

- (38) For the third spectral emission line in Paschen series for H-atom:  $n_2 = \dots\dots$   
 (A) 3 (B) 4 (C) 5 (D) 6
- (39)  $\dots\dots$  stated that no two electrons in the same atom can have the same set of 4 quantum numbers  
 (A) Bohr (B) Heisenberg (C) Pauli (D) de Broglie
- (40) Which of the following is the correct set of quantum numbers for the outermost electron of arsenic, As, (atomic number = 33)?  
 (A)  $n=4, \ell=0, m_\ell=0, m_s=+1/2$  (B)  $n=4, \ell=1, m_\ell=-2, m_s=+1/2$   
 (C)  $n=4, \ell=1, m_\ell=+2, m_s=+1/2$  (D)  $n=4, \ell=1, m_\ell=+1, m_s=+1/2$
- (41) The number of nonbonding electron pair(s) on the Cl atom in the  $\text{ClF}_3$  is  $\dots\dots$   
 (A) 0 (B) 2 (C) 3 (D) 5
- (42) The bond order in  $\text{He}_2^+$  species is  $\dots\dots$   
 (A) 0 (B) 0.5 (C) 1 (D) 1.5
- (43)  $\dots\dots$  molecule is linear.  
 (A)  $\text{H}_2\text{O}$  (B)  $\text{SO}_2$  (C)  $\text{HCN}$  (D)  $\text{NO}_2^-$
- (44) The hybridization of C in ethylene ( $\text{H}_2\text{C}=\text{CH}_2$ ) is  $\dots\dots$   
 (A) sp (B)  $\text{sp}^2$  (C)  $\text{sp}^3$  (D)  $\text{sp}^3\text{d}$
- (45) The number of electron pairs on the S atom in the  $\text{SF}_4$  molecule =  $\dots\dots$   
 (A) 3 (B) 4 (C) 5 (D) 6
- (46) The molecular geometry of  $\text{ClF}_3$  is  $\dots\dots$   
 (A) trigonal planar (B) trigonal pyramidal (C) seesaw (D) T-shaped
- (47) The bond order in  $\text{B}_2$  molecule is  $\dots\dots$   
 (A) 1 (B) 1.5 (C) 2 (D) 2.5
- (48) The molecular geometry of  $\text{SO}_3$  molecule is  $\dots\dots$   
 (A) trigonal planar (B) trigonal pyramidal (C) tetrahedral (D) T-shaped
- (49) The bond in HF molecule is  $\dots\dots$   
 (A) ionic (B) non-polar covalent (C) polar covalent (D) dative
- (50) The highest energy electrons in the  $\text{C}_2$  molecule occupy the  $\dots\dots$  orbital.  
 (A)  $\sigma$  (B)  $\sigma^*$  (C)  $\pi$  (D)  $\pi^*$
- (Atomic weights: hydrogen = 1; carbon = 12; nitrogen = 14; oxygen = 16)  
 (Atomic numbers: H=1, He=2, B=5, C=6, N=7, O=8, F=9, S=16, Cl=17, As=33)  
 (Standard electrode potentials:  $E^\circ_{\text{Cu}/\text{Cu}^{2+}} = +0.34 \text{ V}$ ;  $E^\circ_{\text{Zn}/\text{Zn}^{2+}} = -0.76 \text{ V}$ ;  
 $E^\circ_{\text{Al}/\text{Al}^{3+}} = -1.66 \text{ V}$ ;  $E^\circ_{\text{Ag}/\text{Ag}^+} = +0.80 \text{ V}$ )

GOOD LUCK

Examiners: Prof. Bahaa M. Abu-Zied, Dr. Soliman A. Soliman

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- (22) The formal charge of S atom in  $\text{SO}_3$  molecule equals +2.  
 (23) The bond order in  $\text{O}_2^-$  molecular ion is 2.  
 (24) The electron domain geometry of  $\text{NH}_3$  is trigonal pyramidal.  
 (25) The hybridization of N in  $\text{NH}_3$  is  $\text{sp}^3$ .

