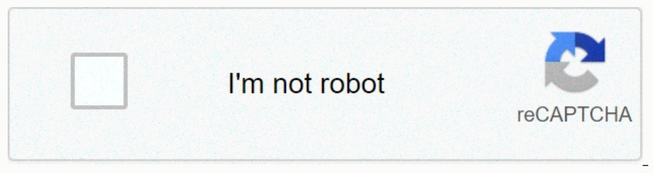

Continue

Stoichiometry problems worksheet 1

Unit VI Stoichiometry Lesson Date Date Topic Worksheet 1. Schimmetry 1 2. Molar gas volume in STP Lab 2 3. Stoichiometry percentage energy yield 3 4. Gas problems STP 4 5. Overview of moles on STP 5 6. Limiting and excess reactant 1 6 7. Restrictive and surplus reactant 2 7 8. Practice test 1 8 9. Practical test 2 9 10. Test sheet #1 Stichiometry 1. Calculate the number of grams of water produced by a complete reaction of 100. g of hydrogen with excess oxygen (theoretical yield). 2H2 + O2 → 2H2O 100. g H2 x 1 mole x 2 mole H2O x 18.02 g = 892 g H2O 2.02 g 2 mole H2 1 mole 2. Calculate the weight of carbon needed to consume 5.67 g of iron oxide III 2Fe2O3 + 3C → 4Fe +3CO2 5.67 g Fe2O3 x 1 mole x 3 mole C x 12.0 g = 0.639 g C 159.6 g 2 Mole2O3 1 mole 3. Calculate the amount of oxygen in grams produced by the reaction of 69.0 g of water. 2H2O → 2H2 + O2 69.0 g H2 O x 1 mole x 1 mole O2 x 32.0 g = 61.3 g O2 18.02 g 2 mole H2O 1 mole 4. Theoretical yield in grams Fe produced by reaction 5,67 g of iron oxide III. 2Fe2O3 + 3C → 4Fe +3CO2 5.67 g Fe2O3 x 1 mole x 4 mole Fe x 55.8 g = 3.96 g Fe 159.6 g 2 mole Fe2O3 1 mole 5. Calculate the number of CO2 moles produced by the reaction of 8,45 g C. 2Fe2O3 + 3C → 4Fe +3CO2 8.45 g C x 1 mole x 3 moles CO2 = 0.704 moles CO2 12.0 g 3 mole C 6. Calculate the number of Fe atoms consumed in response if 100. g fe2O3 respond. 2Fe2O3 + 3C + 235 KJ → 4Fe +3CO2 100. g Fe2O3 x 1 mole x 4 mole Fe x 6.02 x 1023 when = 7.54 x 1023 on Fe 159.6 g 2 mole Fe2O3 1 mole 7. Calculate the number of grams of water produced by a complete reaction of 14.5 g of oxygen (theoretical yield). 2H2 + O2 → 2H2O 14.5 g O2 x 1 mole x 2 mole H2O x 18.02 g = 16.3 g H2O 32.0 g 1 mole O2 1 mole 8. Calculate carbon needed to produce 5.67 g of iron. 2Fe2O3 + 3C → 4Fe +3CO2 5.67 g Fe x 1 mole x 3 mole C x 12.0 g = 0.915 g C 55.8 g 4 mole Fe 1 mole 9. Calculate the amount of oxygen in grams produced by the reaction of 125 g of water. 2H2O → 2H2 + O2 125 g H2O x 1 mole x 1 moleO2 x 32.0 g = 111 g O2 18.02 g 2 mole H2O 1 mole 1 mole 10. The theoretical co2 yield produced by the reaction of 15,6 g of iron oxide III shall be calculated in grams. 2Fe2O3 + 3C → 4Fe +3CO2 15.6 g Fe2O3 x 1 mole x 3 mole CO2 x 44.0 g = 6.45 g CO2 159.6 g 2 mole Fe2O3 1 mole 11. Calculate the number of CO2 molecules produced by the reaction of 2,45 g of iron oxide III. 2Fe2O3 + 3C → 4Fe +3CO2 2.45g Fe2O3 x 1 mole x 3 mole CO2 x 6.02 x 1023 molecules = 1.45g Fe2O3 x 1 mole x 3 mole CO2 x 6.02 x 1023 molecules = 1,439 x 1022 CO2 molecules 159.6 g 2 mole Fe2O3 1 mole Worksheet #2 Molar gas volume on STP Lab Purpose To determine the molar volume of H2 gas on STP. The theory of molar gas volume is the volume in liters per 1 mole of gas. STP is the standard temperature and pressure, which is 0oC and 101 Kpa. To calculate the molar mass, cut the number of liters by the number of moles. Procedure 1. Weigh a 3.9 cm piece of magnesium strip. 2. Add about 10 ml of concentrated HCl to the collection tube. Carefully pour water through the HCl to fill the gas collection tube. 3. Fill the beaker with 500 ml ml with water to 400 ml. 4. Turn the magnesium into a coil that is small to enter the gas collection tube. Place it in a tube and let it drop to acid. When it reaches acid, it begins to bubble and rise. As soon as it starts to rise, place your thumb on top of the tube to completely seal the hole and and place under water in a 500 ml beaker. Once the tube is below the surface of the water, remove the thumb. Fix the tube to the ring stand to secure it. 5. At the end of the reaction, allow the hydrogen gas to reach room temperature. Record the volume of hydrogen gas. 6. Clean and put away all equipment. Wash your lab bench. Data mass Mg 0,470 g Volume H2 48,6 ml = 0,0486 L Calculations 1. To respond between HCl and Mg, write a balanced equation of one replacement. Mg + 2HCl ® H2 + MgCl2 2. Hidden grams of Mg in H2 moles at room pressure and temperature. 