

Mansoura University
Faculty of Science
Chemistry Department
Code: Chem. 242



Second level
Program : Chemistry
Date : January 2015
Time Allowed : 2 Hours
Full Mark : 80 Mark

Answer All Questions

Section A : Phase Rule (40 Marks)

First Question : (20 Mark)

[A] Explain in detail the meaning of : (8Mark)

- (i) Phase (ii) Number of component (iii) Degrees of freedom

[B] Write on : Properties and Conditions of forming solid solution. (5Mark)

[C] Sketch the phase diagram of Sulphur system.

Label areas, lines and points of intersection denoting in each case the number of phases and degree of freedom. (7 marks)

Second Question : (20 Mark)

[A] Write on : (6 Mark)

- (i) Polymorphism. (ii) Phase reaction.

[B] Sketch the phase diagram of :

(i) Two component forming simple eutectic where liquids are partially miscible.

(ii) Two component forming compound with incongruent melting point.

Label phases in each area. Explain, in detail, what happen on cooling liquids with different compositions of A and B. In each case mention phases, number of components and degrees of freedom. (14Mark)

Section B : Kinetic Theory of Gases (40 Marks)

First Question : (20 Mark)

[A] Write equations representing : (15 Mark)

- (1) Deviation from ideal behavior. (2) Law of corresponding states.
(3) Probability of finding molecule according to Boltzmann distribution.
(4) Mean free path. (5) The inflection point.

[B] Calculate each of the kinetic energy and the root mean square velocity of 16 gm of O₂ at 30° C (R= 8.314 J m⁻¹ K⁻¹). (5 Mark)

Second Question : (20 Mark)

[A] Prove that van der Waal's equation has critical volume , temperature and pressure. (10 Mark)

[B] Use the critical point data to derive equations representing the coefficient a,b in van der Waal's equation and the value of the compressibility factor. (10 Mark)

Mansoura University
 Faculty of Science
 Chemistry Department
 Subject: Solid State and Materials Chemistry
 Course code: Chem243



Level: 2
 Major: Chemistry
 Time allowed: 2 hours
 Full Mark: 80 Marks
 Date: Dec 24, 2014

Answer the following questions

1- Complete the missing parts of the table [20 Marks]

	CsCl Structure	NaCl Structure	Diamond Structure
Type of the lattice	--	--	Face-centred
Number of formula units per unit cell	--	--	--
Type of polyhedra	--	--	--
	Cubic System	Orthorhombic System	
a,b,c	--	--	
Minimum symmetry	--	--	
Type of lattices	--	--	
	Ferromagnetism	Anti-ferromagnetism	Ferrimagnetism
Moments alignment	--	--	--
Net moment	--	--	--

2- A certain crystal has a primitive cubic lattice with a unit cell length of 4.70 Å. For X-rays with $\lambda=1.54$ Å, calculate the diffraction angles from 100 and 020 planes. [8 Marks]

3- The density of diamond is 3.51 g cm^{-3} , what are the dimensions of the unit cell? [8 Marks]

4- Compare between: [24 Marks]

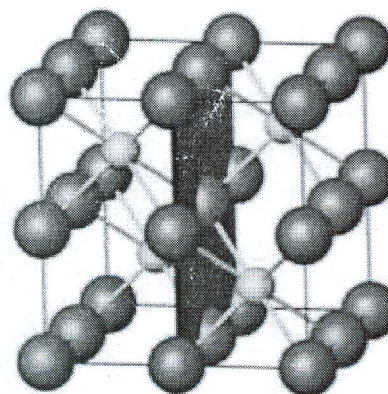
- Frenkel and Schottky point defects
- SEM and TEM
- Neutron diffraction and X-ray diffraction
- Piezoelectric and pyroelectric materials

5- Distinguish only graphically between: [12 Marks]

- Super-exchange and double-exchange mechanisms in magnetic oxides
- Curie and Néel temperatures
- A fuel cell and oxygen sensor (graphs + equations)

6- The unit cell of CaF_2 is depicted in the figure, answer the following questions: [8 Marks]

- Give the Miller indices of the highlighted plane.
- Is the highlighted plane a mirror plane?
- Is the 002 plane a mirror plane?
- What rotation axes may pass through the centres of the upper and lower faces?
- What inverse rotation axes may pass through the centres of the upper and lower faces?



