BOWEN UNIVERSITY, IWO, OSUN STATE

COLLEGE OF AGRICULTURE, ENGINEERING AND SCIENCE

INDUSTRIAL CHEMISTRY PROGRAMME

2022/2023 SESSION B.SC DEGREE FIRST SEMESTER EXAMINATION

Course Code: CHM 101 **Courses Title:** General Chemistry 1 Credit: 3

Date: 13/02/2023 **Time Allowed: 35 min**

INSTRUCTION: **ANSWER 70 QUESTIONS**

USEFUL PHYSICAL CONSTANTS

R = 8.314 $Jmol^{-1}K^{-1}$ = 0.0821 $Latm\ mol^{-1}\ K^{-1}$

[Na = 22.99 g/mol; Cl = 35.45 g/mol; Mn = 54.94 g/mol; Al = 26.98 g/mol; O = 16.00 g/mol; H = 1.008 g/mol; C = 12.01 g/mol; S = 32.06 g/mol; F = 19.00 g/mol; Fe = 55.85 g/mol]

1. Sodium and chlorine react to form sodium chloride:

   What is the theoretical yield of sodium chloride for the reaction of 55.0 g Na with 67.2 g Cl_2?

   A. 1.40×10^2 g NaCl
   B. 111 g NaCl
   C. 55.4 g NaCl
   D. 222 g NaCl

   ANSWER B

2. Select the displacement reaction(s) from the following:

   a: $ZnCO_3 \rightarrow ZnO + CO_2$
   b: $Pb + CuCl_2 \rightarrow PbCl_2 + Cu$
   c: $H_2 + Cl_2 \rightarrow 2HCl$
   d: $Fe_2O_3 + 2Al \rightarrow Al_2O_3 + 2Fe$
   e: $3H_2 + N_2 \rightarrow 2NH_3$

   A. a

B. b
C. c & e
D. b & d

ANSWER D

3. A reaction has a theoretical yield of 45.8 g. When the reaction is carried out, 37.2 g of the product is obtained. What is the percent yield?
   A. 55.1%
   B. 44.8%
   C. 123%
   D. 81.2%

   ANSWER D
4. Which solution forms a precipitate when mixed with a solution of aqueous Na_2CO_3?
   A. $KNO_3(aq)$
   B. $CuCl_2(aq)$
   C. NaBr(aq)
   D. $NH_4Cl(aq)$

   ANSWER B
5. When hydrogen sulphide gas is passed through a blue solution of copper sulphate, a black precipitate of copper sulphide is obtained and the Sulphuric acid so formed remains in the solution. The reaction is an example of a
   A. Combination reaction
   B. Displacement reaction
   C. Double displacement reaction
   D. Decomposition reaction

   ANSWER C
6. Which statements about subatomic particles are false?
   a: If an atom has an equal number of protons and electrons, it will be charge-positive
   b: Electrons are not attracted to protons
   c: Electrons are much heavier than neutrons
   d: Protons have about the same mass of neutrons.
   A. a, b & c
   B. a only
   C. a & b
   D. d only

   ANSWER A
7. Identify the correct balanced equation for the combustion of propane (C_3H_8).
   A. $C_3H_{8(g)} \rightarrow 4\ H_{2(g)} + 3\ C_{(s)}$
   B. $C_3H_{8(g)} + 5\ O_{2(g)} \rightarrow 4\ H_2O_{(g)} + 3\ CO_{2(g)}$
   C. $C_3H_{8(g)} + 3\ O_{2(g)} \rightarrow 4\ H_2O_{(g)} + 3\ CO_{2(g)}$
   D. $2\ C_3H_{8(g)} + 9\ O_{2(g)} \rightarrow 6\ H_2CO_{3(g)} + 2H_{2(g)}$

   ANSWER B
8. Which statements are consistent with Dalton's atomic theory as it was originally stated?
   a: Sulfur and oxygen atoms have the same mass

b: All cobalt atoms are identical.
c: Potassium and chlorine atoms combine in a 1:1 ratio to form potassium chloride.
d: Lead atoms can be converted into gold.

A. a & d
B. b only
C. b & c
D. c only

ANSWER C

9. Manganese(IV) oxide reacts with aluminum to form elemental manganese and aluminum oxide:

What mass of Al is required to completely react with 25.0 g MnO_2?

