

I'm not a robot



Studying chemistry for internal assessment is challenging, especially coming up with good ideas that are relevant and interesting. The task should be demanding enough to demonstrate diploma-level study but also something you can't look up in a textbook easily. ===== Many students struggle to relate IB Chemistry topics to real-world problems they can investigate. To help with this, I've compiled a list of chemistry IA ideas grouped by main experimental technique or measurement method. Dilution effects on pH of strong and weak acids, corrosion rates, electrolysis, voltaic cells, electrodes, galvanic cells, electroplating, oxidation reactions, plant-based essential oils, combustion, solubility, activated charcoal, ocean acidification, biodegradable plastics ===== Looking forward to diluting hydrochloric and ethanoic acids at varying ratios and observing pH changes. Different acids seem to impact corrosion rates significantly on metals like iron nails. I'm planning to immerse iron nails in hydrochloric, sulfuric, and ethanoic acids to measure mass loss over time. The effect of electrolyte concentration on electrochemical cell efficiency is quite fascinating. Testing different salt concentrations affects the voltage of a simple lemon battery. Temperature influences the voltage output of a voltaic cell as well - measuring voltage at different temperatures will provide valuable insights. Electrode material plays a crucial role in an electrolysis reaction, with graphite and copper electrodes producing hydrogen gas at varying rates. I'll be comparing these rates to determine their effectiveness. Different salt bridges can impact galvanic cell performance - using potassium nitrate, sodium chloride, and agar salt bridges will allow me to compare voltages and identify the most efficient bridge. Changing the anode and cathode affects metal deposition in electroplating, with copper being deposited onto iron nails at varying rates. This experiment should provide interesting results on the impact of electrode materials. Investigating oxidation reactions using potassium dichromate is also an area of interest - reacting alcohols like ethanol and propanol will help me understand their reactivity. Light exposure affects Vitamin C degradation in orange juice, with storage in light conditions leading to faster breakdown. Testing natural vs synthetic antioxidants like Vitamin E will provide insights into their effectiveness. Cooking methods can impact vitamin C content in vegetables, with boiling resulting in significant losses. Investigating different solvents for plant-based essential oil extraction will also yield interesting results. Heat energy changes during chemical reactions are crucial - measuring temperature changes during neutralization and combustion reactions will help identify the most efficient processes. Pressure affects boiling points and enthalpy of vaporization of water, with measurements at various altitudes or using a vacuum pump providing valuable data. The relationship between bond enthalpy and combustion efficiency is vital - comparing these values for different hydrocarbons like methane and propane will provide a better understanding of their reactivity. Calorific values of edible oils are also an area of interest - burning olive, coconut, and sunflower oil to measure heat energy released will help identify the most efficient options. Investigating pollutants' impact on rainwater pH and soil's effect on heavy metal leaching will provide insights into environmental issues. Activated charcoal's efficiency in removing impurities from water is also worth exploring. Ocean acidification impacts calcium carbonate solubility, with measurements at varying CO2 levels helping identify the most affected minerals. Biodegradable plastics' decomposition rates compared to traditional plastics will also shed light on sustainable chemistry practices. Investigating Chemistry IA Topics to Maximize Your Score ===== Looking forward to seeing everyone at the meeting tomorrow and discussing our strategies. We are happy to assist with choosing a great IB Chemistry Internal Assessment (IA) topic, which is key to scoring well. A strong IA topic should be focused, measurable, and rooted in clear scientific principles. Below are 100% unique topics to help you design your experiment. 1. Reaction Kinetics & Rate of Reaction These topics focus on how various factors influence the speed of chemical reactions. Choosing a relevant and original idea is crucial for a high-scoring investigation. Below are some examples: * How does changing the temperature influence the reaction rate between sodium thiosulfate and hydrochloric acid? Example: Measure the time it takes for a cross beneath a beaker to disappear as sulfur forms in different temperatures. * Investigating the impact of catalyst concentration on the decomposition rate of hydrogen peroxide. Example: Use different amounts of manganese dioxide and measure oxygen gas production over time. 2. Acid-Base Chemistry & pH Studies These topics explore acids, bases, and their real-world applications. Comparing the buffering capacity of different antacids using titration is an example: * Comparing the buffering capacity of different antacids using titration. Example: Neutralize different antacid brands with hydrochloric acid and measure pH changes. 3. Electrochemistry & Redox Reactions These topics examine electricity and oxidation-reduction reactions. Investigating the impact of electrolyte concentration on the efficiency of an electrochemical cell is an example: * Investigating the impact of electrolyte concentration on the efficiency of an electrochemical cell. Example: Test how different salt concentrations affect the voltage of a simple lemon battery. 