Stoichiometry of precipitation reactions worksheet

Stoihiometry of precipitation reactions and ion concentration1. Determine what the reaction is.2 Write a balanced equation for reaction3. Calculate moles (or mmol) of reactionants (use V x M)4. Determine which reactive limit (I use ICE Box)5. Calculate the moles of the product (s).6. Convert into grams or other units as needed. Concentration of ions remaining7. Find the moles of each of the ions8. Combine the volumes used to determine the total volume. 9. Find the molaria (moles of solution solution solution) of each ionExample100.mL of 0.100 M of potassium sulfate solution is added to the a100.mL solution 0.200 M barium nitrate. Calculate the mass of sediment and concentration of the remaining ions in the solution.1 Determine what reaction occurs in the pepsim sulfate and barium nitrate, barium sulfate barium (s)K2SO4 and Ba (NO3)2 ---'gt; KNO3 and BaSO4 (s)2. Write a balanced equation for the reaction of K2SO4 and Ba (NO3)2 ---'gt; 2KNO3 and BaSO4 (s)3. Calculate moles (or mmol) reactionary (use V x M)K2SO4 100.mL x 0.100M' 10.0mmol or 0.100L x0.100M' 0.0100molesisn't mmols a nicer? Ba (NO3)2 100.mL x .200 MH 20.0 mmol or 0.100 l x0.200 M 0.0200moles4. Determine which reactive limiting K2SO4 (Ba (NO3)2'qgt; 2KNO3 - BaSO4 (s)I-Initial 0.0100moles0.0200moles--------------------------------C-Change-X-X-XE-End00 Find X, one of the reactioners limits, which means that it will run out. X, thus, 0.0100molesif Ba (NO3)2runs qgt; 0.0200moles-x'O ; X so 0.0200molesWhich always reactant gives you a lower value for X which is limiting reactant and this value x applied as X in your ICE BOX. Therefore, K2SO4 restricts... 0.0100moles5. Calculate the moles of the product (s). Apply the value for X back to the ICE box and identify the mole (mmola) sediment.

K2SO4 - Ba (NO3)2'gt; 2KNO3 - BaSO4 (s)I-Initial 0.0100 moles 0.0200 moles --------------------------------C-Change-0.0.0.0.0.0.0 0.00100-0.0100-2 (0.0100) 0.0100E-End00.0100 mol0.0100 mol6. Convert sediment into grams or other units as needed. 0.0100 mol BaSO4 (s) x 233.44g BaSO4-2.33g BaSO41 mol BaSO47. Determine the number of moles each ion left in the solution (click on this link for more information)0.0100mol Ba (NO3)2 Ba (NO3)2 (No3) 2 (Qgt; Ba2) - 2NO3-Therefore 0.0100mol Ba (NO3)2 gives 0.0100mol Ba2 and 0.0100mol Ba (NO3)2 gives 0.0100mol Ba2 and 0.0100mol Ba (NO3)2 gives 0.0100 Bamol2 and 0.0100mol Ba (NO3)2 gives 0.0100mol Ba2 0.0200 mole NO3- (2 x 0.0100 maul)0.0200mol KNO3 (IK NO3-So 0.0200mol KNO3 gives 0.0200mol AND 0.0200 Mole NO3- . Clear that up to Ba2'NO3-K'NO3-0.0100mol0.0200mol0.0200molCombine Determine the total volume by adding the volumes you use. Conversion to Liters.Vol. Total 100.mL 100.mL 200.mLCovert to writers 200.mL x 1l/1000mL' 0.200L9. Determine the concentration (molardity) of each ion left in solution (Ba2) 0.0100mol / 0.200L 0.0500M-NO3-0.040 00mol / 0.200L 0.200M'K'0200mol / 0.200L' 0.100MChemical Demonstration Video Precipitation Reactions occur, When cations and anions in an aqueous solution combine, to form an insoluble ion solid called sediment. Whether this reaction occurs or not can be determined by solubility rules for common ion solids. Because not all aqueous reactions form precipitation, one should consult solubility rules before determining the state of the products and writing a pure Ionic equation. The ability to predict these reactions allows scientists to determine which ions are present in the solution, and allows industry to form chemicals by extracting components from these reactions. Precipitation is an insoluble ion solid reaction product, formed by the combination of certain cats and anions in an aquier solution. Determining factors of sediment formation can vary. Some reactions depend on temperature, such as solutions used for buffers, while others depend only on the concentration of the solution. Solids produced in sedimentary reactions are crystalline solids and can be hung all over the liquid or fall to the bottom of the solution. The remaining liquid is called a super-innate liquid. Two components of the mixture (precipitation and supernat) can be separated by different methods, such as filtration, centrifuge or decanting. Figure 1: Above is a diagram of sediment formation in the solution. Using solubility rules requires understanding how ions