

Quiz 4:

- Hand me your ZipGrade Scantron at the beginning of the class on Wednesday, 12/1.
- Upload your solutions in BbLearn.
- I will not grade any quiz without solutions. Solution means I should see how you have solved the problems.

1) Which of the following does **not** involve a chemical reaction?

- The formation of a solid in a previously clear solution
- Bubbles forming when a soda can is opened → *Not a chemical reaction*
- The formation of a gas when we add a substance to a solution
- All of the above are chemical reactions

2) Is the following statement True or False:

Not subscripts

"We are allowed to change coefficients and subscripts while balancing chemical equations to make sure the number of atoms in the left equals the number of atoms in the right side of the chemical equation."

- True
- b. False**

3) Balance the following chemical equation by substituting A, B, C, and D with suitable numbers:



- A=1, B=1, C=1, D=1
- A=1, B=2, C=1, D=2
- C. A=1, B=1, C=1, D=2**
- A=1, B=2, C=1, D=1

Do not balance individual atoms in polyatomic ions. Consider and balance polyatomic ions as a unit.

4) Which of the following is **not** a gas evolution reaction?

- $2 \text{HCl} + \text{K}_2\text{S} \rightarrow \text{H}_2\text{S} + 2 \text{KCl}$
- $\text{NH}_4\text{Cl} + \text{KOH} \rightarrow \text{H}_2\text{O} + \text{NH}_3 + \text{KCl}$
- $\text{HCl} + \text{K}_2\text{SO}_3 \rightarrow \text{H}_2\text{O} + \text{SO}_2 + 2 \text{KCl}$

Remember Table 7.4 (Types of Compounds that undergo gas evolution reactions).

- d. $\text{H}_2\text{SO}_4 + 2 \text{KOH} \rightarrow 2 \text{H}_2\text{O} + \text{K}_2\text{SO}_4$ → Not a gas evolution reaction.**

Acid Base

5) Which of the following compounds is insoluble in water?

- $\text{Pb}(\text{NO}_3)_2$ → *Always soluble*
- b. CaS : *soluble***
- BaBr_2 → *Mostly soluble (Ba²⁺ is not an exception)*
- PbI_2

Table 7.2: Solubility Rules

→ I⁻ mostly soluble (Pb²⁺ is an exception)



PbI₂ : insoluble

*S²⁻ : mostly insoluble
↓
Ca²⁺ exception*

Compounds
~~that~~ containing Na^+ , K^+ , NO_3^-
are ALWAYS soluble
in water. They would be
aqueous (aq). So they
you won't see any
reaction for a, b, c.

- 6) Which of the following reactions is correct?
- $\text{KI (aq)} + \text{NaCl (aq)} \rightarrow \text{NaI (aq)} + \text{KCl (aq)}$
 - $2\text{NaNO}_3 \text{ (aq)} + \text{CaS (aq)} \rightarrow \text{Na}_2\text{S (aq)} + \text{Ca(NO}_3)_2$
 - $\text{KI (aq)} + \text{NaCl (aq)} \rightarrow \text{NaI (s)} + \text{KCl (aq)}$
 - $2\text{KI (aq)} + \text{Pb (NO}_3)_2 \text{ (aq)} \rightarrow \text{PbI}_2 \text{ (s)} + 2\text{KNO}_3 \text{ (aq)}$

Precipitation
reaction

- 7) Which of the following statements is NOT correct?
- Compounds containing Cl^- , Br^- , and I^- are soluble unless they pair with Ag^+ , Hg_2^{2+} , or Pb^{2+} which makes them insoluble.
 - Compounds containing NO_3^- and $\text{C}_2\text{H}_3\text{O}_2^-$ are always ~~insoluble~~.
 - When SO_4^{2-} pairs with Ca^{2+} , Sr^{2+} , Ba^{2+} , or Pb^{2+} , the compound is insoluble.
 - When either of OH^- or S^{2-} ions pairs with Li^+ or NH_4^+ , the compound is soluble.

