المستوى الثاني كيمياء - النظرية الحركية للغازات وقاعدة الصنف لـ ٢٤٢

Mansoura University Faculty of Science Chemistry Department Code: Chem.242 Subject : Kinetic Theory of Gases- Phase Rule	كلية العلوم جامعة المنصورة	First Term Second Level Program : Chemistry Date : Jan 2014 Time Allowed : 2 hours Full Mark : 80 Marks

Answer All Questions

Phase Rule (40 Mark)

First Question :

[A] Write on :

(i) Number of components C. (ii) Primary and secondary solid solution . (8 marks)

[B] Sketch the phase diagram of :

(i) The sulphur system.

(ii) Two component simple eutectic system characterized by formation of a compound with incongruent melting point.

In each case label areas, lines and points of intersection denoting in each case the number of phases and degree of freedom. (12 marks)

Second Question :

[A] Write on :

(i) Polymorphism. (ii) Efflorescence and deliquescence.

(iii) Properties and Conditions of forming solid solution. (10 marks)

[B] Sketch the phase diagram of :

(i) Two component forming monotectic system. (ii) Water system.

In each case label areas, lines and points of intersection denoting in each case the number of phases and degree of freedom. (10 marks)

Section B: The Kinetic Theory of Gases. (40 marks)

Answer the following questions:

First Question: (25 marks)

a. Write the equations representing the following relations: (20 mark)

1) The kinetic theory equation. (2.5 marks)

2) Virial equation. (2.5 marks)

3) The relation between kinetic energy and temperature. (2.5 marks)

4) The root mean square velocity.

5) The relation between average velocity and average relative velocity. (2.5 marks)

6) The effect pressure on the mean free path. (2.5 marks)

7) Collision frequency. (2.5 marks)

8) Maxwell- Boltzmann distribution velocity. (2.5 marks)

b. Prove that the general gas equation for ideal gases has no critical point. (5 marks)

Second Question: (15 marks)

a. Derive the relation between the constants a and b in Vander Waal's equation and critical constants. (10 marks)

b. If the density (ρ) of steam at 100° and 1.1 bar is 0.6 kg m^{-3} , calculate the compressibility factor and the deviation of the volume from the ideal behavior. (5 marks)

With our best wishes,

Prof. Dr. M. Morsi

Dr. M. A. Hamada

المستوى الثانى كيمياء كيميا حيوى - أسس ومدخل إلى الكيمياء التحليلية ك ١١

Mansoura University Faculty of Science Chemistry Department Subject: Analytical Chemistry Course: **Titrimetry (Volumetry)** Course code:Chem (211)		2 nd level(Chemistry) Date:21/1/ 2014 Time allowed:2 hours Full Mark:60 Marks

Choose Four Questions only From The Following

Question 1.

i) Calculate the mean, confidence limit of five determinations 57 ,57.5 ,55 and 61 (s = 0.02 , Qt =0.05). Does the value 61 rejected or not?

ii) Number of moles of 5.8 g NaCl = ..., when dissolved in 500 ml, the solution has molarity of .....(At.wt Na=23 Cl=35.5)

iii) Calculate the volume of conc. nitric acid, having sp. gravity 1.42 and 69% w/w percentage concentration, required to prepare 1.00L of 0.20 M HNO3. What is the volume of the prepared acid needed to react quantitatively with 0.0106g of Na_2CO_3 (H= 1.00, N=14.00, O= 16.00, Na=23.00, C=12.00).

Question 2.

i)In determination of copper in copper coin,0.7g of it was dissolved in 10ml HCl And enough KI was added, the librated I_2 was titrated with 0.4M of $Na_2S_2O_4$,The volume needed was 25ml.Find the purity percent of the copper sample.Cu=63

ii) Calculate the pH of 50ml of 0.1M CH_3COOH on addition of the following volumes of 0.05M NaOH:

a) 0.0ml b) 5ml c) 100ml d) 120ml

Knowing that ($Ka_{CH3COOH}= 1.8x10^{-5}$, pKa= 4.76)

Question 3.

Discuss:-

i- Factors affecting the break on precipitation titration curve.

ii- The relationship between solubility product and the solubility of a salt.

iii- Methods used for Fe(II) determination(2methods).

Question 4.

i) Define the following:

a) accuracy and precition

b)Zimmermann Reagent in $KMnO_4$ Titrations

c) Self indicator.

d) Nernest equation in Redox Reactions

ii) In titration of Fe^{2+} in acidic medium with 0.0206M $K_2Cr_2O_7$, volume of $K_2Cr_2O_7$ necessary was 40.2ml according to the following equation:

$$6Fe^{2+} + Cr_2O_7^{2-} + 14H^+ \rightarrow 6Fe^{3+} + 2Cr^{3+} + 7H_2O$$

Calculate the weight of iron (in mg) ,(Fe = 56)

iii)-If you have 1M acetic acid and 0.5M sodium acetate .Caculate the necessary volumes from the two solutions to prepare 100ml buffer solution of pH = 4.

