Physical Chemistry Examination For Nano-Technology Students

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Answer the following questions:

1) Discuss the phase diagram for the following:

    i- sulfur system   ii- Two components forming simple eutectic

    iii- Two components system forming compound has conjurent melting
      point.

    iv- Sodium sulfate system

2) Derive the mathematical expression for the phase rule.

3) Define the following:

    i- number of components ii- number of phases

    iii- number of degree of freedom

4) Discuss the cooling curves for constructing the phase diagram.

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Good Luck

**Examinar:**

Prof.Dr. R.M.Gabr

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4- Pyrrole, furan and thiophene do not contain any benzene ring still they are classed as aromatic compounds.

5- Electrophilic substitution reaction in pyridine takes place at C2.

6- A mixture of ethylacetate, formaldehyde and ammonia after heating and treatment of HNO_3 to gave thiazol derivative .

(c) Write the systematic name for (Five Only) : **(Five markts)**

(i) (ii) (iii)

(iv) (v) (vi)
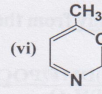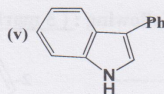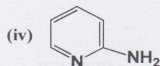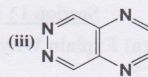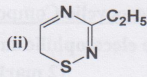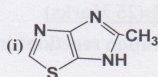
Section II: (Aromatic chemisty)   (25 Marks)

Question No. 3:   **(12 marks)**

A- Indicate the product(s) you would obtain from nitration of the following compounds (**Three only**):

    (i) p-methylphenol   (ii) m-Xylene   (iii) Anisole   (iv) p-Methylacetanilide

B- Electrophilic substitution on phenol occurs at the ortho and para positions. Explain, using resonance structures of the intermediates.

C- Arrange the following compounds in order of increasing *basicites*, and explain the reasons for your choice of the order: (**p-methoxyaniline, p-nitroaniline, m-nitroaniline, aniline**)

Question No. 4:   **(13 marks)**

A- Indicate using the mechanism of **only one** from the following reactions:

    (i) Nitration of benzene.   (ii) Benzidine rearrangement.

B- Using *toluene* as the starting material, devise a synthesis for each of the following: (**Three only**)

    (i) m-Nitrobenzoic acid   (ii) (T.N.T.)

    (iii) Saccharin.   (iv) Benzyl alcohol.

C- Write a note on the *Sand Mayer* reaction.

Best Wishes
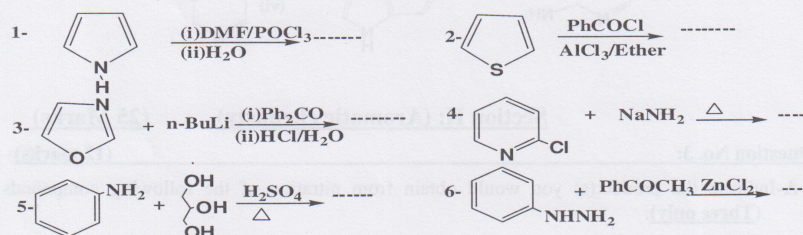
أ.د. زينب حزين & د. فاطمة قاسم

Final Examination of Organic Chemistry (Aromatic and Heterocyclic Compounds, 212C) for Credited Hours Students
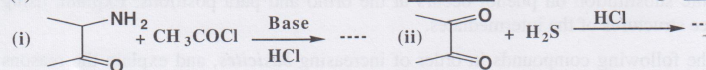
Answer the following questions: (50 Marks)

Section I : Heterocyclic Compounds(25 Marks)

**Question No. 1:** (a) Explain Why *the* **electrophilic substitution reactions in pyrrole occurmainly at C2 .** (2 marks)

(b) Complete **Five Only** from the following : (5 marks)

1- [pyrrole structure] $\xrightarrow[\text{(ii)H}_2\text{O}]{\text{(i)DMF/POCl}_3}$ -------

2- [thiophene structure] $\xrightarrow[\text{AlCl}_3/\text{Ether}]{\text{PhCOCl}}$ --------

3- [oxazole structure] + n-BuLi $\xrightarrow[\text{(ii)HCl/H}_2\text{O}]{\text{(i)Ph}_2\text{CO}}$ --------

4- [2-chloropyridine structure] + NaNH$_2$ $\xrightarrow{\triangle}$ -----

5- [aniline] NH_2 + [glycerol with OH OH OH] $\xrightarrow[\triangle]{\text{H}_2\text{SO}_4}$ ------

6- [phenylhydrazine NHNH$_2$] + PhCOCH$_3$ ZnCl$_2$ ---

(c) Write in details a reaction mechanism of **One Only** from the following : (3 martks)

(i) [structure with NH$_2$ and O] + CH$_3$COCl $\xrightarrow[\text{HCl}]{\text{Base}}$ ----

(ii) [diketone with two O] + H$_2$S $\xrightarrow{\text{HCl}}$ ---

(d) Using retrosynthetic analysis show the structure of starting material required to prepare the target molecule below : (3marks)

[H$_3$C and H$_3$C substituted pyrrole with N-H]
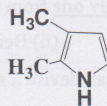
Qusetion No. 2 (a) Illustrate by equation **One Only** from the following : (2 marks)

1- Hantzsch reaction 2-Knorr pyrrolesynthesis

(b)Mark (√) for the right statement and (X) for the wrong ones **(Five Only):** (Five markts)

1-In furan, the O atom contributeds two electrons to the π(or n-)system.

2-Qunoline and Isoqunoline are isomers.

3-Pyridine does not undergo Friedel-Crafts reaction.

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12- A dry cell battery contains Zn and MnO_2 as primary reactants.

13- The reduction potential of an electrode increases as ion concentration decreases.

14- In a concentration cell, the cathode always has a lower ion concentration.

15- The value of the equilibrium constant for a spontaneous redox reaction is less than 1.

16-The cell potential decreases with increasing temperature if the reaction is exothermic.

Q3: Complete the following statements   (12 marks)

1-The ....of a gas electrode is influenced by gas pressure.

2- The ....is rechargeable because it allows the reversal of its chemical reactions.

3- The .... in a galvanic cell prevents mixing of solutions but allows ion transfer.

4- An application of solid electrolytes is in ....

5-The activity of a 0.08 M NaCl solution with an activity coefficient (γ) of 0.79 is ....

6- At infinite dilution, molar conductivity is the sum of ....

7- Daniel cell is considered as .... cell.

8- The ionic strength of 0.05M $CaCl_2$ is ....

9- To determine a single electrode potential, the electrode is coupled with ....

10- An example of metal-insoluble salt electrode is ....

11- The potential of a battery is 2.0V and involves 10 electrons process, the free energy change of this battery is ....

12- The relation between the cell potential and the equilibrium constant of cell reaction is ....

13- A .... requires a continuous supply of reactants to function.

14- One Faraday of charge corresponds to .... electrons.

15- The oxidation number of chromium in potassium dichromate is ....

16- .... is considered as endothermic cell.

Part II Answer *Only one* from the following questions:

Q1) a) Explain: (i) Types of electrolytes (with examples)

(ii) Factors affecting conductivity in solutions   (6 marks)

b) The potential for the cell Ag(s)|Ag⁺(sat'd AgI)||Ag⁺(0.10 M)|Ag(s) is 0.417 V , calculate the K_{sp} of AgI salt.
                    (8 marks)

Q2) a) Write about solid electrolytes, including their characterization and types.   (7 marks)

b) The resistance of a 0.02 M KCl solution is measured using a conductivity cell with a cell constant of 1.25 cm^{-1}. The resistance is 120 Ω. Calculate the specific conductivity (κ) and molar conductivity.   (7 marks)

مع اطيب التمنيات بالتوفيق..