0.0470 g Mg x 1 mol x 1 mol H2 = 1.93 x 10-3 mol H2 24.3 g 1 mol Mg 3. Convert the volume of H2 in litres to STP by multiplying the conversion factor by 0,894. This will reduce the volume to what would be 0 0C and 101 Kpa. 0.0486 L H2 x 0.894 = 0.04345 L H2 4. Calculate the molar volume by dividing the volume of H2 in litres by the number of H2 moles. 0.04345 L = 22.5 l/mol 0.00193 mol 5. Specify the received value from the textbook for the molar volume of gas on the STP. Molar gas volume = 22.4 l/mol 6. Calculate the percentage difference between the received value and the experimental value of the molar volume. Take the difference and break it by the accepted value and then more by 100%. (22.5 -22.4) x 100% = 0.446% (22.4) STP Calculations 1. Volume of F2 gas at STP produced by electrolysis of 8,2 g KF. 2KF → 2K + F2 8.2 g ? L 8.2 g x 1 mole x 1 mole F2 x 22.4 L = 1.6 L 58.1 g 2 mole KF 1 mole 2. Calculate the weight of KF needed to produce 100. L gas F2 in STP. 2KF → 2K + F2 100. L x 1 x 2 mole KF x 58.1 g = 519 g 22,4 L 1 mole F2 1 mole 3. 5.31 g of normal gas at STP takes up 4.25 L. Calculated molar mass of gas. Determine the gas. 4.25 L x 1 mole = 0.1888 molar mass = 5.31 g = 28.1 g/mole 22.4 L 0.18888 mole 4. 2.00 g of normal gas at STP takes up 1,018 L. Calculated molar mass of gas. Determine the gas. 1.018 L x l mole = 0.04545 mole Molar Mass = 2.00 g = 44.0 g/moleCO2 22.4 L 0.04545 mole 5. Calculate the volume of 10. lb co2 gas at STP (2.21 lb = 1.00 kg). 10 lb x 1.00 Kg x 1000 g x 1 mole x 22.4 L = 2.3 x 103 L 2.21 lb 1 Kg 44.0 g 1 mole 6. The volume of H2 gas in STP is calculated by a complete reaction of 10,0 g On water. 2Na + 2HOH ® H2 + 2NaOH 10.0 g ? L 10.0 g On x 1 mole x 1 mole H2 x 22.4 L = 4.87 L 23.0 g 2 mole On 1 mole 7. How many litres of 02, measured at STP, are released at the breakdown of 8,56 g of mercury oxide (II): 2HgO → 2Hg + O2 0,443 L 8. Calculate the number of molecules in 10.0 lb of CO2 gas at STP (2.21 lb = 1.00Kg). 6.19 x 1025 molecules 9. Calculate molar weight Co(NH3)6Cl3. 267.58 g / mole 10. Calculate the number of Cl atoms in 50.0 g Co(NH3)6Cl3. 50.0 g x 1 mol x 6.02 x 1023 FU x 3 per Cl 3.37 x 1023 atoms 267.58 g 1mole 1 FU 11. Covert 2.0 x 1026 FU mgcl2 up to kg. 2.0 x 1026 FU x 1 mole x 95.3 g x 1 kg = 32 kg 6.02 x 1023 1 mole 1000 g Name: 12. Co2O3.6H2O Cobalt III hexahydrate 13. P2O5 Diphosposrous pentoxide 14. H2SO4(aq) Sulphuric acid 15. H2SO4(l) hydrogen sulate 14. HI (aq) Acidhydria 15. HI (l) Hydrogen sirace 16. (NH4) Cr2O7 Amonium Dichromate Write quantum electron configuration for: 17. Sr 1s22s22p63s23p63d104s24p65s2 18. Sr2+ 1s22s22p63s23p63d104s24p6 19. I 1s22s22p63s23p63d104s24p64d105s25p5 20. I- 1s22s22p63s23p63d104s24p64d105s25p6 21. Give an example of a NaCl 22 formula unit. Indicate CO2 molecules 23. Give an example of the Mg 24 atom. Type the formula eqaution. H2SO4(aq) + 2NaOH(aq)® Na2SO4(aq) + 2H2O(l) Worksheet #3 Stichiometry and Percentage Yield and Energy 1. Calculate the energy consumed in response if 150. g C respond. 2Fe2O3 + 3C + 235 KJ → 4Fe +3CO2 150. g C x 1mole x 235 KJ = 979 KJ 12.0 g 3 mole C 2. Calculate the energy consumed in response if 250. Kg C reacts. 2Fe2O3 + 3C + 235 KJ → 4Fe + 3CO2 250. Kg C x 1000 g x 1mole x 235 KJ = 1.63 x 106 KJ 1 Kg 12.0 g 3 mole C 3. Actual yield in grams Fe produced by a reaction of 0,22 kg C, assuming a yield of 85,0 %. 