	Tanta University **Faculty Of Pharmacy** **Department Of Pharmaceutical Analytical Chemistry**			
	Examination For 1st **Level Pharm D Students**			
	Course Title: **Pharmaceutical Analytical Chemistry I**			Course Code: **PA101**
	Date: **3 / 3 /2021**	Term : **First**	Marks: **50** **Total pages: 10**	Time Allowed: **2** hours

- **Check that your exam booklet consists of (10) pages .**
- **Answers should be written in the given ANSWER SHEET . Answers anywhere else won't be marked.**
- **Appendix is provided at the last page of the exam. It contains a table that is helpful in calcuating pH of solutions.**

Best Wishes

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Choose ONE best answer and mark it in the answer sheet

1. .....was the first person to come up with the idea of atom
   a) Dalton b) Bohr c) Democritus d) Thomson

2. ^{235}U, ^{238}U have different number of protons.
   a) True b) False

3. ..... occupied most of the volume of the atom.
   a) Neutrons b) Electrons c) Protons d) a and c

4. All atoms of a given element are.....in mass and size.
   a) Different b) Identical

5. The method of analysis that is made under the microscope using less than 1mg of sample is called .....
   a) Semi microanalysis. b) Macroanalysis.
   c) Ultra analysis. d) Microanalysis.

6. The postulate that Atoms combine in definite whole number ratios to make compounds is referred to.....
   a) Bohr b) Democritus c) Rutherford d) Dalton

7. According to law of conservation of matter, the matter can be .....in any physical or chemical process.
   a) Transferred b) Destroyed c) Disappeared d) None of them

8. Thomson is credited with discovering .....
   a) Electrons. b) Protons.
   c) Neutrons. d) Electrons and protons.

9. .....discovered the existence of: An atomic Nucleus and Protons.
   a) Rutherford b) Thomson c) Dalton d) Bohr

10. Concerned to Electrons are arranged in circles around the nucleus: all are true EXCEPT.....
    a) Electron can jump from one circle to next. b) Electrons are in constant motion.
    c) Circles have the same energy. d) Electrons cant got to the nucleus.

11. The bigger the electronegativity difference the less polar the bond.
    a) True b) False

12. The type of bond between NH_3 and H^+ to give NH_4^+ is .....
    a) Ionic bond. b) Electrocovalent bond.
    c) Coordinate bond. d) Hydrogen bond.

13. Two nonmetal atoms usually form.....
    a) Covalent bonds. b) Ionic bond c) Hydrogen bond. d) None of them.

14. **The higher boiling point of a carboxylic acid compared with its ester is attributed to.....**
a) Ionic bond. b) Hydrogen bond.
c) Strong covalent bond. d) Coordinate bond.

15. **All are considered as simple ligands EXCEPT.....**
a) NH_3 b) H_2O c) HCl d) SCN^-

16. **The molecular formula of Ferrocyanide complex is.....**
a) $[Fe(CN)_6]^{4-}$ b) $[Fe(CN)_6]^{3-}$ c) $Fe(SCN)^{2+}$ d) None of them.

17. **The primary ionization of phosphoric acid is always lower than the secondary.**
a) True b) False

18. **Gases are written in ionic equation as.....**
a) Molecular form. b) Ionic form
c) Either one. d) Neither one.

19. **All are true concerned to chemical equilibrium EXCEPT.....**
a) It is a state of rest.
b) The rate of forward reaction = the rate of backward reaction.
c) Concentrations of all the reacting substances ceases to change.
d) The reaction doesn't stop.

20. **Equilibrium constant (K) of the reaction changes by.....**
a) Temperature. b) Increasing concentration of reactants.
c) Decreasing concentration of reactants. d) The type of catalyst.

21. **The ionization of ammonia will decrease by addition of.....**
a) NH_4Cl b) HCl c) $(NH_4)_2CO_3$ d) a or c

22. **pOH for a solution with $[H^+] = 10^{-5}$ equals.....**
a) 9 b) 5 c) 10^{-9} d) 10^{-5}

23. **If nitrogen is added to the following reaction, $N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g)$, it will.....**
a) Shift to the left. b) Shift to the right. c) Be unaffected. d) Be stopped.