Question 5.

i) How can you prepare 40% HNO_3 solution from 96% HNO_3 ,d=1.495g/ml, assuming density of water= 1g/ml .

(ii) Comment on each of the followings statements:-

a) - The success of an EDTA titration depends upon the precise determination of the end point.

b) - The complexing action of EDTA is unselective.

C) - The detection of the end point of argentiometric titration. Give example.

Good luck

Prof. Dr Mohamed El Defrawy

prof.Dr. Magda Akl

المستوى الثالث - برنامج الكيمياء - ميكانيكية التفاعلات العضوية (ك ٢٣٢

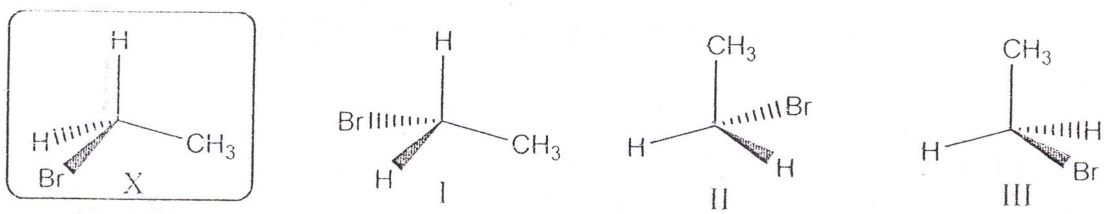
Mansoura University, *Faculty of science,* *Chemistry Department*		Final Examination inPhysical Organic Chemistry 232 Second level (Chemistry Students)

18 / 1/ 2014 | Time Allowed: 2 hrs

ANSWERTHE FOLLOWING QUESTIONS	Full Mark : 80 Marks

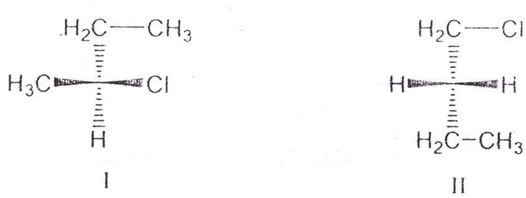
I - Multiple Choice Questions (25Marks):

i] Identifications and Comparisons. Which of the following is the enantiomer of the following substance X ?



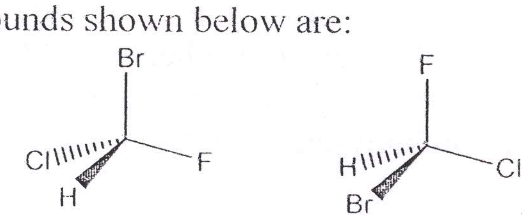
A) I
B) II
C) III
D) It does not have a non superposable enantiomer
E) Both II and III

ii] Compunds I and II are



A) Constitutional isomers
B) enantiomers
C) non-superposable mirror images
D) diastereomers
E) not isomeric

iii] The two compounds shown below are:



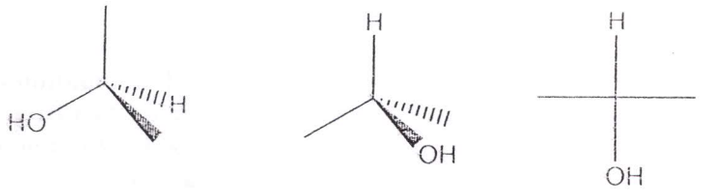
A) Enantiomers
B) diastereomers
C) constitutional isomers
D) identical
E) different but not isomeric.

2] (30 Marks)

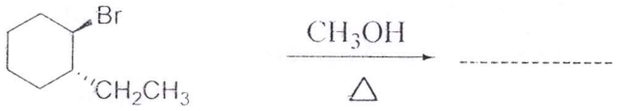
i - A newly isolated natural product was shown to be optically active. If a solution of 2.0 g in 10 mL of ethanol in a50 cm tube gives a rotation of +2.57°, what is the specific rotation of this natural product?

ii- Complete the following partial structures of (S)-3-hexanol

P.T.O.



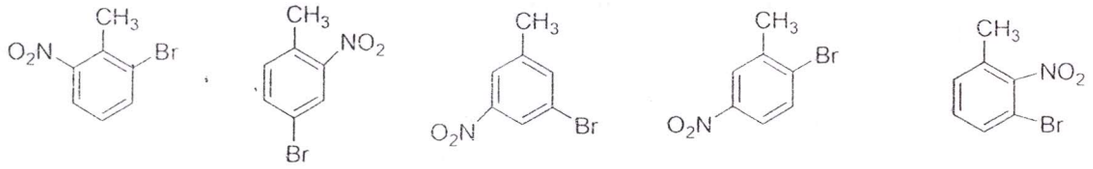
iii- Provide the major organic product of the reaction below and a detailed. stepwise mechanism which accounts for its formation.



iv- From the perspective of viewing down the C2-C3 bond, draw the Newman projection of the most stable conformation of 2,3-dimethyl butane.

