Assiut University

Applied Industrial Chemistry Program
2023-2024 Final Exam
Course Title : Instrumentation &Process Control
Course Code: Eng. 300
Full Mark:50 Marks **Time: 2 H**
Date: 23/5/ 2024

Faculty of Science
Chemistry Department

Answer The Following Questions:

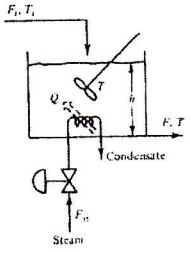
Important Note!! Use net sketches and diagrams to illustrate your answers
إستخدم المخططات والرسومات الواضحه و المنظمه لتوضيح اجاباتك

Question No. 1 (15 Marks) a=6; b=3; c=6.

a. Define the following terminologies and give an example for each: chemical plant, chemical sensor, smart sensor, actuator, and transducer.
b. Compare between open-loop and feedback control systems. State an example for each type.
c. State only without explanation five requirements must be satisfied during the chemical plant operation and explain one of these requirements.

Question No. 2 (15 Marks) 5X3

The operational objectives of the stirred heater tank shown in the Figure are:



1. To keep the Temperature **T** at desired value $\mathbf{T_s}$.
2. To keep the volume of the liquid in the tank at desired value $\mathbf{V_s}$.

Draw the following schemes:

i. Feedback temperature control for stirred tank heater.
ii. Feedforward temperature control for stirred tank heater.
iii. Feedback control of liquid-volume in the stirred tank.
iv. State the types of the sensors used in parts **(i)** and **(iii)**, and explain the operation principles for each sensor.
v. What are the used actuators in stirred tank heater shown in the figure?

Question No. 3 (10 Marks) a=2; b=5; c=3

a. What are the main reasons for the use of control in the chemical industry?
b. What are the types and principles of operations of gas sensors? Explain how to measure the concentration of the following CO_2, and O_2.
c. Explain the operation principles of the material volume flow rate measurement in crushing process in cement industry.

Question No. 4 (10 Marks).

Explain the working principles of the following: **(1)** turbidity process, (2) magnetic flow meter, **(3)** resistive hygrometer and **(4)** radiation pyrometer.

Best Wishes
Dr.-Ing.: Amer Abdelfattah Noureldin

Assiut University
Faculty of Science
Chemistry Department

Final Exam

Chem 334 (Corrosion chemistry) second semester 2023-24 Time: 3 hours

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Answer only five of the following:

Q1 Give (√) for the correct statement and (x) for the wrong one: (10 marks)

1. In the impressed current cathodic protection, the base metal is made as a cathode. ( )
2. Cu, Ni and Ag metals are used as anodic coatings on iron. ( )
3. Anodic protection has wide applications in concentrated H_2SO_4 acid solutions. ( )
4. Phosphate coating is given to the metal surface after finishing. ( )
5. The rust of iron is active and accelerates corrosion by forming more iron oxide. ( )
6. Acetone and xylol are employed as thinners in painting. ( )
7. Cathodic coating is the coating of a metal with a less noble metal. ( )
8. Organic inhibitors are used mainly in boilers and cooling towers. ( )
9. Stainless steel differs from carbon steel by the amount of zinc present. ( )
10. Chromate and nitrite are employed as passivators for iron. ( )

Q2 Select the correct answer: (10 marks)

1. Na_2SiO_3, Na_2CO_3 and Na_3PO_4 are considered as ..... inhibitors.
   A. anodic B. cathodic C. mixed-type D.organic
2. The mechanism which corrosion inhibitors work by is .....
   A. the adsorption on metal surfaces to form protective films.
   B. the combination with corrosion product films to protect metal surfaces.
   C. the formation of precipitates, which visibly coat and protect metal surfaces.
   D. One or more of the previous
3. In the anodic protection method, ... are used.
   A. large anodic and small cathodic areas B. large cathodic and small anodic areas
   C. large anodic and cathodic areas D. small anodic and cathodic areas
4. In the galvanization process, ... coating of iron is used.
   A. aluminum B. lead C. tin D. zinc
5. ..... is an example of cathodic protection of metals.
   A. Galvanization B. Tinning C. Painting D. Annealing
6. Removing the dissolved ..... prevents boiler corrosion.
   A. inhibitors B. organic materials C. CO_2 D. N_2
7. Ferritic stainless steel alloys are hardened by .....
   A. cooling B. heating C. precipitation D. hydrolysis
8. Presence of dissolved ..... causes boiler corrosion.
   A. inorganic salts B. carbonate C. oxygen D. All the previous
9. ..... is Fe-Cr-Ni alloy that is hardened by precipitation process.
   A. Martensitic SS B. Age-hardenable SS C. Austenitic SS D. Duplex SS
10. ..... are used as oxygen scavengers to remove dissolved oxygen.
    A. Na_2SO_3 and hydrazine B. $ZnSO_4$ and $Ca(HCO_3)_2$
    C. Na_2CrO_4 and $NaNO_3$ D. Na_2CO_3 and Na_3PO_4

Q3 Complete the following sentences (10 marks)

1. Some metals form oxide layer protects the metal against the corrosion like, ...
2. A metal with ..... hydrogen overvoltage is more susceptible to corrosion.
3. Increase of temperature increase the ..... of the corrosive medium, thus increase the .....
4. The corrosion rate unit "mpy" means .....
5. For the general engineering work, a high corrosion rate material is more than .....mpy.
6. Dust particles absorb moisture from air due to their ..... nature.
7. Tapped joints, gasket interfaces and bolts in a metallic structure may form ..... corrosion.
8. Use steel materials with less than 0.05% carbon which have sufficient resistance against .....corrosion after welding.
9. The pipe elbows (كوع الانابيب) is usually exposed to ..... corrosion.
10. Corrosion reactions can be considered as electrochemical cells which produce ..... energy.

Q4 a) What are the possible cathodic reactions which might occur during corrosion? (4 marks)

b) Define the bio-corrosion, give an example and explain its mechanisms using the chemical equations. (6 marks)

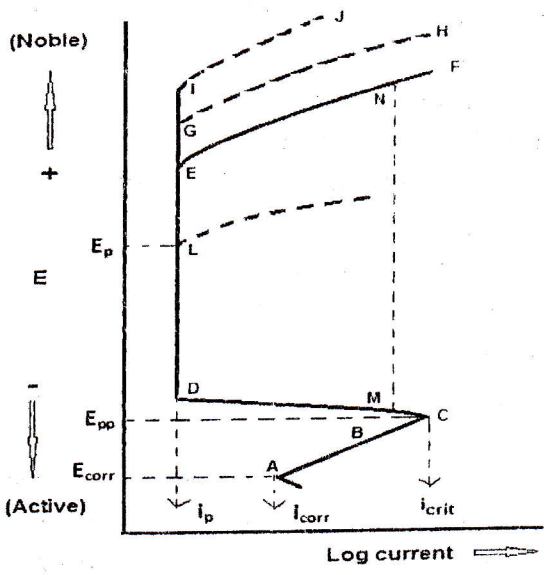
Q5 a) Calculate the cell potential and determine the corrosion behavior of Fe and Zn of this cell at 25°C; Fe/Fe^{2+}// 0.01M NaCl // Zn^{2+}/Zn , where $E°\ (Zn^{2+}/Zn) = 0.763V$, and $E°\ (Fe^{2+}/Fe) = 0.44V$. (4 marks)
($F=96485\ Cmol^{-1}$, $R=8.314 Jmol^{-1}K^{-1}$)

b) Write a short note in only two of the following: (6 marks)

i) Types of metal surface oxide ii) Pourbaix diagram iii) De-alloying

Q6 You are provided with the following anodic polarization curve for an active-passive behavior of a metal; define and explain the following: (10 marks)

a) The points; A, B, C, M, D and L.
b) The lines; A-B, D-E, E-f, G-H, I-J.
c) The characters; i_{corr}, i_{crit}, E_{corr}, E_{pp}, and E_p.



