

**Module A – “BEEing Informed”**

The chart below offers guidance for scoring the PBA. The scoring guide is to be used as a guide. Tutors may develop their own scoring guide that will fit their situation. Students may answer questions differently than the examples provided in this document. Since students may use online resources, they may copy and paste the answers to questions and not be penalized. Students do not need to complete questions with complete sentences, but must ensure that they have answered the questions. If the question asks for a response, students may respond with one of multiple responses. If it asks for three, students must provide three responses. If there is a *right answer*, it is provided below. If there is a narrative, direction for evaluating whether or not it is satisfactory is also provided.

| Evaluative Factor/Criteria for Presentation       | Scoring Guidance (Answer Key)   |                               |                              |  |           |          |                               |                              |          |                  |     |     |         |  |    |     |
|---|---|-------------------------------|------------------------------|--|-----------|----------|-------------------------------|------------------------------|----------|------------------|-----|-----|---------|--|----|-----|
| <b>TASK 1: Interview with the Biology Teacher</b> |   |                               |                              |  |           |          |                               |                              |          |                  |     |     |         |  |    |     |
| Activity 1: What makes Us Alive?                  | <p>List five characteristics of living things.</p> <p>Answers may vary but should include five of the following:</p> <ol style="list-style-type: none"> <li>1. Living things are composed of cells.</li> <li>2. Living things have different levels of organization.</li> <li>3. Living things use energy.</li> <li>4. Living things respond to their environment.</li> <li>5. Living things grow.</li> <li>6. Living things reproduce.</li> <li>7. Living things maintain homeostasis.</li> </ol>  |                               |                              |  |           |          |                               |                              |          |                  |     |     |         |  |    |     |
| Activity 2: Cell Differences                      | <p>1. Complete the chart by filling in the blanks.</p> <table border="1" data-bbox="709 1112 1774 1461"> <thead> <tr> <th data-bbox="709 1112 976 1214">Organelle</th> <th data-bbox="976 1112 1243 1214">Function</th> <th data-bbox="1243 1112 1509 1214">Is it present in Prokaryotes?</th> <th data-bbox="1509 1112 1774 1214">Is it present in Eukaryotes?</th> </tr> </thead> <tbody> <tr> <td data-bbox="709 1214 976 1279">Ribosome</td> <td data-bbox="976 1214 1243 1279">Produces protein</td> <td data-bbox="1243 1214 1509 1279">Yes</td> <td data-bbox="1509 1214 1774 1279">Yes</td> </tr> <tr> <td data-bbox="709 1279 976 1461">Nucleus</td> <td data-bbox="976 1279 1243 1461"> <p>(Either response is acceptable)</p> <ul style="list-style-type: none"> <li>• Controls cell</li> </ul> </td> <td data-bbox="1243 1279 1509 1461">No</td> <td data-bbox="1509 1279 1774 1461">Yes</td> </tr> </tbody> </table> |                               |                              |  | Organelle | Function | Is it present in Prokaryotes? | Is it present in Eukaryotes? | Ribosome | Produces protein | Yes | Yes | Nucleus | <p>(Either response is acceptable)</p> <ul style="list-style-type: none"> <li>• Controls cell</li> </ul> | No | Yes |
| Organelle   | Function  | Is it present in Prokaryotes? | Is it present in Eukaryotes? |  |           |          |                               |                              |          |                  |     |     |         |  |    |     |
| Ribosome  | Produces protein  | Yes                           | Yes                          |  |           |          |                               |                              |          |                  |     |     |         |  |    |     |
| Nucleus   | <p>(Either response is acceptable)</p> <ul style="list-style-type: none"> <li>• Controls cell</li> </ul>  | No                            | Yes                          |  |           |          |                               |                              |          |                  |     |     |         |  |    |     |