الاستاذ الدكتور/ أبوالحجاج عبدالعزيز هرماس

Final Exam for Second Grad Students, Applied Industrial Chemistry
Electrochemistry (Chem 209), 1ˢᵗ semester

($F=96485$ C mol^{-1}, $R=8.314$ J K^{-1} mol^{-1})

Part I: Answer the following questions

Q1: Choose the correct answer　　　　　　　　　　　　　　(12 marks)

1- Which type of polarization is caused by the energy barrier for an electrochemical reaction at the electrode surface?
a) Concentration Polarization　　　　　　　b) Activation Polarization
c) Resistance Polarization　　　　　　　　　d) None of the above

2-Which factor affects concentration polarization the most?
a) Electrode geometry　　b) Stirring　　　c) Reaction kinetics　　d) Gas constant

3-Which equation describes activation polarization?
a) Ohm's Law　b) Diffusion-Limited Current Equation　c) Butler-Volmer Equation　d) Nernst Equation

4- What factor does affect ionic conductivity?
a) Temperature　　　　b) Size of ions　　　c) Solvent polarity　　　d) all the above factors

5- What is the potential difference across the electric double layer (EDL) influenced by?
a) Type of electrode material　　b) Electrolyte concentration　　c) Both a and b　　d) None of the above

6- The Debye-Hückel Limiting Law relates to:
a) Overpotential　　　b) Activity coefficients of ions　　c) Diffusion rates　　d) Viscosity of solvents

7- What happens in resistance polarization?
a) Voltage drop due to ionic resistance　　　　b) Mass transfer limitation
c) Excess charge at the electrode surface　　　d) None of the above

8-What does $\eta=i\cdot R$ represent in electrochemistry?
a) Concentration polarization　　b) Activation overpotential　　c) Resistance polarization　　d) None of the above

9- Which solvent property enhances ion dissociation?
a) Polarity　　　　　　b) Viscosity　　　　c) Density　　　　d) Surface tension

10- What happens to the ionic strength of a solution when more ions are added?
a) Decreases　　　　b) Increases　　　　c) Remains constant　　　d) Becomes negligible

11- The Nernst equation relates the cell potential to:
a) Temperature　　　　b) Concentration of ions　　　c) Both a and b　　　d) Neither a nor b

12- For a reaction to be spontaneous, the Gibbs free energy change (ΔG) must be:
a) Positive　　　　　b) Negative　　　　c) Zero　　　　d) Undefined

13- Which of the following is a strong electrolyte?
a) Acetic acid　　b) Glucose　　　c) Sodium chloride　　　d) Water

14- The unit of conductivity is:
a) Ohm　　　　b) Siemens　　　c) Coulomb　　　d) Ampere

15- The reaction $2H_2 + O_2 \rightarrow 2H_2O$ occurs in which type of cell?
a) Electrolytic cell　　b) Concentration cell　　c) Dry cell　　d) Fuel cell

16- According to Faraday's first law, the amount of substance deposited during electrolysis is proportional to:
a) Current and time　　b) Voltage and resistance　　c) Power and time　　d) Volume of electrolyte

Q2: Give **True** or **False** for the following statements　　　　(12 marks)

1- The standard electrode potential of copper is positive, indicating it is easier to reduce.
2- Electrode material significantly influences resistance polarization.
3- Poorly conducting electrolytes contribute to resistance polarization.
4- The Nernst equation can NOT predict the spontaneity of a redox reaction.
5- Stern's model combines Helmholtz and Gouy-Chapman theories.
6- The limiting current density is a factor in concentration polarization.
7- Ion-ion interaction increases molar conductivity at high concentrations.
8- Electrolytes are substances that conduct electricity only in their solid state.
9- The Gouy-Chapman model assumes ions are rigidly held in place.
10- The activity coefficient (γ) accounts for deviations from ideal behavior in solutions.
11- Electrons flow from the cathode to the anode in a galvanic cell.

<div dir="rtl">باقى الأسئلة بالخلف</div>

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Physical Chemistry-2 Examination (C-232) for 2nd Level Students

Colloidal state Chemistry: (17 Marks)

Q 1: Explain what is meant by four from the following: (4 Marks)

1- Electro-osmosis.   2- Tendall effect.   3- Emulsions.   4- Protective colloids.   5- Syneresis of gels

Q 2: Mark (√) for the correct sentence and (x) for the wrong one: (5 Marks)

1- The surface tension of lyophilic sols is frequently higher than that of the pure medium.
2- The dispersed phase in emulsions are generally positively charged.
3- Lyophobic colloids are characterized by relatively high Tendall effect.
4- Water-insoluble soaps favor the formation of emulsions of water in oil.
5- If the sol particles in a given colloid move towards the negative electrode, the dispersion medium carries negative charge.

Q 3: Mark (√) for the correct answer; A, B, C or D for the following: (6 Marks)

1- A gel is a colloidal system in which a ….…..…. is dispersed in a …….……. medium.
A) solid, liquid   B) liquid , solid   C) liquid, liquid   D) liquid, gas

2- Some gels liquify readily when shaken to form a sol which on standing turns back into a gel. The sol - gel transformation is referred to as …….……. .
A) metathesis   B) thixotropy   C) syneresis   D) A and B correct

3- The charge on hydrous ferric oxide sol is due to ….………. ions.
A) absorption of Cl^- B) adsorption of Cl^- C) adsorption of Fe^{+3} D) absorption of Fe^{+3}

4- Macromolecular colloids possess….……….. .
A) high viscosities   B) high molecular weights   C) weak Brownian motions   D) all of these

5- Lyophobic colloids are ….………. .
A) liquid loving   B) reversible   C) characterized by relatively weak Tendall effect
D) characterized by relatively high Tendall effect

6- Cheese is an example of ….………. .
A) solid in solid   B) liquid in solid   C) solid in liquid   D) none of these.

Q4: Explain with a figure one method for the preparation of platinum sol.
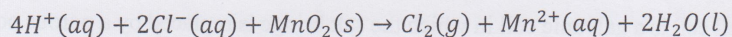(2 Marks)

Good Luck
Prof. Dr. Maher M. Girgis

5. What is the potential of the cell: $2Na + Cl_2 = 2NaCl$, that has a $\Delta G°$ of -165 kJ/mol (F = 96500)?

    A. 2.73   B. 1.37   C. 0.85   D. −2.73

6. Which substance is the reducing agent in the following reaction:

$$4H^+(aq) + 2Cl^-(aq) + MnO_2(s) \rightarrow Cl_2(g) + Mn^{2+}(aq) + 2H_2O(l)$$

    A. H^+(aq)   B. Cl^-(aq)   C. MnO_2(s)   D. Mn^{2+}(aq)

7. What species must copper be oxidized to if the cell potential for one of its redox reactions is 1.5 V and the free energy of the reaction is −289.5 kJ/mol?

    A. Cu^{+2} B. Cu^+ C. Cu^{3+} D. Cu^{4+}

8. The standard cell potential is calculated using the equation:

    A. $E°_{cell} = E°_{anode} - E°_{cathode}$ B. $E°_{cell} = E°_{cathode} + E°_{anode}$

    C. $E°_{cell} = E°_{cathode} - E°_{anode}$ D. $E°_{cell} = E°_{cathode} / E°_{anode}$

With my best wishes

Prof. Dr. Ahmed Fawzy

2

(Electrochemistry)

Answer the following questions:

I- Put (√) in the front of the correct statement and (x) for the wrong one: **(8 Marks)**

1. Daniell cell is a galvanic cell in which the salt bridge is replaced by a porous pot. ( )
2. In electrolytic cell, reaction occurs naturally and deos not require external energy. ( )
3. The representation of calomel electrode is Pt Hg/HgCl$_2$ Cl$^-$. ( )
4. Lead storage battery can be recharged. ( )
5. Overall reaction in Weston cell is: Cd + Hg$_2$SO$_4$ ↔ CdSO$_4$ + 2 Hg. ( )
6. Nernst equation is a relation between electrode potential and its density. ( )
7. You are provided with the following cell: H$^+_{(aq)}$ | H$_2$(g), E° = 0.0 V, Zn$^{2+}_{(aq)}$ | Zn$_{(s)}$,
   E° = -0.76 V, the cell potential is -0.76 V. ( )
8. The potential of a half-cell consisting of zinc electrode in 0.01 M ZnSO$_4$ solution
   at 25°C. (E° = 0.763 V) is 0.881 V. ( )

II. Select the correct answer: **(8 Marks)**

1. The oxidation number of chromium in (NH$_4$)$_2$Cr$_2$O$_7$ is ....

   A. +6   B. +4   C. +5   D. +3

2. The potential of .... electrode depends on the concentration of OH$^-$ ions.

   A. hydrogen   B. oxygen   C. calomel   D. amalgam

3. .... is the process in which electrical energy is used to cause a nonspontaneous
   chemical reaction to occur.

   A. Hydrolysis   B. Photolysis   C. Osmosis   D. Electrolysis

4. .... cell is an electrochemical cell that requires a continuous supply of reactants
   to keep functioning.

