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Ministry of Higher Education and Scientific  
Research  
Djillali Liabès University of Sidi-Bel-Abbès  
Faculty of Medicine  
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وزارة التعليم العالي و البحث العلمي  
بلعباس بسيدى ليابس جيلالي جامعة  
الطب كلية  
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# EXERCISE POLYCOPY GENERAL CHEMISTRY MCQs and QCS

**Dr OUGHILAS Ahmed**  
Associate Professor A  
Faculty of Medicine  
Department of Pharmacy

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# Foreword

This modest work is aimed at first-year students in Medicine, Pharmacy, and Dental Medicine, as well as students in the LMD (Bachelor's-Master's-Doctorate) program (technology sciences, material sciences, civil engineering, electrical engineering, and biology). It focuses primarily on the fundamental concepts of general chemistry, covering most of the chapters in the Pharmaceutical General Chemistry module. It has been reviewed based on the courses taught at the university, which are included in the program established by the Ministry of Higher Education and Scientific Research. (Atomic theory, electronic structure, radioactivity (nuclear reactions, radioactive decay law, periodic table, chemical bonds, states of matter, chemical thermodynamics, including properties of ideal gases, phase transitions, the first law of thermodynamics and its application to chemical reactions, Hess's law, Kirchhoff's law, solutions, acids and bases, and chemical kinetics). It compiles all the MCQs and QCS proposed in the Chemistry exams for first-year students in Medicine, Pharmacy, Dental Surgery, and Electrical Engineering.

Finally, I will gladly welcome any comments and suggestions from users, colleagues, teachers, and students, expressing their interest in this educational aid.

## **Preface**

This exercise booklet in the form of multiple-choice questions (MCQs) has been designed to accompany you throughout your learning journey and help reinforce your knowledge in chemistry. MCQs, as a tool for assessment and revision, allow you to quickly test your understanding of the concepts covered while providing the opportunity to practice interactively. The purpose of this booklet is twofold: on the one hand, it offers an efficient revision of the essential topics in the curriculum, and on the other hand, it helps you better identify your strengths as well as areas that need further improvement. Each question has been carefully selected to encourage critical thinking and to deepen your skills in various situations. The booklet is intended for first-year students in Medicine, Pharmacy, Dental Surgery, as well as first-year LMD students: ST and SM.

I encourage you to approach these exercises seriously and not hesitate to revisit the questions you found more challenging. Remember that the goal is not just to find the correct answer, but to understand why it is correct and learn from any mistakes you may make. This work is the result of a desire to make learning more accessible and interactive. I hope it will provide you with the keys to success and help you progress confidently in your studies. Good luck and happy studying!

Dr. Oughilas Ahmed

University Djilali Liabes of Sidi Bel Abbes  
Faculty of Medicine  
Chemistry Module

Midterm Exam n°1

General Chemistry

\_\_\_\_\_subject1\_\_\_\_\_2011\_\_\_\_\_

1) An electron in the hydrogen atom in its ground state absorbs energy with a wavelength of  $0.122 \mu\text{m}$ . At which level  $n$  does the electron end up?

- a)  $n = 3$
- b)  $n = 4$**
- c)  $n = 5$
- d)  $n = 6$
- e)  $n = 2$

2) To transition from  $n=2$  to  $n=3$ , the hydrogenic ion  $\text{Li}^{2+}$  ( $Z=3$ ) must absorb a photon with a wavelength of:

- a) 389nm
- b) 558nm
- c) 235nm
- d) 657nm
- e) 73nm**

3) The potential energy of an electron as a function of radius is given by the relation:

- a)  $\text{Ke}^2/2r$
- b)  $-\text{Ke}^2/2r$
- c)  $-\text{Ke}^2/r$**
- d)  $2\text{Ke}^2/r$
- e)  $\text{Ke}^2/r^2$

4) One of the lines in the Lyman series has a frequency of  $3.14 \times 10^{15} \text{ Hz}$ . This line corresponds to an electron transition of:

- a)  $6 \rightarrow 2$
- b)  $5 \rightarrow 1$**
- c)  $4 \rightarrow 2$
- d)  $4 \rightarrow 1$
- e)  $1 \rightarrow 6$

5) At level  $n$ , the energy of a hydrogen atom is  $-13.6/n^2$  eV. Which series of the emission spectrum corresponds to the transition  $3 \rightarrow 2$ ?

- a) PFUND
- b) BRACKETT
- c) BALMER**
- d) LYMAN
- e) PASCHEN

The wavelength of this transition is:

- a) 103nm
- b) 548nm
- c) 660nm**
- d) 823nm
- e) 478nm

6) Oxygen has 8 electrons. Its 6th electron is characterized by the following quantum numbers:

- a) (2,3,0,-1/2)
- b) (2,1,0, +1/2)**
- c) (2,1,0,-1/2)
- d) (2,1,1,-1/2)
- e) (2,1,-1,-1/2)

7) The last electron in the electronic configuration of an element X has quantum numbers (4, 1, -1, -1/2). How many electrons does this element possess?

- a)  $30e^-$
- b)  $25e^-$
- c)  $23e^-$
- d)  $20e^-$
- e)  $34e^-$

8) The initial activity of a cesium sample is  $9 \times 10^{14}$  Bq, with  $\lambda = 7.32 \times 10^{-10} \text{ s}^{-1}$ . After 30 years, it reaches:

- a)  $4.5 \times 10^{14}$  Bq
- b)  $5.6 \times 10^7$  Bq
- c)  $6.6 \times 10^7$  Bq
- d)  $8 \times 10^{14}$  Bq
- e)  $9.2 \times 10^7$  Bq

9) Iodine-131I is radioactive with a period  $T = 5$  days. After 20 days, how many nuclei have undergone decay?

- a)  $15N_0/16$
- b)  $N_0/8$
- c)  $7N_0/8$
- d)  $31N_0/32$
- e)  $N_0/32$

10) An element X has an electron configuration ending in  $3d^5$ . To which group does it belong?

- a) In the 2nd period and the 5th column of the periodic table.
- b) In group VII of the periodic table.
- c) In the 5th period and the 3rd column of the periodic table.

**d) In the 4th period and the 7th column of the periodic table.**

**e) no answer.**

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**The solution:**

QCM	1	2	3	4	5	6	7	8	9	10
Answer	<b>b</b>	<b>e</b>	<b>c</b>	<b>b</b>	<b>c, c</b>	<b>b</b>	<b>e</b>	<b>a</b>	<b>d</b>	<b>d</b>

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Chemistry Module

Midterm Exam n°1

General Chemistry

subject1 2012

1) A patient receives a dose of mass  $m=1 \mu\text{g}$  of the radionuclide  $^{99}\text{Tc}$  with a period of  $T=6\text{h}$ . Approximately, after how much time will the remaining mass of the radionuclide be 1% of the initial mass?

- a) 60h
- b) 30h
- c) 50h
- d) pas de réponse
- e) 40h**

2) Molybdenum-99 decays into technetium-99 with a radioactive period of 60h. The activity of molybdenum decreased by 75% after:

- a) 80,25 days
- b) 120 h**
- c) 66 days
- d) 44 days
- e) 5 days

3) Calcium- $^{47}\text{Ca}$  undergoes radioactive decay with a period of 3.5 days. Starting with  $4.1 \times 10^{20}$  nuclei, it disintegrates to  $3.588 \times 10^{20}$  after:

- a) 1 week
- b) 15 days
- c) 10.5 days**
- d) 7 days
- e) 2 days

4) Determine the quadruplets of quantum numbers for the last 4 electrons in the ground state of boron  ${}^5\text{B}$  atom.

- |                 |              |              |               |
|-----------------|--------------|--------------|---------------|
| a) (1,0,0,1/2)  | (1,0,0,-1/2) | (2,0,0,1/2)  | (2,0,-1,-1/2) |
| b) (1,0,0,1/2)  | (1,1,0, 1/2) | (2,0,0,1/2)  | (2,1,0,-1/2)  |
| c) (1,0,0,-1/2) | (1,0,0,+1/2) | (2,0,0,-1/2) | (2,1,-1,+1/2) |
| d) (1,0,0,1/2)  | (1,0,0,-1/2) | (2,0,0,1/2)  | (2,0,0,-1/2)  |
| e) no answer    |              |              |               |

5) Are the following statements, correct?

- a) Two isotopes differ in their number of electrons.
- b) Numbers A and Z characterize the nucleus of an atom.
- c) Two atoms having the same number of protons are isotopes.
- d) The ion  ${}^{715}\text{X}$  is an isotope of  ${}^{614}\text{C}$ .
- e) Isotopes have the same number of protons and neutrons.

6) Among the following propositions, indicate the one(s) that is (are) correct.

- a) Quantum numbers characterize the protons of an atom.
- b) The values of  $l$  are between  $n-1$  and  $n$ .
- c) Two electrons belonging to the same orbital have the same four quantum numbers.
- d) Quantum numbers define the state of an electron.
- e) Quantum numbers are not the result of solving the Schrödinger equation.

7) Among the following propositions, indicate the one(s) that is (are) correct.

- a) Two electrons with the same value of  $m$  do not have the same value of  $n$ .
- b) Dative bonding occurs between a lone pair and an empty orbital.
- c) Pi bonding results from axial overlap of atomic orbitals.
- d) Every covalent bond has an ionic character.
- e) Isotope 14 of carbon has more neutrons than isotope 12.

8) The dipole moment of the H—F bond is 1.82D, and the bond length of H—F is 0.92 Å. The percentage ionic character of the bond is:

- a) 37%
- b) 40.5%
- c) 92.3%
- d) 41.17%**
- e) 64.54%

9) The four quantum numbers of the last electron in the electronic configuration of an element X are (4,2,-1,-1/2). How many electrons does this element have?

- a) 27e<sup>-</sup>
- b) 32e<sup>-</sup>
- c) 52e<sup>-</sup>
- d) 45e<sup>-</sup>**
- e) 64e<sup>-</sup>

10) The activity at time t is related to the initial activity and the number of periods by:

- a)  $A = A_0/2$
- b)  $A = A_0/n^2$
- c)  $A = \ln A_0/2$
- d)  $A = A_0/2^n$**
- e)  $A_0 = Ax2^n$**

**The solution:**

QCM	1	2	3	4	5	6	7	8	9	10
Rep	e	b	c	c	c	C	b,e	d	d	d,e

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 Chemistry Module

Midterm Exam n°1

General Chemistry

subject1

2013

1) Give the abbreviation of the letters presented below.

${}^A_Z X^q$  1 X :.....  
 1- Z :.....  
 2- A :.....  
 5- q:.....

2)  ${}_1X$ ,  ${}_2X^+$ ,  ${}_3X^{2+}$ ,  ${}_4X^{3+}$  are:

a) Isotopes

**b) Hydrogénéoïdes**

c) Gaz rares

d) anions

e) no answer

3) The energy of a photon is given by the relation: (Choose the correct answer).

a)  $\Delta E = h \cdot c \cdot \lambda$

b)  $\Delta E = h/c \cdot \lambda$

**c)  $\Delta E = h \cdot c/\lambda$**

d)  $\Delta E = h \cdot \lambda/c$

e) no answer

4) The empirical formula allowing to find the values of energies is:

a)  $E = E_0 \cdot Z/n$

b)  $E = E_0 \cdot Z^2/n$

**c)  $E = E_0 \cdot Z^2/n^2$**

d)  $E = E_0 \cdot Z^2 \cdot n^2$

e) no answer

5) If the ionization of a hydrogen atom has a wavelength of  $\lambda_n = 9.55 \mu\text{m}$ . So the electron is in the level:

a)  $n=2$

**b)  $n=5$**

c)  $n=6$

d)  $n=8$

e) no answer

6) The empirical formula allowing to find the values of orbit radii is:

a)  $r_n = r_0 \cdot n / Z$

**b)  $r_n = r_0 \cdot n^2 / Z$**

c)  $r_n = r_0 \cdot n / Z^2$

d)  $r_n = r_0 \cdot n^2 / Z^2$

e) no answer

7) The secondary quantum number  $\ell$  defines:

**a) a subshell**

b) an electron layer

c) an orbital

d) an energy

e) no answer

8) Correctly classify the following subshells:

**2s, 5s, 7s, 2p, 4p, 5p, 6p, 3d, 5d, 7d, 5f, 6f, 7f.**

9) Give the electron configuration of the following elements:

$^{12}\text{Mg}$ ,  $^{16}\text{S}$ ,  $^{26}\text{Fe}$ ,  $^{30}\text{Zn}$ ,  $^{47}\text{Ag}$ ,  $^{32}\text{Ge}$ ,  $^{35}\text{Cl}$ ,  $^{36}\text{Kr}$ .

$^{12}\text{Mg}$ .....

$^{16}\text{S}$ .....

$^{26}\text{Fe}$ .....

$^{30}\text{Zn}$ .....

$^{36}\text{Kr}$ .....

$^{32}\text{Ge}$ .....