مع أطيب التمنيات

الاستاذ الدكتور/ أبوالحجاج عبدالعزيز هرماس
الاستاذ الدكتور/ أحمد فوزى

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2. A metal with ..... hydrogen overvoltage is more susceptible to corrosion.
3. Increase of temperature increase the ..... of the corrosive medium, thus increase the .....
4. The corrosion rate unit "mpy" means .....
5. For the general engineering work, a high corrosion rate material is more than .....mpy.
6. Dust particles absorb moisture from air due to their ..... nature.
7. Tapped joints, gasket interfaces and bolts in a metallic structure may form ..... corrosion.
8. Use steel materials with less than 0.05% carbon which have sufficient resistance against .....corrosion after welding.
9. The pipe elbows (كوع الانابيب) is usually exposed to ..... corrosion.
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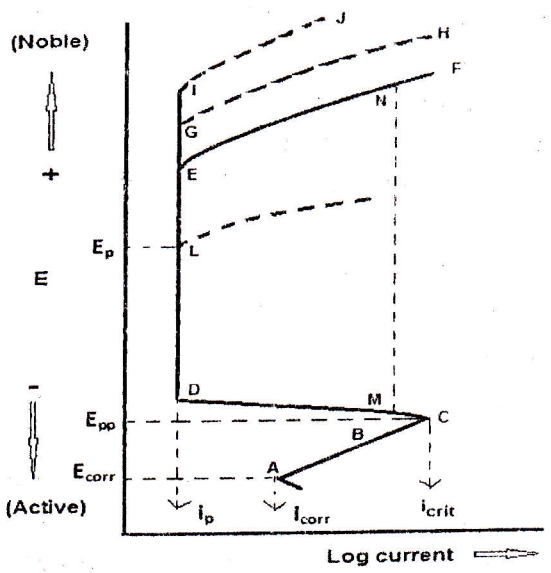

مع أطيب التمنيات

الاستاذ الدكتور/ أبوالحجاج عبدالعزيز هرماس
الاستاذ الدكتور/ أحمد فوزى

Chemistry Department

Faculty of Science

Assiut University

June 2024

Time 2h

Final exam of course 310 C (glass industry) for the third level students of the industrial program.

ملحوظة: الامتحان يقع في ثلاث صفحات

(50 Mark)

1. **Answer FOUR of the following** **(12Marks)**

a)Describe shortly the chemical process used to manufacture toughened glass(tempered glass).

b)Give the constituent oxides, characteristics and two uses of borosilicate glass.

c) Give the importance of Beck lines in the determination of refractive index of different types of glass.

d) Discuss the environmental impact of glass industry regarding CO_2 and SO2.

e) Size (coat) in glass fiber manufacture may contain one or more components". Discuss these components in detail.

2. **Complete the following** **(10 Marks)**

a) Laminated glass is a type of……that holds together when it breaks.

b) Alkali-silicate glass is manufactured from only two components, i.e ……. and ……..

c) Flint glass is a glass containing up to 60% ……

d) Coatings in glass containers industry involve application of a thin layer of……at the hot end while at the cold end a layer of…….is applied.

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e) Fibrization of glass fibers involves a combination of two processes.....and.....

f) Physical definition glass is that it is rigid, ...and.....

3. **Give reasons for the following** **(10 Marks)**

a) Too hot and too long firing of glass causes devitrification.

b) Use of sodium sulphate (salt cake) in glass industry including its contribution in chemical reactions in the tank furnace.

c) Use of waste glass (cullet) as a raw material in glass industry.

d) Addition of arsenic oxide to the glass melt in tank furnace.

e) *Polyester resin is preferred for wetting the chopped strand mat* (CSM).

4. Choose the correct answer (8 Marks)

a) " Spider web" cracking occurs due breaking of
i) tempered glass ii. wired glass iii. laminated glass iv. pyrex glass

b) C-glass is a type of glass that is
i) electrical resistant ii) of high tensile strength
iii) resistant to chemical attack iv) non of them

c) One of the following materials retards devitrification of glass:
i) aluminum oxide ii) sodium sulphate iii) sodium nitrate iv) arsenic oxide

d) Devitrification of glass occurs
i) above 700°C ii) below 700°C iii) at 580°C iv) below 580°C

e)Which of the following raw materials is a major component in glass industry?
i) soda ash ii) alumina iii) borax iv) feldspar.

f) Tubular glass is manufactured by one of the following processes
i) float process ii) rolling process iii) Danner process iv) blowing

g. Sizing in glass fiber manufacturing is used to

i) protect the fibers ii) lubricate the fibers

iii)dictate the extent of intereraction between the fibers and the resins to form the fiberglass. iv)all the above mentioned items.

h. Photochromic glass contains microscopic particles of

i) cobalt halides ii)zinc halides iii)silver halides - iv)barium halides

5. Mark right answer with (√) and the wrong one with(X)

(10 Marks)

a. Neutral glasses are not resistant to chemical attack.
b. Glass fibers are not moisture resistant.
c. Gelcoat used in fiberglass molds gives the mold a shiny appearance.
d. The pot furnace in glass manufacture possesses higher capacity than tank furnaces.
e. Annealing process of glass objects is comes after shaping.
f. Every 10% of cullet (recycled glass) used as a raw material in glass manufacture results in 7% reduction in carbon emission.
g. Bushings in glass fiber furnace is heated and heat should precisely controlled to maintain constant glass viscosity.
h. Thermoplastics can not be remelted back to the liquid state while thermosetting can be.
i. Chopped strand mat consists of glasss fibers that are well organised across each others.
j. Number of glass fibers and type of resin used in fiberglass applications do not affect the strength and durability of fiberglass.

Good Luck

Examinar: Prof. Dr. Aref A. M. Aly

Assiut University

Faculty of Science
Chemistry Department

Final Examination for 3rd (General Division)
Photochemistry and Active Intermediates (313 C)

Date: Sunday, 9/06/2024 **Time: 3 hours**

Answer TEN Only from the following: (50 points)

1) Discuss the storage of Solar Energy in Inorganic Compounds
2) Compare between Phosphorescence and Slow Fluorescence.
3) Explain the difference between Photo- reactions and Thermal reactions.
4) Compare between the properties of Excited state and Ground state.
5) What differences are between Luminescence and Slow Fluorescence.
6) Describe briefly the physical fate of Photoexcited molecules.
7) Explain briefly the photosensitization process on the light of the photodimerization of 1,3-butadiene.
8) Compare between the electronic configuration of singlet and triplet carbenes.
9) Methyl carbocation is less stable than tert-butyl carbocation. Explain this statement.
10) A carbon radical has seven electrons in its valence shell, while carbocation has only six. (Explain this statement).
11) The trifluromethyl and cyclopropyl radicals are σ radicals, while the ethyl and cyclohexyl radicals are π radicals. (Explain this statement).

Good Luck

Examiner:

Prof. Dr. Kamal Ibrahim Aly

Assiut University
Faculty of Science
Chemistry Department

Final Exam

Chem 302(Corrosion Prevention Tech.) Second semester 2023-24 Time: 2 hours

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Answer only four of the following questions:

Q1 Give (√) for the correct statement and (x) for the wrong one: (10 marks)

1. In cathodic protection method, the base metal is made as a cathode. ( )
2. Sn, Ni and Ag metals are used as anodic coatings on iron. ( )
3. The limiting anodic dissolution current of the anodic polarization behavior is the critical current, $i_{crit.}$ ( )
4. Phosphate coating is given to the metal surface after finishing. ( )
5. The thermodynamic provides kinetic information of a metal corrosion in a given environment. ( )
6. If two metals are connected in aqueous solution, the more electropositive metal will corroded. ( )
7. Cathodic coating is the coating of a metal with a less noble metal. ( )
8. Organic inhibitors are used mainly in boilers and cooling towers. ( )
9. Stainless steel differs from carbon steel by the amount of zinc present. ( )
10. Chromate and nitrite are employed as passivators for iron. ( )

Q2 Select the correct answer: (10 marks)