   A. Reversible   B. Fuel   C. Daniell   D. Alkaline

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4- If a reaction is zero order in a particular reactant, changing its concentration will have a great effect on the rate as long as the reactant is present.

5- Catalysts increase the rate of a reaction by decreasing the activation energy of the reaction.

Q 2: Explain what is meant by the following Terms:

1- Average and instantaneous rates. 2- The half life of a process.

3- The activation energy (Ea) of a reaction. 4- The molecularity of a process.

Q 3: For the following three reactions:

a) $C_2H_5I \rightarrow C_2H_4 + HI$: rate = $k[C_2H_5I]$
b) $SO + O_2 \rightarrow SO_2 + O$: rate = $k[SO][O_2]$
c) $ClOO \rightarrow Cl + O_2$: rate = k

1- What are the overall reaction orders for the rate laws described in Equations a, b and c?

2- What are the units of the rate constant for the rate law for equations (a) and (b) ?

Q 4: The rate constants for the first-order decomposition of acetone dicarboxylic acid

$$CO(CH_2COOH)_2(aq) \longrightarrow CO(CH_3)_2(aq) + 2\ CO_2(g)$$
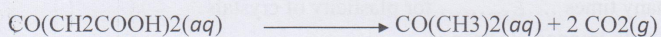
Acetone dicarboxylic acid   acetone

are $k = 4.75 \times 10^{-4}$ s^{-1} at 293 K and $k = 1.63 \times 10^{-3}$ at 303 K.

What is the activation energy, Ea, for this reaction?

(Use the two-point form of the Arrhenius equation to answer this question)

(Good Luck)

Prof. Rabee. M. Gabr , Prof. Abd El-Aziz A. Said and Prof. Maher M. Girgis

Physical Chemistry of Applied Industrial Chemistry for 2nd Level Students (Chem.203)

Assiut University

Time : 2 h

Day: 28/12/2024

Faculty of Science
Chemistry Department

Answer the Following Questions:

Section (I)

Answer the following questions: (16.5 Marks)

1) Discuss the kinetics of oxidation of thiosulphate by H_2O_2 using I^- and MoO_4^{--} ions as catalpas.
2) Derive the relation between the rate constant and ionic Strength.
3) Explain the postulates given by Shpitalsky for the theory of homogeneous catalysis.
a) On the light of equilibrium hypothesis derive kinetic equation for a bimolecular catalytic reaction.

Section (II)

Answer the following questions: :   (16.5 Marks)

1) Complete the following sentences:

i) Slip mention many times …………… for plasticity of crystals.

ii) Anion vacancy with trapped electron is ……………...

iii) Interstitial atom occupies ………….. Position in crystal lattice..

iv) Paramagnetic results from a permanent ………………..

v) Addition of cation with higher valence into solid with lower valence creation ……………

2) Write an account on two only of the following:

a) Edge dislocation in solids.

b) Non-stoichiometric of solid compounds.

c) Point defects in solids.

3- Explain how are the holes within NiO semiconductor can be changed by doping with L^+ or V^{5+} cations and their effects on the electrical condudivity of NiO

Section (III)

Answer the following questions: (17 Marks)

Q1: Mark ($\sqrt{}$) for the correct sentence and (x) for the wrong one (answer four only):

1- The increase in reaction rate is linear with increase in temperature in most reactions.

2- Most reaction rates depend on the fraction of molecules possessing Ea or greater.

3- The half life of a first order reaction depends on reactant concentration.

2-Write the structural formula of the following compounds: (only three)   (5 marks)

1) TNB

2) m-Nitrobenzoic acid

3) p-Toulidine

4) o-Benzoquinone

3- How to prepare the following compounds: (only five questions)   (25 marks)

1) TNT

2) Phenol from benzene

3) Picric acid

4) Nitrochlorobenzene from benzene

5) 1,3-butadiene from pyrrole

6) Benzyl chloride from toulene

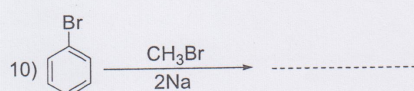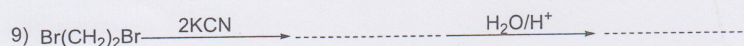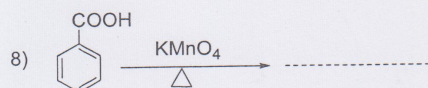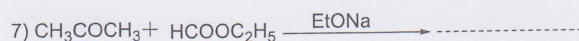**Good luck**

Examiner: Dr/ Maha mohamed samy

2

Answer the following questions: (50 marks)

1- Complete each of the following equations: (20 marks)

1) $CH_2=CBr-CH_2Br \xrightarrow[\triangle]{Zn}$ -------------------

2) NHCOCH$_3$

$\xrightarrow[CH_3COOH]{HNO_3}$ ------------------

3) CH_2OH
$|$
$CHOH$ + $\begin{matrix} COOH \\ | \\ COOH \end{matrix}$ $\longrightarrow$ ------------------ $\xrightarrow{-CO_2}$ ------------------
$|$
CH_2OH

4) 2 ⬡ $\xrightarrow[\text{[O]}]{V_2O}$ ------------------

5) $CH_3CHO + HNO_3$ ------------------ ------------------

6) CH$_3$ ⬡ $\xrightarrow[AlCl_3]{CO, HCl}$ ------------------

7) $CH_3COCH_3 + HCOOC_2H_5 \xrightarrow{EtONa}$ ------------------

8) COOH ⬡ $\xrightarrow[\triangle]{KMnO_4}$ ------------------

9) $Br(CH_2)_2Br \xrightarrow{2KCN}$ ------------------ $\xrightarrow{H_2O/H^+}$ ------------------

10) Br ⬡ $\xrightarrow[2Na]{CH_3Br}$ ------------------

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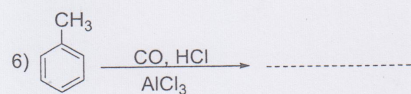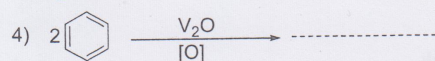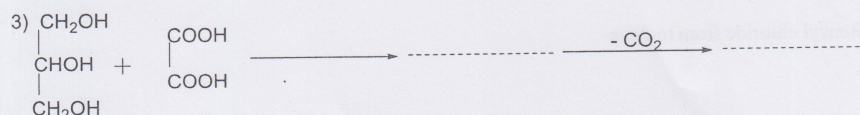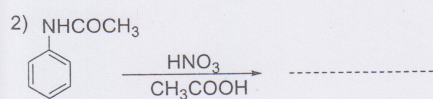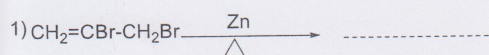
6. Given, for an organic acid that ΔE_{fus}=2600 cal mol^{-1} at its melting point 17°C and ΔH_{vap}=6000 cal mol^{-1} at its boiling point 120°C. Calculate the change in entropy that takes place when 360 gm of this solid acid at -60°C is melted at its melting point and heated up to 220°C, all under constant pressure taken as 1 atm. Assume that molar heat capacity of this acid at its solid, liquid and gaseous state are 17, 27 and 37 cal deg^{-1}mol^{-1}, respectively.(M.wt of the acid=90g/mole)

7. Derive an expression for efficiency of Carnot's engine working between two temperaturesT_1 and T_2.

8. Calculate the equilibrium constant at 25°C for the reaction:
$SO_3 \rightleftharpoons S+3/2\ O_2$,the heat of formation of SO_3 at25°C is -94Kcalmol^{-1} and the standard molar entropy changes for S, O_2, SO_3 are 7.6, 49 and 61 cal deg^{-1}mol^{-1}, respectively.

9. What is the change in entropy when N_2 gas at 25°C and 10 atm. pressure is compressed isothermally from 1000 ml to 500 ml and simultaneously cooled to 5 °C . (Cv of N_2=7.6 cal mol^{-1}K^{-1})

10. Calculate the change in the melting point of ice when application of 200 atm pressure . The volume change upon melting is -1.6x10-2 liter/mole, and the enthalpy of fusion is 1440cal/mole.

