Benha university	**3rd year students**	**Date : 11.06.2019**
Faculty of science	**Inorganic chemistry**	**Time: 2 hours**
Chemistry department	**(Special physics)**	**Code: Ch322**

Answer the Questions: **(48 Marks)**

Q.1: (12 Marks)

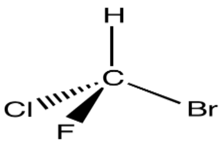
A. (8 Marks) Write short notes on two only the following:

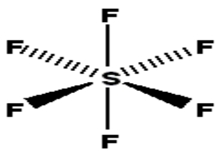
1. **(3 Marks)** Solid state method
2. **(3 Marks)** sol-gel method
3. **(3 Marks)** combustion method

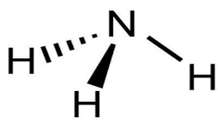
B. (4 Marks) Compare between optical and electron microscopes (Source, Lens, Sample, Magnification, Resolution).

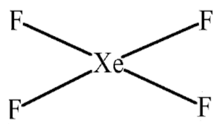
Q.2: (12Marks)

A. (4 Marks) List the symmetry elements for the following molecules:









B. (4 Marks) Calculate the wavelength (nm) in electron microscopy with voltage equal to 200 kV. ($h=6.63x10^{-34}$ J.s, $e= 1.6x10^{-19}$ C, $m_e= 9.1x10^{-31}$ kg, $C= 3x10^{8}$ m/s)

C. (4 Marks) Mention the applications of optical and electron microscopes with example only one.

Q.3: (12Marks)

A. (6Marks) Chose the wright useful of these minerals for human metabolisms life:

[**Copper, Cobalt, Manganese, Zinc, Iodine, Potassium**]

* Regulates heartbeat, maintains fluid balance and helps muscles contract.

* Necessary for red blood cell formation and required for transport of oxygen throughout the body. Important for brain function. Amount needed is higher in women of childbearing age.

* Needed by the thyroid hormone to support metabolism.

* Essential part of more than 200 enzymes involved in digestion, metabolism, reproduction and wound healing Critical role in immune response Important antioxidant

* Key component of enzyme systems, including oxygen-handling enzymes Supports brain function and reproduction Required for blood sugar regulation Part of bone structure.

* Promotes the formulation of red blood cells and serves as a component of the vitamin B-12.

* Essential to normal red blood cell formation and connective tissue formation. Acts as a catalyst to store and release iron to help form hemoglobin. Contributes to central nervous system function.

B. (6Marks)Naming the following complexes:

1. $[Cu(H_2O)_5SO_4]$
2. $[Pt(NH_3)_4\ Cl_2]Cl_2$
3. $K_4[Fe\ (CN)_6]$

<u>Q.4:</u>(12Marks)

A. (6Marks) Chose the correct electron configuration of the following:

A	B
1. Zn atom	**1.** : $1S^2, 2S^2, 2P^6, 3S^2, 3P^6, 3d^{10}$
2. Zn^{2+} ion	**2.** : $1S^2, 2S^2, 2P^6, 3S^2, 3P^6, 4S^2, 3d^{10}$
3. $Fe^{\ 2+}$ ion	**3.** : $1S^2, 2S^2, 2P^6, 3S^2, 3P^6, 4S^2, 3d^6$
4. Fe atom	**4.** : $1S^2, 2S^2, 2P^6, 3S^2, 3P^6, 3\ d^6$
5. Chromium atom:	**5.** :$1S^2, 2S^2, 2P^6, 3S^2, 3P^6, 4S^2, 3d^4$
6. Copper atom	**6.** :$1S^2, 2S^2, 2P^6, 3S^2, 3P^6, 4S^1, 3d^5$
	7. :$1S^2, 2S^2, 2P^6, 3S^2, 3P^6, 4S^1, 3d^{10}$
	8. 8. :$1S^2, 2S^2, 2P^6, 3S^2, 3P^6, 4S^2, 3d^9$

B. (6Marks) What are the metal oxides? Write short note about usages?

With Best Wishes,

Prof. El-Mossalamy and Dr. Ayman Abdel Razik

C. (8 Marks) Write short notes on two only the following:

4. **(3 Marks)** Solid state method
5. **(3 Marks)** sol-gel method
6. **(3 Marks)** combustion method