Mansoura University
Faculty of Science
Chemistry Department
Course: Physical Chemistry
Date: 28/ 12/ 2014



First term Examination
Chemical thermodynamic, Chem 241
Second level students
Full Mark: 60 Marks
Time allowed: 2hours

Answer the following questions

Question I

- a- The heat capacity at constant volume of a certain system is a function of temperature only and may be expressed as $C_v = 2.093 + 41.87/T$ J/K, the system is heated while it is maintained at a pressure of 1 atmosphere until its volume increases from 2.0 L to 2.4L and its temperature increases from 0°C to 100°C. How much does the internal energy of the system increase? (4marks)
- b- A Carnot engine operating between reservoirs at 227°C and 27°C takes in 1000 J of energy from the hot reservoir, how much work will it perform? (4 marks)
- c- From each of the following pairs of substances, choose the one expected to have greater absolute entropy. Explain your choice in each case. Assume one mole of each substance.
- Ne_(g) at 1 atm or Ne_(g) at 0.05 atm both at the same temperature. (2 marks)
 - H₂O_(g) or CH₃CH₂CH₂OH_(l) both at the same pressure. (2 marks)
 - Ca(s) at 0°C or Ca(s) at 150°C both at the same pressure. (2marks)
- d- The pressure exerted on an ideal gas at 2.00 atm and 300 K is reduced suddenly to 1.00 atm while heat is transferred to maintain the initial temperature of 300 K. Calculate q, w, and ΔU in Joules for this process. (6 marks)

Question II

ClF₃ can be prepared by the reaction represented by the equation: $Cl_2(g) + 3 F_2(g) \rightarrow 2ClF_3(g)$. For ClF₃ the standard enthalpy of formation, ΔH_f[°], is -163.2 kJ/mole and the standard free energy of formation, ΔG_f[°], is -123.0 kJ/mole.

- Calculate the value of the equilibrium constant for the reaction at 298K. (4 marks)
- Calculate the standard entropy change, ΔS[°], for the reaction at 298K. (4marks).
- Calculate the temperature at which the reaction must be nonspontaneous. (4marks)
- If ClF₃ were produced as a liquid rather than as a gas, how would the sign and the magnitude of ΔS for the reaction is affected? Explain. (2 marks)
- Can the yield of ClF₃(g) be increased by raising the temperature? Explain. (2 marks)
- At 298K the absolute entropies of Cl₂(g) and ClF₃(g) are 222.96 kJ/mole -K and 281.50 J/mole -K, respectively.
 - Calculate the value of the absolute entropy of F₂(g) at 298K. (4 marks)

Question III

Are the following statements true or false, correct the false ones: (1 mark for each one)

1. Boiling of alcohol produces a decrease of the entropy of the system.
2. The value of the intensive property does not depend on the amount of the substance.
3. Thermodynamics will help in predicting whether a physical or chemical change is possible under given conditions.
4. In an irreversible process there is a loss of heat.
5. For adiabatic expansion $q < 0$.
6. The heat change measured at constant pressure equals ΔU .
7. The overall direction of change in the universe is toward a state of greater disorder.
8. The melting of ice at 0°C and 1 atm is irreversible process.
9. For isothermal irreversible expansion of an ideal gas the work done is given by $W = -\Delta U$
10. ΔS of the system must be positive for a process to be spontaneous.
11. Ice kept in a well insulated thermo flask is an example of closed system
12. In a cyclic process the total change in internal energy of the system must be positive.
13. A superscript zero, such as ΔH° , indicates a specified temperature of 0°C .
14. Specific heat of a substance measures the amount of energy required to raise the temperature of one mole of substance one degree
15. When a system is at equilibrium, the forward process is spontaneous but the reverse process is not.
16. ΔH_{vap} can be determined directly from the slope of an $\ln P$ versus $1/T$.
17. S° is not zero for elements in their standard states.
18. In a given process on an ideal gas, $dW=0$ and $dQ < 0$, then for the gas the temperature will increase.
19. The entropy of a pure crystal at 0 K is negative.
20. No work is done as reaction occurs in which the change in the total number of moles is positive.

