

Multiple Choice: (4 points each. Put answers in left margin as capital letters.)

- 1.30 kJ of heat is required to raise the temperature of 444 g of lead from 15 °C to its final temperature. Taking the specific heat capacity of lead to be 130 J/(kg•°C), the final temperature is:
A) 22.5 °C C) 37.5 °C E) None of these
B) 30 °C D) 45 °C
- The correct number of protons, neutrons, and electrons in P⁻ (P-31) is:
A) 15p, 16n, 14e C) 16p, 16n, 15e E) 16p, 16n, 17e
B) 15p, 16n, 16e D) 16p, 15n, 16e
- What is the charge on nickel in NiSO₄?
A) 0 B) +2 C) +3 D) +4 E) +6
- Which of the following must be an empirical formula?
A) C₃H₈ B) C₄H₂(OH)₂ C) C₄H₈ D) C₆H₆ E) N₂O₄
- Calculate the molar mass (g/mol) for the compound, aluminum chloride, AlCl₃.
A) 62.435 B) 106.36 C) 116.49 D) 124.87 E) 133.34
- What percentage of aluminum chloride is aluminum?
A) 20.2% B) 45.7% C) 69.5% D) 70.4% E) 78.1%
- Which of the following is true for the reaction: $2 \text{H}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2 \text{H}_2\text{O}(\text{g}) - 286 \text{ kJ}$
A) the reaction is exothermic, and the heat of the reaction is positive
B) the reaction is exothermic, and the heat of the reaction is negative
C) the reaction is endothermic, and the heat of the reaction is positive
D) the reaction is endothermic, and the heat of the reaction is negative
E) none are true
- Which of the following processes is most likely to be endothermic?
A) ice melting
B) natural gas burning
C) iron rusting
D) the reaction produces a solid
E) all of the above indicate a reaction is likely endothermic.

9. For the reaction: $4 \text{HCN} + 5 \text{O}_2 \rightarrow 2 \text{N}_2 + 4 \text{CO}_2 + 2 \text{H}_2\text{O}$, how many moles of O_2 are consumed when 18.7 moles of H_2O are produced?
 A) 4.00 mol B) 7.48 mol C) 18.7 mol D) 37.4 mol E) 46.8 mol
10. How many moles of N_2 are needed to completely react with 24.8 grams of O_2 ?
 A) 0.0775 mol B) 0.155 mol C) 0.310 mol D) 0.620 mol E) 1.24 mol

Discussion Questions:

1. Define: (4 points each)

mole –

combustion –

limiting reactant –

Fill-in-the-blanks (4 points each)

1. _____ boron tribromide, CH_4 _____
2. _____ Cr_2O_3 , $\text{Ca}(\text{OCl})_2$ _____
3. Avogadro's number = _____
4. A reaction's actual yield might be lower than its theoretical yield because _____.

For questions 4-5, provide reaction types, but do not use the same type twice.

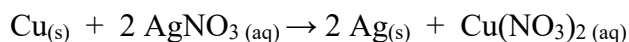
5. $3 \text{Ba}(\text{NO}_3)_2 (\text{aq}) + 2 \text{Al}_2(\text{SO}_4)_3 (\text{aq}) \rightarrow 3 \text{BaSO}_4 (\text{s}) + 2 \text{Al}(\text{NO}_3)_3 (\text{aq})$ _____
6. $4 \text{As} (\text{s}) + 3 \text{O}_2 (\text{g}) \rightarrow \text{As}_4\text{O}_6 (\text{s})$ _____
7. Balance: ____ $\text{Ca}_3(\text{PO}_4)_2$ + ____ $\text{SiO}_2 \rightarrow$ ____ P_4O_{10} + ____ CaSiO_3
8. Aqueous silver(I) nitrate reacts with aqueous hydrochloric acid to produce solid silver(I) chloride and sodium nitrate. Write the balanced equation.

Show your work problems

1. Naturally occurring copper consists of ^{63}Cu (62.9296 amu) and ^{65}Cu (64.9278 amu), with an average mass of 63.546 amu. What is the percent composition of Cu in terms of these two isotopes? (4 points)

2. Glucose is composed of 40.0% carbon, 6.7% hydrogen, and 53.3% oxygen by mass. What is its empirical formula? If its molar mass is approximately 180 g/mol, what is its molecular formula? (You may **NOT** work backwards from the molar mass.) (6 points)

3. For the reaction: (4 points)



A sample of 3.75 g of copper metal and 2.43 g AgNO_3 are reacted.

- What is the limiting reagent? Be sure to include your rationale.
- What is the theoretical yield of silver metal?

4. What is most of the activation energy used for in a chemical reaction?