CH 223 Spring 2024:
"Exam Prep Calculations"
(online) ***Lab:*** *Instructions*

Note: **This is the lab for section W1 of CH 223 only.**

- *If you are taking section 01 or H1 of CH 223*, please use this link:
  http://mhchem.org/q/8a.htm

Step One:

There is no lab video for this lab. This lab will give you a series of multiple choice questions to answer which will help you on the final lecture exam. The concepts in these questions will range from Chemistry 221 through Chemistry 222 and Chemistry 223.

Step Two:

Submit your lab (page Ib-8-8 *plus* the work pages *only* to avoid a point penalty) **as a *single* PDF file to the instructor via email (mike.russell@mhcc.edu) on Wednesday, May 29 by 11:59 PM.** I recommend a free program (ex: CamScanner, https://camscanner.com) or a website (ex: CombinePDF, https://combinepdf.com) to convert your work to a PDF file.

If you have any questions regarding this assignment, please email (mike.russell@mhcc.edu) the instructor! Good luck on this assignment!

Exam Prep Calculations

Directions: Provide your final answers to these questions on the last page of the handout. Good luck!

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1. How many oxygen atoms are in 225 g O_2?

(A) 4.23×10^{23}

(B) 6.84×10^{24}

(C) 8.47×10^{24}

(D) 1.69×10^{25}

2. A 0.300 M solution of HCl is prepared by adding some 1.50 M HCl to a 750 mL volumetric flask and diluting to the mark with deionized water. What volume of 1.50 M HCl must be added?

(A) 100. mL

(B) 150. mL

(C) 225. mL

(D) 250. mL

3. Copper(I) oxide, Cu_2O, is reduced to metallic copper by heating in a stream of hydrogen gas. What mass of water is produced when 10.00 g copper is formed?

(A) 1.259 g

(B) 1.417 g

(C) 2.835 g

(D) 5.670 g

4. The mineral enargite is 48.41% Cu, 19.02% As, and 32.57% S by mass. What is the empirical formula of enargite?

(A) CuAsS

(B) Cu_2AsS_2

(C) Cu_3AsS_4

(D) Cu_4AsS_3

5. A solution contains 0.1 M Ca^{2+} ions and 0.1 M Pb^{2+} ions. Addition of an equal volume of a 0.5 M solution of which reagent will cause precipitation of a silver salt but not a strontium salt?

(A) $NaNO_3$

(B) NaF

(C) NaOH

(D) NaCl

6. Consider the four gases CO_2, N_2, CCl_4, and He. Which is the correct order of increasing average molecular speed at 100 °C?

(A) $He < N_2 < CO_2 < CCl_4$

(B) $CCl_4 < CO_2 < N_2 < He$

(C) $He < CO_2 < N_2 < CCl_4$

(D) $CCl_4 < N_2 < CO_2 < He$

7. In the guanidinium ion, $[C(NH_2)_3]^+$, what is the best description of the hybridizations of the nitrogen atoms?

(A) All three sp^3

(B) Two sp^3, one sp^2

(C) One sp^3, two sp^2

(D) All three sp^2

8. To 100.0 g water at 25.00 °C in a well-insulated container is added a block of aluminum initially at 100.0 °C. The temperature of the water once the system reaches thermal equilibrium is 28.00 °C. What is the mass of the aluminum block? (The specific heat capacity of Al is 0.900 J g^{-1} K^{-1}.)

(A) 4.17 g

(B) 18.6 g

(C) 19.4 g

(D) 130. g

9. The standard enthalpy of formation, ΔH°_f, of the compound MgO(s) is equal to the standard enthalpy change for which reaction?

