

General Chemistry 1 (*CHEM 1141*)

Shawnee State University – Fall 2019

October 24, 2019

Exam # 2 A

Name _____

*Please write your full name, and the exam version (2 A) that you have on the scantron sheet !
(Bubble in the best answer choice for each question on the green & white scantron sheet in pencil !)*

Please check the box next to your correct section number.

Section Number

- 1. (Monday Lab, 11:10 AM – 1:55 PM)
- 2. (Wednesday Lab, 11:10 AM – 1:55 PM)
- 3. (Monday Lab, 2:30 PM – 5:20 PM)
- 4. (Wednesday Lab, 2:30 PM – 5:20 PM)
- 5. (Thursday Lab, 12:30 PM – 3:20 PM)
- 6. (Tuesday Lab, 12:30 PM – 3:20 PM)

Multiple Choice: _____ / 50

Q21: _____ / 10

Q22: _____ / 10

Q23: _____ / 10

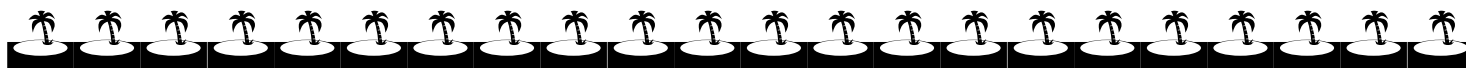
Q24: _____ / 10

Q25: _____ / 10

BONUS: _____ / 3

TOTAL: _____ / 100

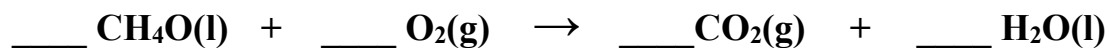
*You are only allowed to use a TI30–XIIS or equivalent non–programmable calculator on this exam !
(This means no cell phones, no smart phones, no smart watches, no ipads, or any other such devices will be allowed !)*



Each problem in this section (multiple choice) is worth 2.5 points !



Q1. What is the coefficient for O_2 when the following combustion reaction of the alcohol is correctly balanced using the lowest set of whole number coefficients?



- A) 3
- B) 5
- C) 7
- D) 9

Q2. What is the molarity of a solution formed by dissolving 97.7 g of LiBr in enough water to yield 750.0 mL of solution ?

- A) 0.130 M
- B) 0.768 M
- C) 1.12 M
- D) 1.50 M

Q3. When dissolved in water, NaOH behaves as:

- A) an acid that forms Na^+ and OH^- ions
- B) an acid that forms NaO^- and H^+ ions
- C) a base that forms Na^+ and OH^- ions
- D) a base that forms NaO^- and H^+ ions

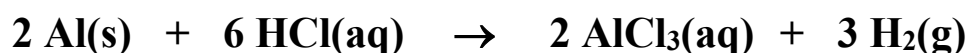
Q4. Identify the diprotic acid.

- A) H_2SO_4
- B) HCl
- C) NaCl
- D) $\text{Mg}(\text{OH})_2$

Q5. Which of the following is an acid–base reaction?

- A) $\text{C}(\text{s}) + \text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g})$
- B) $\text{MgSO}_4(\text{aq}) + \text{Pb}(\text{NO}_3)_2(\text{aq}) \rightarrow \text{Mg}(\text{NO}_3)_2(\text{aq}) + \text{PbSO}_4(\text{s})$
- C) $\text{Fe}(\text{s}) + 2 \text{AgNO}_3(\text{aq}) \rightarrow 2 \text{Ag}(\text{s}) + \text{Fe}(\text{NO}_3)_2(\text{aq})$
- D) $2 \text{HClO}_4(\text{aq}) + \text{Ca}(\text{OH})_2(\text{aq}) \rightarrow 2 \text{H}_2\text{O}(\text{l}) + \text{Ca}(\text{ClO}_4)_2(\text{aq})$

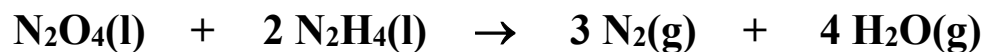
Q6. Aluminum reacts with hydrochloric acid as shown below in the balanced reaction equation.