$^{35}\text{Cl}$ .....

$^{47}\text{Ag}$  .....

10) Give the position of the following elements in the periodic table:

$^3\text{Li}$ ,  $^{12}\text{Mg}$ ,  $^{21}\text{Sc}$ ,  $^{40}\text{Zr}$ ,  $^{48}\text{Cd}$ ,  $^{15}\text{P}$ ,  $^{53}\text{I}$ ,  $^{54}\text{Xe}$ .

	$^3\text{Li}$	$^{12}\text{Mg}$	$^{21}\text{Sc}$	$^{40}\text{Zr}$	$^{48}\text{Cd}$	$^{15}\text{P}$	$^{53}\text{I}$	$^{54}\text{Xe}$
ligne								
colonne								

11) Give the number of bonds formed by the following atoms:  $^6\text{C}$ ,  $^{15}\text{P}$ ,  $^{17}\text{Cl}$ ,  $^{10}\text{Ne}$ .

	$^6\text{C}$	$^{15}\text{P}$	$^{17}\text{Cl}$	$^{10}\text{Ne}$
Nombre des liaisons possible				

12) To measure the volume of a solution, one can use:

- a) flask
- b) Erlenmeyer
- c) balance
- d) becker
- e) pipette

13) To carry out a titration, we use:

- a) graduated test tube
- b) graduated pipette
- c) graduated burette
- d) flask
- e) no answer

14) Dilution:

**a) decreases the concentration**

b) fixes the concentration

c) no answer

d) increases the concentration

e) decreases the volume

15) Phenolphthalein is used in acid-base reactions as:

a) catalyst

**b) colored indicator**

c) reagent

d) inhibitor

e) no answer

16) Concentration is calculated by the formula:

a)  $C = n \cdot V$

b)  $C = V/n$

**c)  $C = n/V$**

d)  $C = m/V$

e) no answer

17) Normality is equal to:

**a)  $N = C \cdot Z$**

b)  $N = Z/C$

c)  $N = Z$

d)  $N = C$

e)  $N = Z/m$

18) Molality  $C_m$  is:

a)  $C^m = n \cdot V$

b)  $C^m=V/m$

**c)  $C^m=n/m$**

d)  $C^m=m/V$

e) no answer

19) To take 20ml of a solution accurately, one should use:

a) 20ml flask

b) two 10ml pipettes

c) 20ml graduated test tube

**d) 20ml pipette**

e) no answer

20) In a chemistry laboratory, distilled water is kept in:

a) a pipette

b) an oven

**c) a spray bottle**

d) a high

e) no answer

21) The unit of density is:

a) g/l

b) g/ml

c) g.l

d) g.ml

**e) unitless**

22) A solution of HCl has a pH of 3, so its concentration is equal to:

a) 0.3 M

b) 0.03M

c) 0.003M

d) 0.01M

e) 0.001M

23) A solution of Ba(OH)<sub>2</sub> has a pH of 9, so its concentration is:

a) 0,5.10<sup>-9</sup>M

b) 10<sup>-5</sup> M

c) 0,5. 10<sup>-5</sup> M

d) 0,05. 10<sup>-9</sup> M

e) 0,25. 10<sup>-5</sup> M

24) A 1M solution of KMnO<sub>4</sub> has a normality of:

a) 0,1 N

b) 0,5N

c) 2N

d) 1N

e) 5N

**The solution:**

QCM	2	3	4	5	6	7	12	13	14	15
Answer	b	c	c	b	b	a	a	c	a	b
QCM	16	17	18	19	20	21	22	23	24	
Answer	c , d	a	c	d	c	e	e	b	b	

1- the abbreviation of the letters presented below.

X: The element (atom)

Z: Atomic number (number of protons)

A: Mass number q: Charge

8- Ranking of subshells:

2s, 2p, 3d, 4p, 5s, 5p, 5d, 6p, 7s, 5f, 7d, 6f, 7f.

9- Electron configuration of the following elements:  ${}_{12}\text{Mg}$ ,  ${}_{16}\text{S}$ ,  ${}_{26}\text{Fe}$ ,  ${}_{30}\text{Zn}$ ,  ${}_{47}\text{Ag}$ ,  ${}_{32}\text{Ge}$ ,  ${}_{35}\text{Br}$ .

${}_{12}\text{Mg}$   $1s^2 2s^2 2p^6 3s^2$

${}_{16}\text{S}$   $1s^2 2s^2 2p^6 3s^2 3p^4$

${}_{26}\text{Fe}$   $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^6$

${}_{30}\text{Zn}$   $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10}$

${}_{36}\text{Kr}$   $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10}$

${}_{32}\text{Ge}$   $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^2$

${}_{35}\text{Br}$   $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^5$

10- Provide the position of the following elements in the periodic table:  ${}_{3}\text{Li}$ ,  ${}_{12}\text{Mg}$ ,  ${}_{21}\text{Sc}$ ,  ${}_{40}\text{Zr}$ ,  ${}_{48}\text{Cd}$ ,  ${}_{15}\text{P}$ ,  ${}_{53}\text{I}$ ,  ${}_{54}\text{Xe}$ .

	${}_{3}\text{Li}$	${}_{12}\text{Mg}$	${}_{21}\text{Sc}$	${}_{40}\text{Zr}$	${}_{48}\text{Cd}$	${}_{15}\text{P}$	${}_{53}\text{I}$	${}_{54}\text{Xe}$
<b>Row</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>5</b>	<b>3</b>	<b>5</b>	<b>5</b>
<b>column</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>12</b>	<b>15</b>	<b>17</b>	<b>15</b>

11- Provide the number of bonds formed by the following atoms:  ${}_{6}\text{C}$ ,  ${}_{15}\text{P}$ ,  ${}_{17}\text{Cl}$ ,  ${}_{10}\text{Ne}$ .

	${}_{6}\text{C}$	${}_{15}\text{P}$	${}_{17}\text{Cl}$	${}_{10}\text{Ne}$
<b>number of bonds formed</b>	<b>4</b>	<b>3</b>	<b>1</b>	<b>0</b>

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Faculty of Medicine  
Chemistry Module

Midterm Exam n°1

General Chemistry

subject2

2013

1) The relationship between the quantity of heat exchanged at constant pressure and the quantity of heat exchanged at constant volume is:

a)  $Q_v = Q_p - \Delta(nRT)$

b)  $Q_v = Q_p + \Delta nRT$

c)  $Q_v = Q_p + nR\Delta T$

d)  $Q_v - Q_p = - \Delta nRT$

e)  $Q_p = Q_v + \Delta nRT$

2) The quantity of heat exchanged at constant volume is equal to:

a)  $Q = \Delta U$

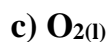
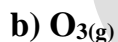
b)  $Q = \Delta H$

c)  $Q = W$

d)  $Q = 0$

e)  $Q = cste$

3) The standard enthalpy of formation for the following compounds is zero: a)  $O_2(g)$



4) Are the following statements true?

a) In a closed system, there is heat exchange but no exchange of matter.

b) In an isolated system, there is heat exchange and energy exchange.

c) In an open system, there is exchange of matter but no exchange of energy.

d) In an isolated system, there is heat exchange but no exchange of energy.

e) No answer.

5) 0.5 moles of an ideal gas at  $T=0^{\circ}\text{C}$  and  $p=1\text{ atm}$  undergo an isobaric transformation until the temperature reaches  $100^{\circ}\text{C}$ . Initial volume is:

initial volume is : a)20L    b)12.5L    **c)11.20L**    d)13L

final volume is : **a)15.3L**    b)25L    c) 40L    d)26L

Work done is:    a)408.2j    b)540j    **c)415j**    d)315.3j

e) No answer

6)1 kg of nitrogen  $\text{N}_2$  assumed to be ideal is compressed isothermally from  $0^{\circ}\text{C}$  and  $P_1 = 1\text{ atm}$  to  $P_2 = 20\text{ atm}$ . The value of work is:

a)  $W = -264.9\text{kJ}$

b)  $W = 86.4\text{kJ}$

c)  $W = 1840\text{j}$

**d)  $W = -242.719\text{j}$**

e) No answer

The initial and final volume are:

a)  $V_i = 84.53\text{L}$     b)  $V_i = 88.43\text{m}^3$     c)  **$V_i = 0.7995\text{m}^3$**     d)  $V_i = 50\text{L}$

a)  $V_f = 260\text{L}$     b)  **$V_f = 39.97\text{L}$**     c)  $V_f = 25\text{m}^3$     d)  $V_f = 150\text{L}$

7) Are the following statements true?

a) For an isothermal expansion, the work is positive.

**b) For an isothermal compression, the work is positive.**

c) A change in volume results in positive work.

d) The change in internal energy is zero in the case of an isochoric transformation.

e) No answer.

8) Given the following reaction  $\frac{1}{2}\text{N}_2 + \text{O}_2 \rightleftharpoons \text{NO}_2$  at  $T=30^\circ\text{C}$ , if the quantity of heat exchanged at constant pressure is 22.4 Kcal/mole and  $R=2$  cal/mol, the quantity of heat exchanged at constant volume is:

- a) **22.7 Kcal/mol**
- b) 25 Kcal/mol
- c) 22.09 Kcal/mol
- d) 100 Kcal/mol
- e) No answer.

9) An isothermal expansion of an ideal gas is characterized by:

- a)  $W=0$
- b)  **$W<0$**
- c)  **$\Delta U=0$**
- d)  **$U = \text{cste}$**
- e) No answer

10) In an isothermal transformation, the work is expressed as:

- a)  $W = -nRT \ln P_2/P_1$
- b)  $W = -nRT \ln V_1/V_2$
- c)  **$W = nRT \ln V_1/V_2$**
- d)  **$W = -nRT \ln V_2/V_1$**
- e) No answer

11) For a chemical reaction:

- a) If  $\Delta H > 0$ , the reaction is exothermic.
- b) **If  $\Delta H < 0$ , the reaction is exothermic.**
- c) If  $\Delta H = 0$ , the reaction is endothermic.
- d) If  $\Delta H > 0$ , the reaction is athermic.
- e) No answer

12) The Mayer relation between  $C_p$  and  $C_v$  is given by:

- a)  $C_p + C_v = R$
- b)  $C_p - C_v = R$**
- c)  $R + C_v = C_p$
- d)  $C_p - R = C_v$**
- e)  $C_v - C_p = R$

13) The change in entropy  $\Delta S$  during an isobaric transformation is given by:

- a)  $\Delta S = nC_v \Delta T$
- b)  $\Delta S = nC_p \ln P_2/P_1$**
- c)  $\Delta S = nC_p \ln T_2/T_1$
- d)  $\Delta S = nC_p \ln V_2/V_1$
- e) no answer

The solution:

QCM	1	2	3	4	5	6	7	8	9	10
Answer	a ,e	a	a , e	a	c,a,c	d,c,d	b	a	B,c,d	c,d
QCM	11	12	13							
Answer	b	b,c,d	b							

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Faculty of Medicine  
Chemistry Module

Midterm Exam n°1

General Chemistry

subject1

2014

Choose the correct answers and results in each exercise.