react. Most precipitation reactions are one-change reactions or double replacement reactions. The double replacement reaction occurs when the two ion reactionions corral and the connection with the corresponding anion or cation from another reactionary. Ions replace each other based on their charges, like either cation or anion. This can be seen as switching partners; i.e., two responders each lose their partner and form a bond with another partner: Figure 2: Double replacement reaction Double replacement reaction is specifically classified as a reaction of precipitation when the chemical equation in question occurs in aqueous soluble and one of the products formed is intractable. An example of precipitation reaction is below: CdSO_4 (aq) (K_2S_) (rightarrow CdS_ (s) (K_2SO_ x 4 (aq) Both reactionions are aqueous and one product is solid. Because the reactionary agents are ionistic and aqueous, they are dissociated and therefore soluble. precipitation in the solution. Solubility rules regardless of whether the reaction forms dictated by the rules of solubility. These rules provide guidelines that say which ions form solids and which remain in their ionic form in an aqueous solution. Rules must be followed from top to bottom, which means that if something is intractable (or soluble) because of rule 1, it takes precedence over a rule with a higher number. Salts formed with group 1 cations and (NH_4) cations are soluble. There are some exceptions for some salts. Acetatas (I C_2H_3O_2)), nitrates (Japanese. NO_3) and ClO_4 perchlorates (japanese bromides, chlorides and iodides are soluble. sulfates (I SO_4.) are soluble, except for sulfates formed with sulfates formed with the help (Ca)), (Sr)) and (Ba'2). Salts containing silver, lead and mercury (I) are insoluble. Carbonates (CO_3), phosphates (yap. PO_4) , sulfides, oxides and hydroxides (HYDRC) are insoluble. Sulfides formed with a group of 2 oxides and hydroxides formed by calcium, strontium and barium are exceptions. If the rules say that the ion is soluble, it remains in its nauseating form of ion. If the ion is insoluble based on the rules of solubility, then it forms a solid with ion from another reactionary. If all the ions in the reaction are shown to be soluble, then no reaction of precipitation occurs. To understand the definition of a pure Ionic equation, think of the equation for a double replacement reaction. Since this particular reaction is a reaction of precipitation, the state of matter can be assigned to each variable pair: AB (aq) - CD (aq) → AD (aq) - CB (s) The first step to writing a pure ionian equation is to separate soluble (ax) reactionary and products into their respective cations and anions. Precipitation is not separated in water, so solids should not be separated. The resulting equation looks like it's lower: A's (aq) - B- (aq) - C q (aq) - D- (aq) → A's (aq) - D- (aq) - CB (s) In the equation above, AK and D-ions are present on both sides of the equation. They are called spectator ions because they remain unchanged throughout the reaction. Since they pass through the equation unchanged, they can be eliminated to show a pure ionical equation: C q (aq) B- (aq) → CB (s) Pure Ionian equation shows only the reaction of precipitation. The pure ionical equation must be balanced on both sides not only in terms of the elements' atoms, but also in terms of electrical charge. Precipitation reactions are usually represented exclusively by pure Ionian equations. If all products are aqueous, a purely ionian equation cannot be written because all ions are cancelled out as spectator ions. Thus, there is no reaction of precipitation. Precipitation reactions are useful in determining whether a particular element is present in the solution. If sediment is formed when the chemical reacts with lead, for example, the presence of in water sources can be verified by adding a chemical and monitoring for Formation. In addition, precipitation reactions can be used to extract elements such as magnesium from seawater. Precipitation reactions even occur in the human body between antibodies and antigens; however, the environment in which this is happening is still being studied. Example 1 Complete the double replacement reaction and then tie it up to a pure Ionic equation. NaOH_ (MgCl_ 2 ;(aq) First, predict the products of this reaction using knowledge