO}_4)_2$

Answer: B

17. What is the formula for potassium sulfide?

- a. KS

b. K_2S

c. KS_2

d. K_2S_2

Answer: B

18. Which of the following pairs of elements is most likely to form an ionic compound?

a. magnesium and fluorine

b. nitrogen and sulfur

c. oxygen and chlorine

d. sodium and aluminum

Answer: A

19. Which of these elements does not exist as a diatomic molecule?

a. Ne

b. F

c. H

d. I

Answer: A

20. How do atoms achieve noble-gas electron configurations in single covalent bonds?

a. One atom completely loses two electrons to the other atom in the bond.

b. Two atoms share two pairs of electrons.

c. Two atoms share two electrons.

d. Two atoms share one electron.

Answer: C

21. Why do atoms share electrons in covalent bonds?

a. to become ions and attract each other

b. to attain a noble-gas electron configuration

- c. to become more polar
- d. to increase their atomic numbers

Answer: B

22. Which of the following elements can form diatomic molecules held together by triple covalent bonds?

- a. carbon
- b. oxygen
- c. fluorine
- d. nitrogen

Answer: D

23. Which of the following is the name given to the pairs of valence electrons that do not participate in bonding in diatomic oxygen molecules?

- a. unvalenced pair
- b. outer pair
- c. inner pair
- d. unshared pair

Answer: D

24. Which of the following diatomic molecules is joined by a double covalent bond?

- a. O₂
- b. Cl₂
- c. N₂
- d. He₂

Answer: A

25. A molecule with a single covalent bond is ____.

- a. CO₂
- b. Cl₂

c. CO

d. N₂

Answer: B

26. Once formed, how are coordinate covalent bonds different from other covalent bonds?

a. They are stronger.

b. They are more ionic in character.

c. They are weaker.

d. There is no difference.

Answer: D

27. When H⁺ forms a bond with H₂O to form the hydronium ion H₃O⁺, this bond is called a coordinate covalent bond because ____.

a. both bonding electrons come from the oxygen atom

b. it forms an especially strong bond

c. the electrons are equally shared

d. the oxygen no longer has eight valence electrons

Answer: A

28. Which of the following atoms acquires the most negative charge in a covalent bond with hydrogen?

a. C

b. Na

c. O

d. S

Answer: C

29. Which of the following covalent bonds is the most polar?

a. H—F

b. H—C

c. H—H

d. H—N

Answer: A

30. What causes hydrogen bonding?

a. attraction between ions

b. motion of electrons

c. sharing of electron pairs

d. bonding of a covalently bonded hydrogen atom with an unshared electron pair

Answer: D

31. Why is hydrogen bonding only possible with hydrogen?

a. Hydrogen's nucleus is electron deficient when it bonds with an electronegative atom.

b. Hydrogen is the only atom that is the same size as an oxygen atom.

c. Hydrogen is the most electronegative element.

d. Hydrogen tends to form covalent bonds.

Answer: A

32. All the commercial liquid fuels are derived from natural petroleum (or crude oil).

a. True

b. False

c. False/True

d. All of the above

Answer: A

33. A cycle consisting of one constant pressure, one constant volume and two isentropic processes is known as

a. Carnot cycle

b. Stirling cycle

c. Otto cycle

d. Diesel cycle

Answer: D

34. The efficiency and work ratio of a simple gas turbine cycle are

- a. low
- b. very low
- c. high
- d. very high

Answer: B

35. The amount of heat required to raise the temperature of the unit mass of gas through one degree at constant volume, is called

- a. specific heat at constant volume
- b. specific heat at constant pressure
- c. kilo Joule
- d. none of these

Answer: A

36. There is a loss of heat in an irreversible process.

- a. True
- b. False
- c. False/ True
- d. All of the above

Answer: A

37. An adiabatic process is one in which

- a. no heat enters or leaves the gas
- b. the temperature of the gas changes
- c. the change in internal energy is equal to the mechanical workdone
- d. all of the above

Answer: D

38. Which of the following is the lightest and most volatile liquid fuel?

- a. Gasoline
- b. Kerosene
- c. Fuel oil
- d. Diesel

Answer: A

39. The processes occurring in open system which permit the transfer of mass to and from the system, are known as

- a. flow processes
- b. non-flow processes
- c. adiabatic processes
- d. none of these

Answer: A

40. Which of the following has the minimum atomic mass?

- a. Oxygen
- b. Sulphur
- c. Nitrogen
- d. Carbon

Answer: D

41. Workdone in a free expansion process is

- a. zero
- b. minimum
- c. maximum
- d. positive

Answer: A

42. The pressure exerted by an ideal gas is _____ of the kinetic energy of all the molecules contained in a unit volume of gas.

