

المستوى الثالث
الفصل الخامس
الزمن 11/11/14

Kafrelsheikh University
Faculty of Science
Level: 3rd level
Course: Trans. Metal Chemistry
Course code: CH 318



Date: 14/ 01/ 2018
Time allowed: 2 hours
Full Mark: 70 Mark
Final Exam

Answer the following questions:

Question I

(30 Marks)

- 1- Zinc, cadmium and mercury of group 12 are not regarded as transition metals, why?
- 2- Why d- block elements are named as 'transition elements'?
- 3- Write the general electronic configuration of d- and f- block elements.
- 4- What is the trend in melting points of transition metals in a series?
- 5- Why do transition metals have higher enthalpies of atomization?
- 6- Why transition metals and their compounds show paramagnetic behavior?
- 7- What are interstitial compounds? Give examples.
- 8- Why transition elements tend to form large number of coordination compounds?
- 9- Write down the electronic configuration **and** calculate the spin only magnetic moments (in low spin) of the following ions: V^{4+} , Cr^{3+} , Fe^{2+} and Co^{2+} .

Question II

(40 Marks)

Discuss the following:

- 1- Different oxides of vanadium group.
- 2- Different oxidation states of manganese group with examples in each case.
- 3- Chemical properties of scandium group with balanced chemical equations.
- 4- The relation between electronic configuration of the first transition series (Sc→Zn) with their color and magnetic properties.

**Good luck for all
Dr/Ibrahim Elmehasseb**

المستوى الثالث
الفترة الصيفية
الأسابيع ١١ و ١٢ و ١٣

Kafr El-Sheikh University
Faculty of Science
Chemistry Department
Third year Students



Date: 3/1/2018
Time of exam: 2 hour
Score: 70 Marks
Heterocyclic Chemistry

Answer The Following Questions

I: (a) Draw the resonance structures of Azine and Quinoline (13 Marks)

(b) Pyrrole -2- carboxyaldehyde does not undergo Cannizzaro reaction , why ?

(c) Discuss in brief : (1) Diels – Alder reaction in Furan

(2) Alkylation reactions of Thiole

II: Draw the chemical structures of the following compounds : (14 Marks)

(a) 2H- Furo [3,2 - b] Pyran

(b) Thieno [2,3 - g] Quinoline

(c) 4 - Oxazolone

(d) Pyrazino [2,3 - c] Carbazole

(e) Coumarin

(f) Phthalazine

(g) Imidazo [2,1- b] Oxazole

(h) Quinoxaline

III: Explain by Equations the mechanism of preparation of the following compounds: (14 Marks)

(a) Isoquinoline

(b) Ethyl Oxirane

(c) Furoin

(d) Indigo – Dye

IV: Write short notes on each of the following reactions (Write the Mechanism) : (14 Marks)

(a) Electrophilic reactions of Pyridine

(b) Feist – Benary synthesis

(c) Hantzsch Pyrrole synthesis

(d) Skraup synthesis of Quinoline

V: Convert the following (By Equations) : (15 Marks)

(a) Ethyne To Nicotinic acid

(b) Aniline To Oxy Indole

(c) Succinic acid To Dipyrrolyl methane

(d) D – Xylose To 2 – Methyl Furan

(e) Benzene To 2 – Hydroxy – 4 – methyl quinoline

Good Luck

Prof. Dr. Adel Attia



Answer the following questions and write your answer in the answer sheet

Question No.1: Choose the number of the more correct answer

(20 درجه)

1 - The number of grams of solute per 100 grams of solution is known as:

- a) Weight/volume percent (w/v) b) Weight percent (w/w)
c) Volume percent (v/v) d) none of the above

2 - Super Saturation of solution arises when: a) Ionic product (Q) > Solubility product (S)

- b) Ionic product (Q) \geq Solubility product (S) c) Ionic product (Q) < Solubility product (S)
d) Ionic product (Q) = Solubility product (S)

3 - The most important **process** with which we are concerned in gravimetric analysis: a)

- Preparation of the sample solution b) Digestion
c) Precipitation process d) Test for completeness precipitation