Examiners: Prof.Dr Y.Temerk   ; Prof.Dr A.El-Awad

Physical Chemistry Examination (C-230) for Second Level Students

Section I

Answer the following questions:

(17Marks)

Q.1) Answer the following statements with **TRUE** (T) or **FALSE** (F), **write** the correct answer in case of statement is false.

a- Plotting log K against 1/T gives a straight line of slope = Δ E.

b- Plotting 1/a-x versus t gives a straight line whose slope is $2K_2$.

c- Hydrolysis of an ester by alkali with concentrations of the base and ester of 0.02mol/liter is an example of first order reaction.

d-The decomposition of sodium hypochlorite in aqueous solution is an example of consecutive reaction.

Q.2) Answer only **Two** from the following:

a-Derive the kinetic equation for the determination the specific rate constant and half live period for the following reaction : $2A \xrightarrow{k_2}$ products

b-Discuss the collision theory of Bimolecular reactions.

c-Discuss the effect of temperature on the reaction velocity.

d-The decomposition of a chemical compound has the rate constant 2.46×10^{-5} at 273°k and 163×10^{-5} at 303° k, find the value of Δ E*. (R=1.978cal/degree/mol)

Section II

(R=1.978cal/degree/mol)   (R=0.082 L.atm./mole/ K)

Answer the following questions:

(33Marks)

1. The latent heat of vaporization of a liquid at 500 K and 1 atm pressure is 10 kcal/mol. What will be the change in internal energy (ΔE) of 3 moles of liquid at the same temperature?

2. Calculate the work done in calories for an expansion of two moles of an ideal gas from a volume of 10 liters to 30 liters at 27°C.

3. The heat of formation of $CO_{(g)}$ and $CO_{2(g)}$ are – 26.4 kcal and – 94.0 kcal mol^{-1}, respectively. Find the heat of combustion of three moles carbon monoxide.

4. Heat of evaporation of benzene is 7350 cal K^{-1} mol^{-1}. Calculate the change in entropy to convert 2 moles gaseous benzene to liquid at 77°C.

5. When 2 moles of water are boiled at 100 °C and converted to vapor at the same temperature. What will be the change in entropy? H_{vap} =9590 cal./mole .

باقى الاسئلة فى خلف الصفحة

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iv. Na_2CO_3 is soluble in water but $CaCO_3$ is not.

v. KO_2 is used in space capsules.

vi. NH_3 is quite poisonous.

b) How you can prepare (Three only) from the following:

H2, NH_3, HI, Na.

c) In each pairs of acids, state which is stronger and why?

HF and HBr, HClO and HIO, H_3PO_3 and H3PO4.

Q2:

a) Choose the correct answer and comment:

1. Which solution of the following reagents gives a precipitate when CO_2 is bubbled into it (KOH, NaOH, $Ba(OH)_2$).

2. Which one of the following species contains an odd number of electrons:

(CO, NH_4^+, NO)

3. In which species does Iodine exhibit its highest oxidation state:

(IO^{4-}, IO^{2-}, I)

4. The species which contains paramagnetic properties is

(NO, O_2, N_2)

b) How does diborane react with ammonia?

c) Give three examples of Freon's and how do they damage the environment?

-- Good Luck--

Examiners:

Prof. Abd-El-Aziz A. Said   Prof. Amna sayed Ahmed

2

Examination of Physical and Inorganic Chemistry for Chem (250) Students

Time :2 h

Date: 11 / 1 / 2025

Assiut University

Faculty of Science
Chemistry Department

<u>Answer the Following Questions:</u>

Section (I)   (25 Marks)

1- <u>Define the following terms:</u>

(i) **Internal energy of system**   (ii) **Enthalpy of a system**   (iii) **Molar heat capacity**

(iv) **Reversible process**   (v) **Cyclic process**   (vi) **Isobari process**

2- (a) Mention three differences between reversible and irreversible processes

(b) What are the criteria for equilibrium of the system.

3- (a) Derive an equation for calculation isothermal expansion work of an ideal

gas.

(b) Find ΔE, q and w if 5 moles of hydrogen at 5 atm pressure expand isothermally at

100°C and reversibly to a pressure of 1 atm.

4- Answer two only from the following:

(a) Prove for adiabatic expansion of ideal gas that C_p is greater than C_v.

(b) Calculate the value of ΔE and ΔH on heating 64g of oxygen from 0°C to 100°C. C_v

and C_p on an average are 5 and 7 cal mol^{-1} deg^{-1}.

(c) Calculate the maximum work done when pressure on 10g of hydrogen is reduced

from 20 to 1 atmosphere at constant temperature of 273K. The gas behaves

ideally. Will there be any change in internal energy? Also calculate q.

Section (II)   (25 Marks)

<u>Answer the following questions:</u>

Q1:

a) Explain the reasons for Five only from the following:

i. Concentrated solution of HF acid is not kept in glass bottle.

ii. CO_2 is an acidic Oxide

iii. Cesium ions conduct electricity more than lithium ions.

6. Choose (T) for true sentence or (F) for false sentence   (16 Marks)

1. $TiCl_4$ and $SnCl_4$ are liquids that fume in moist air.
2. To obtain Ni metal in a high purity the Mond process in which $Ni(CO)_4$ is thermally decomposed is used.
3. $K_2Cr_2O_7$ can not be used as a primary standard in volumetric analysis.
4. ZnS can easily be precipitated when H_2S is passed in an acidic solution of Zn(II) while CdS does not.
5. Iron shows in many of its compounds the maximum group valency.
6. NH_4VO_3 produces V_2O_5 upon heating.
7. Cu^{2+} gives a mixture of I_2 and a CuI precipitate upon reaction with KI.
8. B_2H_6 can be quantitatively prepared by reaction of $NaBH_4$ and BF_3.
9. NO is a diamagnetic compound.
10. Ammonium salts of strong acids are slightly basic.
11. Chromium sulphide can be easily precipitated from H_2S solutions.
12. The first ionization potential of copper is higher than that of the alkali metals.
13. Cr_2O_3 can be prepared by reaction of $K_2Cr_2O_7$ and sulphur.
14. The chemistry of ammonium salts resembles those of K and Rb in solubility and structure.
15. Xenon trioxide is formed upon hydrolysis of XeF_6.
16. Dehydration of metal chlorides can be best done by using thionyl chloride.

Examinar: Prof. Dr. Aref A. M. Aly
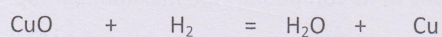
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Final examination of the second level students in "Inorganic chemistry" course, Chem-207 (Industrial program)

Answer the following questions

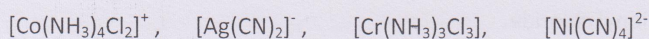1. Suggest a mechanism illustrating the reducing action of hydrogen in the following equation: **(2 Marks)**

   $$CuO \quad + \quad H_2 \quad = \quad H_2O \quad + \quad Cu$$

2. Give one method for the preparation of **TWO** of the following

   (6 Marks)
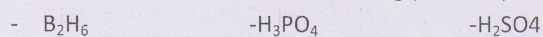
- Industrial preparation of hydrogen.
- Magnesium.
- Metal carbonyls

3. Give reasons for the following **(12 Marks)**

i)   Gallium has the same radius as aluminium.

ii)   Solutions of group I elements in ammonia conduct the electricity.

iii)   Boron trichloride fumes in moist air.

iv) $La(OH)_3$ is more basic than $Lu(OH)_3$.

v) SF_6 is very resistant to chemical attack.

vi)   Lanthanide and actinide contraction.

4. Give the nomenclature of the following compounds: **(8 Mark)**

$[Co(NH_3)_4Cl_2]^+$, $[Ag(CN)_2]^-$, $[Cr(NH_3)_3Cl_3]$, $[Ni(CN)_4]^{2-}$

5. Draw the structure of the following **(6 Marks)**

- B_2H_6 $-H_3PO_4$ $-H_2SO4$

الظهر خلفه

Part 2 (Carbonyl Compounds) ---------------------(25 marks)

Question 3 :

(a) Explain by equation the following reaction and then discuse the mechanism, name the products and give the name of the reaction (Only One) (1 marks)

1- Reaction between two molecules of an ester with each other in the presence of an alkoxide base to form β-keto ester.

2- Reaction between cyclohexanone with excess methanol in presence of acid to form acetal.