- 1. one-half
- 2. one-third
- 3. two-third
- 4. three-fourth

Answer: 3

43. The compression ratio for petrol engines is

- 1. 3 to 6
- 2. 5 to 8
- 3. 15 to 20
- 4. 20 to 30

Answer: 2

45. The efficiency of Diesel cycle approaches to Otto cycle efficiency when

- a. cut-off is increased
- b. cut-off is decreased
- c. cut-off is zero
- d. cut-off is constant

Answer: C

46. The entropy _____ in an irreversible cyclic process.

- a. remains constant
- b. decreases
- c. increases
- d. All of the above

Answer: C

47. The atomic mass of oxygen is

- a. 12
- b. 14
- c. 16
- d. 32

Answer: C

48. The ratio of specific heat at constant pressure (c_p) and specific heat at constant volume (c_v) is

- a. equal to one
- b. less than one
- c. greater than one
- d. none of these

Answer: C

49. Carbonisation of coal consists of

- a. drying and crushing the coal to a fine powder
- b. moulding the finely ground coal under pressure with or without a binding material
- c. heating the wood with a limited supply of air to temperature not less than 280°C
- d. none of the above

Answer: D

50. The efficiency of Stirling cycle is _____ Carnot cycle.

- a. greater than
- b. less than
- c. equal to
- d. All of the above

Answer: C

51. According to Gay-Lussac law for a perfect gas, $p/T = \text{constant}$, if v is kept constant.

- a. True

- b. False
- c. False/True
- d. All off the above

Answer: A

52. There is no change in internal energy in an isothermal process.

- a. Correct
- b Incorrect
- c. Incorrect/correct
- d. All of the above

Answer: A

53. Which of the following statements about kinetic theory of matter is not correct?

- a. The molecules of matter are always in motion
- b. When a body is heated the average kinetic energy of its molecules decreases
- c. Molecules of a liquid move more freely than those of a solid
- d. Matter is made up of very tiny particles called molecules

Answer: B

54. Brownian motion provides evidence that

- a. smoke particles consist of molecules
- b. smoke particles are lighter than air molecules
- c. air molecules are in continuous random motion
- d. air molecules attract smoke particles

Answer: C

55. At room temperature the particles in a solid are best described as

- a. stationary and far apart
- b. stationary and close together

- c. vibrating and close together
- d. moving randomly and far apart

Answer: C

56. Liquids have a definite volume because

- a. the molecules are held in fixed positions
- b. forces between the molecules do not allow them to leave the liquid
- c. the molecules do not vibrate
- d. the molecules are packed close together in a regular pattern

Answer: B

57. The volume of a certain gas in a piston is reduced to $\frac{2}{3}$ of its original value. What happens to the pressure of the gas?

- a. increases by $\frac{2}{3}$
- b. increases by $\frac{3}{2}$
- c. decreases by $\frac{2}{3}$
- d. decreases by $\frac{1}{3}$

Answer: B

58. The pressure of a gas in a piston is 1.5 bar when the volume is 10cm^3 . The volume is increased and the pressure falls to 1.2 bar. By how much was the volume increased?

- a. 2.5cm^3
- b. 12.5cm^3
- c. 8.0cm^3
- d. 1.8cm^3

Answer: A

59. In one minute, a diver breathes 1 litre of air at an atmospheric pressure of 100 kPa. To breathe in the same mass of air in one minute, how much air would he need to breathe when the total pressure on him under water is 300 kPa?

- a. $\frac{1}{3}$ litre

b. 1/2 litre

c. 1 litre

d. 2 litres

Answer: A

60. The air in a large paper bag is heated. The bag is then found to rise through the surrounding cold air. This is because

a. the air in the bag has become less dense

b. the mass of the paper bag has decreased

c. heat always rises

d. the mass of air in the bag has increased

Answer: A

61. The motion of the molecule of two gases cause them to mix. What is this motion called?

a. Brownian motion

b. conduction

c. diffusion

d. evaporation

Answer: C

62. A student observes the Brownian motion of smoke particles in air with a microscope. She sees moving points of light. These points of light come from

a. air particles only moving randomly

b. air particles only vibrating

c. smoke particles only moving randomly

d. smoke particles only vibrating

Answer: C

63. Some gas trapped in a cylinder is compressed at constant temperature by a piston. Which of the following will not change?

a. density

- b. mass
- c. molecular spacing
- d. pressure

Answer: B

64. A given mass of air occupies 12 m³ at normal atmospheric pressure. If the pressure is increased to 4 times the original value without changing the temperature, what volume will the air occupy?