|   |   |   |            |            |
|---|---|---|------------|------------|
|   |   | <b>activities</b> <ul style="list-style-type: none"> <li>• <b>Contains the hereditary material (DNA) of the cell</b></li> </ul>   |            |            |
| <b>Activity 3: How Are You Organized?</b> | <b>Cell membrane</b>  | <b>(Either response is acceptable)</b> <ul style="list-style-type: none"> <li>• <b>Protection</b></li> <li>• <b>Controls movement of materials in/out of cell</b></li> <li>• <b>Barrier between cell and its environment</b></li> <li>• <b>Maintains homeostasis</b></li> </ul> | <b>Yes</b> | <b>Yes</b> |
|   | <ol style="list-style-type: none"> <li>1. Use the word bank to fill in the graphic organizer. <ul style="list-style-type: none"> <li>• Organelles -&gt; cells -&gt; tissues -&gt; organs -&gt; organ systems -&gt; organisms</li> </ul> </li> <li>2. What are the different levels of biological organization in bacteria and humans? (Any of the four responses below are acceptable.) <ul style="list-style-type: none"> <li>• Bacteria are unicellular organisms.</li> <li>• All of the functions required for life are carried out by the single cell.</li> </ul> </li> </ol> |   |            |            |

- Humans are multicellular organisms.
- Cells are organized into tissues, organs, and organ systems that carry out the functions required for life.

## Task 2: Interview With The Local Chef

### Activity 1: Foods for Thought

1. There are four major macromolecule groups found in living things. Name each macromolecule group and list the function of the macromolecule in your body.

| Macromolecule | Function In Your Body   |
|---------------|---|
| Carbohydrates | Supply energy for cell processes  |
| Lipids        | Store and release large amounts of energy   |
| Proteins      | Regulate nearly all chemical reactions in cells   |
| Nucleic Acids | Store coded information in cells<br>Carries information that directs each cell's activities<br>Makes enzymes and other proteins |

### Activity 2: Sugars for Honey

1. Describe how sugar #3 is formed using reactants and products.

Student response must include an understanding of the following:

During dehydration synthesis, two monomers or a polymer and a monomer (as in Sugar#1 and Sugar#2) are bonded together by the removal of a water molecule when forming the covalent bond between them. The products of the reaction are a polymer (as in Sugar#3) and a water molecule.

### Activity 3: Macro-Functions

1. Complete the table below using the word bank.

| Monomer        | Polymer        | Example of Polymer | Function of Polymer |
|----------------|----------------|--------------------|---------------------|
| nucleotide     | nucleic acid   | DNA                | genetic code        |
| monosaccharide | polysaccharide | starch             | energy              |