1) In an aqueous solution of 0.2 mol/L glucose ( $C_6H_{12}O_6$ ), the mole fraction is:

- a)  $X=36\%$
- b)  $X=3,6\%$
- c)  $X=0,36\%$
- d)  $X=0,036\%$
- e)  $X=0,0036\%$

2) A solution of sulfuric acid  $H_2SO_4$  with a density of 1.84 and 96% by mass (100 g of solution contains 96 g of pure  $H_2SO_4$ ). The molar concentration of this solution is:

- a)  $C=17.02 \text{ mol/L}$
- b)  $C=16.02 \text{ mol/L}$
- c)  $C=9.6 \text{ mol/L}$
- d)  $C=18.02 \text{ mol/L}$
- e)  $C=98 \text{ mol/L}$

- its mass concentration is::

- a)  $C^m=1667.96 \text{ g/L}$
- b)  $C^m=1766.4 \text{ g/L}$
- c)  $C^m=1569.96 \text{ g/L}$
- d)  $C^m=940.8 \text{ g/L}$
- e)  $C^m=9604 \text{ g/L}$

3) In an atom (the correct answer) is:

- a) The charge of the neutron is identical to that of the proton, equal to  $1.6 \times 10^{-19}$  coulombs.
- b) In an atom, the number of protons must be equal to the number of neutrons.
- c) The atom is electrically neutral.**
- d) Two isotopes are of the same element with a different number of electrons.
- e) The atomic mass unit is one-twelfth the mass of a calcium atom.
- 4) An isotope with a neutron deficiency is an emitter of:
- a)  $\beta^-$
- b)  $\beta^+$**
- c)  $\alpha$
- d)  $\gamma$
- e) no answer
- 5) In  $\beta^-$  radioactivity:
- a) The proton gives a neutron plus an electron.
- b) The neutron gives a proton plus an electron.**
- c) Potassium gives argon.
- d) The neutron gives an electron.
- e) no answer
- 6) The radioactive constant  $\lambda$  is given by the relation:
- a)  $\lambda = 2/T$
- b)  $\lambda = 2\ln 2/T$
- c)  $\lambda = \ln 2/T$**
- d)  $\lambda = \ln 2/2T$
- e)  $\lambda = 2/\ln T$

7) Calcium  $^{47}\text{Ca}$  decomposes with a half-life of 3.5 days. Starting from an initial mass of 32 mg, 4 mg of untransformed calcium remains after:

- a) 1 day
- b) 1 week
- c) 10.5 days**
- d) 2 weeks
- e) no answer

8) In a hydrogenoid:

- a) The atom contains one proton and  $Z$  electrons
- b) The atom contains  $Z$  protons and one electron**
- c) The atom contains  $Z$  protons and one neutron
- d) The atom contains one proton and one neutron
- e) no answer

9) In Bohr's theory, the kinetic energy is given by the relation:

- a)  $E_c = k e^2/r$
- b)  $E_c = k/2 e^2/r$**
- c)  $E_c = -k e^2/r$
- d)  $E_c = -k/2 e^2/r$
- e) no answer

10) The energy of the third orbit of the hydrogen-like ion  ${}^4\text{Be}^{3+}$   $E_3$  is:

- a) -10.2 eV
- b) -18.13 eV
- c) -30.6 eV
- d) -2.55 eV
- e) -24.17 eV**

11) The radius of the fourth orbit of the hydrogen-like ion  ${}^2\text{He}^{+1}$   $E_4$  is:

- a) 0.53 Å

b) 1.59 Å

**c) 4.24 Å**

d) 4.77 Å

e) 0.0588 Å

12) The fourth line of the Paschen series corresponds to an electron transition:

a)  $3 \rightarrow 2$

**b)  $7 \rightarrow 3$**

c)  $6 \rightarrow 3$

d)  $3 \rightarrow 7$

e)  $2 \rightarrow 6$

13) In the hydrogen emission spectrum for  $n \leq 5$ , there are:

a) 4 lines

b) 8 lines

**c) 10 lines**

d) 12 lines

e) 14 lines

14) Which statements are true? (answer with yes or no)

a) If  $l = 1$ , the electron is in a d subshell.

b) If  $n = 4$ , the electron is in the O shell.

c) For an electron in a d subshell,  $m$  can be equal to 3.

**d) The  $n$  number of an electron in an f subshell can be equal to 4.**

e) no answer

### TD exem

15) Complete the following table:

	Li	F	Co	Cu	Rn	U	Po	Ra	Pb
--	----	---	----	----	----	---	----	----	----

Z	3	9	27	29	86		84	88	82
A	5		59	63		238	212		208
N		10			134			134	

16) How many moles are there in 2g of nitrogen gas ( ${}_{14}^{14}\text{N}$ ) at room temperature?

a)  $n=0.285$  mol

b)  $n=0.142$  mol

c)  $n=0.071$  mol

d)  $n=14$  mol

e)  $n=28$  mol

17) In a sample of living wood, one carbon-14 atom is detected for every  $10^{12}$  carbon-12 atoms. What is the age of the piece of dead wood in which this ratio increases to 1 in  $8 \times 10^{12}$ ? Its half-life ( $t_{1/2}$ ) is 5570 years.

a) 16715.77 years

b) 238830 years

c) 5570 years

d) 2785 years

e) 696.25 years

18) The electron of a hydrogen atom initially at level  $n=3$  emits radiation with a wavelength  $\lambda=1.29\mu\text{m}$ . To which level does the electron transition?

a)  $n=1$

b)  $n=2$

c)  $n=3$

d)  $n=4$

e)  $n=5$

we give:  $h=6.62 \cdot 10^{-34} \text{ j/s}$      $R_H=1.096 \cdot 10^7 \text{ m}^{-1}$      $e=1.6 \cdot 10^{-19} \text{ C}$   
 $H = 1 \text{ g/mol}$      $c = 12 \text{ g/mol}$      $O = 16 \text{ g/mol}$      $S = 32 \text{ g/mol}$

**The solution:**

QCM	1	2	3	4	5	6	7	8	9	10
Answer	e	d, b	c	b	b	c	c	b	b	e
QCM	11	12	13	14	16	17	18			
Answer	c	B	c	d	c	a	e			

**15)**

	Li	F	Co	Cu	Rn	U	Po	Ra	Pb
Z	3	9	27	29	86	<b>92</b>	84	88	82
A	5	<b>19</b>	59	63	<b>220</b>	238	212	<b>222</b>	208
N	<b>2</b>	10	<b>22</b>	<b>34</b>	134	<b>146</b>	<b>128</b>	134	<b>126</b>

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Check the correct answer(s).

1) The mass  $m_t$  of a non-disintegrated sample at time  $t = nt_{1/2}$  is expressed as a function of the initial mass by the relation:

a)  $m_t = \frac{m_0}{2}$

b)  $m_0 = 2^n \cdot m_t$

c)  $m = \frac{m_0}{2^n}$

d)  $m_t = m_0 \cdot 2^{-n}$

e)  $m = \frac{m_0}{n^2}$

2) The activity in a vial of iodine  $^{131}\text{I}$  is  $10^{-2}$  ci. If its half-life is 8 days, after 48 days its activity decreases to:

a)  $1.56 \times 10^{-4}$  ci

b)  $1.56 \times 10^{-3}$  ci

c)  $6.5 \times 10^3$  ci

d)  $9.844 \times 10^{-3}$  ci

e)  $9.84 \times 10^{-2}$  ci

3) A patient is injected with a dose of a radionuclide  $^{99}\text{Tc}$  with a mass of  $0.5 \mu\text{g}$  and a half-life of 6 hours.

1) At what time will the dose decrease by 65%?

a) 3.72h

b) 9.08h

c) 32721.37s

d) 12h

e) 24h

2) At what time will the dose decrease by 90% of its initial value?

- a) 54.7 min
- b) 0.91h
- c) 1194.1min
- d) 19.9h**
- e) 3276s

4) At 25°C, one mole of an ideal gas undergoes an isothermal transformation from  $(P_0, T_0)$  to  $(2P_0, T_0)$ . The values of heat quantity and work are:

- a)  $W = 16.93J$  and  $Q = -16.93J$
- b)  $W = 413J$  and  $Q = -413J$
- c)  $W = 1716.49J$  and  $Q = -1716.49J$**
- d)  $W = -16.93J$  and  $Q = 16.93J$
- e) no answer

5) The initial state of one mole of an ideal gas is characterized by  $P_0 = 2$  atm,  $V_0 = 14$  L. The gas undergoes an isobaric expansion that doubles its volume with a temperature decrease of  $\Delta T = 150$  K. If  $C_p = 7$  cal/mol:

- The work done is:

- a)  $W = -28 \times 10^3 J$
- b)  $W = -2800J$**
- c)  $W = -28J$
- d)  $W = 28 \times 10^3 J$
- e) no answer

-The change in enthalpy is:

- a)  $\Delta H = 1050cal$**
- b)  $\Delta H = -1050cal$
- c)  $\Delta H = 28cal$
- d)  $\Delta H = -28 \times 10^3cal$
- e) no answer

6) Consider the reaction  $\text{NH}_3 + \text{Cl}_2 \rightarrow \text{NH}_2\text{Cl} + \text{HCl}$

We give :  $\Delta H_{\text{reaction}} = -46 \text{ cal/mol}$        $\Delta H_{\text{L(N-H)}} = -22 \text{ cal/mol}$   
 $\Delta H_{\text{L(Cl-Cl)}} = -12.5 \text{ cal/mol}$        $\Delta H_{\text{L(N-Cl)}} = -28 \text{ cal/mol}$

The bond energy  $\Delta H_{\text{L(H-Cl)}}$  is equal to::

- a) -46 Cal/mol
- b) 12.5Cal/mol
- c) -52.5 Cal/mol
- d) -30.5 Cal/mol**
- e) 52.5 Cal/mol

7) The formation reaction of ammonia releases 42.5 kcal/mole of heat at constant pressure at a temperature of 25°C. If  $\Delta C_p = -3.85 \text{ cal/mole}$ , its heat at  $T = 100^\circ\text{C}$  and at the same pressure

- a) 42884 cal/mole
- b) -42,788 Kcal/mol
- c) 42211,25cal/mole
- d) 42,19 Kcal/mole**
- e) no answer

8) The amount of heat received by one mole of an ideal gas heated from 20°C to 100°C at constant volume is:  $C_p = 33 \text{ J/mol}\cdot\text{K}$

- a) Q=1975,2 J**
- b) Q= 2640 J
- c) Q= 720720 J
- d) Q= 5392j
- e) no answer

9) The standard Gibbs free energy change is expressed in terms of the equilibrium constant by the relation:

a)  $\Delta G^\circ = RT \ln K$

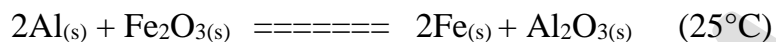
b)  $K = e^{-\frac{\Delta G^\circ}{RT}}$

c)  $\ln K = \frac{-\Delta G^\circ}{RT}$

d)  $\Delta G^\circ = \frac{RT}{\ln K}$

e)  $K = e^{-\frac{RT}{\Delta G^\circ}}$

10) The standard enthalpy of the following reaction::



$$\Delta H_f(\text{Fe}_2\text{O}_{3(s)}) = -196,5 \text{ Kcal/mol} \quad ; \quad \Delta H_f(\text{Al}_2\text{O}_{3(s)}) = -399,1 \text{ Kcal/mol.}$$

a)  $\Delta H_r^\circ = -202,6 \text{ Kcal}$

b)  $\Delta H_r^\circ = +202,6 \text{ Kcal}$

c)  $\Delta H_r^\circ = -595,6 \text{ Kcal}$

d)  $\Delta H_r^\circ = 595,6 \text{ Kcal}$

e) no answer

The solution:

QCM	1	2	3	4	5	6	7	8	9	10
Answer	b,c,d	a	b, d	C	b, a	d	d	a	b, c	a

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1) 2.5 moles of an ideal gas at  $T = 0^{\circ}\text{C}$  and  $P = 1 \text{ atm}$  undergo an isobaric transformation up to a temperature  $200^{\circ}\text{C}$ .

The initial volume is:

a) 5671.57L

**b) 55.9L**

c) 51.89L

d) 1365L

e) no answer

The final volume is:

a) 2365L

b) 2500L

c) 9826.57L

**d) 96.96L**

e) no answer

The work done is:

a) -408.2j

b) 4155j

**c) -4106j**

d) 315.3j

e) no answer

2) The relationship between the amount of heat exchanged at constant pressure and the amount of heat exchanged at constant volume:

a)  $Q_v = Q_p - \Delta(nRT)$

b)  $Q_v = Q_p + \Delta nRT$

c)  $Q_v = Q_p + nR\Delta T$

**d)  $Q_v - Q_p = - \Delta nRT$**

e) no answer

3) 0.05 kg of nitrogen ( $N_2$ ) assumed to be ideal is compressed isothermally from  $25^\circ C$  and  $P_1 = 2$  atm to a pressure  $P_2 = 15$  atm.