A. 7.76 g Al
B. 5.82 g Al
C. 33.3 g Al
D. 10.3 g Al

ANSWER D

10. In a double displacement reaction such as the reaction between sodium sulphate solution and barium chloride solution:
a: exchange of atoms takes place
b: exchange of ions takes place
c: a precipitate is produced
d: an insoluble salt is produced
The correct option is:

A. b & d
B. a & c
C. b only
D. b, c, d

ANSWER D

11. Balance the equation representing the combustion of hexane

$$\_\_C_6H_{14(l)} + \_\_O_{2(g)} \rightarrow \_\_CO_{2(g)} + \_\_H_2O_{(l)}$$

A. 2, 19, 12, 14
B. 2, 18, 12, 14
C. 2, 19, 13, 14
D. 2, 19, 12, 15

ANSWER A

12. The equation below is an example of what type of chemical reaction?

$$CaCO_{3\,(s)} \longrightarrow CaO_{\,(s)} + CO_{2\,(g)}$$

A. Decomposition
B. Combustion

C. Combination reaction
D. Gasification reaction
ANSWER A

13. Calculate the formula weight of Calcium Chloride. Given that Ca = 40.1 amu, Cl = 35.5 amu
A. 111.1 g
B. 75.5 amu
C. 111.1 amu
D. 75.5 g
ANSWER C

14. Calculate the molecular weight of atoms in ethane. Given that C= 12, H= 1
A. 40 amu
B. 30 amu
C. 20 amu
D. 10 amu
ANSWER B

15. Determine the percentage of carbon in ethane. Given that C= 12, H=1
A. 90%
B. 80%
C. 70%
D. 60%
ANSWER B

16. How many mole(s) of ^{12}C has a mass of 12 g.
A. 1
B. 2
C. 3
D. 4
ANSWER A

17. The compound *para*-aminobenzoic acid (you may have seen it listed as PABA on your bottle of sunscreen) is composed of carbon (61.31%), hydrogen (5.14%), nitrogen (10.21%), and oxygen (23.33%). Find the empirical formula of PABA.
A. $C_8H_7NO_2$
B. C_7H_7NO
C. $C_7H_7NO_2$
D. $C_7H_{13}NO_2$
ANSWER C

18. Balance the equation below
$C_3H_5(NO_3)_3 \rightarrow N_{2(g)} + O_{2(g)} + CO_{2(g)} + H_2O_{(l)}$
What is the sum of all the coefficients in the balanced equation?
A. 33
B. 32

C. 22
D. 23

ANSWER A

19. Which of the statements below best describes boiling?
    A. Evaporation takes place only at the surface of a gas while boiling takes place inside the body of a liquid
    B. Evaporation takes place only at the surface of a liquid or solid while boiling takes place throughout the body of a liquid
    C. Boiling takes place only at the surface of a liquid or solid while evaporation takes place inside the body of a liquid
    D. Boiling takes place only at the surface of a liquid or solid while evaporation takes place throughout the body of a liquid

    ANSWER B
20. Which of the following is false about boiling?
    A. During boiling, particles have high kinetic energy
    B. During boiling particles escape and become vapor
    C. During boiling, particles move faster
    D. During boiling, particles move linearly.

    ANSWER D
21. Which of the following statements is not correct?
    A. Melting Point-Temperature is when solid turns to a liquid
    B. Freezing Point-Temperature is when liquid turns to a solid
    C. Boling Point-Temperature is when a liquid turns to a vapor
    D. Condensing Point-Temperature when vapor turns to solid

    ANSWER D
22. Identify the wrong statement
    A. Freezing of water means changing from a liquid to a solid
    B. Melting and freezing of water occur at different temperature
    C. Liquefaction of water means turning a gas to a liquid
    D. Melting of water means changing from solid to liquid

    ANSWER B
23. What is the limiting reactant if 20.0 moles of O_2 react with 30.0 moles of H_2 according to the following reaction?

    $2\ H_2 + O_2 \rightarrow 2\ H_2O$

    A. H_2
    B. O_2
    C. Both A and (B)
    D. H_2O

    ANSWER A

24. An unused flashbulb contains magnesium and oxygen. After use, the contents are changed to magnesium oxide but the total mass does not change. This observation can best be explained by the
    A. Law of Constant Composition.
    B. Law of Multiple Proportions.
    C. Avogadro's Law.
    D. Law of Conservation of Mass.
    ANSWER D
25. Analysis of a sample of a covalent compound showed that it contained 14.4 % hydrogen and 85.6 % carbon by mass. What is the empirical formula for the compound?
    A. CH
    B. CH_2
    C. CH_3
    D. C_2H_3
    ANSWER B
26. The limiting reagent in a chemical reaction is one that:
    A. has the largest molar mass (formula weight).
    B. has the smallest molar mass (formula weight).
    C. has the smallest coefficient.
    D. is consumed completely.
    ANSWER D
27. The main points of the Dalton's atomic theory are listed below except;
    A. All matter is composed of tiny particles called atom
    B. The atoms of an element are different, particularly in their masses, atoms of different elements have different masses.
    C. Chemical reaction occurs by the combination of whole, but not fractional atoms, i.e. atoms are indivisible.
    D. When atoms combine with other atoms, they do so in small whole number ratios.
    ANSWER B
28. An atom is made up of sub-particles, namely:
    A. protons, neutrons and electrons
    B. positrons, neutrons and electrons
    C. protons, neurons and electrons
    D. protons, neutrons and electrons
    ANSWER A
29. Magnesium is in group 2 in the periodic table. Which of the following formulas for magnesium compounds is correct?
    A. MgO_2
    B. MgS_2
    C. MgF_2
    D. Mg_2O
    ANSWER C

