

Avogadro's Number, $N_A = 6.022 \times 10^{23}$

1. [7 points] Given the following mathematical expression:

$$(15.111-15.0)/(2.154 \times 10^3)$$

How many significant figures should the answer contain?

(a) 1

2. [7 points] What is the empirical formula of lead (IV) sulfide?

(c) PbS_2

3. [7 points] Which of the following pairs of atoms (ions) have the same number of electrons?

(b) $^{87}Sr^{2+}$ and ^{83}Kr

4. [7 points] What is the empirical formula of lithium carbonate?

(c) Li_2CO_3

5. [7 points] What is the mass of 0.200 gallons (a fifth) of pure ethanol (density = 0.789 g/cm³)? [1 gallon = 3.785 Liters]

(e) 597 g

6. [7 points] Which of the following pure substances would you expect to be the best conductor of electricity?

(c) Tungsten

7. [7 points] Which of the following statements is false?

(b) It's possible for two compounds with different empirical formulas to have the same molecular formula

8. [7 points] What is the mass of 0.075 moles of silver nitrate?

(b) 13 g

9. [7 points] Compositional analysis of an iron pyrite (fool's gold) sample reveals that this compound is 46.5% iron and 53.4% sulfur by mass. What is the empirical formula of iron pyrite?

(c) FeS_2

10. [7 points] A gaseous sample weighing 0.625 g and containing only carbon and hydrogen was subjected to combustion analysis. The analysis yielded 1.89 g of CO_2 and 0.969 g of H_2O . What is the empirical formula of this compound?

(e) C_2H_5

11. [7 points] Which of the following is the balanced chemical equation that describes the reaction between iron (III) hydroxide and perchloric acid?

(e) $\text{Fe}(\text{OH})_3 (\text{s}) + 3\text{HClO}_4 (\text{aq}) \rightleftharpoons \text{Fe}(\text{ClO}_4)_3 (\text{aq}) + 3\text{H}_2\text{O} (\text{l})$

12. [7 points] Given the following balanced chemical equation:



Consider the reaction between 16 ammonia (NH_3) molecules and 25 oxygen molecules. What molecules will remain after the reaction is complete, assuming the reaction goes to completion.

(b) 5 molecules O_2 + 16 molecules NO + 24 molecules H_2O

13. [7 points] A 1.32 g sample of calcium carbonate reacts with an excess of hydrochloric acid to form calcium chloride, carbon dioxide and water. The CO_2 produced in this reaction is collected and its weight is found to be 0.534 g. What is the percent yield of carbon dioxide?

(a) 92.1%

14. [7 points] What is the molarity of the solution formed when 9.5 g of potassium chloride is dissolved in water to make 250 mL of solution?

(b) 0.51 M

15. [7 points] What is the concentration of the solution which results when 60.0 mL of 0.84 M KI solution is mixed with 30.0 mL of 1.44 M KI solution?

(c) 1.04 M

16. [7 points] What is the oxidation state (oxidation number) of chlorine in sodium hypochlorite?

(e) +1

17. [7 points] Which of the following substances is a weak electrolyte?

(d) NH_3

18. [7 points] Which of the following metals will be oxidized by hydrochloric acid?

(d) both (a) zinc and (b) nickel will be oxidized by hydrochloric acid

19. [7 points] What will be the outcome of the following two steps:

I. First 5.0 L of 1.0 M barium hydroxide solution and 8.0 L of 1.0 M hydrochloric acid solution are mixed in beaker A.

II. Next 12.0 L of 1.0 M zinc nitrate solution is added to beaker A.

(c) A white precipitate will form, and the solution will be neutral

For the next three problems consider the two solutions (A and B) below.

Solution A

Solute = Silver Nitrate

Volume = 50.0 mL

Concentration = 1.50 M

Solution B

Solute = Sodium Carbonate

Volume = 85.0 mL

Concentration = 1.00 M

20. [7 points] If solutions A and B are mixed together what is the identity of the precipitate that forms?

(c) Ag_2CO_3

21. [7 points] If you mix the two solutions together what is the theoretical yield of the precipitate?

(a) 10.3 g

22. [7 points] After mixing the two solutions together and removing the precipitate which ions are still present in solution?

(c) CO_3^{2-} , Na^+ and NO_3^-

23. [7 points] Which of the following equations is the correct balanced net ionic equation for the reaction between copper (II) bromide solution and potassium hydroxide solution.

(e) $\text{Cu}^{2+}(\text{aq}) + 2\text{OH}^-(\text{aq}) \rightarrow \text{Cu}(\text{OH})_2(\text{s})$

24. [7 points] Which of the following reactions is an example of an oxidation-reduction reaction?

(b) $\text{Mg}(\text{s}) + \text{AgNO}_3(\text{aq}) \rightarrow \text{Ag}(\text{s}) + \text{Mg}(\text{NO}_3)_2(\text{aq})$

25. [7 points] How many protons are found in a $^{23}\text{Na}^+$ ion?

(b) 11