about the dual replacement reaction (remember, such as the partner switch and anions). Second, consult with MgCl_ rules of solubility 2NaOH_ ;((aq) (rightarrow 2NaCl) In group 1 cations (yap.) and chlorides are soluble from Rule 1 and 3 respectively, so that (NaCl) will be soluble in water. However, Rule 6 states that hydroxides are insoluble, and thus (Mg(OH)) will form sediment. The result is this: 2NaCl_ 2NaOH ;(MgCl_ (;(2NaOH (aq) Be sure to balance both the electric charge and the number of atoms: -(aq) (rightarrow Mg (OH) 2';(s) eliminate the viewer's ions (ions that occur on both sides of the equation unchanged). In this case, it is sodium and chlorine ions. The final pure ionian equation: Mg 2 (aq) (2OH (aq) (rightarrow Mg (OH) 2 (s) Example 2 Complete the double replacement reaction and then tie it to a pure Ionian equation. CoCl_2 ;(aq) (Na_2SO_ 4;(aq) Solution Projected products of this reaction are (CoSO_4) and (NaCl). Of the rules of solubility, CoSO_4 (CoSO_4) is soluble because rule 4 states that sulfates (SO_4)) are soluble. Similarly, we find that (NaCl) is soluble based on rules 1 and 3. After balancing, the resulting equation is as follows: CoCl_ 2 ;(aq) (Na_2SO_ 4 ;(aq) ;(CoSO_ 2 NaCl_ (aq) Divide the view of their ion forms, as they exist in aqueous solution. Balance the charge and the atoms. Cancel all spectator ions (those that appear as ions on both sides of the equation.): Co2- (a →q) - 2Cl- (aq) q) - SO42-(aq) - 2Naq (aq) - 2Cl- (aq) No precipitation reaction This particular example is important because all reactionary and products are aqueous, that is, they cancel out of pure equation and. There is no solid precipitation; therefore, there is no reaction of precipitation. Write a pure Ionian equation for potentially double displacement reactions. Make sure to turn on the state of matter and balance the equations. (Fe (NO_3 NaOH_ ;() (BaCl_2';(CaCl_ ;(NO_3 ;(aq HI_) «aq)» ;(Na_3PO_ (Pb (NO_3 ;(;(K_2SO_) Regardless of the physical condition, the products of this reaction are (Fe(OH) and (NaNO_3 NaNO_3). After dissociation, the Ionian equation is this: Fe3 (aq) (NO-3';(aq) ;(Rightarrow Fe (OH) (aq) (aq) (NO - 3 ;(aq) The cancellation of spectator ions leaves a pure ion equation: Fe (aq) (OH) (aq) (rightarrow fe (OH);3 (s) From the dual reaction of the replacement products, are (AlCl_3) and BaSO_4 (AlCl_3) soluble because it contains chloride (rule 3); however, (BaSO_4) is insoluble: it contains sulfate, but the ion Ba2) causes it insoluble, because it is one of the cations that causes an exception for rule 4. Ionian Equation (after balancing): 2AL3 (a ;(q) (6Cl'-(aq) Cly-K (ak) - 3BaSO_ x 4; (s) The cancellation of the spectator ions leaves the following pure ionian equation: ;(BaSO_ Ba2 (aq) - SO'2-4';(aq) From a dual replacement reaction, products (HNO_3) and (ZnI_2) are formed. Looking at the rules of solubility, (HNO_3) is soluble because it contains nitrate (rule 2), and (ZnI_2) is soluble because iodides are soluble (rule 3). This means that both products are aqueous (i.e. dissociation in the water) and thus there is no precipitation reaction. 4. The products of this dual replacement reaction are (Ca_3 (PO_4) and (NaCl). (Ca_3 (PO_4) is insoluble ;(. PO_4 ;() Ca_3 After the cancellation of the spectator ions, the net ion equation is below: Ca2 (aq) (aq) (PO)3-4;(aq) rightarrow Ca_3 (PO_4) 2 ;(s). The first product of this reaction, (PbSO_4), is soluble according to Rule 4, because it is sulfate. The second product, (KNO_3), is also soluble because it contains nitrate (rule 2). Thus, there is no reaction of precipitation. Links Campbell, Dan, Linus Pauling, and Davis Pressman. The nature forces between antigen and antibodies and precipitation reactions. Physiological Reviews 23.3 (1943): 203-219. Online. Harwood, William, F Herring, Jeffrey Madura and Ralph Petrucci. General chemistry. 9th ed. Upper Saddle River: Pearson Pritens Hall, 2007. Print. J.L., Griszkowski, D., McInturf, D.T., Warren, A.C., J.M. Woodall (1990). Arsenic also precipitates the semi-isolation properties of the haas buffer layers grown by low temperature molecular epitaxy beam. Applied Physics Letters, 57 (13) Petrucci, et al. General Chemistry: Principles and Modern Applications. 9th o.p. Upper Saddle River, New Jersey 2007. Authors and attributions Julie Shaffer (UCD), Corinne Herman (UCD) (UCD)