

**Section (A): (25 Marks)**

**Answer All the following questions:**

**First Question:** Answer *Only Three* from the following: **(15 Marks)**

- a) State Boyle's law and derive it from the kinetic gas equation.
- b) "The magnitude of adsorption of gases on a solid surface depends on several factors"  
Explain these factors briefly.
- c) i- What is meant by *Only Three* from the following:  
Peptization; Galvanic cell; Electro-Osmosis; Viscosity of liquid.  
ii- How could you prepare *Only Two* from the following lyophobic sol:  
Gold; Ferric oxide; Sulphur.
- d) Give a reason for *Only Four* from the following:
- i- At low pressure the compressibility factor of a gas (Z) is less than one and Z-P curve lie below the ideal curve.
  - ii- Zinc can precipitate copper from its salt solutions.
  - iii- A gas can be liquefied by lowering temperature and increasing pressure.
  - iv- The charge on colloidal particles.
  - v- Vapor pressure of a liquid increases with increasing its temperature.

**Second Question:** Answer *Only Two* from the Following: **(10 Marks)**

- a) Assuming the following cell reaction:  $2\text{Cr}_{(s)} + 3\text{Sn}^{4+}_{(aq)} \longrightarrow 2\text{Cr}^{3+}_{(aq)} + 3\text{Sn}^{2+}_{(aq)}$ ,  
where  $E^\circ \text{Cr}/\text{Cr}^{3+} = -0.74$  and  $E^\circ \text{Sn}^{2+}/\text{Sn}^{4+} = +0.15$
- i- Write the anode and cathode reactions,      ii- Write cell representation,
  - iii- Predict whether the reaction is feasible or not.
- b) i- Write the cell reaction and emf equation for the following cell:



- ii- Calculate the kinetic energy of an ideal gas per molecule (e) and per mole (E) at 27°C  
( $N_A = 6.02 \times 10^{23}$ ,  $R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$ ).
- c) i- A certain gas occupies 100 liters at 3 atm and 27°C. What pressure is required to compress this quantity of gas into 40 liters at 127°C.
- ii- 50 ml of gas A effuses through a pin-hole in 10 second. The same volume of  $\text{SO}_2$  (molar mass of 64) effuses in 20 seconds. What is the molar mass of gas A.

*Examiners: Prof. Maher M. A. Hamed, Dr. Mohamed Koth and Dr. Mohamed Nady*

Please Turn over for Section (B)



**Section (B): (25 Marks)**

**Answer the following questions:**

**First question:** Answer Only Two of the following:

**(10 Marks)**

(a) Choose the correct answer:

- i- The bond order in  $\text{H}_2^+$  is .....  
(a) 0                      (b) 0.5                      (c) 1                      (d) 1.5
- ii- The angular momentum quantum number ( $\ell$ ) describes the orbital's .....  
(a) size                      (b) shape                      (c) energy                      (d) orientation in space
- iii- The hybridization of C in ethene ( $\text{H}_2\text{C}=\text{CH}_2$ ) is .....  
(a) sp                      (b)  $\text{sp}^2$                       (c)  $\text{sp}^3$                       (d)  $\text{sp}^3\text{d}$
- iv- The correct set of quantum numbers for the outermost electron in sulfur (S) is .....  
(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)  $n=3, \ell=1, m_\ell=+1, m_s=+1/2$
- v- The ..... molecule has a polar covalent bond.  
(a) NaCl                      (b)  $\text{Cl}_2$                       (c) HBr                      (d)  $\text{N}_2$

(b) Put true ( $\checkmark$ ) or false (X) for each of the following:

- i- The geometrical shape of  $\text{NH}_3$  is trigonal planar.
- ii- A sigma ( $\sigma$ ) bonding orbital has one nodal plane.
- iii- The ground state is an atom with the lowest energy.
- iv- Bohr's model successfully explains the spectra of the helium atom.
- v- The hybridization in  $\text{PH}_5$  is  $\text{sp}^3\text{d}^2$ .

(c) Give reasons for the following:

- i- The bond angle in  $\text{NO}_2^-$  is smaller than that in  $\text{NO}_2$ .
- ii- The  $\text{Be}_2$  molecule doesn't exist.

**Second question:** Answer each of the following

**(15 Marks)**

- a) Write down Lewis structure and assign the formal charge for each atom for only two of the following:  $\text{SO}_3$ ,  $\text{CH}_2\text{Cl}_2$ , and  $\text{BF}_3$ .
- b) Using the molecular orbital theory, draw the energy level diagrams for  $\text{O}_2$  and  $\text{N}_2$ , calculate the bond order and predict the magnetic properties for each of them.
- c) Based on VSEPR theory, predict the electron domain geometries and the molecular shapes for each of the following:  $\text{SF}_4$  and  $\text{NO}_3^-$ .