30. An atom of sodium has an atomic number of 11 and a mass number of 23. Which of the following statements is correct?
    A. An atom of sodium has 11 protons, 11 electrons, and 11 neutrons
    B. An atom of sodium has 11 protons, 12 electrons, and 11 neutrons.
    C. An atom of sodium has 11 protons, 11 electrons, and 12 neutrons.
    D. An atom of sodium has 11 protons, 12 electrons, and 12 neutrons.
    ANSWER C
31. Determine the number of protons and neutrons in the isotope Fe-58.
    A. 26 protons and 58 neutrons
    B. 32 protons and 26 neutrons
    C. 26 protons and 32 neutrons
    D. 58 protons and 58 neutrons
    ANSWER C
32. An isotope of an element contains 82 protons and 122 neutrons. What is the symbol for the isotope?
    A.
    B.
    C.
    D.
    ANSWER A
33. Which of the following has a positive charge?
    A. Proton
    B. Neutron
    C. Anion
    D. Electron
    ANSWER A
34. A compound is 52.14% C, 13.13% H, and 34.73% O by mass. What is the empirical formula of the compound?
    A. $C_2H_8O_3$
    B. C_2H_6O
    C. C_4HO_3
    D. $C_4H_8O_4$
    ANSWER B
35. What are the correct coefficients (reading from left to right) when the chemical equation is balance?
    $\_PCl_3(l) + \_H_2O(l) \rightarrow \_H_3PO_3(aq) + \_HCl(aq)$
    A. 1,3,1,3
    B. 1,2,1,1
    C. 1,3,2,1
    D. 3,6,1,9
    ANSWER A
36. What is the formula for manganese(IV) oxide?
    A. Mn_4O

B. MnO_4
C. Mn_2O
D. MnO_2
ANSWER D

37. Who coined the word ‘atom’?
A. Democritus
B. Thomson
C. E Rutherford
D. John Dalton
ANSWER A

38. Who was the first to propose Atomic Theory?
A. J.J Thompson
B. Rutherford
C. John Dalton
D. Neil Bohr
ANSWER C

39. Which of the following represents a precipitation reaction?
A. $H_2SO_4 + NaCl \rightarrow NaHSO_4 + HCl$
B. $Fe + H_2SO_4 \rightarrow FeSO_4 + H_2$
C. $4HCl + MnO_2 \rightarrow MnCl_2 + 2H_2O + Cl_2$
D. $Na_2SO_4 + Pb(NO_3)_2 \rightarrow PbSO_4 + 2NaNO_3$
ANSWER D

40. Sulfur and fluorine react to form sulfur hexafluoride:
$S(s) + 3F_2(g) \rightarrow SF_6(g)$
If 50.0 g S is allowed to react as completely as possible with 105.0 g F_2, what mass of the excess reactant is left?
A. 20.5 g S
B. 45.7 g F_2
C. 15.0 g S
D. 36.3 g F_2
ANSWER A

41. What is the percentage of oxygen in $Al_2(SO_4)_3$?
A. 57.8%
B. 56.1%
C. 53.1%
D. 52.6%
ANSWER B

42. True or false: precipitation reactions are ionic reactions.
A. True
B. False
C. Neither true nor false
D. None of the above
ANSWER A

43. What precipitate will form when silver nitrate reacts with sodium chloride?
    A. Silver chloride
    B. Silver nitrite
    C. Both a & b
    D. None of the above
    ANSWER A
44. Which of the following reactions is a precipitation reaction?
    A. $CaCl_2$ (aq) + K_2CO_3 (aq) → 2KCl (aq) + $CaCO_3$ (s)
    B. 2NaBr (aq) + Cl_2 (g) → 2NaCl (aq) + Br_2 (l)
    C. Cl_2 (aq) + $2I^-$ (aaq) → I_2 (aq) + $2Cl^-$ (aq)
    D. None of the above
    ANSWER A
45. What is a coefficient?
    A. A whole number that appears in front of a compound or element in a balanced chemical equation
    B. A whole number that appears as a subscript in front of a formula in a balanced chemical equation
    C. A whole number that appears as a subscript at the end of a formula in a balanced chemical equation
    D. A whole number that appears as a superscript at the end of a formula in a balanced chemical equation.
    ANSWER A
46. Choose the correctly balanced equation for the following reaction:
    Sodium + water → sodium hydroxide + hydrogen gas
    A. $Na_2O + H_2O \rightarrow NaOH + H$
    B. $2Na + 2H_2O \rightarrow 2NaOH + H_2$
    C. $Na + H_2O \rightarrow NaOH + H_2$
    D. $Na_2 + H_2O \rightarrow NaOH + H$
    ANSWER B
47. How many grams of iron (III) chloride will be formed upon the complete reaction of 28.0 grams of chlorine gas with excess iron?
    A. 162.2 g/mol
    B. 0.263 mol
    C. 42.7 g
    D. 0.395 mol
    ANSWER C
48. We can calculate the limiting reagent in a reaction by many factors, but which of the factors cannot help to determine the limiting reactant:
    A. Number of moles
    B. Mass given
    C. Volume given
    D. Pressure given
    ANSWER D