4 - When a minimum number of particles primary particles from ion, atoms or molecules come together to produce microscopic nuclei of the solid phase, the phenomenon is known as: a) Ostwald ripening b) Growth of particles c) Nucleation d) Occlusion

5 - Nucleation can be induced by: a) Suspended solid contaminants

- b) Scratching vessel surface c) Dusts d) All of the above

6 - Growth of particles arises when: a) Rate of nucleation < rate growth of particles

- b) Rate of nucleation < rate growth of particles c) Rate of nucleation = rate growth of particles
d) Rate of nucleation \geq rate growth of particles

7 - Supersaturation is therefore an unstable state which may be brought to a state of stable equilibrium by: a) the addition of a crystal of the solute b) Seeding the solution

- c) Shaking or stirring d) All of the above

8 - Aggregation of the colloidal particles requires a reduction in the repulsive force of the double layer and this goal can be achieved by: a) Addition of an inert electrolyte

- b) Heating and stirring the reaction mixture during the precipitation process
c) Digestion d) All of the above

9 - Stirring the solution during addition of precipitating agent leads to: a) Increase S

- b) Avoid concentration sites b) keep Q low d) All of the above

10 - In mixed-crystal formation, one of the ions in the crystal lattice of a solid is replaced by an: a) ion of another element b) water molecule c) ion of the analyte d) none of the above

11 - When the precipitate is allowed to stand in contact with the mother liquor, a second substance will slowly form a precipitate on the surface of the original one and this type of contamination known as: a) co-precipitation b) post precipitation

- c) mixed crystal formation d) All of the above

- 2 - In case nuclei join together to form a crystal of a certain geometric shape this leads to: a) Ostwald ripening b) Growth of particles c) Nucleation d) Occlusion
- 3 - A common source of co-precipitation is: a) Surface adsorption b) Large specific surface areas c) Colloidal precipitates d) All of the above
- 4 - A drastic but effective way to minimize the effects of co-precipitation is:
The re-precipitation, or double precipitation b) Digestion
Washing the precipitate with volatile electrolyte d) none of the above
- 5 - The composition of the wash solution will depend upon:
The solubility of the precipitate b) Chemical properties of the precipitate
Tendency of the precipitate to undergo peptisation d) the impurities to be removed
All of the above
- 6 - It is evident that only surface impurities will be removed by: a) washing process
Digestion c) Filtration d) All of the above
- 7 - The higher the degree of supersaturation is the greater the rate of:
Nucleation b) Co-precipitation c) Occlusion d) Post precipitation
- 8 - Precipitation in hot solutions, provide: a) the solubility is increased
Coagulation is assisted c) the velocity of crystallization is increased
All of the above
- 9 - The net result of digestion is usually to: a) reduce the extent of co-precipitation
Increase the size of the particles c) Rendering filtration easier d) All of the above
- 10 - The mole fraction (X_A) of the component (A) in a system composed of two components A) and (B) is: a) $X_A = n_A/n_A \times n_B$ b) $X_A = n_A/n_A - n_B$ c) $X_A = n_A/n_A + n_B$
d) $X_A = n_A/n_A \div n_B$

Question No. 2: Check (✓) or (X) and for the false write the correct answer (10 درجات)

- 1 - The wash solution may contain a moderate concentration of a compound with one ion in common with the precipitate. ()
- 2 - Washing a coagulate colloid with a solution containing a nonvolatile electrolyte is recommended. ()
- 3 - In order to make Q minimum we can, in some situations, generate the precipitating agent in the precipitation medium rather than adding it. ()
- 4 - In the precipitation urea hydrolysis method, the main function for the presence of the 'suitable anion' is the formation of a basic salt which seems responsible for the production of a dispersed precipitate. ()
- 5 - The contamination of the precipitate by substances which are normally soluble in the mother liquor is termed post-precipitation. ()
- 6 - Occlusion occurs when a compound that is isomorphous to the precipitate is entrapped within the crystal. ()

7 - Digestion forces the small colloidal particles to agglomerate which decreases their surface area and thus adsorption. ()

8 - The magnitude of contamination by post-precipitation may be much greater than in co-precipitation. ()

9 - Precipitation should be carried out in dilute solution and this will minimize the errors due to post-precipitation. ()

10 - Digestion on the steam bath decreases the effect of co-precipitation and gives more readily filterable precipitates. ()

Question No III: Complete the following

(20 درجة)

1 - A supersaturated solution is one that contains concentration of solute than corresponds to the at the temperature under consideration.

