

Prince Sultan University
Deanship of Educational Services
Department of General Sciences

**COURSE DETAILS:**

GENERAL CHEMISTRY (CHM 101) FINAL EXAM	
Semester:	Spring Semester -Term 182
Date:	Sunday /April 27 th /2019

STUDENT DETAILS:

Student Name:	
Student ID Number:	
Section:	

INSTRUCTIONS:

- You may use a scientific calculator that does not have programming or graphing capabilities. NO borrowing calculators.
- NO talking or looking around during the examination.
- NO mobile phones. If your mobile is seen or heard, your exam will be taken immediately.
- Show all your work and be organized.
- You may use the back of the pages for extra space, but be sure to indicate that on the page with the problem.

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

Constants: Av. Number(6.02×10^{23}), R ($0.082 \text{ atm.L/mol.K}$), $1 \text{ atm} = 760 \text{ torr}$

- 1) **(1 point)** If an object has mass of 29.1253 g and a volume of 25.0 cm^3 , then its density is:
 - A) 1.16 g/cm^3
 - B) 0.858 g/cm^3
 - C) 1.165012 g/cm^3
 - D) 1.2 g/cm^3
 - E) 1.17 g/cm^3

- 2) **(1 point)** If $2.93 \times 10^7 \mu\text{g}$ (microgram) of a new element was isolated from 660 kg of the ore molybdenite. The percent by mass of this element in the ore was:
 - A) % 44
 - B) % 6.6
 - C) % 29.3
 - D) % 0.0044
 - E) 19.3 %

- 3) **(1.0 point)** The average atomic mass of rhenium is 186.2amu and it has two isotopes. Given that 37.1% of natural rhenium is rhenium185, what is the other stable isotope?
 - A) $^{183}_{75}\text{Re}$
 - B) $^{181}_{75}\text{Re}$
 - C) $^{189}_{75}\text{Re}$
 - D) $^{187}_{75}\text{Re}$
 - E) $^{190}_{75}\text{Re}$

- 4) **(1.5 points)** Fill in the blank:
 - A) The name of $(\text{NH}_4)_2\text{Cr}_2\text{O}_7$ is.....
 - B) The formula of potassium nitrite is.....
 - C) MgO_2 is incorrectly names Magnesium dioxide while the correct name is.....

- 5) **(1 point)** Which of the following statements is true?
 - A) Ions are formed by adding or removing protons or electrons.
 - B) The mass of electron is approximately equals the mass of proton.
 - C) Isotopes are elements of different types that have different mass numbers.
 - D) The charge of electron and proton have the same magnitude but opposite sign.
 - E) C and D

- 6) **(1 point)** Calculate the volume of water that must be evaporated from 250 mL of 0.1 M solution to make its new concentration 0.15 M?

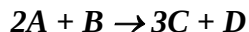
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7) (1 point) In balancing an equation, we change the _____ to make the number of atoms on each side of the equation balance.

- A) formulas of compounds in the reactants
- B) coefficients of compounds
- C) formulas of compounds in the products
- D) subscripts of compounds
- E) none of these

8) (1.5 point) Consider the following reaction:



If 3.0 mol A and 2.0 mol B react to form 4.0 mol C. What is the percent yield of this reaction?

- A) 50 %
- B) 100%
- C) 75%
- D) 89%
- E) 67%

9) (1 point) One atom of which of the following elements has the mass of 4.482×10^{-23} g?

- A) C
- B) P
- C) O
- D) Si
- E) Al

10) (1 point) When solutions of sodium phosphate, Na_3PO_4 and iron(III) nitrate, $\text{Fe}(\text{NO}_3)_3$ react, which of the following terms will be present in the balanced molecular equation?

- A) $\text{NaNO}_3(\text{aq})$
- B) $3\text{NaNO}_3(\text{aq})$
- C) $2\text{FePO}_4(\text{s})$
- D) $3\text{Fe}_3(\text{PO}_4)_3(\text{s})$
- E) $3\text{NaNO}_3(\text{s})$

11) (1.5 point) A solid sample of KOH weighs 0.182 g was dissolved in water to prepare 100 mL **basic** solution. If 20 mL of this basic solution was required to neutralize 30 mL of $\text{H}_2\text{SO}_4(\text{aq})$. Calculate the **molarity** of $\text{H}_2\text{SO}_4(\text{aq})$:

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- 12) (1.5 points) A system consists of one mole of an ideal carbon dioxide gas is compressed from a volume of 100 liter to a volume of 0.5 liters under an external pressure of 17.00 atm. Calculate the change in internal energy of this system if the temperature of the system is dropped down from 25°C to -78.5 °C? *Given that the specific heat of CO₂ is 0.84 J/g. °C and 1 L•atm = 101.3 J*

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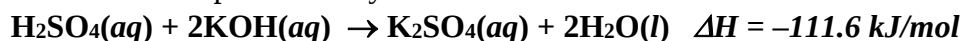
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- 13) (1 point) Which of the following statements is correct?