GOOD LUCK

Prof. Awad I. Ahmed

<p>Mansoura University, Faculty of science, Chemistry Department</p>		<p>Final Examination in Physical Organic Chemistry 232 Second level (Chemistry Students)</p>
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21 / 1 / 2015

Time Allowed: 2 hrs

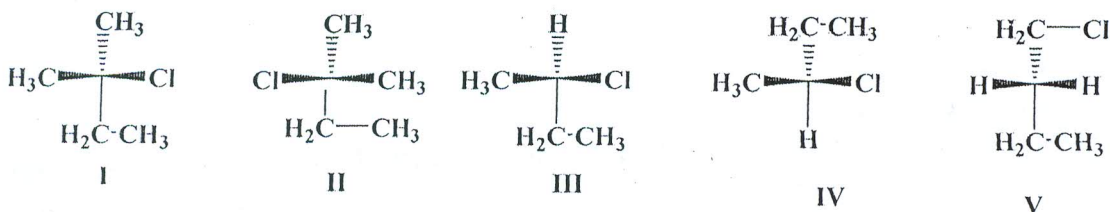
ANSWER THE FOLLOWING QUESTIONS

Full Mark : 80 Marks

1 - Multiple Choice Questions (25 Marks):

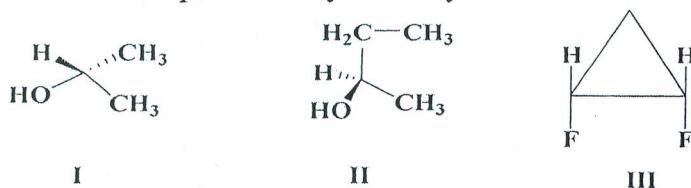
i] Specific names

(R)-2-Chlorobutane is represented by



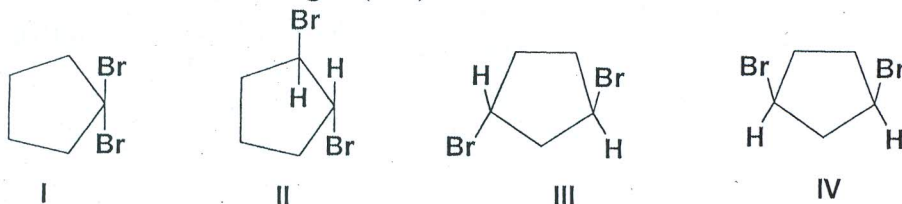
A) I; B) II; C) III; D) IV; E) V

ii] Which molecule has a plane of symmetry?



A) I; B) II; C) III; D) More than one of these; E) None of these

iii] Which of the following is(are) meso?

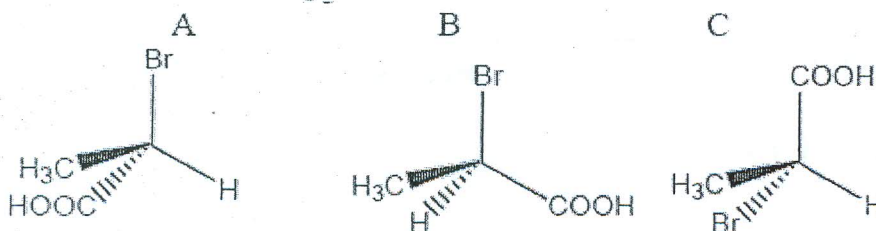


A) I; B) II; C) III; D) IV; E) Two of the above

2] (30 Marks)

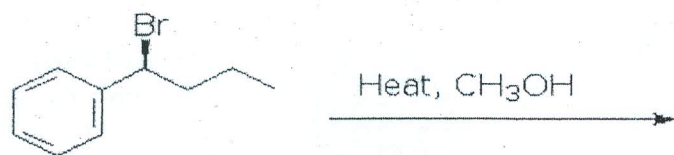
i - Morphine has a specific rotation of -132 . If a lab student uses a sample that has a concentration of $.0128$ g/mL and a path length of 1 dm, what would she expect the observed rotation to be?

ii- Which of the following are enantiomers?

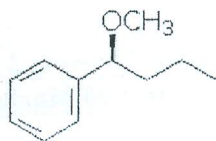


iii- Multiple Choice: Predict the stereochemical outcome for the following reaction:

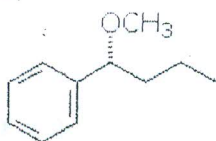
P.T.O. \longrightarrow



a.



b.



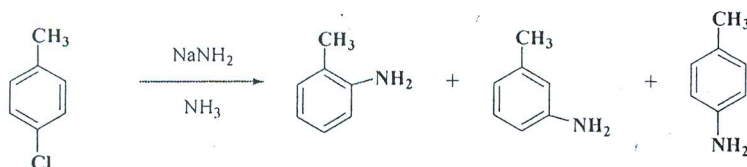
c. (a) + (b) (racemic)

d. Some mixture of (a) and (b).