Q2: Choose the correct answer A, B, C, or D in the following sentences: (One mark each)

- (26) Which of the following liquids has the lowest vapor pressure?  
 (A) water (B) ethyl alcohol (C) methyl alcohol (D) diethyl ether
- (27) The crystalline solid among the following material is:  
 (A) glass (B) sugar (C) rubber (D) plastics
- (28) The density of a gas is 3.48 g/L at STP, what is its molecular mass? ( $R = 0.0821 \text{ L atm mol}^{-1} \text{ K}^{-1}$ )  
 (A) 44.6 g/mole (B) 77.9 g/mole (C) 32.0 g/mole (D) 147 g/mole
- (29) The deviation of  $\text{N}_2$  gas from the ideal behavior is maximized at .....  
 (A)  $0.0^\circ\text{C}$  and 1.0 atm (B)  $100^\circ\text{C}$  and 2.0 atm  
 (C)  $-15^\circ\text{C}$  and 1.0 atm (D)  $-15^\circ\text{C}$  and 2.0 atm
- (30) The compressibility factor for a real gas at high pressure is .....  
 (A) 1 (B)  $1 + (\text{Pb}/\text{RT})$  (C)  $1 - (\text{Pb}/\text{RT})$  (D)  $1 + (\text{RT}/\text{Pb})$
- (31) A plot of " $\log(x/m)$ " against " $\log P$ " for the adsorption of a gas on a solid gives a straight line with intercept equals to .....  
 (A)  $1/n$  (B)  $n$  (C)  $\log K$  (D)  $\log n$
- (32) A sol is prepared by addition of  $\text{AgNO}_3$  solution to an excess of  $\text{KI}$  solution. The charge likely to develop on colloidal particles is .....  
 (A) positive (B) negative (C) both charges (D) no charge
- (33) The effect of pressure on adsorption is high if .....  
 (A) temperature is low (B) temperature is high  
 (C) temperature is very high (D) none of these
- (34) The potential of the cell made up of  $\text{Zn}/\text{Zn}^{2+}$  (0.5 M) and  $\text{Cu}/\text{Cu}^{2+}$  (0.5 M) at  $25^\circ$  is .....  
 (A) 1.19 V (B) 1.09 V (C) 1.10 V (D) 1.29 V
- (35) The cell reaction  $2\text{Ag}^+_{(\text{aq})} + \text{H}_{2(\text{g})} \rightarrow 2\text{H}^+_{(\text{aq})} + 2\text{Ag}_{(\text{s})}$ , is best presented by .....  
 (A)  $\text{Ag}(\text{s}) | \text{Ag}^+_{(\text{aq})} || \text{H}^+_{(\text{aq})} | \text{H}_{2(\text{g})}, \text{Pt}(\text{s})$   
 (B)  $\text{Pt}(\text{s}), \text{H}_{2(\text{g})} | \text{H}^+_{(\text{aq})} || \text{Ag}^+_{(\text{aq})} | \text{Ag}(\text{s})$   
 (C)  $\text{Ag}(\text{s}) | \text{Ag}^+_{(\text{aq})} || \text{Pt}(\text{s}), \text{H}_{2(\text{g})} | \text{H}^+_{(\text{aq})}$   
 (D)  $\text{Ag}^+_{(\text{aq})} | \text{Ag}(\text{s}) || \text{Pt}(\text{s}), \text{H}_{2(\text{g})} | \text{H}^+_{(\text{aq})}$
- (36) The splitting of a spectral line into several components in the presence of a static magnetic field was studied by .....  
 (A) Bohr (B) Planck (C) Zeeman (D) Sommerfeld
- (37) The magnetic quantum number ( $m_l$ ) describes the orbital's .....  
 (A) size (B) energy (C) shape (D) orientation in the space

Please turn over for the rest of questions





Assiut University  
Faculty of Science  
Chemistry Department



28<sup>th</sup> December 2024  
Time allowed: 2 h

*First Semester Examination*  
*Subject: General Chemistry (C-100)*  
*Students: First Level "Plant Biotechnology and Microbiology program"*

