بسم الله الرحمن الرحيم

Quantitative analytical chemistry
Final exam WS/2012-2013

College of Pharmacy
Time: 2 hr

Name:----------

الرجاء كتابة الاسم رباعيا بالعربية

[I] MCQ-part: Calculations are sometimes asked. **(50 P)**

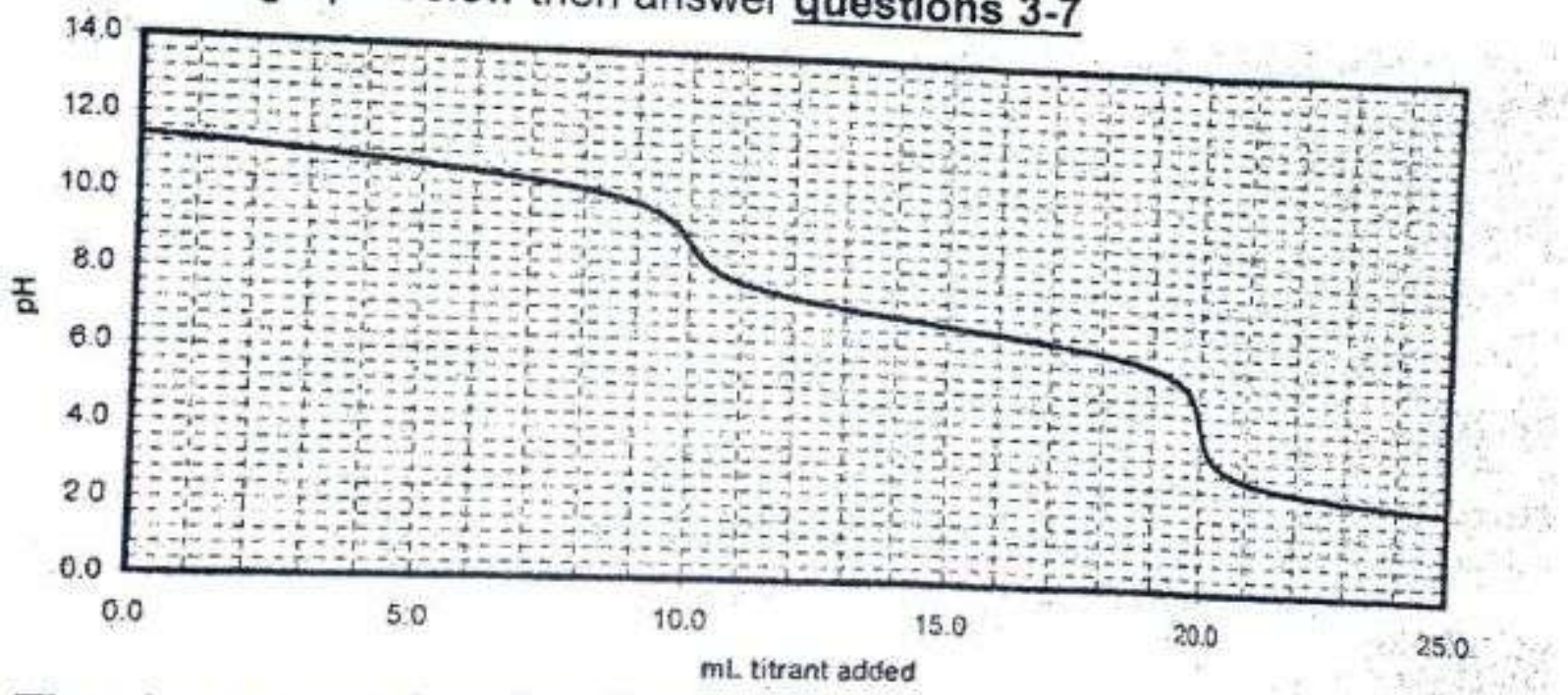
1. What is the ratio of [A-]/ [HA] in a buffer solution of pH 9 if the pKa of HA 7?

a. 0.1
b. 0.01
c. 10
d. 100

2. When choosing a color indicator for acid base titration, pka of indicator should match:

a. the pka of analyte
b. the pH at the equivalence point
c. the pkb of analyte
d. the pH half way to the equivalence point