2Fe2O3 + 3C → 4Fe + 3CO2 0.22 Kg C x 1000 g x 1mole x 4 mole Fe x 55.8 g x 0.850 = 1.2 x 103 g Fe 1 Kg 12.0 g 3 mole C 1 mole 4. Calculate the number of grams of water produced by a complete reaction of 95,5 g of hydrogen with excess oxygen. If the percentage yield is 65.0%, calculate the actual yield. 2H2 + O2 → 2H2O 95.5 g H2 x 1 mole x 2 mole H2O x 18.02 g x 0.650 = 554 g H2O 2.02 g 2 mole H2 1 mole 5. The mass of carbon dioxide produced shall be calculated when 5,67 g of iron oxide III reacts with excess C. If the percentage yield is 85,0 %, it shall calculate the actual yield. 2Fe2O3 + 3C → 4Fe + 3CO2 5.67 g Fe2O3 x 1 mole x 3 mole CO2 x 44.0 g x 0.850 = 1.99 g CO2 159.6 g 2 mole Fe2O3 1 mole 6. Calculate the energy in KJ produced by the reaction of 10.0 kg of hydrogen with excess oxygen. 2H2 + O2 → 2H2O + 213KJ 10.0 Kg H2 x 1000 g x 1 mol x 213 KJ = 5.27 x 105 KJ 1 Kg 2.02 g 2 mole H2 7. The amount of CO2 produced by the reaction of 8,45 g of iron oxide III shall be calculated. If the percentage yield is 75%, calculate the actual yield. 2Fe2O3 + 3C → 4Fe +3CO2 8.45 g Fe2O3 x 1 mole x 3 mole CO2 x 44.0 g x 0.75 = 2.6 g CO2 159.6 g 2 mole Fe2O3 1 mole 8. Calculate the number of grams of water produced by a complete reaction of 100. g of hydrogen with excess oxygen (theoretical yield). If the percentage yield is 65.0%, it calculates the actual yield. 2H2 + O2 → 2H2O 100. g H2 x 1 mole x 2 mole H2O x 18.02 g x 0.650 = 580 g H2O 2.02 g 2 mole H2 1 mole 9. Calculate the theortic mass of iron produced from the reaction of 5,67 g of iron oxide III. If the percentage yield is 85.0%, it calculates the actual yield. 2Fe2O3 + 3C → 4Fe +3CO2 5.67 g Fe2O3 x 1 mole x 3 mole C x 12.0 g = 3.96 g Fe x 0.850 = 0.544 g C 159.6 g 2 mole Fe2O3 1 mole 10. The theoretical oxygen yield in grams produced by the reaction of 69,0 g of water shall be calculated. If the actual yield of O2 is 50.0 g, the percentage yield is calculated. 2H2O → 2H2 + O2 69.0 g H2O x 1 mole x 1 mol O2 x 32.0 g = 61.3 g 18.02 g 2 mole H2O 1 % Yield = 50.0 g x 100 % = 81.6 % 61.1 g 11. Calculate produced by a reaction of 10,0 g of hydrogen with excess oxygen. 2H2 + O2 → 2H2O + 213 KJ 10.0 g H2 x 1 mole x 213 KJ = 527 KJ 2.02 g 2 mole 12. Theoretical yield in grams Fe produced by reaction 5,67 g of iron oxide III. If the actual yield is 2.00 g, the percentage yield is calculated. 2Fe2O3 + 3C → 4Fe +3CO2 5.67 g Fe2O3 x 1 mole x 4 mole Fe x 55.8 g = 3.96 g Fe 159,6 g 2 mole Fe2O3 1 mol % Yield = 2,00 g x 100 % = 50,4 % 3,96 g 13. The amount of CO2 produced by the reaction of 8,45 g of iron oxide III shall be calculated. If the percentage yield is 75%, calculate the actual yield. 2Fe2O3 + 3C → 4Fe +3CO2 8.45 g Fe2O3 x 1 mole x 3 mole CO2 x 44.0 g = 3.49 g CO2 x 0.75 = 2.6 g CO2 159.6 g 2 mole Fe2O3 1 mole 14. Calculate the number of CO2 moles produced by the reaction of 8,45 g C. 2Fe2O3 + 3C → 4Fe +3CO2 8.45 g C x 1mole x 3 mole CO2 = 0.704 mole CO2 12.0 g 3 mole C 15. Calculate the number of fe atoms consumed in response if 500. J energies are absorbed. 2Fe2O3 + 3C + 235 KJ → 4Fe +3CO2 500. J x 1 KJ x 4 mole Fe x 6.02 x 1023 at = 5.12 x 1021 at Fe 1000 J 235 KJ 1 mole Worksheet #4 STP Gas Problems 1. Calculate the volume of STP 150. g nh3 gas. 150. g x 1 mol x 22.4 L = 197 L 17.03 g 1 mole 2. Calculate the weight of 350 ml of CO2 per STP. 350. ml x 1 l 1 mole x 44.0 g = 0.688 g 1000 ml 22.4 L 1 mole 3. Calculate the weight of carbon needed to consume 5.67 g of iron oxide III. 2Fe2O3 + 3C → 4Fe +3CO2 0.639 g C 4. The volume of oxygen at the STP produced by the reaction of 69,0 g of water is calculated. 2H2O → 2H2 + O2 42.9 L 5. If the actual oxygen volume is 40.0 l, what is the % yield? 93.2 % 6. Calculate the energy produced by reaction 100. L hydrogen in STP with excess oxygen. 2H2 + O2 → 2H2O + 213KJ 475 KJ 7. The volume of CO2 produced at STP shall be calculated by reaction of 5,67 g of iron oxide III if the percentage yield is 70,0 %. 