Sensation Stations Student Handout

Station 1: Reaction Time
See instructions on Task Card:

Partner 1 name: _____		**Partner 2 name: _____**	
Trial	**Time (sec)**	**Trial**	**Time (sec)**
Drop 1		Drop 1	
Drop 2		Drop 2	
Drop 3		Drop 3	
Drop 4		Drop 4	
Average Time		Average Time	

Analysis Questions

1. Did your reaction time improve, stay the same or get worse over multiple trials? Why could that be? What variables could affect these differences?

2. What patterns did you notice in your data?

3. Were there any outliers in your data? What might explain them?

4. What parts of your body and brain were involved in the reaction time process?

5. Was your reaction a reflex or a voluntary response? Explain your reasoning.

6. If the brain stores experiences as memories, do you think doing this lab multiple times could affect your performance? Why or why not? Explain your reasoning.

7. Thinking ahead: what differences would you expect between a machine's (AI) reaction time and a human's?

Station 2: Color, Light and Sight

Part 1: Anatomy of the Eye

1. **Watch the video on Eye Anatomy and answer the following questions.**
    a. What key structures in the eye are responsible for focusing and sensing light?

    b. How does the retina contribute to the process of vision?

    c. How does your retina view images when they are received?

    d. Draw a diagram or model that describes the journey of a light signal—from entering your eye to being interpreted by the brain.

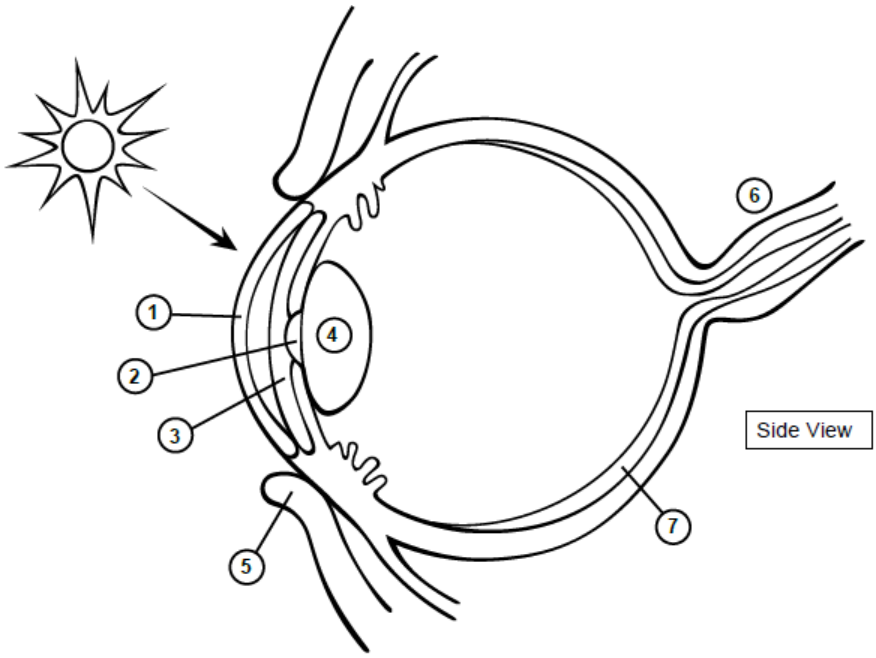
    e. How does your brain fill in gaps or make sense of incomplete visual information?

    f. Thinking ahead? How might understanding human vision help improve technologies like virtual reality or facial recognition systems?

2. **Label the diagram of the eye below using the following word bank**

    a. Retina
    b. Optical nerve
    c. Eyelid
    d. Lens
    e. Iris
    f. Pupil
    g. Cornea

    h.



3. **Use the website for the American Museum of Natural History: Seeing Color**
    a. What is white light?

    b. How does white light create the colors that we see on objects like beach balls?

    c. What are rods? Cones? How do they contribute to color perception?

    d. What happens if someone is missing one type of cone cell?

e. How does the brain combine information about color, shape, and motion to create a meaningful perception of an object?

Part 2: Color

4. **Using the "colorblind test" link to test your eyesight.** *Remember, this is a fun, online, non-medical evaluation of your eyesight. This is not meant to be a diagnostic test or to provide medical information. It is meant to show you how our eyes perceive color and how different people can perceive color differently. If you have concerns about your eyesight, please talk to your parents and a medical professional***.**
   A. What observations did you make while taking this "test"?

5. **Color mixing objects**
   a. **Follow the instructions on the task card for the color mixing objects activity. Record your results below**

Object:		**Object:**	
Observations		Observations	
No color cellophane		No color cellophane	
Color Cellophane What color:		Color Cellophane What color:	
Color Cellophane What color:		Color Cellophane What color:	
Color Cellophane What color:		Color Cellophane What color:	

Station 3: Sound

Part 1: See and Feel the Vibrations

While performing these tasks, make observations and record them in the table below.

1. Strike a tuning fork with the rubber mallet, or against the table and:
    a. Hold it near your ear (without touching your ear) and make observations
    b. Touch the base of the vibrating fork to your elbow and rest your elbow on the table. Make observations
    c. Touch it to the table top and make observations.
    d. Gently dip the fork into a cup of water and make observations.

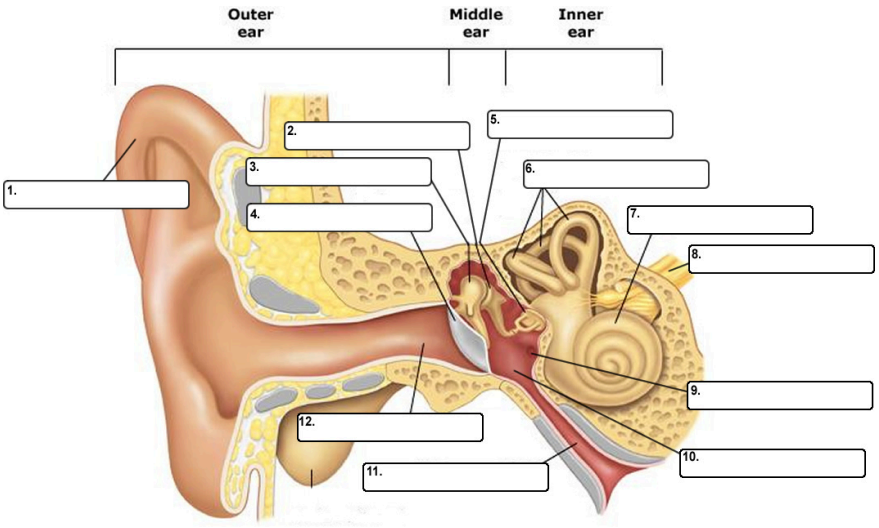
Questions to consider for observations:

1. Do you feel any vibrations?
2. Do you see anything moving?
3. Does the sound change when transferred through solids or water?

Phenomenon	What did you observe or feel? What does this tell you about how sound travels?
1. Near your ear (without touching)	
2. Base of fork to your elbow (with elbow on table)	
3. Table top	
4. In cup of water	

Part 2: How your Ears Detect Sound:

1. Watch the video and label the diagram using the word bank below.
2. Trace or put in sequence how sound is received by your ear and travels to your brain.



Word Bank

- Tympanic membrane
- Auricle
- Auditory Canal
- Eustachian Tube
- Tympanic Cavity
- Cochlea
- Vestibulocochlear nerve
- Malleus
- Incus
- Stapes

Sound Analysis Questions

1. **Where in your ear are the sensory receptors that detect vibrations?**

2. **What happens to those vibrations once they reach the brain?**

3. **Where in your body did you feel the vibrations the strongest?**

4. **Why do you think sound travels differently through solids, liquids and gases?**

5. **What part of your ear is responsible for converting vibrations into neural signals?**

6. **How does your brain know what you are hearing?**

7. **Explain how your body senses sound from a tuning fork. What structures are involved, and what happens in your brain after the sound is detected? Explain in complete sentences (3-5 sentences).**

Station 4: Touch

Part 1: Texture Test

1. With your partner, decide who will be the tester, and who will be the experimenter.
2. Testers will close their eyes or put on a blindfold.
3. Experimenters will GENTLY touch the tester's arm with various materials.
4. Experimenters will ask Testers to state what they think they feel and record the answers.
5. Repeat for all objects
6. Partners will switch roles and repeat the process in steps 1-5.

Partner 1: _____		**Partner 2: _____**	
Actual Object	**Guess**	**Actual Object**	**Guess**

Analysis Question

1. What textures were the easiest to recognize? Why?

Part 2: 2-point Discrimination Test

1. Decide which partner will be the tester and who will be the experimenter.
2. Testers will close their eyes and tell the experimenter how many points they feel.
3. Experimenters will GENTLY touch their partner with the testing device and ask for their observations on each of the areas listed in the data table below.
4. Using a testing device (an open paper clip with the ends spaced 1-2 cm apart), LIGHTLY touch two points on the experimenter and record their observations.

Partner 1: _____		**Partner 2:**	
Location	**Number of points**	**Location**	**Number of Points**
Fingertips		**Fingertips**	
Forearm		**Forearm**	
Back of Hand		**Back of Hand**	
Neck		**Neck**	
Palm		**Palm**	

Analysis Questions:

1. **How did the different parts of the body compare? What areas did you feel 2 points? 1 point? Why do you think that is?**
2. **How might this sensitivity help you in real life?**
3. **WHat happens in your brain after your skin senses something?**

Station 5: Different species, different senses

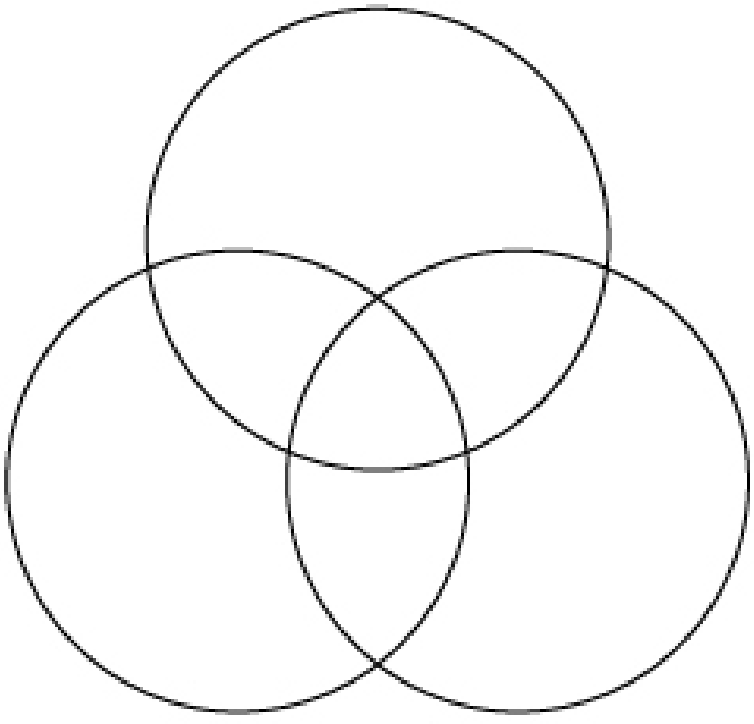
Part 1:

1. **Ready each profile card to learn about these different organisms' sensory systems.**
2. **In the data chart below, fill in the appropriate information.**

	What kinds of stimuli does each organism detect?	What receptors or structures do they use?	How does the information get processed?	Interesting facts about this organism
Human				
Aplysia				
Pit Viper				

Part 2: Venn Diagram

WIth your partner, create a triple venn diagram for these three organisms that shows their similarities and differences.



Analysis Questions

1. **What are some advantages of each system?**

2. **What are some disadvantages of each system?**

3. **Which organism had the simplest system?**

4. **Which organism had the most complex system?**

5. **How might the different environments these organisms live in affect their sensory adaptations?**

Station 6: Machines and how they Learn

Part 1: Simulating Machine Learning

1. With your partner, take a look at the image cards in your set.
2. Decide on a classifying system. (Example: if it has wings it's a bird). Make sure you write down everything you do with the cards and how you are classifying everything.
3. Once you have your rules, you will get a new set of cards. Apply your classifying system to these new cards.

Round 1

Card	Classifying Strategy	Observations, Notes and Ideas

Round 2 Now take the classifying strategy from your first set of cards and apply it to the second set. What worked? What didn't? Make sure you take notes and identify where mistakes occurred.

Card	Classifying Strategy	Observations, Notes and Ideas

Analysis Question:

1. How did your classifying strategy compare from round 1 to round 2? What issues did you have? Were there any classifying strategies that didn't work in round 2 that worked in round 1? What changes would you make?

Note: What you did in the classifying rounds is very similar to machine learning. The system is given a lot of information and then trained on what is and isn't a certain thing. Example: What is and isn't a dog. What isn't and isn't a cat. THis is how they get better at identifying what is and isn't a certain object.

Part 2: Quick Draw

1. You will practice with Google Quick Draw to look at how a system was trained to recognize images as different simple objects.
2. Go to Quick draw and play the game for a few minutes. Do at least 5 rounds of drawings.
3. After playing the game, take a look at the data set for quick draw. There are over 50 million drawings.
    a. Choose a drawing from the list below and answer the following questions.
    b. Take a look at the data set for that image. Make some notes about what you see.
        i. What detail (or lack of detail) do you see?
        ii. Do all of these images fit the prompt (DO the cakes look like cake?)

Drawing (hover over the icons and it will tell you the name of it)	What detail/lack of detail is there? What patterns do you notice?	Do the images in the set look like the prompt image? What similarities and differences do you notice?
Apple		
Bird		
Car		
Flower		
Student Choice _____		

Analysis questions

1. How does the detail (or lack of detail) in the QuickDraw drawings impact the ability for the Neural Network to recognize the drawing?

2. How accurate was the AI model in recognizing your drawings? Were there any instances where the model struggled to identify your doodles? If so why do you think that happened?

3. How do you think the AI model makes predictions about the drawings?

4. Can you think of any real-world applications for image recognition technology like that used in QuickDraw? How might these applications benefit society?

5. How does the diversity (variety and amount) of training data (images) affect the AI models performance? Do you think the model would perform equally well across different cultures and art styles