

**Arabia Mountain High School  
AP Chemistry**

**Summer Assignment**

**Show all calculations as applicable to receive credit.**

**Please note that your answer must be supported by calculations on this paper to receive credit.**

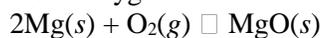
- \_\_\_\_\_ 1. Which method is best for separating a mixture of ethyl alcohol and water?
- distillation
  - light absorption
  - electrolysis
  - gas-liquid chromatography
  - filtration
- \_\_\_\_\_ 2. All of the following relationships are false EXCEPT
- $1.5 \text{ cm}^3 = 1.5 \text{ mL}$ .
  - $3.00 \text{ m}^3 < 3.00 \text{ L}$ .
  - $5.2 \text{ m}^3 = 5.2 \times 10^2 \text{ cm}^3$ .
  - $0.0455 \text{ L} > 455 \text{ mL}$ .
  - $22 \text{ L} = 22 \text{ m}^3$ .
- \_\_\_\_\_ 3. The boiling point for liquid oxygen is 90.0 K. What is the boiling point in Fahrenheit?
- \_\_\_\_\_ 4. How many significant figures are in the following volume:  $5.00 \times 10^4 \text{ mL}$ ?
- \_\_\_\_\_ 5. F-20, a radioactive isotope of fluorine, has
- 9 protons, 10 neutrons, and 1 electron.
  - 9 protons, 10 neutrons, and 9 electrons.
  - 9 protons, 11 neutrons, and 9 electrons.
  - 10 protons, 9 neutrons, and 1 electron.
  - 10 protons, 10 neutrons, and 10 electrons.
- \_\_\_\_\_ 6. Identify the alkali metal from period 5.
- Rb
  - Ca
  - Sr
  - K
  - Ga
- \_\_\_\_\_ 7. Which group of three elements contains an alkaline earth metal, a halogen, and a post-transition element?
- Be, S, U
  - Ba, As, Ce
  - U, Cl, Rb
  - Mg, Br, Pu
  - K, Ga, Se

- \_\_\_ 8. What is the correct formula for potassium dichromate?
- \_\_\_ 9. What is the formula for chlorous acid?
- \_\_\_ 10. The average molar mass of lithium is 6.941. A sample of lithium consists of two isotopes with masses of 6.01512 amu and 7.01600 amu. Determine the percent abundance of each isotope.
- \_\_\_ 11. What is the mass in grams of 0.362 moles sulfur hexafluoride ( $\text{SF}_6$ )?
- \_\_\_ 12. How many moles are present in 0.098 grams of HCl?
- \_\_\_ 13. What mass of oxygen is present in 10.0 grams of potassium nitrate ( $\text{KNO}_3$ )?
- \_\_\_ 14. What is the percent composition of silicon nitride ( $\text{Si}_3\text{N}_4$ )?
- \_\_\_ 15. Isopentyl acetate, a molecule composed of C, H, and O, smells like bananas. Combustion analysis of 1.750 grams of this molecule yields 1.695 g  $\text{H}_2\text{O}$  and 4.142 g  $\text{CO}_2$ . What is the simplest formula for isopentyl acetate?

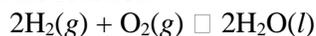
- \_\_\_\_\_ 16. The catalytic conversion of ammonia to nitric oxide is the first step in a three-step process which ultimately results in nitric acid. Balance the equation for the reaction.



- \_\_\_\_\_ 17. What mass of oxygen will react with 2.64 g of magnesium?



- \_\_\_\_\_ 18. A mass of 4.00 g of  $\text{H}_2(g)$  reacts with 2.00 g of  $\text{O}_2(g)$ . If 1.94 g of  $\text{H}_2\text{O}(l)$  is collected, what is the percent yield of the reaction?



- \_\_\_\_\_ 19. 2.500 grams of  $\text{MgSO}_4 \cdot x\text{H}_2\text{O}$ , a hydrated salt with an unknown water content, is dried in an oven to remove the water. After drying, the anhydrous salt has a mass of 1.221 grams. How many moles of water are present per mole of hydrated magnesium sulfate?