(b) Show how the ethyl acetoacetate or diethyl malonate synthesis is used to prepare:

    (i) 2-Benzylbutanoic acid   (ii) 3-Ethyl-2-hexanone   (2 marks)

(c) 2-phenyl-2-butanol can be synthesized by Three different combinations of Grignard reagents and a ketone, show each combination. (3 marks)

(d) Give the reason of the Three Only of the following: (6 marks)

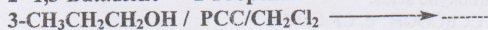1- Carboxylic acids have melting and boiling points than their esters ?
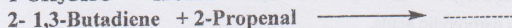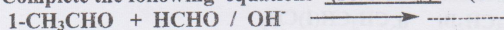
2- 1,3-Dithiane can be used for preparing both RCHO and R_2CO (by equations)

3- Aldehydes are more reactive than ketones toward nuclophile.

4- Triflouro acetic acid is more acidic than acetic acid .

Question 4 :

(a) Complete the following equations (Five Only): (5 marks)

    1- CH_3CHO + HCHO / OH^- ⟶ ------------

    2- 1,3-Butadiene + 2-Propenal ⟶ ------------

    3- $CH_3CH_2CH_2OH$ / PCC/CH_2Cl_2 ⟶ ---------

    4- 2 C_6H_5CHO / NaOH ⟶ -------------

    5- CH ≡ CH + H_2O /Hg^{+2}/H_2SO_4 ⟶ -------------

    6- Cyclohexanone + $HCOOC_2H_5$ /NaOEt /EtOH ⟶ -------------
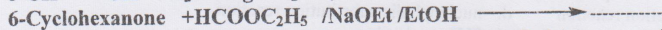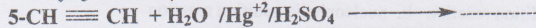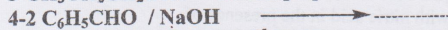
(b) Draw the structure formula of the following (Three Only) (3 marks)

    (i) 2,5-Hexandione   (ii) 3-Isopropylcyclopentanone

    (iii) 2-Chloro-3-methylbutanal   (iv) 3,4-Dimethylpentanoic acid

(c) What is the meaning of the following abbreviations giving their chemical structures

    (i)   DIBAl-H   (ii) PCC   (iii) DMSO   (iv) DMF   (2marks)

(d) Mark (√) or (X) for (Three Only) from the following sentence: (3 mark)

1- When two different aldehyde have α-Hydrogen a crossed aldol reaction is not synthetically useful .

2- Carboxylic acid are less acidic than alcohols because they carboxylic anion is less stable than the alkoxide anion .

3- Mild oxidation of primary and secondary alcohols promoted by oxalyl chloride activation of DMSO.

4- Ozonolysis of 2-Butyne gave ethanoic acid.

Good Luck

ا.د. زينب عبد الحميد حزين

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Final exam in 210 C course for second level's students
==================================

Part 1(Reaction Mechanism): …………………. **(25 marks)**

Answer the following questions:

Question 1: answer five only of the following questions where your answer must be including question a..(20 marks

a. Mention the main types of organic reaction with giving example for each one and showing your answers with equations. ………………………………………………….. ……………… (4 marks)

b. Mention the different intermediates shapes of Carbon in organic reactions with explaining the properties of each intermediate……………………….……………………………..…… (4 marks)

c. Define inductive effect and show its affecting the acidity of carboxylic acids……….... (4 marks)

d. Define hyperconjugation and how affecting the stability of different carbonium ions… (4 marks)

e. What the difference between The E1 and the E1cB reactions…………………………...(4 marks)

f. Draw the reaction coordination profile of tertiary butyl bromide with ethanol and show in the digram the SN1 and E1 reaction………………………………………………………(4 marks)

Question 2. Choose the correct answer for the following questions: ……………... **(5 marks)**

1). Which of the following compounds reacted according SN1 and which reacted according SN2 mechanism in the nucleophelic substitution reactions.

    a. $(CH_3)_3CHI$ **b. CH_3I**   **c. CH_3CH_2Br**   **d. $CH_3CH(I)CH_3$**

2). Which is the most acidic on the following carboxylic acids.

    a. $HCCl_2COOH$ b. $CHCl_2CH_2COOH$ c. CCl_3COOH d. CF_3COOH

3). Nitrobenzene prepared from reaction of benzene with nitric acid in the presence of sulfuric acid via: a. electrophilic addition reaction   b. nucleophelic addition reaction
   c. electrophilic substitution reaction   d. nucleophelic substitution reaction.
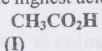
4. which of the following compounds reacts via SN2 mechanism

    a. [benzene ring with CH_2Cl]   b. $CH_2=CH-Cl$ c. CH_3CH_2Cl

5. which of the following is polar protic solvent: a. acetone   b. ethyl acetate   c. methanol

6. Arrange the following compounds according to the descending order of their acidity (the highest acidity first)

    CH_3CO_2H $O_2NCH_2CO_2H$ $HOCH_2CO_2H$ FCH_2CO_2H
    (I)   **(II)**   **(III)**   **(IV)**
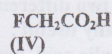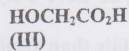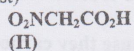
7. Arrange the following compounds according to the descending order of their stability (the highest stability first.
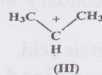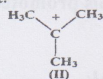
    CH_3^+ [structure with H_3C, CH_3, CH_3]   [structure with H_3C, CH_3, H] $CH_3CH_2^+$
    (I)   **(II)**   **(III)**   **(IV)**

8. Tertiary butyl carbocation was stabilized through: a. hyperconjugation   b. inductive effect
    c. resonance effect

9.The reaction of acetone with HCN to give acetone cyanohydrin($CH_3C(OH)(CN)CH_3$ was considered as: a. Electrophilic addition reaction.   b.Nucleophilic addition reaction
    c. Free radical addition reaction

10. The order of stability of carbanion: $1°>2°>3°$ b) $2°>3°>1°$ c) $3°>2°>1°$

Good Luck
ا.د.عادل محمد كمال الدين

c) How many milliliters of 0.5 M NaOH should be added to 10.0 g tris hydrochloride (pKa = 8.075 , M.wt = 157.596) to give a pH of 7.60 in a final volume of 250 mL?.

d) A solution containing calcium was analyzed with the 6 results listed below. Use the Q test to determine the results of trial 5 can be rejected? Ca^{2+} concentration (μg/L): 2.83 , 2.54 , 2.91 , 2.75 , 3.03 and 2.72 ($Q_{tobulated} = 0.56$).

5. a) Distinguish between systematic error and random error.

   b) Define the following:

   i) Gravimetric factor.

   ii) Ionic strength.

   c) Calculate the pH of a 0.01 M NaCN solution.

   $$(Ka_{(HCN)} = 7.2 \times 10^{-10} , K_w = 1 \times 10^{-14})$$

   d) The carbohydrate content of glycoprotein (a protein with sugars attached to it) is determined to be 12.6 , 11.9 , 13.0 , 12.7 and 12.5 g of carbohydrate / 100 g of protein in replicate analysis. Find the 50% and 90% confidence intervals for the carbohydrate, (t at 50% = 0.741, t at 90% = 2.132).

(At.wt's: N = 14.007 , O = 15.999 , Cl = 35.453 , Ag = 107.870 , I = 126.90 , Ba = 137.34 , Pb = 207.19).

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Good Luck

Examiners: **Prof. Dr. Hassan Sedaira**
               Prof. Dr. Elham Y. Hashem

Final Examination of Introductory Quantitative Analysis for 2nd Level Students (C-240)

Answer Four Questions Only: (50 Mark)

1. a) Explain the Volhard titration of iodide.

   b) Write briefly on "metal ion sensitive indicators".

   c) Calculate the pAg and pCl in a solution prepared by mixing equal volumes of 0.1 M AgNO$_3$ and 0.1 M NaCl.
   $$Ksp\ (AgCl) = 1.2 \times 10^{-10}$$

   d) Chloride in a brine solution is determined by Volhard method. A 10 mL aliquot of the solution is treated with 15 mL of standard 0.1182 M AgNO$_3$ solution. The excess silver is titrated with standard 0.101 M KSCN solution, requiring 2.38 mL to reach the red Fe(SCN)$^{2+}$ end point. Calculate the concentration of chloride in the brine solution, in g/L.