Refer to the graph below then answer **questions 3-7**



3. The above curve describes titration of:

a. a diprotic acid
b. a monoprotic base
c. a diprotic base
d. a monoprotic acid

4. if the volume was 100 ml before titration begin and the titrant was 0.1 M strong acid or base then the concentration of analyte in original solution is:

a. 1.0 M **b.** 0.1 M **c.** 0.01 M **d.** 0.001 M

5. Explain calculation in question 4:

6. At the first equivalence point in the above titration curve the pH can be determined by assuming:

a. a weak acid in the solution
b. a buffer of HA^- and A^{-2}
c. solution of the intermediate form HA^-
d. a weak base in solution

7. If 25 ml titrant were added in the above titration curve then the pH can be calculated by assuming:

a. excess of strong acid added to solution
b. a buffer of HA^- and A^{-2}
c. a weak acid in the solution
d. a salt of weak base

8. What is pH of 0.163 M benzoic acid, if pKa benzoic acid 4.202:

a. 4.3 **b.** 2.5 **c.** 6.8 **d.** 5.7

9. if sulfide (AW= 32.06) in 100 ml sample was precipitated as CdS (FW= 144.47), which weighed 0.034 g.The concentration of sulfide in ppm is:

a. 75 ppm **b.** 230 ppm **c.** 158 ppm **d.** 300 ppm

10. Explain calculation of question 9:

11. If PbI_2 (FW= 461) solubility at a certain temperature 0.7 g per liter, then the molar solubility:

a. $1.518*10^{-3}$ M
b. $3.215*10^{-4}$ M
c. $1.672*10^{-9}$ M
d. $6.467*10^{-2}$ M

12. The reaction forms a galvanic cell. Which statement is true?

$$Zn\ (s) + Cu^{2+}\ (aq) \longrightarrow Cu\ (s) + Zn^{2+}\ (aq)$$

a. The copper electrode loses mass and the zinc electrode is the cathode
b. The copper electrode gains mass and the copper electrode is the cathode.
c. The zinc electrode gains mass and the zinc electrode is the anode.
d. The zinc electrode loses mass and the zinc electrode is the cathode

13. pAg = 8.11 in a saturated solution of AgCN then Ksp of AgCN:

a. $5.97*10^{-17}$

b. $7.32*10^{-10}$

c. $2.79*10^{-21}$

d. $7.95*10^{-12}$

14. Explain calculation of question 13:

15. Standard electrode potential is:

a. the potential which is developed when a metal is immersed in a solution of its ions, such as Zn in a solution of $ZnSO_4$

b. the absolute electrode potential of metals

c. the potential which is developed when a metal is immersed in a solution of its ions at unity activity measured with respect to SHE

d. none of the above.

16. If 23.48 mL of a NaOH solution are needed to neutralize 0.546 g of KHP (MW=204.2). What is the molarity of NaOH:

a. 0.114 M

b. 0.228 M

c. 0.057 M

d. 0.028 M

17. Explain calculation of question 16:

18. If 16.42 mL of 0.1327 M $KMnO_4$ solution is needed to oxidize 25 mL of $FeSO_4$ in acidic medium. Number of **moles** $FeSO_4$ being oxidised is:

a. $2.18*10^{-2}$ mol
b. $1.09*10^{-2}$ mol
c. $0.545*10^{-2}$ mol
d.$0.272*10^{-2}$ mol

19. Explain calculation of question 18:

20. Which of the following compounds, when added to a solution of ammonium nitrate, will result in the formation of a buffer solution?

a. Ammonia
b. Nitric acid
c. Sodium nitrate
d. Ammonium chloride

21. Which of the following is **not true** about gravimetry:

a. the principal compound for calculation is the precipitating agent
b. during ignition the volatile impurities can be removed
c. urea is used to precipitate Al+3
d. digestion is important for particle size and purity of precipitate

22. Which of the following is **not true** about Volhard method:

a. the method is indirect argenometry
b. the indicator based on formation of color solution [Fe $(SCN)_3(H_2O)_3$]
c. filtration is performed before back-titration in case of chloride analysis
d. The pH is acidic by using HCl

