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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) A2. Identify and describe careers related to the fields of science under study, and describe the contributions of scientists, including Canadians, to those fields. C2. Investigate the physical and chemical properties of organic compounds, and analyse some common organic chemical reactions C1. Evaluate the impact on society, human health, and the environment of products made using organic compounds  | 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 A1.7 Select, organize, and record relevant information on research topics from a variety of appropriate sources, including electronic, print, and/or human sources, using suitable formats and an accepted form of academic documentationA1.8 Synthesize, analyse, interpret, and evaluate qualitative and/or quantitative data to determine whether the evidence supports or refutes the initial prediction or hypothesis and whether it is consistent with scientific theory; identify sources of bias and/or error; and suggest improvements to the inquiry to reduce the likelihood of error A1.12 Use appropriate numeric, symbolic, and graphic modes of representation, and appropriate units of measurements A1.11 Communicate ideas, plans, procedures, results, and conclusions orally, in writing, and/or in electronic presentations, using appropriate language and a variety of formats A2.1 Identify and describe a variety of careers related to the fields of science under study and the education and training necessary for these careers C2.7 Conduct an inquiry to synthesize a common organic compound C1.2 Research a useful product made from one or more organic substances, and assess the environmental impact of the production, use, and disposal of the product C1.1 Identify various materials and products used in everyday life that are made from organic compounds and assess the benefits of those products for society, as well as the health hazards they pose  |
| **Concepts** |
| **Terminology** | **Theory** |
| * Enzyme
* Temperature
* Coagulation
 | * Organic molecules
* Polymer
* Plastic
 | * Hydrocarbon
* Organic molecules
* Functional grouping
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| **Material to prepare**  |
| * Context
* Copy of activity
* Copy of assessment grid
* Activity
* Material according to the types of evaluation offered

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| Material/Perishable |
| Part A |
| – Potato starch – HCl 0.1 M– NaOH 0.1 M– 50% glycerol solution in water– 1% solution of cochineal red– Erlenmeyer flask 100 mL– Magnetic heating plate + magnet bar | – Petri dish– Test tube 25 mL– Test tube 10 mL (2)– Spatula– Small beaker 50 mL (6)– Temperature probe |
| Part B |
| * 500 mL milk
* 1 beaker of 1L
* 60 mL acetic acid
* Graduated cylinder
* Erlenmeyer flask 1000 mL

- Magnetic heating plate + magnet bar | * Filter
* Filter paper
* Funnel
* Petri dish
* Pliers
 |
| Part C |
| Material to be determined according to the methods developed by the students Example of material* Flexibility: [malleability] burner, warm water bath
* Resistance: universal holder, rope, weight, force table…
* Impermeability: water bath, stopwatch, scale…
* Lightness: overflow vessel, scale,
 |

* Pushing further
* Computer for analysis and report
* Same material as part B with different milks
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| **Context*** Present a video or an article on plastic production
* **Du pétrole au plastique** [<https://www.youtube.com/watch?v=P9UvzH02o-A> ]
* **Comment c’est fait, Les sacs de plastique** [<https://www.youtube.com/watch?v=ofs2xm9omH8>]
* Discuss the characteristics of plastics. [resistance, flexibility, lightness, impermeability] and how to evaluate these characteristics.
* Presentation of lab work
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| **Activity — part 1 — Writing of evaluation methods for the characteristics of plastics*** Flexibility, resistance, impermeability, lightness

**Activity — part 1 — Experiment** * Group the students
* Students complete the lab protocol.

**Activity — part 2 — Experiment*** Group students according to the variables selected.
* Ensure students follow approved directions.

**Activity — part 3 — Evaluation of the characteristics of plastics*** Ensure student protocols have been validated
* Obtain necessary materials according to established procedures
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| **Pushing further**– Teams work with different types of milk [skim, 1 %, 2 %, 3.25 %, 5 % cream…]– Pool the results of the different teams to determine which type of milk offers the best bioplastic– Research the composition of different milks to explain the different characteristics of the plastics– You can also create a lactic acid polymer by following the protocol below

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| * lactic acid
* concentrated sulphuric acid
* 250 mL plastic beaker (to prevent the polymer from sticking to the walls)
* 50 mL glass beaker
* 10 mL measuring cylinder
* hot plate
* thermometer
* pH paper
* glass rod
 | * Measure and pour 10 mL of pure lactic acid into a plastic beaker.
* Add a few drops of sulphuric acid.
* Heat by gradually raising the temperature to 110°C.
* Shake regularly for 30 min. Allow to cool.
* The lactic acid polymer solidifies and remains transparent.