1. Na_2SiO_3, Na_2CO_3 and Na_3PO_4 are considered as ..... inhibitors.
   A. anodic B. cathodic C. mixed-type D. non
2. The mechanism which corrosion inhibitors work by is .....
   A. adsorption on metal surfaces to form protective films.
   B. combination with corrosion product films to protect metal surfaces.
   C. formation of precipitates, which visibly coat and protect metal surfaces.
   D. One or more of these
3. In the anodic protection method, ... are used.
   A. large anodic and small cathodic areas B. large cathodic and small anodic areas
   C. large anodic and cathodic areas D. small anodic and cathodic areas
4. In the galvanization process, ... coating of iron is used.
   A. aluminum B. lead C. tin D. zinc
5. ..... is an example of cathodic protection of metals.
   A. Galvanization B. Tinning C. Painting D. Annealing
6. Removing the dissolved ..... from the aqueous solution prevents the metal corrosion.
   A. H_2 B. organic materials C. O_2 D. N_2
7. The preferred material selection for nitric acid storage tank is .....
   A. tin B. polymer C. stainless steel D. Cu alloy
8. For cathodic protection of a steel tank which metal is used as sacrificial anode?
   A. Cu B. Ni C. C D. Mg
9. ..... is/or are types of stainless steels.
   A. Martensitic B. Ferritic C. Austenitic D. All of these
10. ..... are used as oxygen scavengers to remove dissolved oxygen.
    A. Na_2SO_3 and hydrazine B. $ZnSO_4$ and $Ca(HCO_3)_2$
    C. Na_2CrO_4 and $NaNO_3$ D. Na_2CO_3 and Na_3PO_4

أنظر بالخلف

Q3 Complete the following sentences **(10 marks)**

1. Some metals form oxide layer protects the metal against the corrosion like, ...
2. A metal with ..... hydrogen overvoltage is more susceptible to corrosion.
3. Increase of temperature increase the ..... of the corrosive medium, thus increase the .....
4. The corrosion rate unit "mpy" means .....
5. For the general engineering work, a high corrosion rate material is more than .....mpy.
6. Dust particles absorb moisture from air due to their ..... nature.
7. Tapped joints, gasket interfaces and bolts in a metallic structure may form ..... corrosion.
8. Use steel materials with less than 0.05% carbon which have sufficient resistance against .....corrosion after welding.
9. The pipe elbows (كوع الانابيب) is usually exposed to ..... corrosion.
10. Corrosion reactions can be considered as electrochemical cells which produce ..... energy.

Q4 a) What are the possible cathodic reactions which might occur during corrosion? **(4 marks)**

b) Define the bio-corrosion, give an example and explain by chemical equations its mechanisms. **(6 marks)**

Q5 a) Calculate the cell potential and determine the corrosion behavior of Fe and Zn of this cell at 25°C; Fe/Fe^{2+}// 0.01M NaCl // Zn^{2+}/Zn , where $E°\ (Zn^{2+}/Zn) = 0.763V$, and $E°\ (Fe^{2+}/Fe) = 0.44V$. **(4 marks)**

($F=96485\ Cmol^{-1}$, $R=8.314 Jmol^{-1}K^{-1}$)

b) Write a short note in only two of the following: **(6 marks)**

i) Types of inhibitors **ii) Pourbaix diagram** **iii) De-alloying**

مع أطيب التمنيات

الاستاذ الدكتور/ أبوالحجاج عبدالعزيز هرماس

امتحان طلاب المستوى الثالث (كيمياء وجيولوجيا)

مقرر (٣٤٥ ج) مبادئ الجيولوجيا التركيبية

الزمن : ٢ ساعة

٢٨ مايو ٢٠٢٤م

PRINCIPALS OF STRUCTURAL GEOLOGY

(50 marks)

Try to illustrate your answers with suitable drawings when possible

i. Write short notes on TWO ONLY: *(14marks)*

1. What is the difference between fault and unconformity and how do you differentiate in field and geological map?
2. Describe the factors, that affect the mechanical behavior of rocks
3. Define stress strain diagram with the explanation of type of deformation.

II- Choose the correct answer for the following statements and Then rewrite in your answer paper *(15 marks)*

4. **When the rocks cool, the resulting hexagonal shape of its contraction is called a**
   a. Mud cracks.
   b. Columnar joints.
   c. Dykes
   d. Faults
   e. Unconformity.
5. **An igneous intrusion that cuts across rock layers is called a**
   a. Batholith.
   b. Sill.
   c. Dike.
   d. Laccoliths
   e. Phacoliths
6. **A surface of erosion between younger and older beds that are parallel with one another is known as**
   a. Unconformity.
   b. Non-conformity.
   c. Stratification.
   d. Disconformity.
   e. Cross bedding.
7. **Compressional stress can result in the formation of**
   a. Thrust faults
   b. Horsts and grabens
   c. Reverse faults
   d. Rift valleys
   e. Both a. and c.

8. **Once the elastic limit of rock is surpassed**
   a. The rock may deform
   b. All of these
   c. Deformation becomes permanent
   d. Only a. and c.
   e. An earthquake may occur

9. **If erosion stripped the top off a basin, one would find**
   a. The oldest rocks were exposed at the center.
   b. The youngest rocks were exposed at the center.
   c. A circular or elliptical pattern of outcropping rock layers.
   d. Both a. and c.
   e. both b. and c.

10. **Elastic deformation is:**
   a. Permanent
   b. becomes permanent if the elastic limit is surpassed
   c. answers a and b
   d. not permanent
   e. Both b and d

11. **Which of the following combinations should favor faulting rather than folding?**
   a. High temperature and low confining pressure
   b. Low confining pressure and low temperature
   c. High confining pressure and low temperature
   d. High temperature and high confining pressure

12. **Folds that appear to be "S" or "Z" shaped are called:**
   a. Synclines
   b. anticlines
   c. monoclines
   d. domes
   e. basins

13. **Dip and strike measurements are used to describe the attitudes and orientation of**
   a. bedding planes.
   b. Joints planes.
   c. Faults planes.
   d. planar surfaces in metamorphic rocks.
   e. all of the above

III- True or False? Circle the correct answer

(3 marks)

14. Vertical faults have a footwall in downthrow side and hanging wall in upthrow side.
True or False?

15. Non-tectonic structures mean deformation of rock by external factors not coming from the deep ground.
True or False?

16. In a Paraconformity the planes above and below the gap are parallel and there is no evidence of erosion.
True or False?

IV. Match each type of fold with its description *(8 marks)*

Fold type	Description
1. Asymmetrical fold.	A. Axis of fold dipping at an angle.
2. Non-plunging fold.	B. Both limbs horizontal with one up-side down.
3. Overturned fold.	C. Limbs with equal dip and both right-side up.
4. Plunging fold.	D. Elongate with layers bent upward in the middle.
5. Recumbent fold.	E. Circular with layers bent downward in the middle.
6. Symmetrical fold.	F. Limbs with unequal dip and both right-side up.
7. Basin.	G. One limb up-side down but at an angle.
8. Anticline.	H. Axis of fold horizontal

V. FILL-INS *(4 marks)*

17. When a rock is **unable** to return to its original shape after it has been deformed, it is said to have experienced..... deformation, a type of response to stress.

18. When a rock breaks after it has been deformed, it is said to have experienced ..... deformation, a type of response to stress.

19. An .....-slip fault is one in which the rock on either side of the fault moves horizontally **and** vertically.

20. A .....-slip fault is one in which the rock on either side of the fault moves vertically.

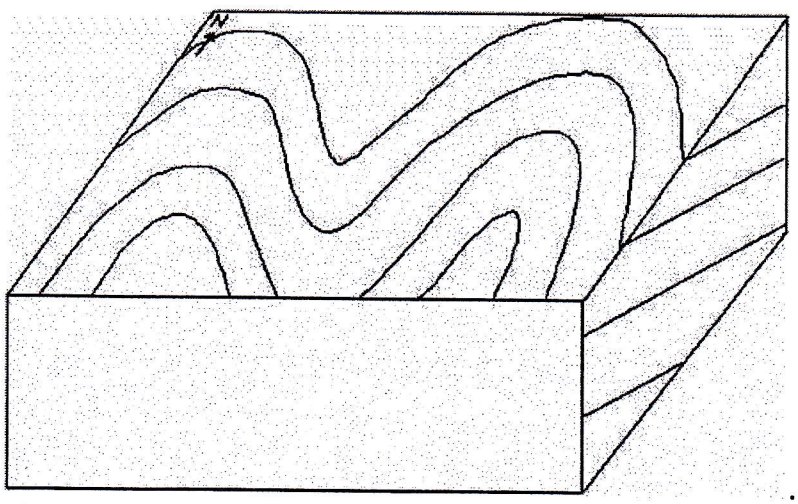
VI. 21. Complete the block (below). *(6marks)*

22. Number the beds from oldest to youngest (**1 being Oldest**).

23. Indicate the axial plane and fold axis with appropriate symbols in the map view and cross-section face of the block.

24. Draw strike and symbols on the map view.

25. What is the name of this structure?



GOOD LUCK

Prof. Dr. Ahmed R. El Younsy *28/5/2024*

الامتحان فى ثلاث صفحات

Assiut University **Date: 28-5-2024**

Faculty of Science **Time: 3h**

Chemistry Department

Final Fertilizer Industry Chemistry Examination
(Chem300)Third Year Industrial Students.