24. **The Ksp of Ag_2CrO_4 equals .....**
a) $(Ag^+)^2 (CrO_4^{2-})$. b) $(Ag^{2+}) (CrO_4^{2-})$. c) $(Ag^+)^2 / (CrO_4^{2-})$ d) $(Ag^+) (CrO_4^{2-})$

25. **The ionization of H_2S will .....in acidic medium**
a) Increase b) Decrease c) Remains constant d) None of them

26. **Silver ion in this complex $[Ag(NH_3)_2]^+$ is considered as.....**
a) Lewis acid b) Lewis base c) None of them

27. **Nonmetal atoms tend to form negative ions called.....**
a) Cations. b) Anions c) Isotopes. d) Basic radicals

28. **Na^+, K^+ and Ca^{2+} ions are formed by.....**
a) Gain of electrons. b) Loss of electrons
c) Gain of protons. d) Loss of protons.

29. **K_a for a Bronsted acid is inversely proportional to K_b of its conjugate base.**
a) True b) False

30. **The identification of SO_3^{2-} in a sample using Zinc nitroprusside is considered as.....**
a) Qualitative analysis. b) quantitative analysis.
c) Instrumental analysis. d) None of them.

31. **The atomic nucleus contains a mixture of positively charged protons and electrically neutral neutrons EXCEPT in the case of .....**
a) ^{2}H b) ^{1}H c) ^{12}C d) ^{13}C

32. **The number of..... determine the Isotope of the element**
a) Protons b) Neutrons c) Electrons d) None of them

33. **The electrons determine the chemical properties of an element**
a) True b) False

34. **Most of the mass of an atom >99.9 % is concentrated in the nucleus**
a) True b) False

35. **SO_4^{2-} is considered as.....ion**
a) Univalent b) Polyatomic c) Single d) Trivalent

36. **The conjugate base of HPO_4^{2-} is.....**
a) $H_2PO_4^{2-}$ b) H_3PO_4 c) PO_4^{3-} d) None of them

37. **The bond that is produced when one or more electrons are completely transferred from one atom to another atom is called.....**
a) Covalent bond. b) Coordinate bond.
c) Ionic bond. d) Hydrogen bond.

38. **Sodium chloride neither consists of sodium and chlorine atoms nor sodium chloride molecule.**
a) True b) False

39. **In covalent bond, atoms react to form more stable structure through ..... of electrons.**
a) Sharing b) Transferring c) Loss d) None of them

40. **Oxygen molecule is formed by.....**
a) Double covalent bond. b) Polar covalent bond.
c) Single covalent bond. d) Coordinate covalent bond.

41. **Consider the following equilibria, then answer question 41**

I.	$CH_3COOH + OCN^- \rightleftarrows HOCN + CH_3COO^-$	Reactants are favored
II.	$CH_3COOH + ClO^- \rightleftarrows HClO + CH_3COO^-$	Products are favored

In the following reaction, $HOCN + ClO^- \leftrightarrow OCN^- + HClO$ ..... are favored

a) Reactants **b) Products**

42. **Which of the following is correct for water?**

$2H_2O(l)$ +energy $\longleftrightarrow$ $H_3O^+(aq) + OH^-(aq)$

When pure water has a pH of 7.27 , the temperature is.....

a) 25 °C and the solution is basic. b) 50 °C and the solution is basic.

c) 25 °C and the solution is neutral. d) 10 °C and the solution is neutral.

43. **The $[H^+]$ in a solution of pOH 3.00 is.....**

a) 1×10^{-11} M b) 1×10^{-9} M c) 1×10^{-6} M d) 1×10^{-3} M

44. **When 90 mL of water is added to 10 mL of 0.1 M NaOH , the pH .....**

a) Changes to 3. b) Decreased by 1.

c) is unchanged because the number of mole of base has not changed

d) Increased by 1 .

45. **A solution of accurately known concentration is the definition of a**

a) Buffer solution. b) Neutral solution.

c) Standard solution. d) Isotonic solution.

