Take-Home Quiz
Topic 09: Chemical Equations and Chemical Reactions

Objective:

This is to assess your comprehension of the material we have covered so far and to help prepare you for the exam.

Instructions and Notes:

- Most of the quiz problems are from or adapted from "Exercises" at the end of the chapters in the Chemistry: Atoms First 2e Online Textbook (OpenStax)
- You must *CLEARLY LABEL* all problems and *SHOW ALL WORK* neatly and legibly to receive credit. If the problems do not require calculations/work then you must explain how you got the answer. (can be a few words up to a few sentences or even a few arrows)
- If the problem requires calculations, the answers should be highlighted or boxed.
- Book sections covered: 7.1, 1.3, 7.2

Submission:

The quiz is usually due ~1 week after we start this section (see our due date schedule). Summer session is due sooner. This should be scanned as a single PDF and submitted online through Canvas. The file cannot be larger than 20 Mb (20,000 kB).

Helpful Tips:

- Start as soon as we're done with the lecture.
- Refer to the lecture and/or videos (if available).
- Use the corresponding chapter in the book to help you through difficult problems/concepts.
- There are answers and solutions available to the odd numbered problems (book number not quiz number) on the OpenStax website under "Student Resources". It is not advised to rely on the solutions because you will not have access to the solutions during the exam. Only use the solutions as a last resort. Struggling is good and that is when you are learning the most!
- Work together with your classmates.
- Go to tutoring in the ASTC or MESA, ask your classmates in our Discord room, watch YouTube Videos, come to office hours, etc.
- To ensure your mastery of the material, do the quiz multiple times.

7.1 Writing and Balancing Chemical Equations

1) (From Chapter 7.1 #1) What does it mean to say an equation is balanced? Why is it important for an equation to be balanced?

(From Chapter 7.1 #3) Balance the following equations (rearranged from book from "easiest" to "hardest":

2) $H_2(g) + I_2(s) \rightarrow HI(s)$

3) (Not in book) Mg + O_2 → MgO

4) (Not in book) H_2 + O_2 -> H_2O

5) $PtCl_4(s) \rightarrow Pt(s) + Cl_2(g)$

6) (Not in book) N_2 + H_2 -> NH_3

7) (Not in book) Al + O_2 -> Al_2O_3

8) $Fe(s) + O_2(g) \rightarrow Fe_2O_3(s)$

9) $P_4(s) + Cl_2(g) \rightarrow PCl_3(l)$

10) $Na(s) + H_2O(l) \rightarrow NaOH(aq) + H_2(g)$

11) $PCl_5(s) + H_2O(l) \rightarrow POCl_3(l) + HCl(aq)$

12) $Cu(s) + HNO_3(aq) \rightarrow Cu(NO_3)_2(aq) + H_2O(l) + NO(g)$

13) $(NH_4)_2Cr_2O_7(s) \rightarrow Cr_2O_3(s) + N_2(g) + H_2O(g)$

1.3 Physical and Chemical Properties

(From Chapter 1.3 #27) Classify each of the following changes as physical or chemical:

14) condensation of steam

15) burning of gasoline

16) souring of milk

17) dissolving of sugar in water

18) melting of gold

19) (From Chapter 1.3 #29) The volume of a sample of oxygen gas changed from 10 mL to 11 mL as the temperature changed. Is this a chemical or physical change?

7.1 Writing and Balancing Chemical Equations

20) (From Chapter 7.1 #2) Consider molecular, complete ionic, and net ionic equations. What is the difference between these types of equations? In what circumstance would the complete and net ionic equations for a reaction be identical?

(From Chapter 7.1 #5) Write a balanced molecular equation describing each of the following chemical reactions.

21) Solid calcium carbonate is heated and decomposes to solid calcium oxide and carbon dioxide gas.

22) Gaseous butane, C_4H_{10}, reacts with diatomic oxygen gas to yield gaseous carbon dioxide and water vapor.

23) Aqueous solutions of magnesium chloride and sodium hydroxide react to produce solid magnesium hydroxide and aqueous sodium chloride.