49. What is a limiting reactant?
    A. The reactant that is used up first and prevents more products from being made.
    B. The reactant that makes the product.
    C. The reactant that is used up last and prevents more products from being made.
    D. The substance that is in excess that doesn't get used up as a reactant.
    ANSWER A
50. If you have an actual yield of 29.3 g of product and the theoretical yield is 35.0 g, what is your percent yield?
    A. 62.5%
    B. 44.6 g
    C. 83.7%
    D. 83.7g
    ANSWER C

51. An element is a substance:
(A) that is the smallest unit of matter that retains all of the chemical properties
(B) that can only be studied systematically
(C) that contains an electron and a neutron
(D) that consists of proton, neutron and electron
Answer A

52. All the following except one is true about Mendeleef's periodic table
(A) He arranged all elements according to their number of atoms
(B) The anomalous position of Hydrogen
(C) He could not account for isotopes
(D) It was arranged based on Mendeleef's periodic law
Answer A

53. The electronic configuration of Si is:
(A) $1S^2, 2S^5, 2P^5$
(B) $1S^2, 2S^2, 2P^6, 3S^2, 3P^2$
(C) $1S^2, 2S^2, 2P^6, 3S^2$
(D) $1S^2, 2S^2, 2P^6, 3S^2, 3P^1$
Answer B

54. The modern periodic law states that
(A) The chemical and physical properties of elements are a periodic function
(B) Metals are capable of releasing electrons
(C) The properties of elements are a periodic function of their atomic numbers
(D) Atomic masses are responsible for isotopic behaviours
Answer C

55. The modern periodic table consists of:
(a) S & P block elements
(b) D & F block Elements
(c) Six periods in all
(d) Options (a) and (b)
Answer D

56. The electronic configuration of Nitrogen (N) is:
(A) 2, 8, 1
(B) $1S^2$, $2S^2$, $2P^3$
(C) 2, 8, 8
(D) $1S^2$, $2S^2$
Answer C

57. How many groups are on the periodic table?
(a) 7
(b) 10
(c) 18
(d) 8
Answer C

58. The symbol for Argon and its electronic configuration are:
(A) A; $1S^2$, $2S^5$, $2P^5$
(B) Ar; $1S^2$, $2S^2$, $2P^6$, $3S^2$, $3P^6$
(C) An; $1S^2$, $2S^5$, $2P^6$
(D) Ag; $1S^2$, $2S^2$, $2P^6$, $3S^2$, $3P^2$
Answer B

59. The nucleus of an atom
(A) consists of the only significant part of it
(B) It is the vital part that partakes in chemical reactions
(C) It determines the charge of an ion
(D) None of the above
Answer D

60. An hydrogen bond can be formed between hydrogen and
(A) Oxygen
(B) Nitrogen
(C) Fluorine
(D) All of the above
Answer D

61. Given the electronegativity value of Hydrogen as 2.20 and that of Fluorine as 3.98. Calculate the electronegativity difference, hence predict the type of bond they can exhibit.
(A) 1.63; Electrovalent bond
(B) 1.78; Covalent bond
(C) 1.80; Hydrogen bond
(D) None of the above
Answer B

62. Periodicity
(A) deals with the comparison of the various periods of elements
(B) deals with the regular patterns the chemical and physical properties of elements present.
(C) aids the studies of properties of elements on the periodic table
(D) Options (B) and (C)
Answer D

63. Atomic radius
(A) is half the distance between the nuclei of two covalently bonded atoms
(B) is used to measure the atom
(C) involves only the atoms
(D) none of the above
Answer A

64. Atomic radius decreases across the periods
(A) True
(B) False
(C) True or the first two periods
(D) None of the above
Answer A

65. The most electronegative element on the periodic table is
(A) Carbon
(B) Chlorine
(C) Fluorine
(D) Bromine
Answer C

66. Electronegativity decreases across the periods from left to right
(A) False
(B) True
(C) True for the first period
(D) None of the above

Answer A

67. Atomic radius increases down the groups
(A) True for only S block elements
(B) True
(C) False
(D) True for P bock elements
Answer B

68. Answer True or False: The size of Na^+ ion is bigger than that of Na atom
(A) False
(B) True
(C) No answer
(D) The size of Na^+ ion is smaller than that of Na atom
Answer A

69. Answer True or False: The size of Cl^- ion is smaller than the size of Br^- ion
(A) False
(B) True
(C) No answer
(D) The size of Cl^- ion is bigger than that of Br^- atom
Answer B

70. Na, Mg, Si belong to the same
(A) Group IA elements
(B) S block elements
(C) No answer
(D) Period 3
Answer D

71. The type of bond that exists within a molecule of NaCl is
(A) Coordinate bond
(B) Hydrogen bond
(C) Covalent bond
(D) Electrovalent bond
Answer D