The value of the work done is:

a)  $W = -1264.9 \text{ kJ}$

**b)  $W = 8906.5 \text{ J}$**

c)  $W = 1840 \text{ J}$

d)  $W = 20362 \text{ J}$

e) no answer

The initial volume is:

a)  $V_i = 84.53 \text{ m}^3$

b)  $V_i = 88.43 \text{ m}^3$

**c)  $V_i = 21.80 \text{ L}$**

d)  $V_i = 21.8 \text{ m}^3$

e) no answer

The final volume is:

**a)  $V_f = 2.9 \text{ L}$**

b)  $V_f = 44.21 \text{ m}^3$

c)  $V_f = 3 \text{ m}^3$

d)  $V_f = 25 \text{ m}^3$

e) no answer

4) for the reaction :  $C_2H_4 + H_2 \rightarrow C_2H_6$

given :  $\Delta H_{\text{reaction}} = -66 \text{ cal/mol}$        $\Delta H_{L(C-H)} = -289.2 \text{ cal/mol}$

$\Delta H_{L(H-H)} = -12.5 \text{ cal/mol}$        $\Delta H_{L(C-C)} = -238 \text{ cal/mol}$

The bond energy  $\Delta H_L(\text{C}=\text{C})$  in cal/mol is:

- a) -46
- b) -125
- c) -261.9**
- d) 416
- e) -152.5

5) The HF bond has an ionic character of 67%. Given that the bond length is 1.57 Å, its dipole moment is:

- a)  $1.0519 \times 10^{-19} \text{ c.m}$
- b)  $1.63 \times 10^{-29} \text{ c.m}$**
- c)  $5 \times 10^3 \text{ D}$
- d)  $1.47 \times 10^{14} \text{ cm}$
- e) no answer

6) An element X has its electronic configuration ending with  $3p^4$ . It belongs to:

- a) Group VII of the periodic table
- b) Group VI of the periodic table**
- c) The 5th period and the 3rd column of the periodic table
- d) The 3rd period and the 16th column of the periodic table**
- e) No answer

7) The combustion of 18 g of an acid releases 272.54 KJ at 25°C under a pressure of 1 atm. Given:



The standard enthalpy of formation of one mole of lactic acid  $\text{CH}_3\text{CHOHCOOH}$  in KJ/mol is:

- a)  $\Delta H^\circ_f = 1686,72$
- b)  $\Delta H^\circ_f = -539$
- c)  $\Delta H^\circ_f = -686,72$**

d)  $\Delta H^{\circ}_f = -684.14$

e)  $\Delta H^{\circ}_f = -1200$

8) The amount of heat required to vaporize 10 kg of water at  $100^{\circ}\text{C}$  is equal to  $5.39 \times 10^6$  cal. The latent heat of vaporization of water is:

a)  $L_v = 80\text{cal/g}$

b)  $L_v = 5.39\text{cal/g}$

c)  $L_v = 530\text{cal/g}$

d)  $L_v = 1\text{cal/g}$

e)  $L_v = 0.08\text{cal/g}$

9) The amount of energy required to transform 10 kg of ice from  $-20^{\circ}\text{C}$  to vapor at  $150^{\circ}\text{C}$  is:

a)  $Q = 1245\text{cal}$

b)  $Q = 1.245\text{Kcal}$

c)  $Q = -4700\text{Kcal}$

d)  $Q = 4180\text{Kcal}$

e)  $Q = 7540\text{Kcal}$

we give :  $C_e = 1\text{cal/g.k}$ ,  $C_g = 0.5\text{cal/g.k}$ ,  $L_f = 80\text{cal/g}$ ,  $L_v = 530\text{cal/g}$

10) We mix 40 L of water at  $70^{\circ}\text{C}$  and 30 L of water at  $10^{\circ}\text{C}$ . The temperature of the mixture is:

a)  $T = 50^{\circ}\text{C}$

b)  $T = 100^{\circ}\text{C}$

c)  $T = 42^{\circ}\text{C}$

d)  $T = 25^{\circ}\text{C}$

e)  $T = 44.28^{\circ}\text{C}$

11) Consider an ideal gas that undergoes successive transformations represented in a Clapeyron diagram from the initial state A ( $P_A=3\text{atm}$ ,  $V_A=16\text{L}$ ,  $T_A=300\text{K}$ ).

A  $\rightarrow$  B isobaric compression  $V_B=8\text{L}$     B  $\rightarrow$  C isochoric heating

C  $\rightarrow$  A isothermal expansion back to the initial state A

- The number of moles of the ideal gas is:

a)  $n = 1.95\text{mol}$

b)  $n = 0.5\text{mol}$

c)  $n = 0.0195\text{ mol}$

d)  $n = 2\text{mol}$

e)  $n = 0.25\text{mol}$

- the pressure at point C is :

a)  $P = 4.5\text{atm}$

b)  $P = 5\text{atm}$

c)  $P = 3.5\text{atm}$

d)  $P = 6\text{atm}$

e)  $P = 6.5\text{atm}$

- The heat quantity from A to B is:

a)  $Q = 432\text{ cal}$

b)  $Q = 816.43\text{cal}$

c)  $Q = 3410.55\text{j}$

d)  $Q = 12.5\text{cal}$

e)  $Q = 500\text{cal}$

- The work done from C to A is:

a)  $W = -3354\text{j}$

b)  $W = -2125\text{j}$

c)  $W = -3412.68\text{j}$

d)  $W = -3369.6\text{j}$

e)  $W = 1500\text{J}$

Given:  $R = 8,31\text{J K}^{-1}\text{mol}^{-1} = 0.082\text{Latm mol}^{-1}\text{K}^{-1} = 2\text{ cal K}^{-1}\text{mol}^{-1}$   
 $C_p = 11,66\text{ J K}^{-1}$        $1\text{ atm} = 1.02 \times 10^5\text{Pa}$

**The solution:**

QCM	1	2	3	4	5	6	7	8	9	10
Answer	<b>b,d,c</b>	<b>d</b>	<b>b,c,a</b>	<b>C</b>	<b>b</b>	<b>b,d</b>	<b>c</b>	<b>b</b>	<b>c</b>	<b>e</b>
QCM	11									
Answer	<b>a,d,c,d</b>									

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subject4

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- 1) The energy of the third Balmer line in the emission spectrum is:
- a)  $40.18 \times 10^{-19} \text{ J}$
  - b)  $3.24 \times 10^{-19} \text{ J}$
  - c)  $4.54 \times 10^{-19} \text{ J}$
  - d)  $5.49 \times 10^{-19} \text{ J}$
  - e)  $69.54 \times 10^{-19} \text{ J}$
- 2) The mole fraction of glucose (180 g/mol) in an aqueous solution containing 36 g/L of glucose is:
- a) 0.2
  - b) 0.08
  - c) 0.36
  - d) 4
  - e) 5
- 3) A sample of radioactive  $^{136}\text{Cs}$  has an activity of  $3 \times 10^{-6} \text{ Ci}$  at time  $t$ . Eight days later, its activity becomes  $2 \times 10^{-6} \text{ Ci}$ .
- a. Its radioactive constant  $\lambda$  is:
- a)  $-4 \times 10^{-3} \text{ s}^{-1}$
  - b)  $5,06 \times 10^{-2} \text{ j}^{-1}$
  - c)  $5 \times 10^{-3} \text{ s}^{-1}$
  - d)  $5,86 \times 10^{-7} \text{ s}^{-1}$
  - e) no answer
- b- Its period  $T$  is:
- a) 139,6 day
  - b) 12,69 day

- c)  $12 \times 10^5 \text{s}$   
 d)  $11,8 \times 10^5 \text{day}$   
 e)  $13,69 \times 10^2 \text{s}$

4) The relationship between the quarter-life  $t_{1/4}$  and  $\lambda$  is given by:

- a)  $t_{1/4} = 1/4 \lambda \ln 2$   
 b)  $t_{1/4} = 2/\lambda \ln(2/3)$   
 c)  $t_{1/4} = 3/4 \lambda \ln 2$   
 d)  $t_{1/4} = 4\lambda \ln 2$   
 e) no answer

5) The equilibrium constant  $K_c$  is related to the equilibrium constant  $K_p$  by the following expression:

- a)  $K_c = K_p(RT)^{\Delta n}$   
 b)  $K_p = K_c R(T)^{\Delta n}$   
 c)  $K_p = \frac{K_c}{(RT)^{-\Delta n}}$   
 d)  $K_p = K_c(RT)^{\Delta n}$   
 e) no answer

6) The standard free energy change is expressed as a function of the equilibrium constant by the relation:

- a)  $\Delta G^\circ = RT \ln K$   
 b)  $K = e^{-\frac{\Delta G^\circ}{RT}}$   
 c)  $\Delta G^\circ = -RT \ln K$   
 d)  $\Delta G^\circ = \frac{RT}{\ln K}$   
 e)  $K = e^{-\frac{RT}{\Delta G^\circ}}$

7) The graphical plot of the variation of radioactive activity as a function of time  $\ln(A) = f(t)$  is:

- a) a straight line**
- b) a hyperbola
- c) a parabola
- d) exponential
- e) no answer

8) 0.75 mole of an ideal gas at  $T = 0^\circ\text{C}$  and  $p = 1 \text{ atm}$  undergoes an isobaric transformation until the temperature reaches  $100^\circ\text{C}$ .

The initial volume is:

- a) 20,5L
- b)1701.4L
- c)11.20L
- d)16.78L**
- e) no answer

the final volume est :

- a) 15.3L
- b)25L
- c)23L**
- d)26L
- e) no answer

The work done is :

- a) 4080.2day
- b)540day
- c)4185.2day
- d)6294.64day**
- e) no answer

9) The relationship between the amount of heat exchanged at constant pressure and the amount of heat exchanged at constant volume is:

a)  $Q_v = Q_p - \Delta(nRT)$

b)  $Q_v = Q_p + \Delta nRT$

c)  $Q_v = Q_p + nR\Delta T$

d)  $Q_v - Q_p = - \Delta nRT$

e)  $Q_p = Q_v + \Delta nRT$

10) Hydrofluoric acid HF 0.1 mol/L has an acidity constant  $K_a = 1.67 \times 10^{-4}$ .

a- The percentage of dissociation is:

a) 6.9%

b) 12.5%

c) 4 %

d) 7.9%

e) 1.25%

b- the concentration of  $H_3O^+$  ions is :

a) 0.05 mol/L

b)  $12.5 \times 10^{-3}$  mol/L

c) 0.06921 mol/L

d) 0.0040 mol/L

e) 0.0079 mol/L

c -the concentration of the remaining hydrofluoric acid is

a) 0.05

b) 0.0875

c) 0.096

d) 0.0298

e) 0.0921

11) Given two solutions of ethanoic acid  $\text{CH}_3\text{COOH}$  with respective concentrations: Solution  $S_1$ :  $10^{-2}$  mol/L and Solution  $S_2$ :  $1.0 \times 10^{-3}$  mol/L.  $\text{pK}_a \text{CH}_3\text{COOH} = 4.78$ .

a) The pH of Solution  $S_1$  is:

a) 2

**b) 3.39**

c) 2.38

d) 3.2

e) 3

b) The pH of Solution  $S_2$ :

a) 3.30

b) 2.38

**c) 3.89**

d) 3

e) 2.5

c) The dissociation rate  $\alpha_1$  of Solution  $S_1$  is:

a) 1.5%

b) 2%

c) 3.2%

d) 0.05%

**e) 4.07%**

d) The dissociation rate  $\alpha_2$  of Solution  $S_2$  is:

a) 10%

b) 3.8%

c) 2.38%

d) 40%

**e) 12.8%**

**The solution:**

QCM	1	2	3	4	5	6	7	8	9	10
Answer	c	a	b,e	b	c,d	c,e	a	d,c,d	d,e	c,d,c
QCM	11									
Answer	b,c,e,e									

University Djilali Liabes of Sidi Bel Abbes  
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Chemistry Module

Midterm Exam n°1

General Chemistry

\_\_\_\_\_ subject1 \_\_\_\_\_ 2015 \_\_\_\_\_

1) The relationship between the amount of heat exchanged at constant pressure and the amount of heat exchanged at constant volume is:

a)  $\Delta U = \Delta H - P(V_f - V_i)$

b)  $\Delta U = \Delta H + P(V_f - V_i)$

c)  $\Delta U = \Delta H - V(P_f - P_i)$

d)  $\Delta U = \Delta H + V(V_f - V_i)$

e) no answer

2) In an isothermal transformation, the work is expressed by:

a)  $W = nRT \ln P_2/P_1$

b)  $W = -nRT \ln V_1/V_2$

c)  $W = nRT \ln V_1/V_2$

d)  $W = -nRT \ln V_2/V_1$

e) no answer

3) A mass of nitrogen gas ( $N_2$ ), assumed to be ideal, is compressed isothermally at  $30^\circ C$  from an initial state of  $V_1 = 40$  L and  $P_1 = 1.5$  atm to a final pressure of  $P_2 = 20$  atm.

The mass of the nitrogen is is

a)  $m = 242,69$  g

b)  $m = 77.27$  g

c)  $m = 1840$  g

d)  $m = 20362$  g

e) no answer

The volume of the final state is:

a)  $V_i = 2.99 \text{ L}$

b)  $V_i = 799,4 \text{ L}$

c)  $V_i = 10 \text{ m}^3$

d)  $V_i = 50 \text{ L}$

e) no answer

4) Are the following statements true or false?

a) **In a closed system, there is an exchange of work but no exchange of matter.**

b) **In an isolated system, there is an exchange of heat and energy.**

c) **In an open system, there is an exchange of matter but no exchange of energy.**

d) **The work is zero in an isochoric transformation.**

e) no answer

5) 0.25 mole of an ideal gas at  $T = 0^\circ\text{C}$  and  $V = 1.5 \text{ L}$  undergoes an isochoric transformation until the temperature reaches  $150^\circ\text{C}$ .

