Assiut University
Faculty of Science
Chemistry Department

May 2024
Time allowed: 2 h

Second Semester Examination
Subject: General Chemistry I (C-100)
Students: First Level "Credit Hours System"

Part (I) (25 Marks)

A) Determine the molecular weight of a gas if 4.5 g of it occupies 4.0 liters at 950 torr and 182 °C. ($R=0.082$ L.atm.mol^{-1} K^{-1})

B) Using Van der Waal's equation, calculate the pressure exerted by 1.0 mole of CO_2 gas at 0 °C in a volume of i) 1.00 liter ii) 0.05 liter,
($a=3.59$ L^2.atm.mol^{-2} , $b= 0.042$ L.mol^{-1})

C) You have the following cell process:

$Fe_{(S)} + Co^{2+}$ (0.05 M) $\leftrightarrow Fe^{2+}$ (1.0 M) $+ Co_{(S)}$

$Fe^{2+} + 2e^- \leftrightarrow Fe_{(S)}$ $E°= -0.44$ eV

$Co^{2+} + 2e^- \leftrightarrow Co_{(S)}$ $E°= -0.28$ eV ,

Find $\Delta E°$, ΔE and the concentration ratio at which E = zero.

D) Write short notes on ***three only*** of the following:

i) Condensation method for preparation of colloidal solutions
ii) Electrical properties of colloids
iii) Purification of colloidal solutions
iv) Reversible cells

Part (II) (25 Marks)

A) Put (√) for true sentences or (X) for false sentences: ..... (6 Marks)

i) The hybridization of **C** in **HCN** molecule is sp^2 ( )
ii) The emission spectra consist of a series of dark lines superimposed on the continuous spectrum of the light source. ( )
iii) de Broglie suggested that particles of matter should show wave characteristics under certain circumstances. ( )
iv) The C_2 molecule has diamagnetic properties. ( )
v) The geometrical shape of BrF_5 molecule is Trigonal bipyramidal. ( )
vi) In an antibonding molecular orbital, the nuclei are attracted to an accumulation of electron density outside the internuclear region. ( )

B) Choose the correct answer (a), (b), (c) or (d): ..... (7 Marks)

i) The hybridization of **P** in PCl_3 is .....
(a) sp^2 (b) sp^3 (c) sp^3d (d) sp^3d^2

Please turn over for the rest of question

ii) Which of the following is the correct set of quantum numbers for the outermost electron of chlorine (**Cl**) atom?

(a) $n=3, \ell=0, m_\ell=0, m_s=+1/2$ (b) $n=3, \ell=1, m_\ell=-2, m_s=+1/2$

(c) $n=3, \ell=1, m_\ell=+2, m_s=+1/2$ (d) $n=3, \ell=1, m_\ell=+1, m_s=+1/2$

iii) The bond order in $\mathbf{O_2^+}$ molecule is .....

(a) 1 b) 1.5 (c) 2 (d) 2.5

iv) The geometrical shape of $\mathbf{BF_3}$ molecule is .....

(a) trigonal planar (b) trigonalpyramidal (c) seesaw (d) T-shaped

v) The angular momentum quantum number (ℓ) describes the ..... of the subshell

(a) size (b) energy (c) shape (d) orientation

vi) The bond in **NaF** molecule is .....

(a) ionic (b) non-polar covalent (c) polar covalent (d) dative

vii) ..... suggested the presence of elliptical orbits in atoms in addition to the spherical orbits.

(a) Plank (b) Pauli (c) Bohr (d) Sommerfeld

C) Answer the following: ..... (12 Marks)

i) Write down Lewis structures for each of the following: $\mathbf{NO_3^-}$ and $\mathbf{ClF_3}$, assign the formal charge for each atom in both of them.

ii) Using the molecular orbital theory, draw the energy level diagrams for $\mathbf{O_2}$ and $\mathbf{B_2}$. calculate the bond order and predict the magnetic properties for each of them.

iii) Based on **VSEPR** theory, predict the electron domain geometries and the molecular shapes for $\mathbf{SO_3}$ and $\mathbf{SF_4}$

[Atomic numbers: H=1 , B=5 , C=6 , N=7 , O=8 , F=9 , Na=11 , P=15 , S= 16 ,Cl= 17 , Br=35

Good Luck

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Assiut University
Faculty of Science
Department of Chemistry

Date: 20th May 2024
Time allowed: 2 hours

Final Examination of General Chemistry (2) (C-105) for 1st level students

يتم طمس (تسويد) الإجابة المختارة من قبل الطالب باستخدام القلم الجاف فقط

Answer the following questions:

Section A; Organic Chemistry (25 Marks)

Q1- Shade the correct answer A,B,C or D (1 Mark each)

1- Ethene characterized with:
A) tetrahedron carbons, B)Free rotation,
C) higher bond length, D) None.