2Fe2O3 + 3C → 4Fe +3CO2 0.836 L 8. Calculate the density of CO2 gas at STP. 1.96 g/L 9. Calculate nh3 gas density at STP 0.760 g/L Stoichiometry Review 10. Chloroform or trichloromethane CHCl3 may be prepared in the laboratory by reaction between chlorine and methane. Calculate the number of grams of chlorine that are needed to produce 50.0 grams of trichloromethane. 3Cl2(g) + CH4(g) → CHCl3(l) + 3HCl(g) 50.0 g CHCl3 x 1 mole x 3 mole Cl2 x 71.0 g = 89.1 g Cl2 119.51 g 1 mole CHCl3 1 mole 1 mole 1 mole 11. The ability to cleanse and the whitening effect of chlorine whitening activity both come from the effective release of oxygen by the reaction below. How many grams of oxygen does 255 grams of chlorine get? 2H2O(l) + 2Cl2(g) → 4HCl(aq) + O2(g) 255 g Cl2 x 1 mole x 1 mole O2 x 32.0 g = 57.5 g O2 71.0 g 2 mole Cl2 1 mole 12. Photosynthesis is the process by which carbon dioxide is converted into sugar, C6H12O6, using sunlight and chlorophyll of green plants acting as a catalyst. This can be summarized by the equation below. How many grams of sugar can be produced in a

reaction that consumes 6.90 carbon dioxide? 6CO2 (g) + 6 H2O (g) → C6H12O6 + 6 02 (g) 6.90 g CO2 x 1 mole x 1 mole C6H12O6 x 180.12 g = 4.71 g C6H12O6 44.0 g 6 mole CO2 1 mole 13. Dinitrogen oxide N2O- Also known as nitrous oxide and tomato gas-was one of the early anesthetics, and recently gained popularity in this role in the dental field. It is carried out by decomposition of ammonium nitrate, which are listed below. How many grams of NH4NO3 (S) is it necessary to prepare 12.8 grams of N2O? NH4NO3 (s) → N2O(g) + 2H2O(l) 12.8 g N2O x 1 mole x 1 mole NH4NO3 x 80.04 g = 23.3 g NH4NO3 44.0 g 1 mole N2O 1 mole 1 mole 14. When extracting copper from sulphide ore, the overall process can be summarized by the equation below. If the percentage yield is 61.2%, how much copper will be the result of treatment with 7.00 x 106 grams of Cu2S? Cu2S(s) + O2(g) → 2Cu(s) + SO2(g) 7.00 x 106 g Cu2S x 1 mole x 2 mole Cu x 63.5 g x 0.612 = 3.42 x 106 g Cu 159.1 g 1 Cu mole 2S 1 mole 15. One of the steps of the Ostwald nitric acid production process is the production of nitrogen oxide by oxidising ammonia in the presence of a platinum catalyst, as shown in the equation below. If the percentage yield is 80.3%, how many grams of NO can be made from 4.00 x 103 grams of NH3? Pt 4 NH3(g) + 502(g) → 4 NO(g) + 6 H2O(g) 4.00 x 103 g NH3 x 1 mol x 4 moles NO x 30.0 g x 0.803 = 5.66 x 103 g NO 17.03 g 4 moles NH3 1 mole 16. The direct combination of powdered zinc with powdered glor only is a spectacular reaction, though not one that students would try, with bright light, flame and smoke. The equation is given below. Calculates the energy released by the reaction grams of zinc. Zn(s) + S(s) → ZnS(s) + 148.5 KJ 9.63 g Zn x 1 mole x 148.5 KJ = 21.9 KJ 65.4 g 1 mole 17. Carbon monoxide is used as fuel in many industrial processes. How much carbon monoxide must be burned in a process requiring 183 KJ? 2CO(g) + O2(g) → 2CO2(g) + 135 KJ 183 KJ x 2 moles CO x 28 g = 75.9 g CO 135 KJ 1 mole Worksheet # 5 Overview of moles on STP 1. Convert 1.65 kg of CO2 into molecules. 2.26 x 1025 CO2 molecules 2. Hidden 2.0 x 1026 FU mgcl2 to kg. 32 kg MgCl2 3. In the propane tank is 9.0 kg C3H8, calculate the number of atoms H. (First calculate molecules and then H atoms). 9.8 x 1026 at H 4. It was found that a certain mass of complex Co(NH3)6Cl3 contains 2.65 x 1021 H atoms, calculates the mass of cobalt chloride hexaline III (change the atoms to 1. fu). 0.0654 g Co(NH3)6Cl3 5. Calculate the percentage composition of Co(NH3)6Cl3 into three significant digits. 