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

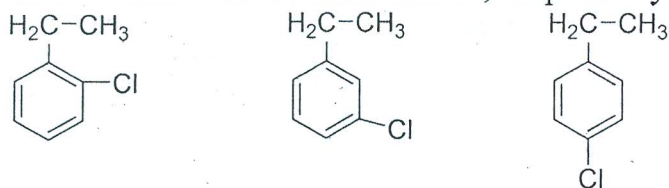
3-(25 Marks)

i- When p- chlorotoluene is treated with sodium amide in liquid ammonia, gave isomers toluidine in molar ratio



A) (1:1:1); B) (0:1:1); C) (0:2:1)

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



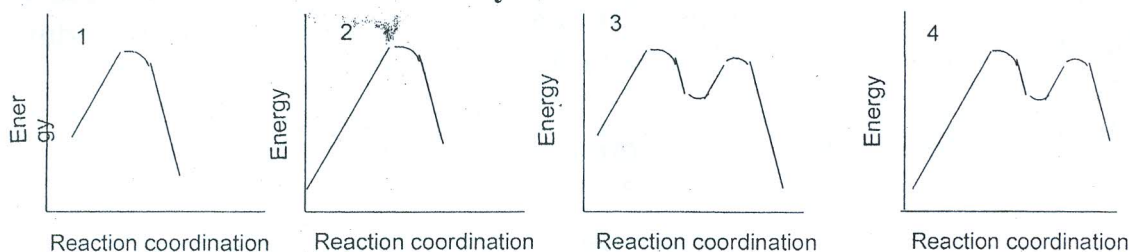
(a) 1 only

(b) 1 and 3

(c) 3 only

(d) 1 and 2

iii- Which of the following energy diagrams best represents the course of the reaction of t-butyl bromide with OH⁻ ?



A) 1; B) 2; C) 4; D) 3

GOOD LUCK

Prof.Dr. Wafaa S. Hamama

III- Discuss two methods only used for detection of the end point in precipitation titrations (argentometric titration). (5 marks)

Question 3: Choose three only. (15marks)

- 1- The success of an EDTA titration depends upon the precise determination of the end point.
- 2- The complexing action of EDTA is unselective.
- 3) A sample of NaCl weighs 0.5g. 50ml of 0.21M AgNO_3 is added to precipitate AgCl. The excess silver nitrate is titrated with 0.28M potassium thiocyanate to give 25.5 ml at the end point. Find the percentage of NaCl in this sample. (Na=23, Cl=35.5)
- 4) - Discuss colour change intervals of neutralization indicators.
- 5) Prove that $\text{pH} = \text{pK}_a + \log [\text{salt}] / [\text{acid}]$ for a buffer solution.

Question 4.

1- Define the following:

- a) Accuracy and precision.
- b) Nernst equation
- c) Buffer solution and buffer capacity. (4marks)

2- The world permissible limit of Pb in food must not exceed than 0.5 ppm (0.5mg/Kg). In the analysis of fish sample weighing 113g, it was found to contain 0.11mg Pb. (3marks)

- a) Find the concentration of Pb in the fish sample expressed as ppm
- b) Does the Pb concentration in the fish sample lie within the permissible limit?

3- A given analytical test was performed five times. The results of the analysis are represented by the following values. 6.738, 6.738, 6.637, 6.739 and 6.738% would you say that these results are precise?. If the standard deviation is 0.012 and t , value =4.1, Find the confidence limit and RSD% . (3 marks)

With our best wishes
Prof. Dr.M.El- Defrawy
Prof.Dr. Magda Akl

Mansoura University
Faculty of Science
Physics Department

First term Exam, 11/1/2015
2nd level
Time allowed : 2 hours

Full mark : 80 marks

Subject : physics

Course : 221- Physical optics

Answer the following questions:

- 1- a) Demonstrate an explanatory diagram of the optical arrangement of Newton's rings interferometer. Drive the necessary formula of these rings. Discuss the forming of the dark spot in the center of these rings. Explain how the wavelength of the unknown monochromatic source can be measured using this interferometer.

(20 marks)

- b) When a thin sheet of transparent material of thickness 6.3×10^{-4} cm is introduced in the path of one of the interfering beams, the central fringe shifts to a position occupied by the sixth bright fringe. If $\lambda = 5460 \text{ \AA}$, find the refractive index of the sheet.

