	<b>Tanta University</b> <b>Faculty Of Pharmacy</b> <b>Department Of Pharmaceutical Analytical Chemistry</b>		
	Examination For 1 <sup>st</sup> Level Pharm D (Clinical Pharmacy) Students		
	Course Title: <b>Pharmaceutical Analytical Chemistry I</b>		Course Code: <b>PA101</b>
	Date: <b>24 / 3 / 2021</b>	Term : <b>First</b>	Marks: <b>50</b> Total pages: <b>10</b>

- 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 calculating pH of solutions.

*Best Wishes*

*Prof. Dr. Sherin F. Hammad*

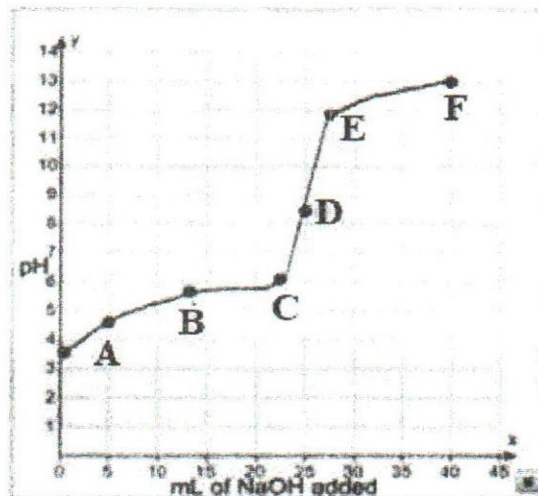
*Assistant prof. Dr. Mohamed A. Abdel Hamid*



9. What is the smallest buffer ratio for which the buffer system in question 8 will buffer effectively?  
 a) 1/10                                      b) 1/20                                      c) 1/50                                      d) 1/2
10. The pH of an aqueous solution prepared by diluting 0.50 moles of pyridinium chloride and 0.20 moles of pyridine ( $C_5H_5N$ ,  $K_b = 1.7 \times 10^{-9}$ ) to a final volume of 500.0 ml is.....  
 a) 8.77                                      b) 5.63                                      c) 5.23                                      d) 4.83
11. What change will be caused by addition of a small amount of NaOH to a solution containing fluoride ions and hydrogen fluoride?  
 a) The concentration of ( $H_3O^+$ ) ions will decrease 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.
12. When choosing a color indicator for an acid base titration, the  $pK_a$  of the indicator should be close to or match .....  
 a) The  $pK_a$  of the analyte.                                      b) The pH half way to equivalent point.  
 c) The pH at equivalent point.                                      d) The  $pK_b$  of the analyte.
13. Mixing of thymol blue and Cresol red in a ratio of (3 : 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.
14. A student combines 24 mL of a 2.5 M  $H_2SO_4$  solution with 19 mL of a 3.2 M KOH solution. If phenolphthalein ( $pK_a = 9.4$ ) is added as an indicator, what color will be?  
 a) Colorless                                      b) Pink
15.  $NH_3$  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.
16. In the titration of  $Na_2CO_3$  with standard HCl using Phph indicator, the end point represents .....  
 a)  $1/4 Na_2CO_3$                                       b)  $1/2 Na_2CO_3$                                       c)  $Na_2CO_3$                                       d) None of them
17. Potassium hydrogen phthalate is a pure, stable, crystalline substance. Which of the following describes one of its uses in acid-base titrations?  
 a) Buffer                                      b) Chemical indicator  
 c) Primary standard                                      d) Stoichiometric indicator

18. The pH of 0.117 M solution of propanoic acid, (pKa = 4.87) is .....  
 a) 4.87                      b) 2.9                      c) 2.00                      d) 0.93
19. A 0.05 M solution of an unknown weak base, B, has a pH of 10.98. The pK<sub>b</sub> of B is .....  
 a) 4.74                      b) 5.20                      c) 8.80                      d) 9.26

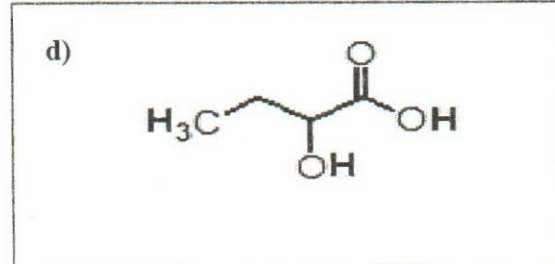
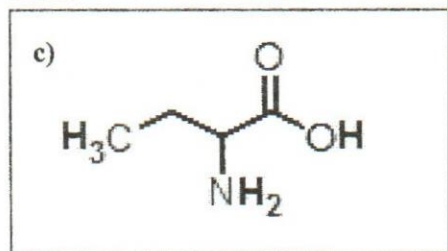
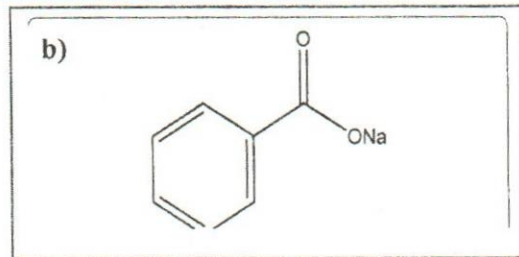
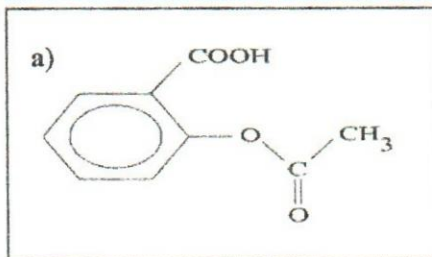
Examine the following titration curve (T.C) that results when weak 100 ml monoprotic acid HA is titrated with 0.10M NaOH, then answer questions (20- 24)