Answer the following questions:(50 M)

Question No.1(10M)

1)Write four methods for determination of reactivity of rock phosphate.(2.5M)

2) Explain the Heber –Bosh method for production of ammonia NH_3 .(7.5M)

Question No.2(10M)

1) Choose the correct answer:(2.5M)

a) The emission of sulfur dioxide gas according to the Egyptian Environmental Law 2015 equal (1500-800-450) mg/m^3 in production of H_2SO_4 acid by contact process.

b) The emission of fluorine gas according to the Egyptian Environmental Law 2015 equal (15-5-20) mg/m^3 in production of SSP .

2) Explain how sulfuric acid is produced by contact prosess and write the equation of the reaction.(7.5M)

Question No.3(10M)

1)Write the structure of pure fluorapatite .(2.5)

2)There are two methods for production of phosphoric acid explain one

of these methods with equation. (7.5M)

Question No.4(10M)

1) Write the equation for production of these fertilizers:

Di-ammonium phosphate(DAP)-Mono-ammonium phosphate(MAP)-Single superphosphate(SSP)-Potassium sulfate - Ammonium sulfate (AS)-Ammonium Nitrite (AN).(7.5M)انظر خلفه

2)Write the conditions Process operating variables in urea production.(2.5M)

Question No.5 (10M)

1) What is the purpose of Primary and Secondary reforming for ammonia production. (2.5M)

2) What is the advantage of direct granulation of TSP. (2.5M)

3) Write the basic chemical reaction involved in production of triple superphosphate(TSP). (2.5M)

4) Write the reaction mechanism of $V_2 0_5$ catalyst using in production of H_2SO_4 by contact process. (2.5M)

Good luck Dr. Atef .H. Ali

Assiut university May, 2024

Faculty of Science Time: 3h

Chemistry Department

Final exam of "Inorganic chemistry III" course code 324C for the third level students

ملحوظة: الامتحان يقع في اربع صفحات

Section I (16 Marks)

Answer the following

A. Complete FOUR of the following (4 Marks)

i. .....is used instead of $LnCl_3$ to prepare metals of heavier lanthanides using calcium at 1400°C.

ii. Breaking of bonds by emitted particles in a sample of a radioactive actinide element is equivalent to a process of.....

iii. Among the actinide elements .....is the only element that forms stable +2 oxidation state.

iv. $Ln(OH)_3$ is .....basic than $Al(OH)_3$ which is.....

v. Very pure thorium can be obtained by thermal decomposition of.....

B. Give reason for the following (4 Marks)

i. La, Gd and Lu form only stable +3 oxidation state.

ii For lanthanide elements, the heavier metals are less reactive than the lighter ones.

iii. AcX_3 hydrolyses with water vapour at 100°C to give AcOX while La hydrolyses to La_2O_3.

iv. $Sc(acac)_3$ (acac = acetylacetonate)can be sublimed without decomposition.

C. Mark the correct sentence with ✓ and the false one with ✗ (5 Marks)

i. Owing to the lanthanide contraction the basic character of the hydroxides decreases with increasing atomic number due to the

decreased covalent character between the ions of the lanthanides and the hydroxides.

ii. Sulphates of lanthanides are less soluble in cold water than in hot water.

iii. Due to the high binding energy of the 5f orbital actinides show higher oxidation states such as +5, +6 and +7.

iv. Actinide compounds are more basic than lanthanide ones.

v. The chemistry of lanthanides is predominantly covalent.

D. Choose the correct answer A, B, C or D (3 Marks)

1. Solution chemistry of uranium is complex due to:

   i) presence of four oxidation states
   ii) complex reactions with anions in solution
   iii) formation of polymeric species only
   iv) all the three reasons.

2. Among the quadrivalent lanthanides, it was found that one of the following quadrivalent lanthanide ions is sufficiently stable in solution as well as in solid state:

   i. Ce(IV) ii. Pr (IV) iii. Tb(IV) iv. Dy (IV).

3. Yttrium from transition group III has a similar +3 ion with both atomic and ionic radii values that are closely related to those of:

   i) Gd and Tb ii) Sm and Eu iii) Tb and Dy iv) Dy and Ho

.....

Section II (17 Marks)

Answer <u>five only</u> from the following: (10 Marks)

1-Define antibonding ; bonding; nonbonding ;HOMO and LUMO on the octahedral MO theory diagram.

2- Discuss the difference in the energy(LFSE) of the high and low spin of Fe^{+2} complexes.

3-Discuss and draw diagram octahedral diagram complex $[CO(NH_3)_6]^{+3}$.

4-By using LFT calculate the total energy (E) of $[Fe(H_2O)_6]^{+2}$ and $[CoF_6]^{-3}$ complexes.

(where: Δ_0=9350 cm^{-1}; Π_c=19600 cm^{-1}; Π_e =-2000 cm^{-1})

5-Discuss the distribution of electrons of $[Ni(H_2O)_6]^{+2}$; $[Ni(Cl)_4]^{-2}$ and $\{Ni(CN)_4]^{-2}$.

6- Account for the factors affecting the stability of complexes.

A) For Four only, Complete of the following : (4Marks)

1- .....and ..... of octahedral complexes have only one possible arrangement of electrons in t_{2g} and e_{g*} MO theory.

2- Treat electrons in t_{2g} orbitals as ..... by $-0.4\Delta_0$ and electrons in e_{g*} orbitals .... by $0.6\Delta_0$.

3- The UV/ Visible spectra are used to determine the value of..... for the complexes.

4- The substitution of 6 H_2O molecules in $[Fe(H_2O)_6]^{+2}$ by 6 CN^- ions , the β_n equal.....

5- The stability constant of metal complexes increases with ..... state of the metal cation.

B) For Three only explain why: (3 Marks)

1- $CuSO_4$ anhydrous colorless while $CuSO_4$ hydrous color.

2- Most d^8 metal ions complexes form square planar have low spin and diamagnetic.

3- $[Sc(H_2O)_6]Cl_3$ complex is colorless.

4- $[Fe(H_2O)_6]^{+2}$ complex show zero crystal field stabilized energy.

.....

Section III (17 Marks)

3) A-Choose the correct answer: (3 Marks)

1-Magnetic moment of $[CoCl_4]^-$ is due to ..... unpaired electrons.

a) 2 b) 4 c) 6 d) zero

2-The correct order of wavelength of light absorbed for the

following complex ions is:

a) $[Co(H_2O)_6]^{3+}$ > $[Co(NH_3)_6]^{3+}$ > $[(Co(CN)_6]^{3-}$

b) $[(Co(CN)_6]^{3-}$ > $[Co(NH_3)_6]^{3+}$ > $[Co(H_2O)_6]^{3+}$

c) $[Co(NH_3)_6]^{3+}$ > $[(Co(CN)_6]^{3-}$ > $[Co(H_2O)_6]^{3+}$

d) $[Co(H_2O)_6]^{3+}$ > $[(Co(CN)_6]^{3-}$ > $[Co(NH_3)_6]^{3+}$

3-$[Cu(NH_3)_4]^{2+}$ complex ion has ..... hybridization:

a)sp^3 b)dsp^2 c)sp^2d d)none of them

B-True or false: (4 Marks)

1- NH_3 neutral ligand gives a significant Δo values larger than might be expected.
2- Many Cu^{2+} complexes show tetragonally distorted octahedral structure.
3- Splitting of ^5D ground state term for d^4 electronic configuration gives $^5T_{2g}$ spectroscopic state lower than ^5E_g one.
4- $Ni(CO)_4$ complex has a tetrahedral geometry.