2. a) Define:
      i) Molality.
      ii) Chelating agents.

   b) PO$_4^{3-}$ can be determined using EDTA titration. Explain how?

   c) Express the titer of 0.05 M EDTA in mg BaO/mL.

   d) Calculate the potential of a solution prepared by mixing 10 ml 0.1 M Ce^{4+} and 10 ml 0.2 M Fe^{2+} (relative to NHE)
   $$(E^{\circ}\ Fe^{3+},\ Fe^{2+} = 0.77\ V,\ E^{\circ}\ Ce^{4+},\ Ce^{3+} = 1.61\ V)$$

3. a) Explain Liebig method for CN$^-$ determination.

   b) What is the solubility of pbI$_2$ in g/L, if the solubility product is 7.1 × 10^{-9}?

   c) Distinguish between co–precipitation and post–precipitation.

   d) A 0.7011 g of an impure chloride containing sample was treated with excess AgNO$_3$, where 0.9805 g of AgCl was obtained. What is the mass percentage of chloride in the sample?

4. a) Distinguish between accuracy and precision.

   b) Explain the principles of the theory of neutralization indicators.

انظر خلفه

6. Choose (T) for true sentence or (F) for false sentence (16 Marks)

1. $TiCl_4$ and $SnCl_4$ are liquids that fume in moist air.
2. To obtain Ni metal in a high purity the Mond process in which $Ni(CO)_4$ is thermally decomposed is used.
3. $K_2Cr_2O_7$ can not be used as a primary standard in volumetric analysis.
4. ZnS can easily be precipitated when H_2S is passed in an acidic solution of Zn(II) while CdS does not.
5. Iron shows in many of its compounds the maximum group valency.
6. NH_4VO_3 produces V_2O_5 upon heating.
7. Cu^{2+} gives a mixture of I_2 and a CuI precipitate upon reaction with KI.
8. B_2H_6 can be quantitatively prepared by reaction of $NaBH_4$ and BF_3. .
9. NO is a diamagnetic compound.
10. Ammonium salts of strong acids are slightly basic.
11. Chromium sulphide can be easily precipitated from H_2S solutions.
12. The first ionization potential of copper is higher than that of the alkali metals.
13. Cr_2O_3 can be prepared by reaction of $K_2Cr_2O_7$ and sulphur.
14. The chemistry of ammonium salts resembles those of K and Rb in solubility and structure.
15. Xenon trioxide is formed upon hydrolysis of XeF_6.
16. Dehydration of metal chlorides can be best done by using thionyl chloride.

Examinar: Prof. Dr. Aref A. M. Aly
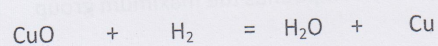
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Final examination of the second level students in "Inorganic chemistry" course, Chem-203 Nanotech program.

Answer the following questions

1. Suggest a mechanism illustrating the reducing action of hydrogen in the following equation: (**2 Marks**)
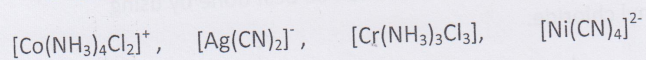
   $$CuO \quad + \quad H_2 \quad = \quad H_2O \quad + \quad Cu$$

2. Give one method for the preparation of **TWO** of the following
   (**6 Marks**)

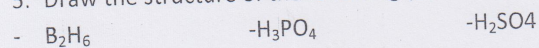   - Industrial preparation of hydrogen.
   - Magnesium.
   - Metal carbonyls

3. Give reasons for the following (**12 Marks**)
   i) Gallium has the same radius as aluminium.
   ii) Solutions of group I elements in ammonia conduct the electricity.
   iii) Boron trichloride fumes in moist air.
   iv) $La(OH)_3$ is more basic than $Lu(OH)_3$.
   v) SF_6 is very resistant to chemical attack.
   vi) Lanthanide and actinide contraction.

4. Give the nomenclature of the following compounds: (**8 Mark**)

   $[Co(NH_3)_4Cl_2]^+$, $[Ag(CN)_2]^-$, $[Cr(NH_3)_3Cl_3]$, $[Ni(CN)_4]^{2-}$

5. Draw the structure of the following (**6 Marks**)
   - B_2H_6 -H_3PO_4 -H_2SO4

الفرقة

6. Choose (T) for true sentence or (F) for false sentence (16 Marks)

1. $TiCl_4$ and $SnCl_4$ are liquids that fume in moist air.
2. To obtain Ni metal in a high purity the Mond process in which $Ni(CO)_4$ is thermally decomposed is used.
3. $K_2Cr_2O_7$ can not be used as a primary standard in volumetric analysis.
4. ZnS can easily be precipitated when H_2S is passed in an acidic solution of Zn(II) while CdS does not.
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9. NO is a diamagnetic compound.
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12. The first ionization potential of copper is higher than that of the alkali metals.
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Examinar: Prof. Dr. Aref A. M. Aly
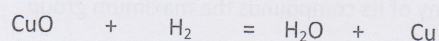
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Final examination of the second level students in "Inorganic chemistry" course,
Chem-203 nanotech program

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Answer the following questions

1. Suggest a mechanism illustrating the reducing action of hydrogen in the following equation: (**2 Marks**)
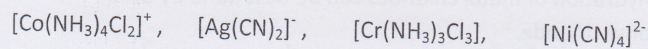
   CuO + H_2 = H_2O + Cu

2. Give one method for the preparation of **TWO** of the following
   (**6 Marks**)
- Industrial preparation of hydrogen.
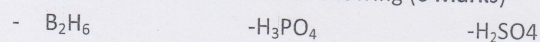- Magnesium.
- Metal carbonyls

3. Give reasons for the following (**12 Marks**)
i) Gallium has the same radius as aluminium.
ii) Solutions of group I elements in ammonia conduct the electricity.
iii) Boron trichloride fumes in moist air.
iv) $La(OH)_3$ is more basic than $Lu(OH)_3$.
v) SF_6 is very resistant to chemical attack.
vi) Lanthanide and actinide contraction.

4. Give the nomenclature of the following compounds: (**8 Mark**)

$[Co(NH_3)_4Cl_2]^+$, $[Ag(CN)_2]^-$, $[Cr(NH_3)_3Cl_3]$, $[Ni(CN)_4]^{2-}$

5. Draw the structure of the following (**6 Marks**)
- B_2H_6 $-H_3PO_4$ $-H_2SO4$

الامتحان

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Final examination in organic chemistry 211C for non chemistry students(chemistry Of aliphatic compounds and some selected aromatic compounds)

Answer the following questions   **50marks**

Question One. Answer five only of the following   **20 marks**

a-Complete the following sequence of reactions

$BrCH_2CH(Br)COOH$+Zn/ethanol/heat----? +H_2/Ni ------?+$LiAlH_4$/ether--------?

b-Prepare 3-methylcyclohexene via Diels-Alder reaction

c-Predict the products of the following reactions

$CN(CH_2)_3CN$ +Con.HCl/heat--------? +Ac_2O/heat------------?

d-Convert cyclohexanone to cyclopentyl bromide

e-The synthesis of 3-methylbutanoic acid from malonic ester(DEM)

f-Complete the following reaction and propose a mechanism

Ph_3CCl +MeOH/heat------------- ?

Question Two Answer five only of the following------------------------------- **20 marks**

a-Complete the following reaction and name the products

2-chloropentane +alc.NaOH/heat------------------ ?

b-Reaction of benzene with Br_2/ Fe and propose a mechanism

c-Convert benzene to m-dibromobenzene

d-Assign the products of the following reactions

p-chloroaniline +$NaNO_2$/HCl------? +HBF_4----------? +heat----------?

e-Complete the following reaction and name the products

Ethylbenzene + Cl_2/sun light----------------?

f-Reaction of aniline with following reagents i-Excess Br_2/ H_2O ii-HNO_3/H_2SO4

Question Three Choose the correct answer a,b.c or.d -------------------------------**10 marks**

1-Which if the following when reacts with 2Na/heat gives diallyl

a-3-chloropropene b-2-chloropropane c-1-chloropropane d-1-chlorobutane

2-Which of the following classified isolated diene

a-1,5-hexadiene ,b-1,3-butadiene c-2-methyl-1,3-butadiene

3-Which of the following acids , when reacts with HI/P yields succinic acid

a-malic acid b-maleic acid   c-oxalic acid   d-fumaric acid

4-which of the following halides is the most reactive in SN^2 reactions

a-$MeCH_2Br$, b-MeBr   c-MeI   d-MeCl

5-The best solvent of the following for SN1 reactions is

a-DMF   b-DMSO   c-EtOH   d-THF

6-Which of the following acids classified saturated dicarboxylic acid

a-Benzoic acid, b-butanoic acid , c- Prop-2-enoic acid d-adipic acid

7-Which if the following groups classified as strongly activating group

    a- OMe, b- NHCOMe, c-COOH   d-none of these

8-The most reactive of the following when reacts with NaOH is

a-m-chloronitrobenzene ,b-o-chloronitrobenzene, p-chloronitrobenzene

9-Which of the following does not reacts under friedel -crafts reactions

a-chlorobenzene, b-bromobenzene,   c-aniline

10-The less basic of the following is

a-o-nitroaniline, b-p-nitroaniline, c-aniline   d-p-chloroaniline

GOOd LUCk

Prof.DrSh.M.Radwan

Final Examination for 2nd level Students (C-232)

First semester

Section II (Phase Rule)

Answer *All* the following questions: -   (17 Marks)

A) Explain briefly only two from the following: (10 marks)

   i- Lead – Silver system and its uses to extract silver from argentiferrous lead ore.

   ii- Two component system *A* and *B* forming compound *AB* with congruent melting point.

   iii- The ternary system NH_4NO_3-$AgNO_3$-H_2O at 30 ^0C, where the Binary compound NH_4NO_3-$AgNO_3$ is formed.

