

University of Baghdad
College of Science
Department of Chemistry
Date: 2017-2018



Graduate Studies Ph.D
Competitive Exam.
Subject: physical chem..
Time: 2 hrs

دكتوراه / فيزيائية

Explain the following using suitable equations and relations:

- 1- Joblonski diagram in photo chemistry.
- 2- The composition of Saturated Calomel Electrode, is this electrode is a reverse electrode for Hg or Cl, ions?
- 3- Lambert –beers law in UV-spectroscopy application.
- 4- The effect of catalysis on rate of reaction?
- 5- Conductivity titration curve, when 0.1N HCl added to 0.1N NaOH solution.
- 6- Dalton`s law for a mixture of gases.
- 7- How Arrhenius equation reflect the temperature dependence on a reaction rate.
- 8- The energy spacing between vibrational energy levels for one mole of hydrogen.
- 9- The units of rate constant for first, second and zero orders reaction, what is the n-order rate equation and 1st –order rate equation.
- 10- The different in the thermodynamic parameters of mixing between ideal and non-ideal solutions, which one have zero enthalpy change (two component system).
- 11- Quantum yield, if its value =1000, what mechanism can be suggested.
- 12- The relation between Michael's constant and equilibrium constant

Best wishes

Ph.D. Competative examination (Analytical Chemistry)

NOTE : (10marks) for each question



Q1: Calculate the cell potential and ΔG° for : (tick the correct answer):

Pt / Fe⁺², Fe⁺³ // Ce⁺⁴, Ce⁺³ / Pt $E^\circ_{Fe^{+3}, Fe^{+2}} = 0.771$ Volt and $E^\circ_{Ce^{+4}, Ce^{+3}} = 1.61$ Volt

- a) -90.96 b) -80.96 c) 95.96 d) 85.96 e) 80.96 f) 90.96 g) -95.96

Q2: Four steps are involved in laser production; numerate them:

1----- . 2-----

3----- . 4-----

Q3: The normal operating frequency in a microwave oven is ----- MHz, which correspond to the wave length of ----- .

Q4: 1) TG in Thermal analysis is the plot of; (tick the correct answer):

- 1-Variation of weight versus variation of concentration ().
- 2-Variation of weight versus variation of time ().
- 3-Variation of weight versus variation of temperature / distance ().
- 4-Variation of weight versus variation of temperature/time ().
- 5-Variation of gained or lost energy versus variation of temperature/time ()

2) - In Thermal analysis , DTA, recorded (Choose the correct answer)

- a- Any change in weight between sample and reference
- b- Any difference in temperature between sample and reference
- c- Any same in temperature between sample and reference
- d- Any loss or added in energy until sample and reference are different in temperature
- e- Any same loss or added in energy until sample and reference are different in temperature

Q5: Interferometer in FTIR spectrophotometer is consist of :

Q6- Equation of N , is equal ($N = 4 t_r^2 \sqrt{w^2}$) when depend on: (tick the correct answer):

- * 4.4% from peak height * 50 % from peak height * 13.5% from peak height
* 60.6 % from peak height * 10 % from peak height * 80 % from peak height

Q7- A- The conductivity for 0.01M KCL solution if the resistance for KCL solution is

2171 ohm and for distilled water is 426 K ohm is(tick the correct answer):

- a- 3.58×10^{-4} b- 1.58×10^{-4} c- 4.58×10^{-4} d- 5.58×10^{-4} e- 1.58×10^{-5} f- 2.58×10^{-6}

B- Draw Potentiometric titration curve for determination of Silver ion .

Q8: Auger Emission spectroscopy occurs

While continuous (bremsstrahlung) x-ray occurs.....

Q9 :A)Karl Fischer titration used for determination of(tick the correct answer):

- a- carboxylic acid b- Ketones c- Hydroxyl compounds d- Aldehydes
e- Amino acid f- Diazonium salts g- Epoxide compounds h - H₂O
m- NaOH n- HCL

B) Mie scattering is occurring when

Q10: In Jablonski diagram , the internal conversion occurs

While the vibration relaxation occurs

and external conversion occurs

organic chemistry:



Q1 Answer True or False

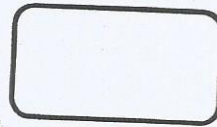
- 1) In electrophilic substitution reaction pyridine is more reactive than benzene
- 2) The S_N1 mechanism occurs in one step with inversion.
- 3) Reaction of ketone with Grignard reagent gives tertiary alcohol.
- 4) Halohydrins forms when halogen added to alkene in presence of peroxide.
- 5) Hofmann synthesis is between amide and hypobromite.
- 6) In alkenes the Z isomer the higher priority groups are in the opposite side.
- 7) In $^1\text{H-NMR}$ spectroscopy the phenolic hydrogen appeared at low field region.
- 8) The racemic mixture is an equal parts of enantiomers.
- 9) Quinone react as dienophile in Diels-Alder reaction.
- 10) Pyrrole is more basic than pyrrolidine.

