



Prince Sultan University

CHEMISTRY 101 FINAL EXAM (162)

Name: _____

Date: May.20th/2017

Student no. _____

Section: _____

Useful Information:

General gas constant $R = 0.0821 \text{ atm.L/mol.K}$; $N_{\text{avogadro}} = 6.02 \times 10^{23} \text{ mol}^{-1}$
 $1 \text{ atm} = 760 \text{ torr} = 760 \text{ mmHg} = 101325 \text{ Pa}$

H^1 1.000																	He^2 4
Li^3 6.941	Be^4 9.012											B^5 10.81	C^6 12.01	N^7 14.01	O^8 16	F^9 19	Ne^{10} 20.18
Na^{11} 22.99	Mg^{12} 24.31											Al^{13} 26.98	Si^{14} 28.09	P^{15} 30.97	S^{16} 32.06	Cl^{17} 35.45	Ar^{18} 39.95
K^{19} 39.10	Ca^{20} 40.08	Sc^{21} 44.96	Ti^{22} 47.9	V^{23} 50.94	Cr^{24} 51.99	Mn^{25} 54.94	Fe^{26} 55.85	Co^{27} 58.93	Ni^{28} 58.71	Cu^{29} 63.54	Zn^{30} 65.37	Ga^{31} 69.72	Ge^{32} 72.59	As^{33} 74.92	Se^{34} 78.96	Br^{35} 79.9	Kr^{36} 83.8
Rb^{37} 85.47	Sr^{38} 87.62	Y^{39} 88.91	Zr^{40} 91.22	Nb^{41} 92.91	Mo^{42} 95.94	Tc^{43} 99.91	Ru^{44} 101.1	Rh^{45} 102.91	Pd^{46} 106.4	Ag^{47} 107.87	Cd^{48} 112.4	In^{49} 114.8	Sn^{50} 118.69	Sb^{51} 121.75	Te^{52} 127.6	I^{53} 126.9	Xe^{54} 131.3
Cs^{55} 132.9	Ba^{56} 137.3	Lu^{71} 175.0	Hf^{72} 178.5	Ta^{73} 180.9	W^{74} 183.85	Re^{75} 186.2	Os^{76} 190.2	Ir^{77} 192.2	Pt^{78} 195.1	Au^{79} 196.97	Hg^{80} 200.6	Tl^{81} 204.37	Pb^{82} 207.2	Bi^{83} 208.98	Po^{84} 210	At^{85} 210	Rn^{86} 222

Student's mark

/40

Important instructions:

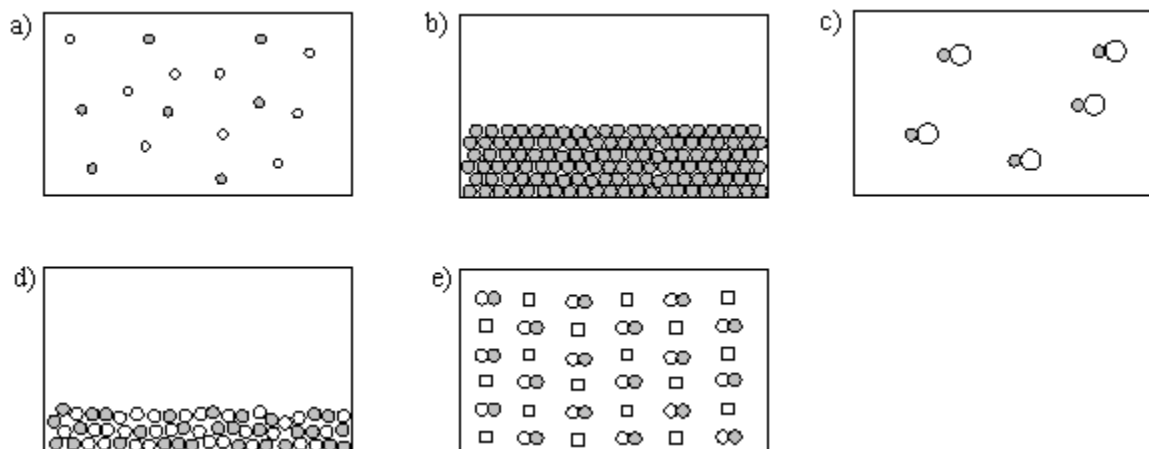
1. Examination time: 180 Minutes.
2. Put any books/notebooks/sheets away and **turn off your cell phone**.
3. Write your name before starting with the questions.
4. The exam contains 11 pages in total, including the cover page and the scratch papers.
5. You may not borrow a calculator.
6. Any cheating signs may cause you to be expelled from the exam.