- A) The internal energy of a system increases when more work is done by the system than heat was flowing into the system.
- B) The internal energy of a system decreases when work is done on the system and heat is flowing into the system.
- C) The system does work on the surroundings when an ideal gas expands against a constant external pressure.
- D) All statements are true.
- E) All statements are false.

- 14) (1.5 point) What is the amount of heat released when excess amount of sulfuric acid reacts with 23.3 mL of 0.309 M potassium hydroxide?

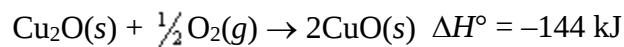


- A) -0.402kJ
- B) -3.17kJ
- C) -2.37kJ
- D) -0.803kJ
- E) -112 kJ

- 15) (1 point) Which of the following is the worst heat conductor?

- A) Iron (specific heat capacity = 0.45 J/g°C)
- B) Copper (specific heat capacity = 0.20 J/g°C)
- C) Lead (specific heat capacity = 0.14 J/g°C)
- D) Aluminum (specific heat capacity = 0.89 J/g°C)
- E) The conductivity cannot be predicted from the given information.

16) (1.5 point) Answer the following two questions (I and II) regarding the following given reactions:



I) Calculate ΔH° for the reaction: $2\text{Cu(s)} + \text{O}_2\text{(g)} \rightarrow 2\text{CuO(s)}$

- A) -155 kJ
- B) 155 kJ
- C) -310 kJ
- D) 310 kJ
- E) None of these

II) Calculate standard enthalpy of formation (ΔH_f°) of CuO(s) ?

- A) -155 kJ
- B) 155 kJ
- C) -310 kJ
- D) 310 kJ
- E) None of these

17) (1 point) A sample of oxygen gas has a volume of 1.72 L at 27°C and 800.0 torr. How many oxygen molecules does it contain?

- A) 4.43×10^{22}
- B) 3.36×10^{25}
- C) 4.92×10^{23}
- D) 8.19×10^{24}
- E) none of these

18) (1 point) Four identical flasks contain the same masses of different gases He, Cl_2 , CH_4 , and NH_3 , each at 0°C and 1 atm pressure. Which gas has the highest density?

- A) He
- B) Cl_2
- C) CH_4
- D) NH_3
- E) All gases have the same density

19) (1 point) Which of the following is an *incorrect* designation for an atomic orbital?

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

20) (1 point) Which arrangement represents the second energy level for Nitrogen atom?

- A) $2s$ $\uparrow\downarrow$ $2p$ $\uparrow$ $\uparrow$ $\uparrow$
- B) $\uparrow$ $\uparrow\downarrow$ $\uparrow$ $\downarrow$
- C) $\uparrow$ $\uparrow\uparrow$ $\uparrow$ $\uparrow$
- D) $\uparrow\downarrow$ $\uparrow$ $\uparrow$
- E) $\uparrow\downarrow$ $\uparrow\downarrow$ $\uparrow$ $\uparrow$

21) (1 point) Which one of the following has the largest radius?

- A) O^{2-}
 B) O^+
 C) S^{2-}
 D) O
 E) S

22) (1.5 point) Arrange the following bonds in order of increasing polarity:

1. B-I 2. In-I 3. Al-I 4. Ga-I

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23) (2 points) Answer the **following** questions which are related to chromium, **Cr** atom:

A) Write the electron configuration of Cr.....

.....

B) The number of valance shell electrons in Cr is.....while the number of unpaired electrons is.....

24) (8.0 points) Answer the following questions with respect to the following species:

- i. Perfluorate, ClO_4^-
- ii. Cyanate, OCN^-
- iii. Nitrogen triiodide, NI_3
- iv. Nitrite, NO_2^-

A) (3 points) Draw all possible Lewis structures for ClO_4^- and OCN^- then indicate the most stable structure of each one:

ClO_4^-

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OCN^-

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B) (1.5 point) The name of the geometry of NI_3 is _____

while the number of lone pairs of electrons is _____

C) (2 point) The name of geometry of NO_2^- is _____ and the possible resonance structures are:

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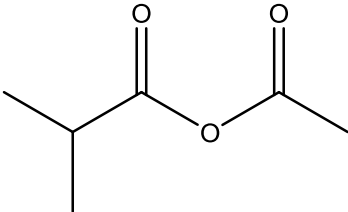
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D) (1.5 points) Rank the following according to the increase in bond angle:
 ClO_4^- , NO_2^- , OCN^-

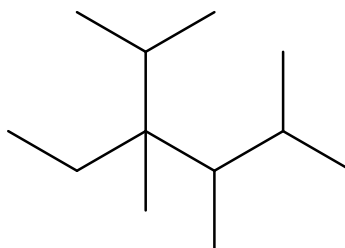
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25) (3 points) Complete the following table:

Condensed structure	Skeletal structure	Class (Family)
		
$ \begin{array}{c} \text{CH}_3 \quad \text{O} \quad \text{CH}_3 \\ \quad \quad \\ \text{CH}_3\text{CCH}_2\text{CCH}_2\text{CH} \\ \quad \\ \text{CH}_3 \quad \text{CH}_2\text{CH}_3 \end{array} $		

26) (1.5 points) Write the IUPAC name of the following molecule:



Scratch Paper

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