CAREER & TECHNICAL EDUCATION

HIGH SCHOOL CHEMISTRY: INTRODUCTION TO BIOTECHNOLOGY

ACADEMIC & PROFESSIONAL SKILLS STANDARDS

CATALINA FOOTHILLS SCHOOL DISTRICT
Approved by the Governing Board
June 23, 2020

CATALINA FOOTHILLS SCHOOL DISTRICT

HIGH SCHOOL CHEMISTRY: INTRODUCTION TO BIOTECHNOLOGY OVERVIEW

High School Chemistry: Intro to Biotechnology is a laboratory course that emphasizes essential chemistry concepts in an industry-based lab setting. Students gain an understanding of the physical and chemical sub-processes that occur within systems at both the micro and macro levels. Students are expected to apply these concepts to real-world phenomena to gain a deeper understanding of causes, effects, and solutions for physical processes in the real world. They will explore topics such as the structure of matter, bonding, chemical reactions, molar relationships, and periodicity, by exploring biological phenomenon using extensive laboratory techniques. Students will be engaged in activities that promote critical analysis, experimental design, and the development of higher-level thinking skills. This course is a combination of guided instruction, collaborative learning, and laboratory design with practical applications.

The standards for Chemistry: Intro to Biotechnology are grouped into four categories: Biotechnology, Physical Science – Chemistry, Earth and Space Sciences, and Professional Skills. The Chemistry and Earth and Space Science standards are designated as "essential" and "plus" standards. Essential standards are those that every high school student is expected to know and understand. Plus standards in chemistry are designed to extend the concepts learned in the essential standards to prepare students for entry level college courses. Two topics from the standards in the Earth and Space Sciences, have been integrated into the course. This is to ensure that students have been taught the full set of "essential" science standards by their third year of high school. Because students have some flexibility in the pathway they select to meet the graduation requirements for science, specific "essential" standards were integrated into some of the science courses to meet this Arizona State Board of Education requirement.

The list of high school Chemistry: Intro to Biotechnology topics below does not indicate the instructional sequence or how the standards will be organized for instruction. Educators will make decisions about instructional sequence and how standards will be grouped by units for classroom instruction and assessment to best meet student needs.

High School Chemistry: Intro to Biotechnology Topics:

- Biotechnology
    - Industry Safety Standards
    - Bioscience Research and Ethical Conduct
    - Investigative and Laboratory Skills
- Physical Science: Chemistry
    - Structures and Properties of Matter
    - Chemical Reactions
    - Nuclear Processes and Applications of Chemistry
- Earth and Space Sciences
    - Earth's Systems
    - Earth's Place in the Universe
- Arizona Professional Skills

Note: While the core content of the course aligns with the Chemistry standards, the application of the content through labs and related activities is focused on the biotechnology domain.

BIOSCIENCE

STANDARDS FOR CHEMISTRY: INTRODUCTION TO BIOTECHNOLOGY

INDUSTRY SAFETY PROCEDURES

- Adhere to health practices and industry safety standards in the classroom and laboratory setting for personal health and safety and the health and safety of others *(i.e., SOPs for biological, biohazardous, and chemical materials, appropriate personal protective equipment [PPE] for the situation, emergency equipment).*
- Safely operate and perform care and routine maintenance of equipment *(e.g., maintain equipment log, report unsafe and nonfunctioning equipment, storage of chemicals, reagents and compounds, and maintenance of equipment).*
    - manufacturing practices pertaining to quality control (QC)
    - control inventory process for materials and supplies
- Apply compliancy procedures for state, local, and industry regulations *(e.g., OSHA [occupational safety and health administration] SDS [safety data sheets], EPA [Environmental Protection Act], FDA [Federal Drug Administration], NIH [National Institute for Health], AZDEQ [Arizona Department of Educational Quality], safety data sheets [SDSs])* for chemicals.
    - Comply with safety signs and symbols and utilize appropriate lab attire and protective equipment *(e.g., safety glasses, gloves).*
    - Interpret safety data sheets (SDS) and apply practices for the safe use of hazardous chemicals according to standards from the Occupational Safety and Health Administration, Environmental Protection Agency, Federal Drug Administration, National Institute for Heath, and the Arizona Department of Educational Quality.
    - Identify appropriate emergency contacts and perform drills for emergency protocols *(e.g., fire procedure, evacuation protocol, hazardous chemical contact).*
    - Explain appropriate handling of biological and biohazardous materials and distinguish between the biosafety levels (BSL-1 to BSL-4).
    - Perform and document tests for quality control *(i.e., accuracy of balances, concentration of chlorine in bleach, pH, spectrophotometry).*

BIOSCIENCE RESEARCH AND ETHICAL CONDUCT

- Summarize findings from scientific and technical literature *(e.g., patents, peer-reviewed articles, white papers, and technical bulletins*).
    - evaluate the scientific merit and commercial viability of prior work and its relevance to experimental design
- Critically analyze the interaction between biotechnology research and society *(e.g., genetically modified foods, cloning, bioterrorism, gene therapy, stem cells, and animal research).*
    - compare and contrast attitudes about the use of biotechnology regionally, nationally, and internationally
    - differentiate between moral, ethical, and legal biotechnology issues
- Describe codes of ethics and protocols used by various organizations that apply to confidentiality and security.
- Adhere to standards for harassment, labor, and employment laws as well as other legal and regulatory codes *(e.g., EPA, FDA, OSHA, NIH, AZDEQ).*
    - Identify and access scientific and technical literature, including patents, peer-reviewed articles, white papers, and technical bulletins.
    - Concisely summarize findings from scientific papers using relevant terminology while taking care to prevent plagiarism.

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- Determine the features of experimental design in prior scientific research that led the research to be successful.
- Explain the implications of bioethical issues for society *(e.g., GMOs and HeLa privacy issue).*
- Describe local, state, and federal standards of practice for treatment, care, and maintenance of living organisms.
- Describe practices (including negligence) that could result in liability and how these situations can be avoided *(i.e., risk management and incident reporting).*

INVESTIGATIVE AND LABORATORY SKILLS

- Apply industry-recognized scientific methods and inquiry to develop knowledge and understanding of scientific ideas and how scientists study the natural world.
    - ask or respond to scientifically-oriented questions
    - develop a testable question or hypothesis based on evidence of scientific principles, probability and/or modeling appropriate to the scientific domain being investigated
    - analyze data using statistics and graphs *(e.g., Excel and other software)*
    - utilize appropriate SI (International System of Units) base units and prefixes for all measurements *(e.g., milli, micro, nano)*
    - perform biomath calculations and use scientific notation, as appropriate
    - formulate explanations based on evidence and connect explanations to prior scientific knowledge
    - communicate results and justify explanations
- Apply standard operating procedures (SOPs) in the laboratory.
- Operate lab equipment *(i.e., centrifuges, gel electrophoresis apparatus, autoclave, glassware, balances, micropipettes, spectrophotometer, fume hoods, incubators, hot plates, water baths, pH meter, etc.),* and store solutions and buffers *(e.g., initials, dates, concentration, lots, storage conditions, sterility, hazards, special directions*) properly and safely.
    - Develop and test a research question (scientific process).
    - Design experiments using best practices (*i.e., control groups, constants, multiple trials, adequate sample size, detailed procedure).*
    - Make observations and collect data using industry-recognized methods *(i.e., contemporaneous notebook*).
    - Demonstrate reproducibility from an SOPs (Standard Operating Procedures).
    - Operate lab equipment properly and safely.
    - Analyze data (graphs and statistical analyses) using spreadsheet software *(e.g., Excel).*
    - Explain the implications of the research and how it connects with prior scientific knowledge.
    - Communicate results of experiments with others using representations that include graphs, pictures, and written descriptions.

PHYSICAL SCIENCE: STRUCTURE AND PROPERTIES OF MATTER

- Essential HS.P1U1.1 Develop and use models to explain the relationship of the structure of atoms to patterns and properties observed within the Periodic Table and describe how these models are revised with new evidence.
    - Develop models (*e.g., in the form of diagrams, drawings, physical replicas, mathematical representations, analogies, and/or computer simulations*) to represent the relationships of the structure of atoms and patterns and properties observed within the Periodic Table:
        - Use design criteria to create models to represent the relationships of the structure of atoms and patterns and properties observed within the periodic table.
        - Use multiple types of models to represent the relationships of the structure of atoms and patterns and properties observed within the periodic table.

        - Develop models based on evidence to illustrate the relationships between the structure of an atom and the way that an atom behaves.
        - Use multiple types of models to represent the relationships of the structure of atoms and patterns and properties observed within the periodic table.
        - Evaluate the merits and limitations of model types in order to select or revise a model that best fits the evidence or design criteria.
    - Use models to explain the relationship of the structure of atoms to patterns and properties observed within the periodic table:
        - Use multiple types of models to support explanations of why various atoms on the periodic table interact.
        - Use models to describe patterns and properties observed in the periodic table.
        - Use models to identify and predict patterns in properties that determine how the periodic table is organized based on subatomic particles and element properties.
    - Describe how models are revised with new evidence:
        - Evaluate limitations of multiple models on predicting relationships between atoms on the periodic table.
        - Describe how the periodic table was created using patterns and how the patterns determine how to add new elements.
    - Describe how and why the atomic model has been changed/revised over time.

- Plus HS+C.P1U1.1 Plan and conduct an investigation to demonstrate how changes in the number of subatomic particles (protons, neutrons, electrons) affect the identity, reactivity, and properties of the element.
    - Plan investigations to test the identity, properties, and stabilities (reactivities) of elements:
        - Ask testable questions regarding the properties, and stabilities (reactivities) of elements.
        - Frame a hypothesis in response to the testable question based on a model or theory.
        - Select appropriate variables and controls.
        - Evaluate the investigation's design to ensure variables are controlled.
        - Determine the data *(e.g., types, amount, and accuracy*) needed to produce reliable measurements of the outcomes.
        - Select appropriate tools to collect, record, and analyze the data.
        - Consider limitations on the precision of the data (*e.g., number of trials, cost, risk, time*), and refine the design accordingly.
    - Conduct investigations individually and/or collaboratively to test the investigative question:
        - Conduct investigations in a safe and ethical manner including considerations of environmental, social, and personal impacts.
        - Gather evidence to support explanations about identity, properties, and stabilities (reactivity) of elements.
        - Use data from the investigation to evaluate hypotheses about identity, properties, and stabilities (reactivity) of elements.
        - Make quantitative and qualitative claims regarding identity, properties, and stabilities (reactivity) of elements.

- Plus HS+C.P1U1.2 Obtain, evaluate, and communicate the qualitative evidence supporting claims about how atoms absorb and emit energy in the form of electromagnetic radiation.
    - Obtain qualitative evidence supporting claims about electromagnetic radiation:
        - Ask questions to frame the collection of evidence.
        - Gather information from a variety of sources *(e.g., texts, investigations, media, data sets, models, etc.)* in response to the investigative questions.
        - Determine the central ideas or conclusions of a complex scientific text.
        - Summarize and paraphrase complex concepts, processes, or information about electromagnetic radiation in simpler, but still accurate terms.

- Evaluate qualitative evidence supporting claims about electromagnetic radiation:
    - Evaluate the validity and reliability of qualitative evidence supporting claims about how atoms absorb and emit energy in the form of electromagnetic radiation.
    - Verify data across texts.
- Communicate qualitative evidence supporting claims about electromagnetic radiation:
    - Produce scientific/technical writing and/or oral presentations (*e.g., blog post, newspaper column, position paper, Socratic Seminar)* that present qualitative evidence supporting claims about electromagnetic radiation - how atoms absorb and emit energy in the form of electromagnetic radiation, and how electromagnetic radiation is either absorbed or emitted by different elements.
    - Compare, integrate, and evaluate multiple sources of information presented in different media or formats *(e.g., visually, quantitatively)* in order to present claims about the link between light and electromagnetic radiation.
    - Explain the relationship between the absorbance and emittance of energy in an atom.
    - Explain the relationship between the Bohr model of the atom and electromagnetic radiation.

- Plus HS+C.P1U1.3 Analyze and interpret data to develop and support an explanation for the relationships between kinetic molecular theory and gas laws.
    - Use tools, technologies, and models to analyze and interpret data (*e.g., from investigations, demonstrations, texts, data sets, simulations, etc.*) related to the kinetic molecular theory and gas laws:
        - Ask questions to frame the data analysis and interpretation.
        - Use tools to generate data that illustrates the relationship between pressure, volume and temperature.
        - Use tools to generate data that proves the validity of kinetic molecular theory.
            - Construct representations of the data (*e.g., graphs, data sets, etc.*) to identify patterns and relationships associated with the gas laws.
            - Use the data to analyze the limitations of the kinetic molecular theory and the ideal gas law (PV=nRT).
    - Use data to develop and support an explanation of the relationships between kinetic molecular theory and gas laws:
        - Apply scientific knowledge and evidence to explain how the kinetic molecular theory explains the gas laws.
        - Base causal explanations on valid and reliable empirical evidence from multiple sources and the assumption that gas laws operate today as they did in the past and will continue to do so in the future.
        - Construct and revise explanations based on evidence obtained from a variety of sources *(e.g., scientific principles, models, theories, simulations)* and peer review.

PHYSICAL SCIENCE: CHEMICAL REACTIONS

- Essential HS.P1U1.2 Develop and use models for the transfer or sharing of electrons to predict the formation of ions, molecules, and compounds in both natural and synthetic processes.
    - Develop models (*e.g., in the form of diagrams, drawings, physical replicas, mathematical representations, analogies, and/or computer simulations*) to represent the transfer or sharing of electrons:
        - Use design criteria to create models to represent the transfer or sharing of electrons.
        - Use multiple types of models to represent the transfer or sharing of electrons.
        - Develop models to show the movement of electrons from one atom to another based on electronegativity changes.
        - Develop models to show the differences between ionic and covalent bonding using the sharing/transfer of electrons between molecules.
        - Evaluate the merits and limitations of model types in order to select or revise a model that best fits the evidence or design criteria.

- Use models to predict the formation of ions, molecules, and compounds in both natural and synthetic processes:
    - Use models to describe the differences between natural and synthetic processes of ion formation.
    - Use models to predict and explain which atoms will form which types of ions.

- Essential HS.P1U1.3 Ask questions, plan, and carry out investigations to explore the cause and effect relationship between reaction rate factors.
    - Ask questions to explore the cause and effect relationship between reaction rate factors:
        - Ask questions that arise from careful observation of reaction rate phenomena.
        - Ask questions that require relevant empirical evidence to answer.
        - Ask and evaluate questions to identify the factors that affect the speed at which a reaction proceeds.
    - Plan investigations individually and/or collaboratively to explore the cause and effect relationship between reaction rate factors:
        - Ask testable questions regarding relationships between independent and dependent variables.
        - Select appropriate variables to illustrate the importance of temperature, surface area, volume, concentration, and/or catalysts on the rates of reactions.
        - Consider possible confounding variables or effects and evaluate the investigation's design to ensure variables are controlled.
        - Determine the data (*e.g., types, amount, and accuracy*) needed to produce reliable measurements of the relationship between reaction rate factors.
        - Select appropriate tools to collect, record, analyze, and evaluate data about reaction rate factors.
        - Consider limitations on the precision of the data (*e.g., number of trials, cost, risk, time*), and refine the design accordingly.
    - Conduct investigations individually and collaboratively to explore the cause and effect relationship between reaction rate factors:
        - Conduct investigations in a safe and ethical manner including considerations of environmental, social, and personal impacts.
        - Use data from the investigation to identify and analyze cause and effect relationships between reaction rate factors.
        - Use evidence from the investigation to describe the significance of reaction rates in chemical processes.
        - Make quantitative and qualitative claims regarding the relationship between reaction rate factors.
        - Explain how reaction mechanisms affect the rate of a reaction.

- Plus HS+C.P1U1.4 Develop and use models to predict and explain forces within and between molecules.
    - Develop models (*e.g., in the form of diagrams, drawings, physical replicas, mathematical representations, analogies, and/or computer simulations*) to represent forces within and between molecules:
        - Use design criteria to create models to represent intermolecular forces.
        - Use multiple types of models to represent intermolecular forces.
        - Evaluate the merits and limitations of chemical models for looking at intramolecular forces.
        - Compare the strength of forces within molecules using bond energy.
    - Use evidence from models to predict and explain forces within and between molecules:
        - Use models to generate data to predict the relative strength between types of intermolecular forces using macroscopic properties.
        - Use models to predict the intermolecular forces expected within molecules using models of bonding and geometries of molecules.
        - Use models to explain the relationship between intermolecular force strength and physical properties.
        - Use models to explain the relationship between intermolecular force strength, molecular shape, and physical properties.

- Plus HS+C.P1U1.5 Plan and carry out investigations to test predictions of the outcomes of various reactions, based on patterns of physical and chemical properties.
  - Plan investigations to test predictions of the outcomes *(e.g., energy, pH, solubility, products, precipitate, color change, gas formation, oxidation/reduction*) of various reactions based on physical states of matter:
    - Ask testable questions regarding the outcomes of various types of chemical reactions.
    - Frame a hypothesis in response to the testable question based on a model or theory.
    - Select appropriate variables and controls.
    - Consider possible confounding variables or effects and evaluate the investigation's design to ensure variables are controlled.
    - Determine the data *(e.g., types, amount, and accuracy)* needed to produce reliable observations in order to determine the type of chemical reaction.
    - Select appropriate tools to collect, record, and analyze the products created in various types of chemical reactions.
  - Conduct investigations individually and collaboratively to test predictions of the outcomes of various reactions:
    - Conduct investigations in a safe and ethical manner including considerations of environmental, social, and personal impacts.
    - Gather evidence to support explanations about why certain products are created in reactions.
    - Use data from the investigation to identify and analyze the outcomes *(e.g., energy, pH, solubility, products, precipitate, color change, gas formation, oxidation/reduction)* of various reactions.
    - Use data from the investigation to evaluate hypotheses about properties of chemicals.
    - Make quantitative and qualitative claims regarding outcomes of various reactions, based on patterns of physical and chemical properties.
    - Determine if a chemical reaction is endothermic or exothermic based on data analysis.

- Plus HS+C.P1U1.6 Construct an explanation, design a solution, or refine the design of a chemical system in equilibrium to maximize production.
  - Construct explanations based on evidence obtained from a variety of sources *(e.g., scientific principles, models, theories, simulations)* of a chemical system in equilibrium:
    - Use calculations of the equilibrium constant for reactions to explain equilibrium in a chemical system.
    - Use evidence to explain the factors (concentration, temperature, pressure) that can shift equilibrium.
    - Use Le Chatelier's principle and evidence to explain shifts in equilibrium in multiple directions.
    - Revise explanations based on data *(e.g., collected in experiments)* or peer review about shifting equilibrium.
  - Design a solution to maximize production of a chemical system in equilibrium:
    - Define the design problem, identifying the complexity of the system, criteria for success, and constraints that may include social, technical and/or environmental considerations.
    - Determine the best method to shift equilibrium given a specific reaction to maximize products.
    - Communicate designs through sketches, drawings, or physical models.
  - Refine the design of a chemical system in equilibrium to maximize production:
    - Ask and evaluate questions that challenge the suitability of the design.
    - Test the design *(e.g., using criteria or simulations)* to identify failure points or improve performance relative to criteria for success.
    - Use peer feedback, design criteria, and constraints to make refinements to the designed system to increase the amount of product and describe the reasoning behind design decisions.

- Plus HS+C.P1U1.7 Use mathematical models and computational thinking to determine stoichiometric relationships between reactants and products in chemical reactions.
  - Use models to balance a chemical reaction using proper coefficients and subscripts.
  - Model the ratios between chemical reactions and the conservation of mass.
  - Calculate in moles the amount of each reactant that was used up.
  - Calculate in moles the amount of product that was produced.
  - Make qualitative and quantitative claims regarding the relationship between reactants and products.
  - Use a model to describe the concept of a limiting reactant and how it affects the amount of product produced in a reaction.
  - Use computational thinking to explain theoretical and actual yield.
  - Use computational thinking to predict grams of product given grams of reactant.
  - Create a model to analyze relationship between units (moles, mass, and volume).

PHYSICAL SCIENCE: NUCLEAR PROCESSES AND APPLICATIONS OF CHEMISTRY

- Essential HS.P1U3.4 Obtain, evaluate, and communicate information about how the use of chemistry related technologies have had positive and negative ethical, social, economic, and/or political implications.
  - Obtain information about the positive and negative implications (*i.e., ethical, social, economic, and/or political*) of the use of chemistry related technologies:
    - Ask questions to frame the collection of information.
    - Gather information from a variety of sources (*e.g., texts, investigations, media, data sets, models, etc.*) in response to the investigative questions.
    - Determine the central ideas or conclusions of a complex scientific text.
    - Summarize and paraphrase complex concepts, processes, or information about the implications of the use of chemistry-related technologies.
  - Evaluate information about the positive and negative implications (*i.e., ethical, social, economic, and/or political*) of the use of chemistry related technologies:
    - Verify data across texts.
    - Use scientific reasoning to evaluate the validity and reliability of information regarding positive and negative implications of the use of chemistry related technologies.
  - Communicate information about the positive and negative implications (*i.e., ethical, social, economic, and/or political*) of the use of chemistry related technologies:
    - Produce scientific/technical writing and/or oral presentations (*e.g., blog post, newspaper column, position paper, poster, Socratic Seminar*) that communicate the cause and effect relationships between chemistry related technologies and their ethical, social, economic, and/or political implications.
    - Compare, integrate, and evaluate multiple sources of information presented in different media or formats *(e.g., visually, quantitatively*) in order to describe the positive and negative implications of the use of chemistry related technologies.

- Plus HS+C.P1U3.8 Engage in argument from evidence regarding the ethical, social, economic, and/or political benefits and liabilities of fission, fusion, and radioactive decay.
  - Evaluate arguments regarding the ethical, social, economic, and/or political benefits and liabilities of fission, fusion, and radioactive decay:
    - Critique and evaluate competing arguments about the benefits and liabilities of fission, fusion, and radioactive decay.

    - Evaluate the claims, evidence, and reasoning of oral and/or written arguments to determine merits of arguments and elicit elaboration from peers.
    - Evaluate ethical, social, economic, and/or political perspectives of fission, fusion, and radioactive decay.
    - Evaluate the evidence and reasoning behind current applications of fission, fusion, and radioactive decay.
- Construct, use, and present oral and written arguments regarding the ethical, social, economic, and/or political benefits and liabilities of fission, fusion, and radioactive decay:
    - Make and defend a claim about the benefits and liabilities of fission, fusion, and radioactive decay.
    - Develop and support the claim with analysis of ethical, social, economic, and/or political perspectives of fission, fusion, and radioactive decay.
    - Construct a counter-argument that is based on data and evidence that challenges another proposed argument.
    - Use scientific evidence to develop and support the claim.

EARTH AND SPACE SCIENCE: EARTH'S SYSTEMS

- ESSENTIAL HS.E1U1.13 Evaluate explanations and theories about the role of energy and matter in geologic changes over time.
    - Apply scientific reasoning, theory, and models to evaluate explanations and theories about the role of energy and matter in geologic changes over time:
        - Identify and explain examples of evidence that support scientific theories that Earth has evolved over geologic time due to natural processes.
        - Explain the mechanisms of heat transfer *(i.e., convection, conduction, radiation)* in a chemical system and then correlate it to the Earth's core and mantle, and why heat transfer is important for the layers of the Earth.
        - Connect Bowen's Reaction Series to the chemical evolution of the continental and oceanic crust composition.
        - Compare and evaluate scientific information and theories to explain the relationships between the different forms of carbon and how they are related.
        - Base causal explanations on valid and reliable empirical evidence from multiple sources that geologic processes that happened in the past can be explained by those same processes that are happening today (uniformitarianism) (*e.g., Japanese war balloon situation).*

EARTH AND SPACE SCIENCE: EARTH'S SYSTEMS

- ESSENTIAL HS.E2U1.15 Construct an explanation based on evidence to illustrate the role of nuclear fusion in the life cycle of a star.
    - Construct explanations based on evidence obtained from a variety of sources *(e.g., scientific principles, models, theories, simulations)* about the role of nuclear fusion in the life cycle of a star:
        - Apply scientific knowledge and evidence to illustrate and/or model the life cycle of a star *(e.g., nebula, protostar, main sequence, etc.).*
        - Apply scientific knowledge and evidence to describe the role of nuclear fusion in the star's core to release energy.
        - Revise explanations based on evidence obtained from a variety of sources and peer review.

PROFESSIONAL SKILLS: PROFESSIONALISM & ORGANIZATIONAL CULTURE

- Demonstrate professionalism in the workplace (being on time, proper dress, courteousness).
- Represent the school [organization] in a positive manner, demonstrating the school's [or organization's] mission and core

values.

- Demonstrate respect for personal and professional boundaries (distinguish between personal and work-related matters).
- Interact respectfully with others; act with integrity.
- Produce high quality work that reflects professional pride and contributes to organizational success.
- Take initiative to develop skills and improve work performance.
    - Communicate the mission and core values of the school [or organization].
    - Follow protocol(s) related to behavior, appearance, and other expectations.
    - Perform my work with a positive attitude.
    - Explain the importance of "dress for success."
    - Demonstrate proper etiquette for introductions with clients.
    - Create work products in a timely manner that are high quality and positively represent the organization.
    - Identify and apply strategies to improve my performance.

PROFESSIONAL SKILLS: COMPLEX COMMUNICATION (TRADITIONAL AND DIGITAL)

- Communicate effectively in a diverse work environment *(i.e., style, format, and medium appropriate to audience/culture/generation, purpose and context; accuracy; use of appropriate technical/industry language; to resolve conflicts; address intergenerational differences/challenges; persuade others).*
- Use documentation *(e.g., itineraries and schedules)* to plan and meet client needs.
- Use appropriate technologies and social media to enhance or clarify communication.
- Use a variety of interpersonal skills, including tone of voice and appropriate physical gestures (for example: eye contact, facing the speaker, active listening) during conversations and discussions to build positive rapport with others.
- Pose and respond to questions, building upon others' ideas in order to enhance the discussion; clarify, verify, or challenge ideas and conclusions with diplomacy.
    - Use appropriate verbal and nonverbal modes of communication.
    - Proof and edit all communications based on [organizational] standards.
    - Verify the accuracy of information and authority of sources.
    - Respond in a timely manner to communications.
    - Address communications in a style that is appropriate to the audience and situation.
    - Use professional etiquette and follow applicable laws and regulations for web-, email-, and social media-based communications.
    - Demonstrate appropriate active listening skills.
    - Ask questions to obtain accurate information.

PROFESSIONAL SKILLS: INITIATIVE AND SELF-DIRECTION

- Apply the skills and mindset of self-direction/self-regulation to accomplish a project.
- Adapt to organizational changes and expectations while maintaining productive and cooperative relationships with colleagues.
- Select and use appropriate technologies to increase productivity.
- Employ leadership skills that build respectful relationships and advance the organization *(e.g., recognize and engage individual strengths, plan for unanticipated changes, pursue solutions/improvements).*
    - Establish priorities and set challenging, achievable goals.
    - Create a plan with specific timelines for completion to achieve the goals.

- Take initiative to select strategies, resources and/or learning opportunities to accomplish the task(s) in the plan.
- Identify the success criteria/metrics to determine the effectiveness of the outcome for each goal.
- Monitor my progress/productivity and self-correct during the learning process.
- Persist when faced with obstacles or challenges.
- Reflect upon my learning (strengths and weaknesses) and use feedback to modify work or improve performance.
- Use appropriate technology tools and resources to create and deliver a product.

PROFESSIONAL SKILLS: CRITICAL THINKING AND INNOVATION

- Identify problems and use strategies and resources to innovate and/or devise plausible solutions.
- Take action or make decisions supported by evidence and reasoning.
- Transfer knowledge/skills from one situation/context to another.
  - Use relevant criteria to eliminate ineffective solutions or approaches and select those that are plausible; put selected alternatives through trials to determine their helpfulness or benefit.
  - Evaluate sources of evidence, the accuracy and relevance of information, and the strengths of arguments.
  - Demonstrate ethical reasoning and judgment by clearly sharing multiple perspectives on why the proposed course of action is ethically the best decision.
  - Identify factors that affect one's objectivity or rationality *(e.g., prejudices, disposition, etc.).*
  - Apply my knowledge and skills in new contexts.

PROFESSIONAL SKILLS: COLLABORATION

- Take responsibility for any role on a team and accurately describe and perform the duties of each role, including leadership.
- Integrate diverse ideas, opinions, and perspectives of the team and negotiate to reach workable solutions.
- Prioritize and monitor individual and team progress toward goals, making sufficient corrections and adjustments when needed.
- Submit high-quality products that meet the specifications for the assigned task.
- Utilize technologies that promote collaboration and productivity, as appropriate.
  - Assess project needs and work with a team in a positive manner to create a final project.
  - Contribute personal strengths to a project.
  - Respect contributions of others.
  - Build team relationships.
  - Proactively solicit feedback; accept and show appreciation for constructive feedback.
  - Act upon feedback to achieve team goals.
  - Critique and reflect on individual and collaborative strengths and weaknesses.
  - Develop a plan for improving individual participation and group productivity.

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