Write the best fit answer of the following questions in this table:

1) (1.0 point) What is the best answer to report for $\frac{3.478 \text{ g} \times 1.164 \text{ g}}{2.00 \text{ mL}} - 0.169 \text{ g/mL}$?

- A) 1.8510 g/mL
- B) 1.851 g/mL
- C) 1.85 g/mL
- D) 1.9 g/mL
- E) 2 g/mL

2) (0.75 point) Which of the following best represents **a homogeneous** mixture of an element and a compound?



3) (1.0 point) Which of the following statements **is true**?

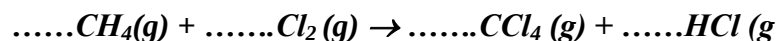
- A) $^{18}_8\text{O}$ and $^{19}_9\text{F}$ have the same number of neutrons.
- B) $^{14}_6\text{C}$ and $^{14}_7\text{N}$ are isotopes of each other because their mass numbers are the same.
- C) $^{18}_8\text{O}^{2-}$ has the same number of electrons as $^{20}_{10}\text{Ne}$.
- D) A and B
- E) A and C

4) (1 point) A hydrocarbon (a compound consisting solely of carbon and hydrogen) is found to be 85.6% carbon by mass. What is the **empirical formula** for this compound?

- A) CH
- B) CH₂
- C) C₂H
- D) C₃H
- E) CH₄

- 5) (0.75 point) The limiting reactant in a reaction
- A) is the reactant for which there is the least amount in grams
 - B) is the reactant which has the lowest coefficient in a balanced equation
 - C) is the reactant for which there is the most amount in grams
 - D) is the reactant for which there is the fewest number of moles
 - E) none of the above
- 6) (2 points) Fill in the blank?
- A) The formula of copper (II) oxide is _____
 - B) The formula of barium chloride dihydrate is _____
 - C) The **common** name of SiH_4 is _____
 - D) The name of Cl_2O_7 is _____
- 7) (0.75 point) Which of the following are **incorrectly** paired?
- A) Ba, alkaline earth metal
 - B) H, noble gas
 - C) Cl, halogen
 - D) Cu, transition metal
 - E) Si, metalloid
- 8) (1.0 point) How many atoms of oxygen are in 0.52 g of limestone, CaCO_3 ?
- A) 3
 - B) 1.81×10^{24}
 - C) 3.55×10^{21}
 - D) 1.07×10^{22}
 - E) 1.18×10^{21}
- 9) (1 point) Oxides of copper include CuO and Cu_2O . You heat 1.51 g of one of these copper oxides in the absence of air and obtain 1.21 g of Cu. True or false: You must have had CuO (SHOW YOUR ANSWER BY CALCULATIONS).
-
-
-
-
-
-
-
-
-
-

10) (2.25 points) Ammonia can be made by reaction of water with magnesium nitride as shown by the following unbalanced equation:



Balance the equation then answer the following two questions:

I) The sum of all coefficients (*reactants* and *products*) in the balanced equation equals:

- A) 9
- B) 8
- C) 10
- D) 7
- E) none of these

II) What mass of CCl_4 will be formed if 1.20 moles of methane react with 1.11 moles of chlorine?

- A) 42.7 g
- B) 171 g
- C) 683 g
- D) 185 g
- E) 19.7 g

III) If the actual collected mass of chlorine is 10.0 grams, then the percentage yield of the reaction is?