Table 7.2

- 8) Which of the following statements is NOT correct?
- Combustion reactions are a subcategory of oxidation-reduction reactions. ✓
 - All gas evolution reactions are also acid-base reactions. X
 - Some gas evolution reactions form an intermediate product that then decomposes into a gas. ✓
 - The key to predicting precipitation reactions is understanding that only insoluble compounds form precipitates. ✓

- 9) Define the following effect: "Certain gases in Earth's atmosphere allow visible-light energy to enter the atmosphere but prevent heat energy from escaping."
- Theoretical yield
 - Stoichiometry
 - Greenhouse effect
 - The Bohr effect

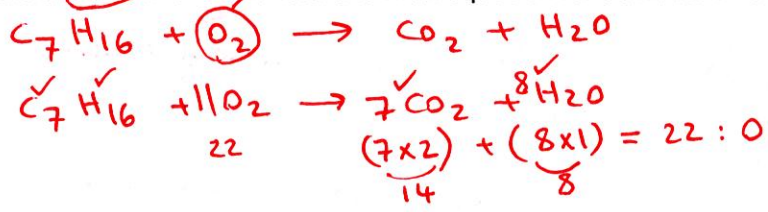
- 10) Which of these are NOT redox reactions?
- $2\text{Mg (s)} + \text{O}_2 \text{ (g)} \rightarrow 2\text{MgO (s)}$ → A metal reacts with a nonmetal → redox
 - $2\text{HBr (aq)} + \text{Ca(OH)}_2 \text{ (aq)} \rightarrow 2\text{H}_2\text{O (l)} + \text{CaBr}_2 \text{ (aq)}$
acid base
 - $\text{Zn (s)} + \text{Fe}^{2+} \text{ (aq)} \rightarrow \text{Zn}^{2+} \text{ (aq)} + \text{Fe (s)}$ → Transfer of electrons → redox
 - $\text{Ca (s)} + \text{Cl}_2 \text{ (g)} \rightarrow \text{CaCl}_2 \text{ (s)}$ → A metal reacts with a nonmetal → redox

- 11) Which of the following is NOT a double-displacement reaction?
- $2\text{HCl (aq)} + \text{Na}_2\text{CO}_3 \text{ (aq)} \rightarrow \text{H}_2\text{CO}_3 \text{ (aq)} + 2\text{NaCl (aq)}$
 - $\text{Zn (s)} + \text{CuCl}_2 \text{ (aq)} \rightarrow \text{ZnCl}_2 \text{ (aq)} + \text{Cu (s)}$ → This is single-displacement
 - $\text{AgNO}_3 \text{ (aq)} + \text{NaCl (aq)} \rightarrow \text{AgCl (s)} + \text{NaNO}_3 \text{ (aq)}$
 - All of the above are double-displacement reactions

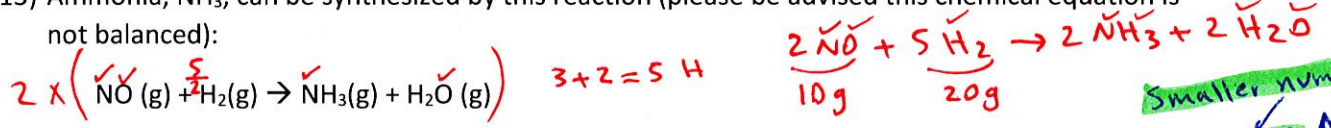
Balance free elements last.
(O₂, H₂, Mg, Al, ...)

12) What is the coefficient of water in the balanced chemical equation for combustion of heptane (C₇H₁₆)?

- a. 8
- b. 15
- c. 14
- d. 16



13) Ammonia, NH₃, can be synthesized by this reaction (please be advised this chemical equation is not balanced):



H	1.01
N	14.01
O	16.00

What maximum amount of ammonia in grams can be synthesized from 10 g of NO and 20 g of H₂? *Smaller number*