22.0% Co, 31.4% N, 6.79% H and 39.8% Cl 6. The compound is 71,6 % C, 6,03 % H, 10,4 % N and 11,9 % O. If the molecular weight of the compound is 268,16 g/mol, the empirical and molecular formula shall be calculated. C16H16N2O2 7. The compound is 63.55% Ag, 8.23% N, and 28.24% O, calculate the empirical formula. AgNO3 8. The volume of ordinary gas used for welding is 0,856 g. The same volume of H2 gas has a weight of 0.0658 g. Calculate the molar mass of the gas and determine its pattern. 26.3 g/mol 9. Calculate the energy dissectioned by a complete reaction of 150. g H2. 2H2 + O2 → 2H2O + 250 KJ 9.28 x 103 KJ 10. Calculate the number of grams of H2 needed to produce 500 J of energy. 2H2 + O2 → 2H2O + 250 KJ 0.00808 g 11. Fermentation of sugar in the presence of zymase, an enzyme in yeast, can be described by the equation below. If 500. g of sugar is fermented and 200 g of alcohol is produced, the theoretical and percentage yield of the alcohol shall be calculated. C6H12O6 → 2C2H5OH + 2CO2 255g 78.3% 12. The mass of Fe produced by reaction 8,56 g Fe2O3 shall be calculated if the percentage yield is 75,0 %. 2Fe2O3 + 3C → 4 Fe + 3CO2 4.49 g 13. What is the weight of 3.25 liters of neon per STP? 2.93 g 14. Find an STP volume of 4.62 grams of ammonia (NH3). 6.08 L 15. How many moles of ethane, C2H6, are in 16.9 liters per STP? 0.754 moles 16. How many litres of O2, measured at STP, are released at the breakdown of 2,65 g of mercury oxide (II): 2HgO → 2Hg + O2 0,137 L 17. What mass of potassium chlorate must be distributed to create 1.50 litres of oxygen at STP? 2KClO3(s) → 2KCl(s) + 3O2(g) 5.47g 18. When treating sodium carbonate with sulphuric acid, carbon dioxide bubbles are emitted: H2SO4(aq) + 2NaHCO3(s) → Na2SO4(aq) + 2H2O(l) + 2CO2(g) What amount of CO2, measured at STP, is available from 8.58 g NaHCO3? 2.29L 19. How much magnesium does a student have to react with excess hydrochloric acid to produce 85.0 ml of hydrogen, measured at STP? Mg(s) + 2HCl(aq) → H2(g) + MgCl2(aq) 0.0922g Worksheet 6 Limiting and excess reactant fill in the ICE charts - all units are in moles. 1. A + 2 B → 1 C + 2 D I 8.00 6.00 0.00 0.00 C 3.00 6.00 3.00 6.00 E 5.00 0.00 3.00 6.00 2. 3 A + 4 B → 4 C 3 D AND 9,00 14,00 0,00 0,00 C 9,00 12,00 12,00 9,00 E 0,00 2,00 12,00 9,00 3. 3 A + 2 B → 5 C + 4 D I 10,00 8,00 0,00 0,00 C 10,00 6,667 16,67 13,33 A 0,00 1,33 16,67 13,33 1 1 3 A + 5 B → 5 C + 4 D I 8,00 16,00 0,00 0,00 C 8,00 13,33 13,33 10,67 A 0,00 2,67 13,3 10,7 5. 2 Al + 3 I2 → 2 AlI3 and 9,0 mol 9,0 mol 0 6 mol 9 mol 6 mol E 3 mol 0 6 mol 6. C + 2Cl2 → CCl4 I 8.0 mol 6.0 mol 0 C 3 mol 6 mol 3 mol E 5 mol 0 3 mol 7. 4 Fe + 3 O2 → 2 Fe2O3 I 10.0 mol 6.0 mol 0 C 8 mol 6 mol 4 mol E 2 mol 0 4 mol 8. 2 NO + O2 → 2 NO2 100,0 g 100,0 g 0 I 3.3333 mol 3.1250 mol 0 C 3 .. 3333 mol 1.6667 mol 3.3333 mol E 0 1.4584 mol 3.3333 mol Gramė 0 46.7 153 g Note that the molar masses had 3 sig figs! 9. 2 Fe + 3 Cl2 → 2 FeCl3 100.0 g 120.0 g 0 I 1,792 mol 1,690 mol 0 C 1.1 27 mol 1.690 mol 1.127 mol E 0.665 mol 0 1.127 mol Grams 37.11 g 0 183.4 g 10. Mg + 2HCl → MgCl2 + H2 45.8 g 65.4 g 0 0 I 1,885 mol 1,791 mol 0 0 C 0.8955 mol 1.791 mol 1.791 mol 1.791 mol 00.8956 mol 0.8956 mol E 0.9895 mol 0.8956 mol 0.8956 mol Grams 24.0 g 85.4 g 1.81 g 11. If 75,4 g Cu reacts to 189,7 g I2, CuI2 is formed. 1 Cu + 1 I2 → 1 CuI2 75.4 g 189.7 g 0 I 1.187 mol 0.7474 mol 0 C 0.7474 mol 0.7474 mol 0.7474 mol E 0.4396 0 mol 0.7474 mol Grams 27.9 g 0 g 237g (a) Which reactant is in surplus? Cu (b) How many grams is in excess? 27.9 g c Calculate the amount of cui2 produced. 237 g 12. If 15,5 g Al reacts 46,7 g Cl2, AlCl3 is formed. 2Al + 3Cl2 → 2AlCl3 15.5 g 46.7 g 0 I 0.5741 mol 0.6577 mol 0 C 0.4385 mol 0.6577 mol 0.4385 mol E 0.1356 mol 0 mol 0.4385 mol Grams 3.66 g 0 g 58.5 g (a) Which reactant is excess? Al (b) How many grams is in excess? 