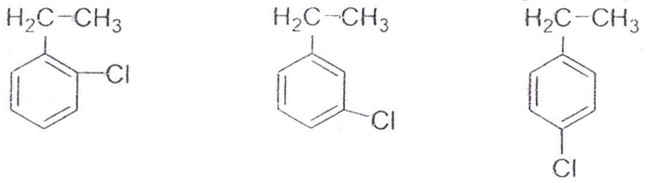
3-(25 Marks)

-i- In the reaction of 2-nitrotoluene with bromine in the presence of iron , which of the products shown below is the most abundant in the mixture?



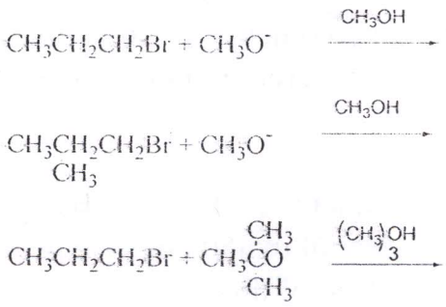
a b c d e

ii- Which of the following compounds gives a single benzyne intermediate on reaction with sodium amide, Explain by equation



(a) 1 only (b) 1 and 3 (c) 3 only (d) 1 and 2

iii- One of the following methods give a much better yield of the ether by a Williamson synthesis than the other. Explain which is the better method and why pointing tocompetition between substitution and elimination reaction.



GOOD LUCK

Prof.Dr. Wafaa S. Hamama

المستوى الثاني – مقدمة في الفيزياء الحيوية ف ع ١١

Mansoura University
Faculty of Science
Physics Department
Course code: Bio-Phys 211
Course title: General biophysics

First term 2013-2014
Date: 14-1-2013

2nd Level students
Biophysics-Physics-Microbiology-Chemistry-Biochemistry-Chemistry Botany - Chemistry Zoology and Environmental Science
Full Mark: 80
Allowed time: 2 hours

Answer all the following questions:

1-	A-	**Write true (√) or False (χ)**	**[each item = 1.5 Mark]**
		i. A graded potential is a minor perturbations in membrane potential due to spontaneous ion leakage through cell membrane.	
		ii. Any change in membrane potential from -70 mV to -80 mV is called hyperpolarization.	
		iii. The dose equivalent measured in Sv and equals the absorbed dose in rad multiplied by quality factor.	
		iv. Glaucoma disease is characterized by a clouding of eye's natural lens.	
		v. The graded potentials last from 5 msec to several minutes.	
		vi. The electrical signals of the brain can be measured using electroencephalogram EEG.	
		vii. Hypermetropia caused by irregularity shaped cornea results in light focusing behind of retina	
		viii. X-rays can be deflected by electric field or magnetic field.	
		ix. The cornea of the eye contains the photoreceptors which are rods and cones.	
		x. The ear canal behaves like pipe that are open from both ends.	
	B-	Potential biological effects depend on how much and how fast a radiation dose is received. Differentiate between the acute and chronic radiation doses, explain your answer by different syndromes.	**[10 Marks]**
	C-	Calculate the velocity of blood through the capillaries inside the lung if you know the radius of aorta is 8 mm, the velocity of blood in aorta is 33 cm/sec and the total cross sectional area of capillaries is 2800 cm^2.**(Comment on your answer)**	**[5 Marks]**
2-	A-	**Complete the following sentences:**	**[each item = 2 Marks]**
		• The heart can be described as an ……(1)……dipole whose magnitude and direction varies in a ……(2)…… manner, repeating for each heart cycle.	