C-Answer <u>*two only*</u> of the following: (10 Marks)

1-a) The mean pairing energy for $[Cr(H_2O)_6]^{2+}$ equals 23,500 cm^{-1} and the magnitude of crystal field splitting is 13,900 cm^{-1}. Calculate CFSE of this complex ion corresponding to HS and LS states.

1-b) Write on the different limitations of crystal field theory.

2-a) $[PtCl_4]^{2-}$ has a diamagnetic behavior, illustrate its hybridization and geometry.

2-b) Assign the ground state terms for V^{2+} and Mn^{2+} free ions.

3-a) Find out the values of expected magnetic moment values for Tetrahedral and octahedral complexes of Ni^{2+} ion.(Use VBT)

3-b) The enthalpy of hydration of Fe^{2+} ion equals -450 kcal mol^{-1} which is higher than that expected value (-425 kcal mol^{-1}) in the absence of CFSE, estimate the value of Δo for $[Fe(H_2O)_6]^{2+}$ complex ion.

(Atomic number: Sc=21; Ti=22; V=23; Cr=24; Mn=25; Fe=26; Co=27; Ni=28;Cu=29)

Prof. Dr. Aref A., Prof. Dr. M. Abd El-Hakeem, Prof.Dr. Asma I.

Assiut University Faculty of Science Chemistry Department	Second Semester Analytical Chemistry (I) (C-342) Third Level (Credit Hours)	May 2024 Time: 2 hour

Questions	Q.1	Q.2	Q.3	Q.4
Marks	10	15	10	15

Answer the Following Questions: (50 Marks)

Q.1: Choose the Correct Answer:

1- For strong electrolytes molar conductivity increase slowly with dilution and can be represented by .....

(A) Debye Huckel Onsager equation (B) Nernst equation
(C) Kohlrausch's equation (D) None

2- The specific conductance of conductor is reciprocal of .....

(A) Equivalent conductance (B) Specific resistance
(C) Molar conductance (D) All of them

3- The number of ions in ..... increases with dilution due to an increase in dissociation.

(A) a strong electrolyte (B) a weak electrolyte
(C) non-electrolyte (D) None of them

4- Cell constant of an electrolytic cell is .....

(A) Distance × Area (B) Distance /Area (C) Area/distance (D) None

5- The unit of conductance cannot be expressed in .....

(A) mho (B) $(ohm)^{-1}$ (C) Siemens (D) ohm/m

6- Which of the following solutions cannot conduct electricity?

(A) Sugar in water (B) NaCl in water
(C) $MgCl_2$ in water (D) KCl in water

7- Which of the following equation(s) is (are) correct?

(A) $G = \frac{1}{R}$ (B) $R = \frac{\rho L}{A}$ (C) $G = \frac{k A}{L}$ (D) All of them

8- Conductance (G) is increased by .....

(A) Increase of temperature (B) Decrease of temperature
(C) Increase hydration of ions (D) A & C

9- Current used for measured of conductance is .....

(A) A.C (B) D.C (C) Both A and B (D) None of these

10- The degree of dissociation of a weak electrolyte is given by .....

(A) $\alpha = \frac{\Lambda_m}{\Lambda^o}$ (B) $\alpha = \frac{\Lambda^o}{\Lambda_m}$ (C) $\alpha = \Lambda^o \times \Lambda_m$ (D) None

1	2	3	4	5	6	7	8	9	10

Q.2: Mark (T) for true and (F) for false statements:

1- The addition of KCl solution reduces the convection current in polarography.

2- Microelectrodes reach the state of polarization very slowly.

3- A sample contains two different ionic species at different concentrations. The two ions can be distinguished in polarography by their half-wave potentials.

4- For reversible cyclic voltammetric systems, E_{pa} and E_{pc} are dependent of the scan rate.

5- Solid electrodes based on carbon have faster electron transfer rates than metal electrodes.

6- A cyclic voltammogram of a reversible process is characterized by $\Delta E_P > 59/n$ (mV).

7- The dissolved oxygen present in experimental solution in acidic medium gets easily reduced at DME to form H_2O_2, in the first step.

8- The current that arises due to the charging of a mercury drop that grows is known as the faradic current.

9- In polarography or voltammetry, voltage is applied between the working and counter electrodes.

10- Reference electrodes should possess a high signal-to-noise ratio.

1	2	3	4	5	6	7	8	9	10

Q.3: (A) A conductivity cell has two platinum electrodes separated by a distance 1.5 cm and the cross sectional area of each electrode is 4.5 cm^2. Using this cell, the resistance of electrolytic solution was measured as 15 Ω. Find the specific conductance of the solution.

(B) Molnupiravir (MOV) possesses high utility for treating patients with COVID-19. The drug MOV gives an adsorptive striping voltammetric peak at a pencil graphite electrode. A 50.0 mL sample containing MOV yielded a peak height of 0.37 μA. When 2.0 mL of 3.0 μM MOV was spiked to the sample, the peak increased to 0.80 μA. Find the concentration of MOV in the sample.

Q.4: (A) **Write the mathematical equations for the following:**

(i) Heyrovsky-Ilkovic equation:

(ii) Randles-Sevcik equation:

(B): Write on *Two Only* form the following:

(i) Advantages of stripping voltammetry:

(ii) The principle of electrochemical biosensor (Give an example).

(iii) Advantages of solid electrodes based on carbon.

GOOD LUCK

Examiner: Prof. Dr. Hossieny Ibrahim

امتحان النظري الفصل الدراسي الثاني
العام الجامعي 2023/2024م

اسم المادة وكودها: ع .ت.أ 1308كيمياء وتحليل الاغذيه والالبان **الزمن:** ساعتان
الفرقة: الثالثه – كليه العلوم
لجنة الممتحنين: **أ.د./ سامي ابراهيم محمد الصياد**

أجب عن جميع الأسئلة التالية :

السؤال الاول:-

ضع علامة (√) أو (x) أمام العبارت الاتية : (30) درجه

1- ( ) Phenoxetol-2-phenoxy ethanol تستخدم في حالة حفظ المستحضرات الإنزيمية وهي مادة تعتبر مضادة للبكتيريا والفطريات في آن واحد.

2- ( ) الماء الموجود في الأغذية كوسط اذابة يطلق عليه الماء المرتبط كيميائيا Chemical Water .

3- ( ) ينصح تغذوياً أن يكون النشا هو المصدر الرئيسي للطاقة التي يحصل عليها الإنسان من الكربوهيدرات.

4- ( ) عند تقدير الرطوبه باستخدام الحرارة المرتفعه في حالة المنتجات المرتفعة في محتواها من السكر – قد يحدث عنها تكرمل Caramelization أو هدم Decomposition للسكر مع فقد الماء.

5- ( ) Oligosaccharides وهي تتكون من إرتباط 2- 10 وحدات من السكريات الأحادية مع بعضها بواسطة مجموعة -OH من سكر مع مجموعة مختزلة من سكر آخر حيث ترتبط الجزيئات برابطة جليكوسيدية glycosidic bond مثل سكر ثنائي كالسكروز ، المالتوز.

6- ( ) Clarification تجري علي المستخلص السكري لمعظم الأغذية قبل إجراء عملية التقدير الكمي- حيث أن المستخلص يحتوي علي بعض الشوائب والتي تعيق عملية التقدير للسكريات بها- فمثلاً العكارة الناتجة عن البروتينات والنشا الذائب تؤثر علي القياسات البولاريمترية.

7- ( ) من أهم المواد المروقة المستخدمة لترويق المستخلصات السكرية هي خلات الرصاص المتعادلة (CH3-COO)2Pb وخلات الرصاص القاعدية (CH3-COO)2Pb.Pb(OH)2.

8- ( ) يستخدم التولوين كأحد المذيبات العضويه عند تقدير الرطوبه بطريقه بيدويل.

9- ( ) سكر القصب من السكريات البسيطه المختزله بينما سكر اللبن من السكريات المركبه غير المختزله

10- ( ) Hydrophilic balance هي توزيع جزيئات المكون الليبيدى ما بين الوسطين الدهنى والمائى.

11- ( ) الأحماض الدهنية الضرورية التي تشمل أحماض اللينوليك – اللينولينك وهي لا يستطيع الجسم تكوينها لابد من الحصول عليها من مصادر خارجيه في الغذاء.

