

Write your answers on Page 1

1 point: How many significant digits are there in the following answer: $15.323 + 99944.2222 - 55.61 - 0.33$?

9 points: We react 333.3 g of KCl (M=74.55 g/mol), 222.2 g of HNO₃ (M=63.01 g/mol), and 111.1 g of O₂ (M=32.00 g/mol) in the following reaction: $4 \text{KCl} + 4 \text{HNO}_3 + \text{O}_2 \rightarrow 4 \text{KNO}_3 + 2 \text{Cl}_2 + 2 \text{H}_2\text{O}$. What mass of KNO₃ (M=101.10 g/mol) will we produce?

Write your answers on Page 2

1 point: An element has an average atomic mass of 104.20 u. It possesses two isotopes: one with an atomic mass of 103.00 u and the other with an atomic mass of 105.00 u. What percentage of the atoms have an atomic mass of 103.00 u?

6 points: The percent composition of an unknown gas is 45.64% C, 30.40% O, 15.21% N, and 8.75% H. The molar masses of C, O, N, and H are 12.01, 16.00, 14.01, and 1.008 g/mol. What is its empirical formula?

3 points: An oxide of chrome (it contains only Cr and O) is 68.42% Cr by mass. What is its empirical formula? The molar masses of Cr and O are 52.00 and 16.00 g/mol.

Write your answers on Page 3

1 point: If HIO₄ is periodic acid, what is the molecular formula of the hypoiodite anion?

9 points: In a steel container of 22.22 L, we have 55.5 g of N₂(g) (M=28.02 g/mol), 66.6 g of CO₂(g) (M=44.01 g/mol), and 99.9 g of an unknown gas. The temperature is 25.0 °C and the total pressure is 5.555 atm. What is the molar mass of the unknown gas? What are the average speeds (or root mean square speeds) of the N₂(g) molecules and of the CO₂(g) molecules? N.B. that $R = 0.082056 \text{ L atm / mol K} = 8.3145 \text{ J / mol K}$.

Write your answers on Page 4

1 point: Give the balanced chemical equation for the combustion of C₅H₁₀O₅(s) (combustion is the reaction of a substance with O₂(g) to produce CO₂(g) and H₂O(l)).

9 points: Under a constant pressure of 1.000 atm, we do the combustion of 1.0000 mol of cyclohexane, C₆H₁₂(l), at 25.0 °C (N.B. combustion is the reaction of a substance with O₂(g) to produce CO₂(g) and H₂O(l)). Calculate the values of ΔH, ΔU, Q, and W for this combustion. What will be the values of Q and W if we do the combustion of 2.0000 mol of C₆H₁₂(l) at constant volume? N.B. that $R = 0.082056 \text{ L atm / mol K} = 8.3145 \text{ J / mol K}$. The enthalpies of formation of C₆H₁₂(l), CO₂(g), and H₂O(l) are -156.4, -393.5, and -285.8 kJ/mol.

Write your answers on Page 5

1 point: Who discovered the neutron?

5 points: We place 111.1 g of a metal at 100.00 °C in 222.2 g of water in a beaker. The water and the beaker are at 20.00 °C. The specific heat of the water is $4.184 \text{ J K}^{-1} \text{ g}^{-1}$. The heat capacity of the beaker is 1.777 kJ K^{-1} . The final temperature of the metal, water, and beaker is 23.00 °C. What is the specific heat of the metal?

4 points: For the decomposition reaction $\text{A}_3(\text{g}) \rightarrow 3 \text{A}(\text{g})$, $Q = +40.00 \text{ kJ}$ for the decomposition of one mole of A₃(g) at constant pressure and a temperature of 25.00 °C. What are the values of Q, W, ΔU, and ΔH for the decomposition of one mole of A₃(g) at constant volume and a temperature of 25.00 °C? N.B. that $R = 0.082056 \text{ L atm / mol K} = 8.3145 \text{ J / mol K}$.