Please follow the rest of questions on the other side of this paper

		• The beta waves of EEG have frequency range .....(3)..... Hz in .....(4).....state.
		• X-rays are produced when rapidly moving .....(5)..... that have been accelerated through a potential difference of order 1 kV to 1 MV strikes a .....(6)..... .
	B-	Magnetic resonance imaging (MRI) is an imaging technique used primarily in medical settings to produce a high quality images of the inside of the human body. Discuss the physical principle of the magnetic resonance imaging (MRI) technique. **[10 Marks]**
	C-	Find an expression given for minimum wavelength and maximum frequency for X-ray tube operates at an accelerating voltage V. **[8 Marks]**
3-	**A-**	**Choose the correct answer :** **[each item = 1 Mark]**
		i. (Absorbed dose- Dose equivalent- Quality factor- Radiation flux) is a measure of energy deposition in any medium by any type of ionizing radiation.
		ii. The human eye is organ design to receive visible light having wavelengths between [(360 and 760 nm) – (380 and 670 nm) –(380 and 760 nm) –(390 and 660 nm)].
		iii. The X-rays emitted from the target is usually consisting of continuous radiation up on which (parallel-superimposed-straight-under) a line spectrum containing a relatively few lines.
		iv. About (64% -54%-44%-34%) of cone cells are red sensitive.
		v. The unit of the absorbed dose is called the (Gray-Sv-Rem-joule)
		vi. (Hypermetropia-Myopia-Astigmatism-Presbyopia) caused by irregularity shaped cornea results in light focusing in front of retina.
		vii. Myopia is corrected by (converging-diverging lens-cylindrical-flat) lens.
		viii. (Absorbed dose- Dose equivalent- Quality factor- Radiation flux) is number of particles or photons crossing an area of 1 square meter in one second.
	B-	Calculate the resistance per unit length of the fluids inside an axon of unmyleinated nerve and the resistance per unit area of the membrane, if the resistivity of the fluids inside the axon is 0.5 ohm-m, resistivity of membrane is 1.6×10^7 ohm-m , the axon radius is 5μm and the axon thickness is 6 nm. **[6 Marks]**
	C-	Each of three people talking, when speaking individually produce an unknown sound level L_1, but when they talk together, the sound level is 70 dB. Calculate the sound level L_1. **[6 Marks]**

Best wishes:

Dr Hany Kamal

Faculty of Science
Chemistry Department
Subject : Inorganic Chemistry
Course(s): Representative Elements
Code : Chem (221)

كلية العلوم
جامعة المنصورة

Second Level (Chemistry) Students.
Date : 11 January, 2014
Time Allowed: 2 hours
Full Mark : 80 Marks

Answer The Following Questions

I. Give an explication of SEVEN ONLY of the following : **[28 Marks]**

1. The high **(1st IE's)** for **($_4$Be, $_7$N and $_{10}$Ne)** and the low **(1st IE) for ($_8$O)**. .
2. The increasing of reactivity of alkali metals, with increasing of the atomic number, is demonstrated by their reactions with water.
3. **(Cs^+)** ion conducts electricity more than **(Li^+)** ion in the aqueous solutions .
4. Boron trioxide **(B_2O_3)** is amphoteric.
5.. Carbon monoxide is a good reducing agent **whereas lead (IV) oxide** is fairly strong oxidizing agent in acid solution. **Support with an example** for each of both properties.
6. i) **Univalent thallium ($_{81}$Tl)** compounds are the most stable.
   ii) **Molten lithium** is very reactive substance.
7. **i)** White phosphorus shoud never be allowed to come into contact with body skin.
   ii) Aqueous solutions of **Be(II)** are acidic.
8. The trends of **both metallic character and stability of the lower oxidation state** on descending the **carbon group.**

II.A)Write on Five Only of the following, on the basis of the chemical reaction equations:

7. **Thermal decomposition methods** for separating elements. **[20 Marks]**
8. Both Na_2O_2 and KO_2 are used in self-contained breathing apparatus.
9. Isolation of the pure elemental **silicon** from **silica (SiO_2).**
10. Separation of aluminum metal from its **ore (bauxite)** , **AlO(OH).**
11. **Photodissociation** of nitrogen dioxide **(NO_2)** and **photochemical smog.**
12. Boric acid $B(OH)_3$ is a monoprotic weak acid in water, the addition of a polyhydroxy compound makes **it** a strong monobasic acid.

II. B) Complete SIX ONLY of the following chemical reaction equations: **[12 Marks]**

1. $Ca(H_2PO_4)_2 + NaHCO_3 \xrightarrow{300°C}$
2. $Li_3N + D_2O \rightarrow$ & 3. $Al_4C_3 + H_2O \rightarrow$
4. $_7N^{14} + {}_0n^1 \rightarrow$ & 5. $Ca\,CN_2 + H_2O \rightarrow$
6. $Ca_3(PO_4)_2 + H_2SO_4 \rightarrow$ & 7. $P_2O_5 + H_2SO_4$ (Conc.) $\rightarrow$

III.A) Give an account on the following : **[13 Marks]**

4) Ortho and para Hydrogen.
5) Diamond and its structure, as an important allotropic form of carbon.
6) Isolation of the elemental **phosphorus** from its mineral phosphate rock $Ca_3(PO_4)_2$.