(7 marks)

- 2- a) If the disturbances are produced at a given point by two coherent sources separately given by:

$$y_1 = a \sin (wt - \alpha_1) \quad \text{and} \quad y_2 = a \sin (wt - \alpha_2)$$

Deduce an expression for the intensity at a given point when both sources interfere. Sketch a plot of this intensity as a function of the phase difference $\delta = (\alpha_1 - \alpha_2)$.

(20 marks)

- b) Explain a method to produce the beam of plane polarized light.

(7 marks)

- 3- a) Give a model to discuss the intensity distribution of Fraunhofer diffraction pattern when using a rectangular slit.

(20 marks)

- b) What should be the total number of lines, a grating must have in order to just separate the sodium doublet ($\lambda_1 = 5896 \text{ \AA}$, $\lambda_2 = 5890 \text{ \AA}$) in the first order?

(6 marks)

With my best wishes
Prof. Dr. Taha Sokkar

السؤال الثاني

Mansoura University Faculty of Science Chemistry Department Subject: Inorganic Chemistry CHEM 221 (s&p-Block elements)		First Semester 2 nd Level Chemistry Students Date: 4 th Jan. 2015 Time: 2 hours Marks: 80
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Answer The Following Questions

I) Comment on (7 only) of the following:-

(28 marks)

- 1) The reactivity of elements of Group IA with water increases **down** the group.
- 2) The 1st Ionization Energy (1st IE) of ($_{12}\text{Mg}$, $_{15}\text{P}$ and $_{18}\text{Ar}$) is high **while** for ($_{16}\text{S}$) is low.
- 3) Beryllium metal is amphoteric **whereas** aqueous solutions of Be(II) salts are acidic.
- 4) Boron trifluoride (BF_3) is Lewis acid.
- 5) The size of sodium ion (Na^+) is smaller than that of sodium atom (Na), **while** that of Cl^- is larger than Cl .
- 6) In aqueous solutions, cesium ions (Cs^+) conduct electricity more than (Li^+), **while** the crystalline salts show decrease on the hydration.
- 7) Thallous (I); $_{81}\text{Tl}^+$ compounds are stable.
- 8) B_2O_3 shows amphoteric behaviour.

.....

II) A- Write shortly on (4 only) of the following:-

(20 marks)

- 1) Separation of Aluminium metal (Al) from bauxite ore $\{\text{AlO}(\text{OH})\}$.
- 2) Plant fertilizers are normally containing **three main ingredients**; (Nitrogen, Phosphorous and Potassium).
- 3) The production of nitric acid (HNO_3) by Ostwald process.

- 4) Photodissociation of nitrogen dioxide (NO_2) and photochemical smog.
 - 5) Isolation of pure silicon (Si) from silica (SiO_2).
 - 6) In aqueous solution, addition of glycerol to $\text{B}(\text{OH})_3$, makes the later strong monobasic acid.
-

II) B-Complete(6 only) ^{of} the following chemical equations:- (8 marks)

- | | |
|---|--|
| 1) $\text{Ba} + \text{O}_2(\text{at } 500^\circ\text{C}) \rightarrow$ | 2) $\text{CH}_4 + \text{H}_2\text{O} (\text{Ni}, 1000^\circ\text{C}) \rightarrow$ |
| 3) $\text{CaC}_2 + \text{H}_2\text{O} \rightarrow$ | 4) $\text{Al}_4\text{C}_3 + \text{H}_2\text{O} \rightarrow$ |
| 5) $\text{KO}_2 + \text{H}_2\text{O} \rightarrow$ | 6) $\text{Ca}(\text{H}_2\text{PO}_4)_2 + \text{NaHCO}_3 (300^\circ\text{C}) \rightarrow$ |
| 7) $\text{P}_4\text{O}_{10} + \text{H}_2\text{SO}_4 \rightarrow$ | 8) $\text{NH}_3 + \text{CO}_2 + \text{H}_2\text{O} + \text{NaCl} \rightarrow$ |
-

III) Answer (3 only) of the following:- (24 marks)

- 1) Give an account for ortho and para hydrogen.
.....
- 2) Diamond and graphite are two allotropic forms of carbon, compare between these two forms.
.....
- 3) Describe the structure and bonding of Diborane (B_2H_6). (Atomic No:5B)
.....
- 4) Explain how Silicon can be converted to semiconductors (n-type & p-type).
Draw the three Figures. (Atomic No:5B, 14Si, 15P)
.....

Best wishes

Prof. Kamal Ahmed, Prof. Gabr Abou El Reash, Prof. Tawfik Rakha, Prof. Sahar Mostafa