The correct number of moles of $\text{HCl}(\text{aq})$ that would be required to react completely with 2.1 moles of $\text{Al}(\text{s})$ would be _____ of $\text{HCl}(\text{aq})$.

- A) 1.6 moles
- B) 4.8 moles
- C) 6.3 moles
- D) 7.2 moles

Q7. What is the limiting reactant when 0.543 moles of N_2O_4 reacts with 1.05 moles of N_2H_4 ?



A) $\text{N}_2\text{O}_4(\text{l})$

B) $\text{N}_2\text{H}_4(\text{l})$

C) $\text{N}_2(\text{g})$

D) $\text{H}_2\text{O}(\text{g})$

Q8. What is the concentration of a solution that is prepared by adding 15.0 mL of water to 5.0 mL of 12.0 M HCl?

A) 3.00 M

B) 4.00 M

C) 12.0 M

D) 15.0 M

Q9. Which pair of solutions listed below would form a precipitate when mixed at 25 °C?

A) $\text{LiCl}(\text{aq}) + \text{Mg}(\text{NO}_3)_2(\text{aq})$

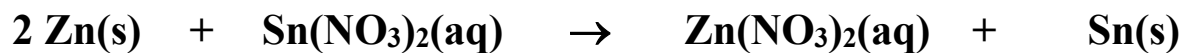
B) $\text{NaC}_2\text{H}_3\text{O}_2(\text{aq}) + \text{NaOH}(\text{aq})$

C) $\text{H}_2\text{SO}_4(\text{aq}) + \text{K}_2\text{CO}_3(\text{aq})$

D) $\text{Ca}(\text{NO}_3)_2(\text{aq}) + \text{Na}_2\text{SO}_4(\text{aq})$

- Q10.** What piece of glassware should be used to prepare a solution of precise concentration in the lab?
- A) buret
 - B) graduated cylinder
 - C) volumetric flask
 - D) Erlenmeyer flask
- Q11.** Which substance contains a sulfur atom with an oxidation state of +2?
- A) SO_4^{2-}
 - B) $\text{S}_2\text{O}_3^{2-}$
 - C) H_2SO_4
 - D) Na_2SO_3
- Q12.** Which of the following ionic compounds will be **SOLUBLE** in water?
- A) NH_4NO_3
 - B) AgBr
 - C) $\text{Fe}(\text{OH})_3$
 - D) CaCO_3
- Q13.** What is the percentage (*by mass*) of **nitrogen** in $\text{Ca}(\text{NO}_3)_2$?
- A) 13.72 % N
 - B) 17.07 % N
 - C) 24.42 % N
 - D) 58.50 % N

Q14. The species that is the reducing agent in the equation shown below would be the _____.



- A) Sn(s)
- B) Sn(NO₃)₂(aq)
- C) Zn(s)
- D) Zn(NO₃)₂(aq)

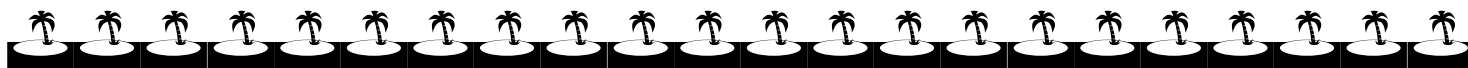
Q15. What is the conversion factor for a 4.10 M solution of KCl?

- A) 4.10 M / 1 L
- B) 4.10 moles / 1 L
- C) 4.10 g / mL
- D) 1 mole / 4.10 L

Q16. Which of the following contains the largest number of atoms?

- A) 12 g of potassium
- B) 12 g of magnesium
- C) 12 g of calcium
- D) 12 g of iron