III.B) Describe the structure and nature of bonding of the following : [7 Marks]

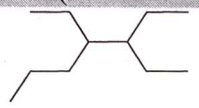
1) Diborane (B_2H_6) & 2) Trimethylamine $(CH_3)_3N$ (At. numbers ($_1$H, $_5$B, $_7$N)

Best Wishes Dr. Abd-El-Latif Prof. Dr. Tawfik Rakha

Mansoura University Faculty of Science Chemistry Department Subject: Chemistry Course: Chem. 231 ***Basic Organic Chemistry II***		Second Term 2nd Level : Chemistry & Biochem. programs Date: 04 January, 2014 Time Allowed: 2 hrs Full Mark: **60** Marks

Question 1: *Select the correct answer.* **(20 Marks)**

Q-1: The name of this compound is :



a) *trans* 3,4-diethylheptane. b) *cis* 3,4-diethylheptane.
c) 3,4-diethylheptane. d) (*Z*) 3,4-diethylheptane

Q-2: The type of hybridization of carbon atoms in compound 1,2,3-trimethylene cyclopropane is:
a; SP ***b;SP^2*** ***c; SP^3*** ***d; Mix between SP and SP^2.***

Q-3 **The following compounds one of them is present in cis/trans isomerism. Select it**
a) CH_2=CH-$CHCl_2$ b) Cl_2C=CH-CH_3
c) CH_2=CCl-CH_2Cl d) ClCH=$CClCH_3$

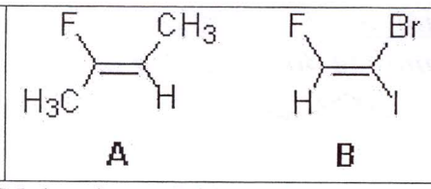
Q-4: What is the electrophile in the following reaction?

benzene + HNO_3 + H_2SO_4 ⟶ nitrobenzene

a) NO_2^+ b) NO^+ c) NO_3^+ d) $N_2O_2^+$

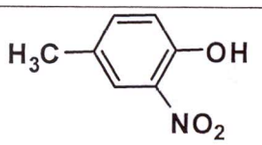
Q-5: Determine the double bond stereochemistry (*E* or *Z*) for the following molecules

a). **A**: *E*; **B**: *E* b) **A**: *Z*; **B**: *Z*
c) **A**: *E*; **B**: *Z* d) **A**: *Z*; **B**: *E*

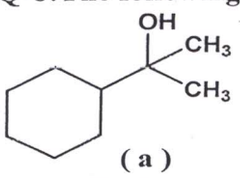


Q6: The compound which has the higher boiling point is: (Note The Molecular weight are the same)
a) Pentane ***b) Isopentane***
c) 1-butanol ***d)Tert. butyl alcohol.***

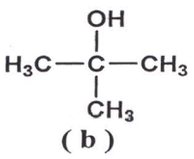
Q-7: The name of the following compound is:
a) 4-Methyl-2-nitrophenol **b) o-nitrohydroxtoluene**
d) 2-Nitro-p-methylphenol **d) 2-Methyl-4-nitrophenol**



Q-8:The following compounds one of them is consider secondary alcohol. Select it.

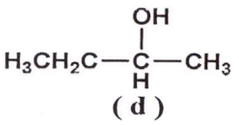


(a)



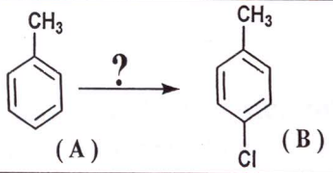
(b)

(c)

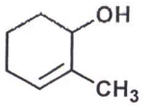


(d)

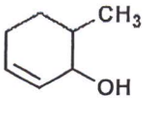
Q-9: The best reagent to prepare (B) from (A) is:
a; Cl_2 b; Cl_2/HCl
c; Cl_2/$FeCl_3$ d; Cl_2/ light



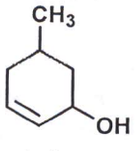
Q 10: One of the following compounds named 5-Methyl-2-cyclohexenol, select it



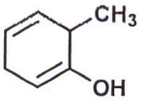
(a)



(b)



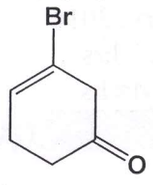
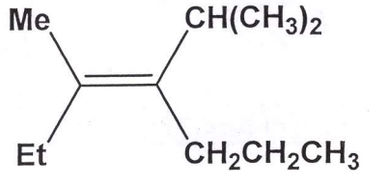
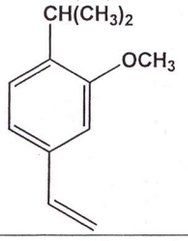
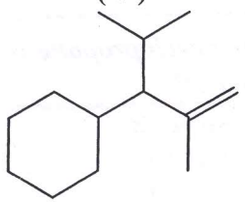
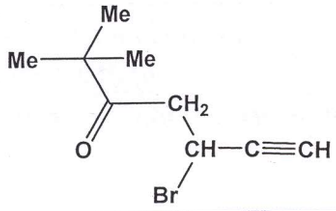
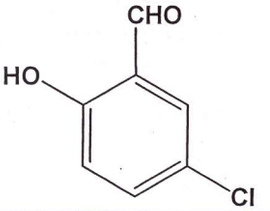
(c)