B) Compare between the phase diagram of water system with that of sulphur system   (4 marks)

C) Complete each of the following: (3 marks)

i- The peritectic reaction can be written as ....

ii- The addition of salt to ice results in considerable lowering of its temperature if there no external source of heat, owing to ....

iii- The number of univariant and bivariant areas existing in Aniline- Phenol- Water phase diagram system at lower temperature are .... and .... respectively.

Good Luck

Prof. Maher M. A. Hamed

Thermodynamics and kinetics Examination for Nano Technology Students Program (202 Chem.)

Answer the following:

1- Discuss and derive the kinetic equation for first order reaction.

2- Discuss two methods only for calculation of half-life time.

3- Derive an expression for the efficiency of heat engine.

4- Discuss the relation between equilibrium constant and temperature.

5- Explain the relation between entropy and temperature.

Thank You   **Prof. Rabei Gabr**

c) All aromatic compounds

d) Only naturally occurring aromatic compounds

6. **When benzene undergoes its typical reactions it behaves as**

    a) An electron donor

    b) An electron acceptor

    c) An electrophile

    d) None of the above is correct

7. **When considering electrophilic aromatic substitution reactions electron donating substituents (e.g. methoxy) are described as:**

    a. *Ortho/para* directing and activating

    b. *Ortho/para* directing and deactivating

    c. *Meta* directing and activating

    d. *Meta* directing and deactivating

8. **The reaction of benzene with MeCl under Friedel-Crafts conditions leads to which of the following:**

    a) A mixture of methylbenzene, 1,2-dimethylbenzene and 1,4-dimethylbenzene

    b) 1,2-dimethylbenzene and 1,4-dimethylbenzene as the only products

    c) Methylbenzene (toluene) as the only products

    d) Methylbenzene and1,2-dimethylbenzene as the only products .

9. **Find the reactants other than $AlCl_3$ in Friedel-Craft's alkylation**

    a) $C_6H_6 + CH_4$

    b) $C_6H_6 + NH_3$

    c) $C_6H_6 + CH_3Cl$

    d) $C_6H_6 + CH_3COCl$

10. **What is the electrophile in the electrophilic substitution reaction of benzene using oleum and conc. H_2SO_4?**

    a) SO_3H

    b) NO_3

    c) NO_2^+

    d) NO^+

11. **Which of the following is the most activating in electrophilic aromatic substitution?**

    a) $-NO_2$

    b) $-NHCOCH_3$

    c) $-CN$

    d) $-NH_2$

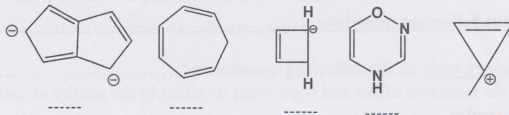12. **Which is the most likely major product in the following react**
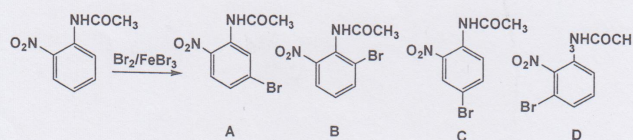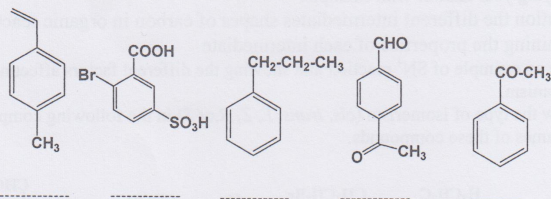
Part II. Aromatic Section: (25 Marks)
Answer the following questions
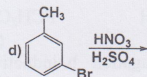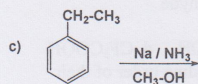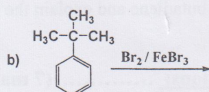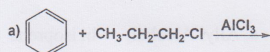1. Describe the following as aromatic, anti-aromatic or non-aromatic (5 Marks)

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2. What is the correct name for the following compounds? (5 Marks)

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3. Complete the following equations: (5 Marks)

a) benzene + $CH_3-CH_2-CH_2-Cl$ $\xrightarrow{AlCl_3}$

b) $\xrightarrow{Br_2 / FeBr_3}$

c) $\xrightarrow[CH_3-OH]{Na / NH_3}$

d) $\xrightarrow[H_2SO_4]{HNO_3}$

Choice the correct answer from the following questions: (10 Marks)
4. Which of (a)-(d) does not give isopropyl benzene as a product upon reaction with benzene?

a) $(CH_3)_2CHCl/AlCl_3$

b) $CH_3CH_2CH_2Cl/AlCl_3$

c) $CH_3CH=CH_2/H_3PO_4$

d) $(CH_3)_2C=CH_2/H_3PO_4$

5. The Huckel's 4n+2 rule on aromaticity is applicable to

a) All hydrocarbons

b) All aromatic hydrocarbons

====================================

Answer the following questions ………………………………………………..(25 marks)

1. Answer <u>six only</u> of the following questions: ……………………………. **(18 marks)**

1). Define the inductive effect and show what its effect in the acidity of carboxylic acid with giving examples.

2. Show the mechanism of addition of bromine to 1,3-butadiene to give 1,4- dibromo-2-butene.

3. Define the hyperconjugation and its effect on the stability of different carbonium ion with clarifying your answer with example.

4. Mention the different intermediates shapes of carbon in organic reactions with explaining the properties of each intermediate

5. Give an example of SN^1 reaction and showing the different factors affecting the SN^1 reaction mechanism.

6. Show the type of isomerism (*cis, trans, E, Z, R*,or *S*) in the following compounds and give the names of these compounds.
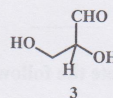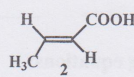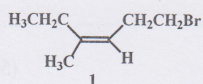
7. Show by equations one method for preparation of : a. Allyl Alcohol;   b. isoprene   c. hexa-1,5-diene

8. What is the name of the reaction of acraldehyde with 1, 3-butadiene and explain the answer by equation.

2. Choose the correct answer for the following questions: …………. **(7 marks)**

1. Vinyl Chloride when hydrolyzed with aqueous sodium hydroxide gave:
    a. Vinyl alcohol   b. acetaldehyde   c. formaldehyde

2. Which is the most acidic on the following carboxylic acids.
    a. $HCCl_2COOH$ b. $CHCl_2CH_2COOH$ c. CCl_3COOH d. CF_3COOH

3. Arrange the following compounds according to the descending order of their acidity (the highest acidity first)
    CH_3CO_2H $O_2NCH_2CO_2H$ $HOCH_2CO_2H$ FCH_2CO_2H
       (I)   (II)   (III)   (IV)

4. Tertiary butyl carbocation was stabilized through: a. hyperconjugation   b. inductive effect   c. resonance effect

5. Which of the following compound is classified as allylic halide:
    a. $PhCH=CBrCH_3$,   b. $PhCH=CH-CH_2Br$,   c. $PhCBr=CHCH_3$

6. Which of the following compounds reacted according SN^1 and which reacted according SN^2 mechanism in the nucleophilic substitution reactions.