- \_\_\_\_\_ 20. When iron and steam react at high temperatures, the following reaction takes place.



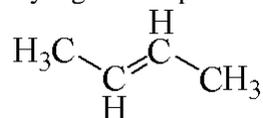
How much iron must react with excess steam to form 300 g of  $\text{Fe}_3\text{O}_4(s)$  if the reaction yield is 69%?

- \_\_\_\_\_ 21. Which of the following species has a Lewis structure with a molecular geometry similar to  $\text{CS}_2$ ?

- $\text{H}_2\text{S}$
- $\text{NO}_2$
- $\text{NO}_2$
- $\text{H}_2\text{O}$
- $\text{SCN}$

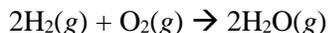
- \_\_\_ 22. Which of the following species has a Lewis structure with a molecular geometry similar to SF<sub>4</sub>?
- BrF<sub>4</sub><sup>+</sup>
  - ICl<sub>4</sub><sup>□</sup>
  - NH<sub>4</sub><sup>+</sup>
  - SO<sub>4</sub><sup>2□</sup>
  - CCl<sub>4</sub>
- \_\_\_ 23. Which of the following species has a Lewis structure with a molecular geometry similar to NH<sub>3</sub>?
- CO<sub>3</sub><sup>2-</sup>
  - BH<sub>3</sub>
  - H<sub>3</sub>O<sup>+</sup>
  - ICl<sub>3</sub>
  - SO<sub>3</sub>
- \_\_\_ 24. Use VSEPR theory to predict the molecular geometry of BH<sub>3</sub>.
- triangular planar
  - triangular pyramidal
  - linear
  - tetrahedral
  - triangular bipyramidal
- \_\_\_ 25. Which of the following molecules contain polar covalent bonds: CO, N<sub>2</sub>, NH<sub>3</sub>, NH<sub>4</sub><sup>+</sup>, and HCl?
- CO and HCl
  - CO and NH<sub>3</sub>
  - CO, NH<sub>3</sub>, and N<sub>2</sub>
  - CO, NH<sub>3</sub>, NH<sub>4</sub><sup>+</sup> and HCl
  - All of the species contain polar covalent bonds.
- \_\_\_ 26. Which of the following molecules are polar: H<sub>2</sub>S, CO<sub>2</sub>, NH<sub>3</sub>, BH<sub>3</sub>, and CCl<sub>4</sub>?
- BH<sub>3</sub>
  - H<sub>2</sub>S and NH<sub>3</sub>
  - H<sub>2</sub>S, CO<sub>2</sub>, and CCl<sub>4</sub>
  - CO<sub>2</sub>, NH<sub>3</sub>, and CCl<sub>4</sub>
  - NH<sub>3</sub>, BH<sub>3</sub> and CCl<sub>4</sub>
- \_\_\_ 27. What is the hybridization of the carbon atoms in benzene, C<sub>6</sub>H<sub>6</sub>?
- sp
  - sp<sup>2</sup>
  - sp<sup>3</sup>
  - sp<sup>3</sup>d
  - sp<sup>3</sup>d<sup>2</sup>
- \_\_\_ 28. What is the hybridization of the carbon atoms in ethyne, C<sub>2</sub>H<sub>2</sub>?
- sp
  - sp<sup>2</sup>
  - sp<sup>3</sup>
  - sp<sup>3</sup>d
  - sp<sup>3</sup>d<sup>2</sup>

\_\_\_ 29. How many sigma and pi bonds are present in the following molecule?



- 8 sigma bonds and 1 pi bond
  - 8 sigma bonds and 2 pi bonds
  - 10 sigma bonds and 2 pi bonds
  - 11 sigma bonds and 2 pi bonds
  - 11 sigma bonds and 1 pi bond
- \_\_\_ 30. A rigid 8.20 L flask contains a mixture of 2.50 moles of H<sub>2</sub>, 0.500 mole of O<sub>2</sub>, and sufficient Ar so that the partial pressure of Ar in the flask is 2.00 atm. The temperature is 127 oC.
- calculate the total pressure in the flask.
  - calculate the mole fraction of H<sub>2</sub> in the flask.
  - Calculate the density (in g L<sup>-1</sup>) of the mixture in the flask.