72. Mendeleef Periodic law states that
(A) The properties of elements are a periodic function of their atomic numbers
(B) The chemical properties of elements are a periodic function of their constituents
(C) The properties of elements are a periodic function of their atomic weights
(D) All of the above
Answer C

73. Noble gases are
(A) Group 7 elements
(B) Group VIII A elements
(C) Group III B elements
(D) Group II A elements
Answer B

74. Which group of elements are called the salt formers?
(A) Group VI A
(B) Group V A
(C) Group IV B
(D) All of the above
Answer A

75. Transition metals belong to
(A) Groups I – IIA
(B) Groups IIIA – VIIIA
(C) Groups IIIB – IIB
(D) Groups IA – VIIA
Answer C

76. Which of the following element attains the dublet state on its outermost shell
(A) Fluorine
(B) Hydrogen
(C) Argon
(D) Calcium
Answer B

77. The S orbital has the shape called
(A) Spherical
(B) Dumb bell
(C) Shapeless
(D) None of the above
Answer A

78. F block elements are
(A) 4F and 5F block elements
(B) Inner-transition elements
(C) Rare earth elements
(D) All block elements
Answer D

79. D block elements are

(A) Transition metals
(B) Elements that contain partially or completely filled d-orbitals
(C) also in the middle of the periodic table
(D) All of the above
Answer D

80. Main group elements belong to
(A) S block
(B) P block
(C) S & P block
(D) D block
Answer C

81. All the following are types of atomic orbitals except
(A) S orbital
(B) P orbital
(C) F orbital
(D) None of the above
Answer D

82. How many electrons can the S-orbital maximally contain?
(A) 2
(B) 4
(C) 8
(D) None of the above
Answer 2

83. Lanthanides belong to
(A) Inner transition metals
(B) Group IA
(C) D block elements
(D) Options (A) and (C)
Answer D

84. What is the symbol for lithium and its electronic configuration?
(A) L; 2, 2
(B) Li; $1S^2$, $2S^1$
(C) Lithium; $1S^2$, $2S^2$
(D) None of the above
Answer B

85. Using the electronegativity value of 2.20 for Hydrogen and 3.16 for Chlorine, the predicted type of bond in HCl is

(A) Hydrogen bond
(B) Ionic bond
(C) Covalent bond
(D) Van der Waal's forces
Answer C

86. The Modern Periodic Law and Table was got by
(A) Mendeleef and Bohr
(B) Mosley and Bohr
(C) Mendeleef and Mosley
(D) Mosley and Hund
Answer B

87. Anomalies of the Modern Periodic Law includes
(A) Inability to account for isotopes
(B) Four anomalous pairs of elements
(C) Inability to properly account for coinage metals
(D) None of the above
Answer D

88. The representative elements of the periodic table belongs to
(A) Groups IA – VIIA
(B) Transition metals
(C) Groups IA – IIA
(D) Groups IIA- VIA
Answer A

88. Group VIIA elements are also
(A) Halogens
(B) Salt formers
(C) slightly reactive
(D) Options (A) and (B)

90. Which of the following is correct about coinage metals?
(A) They are used to make metal bars
(B) Examples are copper, silver and zinc
(C) These are gold, copper and zinc
(D) No answer
Answer D

91. An orbital is
(A) the position around the nucleus of an atom

(B) the nucleus of an atom
(C) the position in space with the highest probability of finding an electron
(D) the position within the nucleus of an atom where reactions often occur
Answer C

92. The following except one is a condition for a covalent bond to occur
(A) None of the following options
(B) Each of the bonding pair of electrons is donated by each of the atoms
(C) There must be sharing of electrons
(D) There must be a maximum overlap of atomic orbitals
Answer A

93. Which of the following elements has the smallest atomic radius: Li, Na, K?
(A) they are all equal in size
(B) Li
(C) Na
(D) K
Answer A

94. Arrange the following elements in the increasing order of their first Ionization Energy:
Na, Mg, Al, Si, P, S
(A) S ‹ P ‹ Si ‹ Al ‹ Mg ‹ Na
(B) Na › Mg › Al › Si › P › S
(C) Na ‹ Mg ‹ Al ‹ Si ‹ P ‹ S
(D) No answer
Answer C

94. Arrange the following elements in the decreasing order of electronegativity:
Na, Mg, Al, Si, P, S, Cl
(A) Cl › S › P › Si › Al › Mg › Na
(B) Na › Mg › Al › Si › P › S
(C) Na ‹ Mg ‹ Al ‹ Si ‹ P ‹ S
(D) No answer
Answer A

95. A molecule of oxygen gas is normally written as
(A) O
(B) O_2
(C) O_3
(D) $[O\text{-}O\text{-}O\text{-}O]_n$
Answer B

96. Which of the following elements will possess the third Ionization Energy:

Na, Mg, Al, Si, P, S
(A) Na
(B) Mg
(C) Al
(D) Si
Answer C

97. Arrange the following elements in the decreasing order of their Ionic radius:
Na, Mg, Al
(A) Al › Mg › Na
(B) Na › Mg › Al
(C) Na ‹ Mg ‹ Al
(D) No answer
Answer B