The initial pressure is:

a)  $26.5 \text{ atm}$

b)  $120,5 \text{ atm}$

c)  $11,20 \text{ atm}$

d)  **$3.731 \text{ atm}$**

e) no answer

The final pressure is :

a)  $15,3 \text{ atm}$

b)  **$5.781 \text{ atm}$**

c)  $40 \text{ atm}$

d)  $26 \text{ atm}$

e) no answer

The work done is:

a) 408,2 J

b) 540 J

**c) 0 J**

d) 315,5 J

e) no answer

6) Consider the following reaction:  $\frac{1}{2} \text{N}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons \text{NO}_2(\text{g})$  at  $T = 30^\circ\text{C}$ . If the amount of heat exchanged at constant pressure is 22.4 Kcal/mole and  $R = 2$  cal/mol, the amount of heat exchanged at constant volume is:

**a)- 22,7 Kcal/mol**

b) 25 Kcal/mol

c) -22,09 Kcal/mol

d) 100 Kcal/mol.

e) no answer

7) The free enthalpy of a reaction is given by the relation:

a)  $\Delta G = \Delta G^\circ + RT \ln T$

**b)  $\Delta G = \Delta G^\circ - RT \ln 1/K$**

c)  $\Delta G = \Delta G^\circ - RT \ln K$

d)  $\Delta G = \Delta G^\circ + RT \ln K$ .

e) no answer

8) An element X whose electronic configuration ends in  $3p^5$  belongs to:

a) the 5th period and the 3rd column of the periodic table.

b) the 3rd period and the 5th column of the periodic table.

c) the 3rd period and the 7th column of the periodic table.

**d) the 3rd period and the 17th column of the periodic table.**

e) no answer

9) The formation reaction of ammonia releases a heat of 12.5 Kcal/mole at constant pressure at a temperature of 15°C. If  $\Delta C_p = -3.85$  cal/mole, its heat at  $T = 120^\circ\text{C}$  and at the same pressure is:

- a) 12904.25 cal/mole
- b) -42,788 Kcal/mol
- c) 12095.75 cal/mole
- d) 42,21 Kcal/mole
- e) no answer

10) The amount of heat exchanged during an adiabatic transformation is given by the relation:

- a)  $Q = nC_v (T_f - T_i)$
- b)  $Q = nC_p (T_f - T_i)$
- c)  $Q = nRT_f \ln V_f/V_i$
- d)  $Q = 0$
- e) no answer

11) The amount of heat received by 1.25 moles of an ideal gas raised from  $20^\circ\text{C}$  to  $100^\circ\text{C}$  at constant volume is:  $C_p = 33$  J/mol.K

- a)  $Q = 590$  cal
- b)  $Q = 2640$  J
- c)  $Q = 720720$  J
- d)  $Q = 539229$  J
- e) no answer

12) In an isothermal transformation:

- a)  $Q = 0$
- b)  $W = 0$

c)  $\Delta U=0$

d)  $\Delta H=0$

e)  $Q=W$

13) The Meyer relation between  $C_p$  and  $C_v$  is given by:

a)  $C_p+C_v=R$

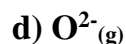
b)  $C_p-C_v=-R$

c)  $R+C_v=C_p$

d)  $C_p-R=C_v$

e)  $C_v-C_p=R$

14) The formation enthalpy of the following compounds is zero:



15) The entropy of an irreversible isothermal transformation is :

a)  $\Delta S= - P (V_f-V_i)/T$

b)  $\Delta S= +nR \ln V_f/V_i$

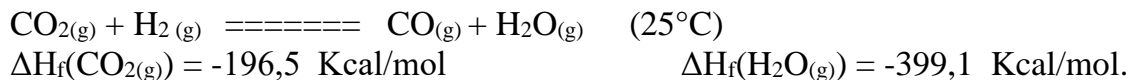
c)  $\Delta S=0$

d)  $\Delta S=nRT \ln V_f/V_i$

e) no answer

**Multiple choice questions for TD exam:**

16) The standard enthalpy of the following reaction is equal to 240 Kcal/mol. We deduce the formation enthalpy of  $CO(g)$ :



a)  $\Delta H_r^\circ = 412,6 \text{ Kcal}$

b)  $\Delta H_r^\circ = +202,6 \text{ Kcal}$

c)  $\Delta H_r^\circ = -595,6 \text{ Kcal}$

**c)  $\Delta H_r^\circ = 442,6 \text{ Kcal}$**

e) no answer

17)  $\Delta H_r^\circ$  is the combustion enthalpy of solid oxalic acid  $\text{C}_2\text{H}_2\text{O}_4$  at atmospheric pressure, knowing that,  $\Delta H_f(\text{C}_2\text{H}_2\text{O}_{4(s)}) = -1822,2 \text{ KJ/mol}$  ;  $\Delta H_f(\text{CO}_{2(g)}) = -393,1 \text{ KJ/mol}$  ;  $\Delta H_f(\text{H}_2\text{O}_{(l)}) = -285,2 \text{ KJ/mol}$

a)  $\Delta H_r^\circ = 1144 \text{ KJ}$

**b)  $\Delta H_r^\circ = 750.9 \text{ KJ}$**

c)  $\Delta H_r^\circ = 2500 \text{ KJ}$

d)  $\Delta H_r^\circ = 1321,4 \text{ KJ}$

e) no answer

18) The half-life of the  ${}^{40}_{19}\text{K}$  nucleus is equal to  $1.5 \times 10^9$  years. Its radioactive constant is:

a)  $2.16 \times 10^9$

**b)  $4.62 \times 10^{-10}$**

c)  $1.33 \times 10^{-9}$

d)  $7.51 \times 10^{-8}$

e) no answer

The solution:

QCM	1	2	3	4	5	6	7	8	9	10	11
Answer	A	a,c	b,a	a,d	d,b,c	a	b	d	c	d	b
QCM	12	13	14	15	16	17	18				
Answer	C	c,d	a,e	B	d	b	b				

University Djilali Liabes of Sidi Bel Abbas  
Faculty of Medicine  
Chemistry Module

Midterm Exam n°1

General Chemistry

subject2

2015

- 1) The number of protons  $p$ , neutrons  $n$ , and electrons  $e$  in the atom  ${}^{132}_{54}\text{Xe}$  are:
- a) **P=54, n=78, e=54.**
  - b) P=78, n=54, e=54.
  - c) P=54, n=54, e=78
  - d) p=132, n=54, e=54
  - e) no answer
- 2) The molar mass of potassium ( $Z = 19$ ) is 39.10 g/mol. The natural abundance of  ${}^{39}\text{K}$  et  ${}^{41}\text{K}$  is::
- a) 99% ; 1%
  - b) 94% ; 6%
  - c) **95% ; 5%**
  - d) 85% ; 15%
  - e) no answer
- 3) Carbon-14 is a  $\beta$ - emitter. Its half-life  $t_{1/2}$  is 5570 years. Its radioactive constant  $\lambda$  is:
- a) **1,244.  $10^{-4}$  ans $^{-1}$**
  - b) 2.196.  $10^{-8}$  ans $^{-1}$
  - c) 1.44.  $10^{-9}$  ans $^{-1}$
  - d) 1,795.  $10^{-4}$  ans $^{-1}$
  - e) no answer

- 4) In the periodic table:
- a)  ${}_1\text{H}$  is an alkaline earth metal.
  - b)  ${}_{11}\text{Na}$  has a larger atomic radius than  ${}_{16}\text{S}$ .**
  - c)  ${}_7\text{N}$  is more electronegative than  ${}_{8}\text{O}$ .
  - d)  ${}_2\text{He}$  is a noble gas.**
  - e) the attractive force increases from right to left in a period.
- 5) The dipole moment of the H-F bond is 1.82 D. Given that the bond length  $d_{\text{H-F}} = 0.92 \text{ \AA}$ , the ionic percentage of the bond is:
- a) 37%
  - b) 40.5%
  - c) 92.3%
  - d) 41.17%**
  - e) 80.21%.
- 6) A hydrogen atom initially in the ground state absorbs an energy of 10.2 eV. At what level is the electron?
- a)  $n=1$
  - b)  $n=2$**
  - c)  $n=3$
  - d)  $n=4$
  - e)  $n=5$
- 7) In a series of emission spectra of the hydrogen atom:
- a) The wavelength increases with the speed of light.**
  - b) The frequency decreases with the speed of light.
  - c) The energy is inversely proportional to the frequency.
  - d) The wavenumber is inversely proportional to the speed of light.**
  - e) no answer.

- 8) In the spectrum of the hydrogen atom, how many lines are there for  $n \leq 8$ :
- a) 7 line
  - b) 28 line**
  - c) 25 line
  - d) 6 line
  - e) no answer
- 9) An element X has 35 electrons, the penultimate electron is characterized by the following quantum numbers:
- a) (3, 2, 0,  $\frac{1}{2}$ )
  - b) (3, 2, -1,  $-\frac{1}{2}$ )**
  - c) (3, 2, 0,  $-\frac{1}{2}$ )
  - d) (3, 1, 0,  $\frac{1}{2}$ )
  - e) pas de réponse
- 10)  $\text{Zn}^{2+}$  ( $Z=30$ ) has the following configuration:
- a)  $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2$
  - b)  $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^1$
  - c)  $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10}$**
  - d)  $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^8$
  - e)  $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^0$**
- 11) The element X belongs to the 14th column and the 3rd row of the periodic table:
- a) X has 1 unpaired electron in its outer shell.**
  - b) X belongs to the same column as  ${}_6\text{C}$ .
  - c) X belongs to the A subgroup.
  - d) X has 2 electrons in its outer shell.**
  - e) no answer

12) The electronic structure of the 3rd halogen in the periodic table ends with:

a)  $3p^5$

b)  $4p^6$

c)  $5p^5$

**d)  $4p^5$**

e) pas de réponse

It contains :

a) 17 électrons

**b) 35 électrons**

c) 20 électrons

d) 53 électrons

e) pas de réponse

13) In the periodic table:

a) The attractive force increases from top to bottom.

**b) The electronegativity increases from left to right.**

**c) The atomic radius decreases from left to right.**

d) The ionization energy increases from right to left.

e) no answer

14) Among the following propositions, indicate which are correct:

a) The covalent bond is established between a lone pair and an empty orbital.

**b) The dative bond is established between a lone pair and an empty orbital.**

**c) The covalent bond is the sharing of two electrons.**

d) The ionic bond is established between a lone pair and an empty orbital.

e) no answer

15) An ion  $X^{2+}$  has 8 electrons in its outer shell L:

a) How many electronic shells does this ion have?

.....

b) Give its electronic configuration.

.....

c) Give the electronic configuration of the corresponding atom.

.....

d) Indicate the position of the element X in the periodic table.

.....

**Données :**  $N=6.023.10^{23}$  ;  $h=6.62.10^{-34}$  J.s ;  $R_h=1.097.10^7 m^{-1}$  ;  $C=3.10^8$  m/s ;  
 $1eV=1,6.10^{-19}J$  ;  $1nm=10^{-9}m$

**La solution:**

QCM	1	2	3	4	5	6	7	8	9	10
Rep	a	C	a	b,d	d	b	a,d	b	b	c,e
QCM	11	12	13	14						
Rep	d	d,b	b,c	b,c						

15) An ion  $X^{2+}$  has 8 electrons on its external L shell:

a) The number of electron shells in this ion is **2 shells**

b) Its electron configuration.  **$1s^2 2s^2 2p^6$**

c) The electron configuration of the corresponding atom.  **$1s^2 2s^2 2p^6 3s^2$**

d) The position of element X in the periodic table. second column and third row in the periodic table

University Djilali Liabes of Sidi Bel Abbes  
Faculty of Medicine  
Chemistry Module

Midterm Exam n°1

General Chemistry

subject3

2015

1 – The initial activity of a cesium sample is  $9 \times 10^{14}$  Bq. Its activity at time  $t_1 = T/2$  (half-life) is:

a)  $4.500 \times 10^{14}$  Bq

b)  $1.72 \times 10^4$  ci

c)  $6.364 \times 10^{14}$  Bq

d)  $4.500 \times 10^7$  dps

e) no answer

if  $t_1 = 15$  years, its activity after 20 years is:

a)  $5.670 \times 10^{14}$  Bq

b)  $3.571 \times 10^{14}$  Bq

c)  $1.364 \times 10^4$  ci

d)  $1.532 \times 10^4$  ci

e) no answer

2 – The radius of the third orbit of the hydrogen-like atom  ${}_3\text{Li}^{2+}$  is:

a)  $0.53 \text{ \AA}$

b)  $1.59 \text{ \AA}$

c)  $3.2 \text{ \AA}$

d)  $0.176 \text{ \AA}$

e) no answer

3- The mass of a radioactive sample after n periods is related to the initial mass by the relation:

a)  $m = 2/m_0^n$

b)  $m_0 = m \times 2^n$

c)  $m_0 = m/n^2$

**d)  $m = m_0 \times 1/2^n$**

e)  $m = m_0/n^2$

4- The penultimate electron of the electronic configuration of an element X is characterized by quantum numbers (3, 2, -1, -1/2). This element has:

a)  $28e^-$

b)  $25e^-$

**c)  $27e^-$**

d)  $24e^-$

e) no answer

5- An element X is missing 6 electrons to have the same structure as an element of the 4th period and the 5th column of the periodic table. It has:

a)  $23e^-$

**b)  $17e^-$**

c)  $18e^-$

d)  $20e^-$

e)  $22e^-$

6- The quantum numbers for the two last electrons in the outer sub-shell of the atom  $^{26}\text{Fe}$  are:

a) (3,2,0,+1/2) (3,2,+2, -1/2)

b) (3,2,-2,1/2) (3,2,-2,-1/2)

c) (4,0,0,1/2) (4,0,0,-1/2)

**d) (3,2+2,+1/2) (3,2,-2, -1/2)**

e) no answer

7- The O-H bond has an ionic character of 67%. Knowing that the bond length is 1.57 Å, its dipole moment is:

**a)  $1.0519 \times 10^{-19} \text{c.m}$**

**b)  $1.68 \times 10^{-29} \text{ c.m}$**

c)  $5 \times 10^3 \text{ D}$

d)  $1.47 \times 10^{14} \text{ cm}$

e) autre réponse

8- An element X belongs to the same column as oxygen (8O) and the same period as bromine ( $_{35}\text{Br}$ ). The element has:

a)  $16e^-$

b)  $35e^-$

c)  $8e^-$

**d)  $34e^-$**

e) No answer

9- An element X has an electronic configuration ending in  $3p^5$ . It belongs to:

a) The 2nd period and the 5th column of the periodic table.