12- ( ) تعتبر الليبيدات مصدر للفيتامينات الذائبة فى الماء مثل A,K,E,D.

13- ( ) Wet Extractionيعتمد على استخلاص الزيت أوالدهن من المواد الغذائية كما هى بدون تجفيفها قبل الاستخلاص مثل طريقه فولش.

14- ( ) رقم الحموضة Acid value هو عبارة عن عدد ملليجرامات البوتاسا الكاوية اللازمة لمعادلة كافة الأحماض الدهنية المنفردة (الحرة) الموجودة في 1 جم زيت أو دهن.

15- ( ) يفضل الترميد الجاف للعينة عند تقدير العناصر المعدنية الصغري.

16- ( ) يستخدم إختبار الـ TBA للتعرف علي محتوي العينة من السكريات.

17- ( ) تقدير الرماد له أهميته في تقييم جودة السكر، الدقيق والمربي.

18- ( ) يقاس معامل الانكسار للزيت عند درجة 20 °م وللدهون عند 40 °م.

19- ( ) قلويه الرماد هي عبارة عن عدد ملليلترات حمض الهيدروكلوريك (1ع) والتي تتفاعل مع الرماد الذائب في الماء والناتج من 100جم من المادة الغذائيه ويفيد هذا التقدير في الكشف عن غش بعض الاغذيه.

20- ( ) ينتج من احتراق 1جم دهن يعطى 4.3 كالورى.

21- ( ) Deleading تجري بهدف التخلص من الرصاص الزائد بعد عملية الترويق – حيث أن الرصاص يتداخل في التفاعلات التي تعتمد علي الإختزال.

22- ( ) السكريات العديدة التغذوية Nutritional polysaccharides وهي مركبات يتم تخزينها ميتابولزمياً في النبات والحيوان في صورة النشا والجليكوجين علي التوالي.

23- ( ) تستخدم Calcium Carbide(Gas production) method في تقدير الرطوبة في منتجات الفانيليا ، الدقيق ، الزبد ، عصير الفاكهة.

24- ( ) عادةً تتناسب قيمة المادة الغذائيه طرديا مع مقدار ما تحتويه من رطوبة.

25- ( ) Fructose وهو مشتق من أبسط السكريات الكيتونية Dihydroxyacetone ، فيوجد في عصائر الفاكهة وعسل النحل ، وهو أحلي السكريات.

26- ( ) تقل درجة الذوبان لليبيدات بزيادة درجة عدم التشبع .

27- ( ) تعتبر البروتينات هي المادة الخام الأساسية في التخمرات الصناعية كما تساهم في إحساس الإنسان بالشبع.

28- ( ) تستخدم طريقه كلداهل في تقدير البروتين في الاغذيه بالطرق غير المباشرة .

29- ( ) يستخدم الرقم اليودي للتفرقه بين الزيوت الصالحه وغير الصالحه للاستهلاك الآدمي .

30- ( ) يستخدم جهاز بدويل في تقدير الرطوبه للعينات التي تحتوي علي مركبات طيارة .

السؤال الثاني : علل لما يأتي :- **(20) درجه**

1- يمكن استخدام مذيب عضوي وزنه النوعي أكبر من الماء عند تقدير الرطوبة بجهاز بدويل.

2- يجب أن يكون المذيب العضوي (مثل الإيثايل) المستخدم في استخلاص السكريات تركيزه حوالي 70%.

3- يجب المحافظة علي ثبات حجم محلول الهضم مع الغليان للمدة المحددة عن تقدير الألياف الغذائية في العينة.

4- العلاقة بين درجة عدم التشبع في الزيت ودرجة قابليته للجفاف طردية.

5- يجب أن يكون المذيب العضوي (مثل الإيثايل) المستخدم في استخلاص السكريات مخفف ومتعادل.

6- يقاس معامل الانكسار للزيت عند درجة 20 °م وللدهون عند 40 °م.

7- لا يفضل استخدام عامل الترويق للمستخلص السكري في صورة محلول مخفف.

8- يجب تجنب حدوث ارتفاع في درجة الحرارة أثناء طحن وتجهيز العينة قبل التحليل.

9- تضاف كربونات الكالسيوم عند استخلاص السكريات من عينة غذائية.

10-استخدام مذيب عضوي وزنه النوعي أكبر من الماء عند تقدير الرطوبة بجهاز بدويل.

انتهت الأسئلة،،،، ***مع تمنياتنا بالتوفيق ،،،،،***

أ.م الصباح

Assiut University
Faculty of Science

Date: 28/5/2024
Time Allowed: 3 hours

Chemistry Department

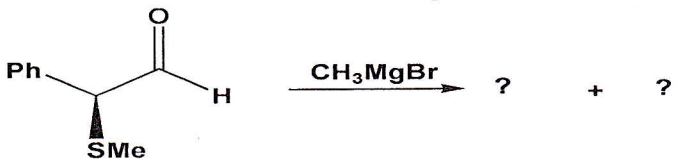
Final Exam of advanced synthetic Organic Chemistry – [Chemistry students (314 C)]

****

Answer the following questions:

Q1) Write by equations on the following: (Only Four) (16 Marks)

a- Define the regioselectivity in organic synthesis and give two examples.
b- Swern method for oxidation of n-propanol (give mechanism)
c- Wolf-Kishner reduction of propanal (give mechanism)
d- THP and POM for the protection of alcohols and their cleavage



e- By using Felkin-ahn model:
i) Complete the following equation, give the major and minor products
ii) Explain that de is equal 88%
iii) Show the effect of Zn^{++} ions on the reaction products

Q2- Choose the correct answer between brackets: (10 marks)

a) Preferential selective of one functional group over another is defined as
(stereioselectivity ..... regioselectivity ----- chemoselectivity)

b) Felkin-anh model can predict
(degree of selectivity --- the major selectivity--- enantioselectivity)

c) Wilkinson catalyst is used to reduce
(Terminal alkenes --- alkynes .... nitro group)

d) Reaction of CH_3CN with DIBAL in hexane at -78 C gave
(CH_3CH_2OH --- $CH_3CH_2NH_2$--- CH_3CHO)

e) For the protection of Carboxylic acid as benzyl ester it could be cleaved using
(Et_3N---- LiOH/THF ---Na/NH_3)

f) In Luche reduction reaction of cyclohexenone, it gives mainly
(cyclohexanole --- cyclohexenol .....cyclohexanone)

g) Using Jones Reagent to oxidize benzyl alcohol, it gives
(benzaldehyde---benzoic acid....Mixture of both)

h) Reduction of alkyne to alkanes was done using
(H_2/Ni -----lindlar catalyst ---Na/NH_3)

i) Oxidation of sec. alcohol over primary one could be obtained by using
(Cr(VI) --- Ag_2CO_3/celite ..... DMS)

j) Oxidation of 2,3-dimethylbutane-2,3-diol with LTA / pyridine gave
(Acetic Acid.- Acetone – Propanal)

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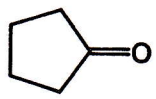
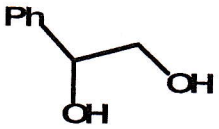
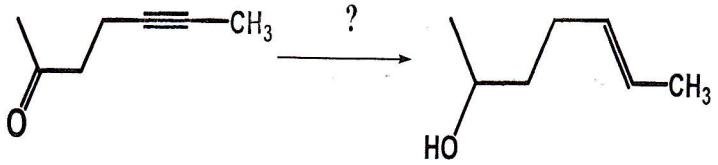
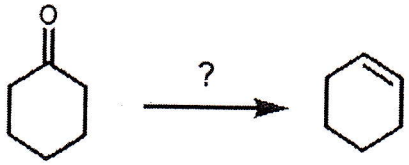
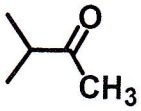
Q3) Complete and find the missing parts of following equations **(16 Marks)**

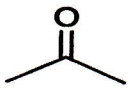
a)  PhCOOOH → ?

b)  DMP → ?