(d)

Question 3:. (20 Marks)

A; Give the IUPAC name of the following compounds:

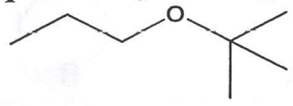
(a) 	(b) 	(c) 
(d) 	(e) 	(f) 

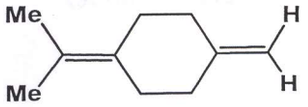
B; Draw the structural formulas and names for all possible structural isomers:

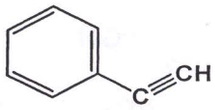
i) C_3H_6BrCl (ii) C_4H_8O.

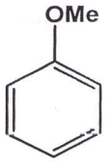
Question 3:. (20 Marks)

A; Complete the following reactions with a suitable mechanism:

1)  HCl (excess) →

2)  a; O_3 → b; $Zn/\overset{\oplus}{H}$

3)  $HgSO_4$ / H_2SO_4 →

4)  CH_3COCl / $AlCl_3$ →

5)  a; CH_3MgBr → b; H_2O / NH_4Cl

B; Write what you know about <u>two only</u> of the following:

i; Conversion of alcohols into alkyl halides.

iii; Reaction mechanism of addition HBr to propylene (in presence and absence peroxides).

iv; Activation and deactivation of monosubstituted benzene.

With Our Best Wishes

Prof. Dr. El-Sayed I. El-Desoky & Dr. Mona El-Sayed

المستوى الثانى - كيمياء - ك ٢٤٣ كيمياء الجوامد والمادة الصلبة ك ٢٤٣

Mansoura University
Faculty of Science
Chemistry Department
Final Exam

Chem. 243
Full Mark: [80]
First semester 2013
Time Allowed: 2 hrs

Answer the following questions:

1(A) Differentiate between intrinsic and extrinsic semiconductors.**[5]**
(B) What is the basic LASER structure? Give some applications.**[5]**

2. F-centers are**[5]**
   (a) The electrons trapped in anionic vacancies
   (b) The electrons trapped in cation vacancies
   (c) Nonequivalent sites of stoichiometric compounds
   (d) All of the above.

3. For metals, conductivity is increased by**[5]**
   (a) Reducing deformation. (b) Reducing imperfections
   (c) Decreasing temperature. (d) None of the above.

4. A ferromagnetic material is one in which neighboring atomic magnetic moments are**[5]**
   (a) Antiparallel and unequal. (b) Predominantly parallel.
   (c) Predominantly parallel in a small region of material.
   (d) All randomly oriented.

5. Frankel and Schottky imperfections are **[5]**
   (a) Dislocations in ionic crystals. (b) Vacancies in ionic crystals.
   (c) Grain boundaries in covalent crystals.(d) Vacancies in covalent crystals.

6. NiO crystallizes in the cubic closest packing structure with the length of the unit cell 418 pm. Calculate the closest distance between Ni nuclei in this structure. **[10]**

7. Calculate the void volume in the BCC structure.**[10]**

8. Calculate the atomic packing factor in the FCC structure.**[10]**

9. Given that solid Ar has an FCC crystal structure with a lattice parameter of a = 531pm, an atomic radius of 217pm, and an atomic weight of 39.948 g/mole, calculate it's density. **[10]**

10. The Fermi level for potassium (M=39.1 $gmol^{-1}$) is 2.1ev. Calculate the velocity of the electrons at the Fermi level. **[10]**

N.B. $N_A=6.02x10^{23}\ mol^{-1}$, $eV=1.602x10^{-19}$ J.

المستوى الثانى - كيمياء - ضوئيات ف ccl

Mansoura University Faculty of Science Physics Department		**First Term Exam, 2014** **Second level** Date:**28-12- 2013** Time allowed : **2 hours** Full Mark: **80 Mark**
Subject: **Physics**		Course: **Physical Optics 221 ف**

Answer the Following Questions

[1] a -Demonstrate an explanatory diagram of the optical arrangement of Newton's rings. Discuss the forming of dark spot in the center of these rings. Derive the necessary formula of these ringes.

[15 Marks]

b - The disturbances produced at a given point by two coherent sources separately are given by;

$y_1 = a \sin \omega t$

and $y_2 = b \sin (\omega t - \delta)$.

Deduce an expression for the intensity at a given point when both the sources act simultaneously.

Show a plot of this intensity as a function of δ for the case where (a=b).