3,66 g c Calculate the quantity of AlCl3 produced. 58.5 g 13. If 5,45 g of KClO3 per KCl and 1,95 g of O2 are spread out, they shall be collected. Calculate the theoretical and percentage yields. 2KClO3 → 2KCl + 3O2 5.45 g ?g 5.45 g KClO3 x 1 mol x 3 mol O2 x 32.0g = 2.1 3 g 122.6 g 2 mol KClO3 1 mol % Yield = 1.95 x 100% = 91.4% 2.13 Worksheet # 7 Limiting reactants 1. 2 Al + I2 → 2 AlI3 I 12 mol 15 mol 0 C 10 mol 15 mol 10 mol E 2 mol 0 10 mol 2. C + 2Cl2 → CCl4 I 13.5 mol 28.6 mol 0 C 13.5 mol 27.0 mol 13.5 mol E 0 1.6 mol 13.5 mol 3. 4 Fe + 3 O2 → 2 Fe2O3 I 15.0 mol 13.2 mol 0 C 15.0 mol 11.3 mol 7.50 mol E 0 1.9 mol 7.50 mol 4. 2 NO + O2 → 2 NO2 80 g x 1 mol 50,0 g x 1 mol 0 30,0 32,00 I 2,667 mol 1,563 mol 0 C 2,667 mol 1,334 mol 2,667 mol E 0 Mol 2,667 mol Grams 0 7.34 g 123 g 5. 2 Fe + 3 Cl2 → 2 FeCl3 45.5g 55.6g 0 I 0.8154 mol 0.7831 mol 0 C 0.52 21 mol 0.7831 mol 0.5221 mol E: 0.2933 mol 0.5221 mol Grams 16.4 g 0 84.7 g 6. Mg + 2HCl → MgCl2 + H2 22.3 g 15.6 g 0 0 I 0.9177 mol 0.4273 mol 0.0 C 0.2136 mol 0.4273 mol 0.4273 mol 0.4273 mol 0.4273 mol 0.4273 mol 0.4273 mol 0.4273 mol 0.4273 mol 0.4273 mol 0.4273 mol 00.2136 mol 0.2136 mol E 0.7041 mol 0.2136 mol 0.2136 mol Grams 17.1 g 0 g 20.4 g 0.431 g 7. Pokud 100.0 g Cu reactor 150.0 g I2, selected that CuI2. 1 Cu + 1 I2 → 1 CuI2 100.0 g 150.0 g I 1.575 mol 0.5910 mol 0 C 0.5910 mol 0.5910 mol E 0.984 mol 0.5910 mol Grams 62.5 g 0 g 188 g (a) Which reactant is in surplus? Cu (b) How many grams is in excess? 62.5 g c Calculate the amount of cui2 produced. 188 g 8. If 25,0 g Al reacts 40,0 g Cl2, AlCl3 is formed. 2Al + 3Cl2 → 2AlCl3 25.0 g x 1 mol 40.0 g x 1mole 0 27.0 g 71.0 g I 0.9259 mol 0.5634 mol 0 C 00.3756 mol 0.5634 mol 0.3756 mol E 0.5503 mol 0 mol 0.3756 mol Grams 14.9 g 0 g 50.1 g (a) Which reactant is excess? Al (b) How many grams is in excess? 14.9 g c Calculate the quantity of AlCl3 produced. 50.1 g 9. If 100,0 g Ca reacts to 100,0 g N2, Ca3N2 is formed. Equation: 3Ca + N2 ® Ca3N2 100.0 g x 1 mol 100.0 g x 1mole 0 40.1 g 28.0 g 2.4938 mol 3.5714 mol 0 C 2.4938mol 0.8313 mol 0.8313 mol E 0 mol 2.7401 mol 0.8313 mol Grams 0 g 76.7 g 123 g Note that molar masses had 3 sig figs (a) Which reactant is excess? N2 (b) How many grams is in excess? 76.72 g c Calculate the amount of Ca3N2 produced. 123.3 g 10. If 100,0 g Ca reacts to 100,0 g Cl2, CaCl2 is created. Equation: Ca + Cl2 ® CaCl2 100.0 g x 1 mol 100.0 g x 1mole 0 40.1 g 71.0 g I 2.4938 mol 1.4085 mol 0 C 1.4085 mol 1.4085 mol 1.4085 mol E 1.0853 mol 0 mol 1.4085 mol Grams 43.52 g 0g 156.5 g (a) Which reactant is in surplus? Ca (b) How many grams is in excess? 43.52 The quantity of CaCl2 produced shall be calculated. 156.5 g 11. If 25,0 g Na reacts 40,0 g O2 and one ionic compound is formed. Equation: 4Na + O2 ® 2Na2O 25.0 g x 1 mol 40.0 g x 1mole 0 23.0 g 32.0 g I 1.0870 mol 1.2500 mol 0 C 0 1.0870 mol 0.2718 mol 0.5435 mol E 0 mol 0.9782 mol 0.5435 mol Grams 0 g 31.3g 33.7 g (a) Which reactant is in surplus? O2 (b) How many grams is in excess? 31.3g (c) Calculate the quantity produced by AlCl3. 33.7 g 12. If 32,7 g of KClO3 per KCl and 11,7 g of O2 are spread out, they shall be collected. Calculate the theoretical and percentage yields. 2KClO3 → 2KCl + 3O2 32.7 g ?g 32.7 g KClO3 x 1 mol x 3 mol O2 x 32.0g = 122.8 g 122.6 g 2 mol KClO3 1 mol % Yield = 11.7 x 100 % = 91.4 % 12.8 13. The same volumes of Gas X and O2 have a weight of 8.75 g and 10.0 g. Calculate molar gas weight X. Gas x = 8.75 x 32.0 g/ mole 28,0 g/mol N2 O2 10,0 g Worksheet No 8 Practical test #1 1. Turn 8.75 H2O moles into molecules. 5.27 x 1024 H2O 2 molecules. Turn 9.7x1019 Fe atoms into moles. 1.6 x10-4 mol Fe 3. Convert 800. g of AgNO3 to formula units and then to O atoms. 