- a. 26.00
- b. 67.48
- c. 41.80
- d. 5.68

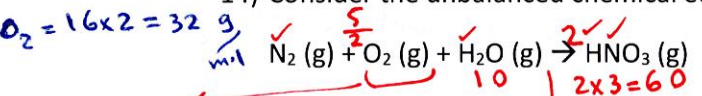
limiting reactant

$$? g NH_3 = 10 g NO \times \frac{1 \text{ mol NO}}{30.01 g NO} \times \frac{2 \text{ mol NH}_3}{2 \text{ mol NO}} \times \frac{17.04 g NH_3}{1 \text{ mol NH}_3} = 5.68$$

$$? g NH_3 = 20 g H_2 \times \frac{1 \text{ mol H}_2}{2.02 g H_2} \times \frac{2 \text{ mol NH}_3}{5 \text{ mol H}_2} \times \frac{17.04 g NH_3}{1 \text{ mol NH}_3} = 67.485$$

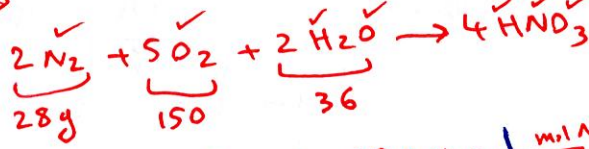
14) Consider the unbalanced chemical equation:

$$N_2 = 14.01 \times 2 = 28.02 \frac{g}{\text{mol}} \quad HNO_3 = 1.01 + 14.01 + 16 \times 3 = 63.02 \frac{g}{\text{mol}}$$



If a reaction mixture contains 28 g of N₂, 150 g of O₂, and 36 g of H₂O, what is the limiting reactant?

- a. N₂
- b. O₂
- c. H₂O
- d. HNO₃

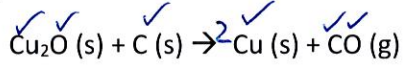


$$? g HNO_3 = 28 g N_2 \times \frac{1 \text{ mol N}_2}{28.02 g N_2} \times \frac{4 \text{ mol HNO}_3}{2 \text{ mol N}_2} \times \frac{63.02 g HNO_3}{1 \text{ mol HNO}_3} = 63.02 g HNO_3$$

$$? g HNO_3 = 150 g O_2 \times \frac{1 \text{ mol O}_2}{32 g O_2} \times \frac{4 \text{ mol HNO}_3}{5 \text{ mol O}_2} \times \frac{63.02 g HNO_3}{1 \text{ mol HNO}_3} = 63.02 g HNO_3$$

$$? g HNO_3 = 36 g H_2O \times \frac{1 \text{ mol H}_2O}{18.02 g H_2O} \times \frac{4 \text{ mol HNO}_3}{2 \text{ mol H}_2O} \times \frac{63.02 g HNO_3}{1 \text{ mol HNO}_3} = 63.02 g HNO_3$$

15) Consider this unbalanced chemical equation:



When 20 g of C are allowed to react with 200 g of Cu₂O, 160 g of Cu are obtained. Determine the percent yield:

- a. 177.64 %
- b. 211.66 %
- c. 90 %
- d. 84 %

$$? g Cu = 20 g C \times \frac{1 \text{ mol C}}{12.01 g C} \times \frac{2 \text{ mol Cu}}{1 \text{ mol C}} \times \frac{63.55 g Cu}{1 \text{ mol Cu}} = 211.66 g Cu$$

$$? g Cu = 200 g Cu_2O \times \frac{1 \text{ mol Cu}_2O}{143.1 g Cu_2O} \times \frac{2 \text{ mol Cu}}{1 \text{ mol Cu}_2O} \times \frac{63.55 g Cu}{1 \text{ mol Cu}} = 177.64 g Cu$$

$$Cu_2O = (63.55 \times 2) + 16.00 = 143.1 \frac{g}{\text{mol}}$$

Theoretical yield

$$\text{percent yield} = \frac{\text{Actual yield}}{\text{Theoretical yield}} \times 100\%$$

$$= \frac{160 g Cu}{177.64 g Cu} \times 100\% = 90\%$$

This should be 5 oxygen.
Remember balance that last

N₂ → 125.95
H₂O → 236.33
H₂O → 251.80

First find limiting reactant

? mol C = 5 mol A $\times \frac{2 \text{ mol C}}{3 \text{ mol A}} = 3.33 \text{ mol C}$
 ? mol C = 6 mol B $\times \frac{2 \text{ mol C}}{5 \text{ mol B}} = 2.40 \text{ mol C}$

16) Consider the generic reaction:



If a reaction mixture initially contains 5 mol of A and 6 mol of B, how much heat (in kJ) will have evolved once the reaction has occurred to the greatest extent possible?