|  | <table border="1"> <tr> <td><b>amino acid</b></td> <td><b>protein</b></td> <td>hemoglobin</td> <td><b>carries oxygen</b></td> </tr> </table>   | <b>amino acid</b> | <b>protein</b>   | hemoglobin | <b>carries oxygen</b>   |                                |                |                                |                 |
|--|--|-------------------|--|------------|---|--------------------------------|----------------|--------------------------------|-----------------|
| <b>amino acid</b>  | <b>protein</b>   | hemoglobin        | <b>carries oxygen</b>                                  |            |   |                                |                |                                |                 |
| Activity 4: Food for Bees  | <p>1. From the graph, what can you conclude about the function of lipids?</p> <ul style="list-style-type: none"> <li>Lipids have more than twice the amount of energy content than proteins or carbohydrates and therefore they function to provide energy.</li> </ul>   |                   |  |            |   |                                |                |                                |                 |
| Activity 5: Being Busy Making Honey                                | <p>1. Identify the enzyme, the substrate, and any products in the production of honey in the chart below.</p> <table border="1"> <tr> <td>Enzyme</td> <td><b>Invertase</b></td> </tr> <tr> <td>Substrate</td> <td><b>Sucrose</b></td> </tr> <tr> <td>Product in production of honey</td> <td><b>Glucose</b></td> </tr> <tr> <td>Product in production of honey</td> <td><b>Fructose</b></td> </tr> </table>  | Enzyme            | <b>Invertase</b>                                       | Substrate  | <b>Sucrose</b>  | Product in production of honey | <b>Glucose</b> | Product in production of honey | <b>Fructose</b> |
| Enzyme   | <b>Invertase</b>   |                   |  |            |   |                                |                |                                |                 |
| Substrate  | <b>Sucrose</b>   |                   |  |            |   |                                |                |                                |                 |
| Product in production of honey                                     | <b>Glucose</b>   |                   |  |            |   |                                |                |                                |                 |
| Product in production of honey                                     | <b>Fructose</b>  |                   |  |            |   |                                |                |                                |                 |
| Activity 6: Too Extreme for Bees?                                  | <p>1. How do changes in temperature and pH affect the performance of an enzyme such as invertase?</p> <ul style="list-style-type: none"> <li>Every enzyme has optimal temperature and pH conditions at which they function most efficiently. If these conditions change, then the enzyme will not function optimally.</li> </ul>   |                   |  |            |   |                                |                |                                |                 |
| Activity 7: Water Drops for Honey                                  | <p>1. Name the property that causes water to form a drop and explain how the property causes water to form a drop.</p> <table border="1"> <tr> <th>Name of property</th> <th>Describe how the property causes water to form a drop.</th> </tr> <tr> <td>Cohesion</td> <td>The hydrogen bonds between water molecules is the reason behind two of water's unique properties: cohesion and adhesion. Cohesion refers to the fact that water sticks to itself very easily, forming droplets.</td> </tr> </table> <p>2. Why is a water molecule polar?</p> <ul style="list-style-type: none"> <li>Water molecules have a polar arrangement of oxygen and hydrogen atoms – one side (hydrogen atoms) has a positive electrical charge and the other side (oxygen atom) had a slightly more negative electrical charge. This allows the water molecule to become attracted to other water molecules as well as many other different types of polar molecules, such as sugars.</li> </ul> | Name of property  | Describe how the property causes water to form a drop. | Cohesion   | The hydrogen bonds between water molecules is the reason behind two of water's unique properties: cohesion and adhesion. Cohesion refers to the fact that water sticks to itself very easily, forming droplets. |                                |                |                                |                 |
| Name of property   | Describe how the property causes water to form a drop.   |                   |  |            |   |                                |                |                                |                 |
| Cohesion   | The hydrogen bonds between water molecules is the reason behind two of water's unique properties: cohesion and adhesion. Cohesion refers to the fact that water sticks to itself very easily, forming droplets.  |                   |  |            |   |                                |                |                                |                 |
| <b>Task 3: Interview With A Local Agricultural Extension Agent</b> |  |                   |  |            |   |                                |                |                                |                 |
| Activity 1: Pesticides of the Bees                                 | <p>1. List two ways to prevent bees from being killed by pesticides. (Students should respond using any two of the responses below)</p>  |                   |  |            |   |                                |                |                                |                 |

|                                    |   |
|------------------------------------|---|
|                                    | <ul style="list-style-type: none"> <li>• When using pesticides that are hazardous to bees, notify the beekeeper so that he may move or protect his hives.</li> <li>• Do not apply insecticides that are toxic to bees to crops in bloom.</li> <li>• Use insecticides that are less toxic to bees when such choices are consistent with pest control recommendations (see the table of relative toxicities).</li> <li>• Choose the least hazardous formulations when possible. Dusts and encapsulated insecticides are more toxic than sprays of the same material. Wettable powder sprays tend to have a longer residual effect (and are more toxic) than emulsifiable concentrate sprays. Granular applications are usually the safest method of treatment around bees.</li> <li>• Avoid drift of toxic sprays onto ground-cover plants, weeds, and crops in nearby fields.</li> <li>• Control weeds in fields and avoid direct insecticide applications to flowering weeds whenever possible.</li> <li>• If ground-cover plants in orchards are in bloom, mow before spraying.</li> <li>• Apply insecticides when bees are not actively foraging, either in the late evening or early morning. This is particularly important with crops such as corn where evening applications avoid many problems since pollen release occurs in the morning. In general, evening applications are least hazardous.</li> <li>• Do not apply insecticides when temperatures are expected to be unusually low following treatment. Residues remain toxic to bees for a longer time under such conditions.</li> <li>• Avoid direct treatment over colonies.</li> <li>• Contact beekeepers with nearby colonies before treatment so that they can move the hives or confine the bees if potential bee losses might occur.</li> </ul> |
| <p>Activity 2: Cell Protectors</p> | <p>A. What is the organelle that serves as a barrier for the cell?</p> <ul style="list-style-type: none"> <li>• The cell organelle that serves as a barrier for the cell is the cell membrane.</li> </ul> <p>B. List the three types of macromolecules that comprise the organelle</p> <ul style="list-style-type: none"> <li>• The three macromolecules that comprise the barrier are carbohydrates, proteins and lipids.</li> </ul> <p>C. Responses will vary in detail. Students should respond to include one of the following responses regarding the membrane structure:</p> <ul style="list-style-type: none"> <li>• The cell membrane consists of two layers of phospholipids.</li> <li>• A phospholipid consists of a nonpolar fatty acid tail and a polar phosphate head.</li> <li>• The phospholipids form two layers with their phosphate polar heads facing in opposite directions</li> </ul>  |

- with fatty acid nonpolar tails facing each other between the polar heads.
- The proteins are embedded in the two layers of the phospholipids and are able to span across the two layers of phospholipids.
  - Small non-polar molecules pass easily across the cell membrane.
  - Polar or large molecules are prevented from passing easily across the cell membrane.
  - Proteins assist in the movement of polar or large molecules across the cell membrane.

Activity 3: Deceptive Pesticides

A. Describe the two mechanisms of transport (active and passive) in terms of concentration gradients.

| Mechanism of Transport | Description of Concentration Gradients  |
|------------------------|---|
| Active Transport       | Particles move along (down) the concentration gradient; particles go from an area of higher concentration to lower concentration. |
| Passive Transport      | Passive transport does not require the expenditure of energy whereas active transport requires energy                             |

- B. Write how the energy requirements differ for active transport and passive transport mechanisms.
- Passive transport does not require the expenditure of energy whereas active transport requires energy.

Activity 4: Infiltrating Pesticides

1. Classify each type of transport as passive or active transport by placing an "X" in the appropriate box below.

| Type of Transport     | Passive Transport | Active transport |
|-----------------------|-------------------|------------------|
| Osmosis               | x                 |                  |
| Facilitated diffusion | x                 |                  |

|  |   |           |   |  |
|--|---|-----------|---|--|
|  | <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%; text-align: center; background-color: #cccccc;">Diffusion</td> <td style="width: 33%; text-align: center;">x</td> <td style="width: 33%;"></td> </tr> </table>   | Diffusion | x |  |
| Diffusion  | x   |           |   |  |
| <p>Activity 5: Mapping the Journey of Pesticides</p> | <p>1. Describe the journey of pesticides from the cell membrane to the rough endoplasmic reticulum in the box under the cell. Include the organelles that are an important part of the journey. Note that there will be a variety of responses and you will need to determine the response that is appropriate for your class and setting. One example may include the following:</p> <ul style="list-style-type: none"> <li>• The protein molecule goes through a series of networks. The protein molecule is manufactured in the ribosome on the endoplasmic reticulum membrane. A vesicle forms which will carry the protein to the Golgi apparatus. At the Golgi apparatus, the protein is modified and processed, and then it is tagged to send to the cell membrane. The purpose of the lysosome is to break down the cell membrane back into macromolecules.</li> </ul>  |           |   |  |
| <p>Activity 6: Maintaining a Balance</p>             | <p>A. Define homeostasis and describe its importance.</p> <ul style="list-style-type: none"> <li>• Homeostasis refers to any process that living things use to actively maintain fairly stable conditions necessary for survival.</li> </ul> <p>B. What is one way honeybees maintain homeostasis in the hive and do not die during the winter months?</p> <p>Students should provide an example from the list below.</p> <ul style="list-style-type: none"> <li>• When nectar in the field becomes scarce, the workers drag the drones out of the hive and do not let them return, causing them to starve to death. Eliminating drones reduces the consumption of winter honey stores.</li> <li>• When the temperature drops to 57°F, the bees begin to form a tight cluster. Within this cluster the brood (consisting of eggs, larvae, and pupae) is kept warm about 93°F – with heat generated by the bees.</li> <li>• When the temperature drops to 57°F, the egg laying of the queen bee tapers off and may stop completely during October and November.</li> <li>• As temperatures drop, the bees draw closer together to conserve heat. The outer layer of bees is tightly compressed, insulating the bees within the cluster.</li> </ul> |           |   |  |