46. **When placed in 1 L of water, which of the following combinations would give a buffer solution? (Remember, in some cases they might react with each other...)**

1) **0.5 mol HClO and 0.5 mol ClONa .** 2) **0.5 mol HCl and 1 mol HCOONa**

3) **0.5 mol HCl and 0.5 mol HCOONa.** 4) **0.5 mol NaOH and 0.5 mol HClO**

N.B (pka of HClO = 7. 54 , pka of HCOOH = 3. 75)

a) 1 only b) 1 and 2 only

c) 1 , 3 and 4 only d) all would give buffer solutions

47. **A chemist needs a solution buffered at pH = 3.0 , which one of the following acids and their sodium salts is the BEST CHOICE to prepare such buffer?**

a) Chloroacetic acid ($pK_a = 2.87$) b) Formic acid ($pK_a = 3.74$)

c) Nitrous acid ($pK_a = 3.34$) d) Hypochlorous acid ($pK_a = 7.46$)

48. **What is the smallest buffer ratio for which the buffer system in question 47 will buffer effectively?**

a) 1/20 b) 1/10 c) 5/2 d) 1/2

49. **The pH of an aqueous solution prepared by diluting 0.20 moles of pyridinium chloride and 0.50 moles of pyridine (C_5H_5N, $K_b = 1.7 \times 10^{-9}$) to a final volume of 500.0 ml is.....**

a) 9.17 b) 8.77 c) 5.63 d) 5.23

50. **What change will be caused by addition of a small amount of HCl to a solution containing fluoride ions and hydrogen fluoride?**

a) The concentration of (H_3O^+) ions will increase significantly.

b) The concentration of fluoride ions will increase as will the concentration of (H_3O^+) ions.

c) The concentration of hydrogen fluoride will decrease and the concentration of fluoride ions will increase.

d) The concentration of fluoride ion will decrease and the concentration of hydrogen fluoride will increase.

51. **When choosing a color indicator for an acid base titration, the pK_a of the indicator should match.....**

a) The pK_b of the analyte. b) The pH half way to equivalent point.

c) The pK_a of the analyte. d) The pH at equivalent point.

52. **Mixing of Thymol blue with Cresol red in a ratio of (6 : 1) is an example of ..... indicator in order to.....**

a) Mixed indicator / change color over narrow pH range.

b) Mixed indicator / sharpen the color change.

c) Screened indicator / change color over narrow pH range.

d) Screened indicator / sharpen the color change.

53. **A student combines 24 mL of a 2.5 M $Ca(OH)_2$ solution with 40 mL of a 3.0 M HBr solution. If phenolpthalein (pka= 9.4) is added as an indicator, what color will be?**

a) Colorless b) Pink

54. **ZnO can be determined by :**

a) Direct titration with NaOH.

b) Direct titration with HCl

c) Back titration by adding known excess of NaOH.

d) Back titration of by adding known excess of HCl.

55. **In the titration of H_3PO_4 with standard NaOH using Phph indicator, the end point represents ....**

a) 1/4 H_3PO_4 b) 1/3 H_3PO_4 c) 2/3 H_3PO_4 d) H_3PO_4

56. **Oxalic acid dihydrate is a pure, stable, crystalline substance. Which of the following describes one of its uses in acid-base titrations?**

a) Buffer b) Primary standard

c) Chemical indicator d) Stoichiometric indicator

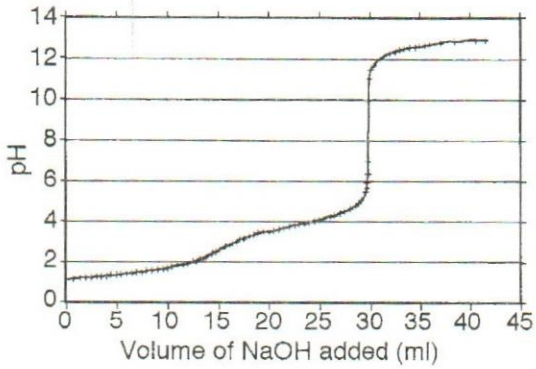
57. **The pH of 0.0200 M solution of methylamine, CH_3NH_2 , (pKb = 3.34) is .....**

a) 11.48 b) 10.56 c) 7.00 d) 2.52

58. **A 0.100 M solution of an unknown weak acid, HX , has a pH of 1.414, The pKa of HX is .....**

a) 1.00 b) 1.414 c) 1.828 d) 2.52

Examine the following titration curve (T.C) that results when 50 mL of DIPROTIC ACID (H_2A) is titrated with 0.1 M NaOH.
Answer questions (59 – 62).