**b) Group VII of the periodic table.**

c) The 3rd period and the 3rd column of the periodic table.

**d) The 3rd period and the 17th column of the periodic table.**

e) No answer

10- The quantum numbers of the penultimate electron in the electronic configuration of a third alkali metal are:

a) (3,0,-0,-1/2)

b) (3,0,0,1/2)

c) (4,0,0,-1/2)

**d) (4,0,0, 1/2)**

e) No answer

11- A sample of radioactive  $^{136}\text{Cs}$  has an activity at time t of  $5 \times 10^{-6} \text{ ci}$ , 10 days before, its activity was  $8 \times 10^{-6} \text{ ci}$ . Its decay constant  $\lambda$  is:

- a)  $4.7 \times 10^{-2} \text{s}^{-1}$
- b)  $5,06 \times 10^{-2} \text{days}^{-1}$
- c)  $1.958 \text{h}^{-1}$
- d)  $4.7 \times 10^{-2} \text{days}^{-1}$**
- e) No answer

b- Its period T is:

- a) 14.74j**
- b) 1274201s**
- c)  $12 \times 10^5 \text{s}$
- d) 353.85j
- e) No answer

12- In the periodic table:

- a) Ionization energy increases with atomic radius in a row.
- b) Attractive force decreases from top to bottom in a column.**
- c) Attractive force is proportional to ionization energy in a row.**
- d) Electronegativity decreases from right to left in a row.
- e) No answer

13- The number of nuclei in a sample of Uranium  $^{235}\text{U}$ , with an initial mass  $m_0 = 32 \text{mg}$ , is:

- a)  $1.2 \times 10^{23}$
- b)  $8.2 \times 10^{19}$**
- c)  $5.6 \times 10^{20}$
- d)  $6.2 \times 10^{25}$
- e) autre réponse

14- In the periodic table, the halogens belong to group:

- a) I<sub>A</sub>
- b) II<sub>A</sub>
- c) V<sub>A</sub>
- d) IV<sub>A</sub>
- e) VII<sub>A</sub>

15- Radioactive activity:

- a) is proportional to the number of nuclei.
- b) is a proportion of disintegrated nuclei.
- c) is a rate of disintegration.
- d) is a number of transformed nuclei.
- e) other answer

---

Données :  $1\text{ci} = 3.7 \times 10^{10} \text{Bq}$     $1\text{A}^\circ = 10^{-10} \text{m}$     $N_A = 6.023 \times 10^{23}$     $1\text{D} = 3.33 \times 10^{-30} \text{c.m}$

The solution:

QCM	1	2	3	4	5	6	7	8	9	10
Rep	a,b	B	b,d	C	b	d	b	d	b,d	D
QCM	11	12	13	14	15					
Rep	d,a,b	b,c	b	E	a,c					

University Djilali Liabes of Sidi Bel Abbes  
 Faculty of Medicine  
 Chemistry Module

Midterm Exam n°1

General Chemistry

\_\_\_\_\_ subject1 \_\_\_\_\_ 2016 \_\_\_\_\_

1 – The initial activity of a cesium sample is  $8.5 \times 10^{12}$  Bq. Its activity at time  $t_1 = T/4$  (a quarter period) is:

- a)  $4.500 \times 10^{12}$  Bq
- b)  $1.72 \times 10^{-12}$  ci
- c)  $6.74 \times 10^{12}$  Bq
- d)  $4.500 \times 10^7$  dps
- e) no answer

If  $t_1 = 14$  years, its activity after 84 years is:

- a)  $4.670 \times 10^{14}$  Bq
- b)  $2.125 \times 10^{12}$  Bq
- c)  $1.364 \times 10^4$  ci
- d)  $1.532 \times 10^4$  ci
- e) no answer

2 – In the hydrogen atom, an electron transitions from its ground state to level  $n=4$  with the absorption of energy of wavelength:

- a) 54.35nm
- b) 124.35nm
- c) 97.35nm
- d) 18.2nm
- e) no answer

3- The mass of a radioactive sample is related to the radioactive activity by the expression:

- a)  $m = A \cdot \lambda M \times \lambda N_A$
- b)  $m = A \cdot / \lambda M N_A$

**c)  $m = A \cdot M / \lambda N_A$**

**d)  $m = A / M \lambda N_A$**

**e)  $m = A \cdot N_A / \lambda M$**

4) A chemical element has 33 electrons. Its penultimate electron is characterized by the following quantum numbers:

**a) (4,2,0,-1/2)**

**b) (4,1-1,-1/2)**

**c) (4,2,-1,-1/2)**

**d) (4,1 0,+1/2)**

**e) no answer**

5) The element  ${}_{35}\text{Br}$  has n electrons in its valence shell:

**a) n=5**

**b) n=15**

**c) n=17**

**d) n=7**

**e) n=2**

6) The quantum numbers for the two last electrons in the outer subshell of the atom  ${}_{17}\text{Cl}$  are:

**a) (3,2,-1,-1/2) (3,2,-1,+1/2)**

**b) (3,2,-2,1/2) (3,2,-2,-1/2)**

**c) (4,0,0,1/2) (4,0,0,-1/2)**

**d) (3,1,-1,-1/2) (3,1,0,-1/2)**

**e) no answer**

- 7) After how many periods does the mass of a radioactive sample decrease to 6.25% of its initial value?
- a) 2T
  - b) 4T**
  - c) 5T
  - d) 3T
  - e) T

8- An element X belongs to the same column as oxygen ( ${}_{16}\text{S}$ ) and the same period as iron ( ${}_{26}\text{Fe}$ ). The element has:

- a)  $26e^-$
- b)  $34e^-$**
- c)  $18e^-$
- d)  $35e^-$
- e) no answer

9- The electronic configuration of an element X ends with  $4p^2$ . It belongs to:

- a) The 2nd period and the 5th column of the periodic table.
- b) Group VII of the periodic table.
- c) The 4th period and the 14th column of the periodic table.**
- d) The 4th period and the 7th column of the periodic table.
- e) other answer

10- The quantum numbers of the eighth electron in the electronic configuration of a third halogen are:

- a)  $(3,2,-1,-1/2)$
- b)  $(4,2,-1,1/2)$
- c)  $(4,1,-2,-1/2)$
- d)  $(2,1,-1,-1/2)$**
- e) no answer

11-A sample of  $^{206}\text{Pb}$  is radioactive with an activity of  $7.5 \times 10^{-5} \text{Ci}$  at time  $t$ . Two years later, its activity is  $4 \times 10^{-5} \text{Ci}$ . Its decay constant  $\lambda$  is:

- a)  $4.7 \times 10^{+9} \text{s}^{-1}$
- b)  $5.06 \times 10^{-2} \text{j}^{-1}$
- c)  $1.958 \text{ ans}^{-1}$
- d)  $31.41 \times 10^{-2} \text{ans}^{-1}$**
- e) no answer

- Its period  $T$  is

- a)  $139.6 \text{ ans}^{-1}$
- b)  $1273.88 \text{s}$
- c)  $2.207 \text{ ans}^{-1}$**
- d)  $353.85 \text{ ans}^{-1}$
- e) no answer

12 – Are the following statements correct?

- a) The energy of an electron is always positive.
- b) The energy of an electron can be positive.
- c) The energy of an electron can be negative.
- d) The energy of an electron is always negative.**
- e) other answer

13- Calcium decomposes with a period of 3.5 days. If starting from an initial mass  $m_0 = 32 \text{ mg}$ , it disintegrates  $1/3$  of the initial mass after:

- a)  $10.50 \text{ days}$
- b)  $49.13 \text{ h}$**
- c)  $16.17 \text{ h}$
- d)  $2.04 \text{ days}$**
- e) no answer

14- The average mass of chlorine is 36.59 g/mol. The natural abundance of  $^{35}\text{Cl}$  and  $^{37}\text{Cl}$ :

- a) **x=79.5%,y=20.5%**
- b) x=84%,y=16%
- c) x=95%,y=5%
- d) x=85%,y=15%
- e) no answer

15- Radioactive activity:

- a) is proportional to the number of nuclei.
- b) is a proportion of disintegrated nuclei.**
- c) is a decay rate.**
- d) is a number of transformed nuclei.
- e) other answer

---

Données :  $1\text{ci} = 3.7 \times 10^{10}\text{Bq}$  ;  $1\text{A}^\circ = 10^{-10}\text{m}$   $N_A = 6.023 \times 10^{23}$

The solution:

QCM	1	2	3	4	5	6	7	8	9	10
answer	c,b	c	c	d	d	d	b	b	c	d
QCM	11	12	13	14	15					
Rep	d,c	d	b,d	a	b,c					

University Djilali Liabes of Sidi Bel Abbes

Faculty of Medicine

Chemistry Module

Midterm Exam n°1

General Chemistry

subject2

2016

1) A solution of formic acid  $\text{HCOOH}$  has a pH equal to:

a)  $\alpha=0.041$

b)  $\alpha= 0.152$

c)  $\alpha=0.032$

d)  $\alpha=0.025$

e)  $\alpha= 0.45$

2) What volume of 0.1M sodium hydroxide solution should be added to 1L of 0.1M hydrochloric acid solution to achieve a pH of 1.5?

a)  $V = 2\text{L}$

b)  $V = 1.75\text{L}$

c)  $V = 0.25\text{L}$

d)  $V = 0.52\text{L}$

e) no answer

3) The entropy change  $\Delta S$  during an isobaric transformation is given by:

a)  $\Delta S = nC_v \Delta T$

b)  $\Delta S = nC_p \ln P_2/P_1$

c)  $\Delta S = nC_p \ln T_2/T_1$

d)  $\Delta S = nC_p \ln V_2/V_1$

e) no answer

4) 0.5 moles of an ideal gas at  $T = 0^\circ\text{C}$  and 2.25 atm undergoes an isobaric transformation until the temperature reaches  $100^\circ\text{C}$ .

The initial volume is:

a) 20 L

b) 12,5 L

c) 11,20 L

**d) 5L**

e) no answer

The final volume is :

a) **6.79 L**

b) 25 L

c) no answer

d) 26 L

e) 40 L

The work done is :

a) **other answer**

**b) 407.58KJ**

c) 418,2 J

d) 315,5 J

e) 408,2 J

5) The amount of heat received by one mole of an ideal gas heated from 20°C to 100°C at constant volume, given  $C_p = 33 \text{ J/mol}\cdot\text{K}$ , is:

**a)  $Q=1975,2 \text{ J}$**

b)  $Q= 2640 \text{ J}$

**c)  $Q= 472.53 \text{ cal}$**

d)  $Q= 539\text{cal}$

e) no answer

6) The combustion of 18 g of lactic acid releases 272.54 KJ at 25°C under a pressure of 1 atm.  $\text{CH}_3\text{CHOHCOOH}$ :  $\text{C}(\text{s}) + \text{O}_2(\text{g}) \rightleftharpoons \text{CO}_2(\text{g}) \Delta H^\circ = -397.31 \text{ KJ/mol}$ .

$\text{H}_2(\text{g}) + \frac{1}{2} \text{O}_2(\text{g}) \rightleftharpoons \text{H}_2\text{O}(\text{l}) \Delta H^\circ = -285,83 \text{ KJ/mol}$ .

The standard enthalpy of formation of one mole of this acid in KJ/mol is:

a)  $\Delta H^\circ_f = -2321.96$

**b)  $\Delta H^\circ_f = -1775.92$**

c)  $\Delta H^\circ_f = 857.19$

d)  $\Delta H^\circ_f = 1191.93$

e) no answer

7) We mix 0.21 g of  $N_2$  and 0.87 g of  $H_2$  at atmospheric pressure and a temperature of 272 K.