98. Arrange the following elements in the decreasing order of their Ionic radius:
Mg, Ca, Sr
(A) Sr › Ca › Mg
(B) Mg › Ca › Sr
(C) Sr ‹ Ca ‹ Mg
(D) No answer
Answer A

99. Which group of elements are called the Alkali metals?
(A) S block elements
(B) P block elements
(C) Group IIA
(D) Group IA
Answer D

100. A group on the periodic table is also
(A) a family
(B) a vertical arrangement of elements
(C) an arrangement based on the outermost number of electrons
(D) All of the above
Answer D

101. A period on the modern periodic table is also
(A) a row
(B) an horizontal arrangement of elements
(C) all the options are correct
(D) an arrangement based on the number of shells the atom of an element contains
Answer C

102. The base in the milk of magnesia is?

A. Magnesium oxide
B. Calcium oxide
C. Magnesium hydroxide
D. Sodium oxide

ANSWER: C

103. Which of the following is an amphiprotic substance?

A. CO_2
B. H_2O
C. H_2SO_4
D. HCl

ANSWER: B

104. Which of the following statements is not true of the strength of an acid or base?

A. The strength of a Bronsted acid depends on its ability to donate a proton.
B. The strength of a Bronsted base depends on its ability to accept electrons.
C. The strength of a Bronsted base depends on its ability to donate electrons.
D. None of the above

ANSWER: C

105. Calculate the K_{sp} of $CaCO_3$ given that it has a solubility of 0.0214 gL^{-1}. [Ca =40.0, C =12.0, O = 16.0]

A. 9.0×10^{-8} mol dm^{-3}
B. 9.0×10^{-8} mol^2 dm^{-6}
C. 3.0×10^{-8} mol dm^{-3}
D. 3.0×10^{-8} mol^2 dm^{-6}

ANSWER: B

106. Which of the following will not have a solubility product constant?

A. AgCl
B. Ag_2CrO_4
C. Na_2SO_4
D. Bi_2S_3

ANSWER: C

107. The Handerson- Hasselbalch equation is given by

A.
B.
C.
D.

ANSWER: C

108. For the reaction of $H_2O(g) \rightleftharpoons H_2(g) + O_2(g)$ the value of K_c is 3.5 x 10^{-4} at 255°C, calculate K_p for the reaction.

A. $3.75x10^{-3}$ B. 2.80×10^{-3} C. 3.50×10^{-3} D. 2.30×10^{-3}

ANSWER: D

109. Which of the following is the condition for K_p to be less than K_c?

A.
B.
C.
D. None of the above

ANSWER: B

110. Find the pH of 0.56 mol dm^{-3} of potassium hydroxide.

A. 13.74

B. 13.86

C. 12.31

D. 13.08

ANSWER: A

111. Calculate the pK_a of an acid whose K_a is 3.25 x 10^{-5}.

A. 5.34

B. 4.49

C. 3.20

D. 2.65

ANSWER: C

112. Consider the reaction

$CH_3COCH_3 + I_2 \longrightarrow CH_3COCH_2I + HI$

Given that the rate law is $R = k[CH_3COCH_3]$ What is the order with respect to CH_3COCH_2I?

A. 0
B. 1
C. 2
D. Not applicable

ANSWER: D

113. Consider the reaction

$2N_2O_{5(g)} \longrightarrow 4NO_{2(g)} + O_{2(g)}$

The rate of reaction is proportional to $[N_2O_5]$. Given that at 70°C, 80 % of the N_2O_5 reacted in 2800 seconds. Determine the value of the rate constant k.

A. $4.82 \times 10^{-5}\ s^{-1}$
B. $7.97 \times 10^{-5}\ s^{-1}$
C. $3.58 \times 10^{-5}\ s^{-1}$
D. $4.82 \times 10^{-4}\ s^{-1}$

ANSWER: B

114. . Which of the following statement is true about a first-order reaction?

A. The half - life of a first order reaction is dependent on the initial concentration of the reactant

B. A first-order reaction is insdependent on the initial concentration of the reactant

C. The rate law for a first-order reaction is R = k[A]

D. The rate determining step is the fastest of the steps in a reaction mechanism

ANSWER: C

115. The strength of a base depends on the

A. Concentration of the H^+ ions in aqueous solution

B. Concentration of the OH^- ions in aqueous solution

C. Concentration of electron pair in aqueous solution

D. Concentration of the base

ANSWER: B

116. What is the unit of a second-order rate constant?

A. $mol^{-1}dm^{3}s^{-1}$

B. $moldm^{-3}s^{-1}$

C. $mol^{-1}dm^{-3}s^{-1}$

D. $moldm^{3}s^{-1}$

ANSWER: A

117. The slowest step in a reaction mechanism is called

A. Equilibrium constant

B. Rate constant

C. Rate determining step

D. Reaction intermediate

ANSWER: C

118. The correct equation for a first order kinetic reaction is given by

A.