59. **The acid being titrated is .....**

a) Maleic acid (pka_1 =1.91, pka_2 = 6.33).
b) Sulfurous acid (pka_1 =1.77 , pka_2 =7.22).
c) Oxalic acid (pka_1 =1.27, pka_2 = 4.28).
d) H_2SO_4

60. **The volume of NaOH required for complete neutralization of such acid is .....**

a) 5 mL b) 15mL
c) 25mL d) 30 mL

61. **The original conc. of the 50 mL sample is.....M**

a) 0.06M b) 0.03 M
c) 0.015 M d) None of them.

62. **Which of the following indicator is the BEST CHOICE for this titration?**

a) Methyl Red (pKa = 5.2) b) Thymol Blue (pKa = 1.6)
c) Phenolphthalein (pKa=9.3) d) Alizarin yellow R (pKa = 11)

63. **A solution of hydrochloric acid (HCl, 25.00 mL) was titrated to the equivalence point with 34.55 mL of 0.1020 M sodium hydroxide. What was the concentration of the hydrochloric acid?**

a) 0.07048 M b) 0.1410 M c) 0.2819 M d) 0.0353 M

64. **H_3BO_3 (Ka = 10 x 10^{-10}) can be titrated directly with NaOH**

a) True . b) False

65. **A mixture of NaOH and Na_2CO_3 required 25 mL of 0.1 M HCl using phenolphthalein as the indicator. However, the same amount of the mixture required 30 mL of 0.1 M HCl when methyl orange was used as the indicator. The volume of HCl ≡ to Na_2CO_3 in the mixture was:**

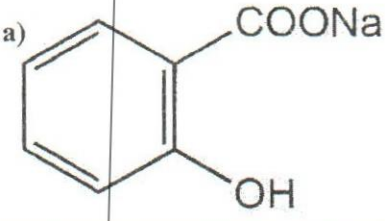
a) 30 mL b) 20 mL c) 10 mL d) 5 mL.

66. **pH of pure water is 7. When a substance Y is dissolved in water, the pH becomes 10.5 . The substance Y is a salt of.....**

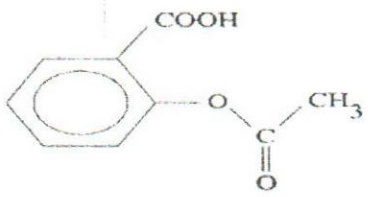
a) weak acid and weak base
b) strong acid and strong base
c) strong acid and weak base
d) weak acid and strong base

Consider the following compounds, then answer questions (67-69)

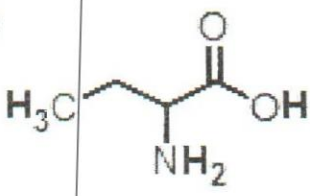
a)



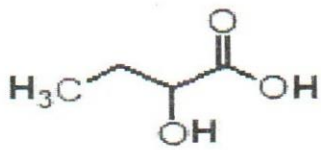
b)



c)



d)



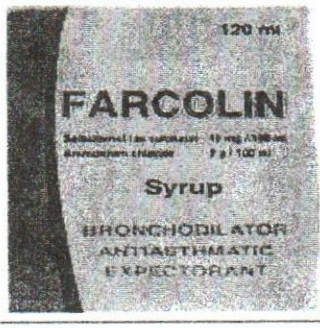
67. **The compound that can be determined by Biphasic titration is ……..**

68. **The compound that can be determined by formol titration is ……..**

69. **The compound that can be determined by residual acid base titration by adding excess NaOH and the excess unreacted NaOH is titrated with standard HCl is ……..**

Consider the pharmaceutical preparation on the right, then answer question 70

Farcolin® syrup contains Ammonium chloride 1g/100 mL and Salbutamol as sulfate 40mg/100mL



70. **Ammonium Chloride content can be determined by…….. ……which involve addition of ……**

a) Residual titration / HCl
b) Formol titration / Glycerol
c) Formol titration / Neutral formalin
d) Biphasic titration /Ether

71. **All of the following are the requirements for the solvent used in non-aqueous titration EXCEPT ……**

a) Availability
b) Low dielectric constant
c) Miscibility with both titrant and solute.
d) Low toxicity.