4. Organic Chemistry & Biochemical Reactions These topics focus on carbon-based molecules and biological chemistry. Investigating the oxidation of alcohols using potassium dichromate is an example: * Investigating the oxidation of alcohols using potassium dichromate. Example: React ethanol, propanol, and butanol with potassium dichromate and observe color changes. Let us know in the comment section if you need more guidance on experimental design, research questions, or data analysis. Measuring Vitamin C Levels in Baked, Steamed, and Raw Spinach Investigating the impact of different solvents on the extraction efficiency of plant-based essential oils. Example: Extract mint oil in water, ethanol, and hexane, then compare yields. 5. Thermochemistry & Energetics These topics explore heat energy changes in chemical reactions. Chemistry IA Topics with Examples: How does the concentration of a solution affect its enthalpy change during neutralisation? Example: Mix different concentrations of hydrochloric acid and sodium hydroxide and record temperature changes. Investigating the impact of different fuel types on energy released during combustion. Example: Burn ethanol, propane, and butane and measure temperature increase in water. How does pressure affect the boiling point and enthalpy of vaporization of water? Example: Measure boiling points at different altitudes or use a vacuum pump. The relationship between bond enthalpy and combustion efficiency of different hydrocarbons. Example: Compare heat released when burning methane, ethane, and propane. Comparing the calorific value of different edible oils. Example: Burn olive, coconut, and sunflower oil and measure the heat energy released. ===== Investigating the efficiency of an electrochemical cell was found to be dependent on electrolyte concentration, particularly salt concentrations. The experiment involved testing different salt concentrations on a simple lemon battery to observe variations in voltage output. Additionally, temperature played a crucial role in influencing the voltage output of a voltaic cell, with higher temperatures resulting in lower voltages. Moreover, various factors were explored that impacted the efficiency of an electrolysis reaction, such as electrode materials and their effect on metal deposition rates during electroplating. Furthermore, different salt bridges were used to compare galvanic cell performance, revealing distinct patterns in cell voltage outputs. A significant key to maximizing scores on a Chemistry IA is selecting a focused and original topic rooted in clear scientific principles. This involves choosing relevant ideas that can be measured and explored through experimentation. The diverse realm of Chemistry IA topics encompasses a wide range of investigations, each probing the intricacies of various chemical reactions, processes, and phenomena. By investigating the effect of pollutants on rainwater pH or studying the efficiency of activated charcoal in removing impurities from water, scientists can gain valuable insights into the fundamental principles governing our environment. ===== Organic chemistry and biochemical reactions also offer a wealth of opportunities for exploration. By investigating the oxidation of alcohols using potassium dichromate, scientists can gain insight into the complex interactions between organic molecules and chemical oxidizing agents. Moreover, examining the effect of light exposure on Vitamin C degradation in orange juice sheds light on the role of environmental factors in biochemical processes. ===== Thermochemistry and energetics provide a fascinating perspective on the world of chemistry, where scientists can explore the relationships between heat energy changes, enthalpy, and combustion reactions. By investigating how concentration affects the enthalpy change during neutralization or comparing the calorific values of different edible oils, researchers can uncover valuable information about chemical reactions and their thermodynamic properties. ===== Finally, environmental chemistry and green chemistry encompass a broad range of topics that address the sustainable use of chemicals and their impact on our environment. By investigating the effect of pollutants on rainwater pH or studying the efficiency of activated charcoal in removing impurities from water, scientists can gain valuable insights into the fundamental principles governing our environment. ===== Chemistry IA topics can be broadly categorized into several areas of study, each with its unique set of challenges and opportunities for discovery. From investigating the effects of carbonation levels on soft drink acidity to exploring the oxidation of alcohols using potassium dichromate, these projects offer a chance to delve into the world of chemistry and uncover new knowledge. ===== One particular area of research that has garnered significant attention is the examination of electrochemistry and redox reactions. By investigating the impact of electrolyte concentration on the efficiency of an electrochemical cell, scientists can better understand how electricity interacts with chemical systems. Furthermore, studying the effect of different acid types on metal corrosion rates reveals the intricate relationships between chemistry and materials science. ===== Organic chemistry and biochemical reactions also offer a wealth of opportunities for exploration. By investigating the oxidation of alcohols using potassium dichromate, scientists can gain insight into the complex interactions between organic molecules and chemical oxidizing agents. Moreover, examining the effect of light exposure on Vitamin C degradation in orange juice sheds light on the role of environmental factors in biochemical processes. ===== Thermochemistry and energetics provide a fascinating perspective on the world of chemistry, where scientists can explore the relationships between heat energy changes, enthalpy, and combustion reactions. 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From investigating the effects of carbonation levels on soft drink acidity to exploring the oxidation of alcohols using potassium dichromate, these projects offer a chance to delve into the world of chemistry and uncover new knowledge. ===== For your IB Chemistry IA, you can choose from various topics that align with the course content. Some examples include analyzing the effect of temperature on a chemical reaction, determining the concentration of a substance in a solution, or investigating the rate of a chemical reaction. These practical topics will help you visualize your experiment and design an effective investigation. ===== A well-structured Chemistry IA consists of several sections: Introduction, Methodology, Data Collection & Analysis, Evaluation & Conclusion, and a reference list. The introduction should include a clear research question, background information, and a hypothesis. The methodology section should outline the detailed procedure, control of variables, and materials used in the investigation. ===== In addition to the structure, it's essential to ensure that your IA meets the requirements set by the International Baccalaureate. This includes a laboratory report that should be 6 to 12 pages long (or up to 3,000 words) and include a research question, methodology section, data analysis, and conclusion. The proposal should also outline a risk assessment and a list of equipment and materials needed. ===== When choosing a topic for your IA, consider the IB Chemistry course content and ensure that it is practical, feasible, and complex enough to demonstrate your understanding of the subject matter. Some examples of previous topics include analyzing the effect of pH on the rate of a chemical reaction or investigating the thermal decomposition of a substance. ===== To prepare for the IA, familiarize yourself with the IB Chemistry 2025 SL and HL course content and practice questions. Reviewing past papers and study notes will also help you develop your skills in designing an effective investigation and presenting your findings in a clear and concise manner. ===== They should practise writing lab reports after their chemistry course and seek feedback from teachers on writing skills and research process understanding, and can enlist IB Chemistry tutor help. Before starting IA, students should familiarise themselves with IB assessment criteria and guidelines provided. This will allow them to show full potential and achieve highest mark possible. Assessment criteria include: Personal engagement: Students should engage with exploration, which can be demonstrated through independent thinking and creativity. Research question or topic should be linked to something of personal significance or interest, and student should show initiative in implementing investigation. (2 marks) Explorashun: Students should identify a relevant and fully-focused research question, which is explored with appropriate background information and investigated with an appropriate methodology. Student should consider safety, ethical or environmental issues that are relevant to methodology. (6 marks) Analysisshun: Students should demonstrate the ability to analyze data and draw conclusions. They should show that they have used appropriate techniques to process and present data, and that they have identified patterns and trends in data. Report should include quantitative and qualitative data, which support detailed and valid conclusions, following appropriate data processing. (6 marks) Evaluashun: Students should demonstrate an understanding of the limitations and uncertainties of their investigation. They should critically evaluate their methodology and results, and suggest ways in which investigation could be improved or extended. (6 marks) Communication: Investigation should be clearly presented, with effective structure, concise writing, and appropriate use of subject-specific terminology. (4 marks) Additionally, students should also make sure that their report is well-written and properly formatted, and that it includes all the required sections. Here are a few examples of potential research questions compiled by expert IB Chemistry tutors that could inspire your Chemistry IA: 1 - How does the concentration of a solution affect the reaction rate between hydrochloric acid and magnesium? Explore how varying the concentration of hydrochloric acid affects its reaction rate with magnesium. This involves measuring the volume of hydrogen gas produced over time and analyzing the results to identify trends. Ensuring all other variables are controlled will enhance the reliability of the experiment. Independent variable: Concentration of hydrochloric acid. Dependent variable: Volume of hydrogen gas produced over time. Controlled variables: Temperature, stirring rate, and magnesium mass/size. Data representation: Plot reaction rates against acid concentration to determine the relationship. 2 - Can the purity of a sample of aspirin be determined using thin-layer chromatography? Determine the purity of an aspirin sample by separating its components with thin-layer chromatography (TLC). This method relies on the differing polarities of components to identify impurities and assess purity through Rf value comparison. Procedure: Dissolve aspirin in a solvent, spot on a TLC plate, and develop using a suitable solvent. Analysis: Measure Rf values and compare with reference values for pure aspirin. Indicators of purity: A single Rf value corresponds to pure aspirin; multiple Rf values suggest impurities. 3 - Investigating the effect of temperature on the solubility of a salt in water. Study how temperature influences the solubility of a salt in water by preparing saturated solutions at varying temperatures and measuring the mass of salt dissolved. The results will enable the creation of a solubility curve. Procedure: Heat water to specific temperatures, saturate with salt, and weigh solutions. Controlled variables: Volume of water and type of salt. Data representation: Solubility curve showing temperature vs solubility. 4 - How does the concentration of hydrochloric acid affect the reaction rate with sodium thiosulfate? Investigate how hydrochloric acid concentration impacts its reaction rate with sodium thiosulfate. The time for the solution to turn opaque indicates the reaction rate, with trends plotted for clarity. Independent variable: Hydrochloric acid concentration. Dependent variable: Time taken for opacity to develop. Controlled variables: Temperature and sodium thiosulfate volume. Data representation: Graph showing reaction rate vs acid concentration. 5 - Can the enthalpy change of a chemical reaction be determined using calorimetry to measure the enthalpy change of a reaction and applying Hess's law for indirect calculations, researchers can gain valuable insights into the thermodynamics of chemical reactions. By conducting and measuring the heat changes of individual reactions, scientists can calculate the individual reaction enthalpies and ultimately determine the overall enthalpy change using Hess's law. The importance of pH indicators in Chemical Experiments ===== Looking forward to examining the effects of different types of acids and bases on the rate of reaction between hydrochloric acid and sodium thiosulfate. By measuring the time for a sulphur precipitate to vanish, we can determine how pH and chemical nature affect reaction kinetics. Investigating how different catalysts affect the rate of a specific chemical reaction is an interesting study. We will use spectrophotometry or gas chromatography to monitor reaction progress and compare reaction rates under controlled conditions. Analyzing how varying the concentration of a reactant influences the rate of a chemical reaction is important. By tracking changes in reactant or product concentrations over time, we can determine the relationship between concentration and reaction rate. Exploring the behavior of different acids and bases in various solutions by measuring their pH and observing their reactions is an interesting area of study. We will examine their strength, reactivity, and influence on the solution based on concentration and solubility. Examining how temperature changes affect the solubility of a solute in a solvent is important. By preparing solutions at varying temperatures and measuring the dissolved solute, we can create a clear visual of the relationship between temperature and solubility. Investigating the behavior of various polymers under environmental conditions like temperature, humidity, and UV radiation is crucial. We will use tensile testing, thermal analysis, and microscopy to evaluate their performance and suitability for specific applications. Investigating how solute concentration impacts osmotic pressure by measuring solutions with varying concentrations using an osmometer is a key study. By plotting the data and comparing the results for different solutes, we can analyze the relationship between concentration and osmotic pressure. Exploring the behavior of surfactants in various solutions by evaluating their ability to reduce surface tension, form micelles, and dissolve in different solvents is an interesting study. We will examine their stability under varying conditions to determine their effectiveness. Investigating how the concentration of a reactant affects the rate of a chemical reaction is important. By tracking changes in reactant or product concentrations over time, we can determine the relationship between concentration and reaction rate leading to a better understanding of the reaction's rate law. Looking at these examples, it seems like researchers are testing various variables to see how they affect different physical properties. They're trying to understand how temperature and concentration impact things like surface tension, conductivity, and viscosity. One experiment is looking at surfactants in cleaning and emulsifying applications. Another one examines the behavior of electrolyte solutions under different temperatures. Some researchers even investigate metal alloys to find out which ones work best under various conditions. The study on solution concentration and its effect on boiling and freezing points reveals a clear relationship between them. It also helps us understand how gases like helium, nitrogen, and oxygen behave under different pressures and temperatures. Concentration's impact on diffusion and effusion rates is another area of focus, as researchers try to track the movement of dyes or gases through semi-permeable membranes. Lastly, some scientists delve into nuclear reactions and their behavior under different conditions, seeking better understanding for energy production and scientific applications. ===== The Behaviour of Compounds Under Various Conditions ===== Understanding how compounds behave under different conditions is crucial for various applications in fields like medicine, agriculture, and materials science. A comprehensive approach to studying compound behaviour involves testing variables such as solubility, reactivity, melting/boiling points, and examining the effects of solvent type, temperature, and pressure on these properties. Measuring the pH of solutions with varying concentrations using a pH meter or indicator paper provides valuable insights into the relationship between concentration and pH. The data obtained from these measurements can be visualised through a graph to observe trends in the pH levels of acidic or basic solutions. The behaviour of electrochemical cells is also influenced by factors such as electrode materials, electrolyte concentration, and temperature. Investigating the properties of different types of electrochemical cells under various conditions helps evaluate cell efficiency and calculate cell potentials across different conditions. This research enables a better understanding of how these cells respond to changes in their operating environment. Moreover, studying the effect of chromophore concentration on its colour and absorption spectrum is essential for creating compounds with specific optical properties. Mathematical modelling of absorption spectra vs. concentration provides valuable insights into the relationship between concentration levels and resulting colours or light interactions. Investigating the properties of covalent compounds under different conditions reveals their responses to temperature, pressure, and pH changes. Advanced techniques like spectroscopy and chromatography are used to test solubility, reactivity, and state changes in these compounds. This research has potential applications in industrial or scientific use. The effect of temperature on the rate of diffusion and effusion is another crucial area of study. Analyzing how temperature influences the rates of gas movement through a small opening at various temperatures helps determine optimal conditions for specific processes. Lastly, examining the properties of intermolecular forces under different conditions provides valuable insights into substance behaviour. Substances with varying intermolecular forces, such as hydrogen bonding, dipole-dipole interactions, and London dispersion forces, respond differently to temperature and pressure changes. This research enables a better understanding of how these forces influence physical properties. By exploring the behaviour of compounds under various conditions, researchers can gain valuable insights into their potential applications in real-world scenarios. The realm of coordination compounds, where subtle variations in temperature, pH, and concentration can yield profound effects on their color, solubility, and stability. By probing the properties of these complexes under different conditions, researchers uncover valuable insights into their chemical behavior and potential applications. # 53 - Exploring Coordination Compounds Temperature, pH, and concentration variables were investigated to examine how changes impact the physical and chemical characteristics of coordination compounds. Colour changes, solubility levels, and stability measurements revealed a rich array of properties that can inform our understanding of these compounds' behavior. Spectroscopy and solubility tests provided crucial data for analyzing the properties of coordination compounds, shedding light on their potential applications in medicine and materials science. # 54 - The Concentration Conundrum How does varying solution concentration influence the equilibrium constant of a chemical reaction? Researchers sought to determine this by manipulating reactant or product concentrations at different temperatures, pressures, and stirring rates. By calculating the equilibrium constant at various starting concentrations, they visualized the relationship between these variables. The output: an equilibrium constant vs. concentration graph, revealing a complex interplay between reactant concentration and chemical reaction rate. # 55 - Chromatography Showdown Which chromatography method reigns supreme in separating mixtures under varying conditions? Researchers compared paper, thin-layer, and gas chromatography techniques to determine the most effective approach for different types of mixtures. By adjusting solvent type, stationary phase, and temperature, they optimized separation quality. Techniques tested: paper, thin-layer, and gas chromatography. Measurements included separation quality, Rf values, or retention times. The outcome? Identification of the optimal chromatography method for specific separations. # 56 - Temperature's Effect on Activation Energy How does temperature impact the activation energy of a chemical reaction? Researchers investigated this by measuring reaction rates at various temperatures and applying the Arrhenius equation to calculate activation energy. Graphical analysis revealed a striking relationship between temperature and activation energy, shedding light on the underlying mechanisms. # 57 - Solid State Materials What properties make metals, ceramics, and polymers suitable for specific industrial or engineering applications? Researchers explored how changes in temperature, pressure, and humidity affect these materials' elasticity, conductivity, and thermal expansion. By measuring strength, conductivity, and thermal expansion, they pinpointed material suitability for particular uses. Applications included identifying materials for industrial or engineering purposes. # 58 - Concentration's Role in Redox Reactions How does varying solution concentration influence the rate of a redox reaction? Researchers examined