2- Reaction mechanism is:
A) step by step description, B) bond breaking and bond making processes,
C) A and B, D) None

3- The IUPAC name of $(CH_3)_2CCH(CH_2)_2C(CH_3)CHCH_2OH$:
A) 2,6-dimethylocta-2,6-diene-8-ol,
B) 3,7-dimethylocta-2,7-diene-1-ol,
C) 2,6-dimethylocta-3,7-diene-8-ol,
D) 3,7-dimethylocta-2,6-diene-1-ol

4- 1,2-dimethylcyclopentane has:
A) one isomer, B) two isomers,
C) three isomers, D) four isomers

5- Which of the following compounds is relatively acidic:
A) CH_3CHCH_2 B) CH_2CH_2,
C) CH_3CCH, D) CHCH

6- Addition of HBr to ethene takes place through:
A) one transition state isolated,
B) two transition states isolated,
C) carbanion,
D) None

7- In ethylene:
A) the two carbons and the four hydrogen atoms that are attached to them lie in a single plane,
B) free rotation about the carbons,
C) short bond length,
D) A and C

8- Allyl alcohol is:
A) $CH_3(CH_2)_2OH$, B) $CHCCH_2OH$,
C) $CH_3CHCHOH$, D) None

9- The pi - bond may be formed by linear overlapping of two p orbitals:

A) one of them is occupied by two electrons and the other is empty,

B) each one is occupied by two electrons,

C) A and B,

D) None

10- Hydration of cyclohexene gave:

A) cyclohexane; B) cyclohexanal,

C) cyclohexanone, D) None

11- Which of the following alkenes exhibit cis - trans isomerism:

A) $CH_3CH_2CHCH_2$, B) $CH_3CHCHCH_2Cl_2$,

C) $CH_3CHCHCH_3$, D) $(CH_3)_2CHCHC(CH_3)_2$

12- The correct order of increasing energy of the following orbitals:

A) S,P, SP^2, SP^3, SP; B) S, SP, SP^2, SP^3, P;

C) S, SP^3, SP, SP^2, P D) S, SP^3, SP^2, SP, P

13- Radicals are:

A) stable; B) unstable;

C) highly reactive; D) B & C

14- The number of isomers of C_4H_8 is:

A) 2, B) 3, C) 4, D) 5

15- Pentane and isopentane are examples for:

A) chain isomerism; B) positional isomerism;

C) functional isomerism; D) None

16- The correct order of increasing angle between the hybrid orbitals are:

A) SP, SP^2, SP^3; B) SP^3, SP^2, SP;

C) SP^3, SP, SP^2; D) SP^2, SP^3, SP

17- The correct order of increasing C-H bond length is:

A) SP^3-H, SP-H, SP^2-H; B) SP^3-H, SP^2-H, SP-H;

C) SP-H, SP^3-H, SP^2-H; D) SP-H, SP^2-H, SP^3-H

18- The rate determining step in two steps reaction of ethene with HBr is:

A) higher energy barrier, B) lower energy barrier,

C) carbanion, D) None

19- The greatest %S character is in:

A) ethane, B) ethylene, C) acetylene, D) cyclohexane

20- Propyne reacts with H_3O^+ to give:

A) propanol, B) propanal, C) propanone, D) None

21-In propyne the number of sigma and pi - bonds are:

A) three sigma and one pi ; B) three sigma and two pi;

C) six sigma and one pi; D) None

22- Ozonolysis of 2- butene gave:

A) ethanol, B) ethanal, C) propanone, D) None

23- The reaction of CH_3CCCH_3 with 2H (Ni) gave:

A) cis - butene; B) trans - butene; C) butanol; D) butane

24- The reaction of propyne with ethyliodide in presence of sod amide gave: