Objective:
To test the presence of organic molecules by using different chemicals.

1. Carbohydrate
   - Sugars will react to Benedict’s reagent (blue colour). The substance that contains sugar will turn into green to red colour.
   - Starch will react to iodine solution (yellowish-brown). The colour change is blue-black.

2. Proteins
   - Proteins or peptides will react to Biuret reagent (blue colour). In the presence of protein molecules, the reagent changes colour to purple.

3. Lipids
   - To test for the lipids, use a paper that fats and oils have been exposed onto: fats and oils will not evaporate and will leave oily spot behind. Absolute ethanol can be used to test for lipids too. When absolute ethanol is added into fats and oils, it will turn the solution white with homogenous mixture (emulsification).

Materials:
- Samples of water, glucose solution, starch solution, gelatin solution, diluted milk, onion + water, potato + water, and 3 unknown samples
- Testing reagents: Benedict solution, Biuret solution, iodine solution, and absolute ethanol
- 300mL and 500mL beakers
- Test tubes, and labeled A and B test tubes for lipid test
- Test tube rack
- magnetic stirrer
- hot plate

Procedures (Carbohydrates and Proteins):
1) Fill 300mL of water into the 500ml beaker with a magnetic stirrer. Place the beaker on the hot plate. (DO NOT TURN ON THE HOTPLATE UNTIL TOLD).
2) Ask an instructor or a lab technician to show you how to use a hot plate. Turn on the hot plate and the stirrer to the instructed levels.
3) Make labels (using the abbreviations) on provided marking tape to be placed on the outside of each test tube.
4) Apply the label on each test tube, and arrange the test tube on the rack.
5) Put on protective gloves and a goggle (for members who will be dealing with chemicals).
6) Add approximately 1cm of each sample according to the label. Do NOT forget to arrange the test tube.

   6.1 In total you should have 3 tubes of each of the following samples
       6.1.1 Water à negative controls
       6.1.2 Glucose solution (Monosaccharide) -> positive controls for Benedict’s solution
6.1.3 Starch solution (Polysaccharide) -> positive controls for iodine solution
6.1.4 Gelatin solution (Protein) à positive controls for Biuret solution
6.1.5 Diluted milk
6.1.6 3-4 pieces of diced onion + water
6.1.7 3-4 pieces of diced potato + water
6.1.8 Unknown1
6.1.9 Unknown2
6.1.10 Unknown3

7) In ROW1: Add 5 drops of Biuret solution into each of the sample.
   7.1 Gently swirl the test tube around so that the solution is evenly spread out in the test tube.
   7.2 Observe and take note any color change in the result section.

8) In ROW2: Add 5 drops of Iodine solution into each of the sample.
   8.1 Gently swirl the test tube around so that the solution is evenly spread out in the test tube.
   8.2 Observe and take note any color change in the result section.

9) In ROW3: Add 5 drops of Benedict’s solution into each of the sample.
   9.1 Gently swirl the test tube around so that the solution is evenly spread out in the test tube.
   9.2 Use the beaker tong to transfer the test tube ONE AT A TIME into the boiling water in the beaker for around 3-5 minutes.
   9.3 Observe and take note any color change in the result section.

10) Turn of the hot plate and stirrer. Be careful not to touch the hot plate as it will remain hot for a long time.
11) Once you have finished the experiment, please help remove the marking tape on the test tubes.
12) Continue to the next part of the experiment.

**Procedures (Lipids):**
1) Collect two test tubes labeled A&B from your instructor.
2) Unscrew the cap of the tube
3) Add approximately the same amount of absolute ethanol into each tube.
   **CAUTION: Absolute ethanol in highly flammable, DO NOT POUR absolute ethanol NEAR THE HOT PLATE. Failure to follow this rule will result in 10% deduction from lab report score**
4) Screw the cap back on tightly.
5) Shake each tube vigorously. Observe the change and record the findings in the results section.
6) Call your instructor to show you the brown-paper test and record the findings in the results section.
Results:

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Water</th>
<th>Glucose Solution</th>
<th>Starch Solution</th>
<th>Gelation Solution</th>
<th>Diluted milk</th>
<th>Onion + Water</th>
<th>Potato + Water</th>
<th>Unknown 1</th>
<th>Unknown 2</th>
<th>Unknown 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROW1</td>
<td>Benedict’s solution</td>
<td>Blue No Change</td>
<td>Blue-Bright Orange</td>
<td>Blue No Change</td>
<td>Purple No Change</td>
<td>Blue-Yellow</td>
<td>Clear Green-Yellow</td>
<td>Clear Yellow</td>
<td>No Change</td>
<td>Blue-Bright Orange</td>
</tr>
<tr>
<td>ROW2</td>
<td>Iodine solution</td>
<td>Yellow No Change</td>
<td>Yellow-No Change</td>
<td>Yellow-Blue Black</td>
<td>Yellow No Change</td>
<td>Yellow-Blue Black</td>
<td>Yellow No Change</td>
<td>Yellow No Change</td>
<td>Yellow No Change</td>
<td>Yellow No Change</td>
</tr>
<tr>
<td>ROW3</td>
<td>Biuret solution</td>
<td>Blue No Change</td>
<td>Blue No Change</td>
<td>Blue-Purple</td>
<td>Blue-Purple</td>
<td>Blue-Yellow</td>
<td>Blue-No Change</td>
<td>Blue-Purple</td>
<td>Blue-No Change</td>
<td>Blue-No Change</td>
</tr>
</tbody>
</table>

Emulsification

<table>
<thead>
<tr>
<th>Tube</th>
<th>With Ethanol</th>
<th>Without Ethanol</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Opaque</td>
<td>Yellow</td>
</tr>
<tr>
<td>B</td>
<td>Clear</td>
<td>Clear</td>
</tr>
</tbody>
</table>

Conclusions:

Check your positive and negative controls. Did they display the correct colors? Put down the information for each of the controls (there are 4 in total)

- Water: doesn’t contain any organic molecule because the test tube remains the same color from the beginning.
- Glucose solution: contains only sugar, the result concluded that glucose had high sugar due to the changes of colors from blue to bright orange. On the other hand, the other test tubes remain the same.
- Starch solution: contains only starch, the result concluded that the color from the test tube has changed from yellow to blue black. On the other hand, the other test tubes remain the same.
- Gelatin solution: contains only proteins, the result shows that the color of the test tube has changed from blue to purple. On the other hand, other test tubes remain the same.
- Diluted milk: contains sugars and proteins, the Benedict’s test tube changed from blue to yellow. Moreover, the Biuret’s test tube also changed from blue to purple. But the Iodine test tube remains the same.
- Onion + Water: contains sugars and proteins, the Benedict’s test tube changed from clear green to yellow. Moreover, the Biuret’s test tube also changed from blue to yellow. But the Iodine test tube remains the same.
- Potato + Water contains: sugars and starch, the Benedict’s test tube changed from clear to yellow. The Iodine test tube changed from yellow to blue black. On the other hand, Biuret’s test tube remains the same.
- Unknown1 contains only protein, the result shows that the color of the test tube has changed from blue to purple. On the other hand, other test tubes remain the same.
- Unknown2 contains only sugar, the result concluded that the Benedict’s test tube changed from blue to bright orange. On the other hand, the other test tubes remain the same.
- Unknown3 doesn’t contain any organic molecule because the test tube remains the same color from the beginning.

For the test for lipids, Tube A is oil as tested with absolute ethanol, it became opaque or white. This is because absolute ethanol has both non-polar and polar ends, which allows oils (non-polar) to interact with and be dispersed in water. Tube B is H2O because it didn’t react chemically with the emulsifier.

We consider our lab experiment to be very good as we followed the instructions without any problems and did not make any errors.