1. Sol-gel process

The sol-gel process may be the most widely used and developed one among various synthetic powder preparation methods. The sol-gel method offers specific advantages in preparations of multi-component oxide ceramics. The early formation of a gel provides a high degree of homogeneity and reduces the need of atomic diffusion during the solid-state calcinations. Moreover, the processing often starts with metal alkoxides, many of which are liquids or volatile solids that can easily be purified, providing extremely pure oxide precursors. This factor is important for electroceramics synthesis. However, the relative high costs of the metal alkoxides may be prohibitive for certain applications, and the release of large amounts of alcohol during the calcination step requires special safety considerations. In sol-gel preparation, a solution of the appropriate precursors (metal salts or metal organic compounds) is formed first, followed by conversion into homogeneous oxide networks (gel) after hydrolysis and condensation. Drying and subsequent calcination of the gel yields an oxide product. Usually, for preparation of multi-component oxides, alkoxides are mixed together in alcohol. Components for which no alkoxides are available are introduced as salts, such as acetates. Hydrolysis is carried out under controlled temperature, PH and concentration of alkoxides, added water and alcohol. Hydrolysis and condensation to polymeric species are represented by the following reaction equations (use alkoxides as an example): Metal oxygen metal (M -0- M) bonds are formed in solution by self-condensation or by cross-condensation when different alkoxides are used. After calcination, the organic group, R, is removed, leaving metal oxides. If the sol-gel process is carried out with a mixture of alkoxides with different hydrolysis and condensation rates, the molecular homogeneity in the initial stage can thus be lost during hydrolysis. The hydrolysis rate, which can be adjusted by the selection of OR ligands and reaction conditions, affects particle formation, growth and aggregation. Subsequent drying steps also influence the purity and morphology of the final product.

2. **Ceramic method**

It is one of the oldest, simplest methods which used in the preparation of inorganic materials. It depends on the reaction between the reactants in solid state for long time under high certain temperature and for example as the following:

The synthesis of magnesium aluminate from aluminum oxide and magnesium oxide at 1400^{o}C for 12 hour.

$$Al_2O_3 + MgO \longrightarrow MgAl_2O_4$$

The factor affects the method:

1. Particle size
2. Grinding time
3. Nature of reactants
4. Temperature
5. Time

Advantage of the method:

Simple method, Easy method, Low contamination, low pollution

Disadvantage of the method:

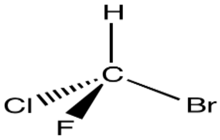
It needs to high temperature, long time, high particle size and two phase production.

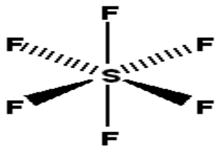
A. Compare between optical and electron microscopes (Source, Lens, Sample, Magnification, Resolution).

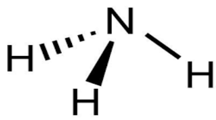
	optical microscopy	electron microscopy
Source	light	electrons
Lens	glass	Electron magnetic wave
Sample	Depend on the type	Depend on the type
Magnification	1500-60000X	Millon X
Resolution	0.3-0.7 µm	0.0001 µm
price	Not expensive	expensive
energy	$E=hc/\lambda$	$E=h/(2mev)^{1/2}$

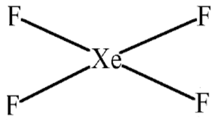
Q.2: **(12Marks)**

D. (4 Marks) List the symmetry elements for the following molecules:









E

E, $C^2{}_4$, $C^1{}_4$, $4C_2$, σ_h, $2\sigma v$, $2\sigma d$

E, $C^1{}_3$, $3\sigma v$ $3c_2$

E, $C^2{}_4$, $C^1{}_4$, $4C_2$, σ_h, $2\sigma v$, $2\sigma d$

E. (4 Marks) Calculate the wavelength (nm) in electron microscopy with voltage equal to 200 kV. ($h=6.63\times10^{-34}$ J.s, $e= 1.6\times10^{-19}$ C, $m_e= 9.1\times10^{-31}$ kg, $C= 3\times10^{8}$ m/s)

1. $\lambda = h/(2mev)^{1/2} =$ nm

F. (4 Marks) Mention the applications of optical and electron microscopes with example only one.

Mention the applications of electron microscopy with explain only one:

1. Study and determine the particle size and shape
2. Study the texture and surface details of materials
3. The study of crystal defects in the crystal of different materials
4. Chemical analysis
5. Structure determination
6. The study of precipitation and phase transitions in materials

Mention the applications of optical and electron microscopes with explain only two

1. Study and determine the particle size and shape
2. Study the texture and surface details of materials
3. The study of crystal defects in the crystal of different materials
4. Chemical analysis
5. Structure determination
6. The study of precipitation and phase transitions in materials