- A) 23.4 %
- B) 50.76 %
- C) 4.27%
- D) 5.4 %
- E) None of these

11) (2.75 points) A 40.88-g sample of KOH is dissolved in enough water to make 1.55 liters of solution.

Answer the following questions:

I) What is the molarity of this solution:

.....
.....
.....
.....

II) How many mL of this solution (KOH solution) must be diluted with water in order to make 1.000 L of 0.100 M $\text{Ba}(\text{OH})_2$?

.....
.....
.....
.....

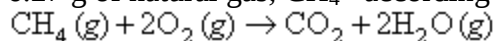
III) How many mL of 0.2 M H_2SO_4 solution are required to neutralize the whole amount (1.55 L) of KOH solution ?

.....
.....

- 12) (1.0 point) When sodium chloride, NaCl and lead(II) nitrate, $\text{Pb}(\text{NO}_3)_2$ react in an aqueous solution, which of the following terms will be present in the **balanced** molecular equation?
- A) $\text{PbCl}(\text{s})$
 - B) $\text{Pb}_2\text{Cl}(\text{s})$
 - C) $\text{NaNO}_3(\text{aq})$
 - D) $2\text{NaNO}_3(\text{aq})$
 - E) $2\text{PbCl}_2(\text{s})$
- 13) (1.0 point) For the reaction $4\text{FeCl}_2(\text{aq}) + 3\text{O}_2(\text{g}) \rightarrow 2\text{Fe}_2\text{O}_3(\text{s}) + 4\text{Cl}_2(\text{g})$, what **volume** of a 0.760 M solution of FeCl_2 is required to react completely with 6.36×10^{21} molecules of O_2 ?
- A) 5.26×10^3 mL
 - B) 10.7mL
 - C) 10.4mL
 - D) 18.5mL
 - E) 6.02 mL
- 14) (0.75 points) In the reaction $2\text{Mg}(\text{s}) + \text{O}_2(\text{g}) \rightarrow 2\text{MgO}(\text{s})$, which species is oxidized?
- A) O_2
 - B) O^{2-}
 - C) Ca^{2+}
 - D) Mg
 - E) MgO
- 15) (1.0 point) Which of the following statements correctly describes the signs of q and w for the following **condensation** process at $P = 1$ atm and $T = 370$ K?
- $$\text{H}_2\text{O}(\text{g}) \rightarrow \text{H}_2\text{O}(\text{l})$$
- A) q and w are negative.
 - B) q is positive, w is negative.
 - C) q is negative, w is positive.
 - D) q and w are both positive.
 - E) q and w are both zero.
- 16) (1.0 points) 30.0 mL of pure water at 282 K is mixed with 50.0 mL of pure water at 306 K. What is the **final temperature** of the mixture?
- A) 294K
 - B) 297K
 - C) 342K
 - D) 588K
 - E) 24 K

- 17) (1.0 points) Calculate the **work** associated with the compression of a gas from 121.0 L to 80.0 L at a constant pressure of 13.1 atm.
- A) – 537L atm
 - B) 537L atm
 - C) 3.13L atm
 - D) – 3.13L atm
 - E) 101 L atm
- 18) (1 point) The total volume of a sample of hydrogen gas was 2.11×10^8 L at 1.00 atm and 24.7°C. How much energy was evolved when it burned according to the following equation?
- $$\text{H}_2(\text{g}) + \frac{1}{2}\text{O}_2(\text{g}) \rightarrow \text{H}_2\text{O}(\text{l}), \Delta H = -286 \text{ kJ}$$
- A) 8.64×10^6 kJ.
 - B) 2.98×10^{10} kJ
 - C) 3.02×10^4 kJ
 - D) 2.47×10^9 kJ
 - E) 4.94×10^9 kJ
- 19) (0.75 point) Gases generally have
- A) low density
 - B) high density
 - C) closely packed particles
 - D) no increase in volume when temperature is increased
 - E) no decrease in volume when pressure is increased
- 20) (1.0 point) You fill a balloon with 2.50 moles of gas at 22°C at a pressure of 1.62 atm. What is the volume of the balloon?
- A) 37.4 L
 - B) 98.0L
 - C) 15.7 L
 - D) 2.79L
 - E) 22.4 L
- 21) (1 point) The temperature of a specific amount of gas in a sealed container changes from 20.0°C to 40.0°C. If the volume remains constant, the pressure will change from 755 mmHg to
- A) 1510 mmHg
 - B) 707 mmHg
 - C) 378 mmHg
 - D) 807 mmHg
 - E) 755 mmHg
- 22) (0.75 point) In **ideal gas** the attractive forces between particles:
- A) are not exist
 - B) are very weak
 - C) are very high
 - D) can not be estimated
 - E) depend on the type of the gas.