**Q1: Answer (T) for True sentences or (F) for False sentences: (One mark each)**

- (1) The kinetic gas equation can be expressed as either  $PV = \frac{1}{3} mnC^2$  or  $PV = \frac{2}{3} E$ .
- (2) At atmospheric pressure  $> 1$  atm, water boils at temperatures  $< 100$  °C.
- (3) Boyle's temperature of a gas is the temperature at which the minimum in the Z-P curve vanishes and the curve remains horizontal.
- (4) Glass exhibits the same value of thermal and electrical conductivities in all directions.
- (5) In the P-V isotherms of  $CO_2$ , it is possible to liquefy  $CO_2$  upon pressure increase at 50 °C.
- (6) The viscosity of a liquid decreases with the increase in the temperature.
- (7) The times of diffusion of equal volumes of two gases are inversely proportional to the square root of their densities.
- (8) For a given mass of a gas, if pressure is reduced to half and absolute temperature is doubled, the volume will become eight times its initial volume.
- (9) Lyophilic colloids are thermodynamically unstable and need small amounts of electrolytes for precipitation or coagulation.
- (10) In chemisorption, many layers of adsorbed molecules may be formed.
- (11) A blue color is obtained when a copper strip is immersed in  $AgNO_3$  solution.
- (12) Removal of electrolytes (via dialysis) would cause instability of colloidal dispersion.
- (13) The adsorption of gases is used for investigating the surface area of solid catalysts.
- (14) In  $Al|Al^{3+}||Zn^{2+}|Zn$  cell, electrons flow from zinc electrode through the wire to the aluminum electrode.
- (15) The single electrode potential is temperature independent.
- (16) The  $C_2$  molecule is paramagnetic.
- (17) In a bonding molecular orbital, the nuclei are attracted to an accumulation of electron density outside the internuclear region.
- (18) The bond energy of  $H_2$  molecule is weaker than that of  $H_2^+$ .
- (19) The bond angle in  $NH_3$  molecule is smaller than that in  $CH_4$ .
- (20) Nonbonding electron pairs are physically larger than bonding pairs.
- (21) The  $H_2CO$  molecule has 3 resonating structures.

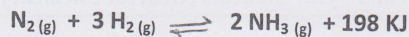
Please turn over for the rest of questions

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### Section (B) (25 Marks)

Answer only five of the following questions:

1. State Le Chatelier's Principle. Predict the effect of the following stresses on the equilibrium of the reaction:



- i) Increasing of total pressure.
- ii) Increasing of the temperature.
- iii) Increasing of ammonia concentration. (5 Marks)

2. Calculate the pH value of the following solutions.

- i) 0.1 M acetic acid.
- ii) 0.5 M sodium acetate.
- iii) 0.01 M ammonium chloride. (5 Marks)

3. If two moles of ozone ( $\text{O}_3$ ) was introduced into 10 L empty flask, Calculate the equilibrium constant for the following reaction:



If the amount of oxygen found at equilibrium was 0.6 mole. (5 Marks)

4. Calculate the solubility of calcium oxalate at the following solutions:

- i) Distilled water.
- ii) 1.0 M sodium oxalate. (5 Marks)

5. What must be the concentration of sodium acetate need to be dissolved one liter of 0.5 M acetic acid to produce a buffer solution with pH = 5.0? (5 Marks)

6. To a solution  $[\text{NaCl}] = 1.0 \times 10^{-3} \text{ M}$  a solution of  $[\text{AgNO}_3] = 1.0 \times 10^{-9} \text{ M}$  was add. Will precipitation be occurred or not? ( Give reason) (5 Marks)

$k_a$  of acetic acid =  $5 \times 10^{-5}$ ,  $k_b$  of ammonium hydroxide =  $5 \times 10^{-5}$ ,  
 $k_{sp}$  of calcium oxalate =  $1.4 \times 10^{-5}$ ,  $k_{sp}$  of silver chloride =  $1.0 \times 10^{-10}$ .

Dr. Gamal Abdel- Wahab Ahmed



Section A (Organic Chemistry)

1- Choose the correct answer (answer 5 only) (5 Marks)

- a) What could be the name of a compound that has the general formula  $RCONH_2$ : i) Acid, ii) Ester, iii) Ketone, iv) None
- b) Which formula represents a saturated hydrocarbon?  
i)  $C_3H_5$ , ii)  $C_3H_4$ , iii)  $C_3H_6$ , iv) None
- c) Which compound is an isomer of ethanol?  
i) Ethene, ii) Methyl formate, iii) Methyl acetate, iv) None.
- d) In a molecule of  $C_2H_6$ , the total number of covalent bonds is:  
i) 5, ii) 6, iii) 9, iv) None.
- e) Which compound is an ether? i)  $CH_3OH$ , ii)  $CH_3COOCH_3$ , iii) None
- f) A molecule of ethene is similar to a molecule of ethane in that they both have the same: i) Structural formula, ii) Molecular formula, iii) Number of carbon atoms.

2- Methane reacts with chlorine to produce methylchloride.

Outline the mechanism of the reaction

(5 Marks)

3- Complete the following equations:

i) 1,3-Butadiene +  $HBr \longrightarrow$  (2 Marks)

ii) 3-bromocyclopentene +  $H_2$  (Pd/C catalyst)  $\longrightarrow$  (2 Marks)

4- a) Explain by equations the addition reaction of  $H_2O/H^+$  to ethyne.

