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| **Overall Expectations** | | **Specific Expectations** |
| A1. Demonstrate scientific investigation skills (related to both inquiry and research) in the four areas of skills (initiating and planning, performing and recording, analysing and interpreting, and communicating)  B3. Demonstrate an understanding of the structures and functions of biological molecules, and the biochemical reactions required to maintain normal cellular function  B2. Investigate the chemical structures, functions, and chemical properties of biological molecules involved in some common cellular processes and biochemical reactions  B1. Analyse technological applications of enzymes in some industrial processes, and evaluate technological advances in the field of cellular biology | | A1.1 Formulate relevant scientific questions about observed relationships, ideas, problems, or issues, make informed predictions, and/or formulate educated hypotheses to focus inquiries or research  A1.2 Select appropriate instruments (e.g., sampling instruments, a microscope, a stethoscope, dissection instruments) and materials (e.g., dichotomous keys, computer simulations, plant cuttings), and identify appropriate methods, techniques, and procedures, for each inquiry  A1.4 Apply knowledge and understanding of safe laboratory procedures when planning investigations by correctly interpreting Workplace Hazardous Materials Information System (WHMIS) symbols; by using appropriate techniques for handling and storing laboratory equipment and materials and disposing of laboratory and biological materials (e.g., preserved specimens); and by using appropriate personal protection  A1.12 Use appropriate numeric, symbolic, and graphic modes of representation, and appropriate units of measurements (e.g., SI units, imperial units)  B3.2 Describe the structure of important biochemical compounds, including carbohydrates, proteins, lipids, and nucleic acids, and explain their function within cells  B3.4 Describe the chemical structures and mechanisms of various enzymes  B2.5 Plan and conduct an investigation related to a cellular process (e.g., factors that affect enzyme activity; factors that affect transport of substances across cell membranes), using appropriate laboratory equipment and techniques, and report the results in an appropriate format  B1.1 Analyse technological applications related to enzyme activity in the food and pharmaceutical industries (e.g., the production of dairy products; bread-making; the use of enzymes to control reaction rates in pharmaceuticals) |
| **Concepts** | | |
| **Terminology** | | **Theory** |
| * pH * Enzyme * Temperature * Coagulation | * Acid * Base * Macromolecule * Protein | * Acids and bases * Enzymes * Denaturation factors for proteins |
| **Material to prepare** | | |
| Scenario   * Copy of activity * Copy of evaluation grid   Activity   * Computer for research and planning protocol * Material according to the type of evaluation suggested  |  |  | | --- | --- | | Material | Perishable | | Graduated pipette 0.5 and 1.0 ml  Dropper  Hot plate + beaker or heating bath  Thermometer  Test tube or 20 ml test tube  Stopwatch  Test tube holder  pH paper or pH meter  Funnel  Cheesecloth or filter paper  Spatula  Graduated cylinder | Animal rennet  Vegetable rennet  Chymosin produced by fermentation  Lemon juice  Acetic acid 5%  Sodium bicarbonate solution 5%  10% cream  Whole milk  0% milk  Ice  Distilled water  Parafilm |   Pushing further   * Computer for analysis and report | | |
| **Scenario**   * Video, steps of cheese production: curdling, enzyme action * Raw materials needed to make cheese * Presentation of the work * Research and selection of the variable to study | | |
| **Activity — part 1 — Planning**   * Group the students. * Divide the work tables according to the selected variables * Students complete the laboratory protocol. [hypothesis, material and method] * Approve the protocol before lab day   **Activity — part 2 — Experience**   * Make sure the students follow the approved instructions | | |
| **Pushing further**  Pool the results to determine the criteria to combine in order to achieve the best yield  Conduct a verification laboratory to verify the choice of optimal coagulation factors | | |
| **Evaluation**   * Summative: writing in the material and method section * Summative: laboratory work — laboratory report | | |
| **Ressources**   * Protocol example * Equipment supplier   Internet   * [Replacing chemical preservatives with functional biofilm with antiviral, antioxydant and bioreactive properties.](https://www.cbc.ca/news/canada/nova-scotia/cape-breton-researchers-looking-into-plastic-that-kills-covid-19-1.5633150)   [[*https://www.cbc.ca/news/canada/nova-scotia/cape-breton-researchers-looking-into-plastic-that-kills-covid-19-1.5633150*](https://www.cbc.ca/news/canada/nova-scotia/cape-breton-researchers-looking-into-plastic-that-kills-covid-19-1.5633150)*]*   * [Biofilm](https://innovateurscanadiensenalimentation.ca/projet/a-la-recherche-d-une-solution-naturelle-contre-la-presence-d-agents-pathogenes-et-de-bacteries-de-contamination-dans-les-produits-de-volaille-et-de-legumes-surgeles)[<https://canadianfoodinnovators.ca/project/in-search-of-a-natural-solution-against-spoilage-bacteria-and-pathogens-in-poultry-and-frozen-vegetable-products>] | | |