- Q17.** What is the correct formula for copper(I) carbonate dihydrate?
- A) $\text{CoCO}_3 \cdot \frac{1}{2} \text{H}_2\text{O}$
 - B) $\text{Cu}(\text{CO}_3)_2 \cdot \text{H}_2\text{O}$
 - C) $\text{Co}_2\text{CO}_3 \cdot 2 \text{H}_2\text{O}$
 - D) $\text{Cu}_2\text{CO}_3 \cdot 2 \text{H}_2\text{O}$
- Q18.** Which of the following is an example of an extensive property?
- A) density
 - B) temperature
 - C) mass
 - D) color
- Q19.** The correct number of protons (p^+), neutrons (n^0), and electrons (e^-) in sodium-24 would be:
- A) $11 p^+, 24 n^0, 11 e^-$
 - B) $11 p^+, 13 n^0, 11 e^-$
 - C) $16 p^+, 32 n^0, 16 e^-$
 - D) $19 p^+, 20 n^0, 39 e^-$
- Q20.** Mercury is the only metal that is a liquid at room temperature and the density of mercury is $13.6 \text{ g} / \text{cm}^3$. What is the volume of mercury in a flask that contains 848 g of mercury?
- A) 16.0 mL
 - B) 0.624 mL
 - C) 6.24 mL
 - D) 62.4 mL



Each problem in this section (short answer) is worth 10 points !

All work must be shown in order to receive full credit !

You must use the factor–label (conversion–factor) method for all conversions !

Be sure to include units where applicable !

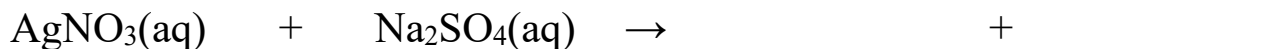
All numeric answers must be rounded to the correct number of significant figures !



Q21. The antacid Milk of Magnesia contains magnesium hydroxide. If 25.0 mL of stomach acid (*HCl*) reacts completely with 10.1 mL of 0.139 M $\text{Mg}(\text{OH})_2$, then what is the concentration (*molarity*) of the stomach acid ?

Q22. Provide a correctly balanced reaction equation that shows the chemical reaction that takes place when an aqueous solution of silver nitrate is mixed with an aqueous solution of sodium sulfate. In addition, provide the correct full ionic as well as the net ionic equation for this reaction. Be sure to show all state symbols and charges where appropriate.

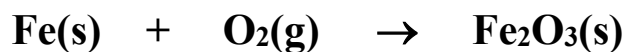
Complete Balanced Reaction Equation (*Molecular Equation*)



Complete Ionic Equation

Net Ionic Equation

Q23. The molecular equation for the reaction between solid iron metal and oxygen gas is shown below. Answer each of the questions listed below the reaction equation.



Provide a correctly balanced equation for this reaction by writing the correct coefficients in front of each reactant and product.

The correct IUPAC (*systematic*) name for the product Fe₂O₃(s) would be _____ .

Show how to determine (*by calculation*) the theoretical yield of Fe₂O₃(s) that could be produced if 8.05 g of Fe(s) is reacted with 3.52 g of O₂(g).

The limiting reactant is _____ .

Given the above conditions, a CHEM 1141 student carries out this reaction and obtains 9.76 g of Fe₂O₃(s). Show how to determine (*and then calculate*) the percent yield for this reaction.

Q24. Answer each of the questions listed involving sodium carbonate.

A) What is the molar concentration of a solution that is prepared by dissolving 15.9 g of Na_2CO_3 in enough water to give a total volume of 589 mL?

B) If you had a 1.50 M solution of Na_2CO_3 , what volume would contain 0.30 moles of solute in both L and mL?

C) How would you prepare 100. mL of a 0.350 M solution of Na_2CO_3 from a stock solution that is 13.0 M.

D) Write a balanced molecular equation for the reaction between aqueous solutions of Na_2CO_3 and H_2SO_4 .

(Be sure to include the state symbols (s, l, g, or aq) for all reactants & products !)

Q25. From the given list of possible answers, choose the correct answer for each of the questions below.

Possible Answers

HF HCl solute solvent dilute NaNO₃ AgCl CH₄ KMnO₄ MnCl₂

Which is a strong acid? _____

Which is an ionic compound that is insoluble in water? _____

Which compound contains an atom with an oxidation state of +7? _____

Which compound contains an atom with an oxidation state of -4? _____

Which is the greater component in a solution? _____



3 Point Bonus Question



What is the Arrhenius definition of an acid and base?