B

C.

D.

ANSWER: C

119. The half life of a first order reaction is 550 s. What is the rate constant for the reaction?

A. 0.0693 s^{-1}

B. 2.78 x 10^{-3} s^{-1}

C. 1.26 x 10^{-3} s^{-1}

D. 2.56 x 10^{-3} s^{-1}

ANSWER: C

120. A male athlete in a kinesiology research study has a lung volume of 8.13 L during deep inhalation. At this volume, his lungs contain 0.254 mol of air. During inhalation, his lung volume decreases to 3.15 L. How many moles of gas did the athlete exhale? Assume constant temperature and pressure.

A. 0.00984 mol

B. 0.156 mol

C. 0.254 mol

D. 0.149 mol

ANSWER: B

121. What is the slope and intercept of the graph of a first order reaction in which ln(a-x) is plotted against t?

A. lna k

B. k -lna

C. -k lna

D. k lna

ANSWER: C

122. All the following are the assumptions of molecular kinetic theory except

A. The molecules of a gas within a container are in a constant rapid motion in all possible directions, and they travel in a straight line.

B. Collisions between gas particles and between particles and the container walls are perfectly elastic.

C. There are no forces of attraction or repulsion between gas particles.

D. The average kinetic energy of gas particles is independent upon the temperature of the gas.

ANSWER: D

123. Consider a proposed mechanism

Step 1 $2NO \longrightarrow N_2O_2$ (slow)

Step 2 $N_2O_2 + O_2 \longrightarrow 2NO_2$ (fast)

What is the overall chemical equation?

A. $2NO_2 \longrightarrow N_2O_2$
B. $2NO + O_2 \longrightarrow 2NO_2$
C. $2NO + O_2 \longrightarrow N_2O_2$
D. $2NO \longrightarrow N_2O_2$

ANSWER: B

124. Which three factors affect the rate of a chemical reaction?

A. Temperature, pressure and humidity

B. Temperature, reactant concentration and catalyst

C. Temperature, reactant concentration and volume

D. Temperature, product concentration and container volume

ANSWER: B

125. Which of the following is **not** true of reaction quotient and equilibrium constant?

A. If Q to favour reactants formation in order to reach equilibrium

B. If Q favour of products formation in order to reach equilibrium

C. If Q the chemical reaction will shift to the right to favour products formation in order to reach equilibrium

D.

ANSWER: B

126. How is the rate law determined?

A. By examining the coefficients in the balanced chemical equation

B. From the equilibrium constant
C. From the rates of the forward and reverse reactions of the system at equilibrium
D. By experiment

ANSWER: D

127. Species that are formed in one step of a reaction mechanism and used up in another step are called

A. Catalyst

B. Intermediates

C. Inhibitors

D. Activated complexes

ANSWER: B

128. Which of the following is true in a three - step reaction mechanism?

A. The activation energy of the rate determining step is the smallest.

B. The activation energy of the rate determining step is the highest

C. The activation energy of the fast steps are the smallest

D. The activation energy of the fast steps are the highest

ANSWER: B

129. For a certain reaction, a plot of ln A versus t gives a straight line with a slope of $-1.46s^{-1}$. The order of the reaction in A is

A. 0

B. 3

C. 2

D. 1

ANSWER: D

130. Which of the following will not act as a Bronsted acid?

A. CH_3COO^-

B. NH_4^+

C. HCO_3^-

D. HSO_3^-

ANSWER: A

131. When a small quantity of NaOH is added to a mixture of sodium acetate and acetic acid (equimolar), the pH value _____

A. Increases

B. Decreases

C. Remains the same

D. Increases abruptly

ANSWER: C

132. The ionic product of water will increase if

A. Temperature is reduced

B. Temperature is increased

C. Pressure is decreased

D. Pressure is increased

ANSWER: B

133. What is the value of in the balanced equation in basic medium?

$a\ MnO_4^- + bI^- + c\ H^+ \longrightarrow d\ MnO_2 + e\ I_2 + fOH^-$

A. 14 B. 2 C. 1 D. 8

ANSWER: C

134. An experiment on the rate of decomposition of N_2O_5 was studied at various concentrations

$N_2O_{5(g)} \longrightarrow N_2O_{4(g)} +$

The following data were obtained

Experiment no.	$[N_2O_5]$ moldm^{-3}	Rate of reaction, moldm^{-3}s^{-1}
1	2.40×10^{-3}	4.02×10^{-5}
2	7.20×10^{-3}	1.21×10^{-4}
3	1.44×10^{-2}	2.41×10^{-4}

Determine the rate law for the reaction

A. R =
B. R =
C. R =
D. R =

ANSWER A

135. Consider a mixture of a moles of ethanoic acid and b moles of ethanol in a volume V dm^3. Given that x moles of ethylethanoate be present at temperature T, determine the equilibrium constant with respect to concentration.