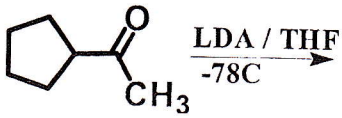
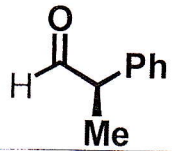
c)  ? →

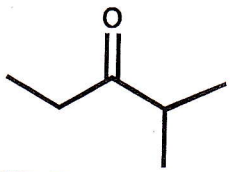
d)  ?

e)  ????????????? → t-butyl methyl ketone

f)  i) $NH(C_2H_5)_2$/ H^+ → Hex-5-ene-2-one

ii) ?????? / $H_3O^{\oplus}$

g)  LDA / THF, -78C → ??????????? →  ??????? + ???????? (Define the Major)

h)  TMSCl, Et_3N/ 60 °C → ? → i) O_3 ii) Zn/ H_2O → ? + ?

****

Q4) Write by equations how you can carry the following conversions (Only Two) **(8 Marks)**

a) 

b) 

c) 

Good luck

Prof.Dr. Shawkat

Assiut University
Faculty of Science
Chemistry Department

28 May 2024
Time: 3 Hours

Final Examination for the 3rd Year Students (Inorganic Chemistry C-321)

Section I (17 Marks)

1. **Answer the Following Questions:** (8 Marks)

a) Give the reason for:

i) $[Fe(CN_6)]^{4-}$ and $[Fe(H_2O)_6]^{2+}$ are different colors in dilute solutions.

ii) $K_3[Fe(OH)_6]$ is attracted most strongly to a magnet than $K_3[Fe(CN)_6]$.

iii) $[Ni(CN)_4]^{2-}$ square planar but $[Ni(CO)_4]$ tetrahedral.

b) Explain on the basis of valence bond theory that $[Ni(CN)_4]^{2-}$ ion with square planar structure is diamagnetic and the $[NiCl_4]^{2-}$ ion with tetrahedral geometry is paramagnetic.

c) Write the formula of the following coordination compounds.

i) Hexammine platinum(II) chloride ii) Sodium hexanitro cobalt iii) Potassium ferrocyanide.

2. **Answer the Following Questions:** (9 Marks)

a) Choose the Correct Answer and Comment:

i) A magnetic moment of 1.73 BM will be shown by one among the following:
$[Cu(NH_3)_4]^{2+}$, $[Ni(CN)_4]^{2-}$, $[Cr(H_2O)_6]^{3+}$.

ii) For the paramagnetic complex $[NiCl_4]^{-2}$, the number of unpaired electrons in the nickel and geometry of this complex ion are (one–tetrahedral, two-tetrahedral, one-square planar).

iii) Which is high-spin and how many the number of electrons in low and high level in each case? $[Mn(H_2O)_6]^{+3}$ $\Delta_o \approx 250$kJ/mol or $[Mn(CN)_6]^{3-}$, $\Delta_o \approx 460$ kJ/mol]

iv) On the basis of CFT for d^4 tetrahedral complex is: ($t_2g^3eg^1$ –eg^4t_2g0, $eg^2t_2g^2$)

v) Coordination number of Ni in $[Ni(C_2O_4)_3]^{-2}$ is: (2 ,4 , 6).

b) Write IUPAC name of the following compounds:

i) $K_2[Zn(OH)_4]$ ii) $[VO(acac)_2]$ iii) $[Fe(CN)_6]^{3-}$

c) Arrange the following complexes ions in increasing order of Δ_0 (C.F.T).
$[Cr(Cl)_6]^{3-}$, $[Cr(CN)_6]^{3-}$, $[Cr(NH_3)_6]^{3+}$.

Section II (33 Marks)

Answer the Following Questions:

1) Give the reason(s) that explains the following phenomena: (10 Marks)

a) The atomic radius of Cr is smaller than that of Mo whereas Mo and W have almost the same atomic radius.

b) Fe^{2+} is easily oxidized to Fe^{3+} while Mn^{2+} is difficult to be oxidized to Mn^{3+}.

c) $KMnO_4$ should be kept in dark bottles.

d) TiO_2 is amphoteric oxide.

e) AgCl has white color while AgBr has pale yellow and AgI has yellow colors.

2) Show by equations <u>Two methods only</u> for extraction of pure Ti. (5 Marks)

3) Complete the following equations (balance if necessary). (9 Marks)

a) $2VF_4 =$ ..... + ... (at 600 °C)

b) $K_2Cr_2O_7 + S =$ ..... + ...

c) $2NH_4VO_3 =$ ..... + ... + ... (under heat)

d) $K_2Cr_2O_7 + HCl$ (conc. H_2SO_4) = ... +..... + ...

e) $MnO_2 + Al =$ ..... + ...

f) $2NH_4VO_3 =$ ..... + ... + ...

g) $(VO)^{2+} + H^+ + Sn^{2+} =$ ..... +..... + ...

4) Choose the correct answer from the following: (5 Marks)

1. Permanganate ion MnO_4^- has intense purple color due to:

a) d-d Transition b) Charge transfer c) Defect in the crystal structure d) Polarization

2. Ziegler-Natta catalyst is used in the ethylene polymerization, it is composed of:

a) $TiCl_4$ b) $TiCl_4/AlEt_3$ c) $TiCl_2$ d) $TiOCl_2$

3. $Fe_{0.95}O$ is a non-stoichiometric oxide, it has:

a) Deficient oxygen sites b) Deficient Fe sites c) Rich oxygen sites d) Rich Fe sites

4. In the vanadium group, the basic properties of the oxides M_2O_5 ..... down the group.

a) Increase b) Decrease c) Remain unchanged d) None of them

5. With increasing the number of unpaired electrons, the magnetic moment (μ):

a) Decreases b) Increases c) Doesn't affect d) None of them

5) What is meant by the disproportionation reaction? (give an example). (4 Marks)

(At. No. of Ti=22, V=23 Cr = 24, Mn = 25, Fe = 26, Co= 27, Ni =28, Cu = 29, Zn = 30)

Best Wishes

Examiners: Prof. Dr. Amna Sayed and Dr. Mohamed Abdel megeed

Assiut University
Faculty of Science
Chemistry Department

28 May 2024
Time: 3 Hours

Final Examination for the 3rd Year Students (Inorganic Chemistry C-321)

Section I (17 Marks)

1. Answer the Following Questions: (8 Marks)

a) Give the reason for:

i) $[Fe(CN_6)]^{4-}$ and $[Fe(H_2O)_6]^{2+}$ are different colors in dilute solutions.

ii) $K_3[Fe(OH)_6]$ is attracted most strongly to a magnet than $K_3[Fe(CN)_6]$.

iii) $[Ni(CN)_4]^{2-}$ square planar but $[Ni(CO)_4]$ tetrahedral.

b) Explain on the basis of valence bond theory that $[Ni(CN)_4]^{2-}$ ion with square planar structure is diamagnetic and the $[NiCl_4]^{2-}$ ion with tetrahedral geometry is paramagnetic.

c) Write the formula of the following coordination compounds.

i) Hexammine platinum(II) chloride ii) Sodium hexanitro cobalt iii) Potassium ferrocyanide.

2. Answer the Following Questions: (9 Marks)

a) Choose the Correct Answer and Comment:

i) A magnetic moment of 1.73 BM will be shown by one among the following:
$[Cu(NH_3)_4]^{2+}$, $[Ni(CN)_4]^{2-}$, $[Cr(H_2O)_6]^{3+}$.

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iii) Which is high-spin and how many the number of electrons in low and high level in each case? $[Mn(H_2O)_6]^{+3}$ $\Delta_o \approx 250$kJ/mol or $[Mn(CN)_6]^{3-}$, $\Delta_o \approx 460$ kJ/mol]

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i) $K_2[Zn(OH)_4]$ ii) $[VO(acac)_2]$ iii) $[Fe(CN)_6]^{3-}$

c) Arrange the following complexes ions in increasing order of Δ_0 (C.F.T).
$[Cr(Cl)_6]^{3-}$, $[Cr(CN)_6]^{3-}$, $[Cr(NH_3)_6]^{3+}$.