    a. $(CH_3)_3CHI$ b. CH_3I c. CH_3CH_2Br d. $CH_3CH(I)CH_3$

7. The order of stability of carbanion: a) $1°>2°>3°$ b) $2°>3°>1°$ c) $3°>2°>1°$

بقية الأسئلة خلف الصفحة

19. Which of the following react with water to form an acid:
    a)sulpher   b) calcium   c)sodium   d) potasium
20. Which one of the following sodium compounds is used for softening hard water?
    a)Na_2CO_3 b) $NaHCO_3$ c)$NaCl$ d) Na_2SO_4
21. Diamond and graphite are both forms of the element:
    a)Mg   b)C   c)Si   d)S
22. Which of the following elements are included in the same group in the periodic table:
    a)Ne, Ar, Na, Mg   b) He, Li, Na, Mg   c) H, Li, Na, k   d) Ne, Ar, Na, Ca
23. Which of the following elements has zero valiancy:
    a) Li   b) Be   c) He   d)F
24. The nitrogen form gas ammonia using hybrid orbitals:
    a)SP   b)SP^2 c)SP^3 d)S^2P
25. The oxidation number of nitrogen atoms in NH_4NO_3 are:
    a) -3, +3   b) -5, +3   c) -3, +5   d) -3, -3
26. The major mineral present in phosphate rock is
    a)$Ca_3(PO_4)_2$ b)Na_2HPO_4 c)$Ca_{10}(PO_4)_6F_2$ d)NaH_2PO_4
27. The carbon form nanotube using hybrid orbitals
    a)SP   b)SP^2 c)SP^3 d)S^2P
28. Which of the following has lowest electron affinity?
    a)F   b) Ne   c) N   d) C
29. Which element of the following has lowest electron nuclear charge?
    a)B   b) Be   c) Ca   d) Mg
30. Which oxide of the following solid?
    a)H_2O b)CO_2 c)SeO_2 d)SO_2

Q2. Make true (T) or false (F):

31. SO_3 is a basic oxide. ( )
32. PCl_5 is not known but NCl_5 is known. ( )
33. NH_3 is quite poisonous gas. ( )
34. $TlCl_3$ used as reducing agent. ( )
35. H_3PO_4 used as reducing agent. ( )
36. Oxygen is never more than divalent. ( )
37. In pure water beryllium salts are basic ( )
38. SO_2 used as oxidizing and reducing agent. ( )
39. D_2 reacts over 13 times faster with Cl_2 than H_2. ( )
40. Deuterium has one proton and two neutrons. ( )
41. All gr(II) elements have an outer electronic structure nS^1nP^1 ( )
42. All hydrides of gr(VI) elements have hydrogen bond ( )
43. All hydrides of gr(VI) are all poisonous and pungent gases( )
44. The solution of HF is called corrosive. ( )
45. The solution of HI are called corrosive ( )
46. The metals are strong reducing agents ( )
47. The inert pair effect increases in group 4 from B to Tl ( )
48. The inert pair effect decreases in group 4 from C to Pb ( )
49. The stability of hydrides decrease from NH_3 to BiH_3 ( )
50. The ability to act as electron donors decreases from NH_3 to BiH_3 ( )

Good luck

Final-Term Examination (Acad. Year 2024/2025)
Subject : Course C-220 (Inorganic Chemistry 1)

Q1. Choose the Correct Answer:

1. Which of the following oxide is most basic:
   a) CO_2 b) Na_2O c) BeO d) NO_2

2. Gr (I) metals react with water liberating
   a) N_2 b) O_2 c) H_2 d) Cl_2

3. Very pure hydrogen gas is made by electrolysis of water or solutions of:
   a) $NaOH$ b) $Ca(OH)_2$ c)$Al(OH)_3$ d) NH_4OH

4. The compound which contains a high oxidation state of sulfur is:
   a) S b) SO_2 c) SO_2 d) SO_4^{-2}

5. Which one of the following species contains an odd number of electrons:
   a) CO b) NH_4^+ c) NO d) N_2

6. The species which contains paramagnetic is:
   a) N_2O b) CO c) N_2 d) H_2

7. The compound which contains hydrogen bond:
   a) CH_4 b) H_2S c) H_2O d)HCl

8. An element X combines with chloride to form XCl_4. To which group does it belong
   a)gr(I)   b)gr(II)   c)gr(III)   d) gr(IV)

9. Which of the following oxides, the most acidic:
   a) B_2O_3 b) BeO c) P_2O_3 d) Na_2O

10 .Temporary hardness of water is due to one salt of calcium and magnesium:·
   a) bicarbonate   b) carbonate   c) chloride   d)sulphate

11. HF is made by heating CaF_2 with concentrate:
   a) H_2SO_4 b) HCl c) H_3PO_4 d)HNO_3

12. An element X from gr (III) reacts with Y from gr (VI) to form a compound:
   a) X_2Y b) X_2Y_3 c) XY_2 d) X_3Y_2

13. Which of the following forms basic oxide
   a) K b) C c) N d)S

14. HBr acid is prepared by reaction of NaBr with:
   a)H_2SO_4 b)H_3PO_4 c)HNO_3 d)HCl

15. The greatest acid strength in water is:
   a)$HClO_2$ b) $HClO$ c) $HClO_4$ d)$HClO_3$

16. The greatest acid strength in water is:
   a)HCl b)HBr c)HF d)HI

17. A mixture of oxygen and......is used for respiration in deep sea diving's
   a) H_2 b) CO_2 c) He d) N_2

18. Which of the following react with water to form a base:
   a)chlorine   b) calcium   c)nitrogen   d) carbon

See Next Page

Question III: (10 Marks)

1. In the back titration of Cl^- ion using Volhard's method, how can you overcome the problems resulting from the presence of AgCl?

2. **Give reason for:**
   a. Mohr's method should be occurred in pH range (6 – 10)?
   b. Addition of nitric acid in Volhard's method?

3. In the titration of 100 mL NaCl (0.1 M) against $AgNO_3$ (0.1 M), calculate the change in chloride ion at the following points: (K_{sp} for AgCl is (1.8×10^{-10})
   a. The beginning of the titration.
   b. After the addition of 20 mL of $AgNO_3$ solution.
   c. At the end point.
   d. After the addition of 110 mL of $AgNO_3$ solution.

Question IV: (10 Marks)

1. Find the pH of the solution obtained when 1.00 mol NH_3 and 0.40 mol NH_4Cl are mixed to give 1 L of solution.   (K_b NH_3 = 1.8×10^{-5}).

2. Calculate the normality of $KMnO_4$ solution resulting from dissolving 0.2 g of $KMnO_4$ in 100 ml water.   (At.Wt of O=16, C=12, K=39, Mn=55)

3. In the titration of 50 mL $FeSO_4$ (0.05M) against Ce $(SO_4)_2$ (0.05M), $E^°(Fe^{3+}/Fe^{2+})$ = 0.767 V, $E^°(Ce^{4+}/Ce^{3+})$ = 1.70 V. Calculate the potential (E) after the addition of: 10 mL, 20 mL, 50 mL and 60 mL of $Ce(SO_4)_2$ solution.

Good Luck

Dr. Doaa Abdel-rahman Mohamed

Answer the following questions (50 Marks)

Question I: Complete the following sentences (20 Marks)

1. A strong acid is ……………… when dissolved in water, while a weak base is ………. when dissolved in water.

2. CH_3COONa derived from ……………… acid and ……………… base.

3. The resulting solution from hydrolysis of NH_4Cl is ………………

4. ………… is formed when a base gains a hydrogen ion, while ………… is formed when an acid loses a hydrogen ion.

5. ……………... resists changes in pH when acids or bases are added, and it consists of ……………. **and** …………….

6. …………… depends on formation of a soluble, colored complex at the end point, while …………… depends on adsorption of a colored indicator on the precipitate.

7. The concentrations of ……….. **and** …. ….. ions cannot be determined successfully using Mohr method.

8. An atom is oxidized if its oxidation number ………. and then becomes ……….

9. An example of self-indicator is …………, while …….. can act as an external indicator.

10. Starch can be used as an indicator in ………. **and** ………… titrations.

Question II: (10 Marks)

1. What is the pH of formic acid (0.1 M) solution? (K_a of formic acid is 1.77×10^{-4}).

2. Calculate the pH of 0.04 M NaOH.

3. Calculate the pH of a solution that is both 1M CH_3COOH and 1M CH_3COONa? ($K_a=1.8 \times 10^{-5}$)

4. Calculate the pH of 0.001M H_2SO_4 solution?   ***Turn Over the page***

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