2.83 x1024 FU AgNO3 8.50 x 1024 atoms O 4. Convert molecules 3.8 x 1025 H2 into grams. 1.3x102g H B Percentage composition 5. Calculate the percentage composition of Na2SO4. 32.4% To 22.6%S 45.0%O C Molecular formula and empirical formula 6. Calculate the empirical formula of the compound, which is 62,2 % Pb, 8,454 % N and 28,8 % O. Is this compound ionic or kovalent? Pb (NO3) 2 Ionic 7. The compound is 42,3 % C, 5,94 % H, 32,9 % N and 18,8 % O and has a molecular weight of 425,25 g/mol. Calculate the empirical and molecular formula. C3H5N2O C15H25N10O5 D Tasmania 8. How many grams of O2 is it necessary to consume 100. g of Al? 4Al + 302 → 2Al2O3 88.9 g O 9. How many Moles Al2O3 produces a reaction of 200. g Al? 4Al + 302 → 2Al2O3 3.70 moles Al2O3 10. How many Al moles are required to produce 300. g of Al2O3? 4Al + 302 → 2Al2O3 5.88 moles Al 11. How many litres of O2 gas is needed to produce the 100. g Al2O3? 4Al + 302 → 2Al2O3 32.9 L E Percentage yield 12. 100. g Al reacts with a surplus of O2 to the production of 150. g Al2O3 according to the calculation of theoretical and percentage yield. 4Al + 302 → 2 Al2O3. Theoretical yield = 189g Al2O3 F energy calculations 13. Calculate the energy displaced by a complete reaction of 150.g H2. 2H2 + O2 → 2H2O + 130KJ 4.83 x 103 KJ 14. How many grams of H2 would it take to produce 260. KJ energy? 2H2 + O2 → 2H2O + 130KJ 8.08 g H2 G limiting reactants 15. 20. Mol H2 reacts with 8.0 mol O2 to produce H2O. Specify the number of reactant and the number of grams of H2O produced. Identify the limiting reactant. 8 g excess H2 2,9 x 102 g H2O above 16. 128g Al reacts with 128g O2 to al2O3 production. How many grams of Al2O3 is produced? Determine the mass of the reactant in excess and limit the reactant. Al's limitations of 14g O2 are more than 242g Al2O3 17. 13.6 g Al reacts with 8.33 g of O2 to produce Al2O3.How many grams of Al2O3 are produced? Determine the mass of the reactant in excess and limit the reactant. O2's limitations of 4.23 g Al are in more than 17.7 g Al2O3 are produced 18. The gas weighs 21.9 g. The same volume he weighs 1,991 g. Determine the molar weight and gas formula (help-gas can cook steak). 44.0 g/mol propane 19. Calculate the molar mass of gas weighing 19.43 g and has a stp volume of 9,894 l. If the gas is a very funny one containing nitrogen and used by the dentist, determine the molar mass and molecular formula for the gas. 44.0 g/mole N2O 20. The 45,0 g sample of bronze, Cu and Sn alloy, is completely reacted by concentrated HNO3 according to the following equations. A total of 59,978 g of NO2 was isolated. Assuming 100 % yield of NO2, the mass of Cu and Sn in the alloy shall be determined. Cu(s) + 4HNO3(aq) → Cu(NO3)2(aq) + 2NO2(g) + 2H2O(l) X g Cu x 1 mole x 2 mole NO2 x 46.0 g = 1.4488 X 63.5 g 1 mole Cu 1 mole Sn(s) + 4HNO3(aq) → Sn(NO3)2(aq) + 2NO2(g) + 2H2O(l) (45.0 - X) g Sn x 1 mole x 2 mole NO2 x 46.0 g = 34.878 - 0.77506 X 118.7 g 1 mole Sn 1 mol 1.4488 X + 34.878 - 0.7751 X = 59.978 0.6737 X = 25.5 1 X = Cu = 37.3 g Sn = 45.0 - 37.3 = 7.7 g Sn (s) + 4HNO3(aq) → Sn(NO3)2(aq) + 2NO2(g) + 2H2O(l) 21. 80,0 g of the brass sample, Cu/Zn alloy, is fully reacted by concentrated HNO3 according to the following equations. A total of 115,232 g of NO2 was isolated. Assuming a 100 % yield of NO2, the mass cu and zn in the alloy shall be determined. Cu(s) + 4HNO3 (aq) Cu(NO3)2(aq) + 2NO2(g) + 2H2O(l) X g Cu x 1 mole x 2 mole NO2 x 46.0 g = 1.4488 X 63.5 g 1 mole Cu 1 mole Zn (s) + 4HNO3(aq) → Zn(NO3)2(aq) + 2NO2(g) + 2H2O(l) (80.0 - X) g Zn x 1 mole x 2 mole NO2 x 46 .0 g = 112.54 - 1.4067 X 65.4 g 1 mole Cu 1 mol 1.4488 X + 112.54 - 1.4067 X = 115,232 2 0.042072 X = 2,692 X = Cu = 64.0 g Zn = 16.0 g With the right sig figs: Cu = 60 g and Zn = 20 g Worksheet # 9 Training test 2 1. Hidden 200 g Of NaCl per formula unit. 200 g x 1 mol x 6.02 x 1023 FU = 2 x 1024 FU 58.5 g 1 mole 2. Convert 5.99 x 1025 H2O molecules into grams. 