An Arrhenius acid is defined as:

An Arrhenius base is defined as:

Exam checklist

(Check the boxes to certify the following:)

- My full name is written legibly on the front page
- My correct lab section has been indicated on the front page
- My full name is written legibly on the scantron sheet
- My exam version (*2A, 2B, 2C, or 2D*) is written on the scantron sheet
- I have shown work for all problems (*where appropriate*), paying attention to
 - Significant figures / decimal places
 - Units
- I have used the conversion–factor method for all conversions
- If I have torn off the back page (*periodic table*), I will not turn it in with my exam!

Thank–you from the Chemistry Professors and Good Luck!



Useful Information

$$N_A \text{ (Avogadro's number)} = 6.022 \times 10^{23}$$

TABLE 5.1 ■ Solubility Rules for Ionic Compounds in Water

Compounds Containing the Following Ions Are Generally Soluble	Exceptions
Cl^- , Br^- , and I^-	When these ions pair with Ag^+ , Hg_2^{2+} , or Pb^{2+} , the resulting compounds are insoluble.
SO_4^{2-}	When SO_4^{2-} pairs with Sr^{2+} , Ba^{2+} , Pb^{2+} , Ag^+ , or Ca^{2+} , the resulting compound is insoluble.
Compounds Containing the Following Ions Are Generally Insoluble	Exceptions
OH^- and S^{2-}	<p>When these ions pair with Li^+, Na^+, K^+, or NH_4^+, the resulting compounds are soluble.</p> <p>When S^{2-} pairs with Ca^{2+}, Sr^{2+}, or Ba^{2+}, the resulting compound is soluble.</p> <p>When OH^- pairs with Ca^{2+}, Sr^{2+}, or Ba^{2+}, the resulting compound is slightly soluble.</p>
CO_3^{2-} and PO_4^{3-}	When these ions pair with Li^+ , Na^+ , K^+ , or NH_4^+ , the resulting compounds are soluble.

Periodic Table of the Elements

IA
IIA
IIIA
IVA
VA
VIA
VIIA
VIIIA

1 H 1.008	2 He 4.003											17 F 19.00	18 Ne 20.18				
3 Li 6.941	4 Be 9.012											9 O 16.00	10 Ne 20.18				
11 Na 22.99	12 Mg 24.31											16 S 32.07	17 Cl 35.45	18 Ar 39.95			
19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.87	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.69	29 Cu 63.55	30 Zn 65.39	31 Ga 69.72	32 Ge 72.61	33 As 74.92160	34 Se 78.96	35 Br 79.90	36 Kr 83.80
37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc [98]	44 Ru 101.1	45 Rh 102.9	46 Pd 106.4	47 Ag 107.9	48 Cd 112.4	49 In 114.8	50 Sn 118.7	51 Sb 121.8	52 Te 127.60	53 I 126.9	54 Xe 131.3
55 Cs 132.9	56 Ba* 137.3	71 Lu 175.0	72 Hf 178.5	73 Ta 180.9	74 W 183.8	75 Re 186.2	76 Os 190.2	77 Ir 192.2	78 Pt 195.1	79 Au 197.0	80 Hg 200.6	81 Tl 204.4	82 Pb 207.2	83 Bi 209.0	84 Po [210]	85 At [210]	86 Rn [222]
87 Fr [223]	88 Ra** [226]	103 Lr [262]	104 Rf [261]	105 Db [262]	106 Sg [266]	107 Bh [264]	108 Hs [265]	109 Mt [268]	110 Dt [269]	111 Rg [272]	112 Cn [277]	113 Nh [285]	114 Fl [285]	115 Mc [289]	116 Lv [289]	117 Ts [293]	118 Og [293]

57 La 138.9	58 Ce 140.1	59 Pr 140.9	60 Nd 144.2	61 Pm [145]	62 Sm 150.4	63 Eu 152.0	64 Gd 157.3	65 Tb 158.9	66 Dy 162.50	67 Ho 164.9	68 Er 167.3	69 Tm 168.9	70 Yb 173.0
89 Ac [227]	90 Th 232.0	91 Pa 231.0	92 U 238.0	93 Np [237]	94 Pu [244]	95 Am [243]	96 Cm [247]	97 Bk [247]	98 Cf [251]	99 Es [252]	100 Fm [257]	101 Md [258]	102 No [259]

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