- The mole fraction of nitrogen is:

a) 0.435

b)  $7.5 \times 10^{-3}$

c) 0.98

**d) 0.0169**

e) no answer

- The partial pressure of hydrogen is:

a) 0.435

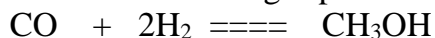
**b) 0.0169**

c)  $7.5 \times 10^{-3}$

d) 0.983

e) no answer

8) We study the synthesis of methanol in the gas phase at 298 K:



	CO	$H_2$	$CH_3OH$
$\Delta H^\circ_f$ kcal/mol	-26.4	-	-48.1
$\Delta S^\circ_f$ cal/mol k	47.3	31.2	56.6

The value of the equilibrium constant is:

a)  $K_p = 1.3 \times 10^{-4}$

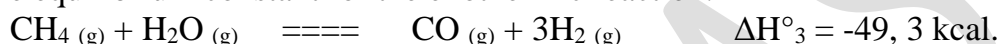
**b)  $K_p = 458.24$**

c)  $K_p = 6.12$

d)  $K_p = 1.25$

e) no answer

9) The equilibrium constant for the exothermic reaction:



is  $1.1 \times 10^{-6}$  atm at 1400 K. The value of the constant at 2000 K is:

**a)  $K_p = 5.6 \times 10^{-9}$**

b)  $K_p = 1.5 \times 10^{-5}$

c)  $K_p = 2.57 \times 10^{+9}$

d)  $K_p = 7.5 \times 10^{-5}$

e) no answer

10) The combustion of aspirin ( $\text{C}_9\text{H}_8\text{O}_4$ ) is an exothermic reaction that releases 65.19 Kcal/mol at  $25^\circ\text{C}$  under a pressure of 1 atm according to the following reaction:



given:  $\Delta H_r = -65,19 \text{ Kcal/mol}$      $\Delta H_f \text{ CO}_2 = -95,04 \text{ Kcal/mol K}$      $\Delta H_f \text{ H}_2\text{O} = -68,37 \text{ Kcal/mol K}$

1/ The enthalpy of formation of  $\text{C}_9\text{H}_8\text{O}_4$  at  $25^\circ\text{C}$  in kcal/mol is:

**a)  $\Delta H^\circ_f = -1128.84$**

b)  $\Delta H^\circ_f = -1063.65$

c)  $\Delta H^\circ_f = 1194.03$

d)  $\Delta H^\circ_f = -1128.84$

e) no answer

2/ Given that the specific heats in cal/mol·K are:

$C_p (\text{C}_9\text{H}_8\text{O}_4) = 12,5$  ;     $C_p (\text{C}_s) = 5,2$  ;     $C_p (\text{H}_2) = 6,88$  ;     $C_p (\text{O}_2) = 7,17$ , The enthalpy of formation of  $\text{C}_9\text{H}_8\text{O}_4$  at  $100^\circ\text{C}$  in kcal/mol

- a)  $\Delta H^{\circ}_f = -1069.3$
- b)  $\Delta H^{\circ}_f = 6775.5$**
- c)  $\Delta H^{\circ}_f = -6840.84$
- d)  $\Delta H^{\circ}_f = -4583.16$
- e) no answer

11) An isothermal expansion is characterized by

- a)  $W=0$
- b)  $W<0$**
- c)  $\Delta U=0$**
- d)  $\Delta H = 0$
- e)  $U = \text{cst}$

12) An acid AH in solution has a concentration  $C = 10^{-2}$  mol/L and its  $pK_a = 4.78$ . Its pH is:

- a) 2
- b) 3.39**
- c) 2.38
- d) 3.2
- e) 3

13) The relationship between the amount of heat exchanged at constant pressure and the amount of heat exchanged at constant volume is:

- a)  $Q_v = Q_p - \Delta(nRT)$
- b)  $Q_v = Q_p + \Delta nRT$
- c)  $Q_v = Q_p + nR\Delta T$
- d)  $Q_v - Q_p = - \Delta nRT$**
- e)  $Q_p = Q_v + \Delta nRT$**

14) The pH of a weak acid is given by the following relation:

- a)  $\text{pH} = -\log [\text{H}_3\text{O}^+]$
- b)  $\text{pH} = 1/2 \text{pKa} - 1/2 \log C.$**
- c)  $\text{pH} = 1/2 \text{pKa} + 1/2 \log C.$
- d)  $\text{pH} = 7 + 1/2 \text{pKa} - 1/2 \log C.$
- e)  $\text{pH} = -1/2 \text{pKa} - 1/2 \log C.$

15) The amount of heat exchanged at constant temperature is equal to:

- a)  $Q = \Delta U$
- b)  $Q = \Delta H$
- c)  $Q = -W$**
- d)  $Q = 0$
- e)  $Q = \text{cste}$

given :  $R = 0.082 \text{ L.atm/ ou } 8.31 \text{ J/mol. ou } 2 \text{ cal/mol.K}$   $1 \text{ atm} = 1.012 \times 10^5 \text{ Pa}$

The solution:

QCM	1	2	3	4	5	6	7	8	9	10
answer	c	d	c	d,a,b	a,c	b	d,b	b	a	a,b
QCM	11	12	13	14	15					
answer	b,c	b	d,e	b	c					

University Djilali Liabes of Sidi Bel Abbes  
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Chemistry Module

Midterm Exam n°1

General Chemistry

\_\_\_\_\_ subject3 \_\_\_\_\_ 2016 \_\_\_\_\_

1) The amount of heat exchanged at constant volume is equal to:

- a)  $Q = \Delta U$
- b)  $Q = \Delta H$
- c)  $Q = W$
- d)  $Q = 0$
- e)  $Q = cste$

2) Are the following propositions true?

- a) During a process, an open system does not exchange matter.
- b) The variation in internal energy corresponds to the heat of reaction at constant volume.
- c) Work corresponds to an energy transfer between the system and the surroundings.
- d) The standard entropy of a simple pure substance is zero.
- e) The Gibbs free energy of a spontaneous reaction is positive.

3) Given the following reaction:  $S_{(g)} + O_{2(g)} \rightleftharpoons SO_{2(g)}$  at  $T = 30^\circ C$ , if the amount of heat exchanged at constant volume is 35.4 kcal/mol, what is the amount of heat exchanged at constant pressure?

- a) 35.4 Kcal/mol
- b) 25 Kcal/mol
- c) 22,7 Kcal/mol
- d) 100 Kcal/mol
- e) no answer.

4) At 298 K, under standard conditions, the studied reaction is an equilibrium process between two gaseous compounds:  $2\text{NO}_2 \rightleftharpoons \text{N}_2\text{O}_4$

1- The standard entropy change  $\Delta_r S^\circ$  en j/k.mol est

- a)  $\Delta S^\circ_f = 250$
- b)  $\Delta S^\circ_f = -120$
- c)  $\Delta S^\circ_f = -176$**
- d)  $\Delta S^\circ_f = 64$
- e) no answer.

2- The standard Gibbs free energy change  $\Delta_r G$  of this reaction in  $\text{Jmol}^{-1}$  at 298 K.

- a)  $\Delta G^\circ_f = -28473$
- b)  $\Delta G^\circ_f = 24000$
- c)  $\Delta G^\circ_f = -4752$**
- d)  $\Delta G^\circ_f = 28448$
- e) no answer.

3- Its equilibrium constant  $K^\circ$  à 298°K :

- a)  $K = 10^5$
- b)  $K = 6.81$**
- c)  $K = 1.02 \times 10^{-5}$
- d)  $K = 102$
- e) no answer.

We give :

	$\Delta_f H^\circ$ (298°K) in KJ/mol	$S^\circ$ (298°K) in J/K.mol
$\text{N}_2\text{O}_4$ (g)	9,20	304
$\text{NO}_2$ (g)	33,20	240

5) The reaction for the formation of sulfur trioxide:  $2\text{S} + 3\text{O}_2 \rightleftharpoons 2\text{SO}_3$  releases a heat of 65.5 Kcal/mol at constant pressure at a temperature of 20° C.

if  $\Delta C_p = -13,85$  cal/mole, its heat at  $T = 140^\circ \text{C}$  is:

- a) 42884 cal/mole
- b) -42,788 Kcal/mol
- c) -65776 cal/mole**
- d) 42,21 Kcal/mole
- e) no answer.

6) The amount of heat exchanged during an adiabatic transformation is given by the equation:

- a)  $Q = nC_v (T_f - T_i)$
- b)  $Q = nC_p (T_f - T_i)$
- c)  $Q = nRT_f \ln V_f / V_i$
- d)  $Q = 0$**
- e) no answer.

7) Consider the following reaction.



- a) If the temperature decreases, the equilibrium shifts toward direction 1.**
- b) If the total pressure increases, the equilibrium shifts toward direction 1.**
- c) If the concentration of iron increases, the equilibrium shifts toward direction 1.
- d) If the partial pressure of  $\text{Fe}_2\text{O}_3(s)$  decreases, the equilibrium shifts toward direction 2.
- e) Other answer

8) soit la réaction :  $\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3$

The equilibrium constant  $K_{p1} = 1.11 \times 10^{-2}$  at température  $T_1 = 1800\text{K}$

The equilibrium constant  $K_{p2} = 2.02 \times 10^{-2}$  at température  $T_2 = 2000\text{K}$

The enthalpy change of the reaction is equal to:

- a)  $\Delta H^\circ_f = 2.15\text{cal}$
- b)  $\Delta H^\circ_f = 2.2 \text{ cal}$**

c)  $\Delta H^{\circ}_f = 21.2 \text{ cal}$

d)  $\Delta H^{\circ}_f = 1.6 \text{ cal}$

e) no answer.

9) The entropy change in an isochoric transformation is given by:

a)  $\Delta S = nC_v \Delta T$

b)  $\Delta S = nC_p \ln P_2/P_1$

c)  $\Delta S = nR \ln T_2/T_1$

**d)  $\Delta S = nC_v \ln T_2/T_1$**

e) no answer.

10) consider the reaction  $\text{CH}_4 + \text{Cl}_2 \rightarrow \text{CH}_3\text{Cl} + \text{HCl}$

Given data:  $\Delta H_{L(\text{Cl-Cl})} = -24.6 \text{ cal/mol}$

$\Delta H_{L(\text{C-H})} = -22 \text{ cal/mol}$

$\Delta H_{L(\text{H-Cl})} = -32.5 \text{ cal/mol}$

$\Delta H_{L(\text{C-Cl})} = -28 \text{ cal/mol}$

The enthalpy of the reaction  $\Delta H_{\text{reaction}}$  is equal to:

a)  $-107.1 \text{ Cal/mol}$

**b)  $-13.9 \text{ Cal/mol}$**

c)  $-52.5 \text{ Cal/mol}$

d)  $46 \text{ Cal/mol}$

e) no answer.

The solution:

QCM	1	2	3	4	5	6	7	8	9	10
Answer	A	b	a	c	c	c	d	b	D	b

University Djilali Liabes of Sidi Bel Abbas  
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 Chemistry Module

Midterm Exam n°1

General Chemistry

subject4

2016

1) The quadruplets of quantum numbers of the beryllium atom 4Be in its ground state are:

- |                       |                     |                    |                     |
|-----------------------|---------------------|--------------------|---------------------|
| a) (1,0,0,1/2)        | (1,0,0,-1/2)        | (2,0,0,1/2)        | (2,0,-1,-1/2)       |
| b) (1,0,0,1/2)        | (1,1,0, 1/2)        | (2,0,0,1/2)        | (2,1,0,-1/2)        |
| c) (1,0,0,1/2)        | (1,0,0,-1/2)        | (2,1,1,1/2)        | (2,1,1,-1/2)        |
| <b>d) (1,0,0,1/2)</b> | <b>(1,0,0,-1/2)</b> | <b>(2,0,0,1/2)</b> | <b>(2,0,0,-1/2)</b> |
| e) no answer          |                     |                    |                     |

2) Are the following statements correct?

- a) Two isotopes differ by their number of electrons.
- b) The numbers A and Z characterize the nucleus of an atom.
- c) Two atoms having the same number of neutrons are isotopes.
- d) Isotopes have the same number of protons and neutrons.
- e) No answer.**

3) Among the following propositions, indicate which one(s) is/are correct.

- a) The quantum numbers characterize the nucleus of an atom.
- b) The values of l range from n-1 to n+1.
- c) Two electrons belonging to the same orbital have the same 4 quantum numbers.
- d) The quantum numbers define the state of an electron.**
- e) The quantum numbers are the results of solving the Schrödinger equation.**

4) The second-to-last electron in the electron configuration of an  $X^{2+}$  is characterized by the quantum numbers (3, 2, 0, +1/2). The element X has...