[12 Marks]

[2] a- Using Fresnel's biprism give an experiment to determine the refractive index of the thin sheet of a transparent material having thickness t. Derive the necessary formula. Explain why a white light is used in this experiment. **[15 Marks]**

b- A grating with 6000 ruling /cm is illuminated with white light at normal incidence. Describe the diffraction pattern for zero and first order assuming that the wavelength of light extends from (4000 A^o) to(7000 A^o).

[12 Marks]

[3] a- Discuss Fraunhofer diffraction pattern when using a rectangular slit. Derive an expression for the intensity distribution of the observed diffraction pattern . Show a plot of this intensity.

[18 Marks]

b- Drive the Malus law of the intensity of polarized light transmitted through the analyzer.

[8 Marks]

Good Luck

Examiners: Prof. Dr. Taha Sakkar & Prof. Dr. Karemal El -Farhaty

Prof. Dr. Eman Seisa & Prof. Dr. Mohamed Kabeel

المستوى الثانى - كيمياء - ديناميكا حرارية ٢٤١

Mansoura University
Faculty of Science
Chemistry Department
Course: Physical Chemistry
Date: 23/ 12/ 2013

First term Examination
Subject: Chemistry (241)
Second level chemistry students
Full Mark: 60 Marks
Time Allowed : 2hours

Answer the following questions (20 marks for each question) (الامتحان فى اربع ورقات)

Question I

I-A) $Cl_2(g) + 3\ F_2(g) \rightarrow 2\ ClF_3(g)$. ClF_3 can be prepared by the reaction represented by the equation above. For ClF_3 the standard enthalpy of formation, $\Delta Hf°$, is –163.2 kJ/mole and the standard free energy of formation, $\Delta G_f°$, is 123.0 kJ/mole.

(a) Calculate the value of the equilibrium constant for the reaction at 298K.

(b) Calculate the standard entropy change, $\Delta S°$, for the reaction at 298K.

(c) If ClF_3 were produced as a liquid rather than as a gas, how would the sign and the magnitude of ΔS for the reaction be affected? Explain.

(d)The absolute temperature at which the forward reaction becomes nonspontaneous can be predicted. Write the equation that is used to make the prediction.

(d) At 298K the absolute entropies of $Cl_2(g)$ and $ClF_3(g)$ are 222.96 J/ mole–K and 281.50 J/ mole–Kelvin, respectively.

(i) Account for the larger entropy of $ClF_3(g)$ relative to that of $Cl_2(g)$.

(ii) Calculate the value of the absolute entropy of $F_2(g)$ at 298K.

I-B) Complete the text.

Thermodynamics is a science that aims to identify ways and limits of converting ... [1] into work. The flow of heat is produced not only by differences in ... [2], but also by the work of ... [3] forces on moving objects. A thermodynamic system is any device that exchanges heat and work with the ... [7]. The first law of thermodynamics is a special formulation of the energy ... [8] principle. Internal ... [9] quantifies the energy level of a thermodynamic system, energy, associated with the link between the particles. Internal energy, U, is a function of ... [12] and its variations depend on the initial state and on the ... [13], but do not depend on the type of transformation. Assuming that both the heat ... [14] by a thermodynamic system from the system`s environment during a transformation, and the work ... [15] are positive, the ... [16] Law of Thermodynamics can be expressed mathematically by the equation ... [17]. Thus, the variation of ... [18] energy, in a thermodynamic system, is equal to the algebraic difference between ... [19] exchanged and ... [20] exchanged.

I-C) Find ΔS for the conversion of 10.0 g of supercooled water at –10 °C and 1.00 atm to ice at –10 °C and 1.00 atm. Average C_p values for ice and supercooled water in the range 0 °C to –10 °C are 0.50 and 1.01 cal/g K, respectively.

Question II

II-A)-Use the following thermodynamic data

Species	HΔ (kJ/mol)	S° (J/Kmol)
$H_2O_2(\_)$	-187.78	109.6
$H_2O(\_)$	-285.83	69.91
O2(g)	0	205.14

to calculate for ΔS_{univ} the decomposition of hydrogen peroxide at 25°C.

$2\ H_2O_2(\_) \rightarrow 2\ H_2O(\_) + O_2(g)$

II- B) State if the sentences are true or false.

1) Thermodynamics was born in the Middle Ages.
2) Joule and calorie are two units of energy.
3) A thermodynamic system exchanges heat and work with the external environment.
4) The internal energy of a system is the sum of the kinetic energy of molecules and the different types of potential energy associated with the molecular bonds.
5) The heat absorbed by a thermodynamic system is considered negative.
6) In an isochoric transformation, the change of internal energy depends only on the exchange of heat.
7) In an adiabatic transformation, the change of internal energy does not depend on heat exchanges.
8) A heat engine transforms work into heat.
9) If a heat engine makes a thermodynamic cycle, there will be no change of internal energy.
10) A heat engine takes in heat from the low temperature reservoir, does work using this energy, and expels the rest in the heat sink at the high-temperature reservoir.