*NOTE: use safety gloves and goggles* |

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| **Assessment** * Summative: lab work — Evaluation method for characteristics — lab report
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| **Resources*** Example of protocol — polymer lab
* Lab report assessment grid
* Lab work assessment grid
* Material supplier
* Internet
* [Accros au plastique](https://plus.lapresse.ca/screens/1ea2e0ef-3ada-49f0-bd66-7c40cae394eb__7C___0.html) *[*[*https://plus.lapresse.ca/screens/1ea2e0ef-3ada-49f0-bd66-7c40cae394eb\_\_7C\_\_\_0.html*](https://plus.lapresse.ca/screens/1ea2e0ef-3ada-49f0-bd66-7c40cae394eb__7C___0.html)*]*
* [Peut-on se passer des plastiques](https://synchronex.ca/nouvelles/peut-on-se-passer-des-plastiques-dans-lemballage%E2%80%89/) *[*[*https://synchronex.ca/nouvelles/peut-on-se-passer-des-plastiques-dans-lemballage%E2%80%89/*](https://synchronex.ca/nouvelles/peut-on-se-passer-des-plastiques-dans-lemballage%E2%80%89/) *]*
* The 100% biodegradable packaging is coming soon *[*[*https://www.bpkpackaging.com/2018/09/05/the-100-biodegradable-packaging-is-coming-soon/*](https://www.bpkpackaging.com/2018/09/05/the-100-biodegradable-packaging-is-coming-soon/)*]*
* [4 innovations de l’industrie agroalimentaire](https://www.cartoffset.com/4-innovations-de-lindustrie-agroalimentaire-pour-reduire-le-plastique-dans-nos-emballages/)  *[*[*https://www.cartoffset.com/4-innovations-de-lindustrie-agroalimentaire-pour-reduire-le-plastique-dans-nos-emballages/*](https://www.cartoffset.com/4-innovations-de-lindustrie-agroalimentaire-pour-reduire-le-plastique-dans-nos-emballages/)*]*
* Innovating dairy packaging until the cows come home [*[*](https://tctranscontinental.com/fr-ca/emballages/marches/fromages-et-produits-laitiers)[*https://tctranscontinental.com/en-us/packaging/markets/cheese-dairy*](https://tctranscontinental.com/en-us/packaging/markets/cheese-dairy)*]*
* [Bioplastique et plastique fossile](https://fliphtml5.com/mjnth/edzm/basic) *[*[*https://fliphtml5.com/mjnth/edzm/basic*](https://fliphtml5.com/mjnth/edzm/basic)*]*
* [Les résidus de filtration](https://www.laterre.ca/du-secteur/formation/les-residus-de-filtration-du-lait-valorises) *[*[*https://www.laterre.ca/du-secteur/formation/les-residus-de-filtration-du-lait-valorises*](https://www.laterre.ca/du-secteur/formation/les-residus-de-filtration-du-lait-valorises)*]*
* [Bioplastique Lactips](https://www.agro-media.fr/tag/bioplastique) *[*[*https://www.agro-media.fr/tag/bioplastique*](https://www.agro-media.fr/tag/bioplastique)*]*
* Un plastique compostable fait de déchets *[*[*https://novae.ca/un-plastique-compostable-fait-de-dechets/*](https://novae.ca/un-plastique-compostable-fait-de-dechets/)*]*
* Milk-based plastics plastics to reduce environmental damage*[*[*https://cordis.europa.eu/article/id/254165-milkbased-plastics-plastics-to-reduce-environmental-damage*](https://cordis.europa.eu/article/id/254165-milkbased-plastics-plastics-to-reduce-environmental-damage)*]*
* [Du bioplastique made in Québec](https://unpointcinq.ca/economie/bioplastique-compostable-quebec/) *[*[*https://unpointcinq.ca/economie/bioplastique-compostable-quebec/*](https://unpointcinq.ca/economie/bioplastique-compostable-quebec/)*]*
* [Les bioplastiques biodégradables](https://www.emballagesmagazine.com/mediatheque/2/9/0/000035092.pdf) *[*[*https://www.emballagesmagazine.com/mediatheque/2/9/0/000035092.pdf*](https://www.emballagesmagazine.com/mediatheque/2/9/0/000035092.pdf)*]*
* [Remplacer les agents de conservation chimiques par un biofilm fonctionnel aux propriétés antimicrobiennes, antioxydantes et bioréactives.](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)*]*
* In search of a natural solution against spoilage bacteria and pathogens in poultry and frozen vegetable products [<https://canadianfoodinnovators.ca/project/in-search-of-a-natural-solution-against-spoilage-bacteria-and-pathogens-in-poultry-and-frozen-vegetable-products>]
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