- a. 3 m³
- b. 6 m³
- c. 24 m³
- d. 48 m³

Answer: A

65. When the temperature of a gas rises at constant volume, its molecules

- a. move closer together
- b. move with greater average speed
- c. collide with one another less often
- d. exert smaller forces on one another

Answer: B

66. What is a property of both liquids and gases?

- a. they always fill their containers
- b. they are incompressible
- c. they can flow
- d. they have molecules in fixed positions

Answer: C

67. Which of the following is the correct explanation for the expansion of a substance when it is heated?

- a. The particles of the substance increase in number
- b. The particles of the substance vibrate faster

c. The particles of the substance push each other further away

d. The particles of the substance expand

Answer: C

68. In the Brownian motion experiment, the evidence of the movement of molecules is inferred by observing

a. the air particles moving randomly

b. the molecules moving randomly

c. the smoke particles moving randomly

d. the air particles colliding with the smoke particles

Answer: C

69. The characteristic properties of an acid is due to the presence of _____.

a. hydride ions

b. hydroxyl ions

c. hydronium ions

d. oxide ions

Answer: C

70. A strong acid in solution is _____.

a. mostly molecules

b. mostly ions

c. both molecules and ions

d. mostly water

Answer: B

71. A weak acid in solution is _____.

a. mostly molecules

b. mostly ions

c. both molecules and ions

d. less water

Answer: C

72. The pH of a carbonated drink is _____.

a. less than 7

b. more than 7

c. equal to 7

d. approximately 7.8

Answer: A

73. An acid is _____.

a. a proton donor

b. a proton acceptor

c. electron donor

d. electron acceptor

Answer: A

74. The drying of milk of lime (white washing) is due to the action of _____.

a. oxygen in air

b. nitrogen in air

c. CO₂ in air

d. hydrogen in air

Answer: C

75. A salt derived from a strong base and a weak acid will give a salt that is _____.

a. acidic

b. basic

c. neutral

d. volatile

Answer: C

76. When litmus is added to a solution of borax it turns_____.

- a. red
- b. pink
- c. remains colourless
- d. blue

Answer: D

77. Which of the following is not a mixed salt?

- a. K_2CaPO_4
- b. $Ca(OCl)Cl$
- c. $Na_2K_2CO_3$
- d. KCl

Answer: D

78. Which is a soluble base in water?

- a. $Fe(OH)_3$
- b. $Cu(OH)_2$
- c. $Zn(OH)_2$
- d. $NaOH$

Answer: D

79. Which of the following is a weak base?

- a. $NaOH$
- b. KOH
- c. NH_4OH
- d. $Ca(OH)_2$

Answer: C

80. Choose the acid salt from the following:

- a. NaNO_3
- b. Na_2SO_4
- c. NaHSO_4
- d. Na_2CO_3

Answer: C

81. In the following reaction, identify the products

- a. sodium chloride and water
- b. water and carbon dioxide
- c. sodium carbonate, carbon dioxide and water
- d. sodium chloride, carbon dioxide and water

Answer: D

82. In the following reaction, identify the salt formed

- a. NH_4NO_3
- b. $(\text{NH}_4)_2\text{SO}_4$
- c. $(\text{NH}_4)_3\text{PO}_4$
- d. $(\text{NH}_4)_2\text{S}$

Answer: B

83. Which of the following ionic species exist in a neutralization reaction?

- a. HCl
- b. H^+
- c. H_2O
- d. H_3O^+

Answer: D

84. An equilibrium constant with a value $K > 1$ means:

- a. there are more reactants than products at equilibrium
- b. there are more products than reactants at equilibrium
- c. there are the same amount of products and reactants at equilibrium
- d. the reaction is not at equilibrium

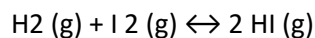
Answer: B

85. Equal amounts of reactants are poured into a suitable container. Given sufficient time, the reactants may be converted almost entirely to products if:

- a. K is less than 1
- b. K is greater than 1
- c. K is equal to 1
- d. K is equal to 0

Answer: B

86. The equilibrium constant for the reaction

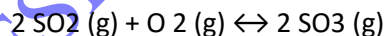


would be:

- a. $K = [\text{HI}]^2 / [\text{H}_2][\text{I}_2]$
- b. $K = [\text{H}_2][\text{I}_2] / [\text{HI}]^2$
- c. $K = 2[\text{HI}] / [\text{H}_2][\text{I}_2]$
- d. $K = [\text{H}_2][\text{I}_2] / 2[\text{HI}]$

Answer: A

87. The equilibrium constant for the reaction



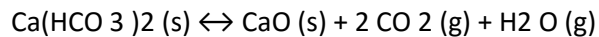
would be:

- a. $K = 2[\text{SO}_3] / 2[\text{SO}_2][\text{O}_2]$
- b. $K = 2[\text{SO}_2][\text{O}_2] / [\text{SO}_3]$
- c. $K = [\text{SO}_3]^2 / [\text{SO}_2]^2 [\text{O}_2]$

d. $K = \frac{[\text{SO}_2]^2 [\text{O}_2]}{[\text{SO}_3]^2}$

Answer: C

88. The equilibrium constant for the reaction



would be:

a. $K = \frac{[\text{CaO}][\text{CO}_2]^2 [\text{H}_2\text{O}]}{[\text{Ca}(\text{HCO}_3)_2]}$