5.99 x 1025 H2O moles x 1 mole x 18.02 g = 1.79 x 103 g H2O 6.02 x 1023 mole 1 mole 3. A certain mass of CH4 contains 2.00 x 1025 H atoms. Calculate the mass of CH4. 2.00 x 1025 atoms H x 1 mole CH4 x 1 mole x 16.04 g = 133 g CH4 4 at H 6.02 x 1023 mole 1 mole 4. Calculate the number of grams of SO2 in 250. L @ STP. 250. L SO2 x 1 mole x 64.1 g = 715 g SO2 22.4 L 1 mole 5. The mass of diatomic gas is 15.13 g. The weight of the same Volume He is 1,593 g. What is the molar mass of diatomical gas and what is gas? Gas X = 15,13 g x 4,0 g/mole = 38 g/mole F2 1,593 g 6. The volume of F2 gas at STP is calculated by a reaction of 15,6 g KF. 2KF → 2K + F2 15.6g KF x 1 x 1 mole F2 x 22.4 L = 3.01 L F2 58.1 g 2 mole KF 1 mole 7. The compound was found to consist of 6.89 g Si and 5.89 g O. If the molecular weight of the compound is 417 g/mol, what is the molecular formula of the compound? 6.89 g Si x 1 mole = 0.2452 mole = 1 x 2 = 2 28.1 g 0.2452 mole 5.89 g O x 1 mole = 0.3 681 mole = 1,501 x 2 = 3 16.0 g 0.2452 mole Si2O3 104.2 g/mole Si8O12 417 g/mole 8. Calculate the energy dissectioned by a complete reaction of 25,0 g C4H10 . 2C4H10 + 13O2 → 8CO2 + 10H2O + 256 KJ 25.0 g C4H10 x 1 mole x 256 KJ = 55.1 KJ 58.1 g 2 mole C4H10 9. Calculate the weight of C4H10 needed to produce energy of 2.06 x 106 J. 2C4H10 + 13O2 → 8CO2 + 10H2O + 256KJ 2.06 x 106 J x 1 KJ x 2 mole C4H10 x 58.1 g = 935 g 1000 J 256 KJ 1 0 mole. 500. g Fe2O3 are refined to produce 200. g Fe. Calculate fe's percentage yield. 2Fe2O3 + 3C → 4Fe + 3CO2 500. g Fe2O3 x 1 mole x 4 mole Fe x 55.8 g = 350 g 159.6 g 2 mole Fe2O3 1 mole Percentage yield = 200 g x 100% = 57.1% 350 g 11. 500. g Fe2O3 is refined to produce Fe with a yield of 78,0 %, the actual yield of Fe is calculated. 2Fe2O3 + 3C → 4Fe + 3CO2 500 g Fe2O3 x 1 mole x 4 mole Fe x 55.8 g x 0.780 = 273 g 159.6 g 2 mole Fe2O3 1 mole 12. Calculate the molar mass Cr2(H20)6(SO4)3. 500.42 g/mole 13. Calculate the weight of 3,25 l so2 of gas at STP. 3.25 L x 1 mole x 64.1 g = 9.30 g 22.4 L 1 mole 14. What mass of magnesium must react with excess hydrochloric acid to produce 85,0 ml of hydrogen measured at STP? Mg(s) + 2HCl(aq) → H2(g) + MgCl2(aq) 85.0 ml H2 x 1l x 1 mole x 1 mole Mg x 24.3 g = 0.0922 g 1000ml 22.4 L 1 mole H2 1 mole 1 mole 15. 2 Al + 3 I2 → 2 AlI3 Initial: 12 mol 15 mol 0 Changes: 10mol 15mol 10mol End: 2 mol 0 10 mol 16. 12.8 g Al reacts with 12.8 g O2 to the production of Al2O3. How many grams of Al2O3 is produced? Determine the mass of the reactant in excess and limit the reactant. 27.0 g 32.0 g 102.0 g 4Al + 3O2 → 2Al2O3 12.8 g 0 I 0.4741mol 0.4000mol 0 C 0.4741 0.3555 mol 0.2371 mol E 0 0.0445 mol 0.237mol grams 24.2 g Limiting reactant Al= 0g Excess reactant O2=1.42 g 17. Calculate the molar mass of gas weighing 38,87 g and molar volume of STP 19,789 l. If gas is one used in cars in Fast and Furious determine the molar weight of the gas and formula. 44.0 g/mole N2O 18. 100. g aqueous compound, which is 62,2 % Pb, 8,454 % N and 28,8 % O, reacts with another compound which is 28,16 % N, 8,13 % H, 20,79 % P and 42,91 % O. And you thought the last question was hard!!!! 3Pb(NO3)2(aq) + 2(NH4)3PO4(aq) → Pb3(PO4)2(s) + 6NH4NO3(aq) 100. G? g Theoretical yield = 81,68 g Percentage yield = 60,0 g x 100 % = 73,5 % 81,7 g 19. 10,0 g of the Cu/Ag alloy sample reacted with concentrated HNO3 according to the following equations. A total of 7,3307 g of NO2 was isolated. Assuming 100 % of the yield of NO2, the mass of Cu and Ag in the alloy shall be determined. Cu(s) + 4HNO3(aq) → Cu(NO3)2(aq) + 2NO2(g) + 2H2O(l) 2Ag(s) + 4HNO3(aq) → + 2NO2(g) + 2H2O(l) 7.00 g Ag a 3,00 g Cu