this by monitoring colour change or pH measurement to calculate reaction rates based on changes in absorbance or pH over time. Temperature, reactant volume, and stirring rate controlled factors influenced the outcome. # 59 - Nanomaterials Under the Microscope What properties do nanomaterials exhibit under varying size, shape, composition, and environmental conditions? Researchers investigated conductivity, reactivity, and strength to identify optimal conditions for specific applications. Techniques included microscopy, spectroscopy, and mechanical testing. # 60 - Precipitation Reaction Dynamics How does reactant concentration impact the rate of a precipitation reaction? By measuring time to formation or mass of precipitate formed, researchers analyzed trends to understand the relationship between concentration and reaction rate. Independent variables and controlled factors informed their approach. The IB Chemistry Scientific Investigation: A Comprehensive Guide to Success ===== As students prepare for their IB Chemistry exams, it is essential to understand the significance of the Scientific Investigation (IA) component. This assessment accounts for 20% of the final grade and is designed to evaluate a student's ability to conduct independent research and think critically about scientific concepts. The IB has introduced significant updates to the IA, effective from May 2025, with a focus on improving student outcomes. The new assessment criteria are based on four key areas: Research Design, Data Analysis, Conclusion, and Evaluation, each allocated six marks, totaling 24 marks. To succeed in this component, students must adhere to the following practical implications: Early planning is crucial to allow sufficient time for research design, data collection, and analysis. It is essential to formulate a unique research question and gather distinct data, even when collaborating with others. Structuring the report effectively is vital, focusing on clarity and conciseness in presenting methodology, findings, and evaluations. The 3,000-word limit provides a clear framework for organizing the investigation. By understanding the IB Chemistry curriculum and practicing writing lab reports, students can develop essential skills and increase their chances of success in the Scientific Investigation component. To conduct this experiment, we will collect several water samples from different sources and measure their dissolved oxygen concentration using both the Winkler method and the dissolved oxygen meter. We will then compare the results and calculate the percentage error for each method, investigating the effect of temperature and pH on the accuracy of the Winkler method by repeating measurements at different temperatures and pH levels. This experiment aims to investigate the effects of varying conditions on the measurement of dissolved oxygen concentration, providing a deeper understanding of the investigative process in chemistry. By following these practical implications and adhering to the IB guidelines, students can successfully complete their Scientific Investigation component and achieve a high grade in their IB Chemistry exams. We are looking at various chemical experiments and their setups. ===== 1. We would test how much iodine is consumed when reacting with another substance, then we try it at different temperatures using a heating mantle or a water bath to maintain the temperature. We measure the equilibrium constant by figuring out how much iodine was used up in each reaction. 2. We are studying how storage temperature affects wine's sulfite concentration. Different wines are stored at various temperatures for a set amount of time and their sulfite levels will be measured with a spectrophotometer. 3. A ferromagnetic material, such as iron or nickel, is tested by applying different temperatures ranging from -10°C to 100°C using a magnetometer. 4. An acid's concentration in an unknown substance can be found through back titration with base. 5. We compare how different ligands affect the stability and structure of metal complexes synthesized using a common transition metal. 6. This experiment is about testing how adding varying amounts of solute affects crystal formation during crystallization, where sodium chloride is dissolved in distilled water. The solutions will then be placed in a controlled environment to allow for crystallization to occur. The rate of crystal formation will be measured by observing and recording the time taken for crystals to form in each solution. Independent Variables: The concentration of the solute (sodium chloride) Constant Variables: Temperature, volume of solvent, type of solute, method of mixing the solution Dependent Variables: The rate of crystal formation ===== We will examine how changing temperature affects the change (ΔG) of a chemical reaction. ===== We will use a coffee cup calorimeter to measure heat during a reaction and calculate ΔG using ΔG = ΔH - TAS, where ΔH is enthalpy change, T is temperature in Kelvin, and AS is entropy change. We will vary the system's entropy by adding different solid solute amounts to a fixed solvent volume and determine the temperature at which the reaction becomes spontaneous (ΔG < 0). We repeat this experiment with various solutes to see how molecular size and structure affect entropy and spontaneity. Independent Variables: Amount and type of solute, temperature, solvent concentration Constant Variables: Solvent mass and purity, laboratory pressure, equipment for temperature measurement Dependent Variables: Change in Gibbs free energy, temperature at reaction spontaneity

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