(Atomic numbers: H=1, He=2, Be=4, B=5, C=6, N=7, O=8, F=9, Na=11, P=15, S=16, Cl=17, Br=35)

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**Good Luck**

Dr. S.A. Soliman, Dr. A.M. Kamal, Dr. A.A.K. Mohammed, and Dr. A. Abo Markeb





Assiut University  
Faculty of Science  
Chemistry Department

22 December, 2019  
Time: 2 hr.

**Final Examination For 1<sup>st</sup> year Students (General Chemistry I, C100, Industrial Chemistry Group).**

**Section (A)**

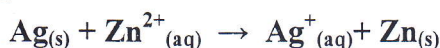
Answer Five only of the following questions: (25 Marks)

1. Using the concept of electron-pair repulsions (VSEPR theory) predict and draw the geometrical shape of each of the following: CO<sub>2</sub>, BF<sub>3</sub>, CH<sub>4</sub> and SF<sub>6</sub>. (5 Marks)
2. What type of the hybrid orbitals is employed by the central atom of each of the following species: BeCl<sub>2</sub>, SO<sub>3</sub>, CCl<sub>4</sub> and PCl<sub>5</sub>. (5 Marks)
3. Draw the Lewis structure of SO<sub>4</sub><sup>-2</sup> (S is the central atom) and HNO<sub>3</sub> (N is the central atom), then calculate the formal charge on each atom. (5 Marks)
4. At what wavelength will emission from n = 4 to n = 1 for the He<sup>+</sup> atom be observed? [Constant = 2.18 x 10<sup>-18</sup> J, h = 6.63 x 10<sup>-34</sup> Js and C = 3 x 10<sup>10</sup> cm/s]. (5 Marks)
5. The bond distance in N<sub>2</sub> is 109 pm and in N<sub>2</sub><sup>+</sup> is 112 pm. Draw the molecular-orbital energy-level diagrams for these species, and explain why the bond distance vary in the way described. (5 Marks)
6. Write the notations for the ground-state electronic configuration of the following atoms and ions: <sup>17</sup>Cl<sup>-</sup>, <sup>22</sup>Ti<sup>2+</sup>, <sup>36</sup>Kr and <sup>42</sup>Mo  
[Atomic no. of H = 1, Be = 4, B = 5, C = 6, N = 7, F = 9, O = 8, P = 15, S = 16 and Cl = 17]

**Section (B)**

Answer Five only of the following questions: (25 Marks)

1. If a gas diffuses at a rate of one-half as fast as O<sub>2</sub>, find the molecular mass of the gas. (5 Marks)
2. From the kinetic theory of gases show how can you derive Boyle's Law? (5 Marks)
3. By two different methods show how can you prepare the Au sol? (5 Marks)
4. What is the difference between electrophoresis and electro-osmosis? (5 Marks)
5. Discuss briefly the factors that affect the adsorption of gases on surfaces of solids. (5 Marks)
6. For the following reaction: (5 Marks)



$$E^{\circ}(\text{Ag}/\text{Ag}^{+}) = 0.8 \text{ V and } E^{\circ}(\text{Zn}^{2+}/\text{Zn}) = -0.76 \text{ V}$$

a) Write the cell reaction and cell representation, b) Calculate the cell potential and predict the reaction feasibility.

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Best Wishes

Dr. Mohamed Abdel megeed



**PLEASE ANSWER THE FOLLOWING QUESTIONS:**

**Choose the right answer of the following statements**

- 1) What actions are required to satisfy the wants and needs of a market?
  - A) Selecting a target market and designing a marketing mix
  - B) Selecting a target market and designing a promotion mix
  - C) Selecting global and domestic markets and distribution strategies
  - D) Selecting global markets and designing promotional strategies
- 2) Which of the following does NOT represent the maintenance of marketing research integrity?
  - A) Data will never be falsified or omitted.
  - B) Research results will be reported accurately and honestly.
  - C) Research companies may withhold damaging client data.
  - D) Researchers will not misrepresent the impact of the sampling method and its impact on sample data.
- 3) Firms sometimes hire an outside marketing research company to conduct its research. This is referred to as:
  - A) In-house research.
  - B) Supply-side research.
  - C) Do-it-yourself research.
  - D) Client-side research.
- 4) Full-service supplier firms:
  - A) Focus primarily in quantitative research.
  - B) Provide services at a reduced cost due to economies of scale.
  - C) Have the ability to conduct the entire marketing research project.
  - D) Provide qualitative services only
- 5) What is the definition of marketing research?
  - A) The process of analyzing secondary information and providing executives with timely reports to solve a marketing problem.
  - B) The process of designing experiments that provides decision makers with causal information.
  - C) The process of analyzing existing information so decision makers can make better decisions.
  - D) The process of designing, gathering, analyzing, and reporting information that may be used to solve a specific marketing problem.
- 6) There is an increasing demand for researchers to present results:
  - A) With full statistical analysis and commentary.
  - B) With competitor data and profiles.
  - C) In unambiguous, understandable, easy-to-grasp reports.
  - D) In an understandable format that connects to the client's strategic plan.