(4 Marks)

b) In which compound is carbon more oxidized: sodium carbonate or sodium acetate

(3 Marks)

c) Explain by using a mechanism the free radical polymerization of ethene to give polyethene

(4 Marks)

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V.

- (37) The magnetic quantum number ( $m_l$ ) describes the orbital's .....  
 (A) size (B) energy (C) shape (D) orientation in the space
- (38) For the third spectral emission line in Paschen series for H-atom:  $n_2 = \dots\dots$   
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 (C)  $n=4, \ell=1, m_\ell=+2, m_s=+1/2$  (D)  $n=4, \ell=1, m_\ell=+1, m_s=+1/2$
- (41) The number of nonbonding electron pair(s) on the Cl atom in the  $\text{ClF}_3$  is .....  
 (A) 0 (B) 2 (C) 3 (D) 5
- (42) The bond order in  $\text{He}_2^+$  species is .....  
 (A) 0 (B) 0.5 (C) 1 (D) 1.5
- (43) ..... molecule is linear.  
 (A)  $\text{H}_2\text{O}$  (B)  $\text{SO}_2$  (C) HCN (D)  $\text{NO}_2^-$
- (44) The hybridization of C in ethylene ( $\text{H}_2\text{C}=\text{CH}_2$ ) is .....  
 (A) sp (B)  $\text{sp}^2$  (C)  $\text{sp}^3$  (D)  $\text{sp}^3\text{d}$
- (45) The number of electron pairs on the S atom in the  $\text{SF}_4$  molecule = .....  
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- (48) The molecular geometry of  $\text{SO}_3$  molecule is .....  
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 (A) ionic (B) non-polar covalent (C) polar covalent (D) dative
- (50) The highest energy electrons in the  $\text{C}_2$  molecule occupy the ..... orbital.  
 (A)  $\sigma$  (B)  $\sigma^*$  (C)  $\pi$  (D)  $\pi^*$

(Atomic weights: hydrogen = 1; carbon = 12; nitrogen = 14; oxygen = 16)

(Atomic numbers: H=1, He=2, B=5, C=6, N=7, O=8, F=9, S= 16, Cl=17, As=33)

(Standard electrode potentials:  $E^\circ_{\text{Cu}^+/\text{Cu}^{2+}} = +0.34 \text{ V}$ ;  $E^\circ_{\text{Zn}^0/\text{Zn}^{2+}} = -0.76 \text{ V}$ ;  $E^\circ_{\text{Ag}^0/\text{Ag}^+} = +0.80 \text{ V}$ ;

$E^\circ_{\text{Al}^0/\text{Al}^{3+}} = -1.66 \text{ V}$ )

GOOD LUCK

Examiners: Prof. Maher M. A. Hamed, Prof. Bahaa Abu-Zied, Dr. Soliman A. Soliman, Dr. Ahmed Abdelrady



- (20) Nonbonding electron pairs are physically larger than bonding pairs.  
 (21) The  $\text{H}_2\text{CO}$  molecule has 3 resonating structures.  
 (22) The formal charge of S atom in  $\text{SO}_3$  molecule equals +2.  
 (23) The bond order in  $\text{O}_2^-$  molecular ion is 2.  
 (24) The electron domain geometry of  $\text{NH}_3$  is trigonal pyramidal.  
 (25) The hybridization of N in  $\text{NH}_3$  is  $\text{sp}^3$ .

Q2: Choose the correct answer A, B, C, or D in the following sentences: (One mark each)