2 - According to von Weimarn, the initial velocity of precipitation is proportional to

3 - The process by which a coagulated colloid reverts to its original dispersed state refers to

4 - A technique in which a precipitating agent is generated in a solution of the analyte by a slow chemical reaction known as

5 - For colloidal precipitate the primary layer charged surface electrostatically attracts oppositely-charged ions in the surrounding solution, forming a

6 - Digestion will increase the extent of post precipitation, but and will decrease the extent of this type of contamination.

7 - The precipitate should be washed with the appropriate dilute solution of an electrolyte to prevent

8 - Test to make sure that the analyte has been completely precipitated is easily done by

- To achieve successful precipitation process the following precautions should be consider

9- Usually add a of the precipitating agent for quantitative precipitation and check for completeness of the precipitation.

10- Precipitation using dilute solutions to decrease and increase

11 - Increase solubility by precipitation from

12 - To prevent supersaturation from occurring precipitation is carried out from solution.

- There are three types of co-precipitation namely:

13 - 14 - 15 -

- Q is the degree of supersaturation and S is solubility of precipitates at equilibrium, accordingly:

16- When $(Q - S) / S$ is large, the precipitate is tends to be a

17- When $(Q - S) / S$ is small, the precipitate is tends to be a

The wash solutions are classified into three classes as follows:

18-

19-

20-

Question number No. IV

(20 درجة)

1- What are the experimental variables influence the particle size of a precipitate?

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2- Calculate the gravimetric factor for each of the following

Weighed as	Analyte	GF
BaSO ₄	S
BaSO ₄	SO ₃
Fe ₂ O ₃	FeO
Mg ₂ P ₂ O ₇	MgO
PbCrO ₄	Cr ₂ O ₃

3 - Determine the molarity (M) and normality (N) of 62% of sulfuric acid (H₂SO₄), the density is 1.52 g/cm³?

- Calculate the new concentrations in molarity and in normality if enough water is added to 100 ml of this solution to make up 1.5 L.

المستوى الثالث الفترة الصباحية الأعداد ٢٤ / ١٢١ / ١٧١٧

Kafr El-sheikh University

Faculty of Science

Chemistry Department



Final examination (2017 -2018)

Third year student (Chemistry)

Time allowed (2) hours

Petrol & petrochemical

Answer the following questions:

Question (1) : Discuss the following point:

- Discuss organic theory of petrolume and its defects .
- Writ the types of lubrication oil additives .
- Write the purification of petrol .

Question (2) : Write brief notes on the following:-

- 1)Bergious process in synthetic petrol .
- 2)Reforming process and its types .
- 3 Mechanism of cracking .

Question (3) :

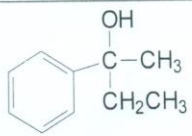
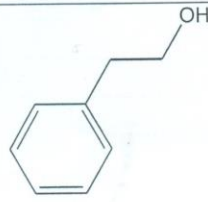
Defing the petrochemicals and the equations of Neoprene , Nylone 6 , Polyester , Polypropylene and Buna S .

GOOD LUCK



(USE A PEN NOT A PENCIL. QUESTIONS WILL BE GRADED ON BOTH HOW CORRECT AND HOW COMPLETE YOUR ANSWER IS)
Answer the following questions

- a) Using retro-synthetic plan how to synthesize the next products; draw the reactions sequences in each step (6 Marks).

<p>i.</p> 	
<p>ii.</p> 	

- b) Explain WHY? (9 Marks)

- I. Reaction of cyclohex-2-en-1-one using sodium borohydride gives saturated 2°ry alcohol?

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- II. Singlet dichloromethene is more stable than triplet one?

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III. Heck substitution reaction of bromobenzene with methylacrylate gives stereo selective products?