- 7) Which of the following is NOT a step in the marketing research process?
- |                       |                                       |
|-----------------------|---------------------------------------|
| A) problem definition | C) research design formulation        |
| B) problem correction | D) report generation and presentation |
- 8) The first step in any marketing research project is to \_\_\_\_\_.
- |                                       |                                  |
|---------------------------------------|----------------------------------|
| A) define the problem                 | C) formulate the research design |
| B) develop an approach to the problem | D) correct the problem.          |
- 9) A marketing research project is warranted when \_\_\_\_\_.
- |  |  |
|--|--|
| A) the required information is already in the organization         | C) the research will be used for gaining political ends        |
| B) the decision which the research addresses has already been made | D) the cost of the research is less than its eventual benefits |
- 10) Marketing researchers not only need to be skilled at gathering and analyzing data, but also at communicating results effectively because of:
- |  |   |
|--|---|
| A) The multiple new types of data and methods now in use | C) The multiple new types of interactive resources        |
| B) The multiple new types of social media                | D) The multiple new types of traditional data and methods |
- 11) \_\_\_\_\_ is data originated by the researcher for the specific purpose of addressing the research problem.
- |                   |                      |
|-------------------|----------------------|
| A) Primary data   | C) Experimental data |
| B) Secondary data | D) Virtual data      |
- 12) A research firm that specializes in one, or, at most, a few marketing research activities is:
- |                                    |                                    |
|------------------------------------|------------------------------------|
| A) A full-service supplier firm.   | C) An internal supplier firm.      |
| B) A syndicated data service firm. | D) A limited-service supplier firm |
- 13) According to the American Marketing Association (AMA), what is the function of marketing research?
- |   |  |
|---|--|
| A) To link the consumer to the marketer   | C) To link consumers and customers           |
| B) To link the marketer to global markets | D) To link consumers, customers, and markets |
- 14) A retailer may experience a decrease in sales over previous periods, a website begins losing traffic, or an advertising campaign does not reach its expected level of awareness. These situations are examples of:
- |   |                                   |
|---|-----------------------------------|
| A) Failure to perform marketing research. | C) Failure to meet sales targets. |
| B) Failure to perform marketing planning  | D) Failure to meet objectives.    |

15) The term "research design" refers to the research approach used to meet the research objectives. Three widely recognized research designs are:

- |  |  |
|--|--|
| A) Exploratory, structured, and causal.      | causal.                                  |
| B) Formal research, descriptive, and causal. | D) Descriptive, casual, and exploratory. |
| C) Exploratory, descriptive, and             |  |

16) When a gap exists between what did happen and what could have happened, it is known as:

- |                    |                    |
|--------------------|--------------------|
| A) Sampling error. | C) An opportunity. |
| B) A symptom.      | D) A problem       |

17) What is the document that the marketing researcher pledges to deliver as a result of the marketing research process?

- |                              |                                    |
|------------------------------|------------------------------------|
| A) Marketing research plan   | C) Marketing research proposal     |
| B) Marketing research report | D) Marketing research presentation |

18) The first and one of the most critical elements of a proposal is:

- |                        |                       |
|------------------------|-----------------------|
| A) Research objective. | C) Project cost.      |
| B) Research method.    | D) Problem statement. |

19) Falsifying data in order to make the findings consistent with predetermined points of view would demonstrate:

- |                                 |  |
|---------------------------------|--|
| A) Lack of research integrity.  | C) Lack of proper study supervision.                         |
| B) Lack of proper study design. | D) Lack of the use of data falsification detection software. |

20) To what does the number of elements of the population that are used to make up the sample refer?

- |                  |                 |
|------------------|-----------------|
| A) Sampling unit | C) Sample frame |
| B) Sample size   | D) Sample plan  |

**Please indicate whether each statement is true or false:**

- 1) With the multiple new types of data and methods now in use, marketing researchers not only need to be skilled at gathering and analyzing data but also at communicating results effectively.
- 2) Full-service supplier firms have the ability to define the problem, specify the research design, collect and analyze the data. However, the client prepares the final report.
- 3) Client-side research is research that is conducted within an organization.
- 4) Marketing research is defined as a process that reports information that can be used to solve a marketing problem, such as determining price or identifying the most effective advertising media.
- 5) Consumers wanted increasingly large TV screens to hang on their walls, so Samsung developed an ultra-thin, LED, large-screen TV. This is an example of using market research to identify market opportunities and problems.



