Question I: (36 Marks)
A- Complete the following: (9 Marks)
1- The main sources of error in titration are
   a- 
   b- 
   c- 

2- Among the requirement of substance to be a primary standard
   a- 
   b- 
   c- 

3- The main drawbacks of Arrhenious theory are
   a- 
   b- 
   c- 

B- By chemical balanced equations, illustrate how can you analyze the following, mention the method, standard(s), indicator(s), conditions and any percussions) (9 Marks)
   a- Mixture of NaOH & Na₂B₄O₇
   
   b- NH₄Cl by formol method.
   
   c- Sodium salicylate

C- Choose the correct statement (5 Marks)
1- AlCl₃ is an acid according to
2-An example of a primary standard substance is
   a- FeSO₄  b- Na₂CO₃
   c- NH₄OH  d- NaOH.

3- In the titration of weak acid with strong base, the shape of the curve, the pH at the equivalence point and the suitable indicator depend on
   a- concentration of weak acid  b- concentration of strong base
   c- Kₐ of weak acid  d- all of the above.

4- Sodium benzoate can be determined by
   a- back titration  b- biphasic titration
   c- displacement titration  d- non aqueous titration.

5- In the determination of aspirin by indirect method, the suitable indicator is
   a- phenolphthalein  b- methyl orange
   c- methyl red  d- bromophenol blue.

6- A normal solution is one which contains
   a- gram molecular weight/L  b- gram equivalence weight/L
   c- gram formula weight/L  d- gram molecular weight/Kg.

7- The scientist who put the equations for buffer solutions
   a- Henderson  b- Ostwald
   c- Sorenson  d- Lewis.

8- In the determination of K₂S₂Os, Ag⁺ is used as
   a- standard  b- indicator
   c- catalyst  d- solvent.

9- Mixture of methyl orange and indigo carmine is used as
   a- screened indicator  b- mixed indicator
   c- universal indicator  d- turbidity indicator.

10- The following are buffer solutions except
    a- CH₃COOH & CH₃COONa  b- HCOOH & HCOONa
    c- NH₄OH & NH₄Cl  d- HCl & NH₄Cl.

D- Define the following (5 Marks)
1- Precision
2- Titration error

3- Buffer capacity

4- Titer

5- Ionization

F- Put the sign (√) for the correct statement and the sign (X) for the incorrect one and then correct it. (5 Marks)

1- FeSO₄ is a primary standard substance. ( )

2- In the determination of CaO by dissolving in sucrose and then titrated with standard HCl, alcohol is added to prevent the formation of lumps. ( )

3- Kjeldahl's method is used for determination of inorganic nitrogen. ( )

4- The pH of solution of CH₃COONa is more than 7. ( )

5- Aspirin can be determined by direct titration with standard NaOH. ( )

G- Calculate the pH of solution obtained by mixing 50 ml 0.1 N HCCOH with 20 ml of 0.15N NaOH (Kₐ of HCOOH = 1.76x10⁻⁵) (3 Marks)

Question II (7 Marks)

1- Mark the following statements with True (√) or False (X) (4 Marks)
(1) Protogenic solvents have levelling effects on weak bases.

(2) Amphoteric solvents are basic and readily donate protons.

(3) Potassium hydrogen phthalate acts as an acid in aqueous solutions and as a base in non-aqueous solvents.

**Question No. III:** (21 marks)

1-Multiple Choice Questions: (14 marks)

1- Ksp of Ag₃PO₄ equals:
   a- [3Ag⁺][PO₄³⁻]  
   b- [Ag⁺][PO₄³⁻]  
   c- [Ag⁺][PO₄³⁻]³  
   d- [3Ag⁺][PO₄³⁻]

2- The turbidity in Leibeg's method is due to formation of:
   a- Ag(CN)  
   b- Ag(CN)₂⁻  
   c- Ag[Ag(CN)₂]  
   d- AgNO₃

3- If we titrate 100 ml, 0.1 M NaCl solution by 0.1 M AgNO₃ then pCl at equivalence point equals: (Ksp= 1.2x10⁻¹⁰):
   a- 3.3  
   b- 4.96  
   c- 7.6  
   d- 7.08

4- In the above problem pCl after addition of 120 AgNO₃:
   a- 7.08  
   b- 7.88  
   c- 4.96  
   d- 3.30

5- Zinc ions could be determined by titration using ferrocyanide and the following external indicator:
   a- Eosin  
   b- Rosebengal  
   c- Diphenylamine  
   d- Urinayl nitrate

6- AgS is soluble in:
   a- NH₃ solution  
   b- CN⁻  
   c- Both a & b  
   d- None of the above

7- The solubility of Ca oxalate increases in:
   a- CaCl₂ solution  
   b- Sod. oxalate solution  
   c- HCl solution

8- As the Ksp decreases, the infection of the titration curve
   a- Increases  
   b- Decreases
c- Not affected
9- If we add a solution of AgNO₃ to a solution of NaI, 0.001 M (Ksp = 1.7x10⁻¹⁶), precipitation of AgI will start when Ag⁺ concentration equals:
a- 1.7x10⁻¹⁶ M  
  b- 1.7x10⁻¹³ M  
  c- 1.7x10⁻¹ M  
  d- less than 1.7x10⁻¹⁶ M