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IV. Mention True (✓) or False (X), and correct the false sentence: (Draw chemical reactions in need) (26 Marks)

1) Addition of triplet carbene to cis 2-butene gives a mixture of two products ()

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2) Singlet carbenes insert into alkyl C-H bonds selectively, whereas singlet nitrenes do so randomly. Both singlet species insert into alkyl C-H bonds with the same configuration. ()

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3) Addition of diethyl-2-butyne-1,4-dioate to 1,3-butadiene gives cyclohexane. ()

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4) In Suzuki coupling sodium *tert*-butoxide is used in oxidative addition step ()



- 5) Diels alder addition reaction is an ionic reaction mechanism. ()
- 6) Triphenyl phosphate is the most used ligands in Heck cycle. ()
- 7) Organometallic compounds consider as a source of strong electrophiles. ()
- 8) Thermolysis of sodium trichloro-actetate gives only singlet dichlorocarbene ()
- 9) Alkene metathesis of 4,4-dipropionoate-1,6-heptadiene gives 4,4-di-propionoate-1,3-cyclopentadiene ()
- 10) Triplet state of carbene is carbocation-like in nature, trigonal planar geometry ()
- 11) Relative reactivity of halides towards Grignard reagent is
 $RBr > RF > RI > RCl$. ()



12) Reaction of ethenyllithium with benzaldehyde gives saturated secondary alcohol. ()

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13) Lithium diorganocuprate reagent is used for substitution of alkyl chain () --

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V. Draw the chemical reactions mechanism of the following (paying attention to any stereo-/regio-chemistry of the products, Nomenclature of the products) (29 Marks)

I. Reaction mechanism of water addition to ketene?

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II. Removing of halides from arylhalides using organolithium compounds?

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III. Reaction of phenyl borates with 2-amino-5-bromopyridine?

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IV. Reaction mechanism of protonation of 2,3-dimethylbutan-2,3-diol? (Give reaction name) -----

V. Rearrangement of 3,3-dimethyl-1,5-hexadiene? (Give reaction name) -----

VI. Reaction mechanism of addition of dichloro-carbene to pyrrole? -----

VII. Reaction of methyl magnesium bromide with ethylene epoxide in dry ether followed by hydrolysis? -----

VIII. Reaction of nitrous acid with *p*-toluidine followed by addition of copper chloride? -----



IX. Reaction of bromobenzene with methylacrylate in the presence of Pd catalyst? ----

The End of exam

مع أتمنى التوفيق بالنجاح والتفوق



Part I: Choose the correct answer (read carefully)

(Each 3 Marks):

- Which statement is *incorrect* for the reaction $2A \rightarrow B + 2C$?
 - Rate of formation of B = double the rate of disappearance of A
 - Rate of disappearance of A = rate of formation of C
 - Rate of formation of C = double rate of formation of B
- Which statement is *correct* for the reaction: $2C_2H_6(g) + 7O_2(g) \rightarrow 4CO_2(g) + 6H_2O(l)$
 - the rate of consumption of ethane is seven times faster than the rate of consumption of oxygen.
 - the rate of formation of CO_2 equals the rate of formation of water.
 - water is formed at a rate equal to two-thirds the rate of formation of CO_2 .
 - the rate of consumption of oxygen equals the rate of consumption of water.
 - CO_2 is formed twice as fast as ethane is consumed.
- The speed of a chemical reaction
 - is constant no matter what the temperature is.
 - is independent of the amount of contact surface of a solid involved.
 - varies inversely with the absolute temperature
 - none of these.
- For a reaction $2A + B \rightarrow 2C$, with the rate equation: $\text{Rate} = k[A]^2[B]$
 - the order with respect to A is 1 and the order overall is 1
 - the order with respect to A is 2 and the order overall is 2.
 - the order with respect to A is 2 and the order overall is 3
 - the order with respect to B is 2 and the order overall is 2.
- Given the following data for this reaction: $NH_4^+(aq) + NO_2^-(aq) \rightarrow N_2(g) + 2H_2O(l)$, The rate law for the reaction is:

