Measuring energy changes worksheet answers

50 cm3 copper sulfate solution (an excess) is added to 2g of zinc and the temperature increases from 20 to 50oC. 1. What ΔT - the temperature change? 2. What is the mass (m) of heated water? (Suppose the solution is pure water with a density of 1gcm-3) 3. Suppose the solution has the same specific thermal capacity (c) as pure water (4.18 Jg-1K-1). Apply the formula $q=mc\Delta T$ to calculate the released heat. In what unit is this measured? 4. Convert the released energy to Kilojoules. 5. How many zinc moles were used? 6. What is ΔH for this reaction? (ΔH = q/moles reacted) What is your unit? Questions {Suppose solution densities = 1.00 g cm-3, the specific heat capacity of the solutions is 4.18 J g-1 K-1. Ignores the heat capacity of solids}. 1. 100 cm3 of 0.20 mol dm-3 copper sulfate solution was put in a calometer and 2.0g of magnesium powder added. The temperature of the solution increased by 25.1°C. Find out which reagent was in excess and then calculate the enthalpy change for the reaction. 2. 25 cm3 of 2.0 mol dm-3 nitric acid was added to 25 cm3 of 2.0 mol dm-3 potassium hydroxide solution. The temperature increased by 13.7 °C (51.7 °F). Calculate the neutralization enthalpy for this reaction. 3 was added. 50 cm3 of hydrochloric acid from 2.0 mol dm-3 to 50 cm3 of ammonia solution of 2.0 mol dm-3. The temperature increased by 12.4 °C (49.5 °F). Calculate the neutralization enthalpy for this reaction. 4. 50 cm3 of 1.0 mol dm-3 nitric acid was added to 20 cm3 of 1.0 mol dm-3 barium hydroxide solution. The temperature increased by 7.9 °C (25.5 °F). Calculate neutralization enthalpia (to react nitric acid mole). 5. 50 cm3 of 0.10 mol dm-3 silver nitrate solution was put in a calorimeter and 0.2 g of zinc powder added. The temperature of the solution increased by 4.3 °C .C. Find out which reagent was in excess and then calculate the enthalpia change for the reaction (for reacting zinc mole).2 $AgNO_3(aq) + Zn(s) \rightarrow 2 Ag(s) + Zn(NO_3)_2(aq)$ 6. 3.53 g sodium hydrogen was added to 30.0 cm3 of hydrochloric acid mol dm-3. The temperature dropped by 10.3 K. Find out which reagent was in excess and calculate the reaction change. $NaHCO_3(s) + HCl(aq) \rightarrow NaCl(aq) + H_2O(l) + CO_2(g)$ 7. In one experiment, 0.750 g of benzene (C_6H_6) were completely burned in the air. The heat evolved by increasing the temperature of 200 g of water by 43.7 °C (150 °F). Use this data to calculate benzene 8 combustion enthalpia. a) Write an equation to represent the ΔH_c of butan-1-ol ($C_4H_9OH(l)$).b) A simple flame calorimeter was used to measure the ΔH_c of butan-1-ol. 0,600g of butan-1ol was burned on a simple spirit burner under a container of water. There was 250 g of water in the container and its temperature increased by 19.4 °C. 9. When 1.30 g of zinc reacts 100 cm3 of 2.00 m-3 nitric acid, the temperature increases by 6.0oC. The equation for the reaction is: $Zn(s) + 2 HNO_3(aq) \rightarrow Zn(NO_3)_2(aq)$ + + Calculate which reagent is in excess.b) Calculate the heat given in the experiment.c) Calculate the enthalpy change for the reaction. 10. When 0.40 g of calcium reacts with 100 cm3 of 2.00 mol dm-3 hydrochloric acid, the temperature increases by 12.0oC. The equation for the is$Ca(s) + 2 HCl(aq) \rightarrow CaCl_2(aq) + H_2(g)$a) Reaction calculate the heat released in the reaction.b) Calculate which reagent is in excess.c) Calculate the enthalpia change for this mole reaction of the calcium reaction. Improving Investigation.It impossible for a reaction to immediately end the two reagents to meet. Why? ____But as the reaction continues in energy is released and some will escape. Why could it be a problem for the final calculation of $q=mc\Delta T$? ____It it is impossible to stop all heat loss, so we have to try to explain it. Imagine an experiment that has the following results. Draw them. The energy of the 0.5 g propenum cream was transferred to 100 cm3 of water to raise its temperature by 20 °C. Calculate the enthalpy change (in kJ), and then use it to calculate the change of enthalpy molar (in kJ/mol). (Suppose 1cm3 of water has