$CH_3COOC_2H_{5(l)} + C_2H_5OH_{(l)} \rightleftharpoons CH_3COOC_2H_{5(l)} + H_2O_{(l)}$

A.
B.
C.
D.

ANSWER D

136. Calculate the average kinetic energy of a hydrogen molecule at 5°C. [r = 8.314 J

A. $5.697x10^{-21}$ J
B. 5.759×10^{-21} J
C. 10.234×10^{-21} J
D. 1.2326×10^{-21} J

ANSWER B

137. Consider the equation $CaCO_{3\,(s)} \rightleftharpoons CaO_{(s)} + CO_{2(g)}$

The pressure equilibrium constant for the above reaction is

A. $K_p = \frac{P_{CaO}P_{CO_2}}{P_{CaCO_3}}$

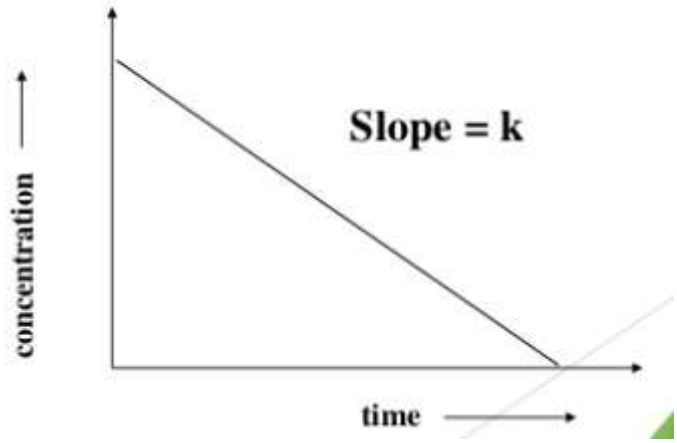
B. $K_P = \frac{P_{CaCO_3}}{P_{CaO}P_{CO_2}}$

C. $K_P = \frac{1}{P_{CO_2}}$

D. $K_P = P_{CO_2}$

ANSWER: D

138. Consider the graph below:



The above graph is for which order of reaction?

A. 0
B. 1
C. 2
D. 3

ANSWER A

139. What is the molecularity of the reaction below?

$2NO_{(g)} + O_{2(g)} \rightarrow 2NO_{2(g)}$

A. Unimolecular
B. Bimolecualar
C. Termolecular
D. None of the above

ANSWER C

140. The formula for calculating the pH of a weak acid is given by

A. pH = p- $\log_{10}$ C

B. pH = p- $\log_{10}$ C

C. pH = p- $\log_{10}$ C

D. pH = p- $\log_{10}$ C

ANSWER D

141. An aqueous solution of $Ba(OH)_2$ has a pH of 8.75 at 26°C . Calculate the original concentration of base in the solution.

A. 5.62×10^{-6}

B. 5.62×10^{-5}

C. 3.45×10^{-4}

D. 1.23

ANSWER A

142. Which of the following is the correct relationship between pK_a and pK_b?

A. p=14

B. p=14

C. p14 =

D ,None of the above

ANSWER B

143. Given that K_b for nitrite ion,NO_2^-, is 9.65×10^{-11}, calculate K_a for the conjugate acid, HNO_2.

A. 4.61×10^{-4}

B. 9.65×10^{-4}

C. 4.67×10^{-4}

D. 1.04×10^{-4}

ANSWER D

144. Which of the following is correct for the solubility product (equilibrium constant) of Bi_2S_3?

A. $K_{sp}=$

B. $K_{sp}=$

C. $K_{sp}= [Bi^{3+}][S^{2-}]$

D. $K_{sp}=$

ANSWER A

145. Which of the following is not an application of solubility product?

A. It is used for the determination of solubilities of sparingly soluble salts.

B. It is used to predict precipitation reaction

C. Preferential precipitation of an insoluble salt

D. Determination of solubilities of soluble salts

ANSWER D

146. Which of the following is not true of a common ion effect?

A. It involves the use of sparingly soluble salt

B. It involves the use of soluble salt having a common ion with the sparingly soluble salt

C. It has no effect on the solubility of sparingly soluble salt

D. It reduces the solubility of sparingly soluble salt

ANSWER C

147. Calculate the equilibrium constant K for a reaction which has -20 kJ at 25°C

A. 1.20×10^3
B. 3.56×10^4
C. 5.30×10^3
D. 3.20×10^3

ANSWER D

148. The factor(s) that affect(s) rate constant is

A. Nature of the surface area

B. Temperature

C. Pressure

D. All of the above

ANSWER B

149. What is the oxidation number of V in ?

A. +2

B. +3

C. +4

D +5

ANSWER D

150. What is the buffer agent in blood?

A. CH_3COOH and CH_3COONa

B. HCO_3^- and CO_3^{2-}

C. HCl and NaCl

D. H_2SO_4 and Na_2SO_4

ANSWER B

151. Which of the following is **not** correct at 25°C?

A. $[H^+][OH^-] = 1.0 \times 10^{-14}$

B. pH + pOH = 14

C. =

D. $= 2.0 \times 10^{-14}$

ANSWER D