- (26) Equal volumes of  $\text{NO}_{(\text{g})}$  and  $\text{C}_2\text{H}_{6(\text{g})}$  at the same conditions (T, P) have equal .....  
 (A) number of atoms (B) number of molecules  
 (C) masses (D) both B and C
- (27) A gas occupies 50 litre at  $27^\circ\text{C}$  and 3 atm. What pressure is required to compress this quantity of gas into 20 litre at  $127^\circ\text{C}$ ?  
 (A) 5 atm. (B) 10 atm. (C) 15 atm. (D) 20 atm.
- (28) At STP conditions one litre of certain gas weights 1.25 gm, the gas is .....  
 (A)  $\text{O}_{2(\text{g})}$  (B)  $\text{CO}_{2(\text{g})}$  (C)  $\text{NO}_{2(\text{g})}$  (D)  $\text{N}_{2(\text{g})}$
- (29) Which of the following liquids has maximum viscosity?  
 (A) Acetone (B) Ethyl alcohol (C) Glycerin (D) Water
- (30) The amorphous solid among the following is .....  
 (A) Glass (B) Diamond (C) Graphite (D) Sugar
- (31) A plot of " $\log (x/m)$ " against " $\log P$ " for the adsorption of a gas on a solid gives a straight line with intercept equals to:  
 (A)  $1/n$  (B)  $n$  (C)  $\log K$  (D)  $\log n$
- (32) A sol is prepared by addition of  $\text{AgNO}_3$  solution to an excess of KI solution. The charge likely to develop on colloidal particles is:  
 (A) positive (B) negative (C) both charges (D) no charge
- (33) The effect of pressure on adsorption is high if:  
 (A) temperature is low (B) temperature is high  
 (C) temperature is very high (D) none of these
- (34) The potential of the cell made up of  $\text{Zn}/\text{Zn}^{2+}(0.5\text{ M})$  and  $\text{Cu}/\text{Cu}^{2+}(0.5\text{ M})$  at  $25^\circ\text{C}$  is .....  
 (A) 1.19 V (B) 1.09 V (C) 1.10 V (D) 1.29
- (35) The cell reaction  $2\text{Ag}^+_{(\text{aq})} + \text{H}_{2(\text{g})} \rightarrow 2\text{H}^+_{(\text{aq})} + 2\text{Ag}_{(\text{s})}$ , is best represented by:  
 (A)  $\text{Ag}(\text{s}) \mid \text{Ag}^+_{(\text{aq})} \parallel \text{H}^+_{(\text{aq})} \mid \text{H}_{2(\text{g})}, \text{Pt}(\text{s})$   
 (B)  $\text{Pt}(\text{s}), \text{H}_{2(\text{g})} \mid \text{H}^+_{(\text{aq})} \parallel \text{Ag}^+_{(\text{aq})} \mid \text{Ag}(\text{s})$   
 (C)  $\text{Ag}(\text{s}) \mid \text{Ag}^+_{(\text{aq})} \parallel \text{Pt}(\text{s}), \text{H}_{2(\text{g})} \mid \text{H}^+_{(\text{aq})}$   
 (D)  $\text{Ag}^+_{(\text{aq})} \mid \text{Ag}(\text{s}) \parallel \text{Pt}(\text{s}), \text{H}_{2(\text{g})} \mid \text{H}^+_{(\text{aq})}$
- (36) The splitting of a spectral line into several components in the presence of a static magnetic field was studied by .....  
 (A) Bohr (B) Planck (C) Zeeman (D) Sommerfeld

Please turn over for the rest of questions



Assiut University  
Faculty of Science  
Chemistry Department



28<sup>th</sup> December 2024  
Time allowed: 2 h

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

**Q1: Answer (T) for True sentences or (F) for False sentences: (One mark each)**

- (1) At STP conditions (0 °C, 1 atm) helium, nitrogen, oxygen, and most simple gases behave ideally.
- (2) The kinetic gas equation can be expressed as either  $P = \frac{1}{3} \rho C^2$  or  $PV = \frac{3}{2} E$ .
- (3) The pressure of real gas is less than the pressure of ideal gas due to the excluded volume of molecules.
- (4) Anisotropy in crystals is due to different arrangements of particles in different directions.
- (5) In the region above 31 °C in Andrews' isotherm, CO<sub>2</sub> always exist in gaseous state.
- (6) The volumes of two gases diffuse in the same time are inversely proportional to the square root of their molar masses.
- (7) The vapor pressure and surface tension of a liquid increase with increasing temperature.
- (8) Gases can be liquified above their critical temperatures only by applying very high pressure.
- (9) Lyophilic colloids are thermodynamically unstable and need small amounts of electrolytes for precipitation or coagulation.
- (10) In chemisorption, many layers of adsorbed molecules may be formed.
- (11) A blue color is obtained when a copper strip is immersed in AgNO<sub>3</sub> solution.
- (12) Removal of the electrolytes (via dialysis) would cause instability of colloidal dispersions.
- (13) The adsorption of gases is used for investigating the surface area of solid catalysts.
- (14) In Al | Al<sup>3+</sup> || Zn<sup>2+</sup> | Zn cell, electrons flow from zinc electrode through the wire to the aluminum electrode.
- (15) The single electrode potential is temperature independent.
- (16) The C<sub>2</sub> molecule is paramagnetic.
- (17) In a bonding molecular orbital, the nuclei are attracted to an accumulation of electron density outside the internuclear region.
- (18) The bond energy of H<sub>2</sub> molecule is weaker than that of H<sub>2</sub><sup>+</sup>.
- (19) The bond angle in NH<sub>3</sub> molecule is smaller than that in CH<sub>4</sub>.

Please turn over for the rest of questions

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