a mass of 1 g.) Water mass = 100 gEnergy transferred = heated water mass × specific thermal capacity of water × temperature increase = 100 × 4.2 × 20 = 8,400 J It is also useful to remember that 1 kilojoule, 1 kJ, equals 1,000 J. So the energy transferred is 8.4 kJ. Therefore, we can say that the enthalpy change is 8.4 kJ.Now, go ahead in the next step – which is to calculate the change of enthalpy molar. Remember: moles = ÷ relative formula mass (Mr)Burnt propa moles = 0.5 ÷ 44 = 0.01136.So, the change molar enthalpy, ΔH = 8.4 ÷ 0.01136 = 739 kJ/molHo but, we must also remember that exothermic reactions, like this one, must have negative changes, so the final answer is -739 kJ/mol. In this spreadsheet, we will practice conducting calorimetry experiments and using the results to calculate the enthalpy change for a chemical reaction. Q1: The following diagram shows the experimental configuration of a simple calometer to measure enthalpy change in certain reactions. For what kind of reaction would this experimental apparatus be unsuitable for measuring change in enthalpia? ADissolution BCombustion CDisplacement DNeutralization EPrecipitation Q2: Which of the following statements best describes what calorimetry is? AThe measurement of the in the number of degrees of freedom that a system has amount of heat needed to raise the temperature of 1 gram of a substance by 1∘CThe amount of energy needed to break 1 mole of DlinksThe amount of energy produced by the combustion of An EThe measurement of the amount of thermal energy transferred in or out of a system during a chemical or a Q3 physical change: The following diagram shows the experimental apparatus for a combustion calorimeter. Why is a copper container used in this calometer? ACopper is a good heat driver and allows an efficient energy transfer of heat to the water. BCopper is malleable and can be easily formed. CCopper is a good electricity driver. DCopper has a high melting point and is therefore not affected by the heat of the flame. ECopper does not react with water, preventing chemical reactions from occurring. Why is the experimental apparatus surrounded by dredging extractors? ATo protect the calorimeter from BTo vibrations prevent fuel or water from evaporating CTo prevent the wind from blowing the DTo flame by reducing the amount of heat lost in the ETo environment to keep the pressure inside the Q4 calorimeter constant: A student wants to take 150 mL of water to 25∘C and boil it. They are given some fuel that produces 6.75 kJ of thermal energy per 1g of burnt fuel. How much fuel does the student need to burn so that the water reaches its boiling point? Give your answer to the nearest integer number. Assuming the heat capacity of the water remains constant. Q5: In one experiment, 14.9g of potassium chloride was added to 150 mL of water at 22∘C . The temperature change was recorded and shown in the graph below. Drawing a better adjustment line between data points from 0 to 40 seconds, which of the following is the temperature at 40 seconds? A22∘C B21.4∘C C22.2∘C D20.5∘C E18.0∘C Drawing a better-fitting line between data points of 75 to 120 seconds and extrapolating, which of the following is the temperature at 40 seconds? A18.0∘C B17.0∘C C17.5∘C D18.4∘C E17.9∘C Using the two best-fit lines, calculate the temperature change at 40 seconds. Determine the value of ΔH for this reaction, taking the water-specific heat capacity to be 4.2/·JgC∘. Give your answer in units of kilojoules for mole and 1 decimal. Remember to include a login to your response. Q6: A student launches an experiment using callometry to measure the change of a neutralization reaction. Instead of a polystyrene cup, the student decides to use a glass. How will this affect the results of the experiment? AThe reaction will be faster in the glass glass, making the temperature change faster. BThe temperature change will be higher, as the glass is more insulating than the polystyrene cup. CThe temperature change will be more since more heat will be lost through the glass in the DThe glass has a higher mass than the polystyrene cup, so the amount of thermal energy transferred