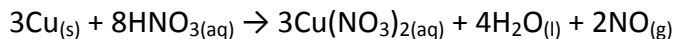


Problem Set 1 – October 2020

- The name of the SO_3^{2-} ion is:
 - Sulfite
 - Sulfate
 - Sulfide
 - Sulfurate
 - bisulfide
- Which of the following compounds is a salt?
 - $\text{CH}_3\text{BrC}(\text{O})\text{OH}$
 - $\text{CH}_3\text{C}(\text{O})\text{OCH}_3$
 - $\text{CH}_3\text{C}(\text{O})\text{ONa}$
 - $\text{CCl}_3\text{COOCH}_3$
 - CH_4
- The ground state electronic configuration for copper (Cu) is.
 - $1s^2 2s^2 2p^6 3s^2 3p^6 3d^9 4s^2$
 - $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^1$
 - $1s^2 2s^2 2p^6 3s^2 3p^6 3d^9$
 - $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10}$
 - none of the above
- Calculate the number of moles of potassium in a 50.0 g sample of potassium sulfate, K_2SO_4 .
 - 0.574 mol
 - 1.28 mol
 - 2.00 mol
 - 0.287 mol
 - 1.74 mol
- For the following reaction, which statement is *false*?



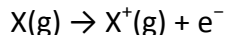
- The solid copper has a formal oxidation number of 0
- The oxidation state of copper in $\text{Cu}(\text{NO}_3)_2$ is +2
- Both oxidation and reduction occur during this reaction
- The nitrogen of NO_3^- is neither oxidized nor reduced in this reaction
- H^+ is not reduced in this reaction

6. A mixture of 50.0 g of ammonia and 60.0 g of oxygen gas reacts according to the following equation:



If all gases are at the same temperature and pressure, and the reaction continues until one of the gases is completely consumed, what mass of water vapour is produced?

- a. 48.2 g
 - b. 60.4 g
 - c. 72.8 g
 - d. 40.5 g
 - e. 110 g
7. An ore contains 1.34% of the mineral argentite, Ag_2S , by weight. How many grams of this ore would have to be processed in order to obtain 1.00 g of pure solid silver, Ag?
- a. 74.6 g
 - b. 85.7 g
 - c. 107.9 g
 - d. 134.0 g
 - e. 171.4 g
8. A 3.00 g sample of an alloy containing only Pb and Sn was dissolved in nitric acid (HNO_3). When excess sulfuric acid was added to this solution, 2.93 g of PbSO_4 precipitated. Assuming that all the lead precipitated, what is the mass percentage of Sn in the sample?
- a. 1.00 %
 - b. 20.5 %
 - c. 50.0 %
 - d. 66.7 %
 - e. 33.3 %
9. The first ionization energy of an element is the energy required to remove one electron from a gaseous atom of that element, that is, it is the energy required for the reaction



where X stands for any element. Which of the following elements would you expect to have the lowest first ionization energy?

- a. Mg
- b. Rb
- c. Li
- d. Ca
- e. Be

10. Molecular bromine (Br_2) will react with molecular fluorine (F_2) at 150°C to produce BrF_n compounds that are representative of the stoichiometric ratio of the reactants. What is the n of the BrF_n produced when 0.488 mL of liquid bromine is added to a 1.0 L flask that contains only fluorine gas at a temperature of 150°C and a total pressure of 750 mmHg. (the density of liquid bromine is 3.1028 g mL^{-1})
- 1
 - 2
 - 3
 - 4
 - 5
11. What is the molecular weight of an unknown gas where a total mass of 0.599 g fills a 250 mL container at 1.0 atm at 25°C ?
- 98.4 g mol^{-1}
 - 122 g mol^{-1}
 - 88.1 g mol^{-1}
 - 58.6 g mol^{-1}
 - 72.4 g mol^{-1}
12. The vapour pressure of pure benzene (C_6H_6) and toluene (C_7H_8) at 25°C are 95.1 and 28.4 mm Hg, respectively. What is the total vapour pressure of a solution of benzene and toluene with a mole fraction of 0.750 toluene? (Assume the solution to be ideal)
- 62.8 mmHg
 - 66.7 mmHg
 - 123.5 mmHg
 - 77.6 mmHg
 - 45.1 mmHg
13. What is the partial pressure of $\text{SO}_2(g)$ in a system where 100 g of $\text{O}_2(g)$ is mixed with 100 g of $\text{SO}_2(g)$, and the total pressure is 600 mm Hg?
- 500 mm Hg
 - 400 mm Hg
 - 300 mm Hg
 - 200 mm Hg
 - 100 mm Hg

14. A sample of hydrogen gas is contained in a balloon. The volume of the balloon is 2.15 L at 15°C. The temperature is changed until the volume of the balloon is 3.25 L. What is the new temperature of the gas in °C?
- 162 °C
 - 25 °C
 - 82 °C
 - 181 °C
 - 435 °C
15. Body temperature is about 308 K. On a cold day, what volume of air at 273 K must a person with a lung capacity of 2.00 L inhale to fill their lungs?
- 2.00 L
 - 1.77 L
 - 1.13 L
 - 1.51 L
 - none of these
16. The minimum energy needed to eject an electron from a sodium atom is 4.41×10^{-19} J. What is the maximum wavelength of light, in nanometers, that will show a photoelectric effect with sodium?
- 4.51×10^{-7} nm
 - 451 nm
 - 4.41×10^{-7} nm
 - 257 nm
 - 2.22×10^6 nm
17. In the upper atmosphere the formation of the ozone layer is initiated by the photolytic cleavage of molecular oxygen (O₂). Given the bond dissociation energy of O₂ is 497 kJ mol⁻¹, what is the maximum wavelength of a photon that will facilitate this reaction.
- 240 nm
 - 570 nm
 - 120 nm
 - 290 nm
 - 310 nm

18. Equal volumes of 0.200 M HCl and 0.400 M KOH are mixed. The resulting concentrations are:

- a. $[K^+] = 0.400\text{ M}$, $[Cl^-] = 0.200\text{ M}$, $[H^+] = 0.200\text{ M}$
- b. $[K^+] = 0.200\text{ M}$, $[Cl^-] = 0.100\text{ M}$, $[OH^-] = 0.100\text{ M}$
- c. $[K^+] = 0.100\text{ M}$, $[Cl^-] = 0.100\text{ M}$, $[OH^-] = 0.100\text{ M}$
- d. $[K^+] = 0.200\text{ M}$, $[Cl^-] = 0.100\text{ M}$, $[H^+] = 0.100\text{ M}$
- e. $[K^+] = 0.200\text{ M}$, $[Cl^-] = 0.200\text{ M}$

19. A 0.50 L sealed flask contains only 0.050 g of glucose ($C_6H_{12}O_6$) and 0.20 atm of oxygen. The glucose is ignited and burned entirely to carbon dioxide (CO_2) and water (H_2O) via the balanced equation below. Once the flask is cooled back to 298 K, what is the total pressure within the system? (assume all of the water vapour remains in the gas phase)



- a. 0.21 atm
- b. 0.59 atm
- c. 0.28 atm
- d. 0.15 atm
- e. not enough information provided

20. Methanol has a boiling point of 64.7°C and a heat of vaporization (ΔH_{vap}) of 35.3 kJ mol^{-1} . If 1.20 mL of methanol is added to a sealed 250 mL flask at 25.0°C , what volume of methanol remains in the flask after it is heated to 45.0°C ? (density of methanol is 0.791 g mL^{-1})

- a. 1.20 mL
- b. 1.18 mL
- c. 0.98 mL
- d. 1.02 mL
- e. No liquid methanol remains in the flask