20. What part of the curve corresponds to the maximum buffer action of the HA /A<sup>-</sup> ion pair?  
 a) Point A  
 b) Point B.  
 c) Point D.  
 d) All along the section CE.
21. The volume of 0.10 M NaOH required for complete neutralization of such acid is .....  
 a) 5 mL                      b) 15mL  
 c) 25mL                      d) 30 mL
22. The original conc. of such acid is.....M  
 a) 0.10 M                      b) 0.05 M  
 c) 0.03 M                      d) 0.025 M.
23. 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)
24. HA is the dominant form of such weak acid at .....  
 a) Point A                      b) Point B                      c) Point C                      d) Point D.
25. 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
26. H<sub>3</sub>BO<sub>3</sub> ( K<sub>a</sub> = 10 x 10<sup>-10</sup>) can be titrated directly with NaOH  
 a) True                      b) False

27. A mixture of NaOH and Na<sub>2</sub>CO<sub>3</sub> 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  $\equiv$  to NaOH in the mixture was:
- a) 5 mL                      b) 10 mL                      c) 20 mL                      d) 30 mL.
28. pH of pure water is 7. When a substance Y is dissolved in water, the pH becomes 5.10, the substance Y is a salt of.....
- a) Strong acid and weak base                      b) Strong acid and strong base  
c) Weak acid and weak base                      d) Weak acid and strong base

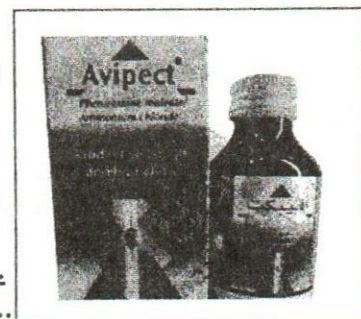
Consider the following compounds, then answer questions (29-31)



29. The compound that can be determined by Biphasic titration is .....
30. The compound that can be determined by formol titration is .....
31. 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 32

**Avipect<sup>®</sup> syrup**, each 5 ml (1 teaspoonful) syrup contains:  
Pheniramine maleate 15 mg + Ammonium chloride 125 mg



32. Ammonium Chloride content can be determined by..... which involve addition of .....
- a) Residual titration / HCl  
b) Formol titration / Neutral formalin  
c) Formol titration / Glycerol                      d) Biphasic titration / Ether

33. 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.

34. ..... is an example of Aprotic solvents.

- a) Acetic acid (glacial)      b) Ethanol      c) Benzene      d) DMF

35. ..... is an example of protophilic solvents.

- a) Acetic acid (glacial)      b) Ethanol      c) Benzene      d) DMF

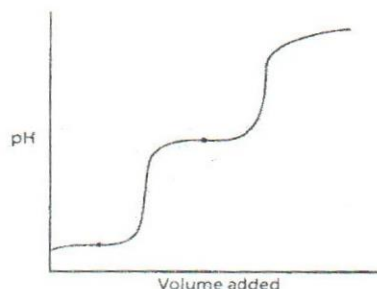
A sample containing TWO Acids was dissolved in a non-aqueous solvent and titrated with sodium methoxide (NaOCH<sub>3</sub>). pH values were recorded and the titration curve was drawn. Answer questions (36 – 37)

36. The sample was dissolved in .....solvent.

- a) Levelling      b) Differentiating

37. The solvent may be .....

- a) Benzene      b) Ethanol  
 c) Acetic acid ( glacial)      d) DMF



The following figure shows the chemical structure of Lidocaine

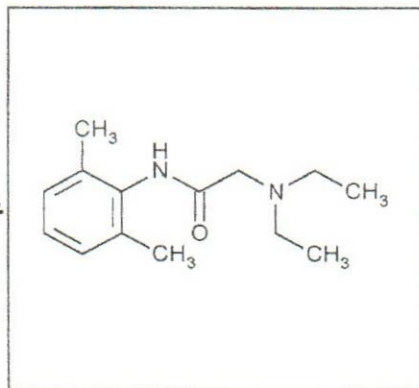
Which is a local anesthetic. Answer questions (38 - 39 )

38. The best solvent used for this compound is.....

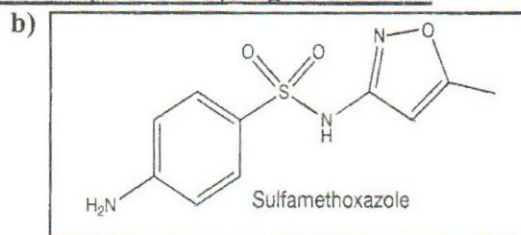
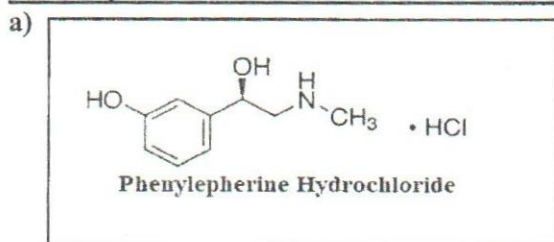
- a) Acetic acid (gl.)      b) 1 M HCl  
 c) Ethanol      d) Pyridine

39. 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.