(A) $Mg(s) + 1/2\ O_2(g) \rightarrow MgO(s)$

(B) $2\ Mg(s) + O_2(g) \rightarrow 2\ MgO(s)$

(C) $Mg(g) + O(g) \rightarrow MgO(s)$

(D) $Mg^{2+}(aq) + O^{2-}(aq) \rightarrow MgO(s)$

10. What is the standard Gibbs free energy of formation, ΔG°_f, of $NH_3(g)$ at 298 K?

Substance	ΔH°_f, kJ mol^{-1}	S°, J mol^{-1} K^{-1}
$H_2(g)$	0	131
$N_2(g)$	0	192
$NH_3(g)$	–46	193

(A) -104 kJ mol^{-1}

(B) -16 kJ mol^{-1}

(C) -7 kJ mol^{-1}

(D) 13 kJ mol^{-1}

11. Which of the following reactions takes place with an increase in entropy under standard conditions?

(A) $K_2CO_3(s) \rightarrow K_2O(s) + CO_2(g)$

(B) $CaO(s) + CO_2(g) \rightarrow CaCO_3(s)$

(C) $NH_3(g) + HCl(g) \rightarrow NH_4^+(aq) + Cl^-(aq)$

(D) $C_2H_4(g) + Br_2(l) \rightarrow C_2H_4Br_2(l)$

12. Iodine-131 decays with a half-life of 8.02 d. In a sample initially containing 5.00 mg of ^{131}I, what mass remains after 17.2 d?

(A) 1.13 mg

(B) 1.87 mg

(C) 2.97 mg

(D) 3.13 mg

13. For an irreversible reaction A → products, the graph of 1/[A] as a function of time is linear. What is the reaction order in A?

(A) Zero order

(B) First order

(C) Second order

(D) The order in A cannot be determined based on the information given.

14. In comparing two reactions, the reaction with the greater activation energy always has

(A) the slower rate.

(B) the faster rate.

(C) the rate that varies less with temperature.

(D) the rate that varies more with temperature.

15. The formation of NOBr:

$2\ NO(g) + Br_2(g) \rightarrow 2\ NOBr(g)$,

is studied, and the following mechanism is proposed: In this reaction, $NOBr_2(g)$ is best described as:

$NO(g) + Br_2(g) \leftrightarrows NOBr_2(g)$ *fast, equilibrium*

$NO(g) + NOBr_2(g) \rightarrow 2\ NOBr(g)$ *slow*

In this reaction, $NOBr_2(g)$ is best described as:

(A) an intermediate.

(B) a product

(C) a homogeneous catalyst.

(D) a heterogeneous catalyst.

16. What mass of silver chloride (MM = 143.4 g mol^{-1}) will dissolve in 1.00 L of water? The K_{sp} of AgCl is 1.8×10^{-10}.

(A) 1.4mg

(B) 1.9mg

(C) 2.9mg

(D) 3.8mg

17. What is the pH of a 0.98 M solution of sodium benzoate, NaC_6H_5COO? The K_a of benzoic acid, C_6H_5COOH, is 6.5×10^{-5}.

(A) 5.26

(B) 8.74

(C) 9.09

(D) 11.56

18 Sulfur trioxide is formed from the reaction of sulfur dioxide and oxygen:

$$SO_2(g) + 1/2\ O_2(g) \rightleftharpoons SO_3(g)$$

At 1000 K, an equilibrium mixture has partial pressures of 0.562 atm SO_2, 0.101 atm O_2, and 0.332 atm SO_3. What is the equilibrium constant K_p for the reaction at this temperature?

(A) 1.86

(B) 3.46

(C) 5.85

(D) 16.8

19. The following exothermic reaction is at equilibrium in a sealed container:

$$PCl_3(g) + Cl_2(g) \rightarrow PCl_5(g)$$

Which of the following changes would result in an increase in the number of moles of $PCl_3(g)$ present at equilibrium?

I. Increasing the temperature
II. Increasing the volume

(A) I only

(B) II only

(C) Both I and II

(D) Neither I nor II

20. Which gas-phase molecule is linear?

(A) COS_2

(B) SO_2

(C) HCCH

(D) Br_2CCBr_2

Exam Prep Calculations - *Worksheet*

YOUR NAME: _____

Enter your answer next to the question number. There is *only* one best answer for each question. To the back of this form include all work necessary to complete each question.

Question	***Answer***	***Question***	***Answer***
1	_____	**11**	_____
2	_____	**12**	_____
3	_____	**13**	_____
4	_____	**14**	_____
5	_____	**15**	_____
6	_____	**16**	_____
7	_____	**17**	_____
8	_____	**18**	_____
9	_____	**19**	_____
10	_____	**20**	_____

Good luck!