- 6) The marketing research industry is currently facing a number of important challenges including evolving sources of data and methodologies, the effective communication of results, and the need for talented and skilled employees.
- 7) When a revolutionary new product is created, marketers use pricing research to determine the "value" consumers perceive in the new product.
- 8) Distribution research would be used by companies who want to know the best channels to get their product to consumers; the location of the best dealers for their product, or how to evaluate the service the dealer provides.
- 9) The research design is a framework or blueprint for conducting the marketing research project that specifies the procedures necessary to obtain the information needed to structure and/or solve the marketing research problem.
- 10) Unstructured, informal research that is undertaken to gain background information about the general nature of the research problem is called causal research.
- 11) In almost all cases, the research process is made up of 11 definite and clearly defined steps.
- 12) Most research projects follow an orderly, step-by-step process.
- 13) When products have been around for many years and are reaching the decline stage of their life cycle, it may be too late for research to produce valuable results.
- 14) Marketing research is part of marketing.
- 15) Some product failures are a result of being brought to market without any research, which increased the probability of failure.
- 16) The methodologies necessary to analyze the data from social media websites, the Internet of Things (IoT) and new kinds of syndicated data have the potential to provide valuable insights, but are not easy to develop and learn.
- 17) There is an increasing demand that marketing researchers provide simple and straightforward reports that "tell a story" rather than give clients lengthy, complex documents.
- 18) Managers may be aware of symptoms, but that does not mean they know what the problem is.
- 19) Price changes, product modification or improvement, are examples of decision alternatives, which are all marketing actions the manager thinks may resolve the problem.
- 20) Late identification of problems can lead to managerial changes that can greatly improve bottom-line profits.

**Wish you all the best,**

**Dr. Ziad Hassan**



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  $\text{RCOOR}$ ?
- i) Acid, ii) Ester, Ketone, iii) Alcohol
- b) Which formula represents a saturated hydrocarbon?
- i)  $\text{C}_3\text{H}_5$ , ii)  $\text{C}_3\text{H}_4$ , iii)  $\text{C}_3\text{H}_6$ , iv)  $\text{C}_3\text{H}_8$
- c) Which compound is an isomer of ethanol?
- i) Ethene, ii) Methyl formate, iii) Methyl acetate, iv) dimethyl ether.
- d) In a molecule of  $\text{C}_2\text{H}_6$ , the total number of covalent bonds is:
- i) 6, ii) 7, iii) 8, iv) none.
- e) Which compound is an ether? i)  $\text{CH}_3\text{OH}$ , ii)  $\text{CH}_3\text{OCH}_3$ , iii)  $\text{CH}_3\text{COOCH}_3$
- 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 bromine to produce methyl bromide.

Outline the mechanism of the reaction

(5 Marks)

3- Complete the following equations:

i) 1-Butene +  $\text{HBr}$  ---->

ii) 3-methylcyclopentene +  $\text{H}_2$  (Pd/C catalyst) --->

(4 Marks)

4- a) Explain by equation the addition reaction of bromine 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 ethylene to give polyethylene

(4 Marks)

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Examiner: Prof. Ali Ahmed Abdel-Hafez



## Section B (Analytical Chemistry)

Answer only Five of the following questions

(25 Marks)

1. For the following gaseous reaction:



What is the effect of i) Addition of more nitrogen, ii) Lowering the temperature and iii) Reducing the volume of the mixture to one-half of its original value.

2. What is the pH value of a solution prepared by dissolving 0.0155 mole  $\text{Ba}(\text{OH})_2$  in water to give 735 ml aqueous solution? Assume that  $\text{Ba}(\text{OH})_2$  is completely dissociated.
3. What is the pH of 5%(w/w)  $\text{H}_3\text{PO}_4$  solution? ( $d = 1.03 \text{ g/ml}$ ; At. Wt. of H = 1, O = 16 and P = 31;  $K_{a1} = 7.1 \times 10^{-3}$ )
4. At  $18^\circ\text{C}$ , the solubility of  $\text{CaC}_2\text{O}_4$  in water is  $0.00067 \text{ g/100 ml}$ . Calculate its solubility product ( $\text{Ca} = 40, \text{C} = 12, \text{O} = 16$ ).
5. What is the solubility of  $\text{Mg}(\text{OH})_2$  in a buffer solution having  $\text{pH} = 9$ ?
- $$\text{Mg}(\text{OH})_2 \rightleftharpoons \text{Mg}^{2+} + 2\text{OH}^- \quad (K_{sp} = 1.8 \times 10^{-11})$$
6. Calculate the molarity of  $\text{NH}_4\text{NO}_3$  solution that has a  $\text{pH} = 5.2$ ? ( $K_b$  for  $\text{NH}_4\text{OH} = 1.8 \times 10^{-5}, K_w = 1 \times 10^{-14}$ )
- .....

Best Wishes

Examiner: Dr. Mohamed Abdel megeed