EXPT	$[NH_4^+]$	$[NO_2^-]$	RATE
1	0.010 M	0.020 M	0.020 M/s
2	0.015 M	0.020 M	0.030 M/s
3	0.010 M	0.010 M	0.005 M/s

 - Rate = $k[NH_4^+][NO_2^-]$
 - Rate = $k[NH_4^+]_2[NO_2^-]_2$
 - Rate = $k[NH_4^+]_2[NO_2^-]$
 - Rate = $k[NH_4^+][NO_2^-]_2$
 - none of the above
- What are the units of k for the rate law: $\text{Rate} = k[A][B]^2$, when the concentration unit is mol/L
 - s^{-1}
 - s
 - $L \text{ mol}^{-1} s^{-1}$
 - $L^2 \text{ mol}^{-2} s^{-1}$
 - $L^2 s^2 \text{ mol}^{-2}$
- Most reactions are more rapid at high temperatures than at low temperatures. This is consistent with?
 - an increase in the activation energy with increasing temperature
 - an increase in the rate constant with increasing temperatures
 - an increase in the percentage of "high energy" collisions with increasing temperature.
 - BOTH a and b
 - BOTH b and c



8. A catalyst?

- actually participates in the reaction
- changes the equilibrium concentration of the products
- does not affect a reaction energy path.
- always decreases the rate for a reaction
- always increases the activation energy for a reaction:

9. Given: $A + 3B \rightarrow 2C + D$, this reaction is first order with respect to reactant A and second order with respect to reactant B. If the concentration of A is doubled and the concentration of B is halved, the rate of the reaction would _____ by a factor of _____.

- increase, 2
- decrease, 2
- increase, 4
- decrease, 4
- not change

10. The reaction $CS_2 \rightarrow CS + S$ is first order with $k = 2.8 \times 10^{-7} s^{-1}$ at $1000^\circ C$, the half-life of this reaction at $1000^\circ C$ is:

- $5.0 \times 10^7 s$
- $4.7 \times 10^{-6} s$
- $3.8 \times 10^5 s$
- $6.1 \times 10^4 s$
- $2.5 \times 10^6 s$

11. Which of the following can be used to represent the rate of a reaction?

- g/L
- g/mol
- $(g \cdot min) / mol$
- M / min

12. Suppose the reaction: $A + 2B \rightarrow AB_2$ occurs by the following mechanism, The rate law expression must be

- $k[A]$
- $k[B]$
- $k[A][B]$
- $k[B]^2$
- $k[A][B]^2$

Step 1	$A + B \rightarrow AB$	slow
Step 2	$AB + B \rightarrow AB_2$	fast
Overall	$A + 2B \rightarrow AB_2$	

13. When the concentration of reactant molecules is increased, the rate of reaction increases. The best explanation is: As the reactant concentration increases,

- the average kinetic energy of molecules increases.
- the frequency of molecular collisions increases.
- the rate constant increases.
- the activation energy increases.
- the order of reaction increases.

14. For the reaction, $2H_2S(g) + O_2(g) \rightarrow 2S(s) + 2H_2O(l)$, which one of the following statements is true?

- The reaction is first order with respect to H_2S and second order with respect to O_2 .
- The reaction is fourth order overall.
- The rate law is: $rate = k[H_2S]^2[O_2]$.
- The rate law is: $rate = k[H_2S][O_2]$.
- The rate law cannot be determined from the information given.

15. For an enzyme that follows Michaelis-Menton kinetics, K_m is equal to

- The $[S]$ at one-half V_{max}
- The $[S]$ at one-half V
- The v at one-half V_{max}
- The V at one-tenth V_{max}

16. Activation energy can be described as the

- energy of motion.
- energy of the activated complex.
- energy difference between the reactants and the products.
- energy difference between the reactants and the activated complex.

17. The rate of enzymatic reaction is depending on the substrate concentration based on Michaelis-Menten equation, explain the curve of the enzyme? (7 Marks)

18. Proof that the integrated rate law of the zero order reaction (5 Marks)

19. define Km and what you understand from?..... (5 Marks)

20. What are inhibitors and what are their types?