72. **..... is an example of Aprotic solvents.**

a) Acetic acid (glacial) b) Ethanol c) Pyridine d) CCl_4

73. **..... is an example of protophilic solvents.**

a) Acetic acid (glacial) b) Ethanol c) Pyridine d) Ethanol

A sample containing TWO Acids was dissolved in a non-aqueous solvent and titrated with sodium methoxide ($NaOCH_3$) . pH values were recorded and the titration curve was drawn. Answer questions (74 – 75)

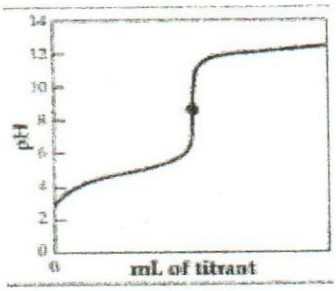
74. **The sample was dissolved in .....solvent.**

a) Levelling b) differentiating

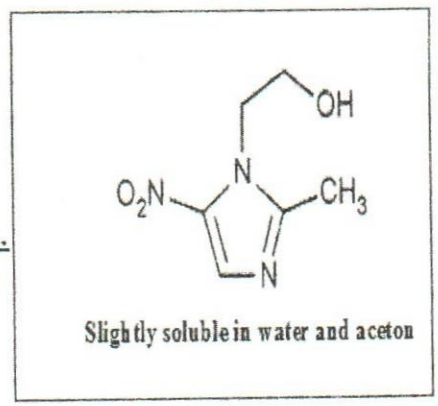
75. **The solvent may be .....**

a) Benzene b) Ethanol

c) Acetic acid (glacial) d) DMF



The following figure shows the chemical structure of Metronidazole Which is an antibiotic and antiprotozoal medication Answer questions (76 - 77)



76. **The best solvent used for this compound is.....**

a) Acetic acid (gl.) b) 1 M HCl

c) Ethanol d) Pyridine

77. **The best titrant for determination of this drug is ..... WHILE the indicator used for detection of end point is .. ..**

a) Sodium methoxide / Crystal violet.

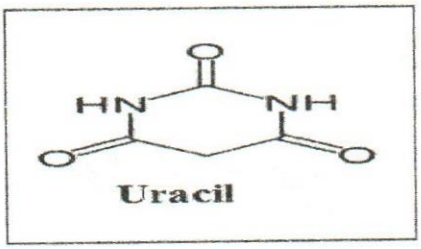
b) Acetous perchloric / Oracet blue B .

c) Sodium methoxide / Thymol blue.

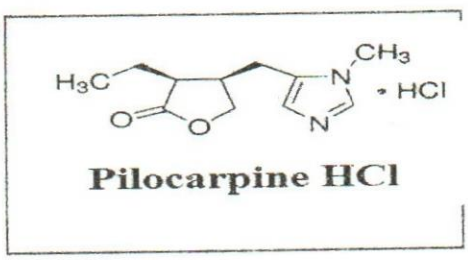
d) Acetous perchloric / Azo violet..

Consider the following compounds, then answer question 78

a)



b)



78. **The compound that can be determined by Non-aqueous acid base titration using acetous perchloric acid as a titrant after addition of $(CH_3COO)_2Hg$ is .....**

79. **We have a sample that contains a mixture of $HClO_4$, HCl, CH_3COOH, Phenol and Salicylic acid.**
By using data in the following table; the most suitable solvent that can be used for determination of this mixture is .....

a) MIBK b) Ethanol c) Acetic acid d) Water .

Solvent	pK_{auto}
Water	14
Acetic acid	14.5
Ethanol	19
MIBK	25.7

80. **The pH of a 0.1 M solution of the following salts increases in the order**

a) NaCl < NH4Cl < NaCN < HCl
b) HCl < NH4Cl < NaCl < NaCN
c) NH4Cl < NaCl < NaCN < HCl
d) HCl < NaCl < NaCN < NH4Cl

Appendix

Equations used for calculating pH of different solutions.

SA	$pH = -\log f \times C_a$
SB	$POH = -\log f \times C_b \rightarrow pH = 14 - pOH$
WA	$pH = \frac{1}{2}(pK_a + pC_a)$
WB	$pH = pK_w - \frac{1}{2}(pK_b + pC_b)$
S(SA-SB)	$pH = pOH = 7$
S(SB-WA)	$pH = \frac{1}{2}(pK_w + pK_a - pC_s)$
S(SA-WB)	$pH = \frac{1}{2}(pK_w - pK_b + pC_s)$
S(WA-WB)	$pH = \frac{1}{2}(pK_w + pK_a - pK_b)$