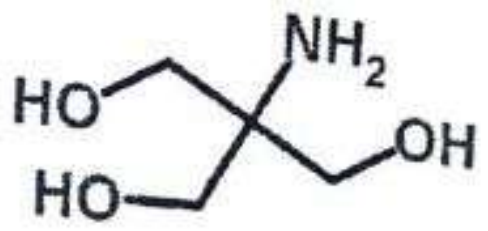
23. Regarding complexometry, which is **not true**:

a. The medium is basic and NaOH is used for this purpose
b. Erichromblack-T can form wein red color due to complexing of analyte
c. cyanide is used to mask copper ion in a sample
d. EDTA is used in form of disodium salt as titrant

24. A reducing agent can:

a. Give oxygen to another substance
b. Decrease the oxidation state of another substance
c. Take hydrogen from another substance
d. Take electrons from another substance

25. How many ml of 0.02 M HCl should be added to 0.231 g tris (MW = 121.14, pKb=5.9) to prepare 0.5 liter buffer has pH=8.1)



Tris

a. 59.2 ml
b. 47.7 ml
c. 34.1 ml
d. 13.5 ml

26. Explain calculation of question 25:

27. If 0.322 g NaOH (MW 40) added to 50 ml 0.161 M HOCl (pKa = 7.5) the resulting pH is:

a. 5.8 **b.** 4.6 **c.** 10.35 **d.** 7.5

28. Explain calculation of question27:

[II] Regarding Redox titration:

a. Explain with equation the problem and how can be solved in titration of nitrite with $KMnO_4$? **(5 p)**

b. A magnesium supplement tablets (MgO) were analyzed as follows: **10 tablets** were pulverized and dissolved in 500 ml volumetric flask. 50 ml aliquot of the solution was treated with an excess of 8-hydroxyquinoline to precipitate magnesium as $Mg(C_9H_6NO)_2$. The precipitate was filtered, washed then redissolved in acid. To the resulting solution15 ml, 0.95 M KBrO3, an excess of KBr were added and allowed to stand for 15 minutes, during which the liberated 8-hydroxyquinoline was brominated. potassium iodide was added in excess, following which the liberated iodine required 5.5 ml, 0.5 M $Na_2S_2O_3$ solution. **(15 P)**

1. **What** is the name of such analysis, **explain** how should end point be detected?

2. **Write** balance chemical equations involved in the process?

3. **Calculate** the weight (mg) of MgO (MW 40.3) per tablet?

[III] Regarding Argenometry:

a. Explain the following about Moher,s Method? (pH and why, indicator, and end point detection)? **(5 P)**

b. A 5.57 g powder contains citalopram hydrobromide **($C_{20}H_{21}FN_2O$). HBr (MW = 405)** was dissolved in water and diluted to 500 ml in a volumetric flask. 35 ml of the solution were transferred in 250 ml volumetric flask and diluted with water. 50 ml of the resulting solution were further diluted to 150 ml. To 70 ml aliquot of the end solution 20 ml, 0.55 M $AgNO_3$ was added. Titration of unreacted Ag^+ consumed 16.8 ml, 0.65 M KSCN. **(10 p)**

1. What is the name of such analysis?

2. Explain with equation how can the end point during titration step be determined?

3. **Calculate** the percent **w/w** of citalopram hydrobromide in powder, **write** balanced equations?

[IV] A 1.022 g calamine powder, which consists of zinc and iron oxides, was dissolved in acid and diluted to 250 ml. Potassium fluoride was added to 10.0 ml aliquot of the diluted solution to mask iron and titration of Zn^{+2} consumed 2.67 ml, 0.13 M EDTA. A second 50.0 ml aliquot was suitably buffered and titrated with 24 ml, 0.03 M $[ZnY]^{-2}$ solution

$$Fe^{+3} + [ZnY]^{-2} \longrightarrow [FeY]^{-} + Zn^{+2}$$

1. What is the condition, that enables the second titration step? **(15P)**

2. Define masking agent, **Mention** another three examples?

3. What is the abbreviation EDTA**? Mention two** advantages of EDTA in complexometry?

4. Calculate the percentages of ZnO (MW 81.4) and Fe_2O_3 (MW 159.7) in the sample?