- a)  $28e^-$
- b)  $25e^-$
- c)  $23e^-$
- d)  $21e^-$
- e)  $26e^-$

5) A doctor prescribes a therapeutic activity of  $8 \times 10^8$  Bq of Samarium 153, with a half-life of 2 days, 8 days before its administration to the patient. The activity is:"

- a)  $128 \times 10^8$  Bq
- b) 6400 Bq
- c)  $32 \times 10^8$  Bq
- d)  $18 \times 10^8$  dps
- e) no answer

6) The amount of heat received by 2.5g of nitrogen ( $N_2$ ) when heated from  $20^\circ\text{C}$  to  $100^\circ\text{C}$  under atmospheric pressure is: we give  $C_v = 24.69 \text{ J/mol.K}$

- a)  $Q = 234.96 \text{ cal}$
- b)  $Q = 177.71 \text{ cal}$
- c)  $Q = 168.55 \text{ cal}$
- d)  $Q = 56.21 \text{ cal}$
- e) no answer

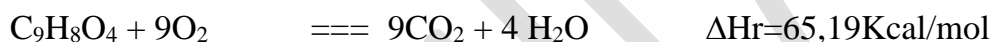
7) 200 mL of an ideal gas expands to 1 liter under a pressure  $P = 5 \text{ atm}$ . The work is:

- a)  $W = -404.8 \text{ j}$
- b)  $W = -40 \times 10^5 \text{ j}$
- c)  $W = 404.8 \text{ j}$
- d)  $W = 810 \text{ j}$
- e) no answer

8) At 25°C, one mole of an ideal gas undergoes an isothermal transformation from state 1 ( $P_1, T_1$ ) to state 2 ( $2P_1, T_1$ ). The values of the amount of heat and work are:

- a)  $W = 16.93J$        $Q = -16.93J$   
 b)  $W = 413J$        $Q = -413J$   
 c)  $W = 1716.13J$        $Q = -1716.13J$   
 d)  $W = -1716.13J$        $Q = 1716.13J$   
 e) no answer

9) The combustion of aspirin ( $C_9H_8O_4$ ) is an exothermic reaction that releases an amount of heat equal to 65.19 Kcal/mol at 25°C under a pressure of 1 atm according to the following reaction:



We give:  $\Delta H_f CO_2 = -95,04 \text{ Kcal/mol K}$        $\Delta H_f H_2O = -68,37 \text{ Kcal/mol K}$ .

The specific heats in cal/mol·K are:

$C_p (C_9H_8O_4) = 12,5$ ;       $C_p (C_s) = 5,2$        $C_p (H_2) = 6,88$ ;       $C_p (O_2) = 7,17$ .

The enthalpy of formation of  $C_9H_8O_4$  at 100°C in kcal/mol is :

- a)  $\Delta H_f^\circ = -1036.65$   
 b)  $\Delta H_f^\circ = -1063.65$   
 c)  $\Delta H_f^\circ = 0$   
 d)  $\Delta H_f^\circ = -1069.36$   
 e) no answer

10) The quantum numbers of the second-to-last electron in the electronic configuration of a fifth transition metal are:

- a) (3,2,1,-1/2)  
 b) (3,2,-2,1/2)  
 c) (3,2,1,1/2)  
 d) (3,2,-2,-1/2)  
 e) no answer

**The solution:**

QCM	1	2	3	4	5	6	7	8	9	10
Answer	<b>d</b>	<b>e</b>	<b>d, e</b>	<b>e</b>	<b>A</b>	<b>d</b>	<b>a</b>	<b>c</b>	<b>d</b>	<b>c</b>

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University Djilali Liabes of Sidi Bel Abbas  
Faculty of Medicine  
Chemistry Module

Midterm Exam n°1

General Chemistry

subject1

2017

1) The energy of an electron in a shell  $n$  is equal to  $0.8704 \times 10^{-19}$  J, the electron is located in shell:

- a)  $n = 3$
- b)  $n = 1$
- c)  $n = 5$**
- d)  $n = 1$
- e) no answer

2) The second-to-last electron of an ion  $X^+$  has the following set of quantum numbers: (3,1,0,-1/2). The element X is located in:

- a) 3<sup>rd</sup> line, 1<sup>st</sup> column
- b) 3<sup>rd</sup> line, 16<sup>th</sup> column
- c) 3<sup>rd</sup> line, 17<sup>th</sup> column
- d) 3<sup>rd</sup> line, 18<sup>th</sup> column**
- e) no answer

3) In the emission spectrum of the hydrogen atom, and in the visible range for  $n \leq 6$ , there exists

- a) no answer
- b) 15 rays
- c) 6 rays
- d) 10 rays
- e) 4 rays**

4) The 4th alkaline metal, its electronic configuration ends with

- a)  $4s^1$
- b)  $4s^2$

c)  $5s^1$

d)  $5s^2$

e)  $3s^1$

5) An element X located in the 4th period and group III<sub>A</sub> of the periodic table, its electronic structure ends with:

a)  $3d^1$

b)  $4p^3$

c)  $3d^5$

d)  $4p^1$

e) no answer

6) To go from  $n=2$  to  $n=3$ , hydrogen must absorb a photon with a wavelength of

a) 734nm

b) 660nm

c) 123.5nm

d) 65.7nm

e) no answer

7) The energy of an electron as a function of the radius is given by the relation

a)  $Ke^2/2r$

b)  $-Ke^2/2r$

c)  $Ke^2/r$

d)  $2Ke^2/r$

e)  $Ke^2/r^2$

8) The radius of the hydrogen-like ion  $A^{n+}$  is related to the radius of the hydrogen atom by:

a)  $r_{A^{n+}} = Zr_H$

b)  $r_{A^{n+}} = r_H/Z$

**c)  $r_H = Z r_{An+}$**

**d)  $r_H = r_{An+} / Z^2$**

**e) no answer**

9) An electron in the hydrogen atom in its ground state absorbs an energy of 13.056 eV. The electron is on the level:

**a)  $n = 3$**

**b)  $n = 4$**

**c)  $n = 5$**

**d)  $n = 6$**

**e) no answer**

10) The radius of the 3rd shell of the hydrogen-like ion  $Li^{2+}$  is

**a)  $r_{Li^{2+}} = 1.59A^\circ$**

**b)  $r_{Li^{2+}} = 4.77A^\circ$**

**c)  $r_{Li^{2+}} = 0.176A^\circ$**

**d)  $r_{Li^{2+}} = 1.06A^\circ$**

**e) no answer**

11) The relationship between the energy of the hydrogen-like ion  $A^{n+}$  and the energy of the hydrogen atom is given by:

**a)  $E_{An+} = ZE_H$**

**b)  $E_{An+} = E_H/Z^2$**

**c)  $E_{An+} = Z^2E_H$**

**d)  $E_H = E_{An+} / Z^2$**

**e) no answer**

12) One of the lines of the Lyman series at a frequency of  $61.2 \times 10^{13}$  Hz corresponds to an electronic transition from:

**a)  $6 \rightarrow 2$**

**b)  $6 \rightarrow 1$**

c)  $4 \rightarrow 2$

d)  $4 \rightarrow 1$

e)  $1 \rightarrow 6$

13) The wavelength of the third line of the Paschen series is:

a) 1280nm

b) 1291nm

c) 7740nm

d)  $0.774\text{\AA}$

e) no answer

14) In an emission spectrum series of the hydrogen atom:

a) The wavelength decreases from the first line to the limiting line.

b) The frequency decreases from the limiting line to the first line.

c) The wavenumber increases from the limiting line to the first line.

d) The energy change  $\Delta E$  decreases from the first line to the limiting line.

e) Other answer

15) The first postulate of BOHR is given by

a)  $nvr = mh/\pi$

b)  $2\pi r = nh/mv$

c)  $2\pi m = nh/vr$

d)  $mvr2\pi = nh$

e)  $mv = nh/2\pi r$

16) The penultimate electron of the electronic configuration of an  $X^{2+}$  is characterized by the quantum numbers (3, 2, 0, +1/2). The element X has

a)  $28e^-$

b)  $25e^-$

c)  $23e^-$

d)  $21e^-$

e)  $26e^-$

17) The potential energy of an electron located at a distance  $r$  from the nucleus is:

a)  $E_p = mv^2/2$

b)  $E_p = -Ke^2/r$

c)  $E_p = -Ke^2/2r$

d)  $E_p = Ke^2/r$

e)  $E_p = -Ke^2/r^2$

18) In the periodic table:

a) **The attraction force decreases from right to left.**

b) **The elements are arranged in increasing order of mass number.**

c) **The elements in the same period have identical physical and chemical properties.**

d) **The elements are arranged in decreasing order of atomic number.**

e) **The elements are arranged in increasing order of proton number.**

19) An element X is missing 2 electrons to have the same structure as an element in the 5th period and the 4th column of the periodic table. It has

a)  $40e^-$

b)  $35e^-$

c)  $38e^-$

d)  $36e^-$

e) no answer

20) An element X belonging to the same column as nitrogen ( ${}_{7}\text{N}$ ) and to the same period as bromine ( ${}_{26}\text{Fe}$ ), the element has:

- a)  $26e^{-}$
- b)  $7e^{-}$
- c)  $35e^{-}$
- d)  $33e^{-}$**
- e) no answer

The solution:

QCM	1	2	3	4	5	6	7	8	9	10
Answer	<b>C</b>	<b>d</b>	<b>e</b>	<b>c</b>	<b>d</b>	<b>b</b>	<b>b</b>	<b>b, c</b>	<b>c</b>	<b>a</b>
QCM	11	12	13	14	15	16	17	18	19	20
Answer	<b>c, d</b>	<b>c</b>	<b>e</b>	<b>a, b</b>	<b>b, c, d, e</b>	<b>e</b>	<b>b</b>	<b>A, e</b>	<b>c</b>	<b>D</b>

University Djilali Liabes of Sidi Bel Abbas  
Faculty of Medicine  
Chemistry Module

Midterm Exam n°1

General Chemistry

\_\_\_\_\_ subject2 \_\_\_\_\_ 2017 \_\_\_\_\_

1) The energy of an electron in a shell  $n$  is equal to  $-2.506 \times 10^{-19}$  J, the electron is located in shell:

- a)  **$n = 3$**
- b)  $n = 1$
- c)  $n = 5$
- d)  $n = 1$
- e) no answer

2) In the emission spectrum of the hydrogen atom and in the visible range for  $n \leq 6$ , there exists

- a) **Other answer**
- b) 15raies
- c) 6raies
- d) 10raies
- e) **4raies**

3) The electronic configuration of the 4th alkali metal ends with:

- a)  $4s^1$
- b)  $4s^2$
- c)  **$5s^1$**
- d)  $5s^2$
- e)  $3s^1$

4) An element X located in the 4th period and group IIIA of the periodic table has its electronic structure ending with:

- a)  **$3d^1$**

b)  $4p^3$

c)  $3d^5$

**d)  $4p^1$**

e) no answer

5) To go from  $n=2$  to  $n=3$ , the hydrogen-like ion  $Li^{2+}$  ( $Z=3$ ) must absorb a photon with a wavelength of:

**a) 73.39nm**

b) 55.8nm

c) 23.5nm

d) 65.7nm

e) no answer

6) The radius of the hydrogen-like ion  $An^+$  is related to the radius of the hydrogen atom by:

a)  $r_{An^+} = Zr_H$

**b)  $r_{An^+} = r_H/Z$**

c)  $r_H = Z r_{An^+}$

d)  $r_H = r_{An^+} / Z^2$

e) no answer

7) An electron in the hydrogen atom in its ground state absorbs an energy equal to 12.68 eV. The electron is on the level:

a)  $n = 3$

**b)  $n = 4$**

c)  $n = 5$

d)  $n = 6$

e) no answer

8) The radius of the 3rd shell of the hydrogen-like ion  $\text{Li}^{2+}$  is

a)  $r_{\text{Li}^{2+}} = 1.59 \text{ \AA}$

b)  $r_{\text{Li}^{2+}} = 4.77 \text{ \AA}$

c)  $r_{\text{Li}^{2+}} = 0.176 \text{ \AA}$

d)  $r_{\text{Li}^{2+}} = 1.06 \text{ \AA}$

e) no answer

9) The relationship between the energy of the hydrogen-like ion  $\text{An}^+$  and the energy of the hydrogen atom is given by:

a)  $E_{\text{An}^+} = Z E_{\text{H}}$

b)  $E_{\text{An}^+} = E_{\text{H}}/Z^2$

c)  $E_{\text{An}^+} = Z^2 E_{\text{H}}$

d)  $E_{\text{H}} = E_{\text{An}^+}/Z^2$

e) no answer

10) In a series of emission spectra of the hydrogen atom:

a) The wavelength decreases from the first line to the limit line.

b) The frequency decreases from the limit line to the first line.

c) The wavenumber increases from the limit line to the first line.

d) The energy change  $\Delta E$  decreases from the first line to the limit line.

e) Other answer

11) The amount of heat received by 2.5g of nitrogen ( $\text{N}_2$ ) when heated from  $20^\circ\text{C}$  to  $100^\circ\text{C}$  under atmospheric pressure is: we give  $C_v = 24.69 \text{ J/mol.K}$

a)  $Q = 234.96 \text{ cal}$

b)  $Q = 177.71 \text{ cal}$

c)  $Q = 168.55 \text{ cal}$

d)  $Q = 56.21 \text{ cal}$

e) Other answer