

Exam 2 Chm 203 (Dr Mattson) 26 September 2018

Academic Integrity Pledge: In keeping with Creighton University's ideals and with the Academic Integrity Code, I pledge that this work is my own and that I have neither given nor received inappropriate assistance in preparing it.

Signature: _____

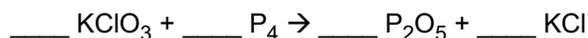
Name: _____

Chemistry Student Number: _____
(1 point bonus for completing 1. signature, 2. printed name and 3. your correct chemistry student number)

Instructions: Show all work whenever a calculation box is provided! Write legibly. Include units whenever appropriate. You will receive credit for **how** you worked each problem as well as for the correct answer. If you need more space, you may use the back of the data sheet provided — Write: "See data sheet" in the answer box — then write your name on the data sheet. On your desk you are allowed only pencils (but no pencil pouch), an eraser, and a non-programmable calculator without a slipcover. Backpacks, bags, and purse-like items must be stored on the tables in the back of the room. Cell phones must be silent and placed in your backpack/bag/purse — not in your pocket.

1. (3 pts each) Balance these equations with the smallest whole-number coefficients:

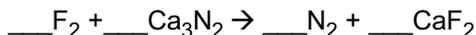
Answer with smallest whole-number coefficients.



Answer with smallest whole-number coefficients.



Answer with smallest whole-number coefficients.



2. (3 pts) Balance the reaction for the combustion of ethane, C_2H_6 with the smallest whole-number coefficients.

Answer with smallest whole-number coefficients.

3. (3 pts) Aqueous ammonium chloride reacts with aqueous lead(II) nitrate to produce aqueous ammonium chloride and solid lead(II) chloride. Balance the reaction.

Answer with smallest whole-number coefficients.

- 4a. (4 pts) What is the molar mass of ammonium dichromate? Report answer to the hundredths place.

Show your work for full credit.

Answer to the hundredths place with units: _____

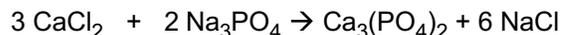
- 4b. (4 pts) How many moles of ammonium chlorate are in a 150 g sample?

Show your work for full credit.

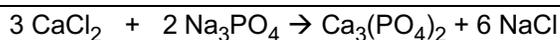
Answer with units: _____

- 5a – 5e pertain to the equation below. Molar masses are given in blue above each compound formula.

110.98 g/mol 163.94 g/mol 310.18 g/mol 58.44 g/mol

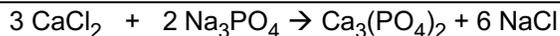


- 5a. (3 pts) How many moles of sodium phosphate are required to react stoichiometrically with 41.5 mmol of calcium chloride? Show your work for full credit.



Answer with units: _____

- 5b. (4 pts) Suppose 5.33 g CaCl_2 and 7.16 g Na_3PO_4 were reacted to produce the products as shown. Which is the limiting reagent? Show your work for full credit.



The limiting reagent is: _____

- 5c. (4 pts) Using your answer to 5b, what is the theoretical yield in grams of calcium phosphate?

Show your work for full credit.

Answer with units: _____

- 5d. (4 pts) What mass of the excess reagent is left over?

Show your work for full credit.

Answer with units: _____

- 5e. (3 pts) Suppose the actual yield of calcium phosphate is 4.82 g. What is the percent yield?

Show your work for full credit.

Answer: _____

6. (5 pts) Penicillin contains C, H, N, O and S. It is 57.45% C, 5.43% H, 8.38% N, 9.59% S and the rest is oxygen. What is the formula for penicillin?

Show your work for full credit.

Answer: _____

7. (5 pts) A sample of a hydrocarbon (a compound of C and H only) is combusted to yield 15.13 mg CO₂ and 7.744 mg H₂O. What is the simplest formula? Given its molar mass is approximately 58 g/mol, what is the molecular formula of the compound?

Show your work for full credit.

Simplest formula: _____ Molecular formula: _____

- 8a. (4 pts) What is the molarity of a solution prepared by 14.7 g sodium acetate, MM = 82.03 g/mol in enough water to make 100.00 mL?

Show your work for full credit.

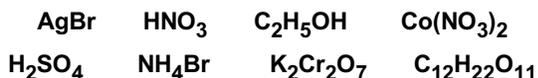
Answer with units: _____

- 8b. (4 pts) What volume in mL of the previous solution is needed to make 500.00 mL of a 7.50×10^{-2} M solution?

Show your work for full credit.

