



مفردات الامتحان التنافسي لطلبة الدكتوراه
للعام الدراسي 2023-2024

Physical Chemistry:

Thermodynamic:

1. Heat Capacity p.(63), Thermal Energy p.(63), Reversible processes p.(64), Irreversible processes p.(66), Spontaneous phase transitions p.(68), Reversible isothermal expansion of an ideal gas p.(75), Reversible adiabatic expansion of an ideal gas p.(75). [Ref. (1)]
2. The first law of thermodynamic p.(56), the second law of thermodynamic p(101), Enthalpy, Helmholtz energy and Gibbs energy p.(137), Equilibrium conditions in multicomponent systems p.(362). [Ref. (1)]

Kinetic Chemistry and Electrochemistry:

1. The Arrhenius parameters p.(807), Consecutive elementary reactions p.(811-816), the activity energy of a composite reaction p.(822-823), Chain reaction p.(830-835), Collision theory p.(870-876), The Eyring equation p.(880-885). [Ref. (2)]
2. Galvanic cell p.(443), Electrode reaction and the cell reaction p.(445), Faraday constant p.(446), Cell potential p.(447), The Nernst equation p.(456), Standard electrode potentials p.(458). [Ref. (1)]

Quantum Chemistry and Molecular Spectroscopy:

1. The origins quantum mechanics p.(243-254), the Schrödinger equation p.(254-256), The Born interpretation of the wavefunction p.(256-260), Translation motion p.(277-288), Vibrational motion p.(290-297), Rotational motion p.(297-306). [Ref. (2)]
2. Magnetic resonance spectroscopy p.(516-517), The NMR spectrometer p.(517-533), Spin relaxation p.(536-541), Two-dimensional NMR p.(544-548), The EPR spectrometer p.(549-554). [Ref. (2)]
3. Mass spectroscopy (MS) p.(2-38), Infrared spectroscopy (IR) p.(71-110). [Ref. (3)]

References:

1. Howard DeVoe, *Thermodynamics and Chemistry*, second edition (2010).
2. Peter Atkins and Julio de Paula, *Physical Chemistry*, eighth edition (2006).
3. R.M. Silverstein F.X. Webster, *Spectrometric Identification of Organic Compounds*, sixth edition, (2003).

Inorganic Chemistry:

- 1- Coordination chemistry and isomers
- 2- Coordination complexes
- 3- Isomers
- 4- Stability of complexes
- 5- Magnetic properties of complexes
- 6- Electronic transitions of complexes
- 7- Valence bond theory
- 8- Crystal field theory
- 9- Molecular orbital theory
- 10 – Organometallic chemistry of transition elements
- 11- 18- electron rule
- 12- Stability of organometallic compounds
- 13- Alkenes organometallic
- 14- Alkyl and aryl organometallic

15- Metallocenes

16- Bonding in organometallic compounds

References:

- 1- الكيمياء العضوية الفلزية تأليف طلال العلاف
- 2- الكيمياء اللاعضوية تأليف د. احسان عبد الغني
- 3- الكيمياء اللاعضوية تأليف د. مهدي ناجي الزكوم

Organic Chemistry:

- 1- Three, four, five and six membered rings name, classification, preparation and special topic reaction.
- 2- Heterocyclic ring fused with benzene ring like indole, quinoline,etc.
- 3- Stereochemistry
 - I. Inversion (SN^2)
 - II. Retention (SN^i)
 - III. Racemization (SN^1)
 - IV. Elimination reactions ($E1$, $E2$, $E1_{CB}$)
Conclude the effect of base, nucleophile solvent, leaving group, structures and type of solvents.

References:

- 1- Organic Chemistry, Morrison and Boyd's, 7th ed. (2020).
- 2- Heterocyclic Chemistry at a glance, John A. Joule, Keith Mills, 2nd ed. (2022).

Analytical Chemistry:

متوفر على النت و توجد نسخة الكترونية الفصول المطلوبة هي: الفصل الخامس من ص 141 الى ص 188

Stoichiometric calculations: the workhorse of the analyst

المواضيع الاساسية في الفصل

Review of the Fundamentals.

How do we express concentrations of solutions?

Expression of analytical results- so many ways.

Volumetric analysis: how do we make stoichiometric calculations?

Volumetric calculation-let`s use molarity.

Normality- A different way to do volumetric calculations.

Titer-how to make rapid routine calculations.

Weight relationships- you need these for gravimetric calculations.

الفصل الثامن من ص 266 الى ص 293

Acid-base titration

المواضيع الاساسية في الفصل

Strong acid versus strong base- the easy titrations.

Detection of the end point: Indicators.

Standard acid and base solutions.

Weak acid versus strong base-A bit less straightforward.

Weak base versus strong acid.

Titration of sodium carbonate- A diprotic base.

Titration of polyprotic acids.

Mixtures of acids or bases.

Titration of Amino Acids- they are acids and bases.

Kjeldahl analysis: protein determination.

الفصل التاسع من ص 294 الى ص 312

Complexometric reactions and titrations

Complexes and formation constant- How stable are complexes?

Chelates: EDTA- the ultimate titrating agent for metals.

Metal-EDTA titration curves.

Detection of the end point: indicators- they are chelating agents.

Other uses of complexes.

Fraction of dissociating species in polyligand complexes: β values- how much of each species?

Industrial Chemistry:

- 1- Ionic Polymerization.
- 2- Coordination polymerization.
- 3- Ring-opening polymerization.
- 4- Copolymerization.
- 5- Additives of polymers.

References:

- 1- Principles of Polymerization, George Odian, John Wiley & Sons, Inc., 4thEd. (2004).
- 2- Introduction to Polymer Chemistry, Charles E. Carraher, Jr., Taylor & Francis Group, 4th Ed., (2017).
- 3- Introduction to Polymers, Robert J. Young and Peter A. Lovell, Taylor & Francis Group, 3rd Ed., (2011).

Biochemistry:

- 1- Carbohydrates metabolism
 - Glucose metabolism
 - glycogen metabolism
 - Disaccharides metabolism
- 2- Amino acids metabolism
 - Their chemical structures, classification and chemical reactions.
 - Chemical reactions of amino acids catabolism
- 3- Active chemical compounds
 - Secondary metabolism concept,
 - Classification of secondary active compounds
 - Biochemical activity of secondary metabolites.

المصادر:

1- الكيمياء الحياتية – أ.د. عباس دواس مطر (2016) , جامعة البصرة.

2- Text book biochemistry by T.M. Devlin. (2011).