will be higher. Raising the temperature will cause the glass to crack. Q7: When burned, 40.1 g of methane (M = 16.04/gmol) was found to raise the temperature of 10 kg of water by 53∘C. What is the change from enthalpy molar, to the nearest whole number, for methane combustion? Take the specific heat capacity of water to be 4.2/·JgC∘. Q8: Why will the measured change in energy always be less than the total energy transferred? Some of the energy is destroyed during the reaction. BThe thermometers will have an error associated with them. CThere will always be some thermal energy lost in the environment. DNot all reagents will be used. Water will contain impurities that will absorb some of the thermal energy. Q9: When 50 mL of water containing 0.5 M HSO24 to 20∘C was mixed with 50 mL of water containing 0.5 M NaOH to 20∘C , the highest temperature recorded was 26∘C . What is the value of q for this reaction? Use a value of 4.2/·JgC∘ for water-specific heat capacity. Give your answer in joules. If NaOH is the limiting reagent, what is the value of q in kilojoules per NaOH mole? The balanced equation for the reaction is HSO()+2NaOH()NaSO()+2HO()24242aqaqaqAq What is the change of molar enthalpy for each HSO24 mole consumed? Give your answer as a whole. Q10: The experimental configuration of a simple calorimeter is shown below. Why should the calometer have a lid? ATo prevent debris from falling into the BTo reaction mix keeping the thermometer in place CTo prevent the reaction mix from being spilled DTo prevent air from reacting with the ETo mix reducing thermal energy loss through evaporation Why is the polystyrene cup placed in a glass of cotton wool? ATo prevent the glass glass from breaking BTo help catalyze the CTo reaction keep the polystyrene cup in place DTo increase insulation and prevent heat loss in the ETo environment by stopping the leak reaction mixture out of the polystyrene cup Q11: An experiment is conducted using callometry to compare the heat released from a range of fuels Which of the following factors should not be kept constant when repeating the experiment for each different fuel? ASame mass burned fuel BThermometer CVolume water DStarting water burner temperature ESame water and wick Q12: In one experiment, 80g of water was measured, placed in a copper container, and its temperature recorded. A spirit lamp containing a fuel was weighed and then placed under the copper bowl. The wick of the spirit lamp was lit, and the water warmed up until the temperature went off at 50∘C. The flame became extinct, and the final water temperature was recorded. The spirit lamp was then also The results are shown in the following table. Initial water temperature (∘C)Final water temperature (∘C)Spirit light mass before heating (g)Spirit light mass after heating (g)22.551.254.3852.88 What is the value of q, the thermal energy transferred, in the experiment? Give your answer in units of kilojoules and 1 decimal. Use a value of 4.18/·JgC∘ for water-specific heat capacity. What is the heat change per gram of fuel? Give your answer in units of kilojoules per gram of fuel. A2.2 kJ/g fuel B14.4 kJ/g fuel C8.1 kJ/g fuel D11.4 kJ/g fuel E6.4 kJ/g fuel Q13: Which of the

following equations can be used with the results of a calorimetry experiment to calculate thermal energy transferred during a chemical reaction? A$q=(c\times\Delta T)m$ B$q=mc\times\Delta T$ C$q=m\times c\times\Delta T$ D$q=cm\times\Delta T$ E$q=(m\times c)\Delta T$ Q14: A student is launching an experiment to measure the change of enthalpy in a neutralization reaction between hydrochloric acid and potassium hydroxide. Before mixing the two solutions in a polystyrene cup, the student places a glass of each solution in a water bath set at 25∘C. Why does the student do this? ATo ensure that the reagents have the correct activation energy needed to react BTo make the least viscous solutions CTo make sure both solutions are at the same temperature as the other DTo increase the reaction rate between hydrochloric acid and potassium hydroxide ETo eliminate any impurity in solutions

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