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5) What is meant by the disproportionation reaction? (give an example). (4 Marks)

(At. No. of Ti=22, V=23 Cr = 24, Mn = 25, Fe = 26, Co= 27, Ni =28, Cu = 29, Zn = 30)

Best Wishes

Examiners: Prof. Dr. Amna Sayed and Dr. Mohamed Abdel megeed

كلية العلوم جامعة أسيوط	**Final-term exam, 2nd semester, 2023/2024** **Histochemistry (Z 316)** **Time limit: 2 hours, Date: May. 21st, 2024** **Total score: 50 marks, the test consists of 5 pages**	جامعة أسيوط

I- Choose the correct answer from "A, B, C, or D", then put your answer inside the empty box, under the black arrow: *(35 marks, one mark for each)*

1	**Which histochemical technique is used for the detection of arginine in proteins?** A) Ninhydrin-Schiff method B) Sagaguchi method C) Mercury orange method D) Millon's reaction	
2	**Which nucleic acid preferentially stains with methyl green, producing a green color?** A) DNA B) RNA C) Both DNA and RNA D) Neither DNA nor RNA	
3	**The histochemical method used to detect cholesterol and its ester is:** A) Copper rubeanic acid method B) Schultz method C) Calcium lipase method D) Acid hematin method	
4	**What is the classification of "Ketone bodies" within the lipid categories?** A) Simple lipids B) Compound lipids C) Derived lipids D) Miscellaneous Lipids	
5	**Acid hematin is a histochemical method used for the demonstration of:** A) Cholesterol esters B) Phospholipids C) Triglycerides D) Plasmalogens	
6	**Which microscopy technique is used after staining with osmium tetroxide?** A) Confocal microscopy B) Light microscopy C) Fluorescence microscopy D) Electron microscopy	
7	**Which of the following methods is used to demonstrate antigens, antibodies, and antigen-antibody complexes in tissues and cells?** A) Autoradiography B) Histological methods C) Immunohistochemical methods D) Enzyme labeling	
8	**The structural unit of nucleic acids is:** A) Monosaccharides B) Nucleotides C) Fatty acids D) Amino acids	
9	**The general chemical formula for carbohydrates is:** A) $C_n(H_2O)_n$ B) $C_n(H_2O)_{2n}$ C) $C_n(H_2O)_{n+1}$ D) $C_n(H_2O)_{2n+1}$	

10	**Which method involves the simultaneous production and capture of primary reaction product (PRP) and final reaction product (FRP) in one incubating medium?** A) Self-colored substrate B) Post-incubation coupling C) Metal precipitation technique D) Simultaneous coupling	
11	**What is the recommended type of sections to use in histochemical methods for lipids?** A) Fixed sections B) Paraffin-embedded sections C) Celloidin-embedded sections D) Fresh frozen sections	
12	**Which type of enzymes catalyze the rearrangement of chemical bonds within a molecule?** A) Ligases B) Transferases C) Isomerases D) Hydrolases	
13	**What enzyme is commonly used to illustrate lysosomes?** A) Alkaline phosphatase B) Acid phosphatase C) Dehydrogenase D) Esterase	
14	**Which of the following staining reactions for proteins depends on their physical configuration rather than their chemical composition?** A) Sagaguchi method B) Ninhydrin-Schiff method C) Mercury orange method D) Masson's Trichrome stains	
15	**What are the monosaccharide units that compose lactose?** A) Glucose and fructose B) Glucose and galactose C) Glucose and mannose D) Glucose and ribose	
16	**Which histochemical method is used to demonstrate free fatty acids?** A) Copper rubeanic acid method B) Acid hematin method C) Schultz method D) Calcium lipase method	
17	**What type of lipid plays a crucial role as a structural component in cell membranes?** A) Triglycerides B) Phospholipids C) Steroids D) Sphingolipids	
18	**Which microscopy technique is used to identify crystalline cholesterol and cholesterol esters?** A) Polarizing microscopy B) Fluorescent microscopy C) Transmission electron microscopy D) Scanning electron microscopy	
19	**What type of bond links monosaccharide subunits in a polysaccharide?** A) Peptide bond B) Hydrogen bond C) Ionic bond D) Glycosidic bond	
20	**Two pentoses that play crucial roles in nucleic acids and energy molecules are:** A) Glucose and ribose B) Deoxyribose and fructose C) Ribose and deoxyribose D) Fructose and glucose	

21	**The esters of fatty acids with alcohol groups are commonly known as:** A) Triglycerides B) Phospholipids C) Steroids D) Carotenoids	
22	**What is the substrate used to visualize peroxidase activity in immunoenzyme staining?** A) Hematoxylin B) Alcian Blue C) Eosin D) Diaminobenzidine (DAB)	
23	**Which fixation method provides better preservation of enzymatic activity and localization?** A) Formalin fixation B) Cryostat fresh-freezing C) Paraffin embedding D) lyophilization	
24	**What cellular structures can be visualized using dehydrogenase and ATPase enzymes?** A) Nuclei B) Golgi apparatus C) Mitochondria D) Lysosomes	
25	**Which staining method is specific for glycogen?** A) Alcian Blue stain B) PAS stain C) DPAS stain D) None of the above	
26	**Which method involves the precipitation of colored PRP at the site of enzyme activity?** A) Self-colored substrate B) Post-incubation coupling C) Metal precipitation technique D) Simultaneous coupling	
27	**Which of the following is a pyrimidine base?** A) Adenine B) Cytosine C) Guanine D) Inosine	
28	**The primary purpose of using fluorescence microscopy for lipid staining is to examine:** A) Phospholipids B) Triglycerides C) Waxes D) Fluorescent lipids	
29	**Which method is used to demonstrate triglycerides in histochemical methods for lipids?** A) Copper rubeanic acid method B) Acid hematin method C) Schultz method D) Calcium lipase method	
30	**What color does the PAS stain produce in areas where carbohydrates are present?** A) Blue B) Magenta C) Yellow D) Green	
31	**Which of the following is NOT an example of a simple protein?** A) Albumin B) Fibrin C) Glycoproteins D) Reticulin	
32	**Which radioactive nucleotide is used to detect DNA specifically at autoradiography?** A) Tritiated guanine B) Tritiated cytosine C) Tritiated thymidine D) Tritiated uracil	
33	**When osmium tetroxide is reduced by unsaturated fatty acids and their esters, it turns into a:** A) White oxide B) Yellow oxide C) Black oxide D) Red oxide	

34	**Which histochemical method is specifically used to demonstrate DNA?** A) Feulgen method B) Basophilia C) Acridine red method D) Methyl Green Pyronin method	
35	**Which of the following is a function of carbohydrates?** A) Energy storage B) DNA and RNA synthesis C) Cell-cell recognition D) All of the above	

II- Write the letter (T) if the statement is true, and write the letter (F) if the statement is false, then put your answer inside the empty box, under the black arrow: *(15 marks, one mark for each)*

36	Verbascose is an example of an oligosaccharide that contains 5 monosaccharide units.	
37	The staining reactions for proteins or protein-containing substances depend on their amino acid composition.	
38	Formaldehyde is the best routine fixative for lipid histochemical methods.	
39	The "Performic acid-Alcian blue" method is a histochemical technique used for the detection of tyrosine in proteins.	
40	Glycogen is a homopolysaccharide composed of only one type of monosaccharide subunit.	
41	In Immunohistochemical methods, most of disadvantages of fluorochrome have been overcome by using of enzyme-labeling of the antibodies especially with the horseradish peroxidase.	
42	Histochemical demonstration of proteins is possible only in fresh tissue due to their high sensitivity.	
43	Cerebrosides are a type of glycolipids that consist of a fatty acid linked to sphingosine and a single carbohydrate residue.	
44	Proteins are involved in the synthesis of hormones, such as testosterone and estrogen.	
45	Alcian Blue stain is a histochemical method used to detect acidic polysaccharides in tissue samples.	
46	Sudan Black B is an appropriate histochemical method for the demonstration of phospholipids.	

47	In the Malachite green and Acridine red histochemical method, DNA is stained red, and RNA is stained green.	
48	A nucleotide is an organic molecule formed of a nitrogenous base, a six carbon-sugar, and a phosphate group.	
49	Metachromasia is the phenomenon where certain dyes or stains exhibit a color change or shift when they bind to specific tissue components.	
50	Peptide bonds are the type of bond that links monosaccharide subunits in a disaccharide.	

End of Questions, With My Best Wishes!

Dr. Ahmad U. M. Mahmoud