The mixture in the flask is ignited by a spark, and the reactions represented below occurs until one of the reactants is entirely consumed.



- Give the mole fraction of all species present in the flask at the end of the reaction
- \_\_\_ 31. What net ionic reaction occurs when aqueous solutions of potassium carbonate and iron(III) bromide are mixed?

\_\_\_ 32. What volume of 1.75 M hydrochloric acid must be diluted with water to prepare 0.500 L of 0.250 M hydrochloric acid?

- \_\_\_\_\_ 33. Which list contains only strong acids?
- HCl, HNO<sub>3</sub>, HF, HClO<sub>4</sub>
  - H<sub>2</sub>SO<sub>4</sub>, H<sub>3</sub>PO<sub>4</sub>, HClO<sub>4</sub>, NH<sub>3</sub>
  - HCl, HNO<sub>3</sub>, H<sub>3</sub>PO<sub>4</sub>, HClO<sub>4</sub>
  - HCl, H<sub>2</sub>SO<sub>4</sub>, HClO<sub>4</sub>, HI
  - HNO<sub>3</sub>, H<sub>2</sub>SO<sub>4</sub>, NaOH, H<sub>3</sub>PO<sub>4</sub>
- \_\_\_\_\_ 34. Which of the following is a weak acid?
- HBr
  - HCl
  - HF
  - HI
  - HClO<sub>4</sub>
- \_\_\_\_\_ 35. What is the net ionic equation for the reaction of lithium hydroxide with hydroiodic acid?
- $\text{H}^+ + \text{I}^- \rightarrow \text{HI}(s)$
  - $\text{Li}^+ + \text{I}^- \rightarrow \text{KI}(s)$
  - $\text{LiOH}(aq) + \text{HI}(aq) \rightarrow \text{LiI}(s) + \text{H}_2\text{O}$
  - $\text{LiOH}(s) + \text{H}^+(aq) \rightarrow \text{Li}^+(aq) + \text{H}_2\text{O}$
  - $\text{OH}^-(aq) + \text{H}^+(aq) \rightarrow \text{H}_2\text{O}$
- \_\_\_\_\_ 36. The following reaction occurs spontaneously.
- $$\text{Cu}^{2+}(aq) + \text{Zn}(s) \rightarrow \text{Cu}(s) + \text{Zn}^{2+}(aq)$$
- Write the balanced reduction half-reaction.
- $\text{Zn}(s) + 2e^- \rightarrow \text{Zn}^{2+}(aq)$
  - $\text{Zn}(s) \rightarrow \text{Zn}^{2+}(aq) + 2e^-$
  - $\text{Zn}^{2+}(aq) + 2e^- \rightarrow \text{Zn}(s)$
  - $\text{Cu}^{2+}(aq) + 2e^- \rightarrow \text{Cu}(s)$
  - $\text{Cu}(s) + 2e^- \rightarrow \text{Cu}^{2+}(aq)$
- \_\_\_\_\_ 37. Given the following half-reactions, write the balanced overall reaction.
- $$\text{Pb}(s) + 2\text{I}^-(aq) \rightarrow \text{PbI}_2(s) + 2e^-$$
- $$\text{I}_2(aq) + 2e^- \rightarrow 2\text{I}^-(aq)$$
- $\text{Pb}(s) + \text{I}_2(aq) + 2e^- \rightarrow \text{PbI}(s) + \text{I}^-(aq)$
  - $\text{Pb}(s) + \text{I}_2(aq) \rightarrow \text{PbI}_2(s)$
  - $\text{Pb}(s) + \text{I}_2(aq) \rightarrow \text{Pb}^{2+}(aq) + 2\text{I}^-(aq)$
  - $2\text{Pb}(s) + 4e^- \rightarrow 2\text{PbI}(s) + \text{I}_2(aq)$
  - $\text{Pb}(s) + e^- + 2\text{I}^-(aq) \rightarrow \text{PbI}_2(aq)$