40. The compound that can be determined by Non-aqueous acid base titration using acetous perchloric acid as a titrant after addition of (CH<sub>3</sub>COO)<sub>2</sub> Hg is .....









68. Both  $\text{Ca}^{2+}$  and  $\text{Mg}^{2+}$  can be determined in their mixture by.....  
 a) Direct titration with EDTA at pH 10.                      b) Direct titration with EDTA at pH 3  
 c) Direct titration with EDTA at pH 12.                      d) None of them.
69. To determine  $\text{Ca}^{2+}$  only in this mixture we should add .....  
 a) NaOH using Murexide indicator.                      b) HCl using Murexide indicator  
 c)  $\text{HNO}_3$  using Eriochrome black T.                      d) None of them.
70. It is possible to prevent the interference of  $\text{Cr}^{3+}$  in EDTA titration by addition of .....  
 a) Ascorbic acid                      b) Hydrogen peroxide                      c) triethanolamine                      d) None of them
71.  $\text{Hg}^{2+}$  can be masked by.....  
 a) Triethanolamine                      b) Iodide                      c) Fluoride                      d) Phosphate
72. The stability of complex increases by.....  
 a) Decreasing ionic radius of the metal.                      b) Increasing ionic radius of the anion.  
 c) Both of them.                      d) None of them
73. On titration of mixture of  $\text{Cr}^{3+}$  &  $\text{Fe}^{3+}$  by EDTA at pH 1 using suitable indicator; the volume of EDTA is equivalent to.....  
 a)  $\text{Fe}^{3+}$  &  $\text{Cr}^{3+}$                       b)  $\text{Fe}^{3+}$                       c)  $\text{Cr}^{3+}$                       d) None of them
74. On titration of another aliquot of the previous mixture with EDTA after addition of alkaline peroxides followed by adjusting pH 1 ; the volume of EDTA is equivalent to...  
 a)  $\text{Cr}^{3+}$                       b)  $\text{Fe}^{3+}$  &  $\text{Cr}^{3+}$                       c)  $\text{Fe}^{3+}$                       d) None of them
75. The stability of complex increases by decreasing the charge of the metal ion  
 a) True                      b) False
76. On titration of mixture of  $\text{Bi}^{3+}$  &  $\text{Fe}^{3+}$  with EDTA after addition of ascorbic acid and adjust the pH 1 , volume of EDTA consumed is equivalent to.....  
 a)  $\text{Bi}^{3+}$                       b)  $\text{Fe}^{3+}$                       c)  $\text{Fe}^{3+}$  &  $\text{Bi}^{3+}$                       d)  $\text{Fe}^{2+}$
77. In substitution titration involving EDTA; the metal to be replaced is usually.....  
 a)  $\text{Ca}^{2+}$                       b)  $\text{Al}^{3+}$                       c)  $\text{Mn}^{2+}$                       d)  $\text{Mg}^{2+}$
78. The selection in the previous point is due to.....  
 a) Its stability constant with EDTA is the smallest.                      b) Its rate of reaction with EDTA is low.  
 c) It has high affinity to EDTA.                      d) It does not give sharp end point.
79. Demasking of  $\text{Zn}(\text{CN})_4^{-2}$  can be carried out using.....  
 a) Acetaldehyde and sulfuric acid.                      b) Formaldehyde in alkaline medium  
 c) Formaldehyde in acetic acid.                      d) All of them
80. EDTA can be used for indirect determination of halides and phosphates  
 a) True                      b) False

*Good luck!*

## Appendix

Equations used for calculating pH of different solutions.

SA	$\text{pH} = -\log f \times C_a$
SB	$\text{POH} = -\log f \times C_b \Rightarrow \text{pH} = 14 - \text{pOH}$
WA	$\text{pH} = \frac{1}{2} (\text{pK}_a + \text{pC}_a)$
WB	$\text{pH} = \text{pK}_w - \frac{1}{2} (\text{pK}_b + \text{pC}_b)$
S(SA-SB)	$\text{pH} = \text{pOH} = 7$
S(SB-WA)	$\text{pH} = \frac{1}{2} (\text{pK}_w + \text{pK}_a - \text{pC}_a)$
S(SA-WB)	$\text{pH} = \frac{1}{2} (\text{pK}_w - \text{pK}_b + \text{pC}_b)$
S(WA-WB)	$\text{pH} = \frac{1}{2} (\text{pK}_w + \text{pK}_a - \text{pK}_b)$