II-C) Choose the response that best complete each statement:

1) The thermodynamically expression for change in entropy is given by

1) q_{rev}/T 2) q_{irrev}/T 3) $w+q/T$ 4) W_{irrev}/T

2) A system goes from A to B via two processes reversibility. If ΔU_1 and ΔU_2 are the changes in internal energies in the processes I and II respectively, then

(a) relation between ΔU_1 and ΔU_2 cannot be determined
(b) $\Delta U_1 = \Delta U_2$ (c) $\Delta U_2 < \Delta U_1$ (d) $\Delta U_2 > \Delta U_1$

3) Which of the following statements is correct for any thermodynamic system ?

(a) The internal energy changes in all processes.
(b) Internal energy and entropy are state functions.
(c) The change in entropy can never be zero.
(d) The work done in an adiabatic process is always zero.

4) For an isothermal expansion of a perfect gas, the value of $\Delta P / P$ is equal to

(a) $-\Delta V / V$ (b) $\gamma \Delta V / V$ (c) $-\gamma \Delta V / V$ (d) $-\gamma 2\Delta V / V$

) An ideal gas expands isothermally from volume V_1 to V_2 and then compressed to original \ volume V_1 adiabatically. Initial pressure is P_1 and final pressure is P_3. The total work done is W. Then

(a) $P_3 > P_1$, $W > 0$ (b) $P_3 < P_1$, $W < 0$ (c) $P_3 > P_1$, $W < 0$ (d) $P_3 = P_1$, $W = 0$

6) If the reaction $A + B \rightarrow C$ has equilibrium constant greater than one, which of the following statements is correct?

(a) The reaction is not spontaneous. (b) The forward rate of reaction is fast.
(c) The backward rate of reaction is slow. (d) The reaction is product favored.

7) For a chemical system, ΔG° and ΔG are equal when

(a) the equilibrium constant, K, equals 1. (b) the equilibrium constant, K, equals 0.
(c) a system is at equilibrium. (d) the reactants and products are in standard state concentrations.

8) At what temperature would you expect a reaction to become spontaneous if $\Delta H = +67.0$ kJ and $\Delta S = -131$ J/K?

(a) $T < -511$ K (b) $T > 238$ K (c) $T > 511$ K
(d) The reaction will be spontaneous at any temperature.
(c) The reaction will NOT be spontaneous at any temperature.

9) Which of the following statements is correct ?

(a) The increase in entropy is obtained from a given quantity of heat at a low temperature
(b) The change in entropy may be regarded as a measure of the rate of the availability of heat for transformation into work
(c) The entropy represents the maximum amount of work obtainable per degree drop in temperature
(d) All of the above.

10) In an irreversible process there is a

(a) loss of heat (b) no loss of work (c) gain of heat (d) no gain of heat.

11) The main cause for the irreversibility is

(a) mechanical and fluid friction (b) unrestricted expansion
(c) heat transfer with a finite temperature difference (d) all of the above.

12) Which of the following is the correct statement ?

(a) All the reversible engines have the same efficiency
(b) All the reversible and irreversible engines have the same efficiency
(c) Irreversible engines have maximum efficiency
(d) All engines are designed as reversible in order to obtain maximum efficiency.

13) An ideal gas expands into a vacuum in a rigid vessel. As a result there is:

(a) a change in entropy (b) an increase of pressure
(c) a change in temperature (d) a decrease of internal energy

Question III

III-A)

$PCl_5(g) = PCl_3(g) + Cl_2(g)$ For the reaction above, $\Delta H° = +22.1$ kcal/mole at 25°C

(a) Does the tendency of reactions to proceed to a state of minimum energy favor the formation of the products of this reaction? Explain

(b) Does the tendency of reactions to proceed to a state of maximum entropy favor the formation of the products of this reaction? Explain.

(c) State whether an increase in temperature drives this reaction to the right, to the left, or has no effect. Explain.

III-B) What is the normal boiling point of NH_3 if the vapor pressure of NH_3 (in atm) at 25°C is 10.3 atm. and the value of ΔH_{vap} is 23.4 kJ mol^{-1}.

III-C) When crystals of barium hydroxide, $Ba(OH)_2 .8H_2O$, are mixed with crystals of ammonium thiocyanate, NH_4SCN, at room temperature in an open beaker, the mixture liquefies, the temperature drops dramatically, and the odor of ammonia is detected. **Indicate how the enthalpy, the entropy, and the free energy of this system change as the reaction occurs. Explain your predictions.**

III-D) A Carnot engine takes 3 × 106 cal. of heat from a reservoir at 627° C and gives it to a sink at 27° C. What is the work done by the engine?

Good Luck **Prof. Dr. Awad I. Ahmed**