24) Water vapor reacts with sodium metal to produce solid sodium hydroxide and hydrogen gas.

(From Chapter 7.1 #9) Aqueous hydrogen fluoride (hydrofluoric acid) is used to etch glass and to analyze minerals for their silicon content. Hydrogen fluoride will also react with sand (silicon dioxide).

25) Write an equation for the reaction of solid silicon dioxide with hydrofluoric acid to yield gaseous silicon tetrafluoride and liquid water.

26) The mineral fluorite (calcium fluoride) occurs extensively in Illinois. Solid calcium fluoride can also be prepared by the reaction of aqueous solutions of calcium chloride and sodium fluoride, yielding aqueous sodium chloride as the other product. Write complete and net ionic equations for this reaction.

(From Chapter 7.1 #11) From the balanced molecular equations, write the complete ionic and net ionic equations for the following:

27) $K_2C_2O_4(aq) + Ba(OH)_2(aq) \rightarrow 2KOH(aq) + BaC_2O_4(s)$

28) $Pb(NO_3)_2(aq) + H_2SO_4(aq) \rightarrow PbSO_4(s) + 2HNO_3(aq)$

29) $CaCO_3(s) + H_2SO_4(aq) \rightarrow CaSO_4(s) + CO_2(g) + H_2O(l)$

(From Chapter 7.1 #12) Use the following equations to answer the next four questions:

i. $H_2O(s) \rightarrow H_2O(l)$

ii. $Na^+(aq) + Cl^-(aq) + Ag^+(aq) + NO_3^-(aq) \rightarrow AgCl(s) + Na^+(aq) + NO_3^-(aq)$

iii. $CH_3OH(g) + O_2(g) \rightarrow CO_2(g) + H_2O(g)$

iv. $2H_2O(l) \rightarrow 2H_2(g) + O_2(g)$

v. $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$

30) Which equation describes a physical change?

31) Which equation identifies the reactants and products of a combustion reaction?

32) Which equation is not balanced?

33) Which is a net ionic equation?

(From Chapter 7.1 #13) Indicate what type, or types, of reaction each of the following represents:

34) $Ca(s) + Br_2(l) \rightarrow CaBr_2(s)$

35) $Ca(OH)_2(aq) + 2HBr(aq) \rightarrow CaBr_2(aq) + 2H_2O(l)$

36) $C_6H_{12}(l) + 9O_2(g) \rightarrow 6CO_2(g) + 6H_2O(g)$

(From Chapter 7.1 #17) Determine the oxidation states of the elements in the compounds listed. None of the oxygen-containing compounds are peroxides or superoxides.

37) H_3PO_4

38) $Al(OH)_3$

39) SeO_2

40) KNO_2

41) In_2S_3

42) P_4O_6

(From Chapter 7.1 #19) Classify the following as acid-base reactions or oxidation-reduction reactions:

43) $Na_2S(aq) + 2HCl(aq) \rightarrow 2NaCl(aq) + H_2S(g)$

44) $2Na(s) + 2HCl(aq) \rightarrow 2NaCl(aq) + H_2(g)$

45) $Mg(s) + Cl_2(g) \rightarrow MgCl_2(s)$

46) $MgO(s) + 2HCl(aq) \rightarrow MgCl_2(aq) + H_2O(l)$

47) $K_3P(s) + 2O_2(g) \rightarrow K_3PO_4(s)$

48) $3KOH(aq) + H_3PO_4(aq) \rightarrow K_3PO_4(aq) + 3H_2O(l)$

(From Chapter 7.1 #21) Complete and balance the following acid-base equations:

49) HCl gas reacts with solid $Ca(OH)_2(s)$.

50) A solution of $Sr(OH)_2$ is added to a solution of HNO_3.

51) (From Chapter 7.1 #27) The military has experimented with lasers that produce very intense light when fluorine combines explosively with hydrogen. What is the balanced equation for this reaction?

52) (From Chapter 7.1 #29) Great Lakes Chemical Company produces bromine, Br_2, from bromide salts such as NaBr, in Arkansas brine by treating the brine with chlorine gas. Write a balanced equation for the reaction of NaBr with Cl_2.