Q2) Choose the right answer:

- 1) Cannizzaro reaction gives:
 - a) Two alcohols
 - b) Aromatic acid and alcohol
 - c) Two aromatic acid
- 2) Anthracene prepared from:
 - a) Benzene and phthalic anhydride
 - b) Benzene and succinic amide
 - c) Benzene and succinic anhydride
- 3) The more reactive carboxylic acid derivatives are:
 - a) Ester
 - b) Acid chloride
 - c) Acid anhydride

- 4) The Bischler – Napieralski synthesis is a method for synthesis:
- a) Quinoline b) Isoquinoline c) Benzoquinoline
- 5) Benzyne is:
- a) An unstable compound having a triple bond in benzene ring
- b) An unstable compound having a free radical in benzene ring
- c) An unstable compound having conjugated double bond with benzene ring
- 6) Cyclohexane has
- a) Planer conformation b) Chair and boat conformation
- c) Chair, boat and twist conformation
- 7) Deshielding is:
- a) An effect in NMR that cause a nucleus to absorb down field on the left
- b) An effect in NMR that cause a nucleus to absorb down field on the right
- c) An effect in NMR that cause a nucleus to absorb high field on the left
- 8) Wolf – Kishner reagent is:
- a) Zinc amalgam and acid b) Zinc and acid c) Hydrazine and base
- 9) Malonic ester ion is:
- a) Stable anion b) Unstable anion c) Stable cation
- 10) α - β – Unsaturated carbonyl compounds undergo:
- a) Only electrophilic addition reaction
- b) Only nucleophilic addition reaction
- c) Electrophilic and nucleophilic addition reaction

Good luck



Choose the correct answer: (20 degree)

- 1- Polysaccharides are:
- a) Polymers.
 - b) Acids.
 - c) Proteins.
 - d) Oils.
- 2- Which of the following statements is not true about receptors?
- a) Most receptors are proteins situated in the cell membrane.
 - b) Receptors contain a hollow or cleft on their surface which is known as a binding site.
 - c) Receptors bind chemical messengers such as neurotransmitters or hormones.
 - d) Receptors catalyze reactions on chemical messengers.
- 3- Which of the following statements about the oxidative decarboxylation of pyruvate is correct?
- a) The oxidative decarboxylation of pyruvate formed in aerobic glycolysis occurs in the cytosol.
 - b) The oxidative decarboxylation of pyruvate is catalyzed by the enzyme pyruvate decarboxylase.
 - c) The oxidative decarboxylation of pyruvate is reversible since there is a large decrease of free energy in the reaction.
 - d) The oxidative decarboxylation of pyruvate forms acetyl-CoA which is fed into the citric acid cycle.
- 4- Identify the strongest form of intermolecular bonding that could be formed involving the residue of the amino acid serine.
- a) ionic bond
 - b) hydrogen bond
 - c) van der Waals interactions
 - d) none of the above



- 5- At the end of glycolysis, each molecule of glucose has yielded 2 molecules of _____, 2 molecules of _____, and a net of 2 molecules of _____.
- FAD; NAD⁺; ADP.
 - CO₂; NAD⁺; ADP.
 - Lactic acid; ethanol; CO₂.
 - Pyruvate; NADH; ATP.
- 6- Deamination is _____ of amino group.
- Removal.
 - Addition.
 - Supplementation.
 - None of these.
- 7- A polysaccharide which is often called animal starch is
- Starch.
 - Inulin.
 - Glycogen.
 - Dextrin.
- 8- Which of the following statements best describes an allosteric binding site?
- It is a binding site containing amino acids with aliphatic side chains.
 - It is a binding site that can accept a wide variety of differently shaped molecules.
 - It is a binding site, which is separate from the active site, and affects the activity of an enzyme when it is occupied by a ligand.
 - It is a description of an active site which has undergone an induced fit.
- 9- Absorbance at 280nm exhibited by protein is due to
- Aliphatic amino acids
 - All amino acids
 - Non-polar amino acids
 - Aromatic amino acids
- 10- What role does small nuclear RNA play in the synthesis of proteins?
- It catalyses the process.
 - It modifies messenger RNA molecules prior to protein synthesis.
 - It provides the genetic blueprint for the protein.
 - It translates the genetic code to a specific amino acid.



Competition Examination for Ph.D Candidates in Inorganic Chemistry

Q1. In the molecules H_2O , NH_3 and CH_4 .

- (a) The bond angles are same.
- (b) The bond distances are same.
- (c) The hybridizations are same.
- (d) The shapes are same.

Ans.

Q2. The pair of compounds having metals in their highest oxidation state is

- a- MnO_2 , FeCl_2
- b- $[\text{NiCl}_4]^{2-}$, $[\text{CoCl}_4]^-$
- c- $[\text{Fe}(\text{CN})_6]^{2-}$, $[\text{Co}(\text{CN})_2]$
- d- $[\text{MnO}_4]^-$, CrO_2Cl_2 .

Ans.

Q3. The value of the 'spin only' magnetic moment for one of the following configurations is 2.84 BM. The correct one is :

- a- d^4 (in strong ligand field)
- b- d^4 (in weak ligand field)
- c- d^5 (in strong ligand field)
- d- d^3 (in weak as well as in strong fields)

Ans.

Q4. Which has maximum paramagnetic character ?

- a- $[\text{Fe}(\text{CN})_6]^{4-}$ b- $[\text{Cu}(\text{H}_2\text{O})_4]^{2+}$ c- $[\text{Cu}(\text{NH}_3)_4]^{2+}$ d- $[\text{Mn}(\text{H}_2\text{O})_6]^{2+}$

Ans.

Q5. A solution of potassium ferrocyanate would contain ions :

- a- 2 b- 3 c- 4 d- 5

Ans.

Q6. The crystal field Splitting energy for octahedral ($\Delta_{o,h}$) and tetrahedral (Δ_t) complexes is related to :

- a- $(\Delta_t) = (1/2) (\Delta_{o,h})$ b- $(\Delta_t) = (4/9) (\Delta_{o,h})$ c- $(\Delta_{o,h}) = 2\Delta_t$
d- $(\Delta_{o,h}) = (4/9) \Delta_t$

Ans.

Q7. Which one of the following statement is incorrect?

- (a) Greater the formation of (K_f) of a complex ion, greater is its stability.
(b) Greater the positive charge on the central metal ion, greater is the stability of the complex.
(c) Greater is the basic character of the ligand, lesser is the stability of the complex.
(d) Chelate complexes have high stability constants.

Ans: