Section #1: Scientific Processes
1. List one safety rule that should be followed at all times when working in a science lab?
   a. __________

2. Biologists have found a connection between the amount of soda pop a person drinks with the length of nail growth. Devise an experiment that will test this statement. You do not need to outline your procedure, just your hypothesis and variables below.
   a. Hypothesis:
       If __________ then __________ because __________
   b. Independent variable: __________
   c. Dependent variable: __________

3. Explain one trend you can extract from this graph:

   "As adults age, the amount of stomach acid decreases."

4. What is this cartoon referring to? Do you use a “control group” in experimentation? Why or why not?

   "All science experiments need a control so that you know what actual is happening due to the experimental variable."

   "Well, I guess we’re the control group.”
Section #2: Animal Cells

1. Label the following organelles:

- Secretory Vesicle
- Nucleus
- Mitochondria

2. Describe what is happening in the below beaker:

A hypertonic solution will cause the water to leave the cell and the cell will shrink.

3. Explain the difference between facilitated transport and active transport:

Facilitated transport requires a protein channel but no ATP. Whereas active transport requires both protein channel + ATP.

4. Draw the phospholipid bilayer of a cell membrane. Label the hydrophilic side, hydrophobic side, glycoproteins, phospholipids, carrier proteins, glycolipids.

5. Carrier molecules that bring materials into cells are
   a. Lipids
   b. Proteins
   c. Glycogen
   d. Phospholipids
1. What are each of the below molecules?

This molecule is a: glucose/monosaccharide
This is a type of carbohydrate

This molecule is a: amino acid
This is a type of protein

This molecule is a: starch
This is a type of carbohydrate

This molecule is a: Glycosidic bond

This molecule is a: RNA
This is a type of nucleic acid
2. Water is considered a polar molecule because the:
   a. oxygen atom has given electrons to the hydrogen atoms
   b. hydrogen atoms have given electrons to the oxygen atoms
   c. oxygen is located on the opposite end of the molecule to the hydrogen atoms
   d. electrons are not shared equally between the oxygen and hydrogen atoms

3. What are the roles that water plays in our body?
   - Lubricate for joints
   - Regulate body temperature
   - Universal solvent

4. When added to a neutral solution, a base will:
   a. increase the hydrogen ion concentration and therefore, increase the pH
   b. increase the hydroxide ion concentration and therefore, decrease the pH
   c. increase the hydrogen ion concentration and therefore, decrease the pH
   d. increase the hydroxide ion concentration and therefore, increase the pH

5. Is pH important in your body? Why or why not?
   pH allows enzyme to function. Enzymes will denature if it is out of pH range. pH is important in our body homeostasis.

6. If the polymer is a protein, what do we call the monomer? **Amino acid**

7. What are two biological functions of proteins?
   a. **Enzymes**
   b. **Hormones**

8. Identify the below biological molecule structure below. List the importance (functions) of each molecule in our body.

   ![Amino Acid Diagram]

   **Name:** Amino acid

   **Functions in our body:**
   - Build structures such as tissue, in cell membranes, hormones, enzymes.

9. What are each of the below molecules?
   a. **Nucleotide**
   b. **Triglyceride**
   c. **Cholesterol**
   d. **Deoxyribose**
10. Outline the three steps in ATP production using a flow chart or diagram. Summarize how much ATP is made in each phase.

11. In the below diagram, what is the name of the enzyme?  

12. Where is the above enzyme produced?  

Section #4: DNA and Protein Synthesis  
1. Draw and label the process of DNA replication.
   a. 3' and 5' ends  
   b. Leading strand  
   c. Single Stranded BP  
   d. Lagging strand  
   e. Okazaki fragments  
   f. Helicase  
   g. DNA polymerase  
   h. Ligase  
   i. Primase  
   j. Primer  
   k. topoisomerase
2. What are three differences between RNA and DNA?
   a. DNA has T, RNA has U
   b. DNA is deoxyribose, but RNA is ribose
   c. DNA is double-stranded, RNA is single-stranded.
      DNA is stuck in nucleus; RNA can leave to cytoplasm.

3. What is recombinant DNA? How do scientists make it?
   - Scientists use a bacterial plasmid (vector) to put desired DNA into a new organism.
   - Use restriction enzymes to cut open plasmid + ligase to close it.

4. DRAW what is happening in the process of protein synthesis in as much detail as possible below. What are important CODES to know for each step of the process. Be as DETAILED as you can about each process:

<table>
<thead>
<tr>
<th>Step #1: Transcription</th>
<th>Step #2: Translation</th>
</tr>
</thead>
<tbody>
<tr>
<td>DNA TATAACCCTACAAT</td>
<td>mRNA GSAUGUUAA ......</td>
</tr>
<tr>
<td>3'</td>
<td>5'</td>
</tr>
<tr>
<td>nucleus</td>
<td>mRNA go to a ribosome</td>
</tr>
<tr>
<td>RNA polymerase reads</td>
<td>tRNA reads the codon</td>
</tr>
<tr>
<td>DNA code</td>
<td>bring the appropriate</td>
</tr>
<tr>
<td>5' cap, AAA tail</td>
<td>amino acid</td>
</tr>
</tbody>
</table>

5. What are the two main type of mutations? How do they differ? What causes them?
   - Frameshift: deletion or an addition (change all)
   - Point Mutation: substitution (change one or two)

Section #5: Digestive System
13. A bolus is moved through the digestive system by:
   a. peristalsis
   b. osmosis
   c. diffusion
   d. gravitational forces
14. Which structure, in the diagram above, stores glycogen?
   a. W
   b. X
   c. Y
   d. Z

15. Which structure, in the diagram above, is responsible for final digestion and absorption of all nutrients?
   a. W
   b. X
   c. Y
   d. Z

16. Muscles that encircle and can open or close tubes within the body are called:
   a. sphincters
   b. valves
   c. cardiac muscle

17. What is the role of sodium bicarbonate in the pancreatic juices? neutral chyme

**Section #6: Circulatory System**

1. Which blood vessel carries blood from the heart to the lower body?
   a. hepatic artery
   b. Posterior Vena Cava
   c. hepatic portal vein
   d. Aorta

2. Which blood vessel carries blood from the lung back to the heart?
   a. pulmonary capillary
   b. pulmonary artery
   c. pulmonary vein
   d. pulmonary trunk

3. For the diagram to the right, which of the following accurately describes the path of blood after it enters the heart from the vena cava?
   a. V → Y → Z → U
   b. V → U → Z → Y
   c. V → U → Y → Z
   d. Y → Z → V → U

4. The contraction of V and Y is called:
   a. atrial systole
   b. atrial diastole
   c. ventricle systole
   d. ventricle diastole

**diastole=relax**
5. Describe what happens in a capillary?
- gas exchange occurs
- internal respiration

6. You just took a sample of your blood (also known as a hemocrit). Label what it would look like if you separated all the various blood components. Include the % of volume.

- plasma 54%
- wbc 1%
- rbc 45%

7. What are the three main types of cells in your blood? What does each of them do?

<table>
<thead>
<tr>
<th>Cell Name</th>
<th>Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>erythrocyte</td>
<td>carry O2</td>
</tr>
<tr>
<td>thromocyte</td>
<td>blood clotting</td>
</tr>
<tr>
<td>leukocyte</td>
<td>fighting infection</td>
</tr>
</tbody>
</table>

Section #7: Respiratory System
1. Internal respiration occurs:
   a. between the alveoli and the pulmonary capillaries
   b. in the mitochondria
   c. between tissue cells and tissue capillaries
   d. between air in the nasal passage and the nasal capillaries

2. Which of the following mechanisms cause air to enter the lungs?
   a. diaphragm and external intercostals muscles contract, thoracic pressure increases
   b. diaphragm and external intercostals muscles contract, thoracic pressure decreases
   c. diaphragm and external intercostals muscles relax, thoracic pressure increases
   d. diaphragm and external intercostals muscles relax, thoracic pressure decreases

3. How does the process of breathing work? How does air come into the thoracic cavity?

  phrenic nerve causes diaphragm to:

  - increase volume of thoracic cavity
  - decrease pressure inside thoracic cavity

  O2 to flow in
4. What would be the direct consequence if hemoglobin molecules could not become reduced (HHb)?
   a. oxygen would not be transported
   b. H⁺ ions would accumulate in the blood, decreasing its pH
   c. carbon dioxide would not be transported
   d. HCO₃⁻ ions would accumulate in the blood, increasing its pH

5. What are two illnesses that can impact the functioning of the respiratory system? Give details using appropriate science vocab as to how the respiratory system is impacted.

<table>
<thead>
<tr>
<th>Disease</th>
<th>Impact to Respiratory System</th>
</tr>
</thead>
</table>
| emptysma  
brocho  
avy  
C.F.        |                             |

Section #8: Excretory System

1. In the diagram above, which structure represents the urethra?
   a. U
   b. V
   c. W
   d. X

2. If a drop in the pH of the blood occurs, the kidneys will
   e. Increase the absorption of urea
   f. Decrease the absorption of sodium ions
   g. Decrease the secretion of hydrogen ions
   h. Increase the reabsorption of bicarbonate ions
3. Draw and label a nephron. Be sure to label the glomerulus, bowman’s capsule, proximal convoluted tubule, descending loop of henle, ascending loop of henle, distal convoluted tubule, collecting duct.

4. What are the three main hormones that regulate the excretory system. Complete the chart below.

<table>
<thead>
<tr>
<th>Hormone Name:</th>
<th>Where it acts (first action)</th>
<th>What it does (big picture)</th>
<th>How it impacts urine VOLUME</th>
<th>How it impacts urine CONCENTRATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aldosterone</td>
<td>loop of henle</td>
<td>↑ bp</td>
<td>↗</td>
<td>▼</td>
</tr>
<tr>
<td>ADH</td>
<td>collecting ducts</td>
<td>↑ osmoreg</td>
<td>↑</td>
<td>↓ bp</td>
</tr>
<tr>
<td>ANH</td>
<td>juxtaglomerular app</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Section #9: Nervous System

1. Structure W in the diagram above is a:
   a. reflex arc
   b. motor neuron
   c. interneuron
   d. sensory neuron
2. The above structure is likely to represent a ______________ within a neuron.
   a. gated sodium channel
   b. gated potassium channel
   c. sodium-potassium pump
   d. neurotransmitter receptor
   [Answer: c. sodium-potassium pump]

3. Which structure connects the left and right hemispheres of the brain?
   a. lateral ventricle
   b. longitudinal fissure
   c. interhemispheric
   d. corpus callosum
   [Answer: d. corpus callosum]

4. In the diagram to the right, which structure has regulated your heart and breathing rate throughout this test?
   a. X
   b. W
   c. Y
   d. U
   [Answer: d. U]

5. Draw a flow chart to show the various categories of the nervous system.
Section #10: Reproductive System

1. In males, what would be the immediate effect of a lack of Luteinizing Hormone?
   a. Spermatogenesis would be promoted
   b. Seminal fluid production would stop
   c. Body hair would start to grow
   d. Testosterone production would stop

2. The function of the mid-piece of the sperm is to
   a. Protect sperm
   b. Nourish sperm
   c. Carry genetic material
   d. Produce energy for the flagellum

3. Draw a flow chart showing the 5 hormones of the female reproductive system including where they are made and what they do.

4. Label the below diagram:

Section #11: Tying It All Together

The human body is a complex system made up of many individual parts that work together. Discuss how the body systems that we have studied throughout this course work together. Be sure to add details about how the functioning of each individual system contributes to the larger picture. You can show your understanding through writing paragraphs, diagrams, or flow charts. (use an additional piece of paper if needed)