Answer with units: _____

9. (8 pts) Circle all of the following compounds that are strong electrolytes when placed in distilled water? (Hint: Some do not dissolve.)



- 10a. (3 pts) Solutions of AgNO₃(aq) and KI(aq) form a precipitate when mixed. Write the balanced overall equation for this reaction. Include states of matter.

- 10b. (3 pts) Write the balanced net ionic equation for this reaction. Include states of matter.

11. (8 pts) Which of these solutions, when mixed, are expected to form a precipitate? Circle Yes for a precipitate or No if no precipitate is expected. If a precipitate is expected, write its formula in the right-hand column; otherwise leave it blank.

Will a precipitate form if we mix...	Precipitate is:
Yes or No FeCl ₂ (aq) + K ₂ S(aq)	
Yes or No Na ₂ CO ₃ (aq) + KCl(aq)	
Yes or No K ₂ SO ₄ (aq) + Ba(NO ₃) ₂ (aq)	
Yes or No CrCl ₃ (aq) + KOH(aq)	

12. (3 pts) Strong acids such as HBr(aq) dissociate 100% into ions. Specifically, HBr(aq) takes up with a water molecule to produce aqueous hydronium ion and aqueous bromide ion. Write the chemical equation for this dissociation. Include states of matter.

- 13a. (3 pts) Aqueous perchloric acid undergoes a neutralization reaction with aqueous potassium hydroxide. Write the balanced overall equation for this reaction. Include states of matter.

- 13b. (3 pts) Write the balanced net ionic equation for this reaction. Include states of matter.

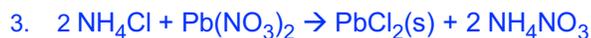
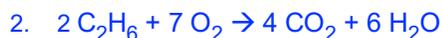
14. (10 pts) Nomenclature. Complete each of these. Skip this question if you are nomenclature certified.

nitrous acid	
sodium hydrogen carbonate	
cobalt(III) nitrate	
phosphorus triiodide	
disulfur dichloride	
	CrO ₃
	HClO ₂ (aq)
	B ₃ N ₃
	K ₂ SO ₃
	N ₂ O ₅

Total score (out of 100): _____

A+ ≥ 95% A ≥ 90% B+ ≥ 85% B ≥ 80% C+ ≥ 75% C ≥ 70% D ≥ 60%

Answers



4a. 252.08 g/mol

4b. 1.478 mol

5a. 0.0277 mol

5b. CaCl_2

5c. 4.96 g

5d. 1.91 g

5e. 97%

6. $\text{C}_{16}\text{H}_{18}\text{N}_2\text{SO}_4$

7. C_2H_5 and C_4H_{10}

8a. 1.79 mol/L

8b. 20.93 mL

9. HNO_3 $\text{Co}(\text{NO}_3)_2$ H_2SO_4 NH_4Br $\text{K}_2\text{Cr}_2\text{O}_7$

10a. $\text{AgNO}_3(\text{aq}) + \text{KI}(\text{aq}) \rightarrow \text{AgI}(\text{s}) + \text{NaNO}_3(\text{aq})$

10b. $\text{Ag}^+(\text{aq}) + \text{I}^-(\text{aq}) \rightarrow \text{AgI}(\text{s})$

11. **Yes** $\text{FeS}(\text{s})$

No

Yes $\text{BaSO}_4(\text{s})$

Yes $\text{Cr}(\text{OH})_3(\text{s})$

12. $\text{HBr}(\text{aq}) + \text{H}_2\text{O}(\text{l}) \rightarrow \text{H}_3\text{O}^+(\text{aq}) + \text{Br}^-(\text{aq})$

13a. $\text{HClO}_4(\text{aq}) + \text{KOH}(\text{aq}) \rightarrow \text{H}_2\text{O}(\text{l}) + \text{KClO}_4(\text{aq})$

13b. $\text{H}_3\text{O}^+(\text{aq}) + \text{OH}^-(\text{aq}) \rightarrow 2 \text{H}_2\text{O}(\text{l})$

14.

nitrous acid	$\text{HNO}_2(\text{aq})$
sodium hydrogen carbonate	NaHCO_3
cobalt(III) nitrate	$\text{Co}(\text{NO}_3)_3$
phosphorus triiodide	PI_3
disulfur dichloride	S_2Cl_2
chromium(VI) oxide	CrO_3
chlorous acid	$\text{HClO}_2(\text{aq})$
triboron trinitride	B_3N_3
potassium sulfite	K_2SO_3
Dinitrogen pentoxide	N_2O_5