10- Sodium rhodizonate forms a complex with Ba²⁺ has the following color:
a- Yellow  
b- Red  
c- Blue  
d- Colourless
11- AgCl has to be filtered off before titration using:
a- Volhard's method  
b- Mohr's method  
c- Fajan's method  
d- None of the above
12- If we add AgNO₃ solution to AgBr, the solubility of the ppt will:
a- Increase  
b- Decrease  
c- Not changed
13- The adsorption indicator in Fajan's method has to be:
a- Of the same charge as titrant  
b- Of the opposite charge as titrant  
c- Has no charge.
14- Which statement is correct:
a- Ksp of AgCl is more than Ag₂CrO₄  
b- Ksp of AgCl is less than Ag₂CrO₄  
c- Ksp of AgCl is equal that of Ag₂CrO₄

2- Complete the following: (7 marks)
1- The most suitable pH in Mohr's method is-----------------------
2- AgCl is soluble in------------------ and ------------------
3- Ksp of Bi₂S₃ equals-----------------------------
4- For determination of mixture of NaCl and NaCN a combination of------------------ and ------------------ methods is used.
5- The most suitable adsorption indicator for Ag⁺ is------------------
Question No. IV. (21 marks)

In the following Answer sheet, select one letter only indicating the most correct answer for each of the following statements: (12 marks)

<table>
<thead>
<tr>
<th>Statement No.</th>
<th>1</th>
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<th>3</th>
<th>4</th>
<th>5</th>
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1- Gravimetry is:
A. Determination of the specific gravity of the analyte.
B. One of the volumetric methods of analysis.
C. One of the instrumental methods of analysis.
D. A determination method based on weighing.

2- Gravimetry has the following advantages:
A. Sensitivity and selectivity.
B. Occlusion and inclusion.
C. Accuracy and precision.
D. Simplicity and time saving.

3- Peptization is:
A. The coagulation of the precipitate.
B. The transformation of the precipitate into a colloid.
C. The precipitation from homogenous solution.
D. The digestion of the precipitate.

4- According to Von Wiemarn equation the reactants for optimal precipitate formation should be:
A. Hot and concentrated.
B. Hot and dilute.
C. Cold and concentrated.
D. Cold and dilute.

5- Thermogravimetry is:
A. The formation of the precipitate on hot.
B. The removal of water of crystallization by heating.
C. A relation between weight loss of the precipitate and temperature of ignition.
D. Deposition of metal on an electrode after electrochemical analysis.

6- On the gravimetric determination of Ca^{2+}, the most satisfactory form (being nonhygroscopic) to be weighed is:
A. CaCO₃  B. CaO  C. CaC₂O₄·H₂O  D. CaC₂O₄

7. The following is not a form of "co-precipitation":

8- For optimal precipitation process, requirements are:
A. High "relative super saturation".  B. High rate of "nucleation".
C. Formation of large number of fine crystals.  D. Formation of small number of large crystals.

9- During the formation of BaSO₄ crystals! "non-isomorphic inclusion" may be caused by:
A. PbSO₄  B. K₂SO₄  C. Ba(NO₃)₂  D. BaCl

10- The most efficient method for treatment of occlusion is:
A. Washing.  B. Digestion  C. Reprecipitation  D. All are equivalent.
11- On precipitation of Ag+ by NaCl, a slight excess of NaCl is added to:
A- Increase precipitation by common ion effect.
B- Increase solubility of AgCl by common ion effect.
C- Increase precipitation by diverse ion effect.
D- Increase precipitation by complex formation.

12- On the gravimetric determination of Cl- if the weight of AgCl ppt. was 1.433 g. the weight of Cl in the sample will equals to: ..... 
(AgCl molecular weight = 143.3 and Cl = 35.5) 
A. 0.355 g.  B. 3.55 g.  C. 0.1433 g.  D. 143.3/35.5 g.

13- Piperazine as a pharmaceutical compound can be gravimetrically determined after precipitation as:

14- One of the following is not an oxidant for the pretreatment of Fe2+ before its determination as Fe3+.
A. HNO3•  B. H2O2.  C. NH4OH.  D. Br2.

15- AgCl crystals may be washed by dilute : to prevent precipitation:
A. NH4NO3•'  B. HNO3•.  C. A&B are correct  D. A&B are not correct.

16- If the degree of supersaturation is (Q) and the solubility of precipitate is (S); then, according to VonWiemarn equation, the relative supersaturation equals to:
A. (Q-S)/S  B. (S-Q)/Q  C. (S-Q)/S  D. (Q-S)/Q

III. Complete the following table by giving the name and chemical structure of the precipitating agent: (9 marks)

<table>
<thead>
<tr>
<th>Analyte (ion)</th>
<th>Direct precipitating</th>
<th>Homogenous precipitating</th>
<th>Organic precipitating</th>
</tr>
</thead>
<tbody>
<tr>
<td>SO4^{2-}</td>
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<tr>
<td>Fe^{3+}</td>
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<td>Ni^{2+}</td>
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<td>Ba^{2+}</td>
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WITH BEST WISHES