|   |  |   |  |   |
|---|--|---|--|---|
|   | <ul style="list-style-type: none"> <li>As the temperature rises and falls, the cluster of bees expands and contracts. The bees within the cluster have access to the food stores.</li> </ul>   |   |  |   |
| <b>Task 4: Interview With A Local Beekeeper</b>   |  |   |  |   |
| Activity 1: Food! Food! Food!   | 1. Describe the flow of energy from the sun to the food you eat.<br><br>Students' response should reflect the following:<br><br>The sun is the source of energy for all life. Plants capture energy from the sun and produce sugars during photosynthesis. The energy in the sugars that are produced during photosynthesis are used in cellular respiration to make energy for the organism, either the producer or the consumer.<br><br>sun → producers → consumers  |   |  |   |
| Activity 2: Being Connected   | 1. Describe the relationship between photosynthesis and respiration below.<br><br><table border="1" data-bbox="709 829 1934 1013"> <tr> <td>Photosynthesis is: uses the energy of sunlight to produce sugars and other organic molecules. It changes solar energy into chemical energy.</td> </tr> <tr> <td>Respiration is: A chemical reaction used to release energy from glucose.</td> </tr> <tr> <td>How are photosynthesis and respiration connected? The products of one reaction become the reactants for the other reaction.</td> </tr> </table> | Photosynthesis is: uses the energy of sunlight to produce sugars and other organic molecules. It changes solar energy into chemical energy. | Respiration is: A chemical reaction used to release energy from glucose. | How are photosynthesis and respiration connected? The products of one reaction become the reactants for the other reaction. |
| Photosynthesis is: uses the energy of sunlight to produce sugars and other organic molecules. It changes solar energy into chemical energy. |  |   |  |   |
| Respiration is: A chemical reaction used to release energy from glucose.  |  |   |  |   |
| How are photosynthesis and respiration connected? The products of one reaction become the reactants for the other reaction.                 |  |   |  |   |
| Activity 3: Plant Food  | A. Name the form in which energy is packaged as a result of cellular respiration <ul style="list-style-type: none"> <li>Energy is packaged in the form of ATP.</li> </ul> B. Give three examples of how bees use this energy for their life processes.<br><br>Students must provide three of the following: <ul style="list-style-type: none"> <li>Flying</li> <li>Clustering</li> <li>Reproducing</li> </ul>  |   |  |   |



|  |  |
|--|--|
|  | <ul style="list-style-type: none"> <li>• Pollinating</li> <li>• Tending the hive</li> <li>• Producing honey</li> </ul>   |
| Activity 4: Shine On Me                                | <p>A. What is the function of chloroplast?</p> <ul style="list-style-type: none"> <li>• The function of the chloroplast is to transform the light energy from the sun to the chemical energy found in food.</li> <li>• Photosynthesis</li> <li>• Absorb sunlight</li> <li>• Provide food for the plant</li> </ul>  |
| Activity 5: The Powerhouse                             | <p>A. What are two functions of the mitochondria that is important for cells?</p> <ul style="list-style-type: none"> <li>• The function of the mitochondria is to transform the chemical energy from sugars or food to the packaged energy the cell uses in the form of ATP.</li> <li>• Perform cellular respiration</li> <li>• Takes in nutrients from the cell</li> </ul>  |
| <b>Task 5: What Is Happening to the Bees and Honey</b> |  |
| Activity 1: Your Conclusion                            | <p>Students may give a number of different responses for the conclusion. They must provide four reasons to support the conclusion. Conclusions and claims will vary and you will need to score the responses based upon the work completed by the student. See example below:</p> <p>Claim – Herbicides do not impact bees</p> <p>Evidence to support claim – Cell membrane prevents the transport of the herbicide into the bees.</p> |