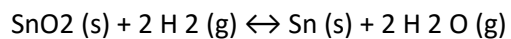
b. $K = \frac{[\text{Ca}(\text{HCO}_3)_2]}{[\text{CaO}][\text{CO}_2]^2 [\text{H}_2\text{O}]}$

c. $K = [\text{CO}_2]^2$

d. $K = [\text{CO}_2]^2 [\text{H}_2\text{O}]$

Answer: D

89. The equilibrium constant for the reaction



would be:

a. $K = \frac{[\text{H}_2\text{O}]^2}{[\text{H}_2]^2}$

b. $K = \frac{[\text{Sn}][\text{H}_2\text{O}]^2}{[\text{SnO}][\text{H}_2]^2}$

c. $K = \frac{[\text{SnO}][\text{H}_2]^2}{[\text{Sn}][\text{H}_2\text{O}]^2}$

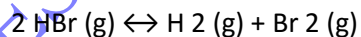
d. $K = \frac{[\text{H}_2]^2}{[\text{H}_2\text{O}]^2}$

Answer: A

90. For the reaction



$K = 4.0 \times 10^{-2}$. For the reaction



K =:

a. 4.0×10^{-2}

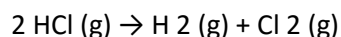
b. 5

c. 25

d. 2.0×10^{-1}

Answer: C

91. At a certain temperature, $K = 1$ for the reaction



At equilibrium, you can be certain that:

a. $[\text{H}_2] = [\text{Cl}_2]$

b. $[\text{HCl}] = 2[\text{H}_2]$

c. $[\text{HCl}] = [\text{H}_2] = [\text{Cl}_2] = 1$

d. $[\text{H}_2][\text{Cl}_2]/[\text{HCl}]^2 = 1$

Answer: D

92. For the reaction: $\text{A} + \text{B} \leftrightarrow \text{C} + \text{D}$

6.0 moles of A and 5.0 moles of B are mixed together in a suitable container. When equilibrium is reached, 4.0 moles of C are produced.

The equilibrium constant for this reaction is:

a. $K = 1/8$

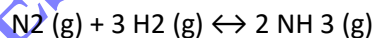
b. $K = 8$

c. $K = 30/16$

d. $K = 16/30$

Answer: B

93. The Haber process is a method to produce ammonia from hydrogen and nitrogen gases. The reaction is



If hydrogen gas is added after the reaction has reached equilibrium, the reaction will:

a. shift to the right to produce more product

b. shift to the left to produce more reactants

c. stop. All the nitrogen gas has already been used up.

d. Need more information.

Answer: A

94. On increasing the temperature, the rate of a reaction:

a. always increases

b. always decreases

c. first increases and then decreases

d. may increase or decrease depending upon the nature of the reaction

Answer: A

95. In a vessel containing H_2 , N_2 and NH_3 at equilibrium, some helium gas is introduced so that the total pressure increase while temperature and volume remain constant. According to Le Chatelier's principle, the dissociation of ammonia:

a. increases

b. decreases

c. remains unaltered

d. changes unpredictably

Answer: C

96. Which one of the following statements regarding a dynamic equilibrium is false?

a. At equilibrium, there is no net change in the system

b. At equilibrium, the concentration of reactants and products stays the same

c. At equilibrium, the forward and back reactions cease to occur

d. At equilibrium, the rates of the forward and back reactions are identical

Answer: C

97. A large value of K tells us which of the following?

a. The reaction lies to the left

b. The reaction lies in the middle

- c. The reaction lies to the right
- d. The reaction will lie on both sides

Answer: C

98. Which one of the following statements regarding chemical equilibria is false?

- a. Catalysts do not alter the position of equilibrium: they do not shift the equilibrium to the left or right
- b. At equilibrium, $G = 0$
- c. If G for a reaction is negative, the forward reaction happens spontaneously
- d. If the equilibrium constant is very large, G is positive

Answer: D

99. The free energy change under standard conditions (G) is related to the equilibrium constant by the van't Hoff isotherm:

$G = -RT \ln K$. But what does the symbol R represent?

- a. The entropy of the system
- b. The gas constant
- c. The Avogadro constant
- d. The reaction quotient

Answer: B

100. Consider the binding of a protein and its ligand, represented by the expression $P + L \rightleftharpoons PL$. Which of the following statements in relation to this binding process is true?

- a. The expression for the dissociation constant
- b. A small value of K_d tells us that the protein and ligand bind tightly.
- c. If binding is strong, the association reaction lies to the left.
- d. If binding is weak, the dissociation reaction lies to the left.

Answer: B