- 23) (1.0 point) What volume of water vapor, H_2O measured at STP is produced by the combustion of 6.27 g of natural gas, CH_4 according to the following equation:



.....

.....

.....

.....

.....

.....

- 24) (2.0 points) Regarding the atomic structure and quantum numbers answer the following questions:

- A) The number of *f* orbitals that have the value $n=4$ is _____
- B) The maximum number of electrons that can be contained in all energy sub-levels when $n=4$ is _____
- C) The *l* quantum number for a 4s orbital is _____
- D) Write the electron configuration of Cu _____

- 25) (1 points) Which of the following statements about quantum theory is correct?

- A) The position and the momentum of an electron in the atom can be determined exactly.
- B) Lower energy orbitals are filled with electrons before higher energy orbitals.
- C) When filling orbitals of equal energy, two electrons will occupy the same orbital before filling a new orbital.
- D) No two electrons can have the same four quantum numbers.
- E) B and D.

- 26) (1 point) Which of the following arrangements best represents the last energy level of N^- ?

- | | 2s | 2p |
|----|----|------------|
| A) | ↑↓ | ↑ ↑ ↑ |
| B) | ↑ | ↑↓ ↑ ↓ |
| C) | ↑ | ↑↑ ↑ ↑ |
| D) | ↑↓ | ↑ ↑ |
| E) | ↑↓ | ↑↓ ↑ ↑ |

- 27) (0.75points) Which of the following is an incorrect designation for an atomic orbital?

- A) 1s
- B) 3d
- C) 1p
- D) 4f
- E) 6s

28) (0.75 point) Which of the following best describes an orbital?

- A) space where electrons are unlikely to be found in an atom
- B) space which may contain electrons, protons, and/or neutrons
- C) the space in an atom where an electron is most likely to be found
- D) small, walled spheres that contain electrons
- E) a single space within an atom that contains all electrons of that atom

29) (1.0 point) What is the correct order of the following bonds in terms of decreasing polarity?

- A) C-F < O-F < N-F
- B) C-F < N-F < O-F
- C) O-F < N-F < C-F
- D) N-F < O-F < C-F
- E) N-F < C-F < O-F

30) (10 points) Answer the following questions with respect to the following species:

- | | |
|---|---|
| i) Xenon oxydifluoride, XeOF_2 | ii) Nitrate, NO_3^- |
| iii) Nitrogen dioxide, NO_2 | iv) Formaldehyde, CH_2O |

A) (3 points) Draw all possible Lewis structures of XeOF_2 and NO_2 then indicate the most stable structure of each one:

XeOF_2

.....

.....

.....

.....

.....

.....

.....

.....

.....

NO_2

.....

.....

.....

.....

.....

.....

.....

.....

.....

B) (1.0 points) Draw all resonance structures of nitrate, NO_3^-

.....

.....

.....

.....

.....

.....

C) (1 point) The number of sigma (σ) bonds in NO_2 is _____ while the number of pi (π) bonds is _____

D) (0.5 point) The number of lone pairs of electrons around the central atom of _____ in CH_2O is _____

E) (4.5 points) Fill the following table:

Molecule	Geometry name	3D-sketch	Bond angle(s)
CH_2O			
XeOF_2			
NO_3^-			

Scratch Paper

Scratch Paper