- a. -100 kJ
- b. -240 kJ**
- c. -480 kJ
- d. -330 kJ

limiting reactant
 Theoretical yield
 use limiting reactant to find heat.
 ? kJ = 6 mol B $\times \frac{-200 \text{ kJ}}{5 \text{ mol B}} = -240 \text{ kJ}$

17) Which of the following is a component of white light?

- a. Red**
- b. Infrared
- c. Ultraviolet
- d. Gamma

1s 2s 2p 3s 3p 4s 3d 4p : This is the order we fill orbitals with electrons.

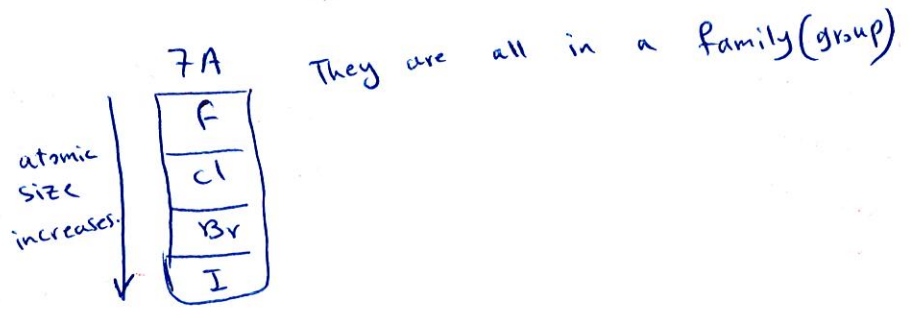
18) Write the electron configuration of bromine?

- a. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^5$**
- b. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^4$
- c. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6$
- d. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 4p^5$

35 Br
 $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^5$
 $2+2+6+2+6+2+6+10+5 = 30 \text{ electrons}$
 $35 - 30 = 5$

19) Which atom has the biggest size?

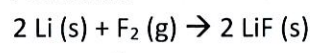
- a. F
- b. Cl
- c. Br
- d. I**



20) What is the orbital?

- a. Orbits X
- b. Electrons around the nucleus in exact locations X
- c. Circular path around the protons X
- d. Probability maps indicating where electron is likely to be found**

21) What is the limiting reactant for the following chemical equation and initial quantities of reactants?



- a. Li
- b. F_2
- c. LiF
- d. Cannot be determined based on the information provided**

We need to have moles or grams of reactants to determine limiting reactant, and initial quantities of reactants.

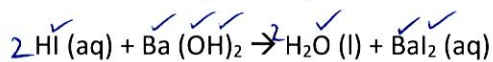
22) Which electromagnetic radiation is most dangerous to human beings?

- a. Radio waves
- b. Gamma rays → highest energy is the most dangerous
- c. Ultraviolet radiation
- d. X-rays

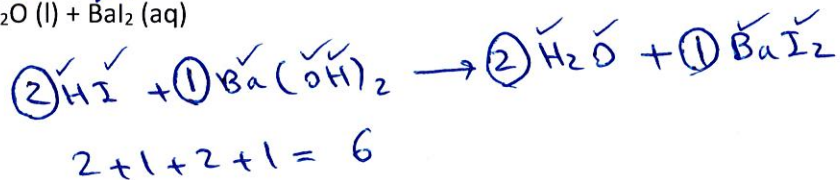
23) Which wavelength of light has the highest energy?

- a. 200 nm
 - b. 500 nm
 - c. 700 nm
 - d. 100 nm
- shortest wavelength

24) After balancing the following equation, what is the sum of all the coefficients? (Consider all the reactants and products)



- a. 3
- b. 4
- c. 6
- d. 5



25) Is the following statement True or False:

The Pauli exclusion principle states that orbitals may hold more than two electrons with opposing spins.

- a. True
- b. False

NO

