White Hill Science Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ **PUMP IT UP!**

This year in science, we are going to be paying a lot of attention to the notion that **STRUCTURE AND FUNCTION ARE RELATED**….. in other words, the way something is built fits the job it does. This applies not only to the way we engineer and build things, but to living things as well.

This week you will design a pump that will effectively pump a fluid through a “circulatory system”. When you are finished, you will evaluate what works and what doesn’t within your design and how these flaws would impact you if this were an actual circulatory system.

As you embark on your design, please be sure to use the **Design Thinking** process and the **Brainstorming Rules** that we discussed in class.

Good Luck!

**The Challenge:**

Design and build a pump device that will squirt water through a “circulatory system” using what you already know about this system.

**Constraints:**

1. Only the provided materials may be used.
2. A catch system must be included for water pumping out the other end of the system.
3. Students may only use materials for their intended lab purpose.
4. You may not destroy the materials (except the balloons and plastic bags). All classes will be sharing them.
5. If you need holes in your device, consult the teacher.

**Testing the Effectiveness:**

The circulatory system will be considered effective if:

1. Blood travels through the lungs.
2. Blood flows through the majority of the body.
3. The pumping device is able to continually move blood throughout the body.
4. The majority of the blood does not leak out of the circulatory system.

**Your Evaluation:**

Your evaluation for this design challenge will be based on the following.

1. Your group’s adherence to the brain storming rules.
2. Appropriate lab behavior and communication.
3. Equal participation and respect of all lab members.
4. The effectiveness of your “circulatory system” (see criteria above)
5. Your thoughtfulness and thoroughness in answering the analysis questions.

**Brainstorming Ideas-** Record your thinking and ideas for your group in the space below (even if you don’t use them)

**Your Final Design-** When you have completed your final design, sketch it in the space below. Be sure to label and annotate with is happening in your “circulatory system”.

**Make this neat. It is part of the observation of your FINAL design.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Group Name** | **Unique Features** | **How features help** | **System Problems** |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

**Peer Observation**

**Analysis Questions:**

1. In the space below, list the successes of your circulatory system (there should be at least 3-4) AND why each of these would be important in the human body.

2. What were some of the weaknesses of the circulatory system (there should be at least 3-4) AND how each of these would be detrimental (bad) to the human body?

1. What are some successes of your classmates’ models?

4. If you were to re-design your circulatory system, what changes would you make and why?

5. For each of the following, list a successful way in which the problem was addressed by your group. (If it did not become a problem, how did you avoid the issue.) If it was not addressed, put an “X” in the box.

|  |  |
| --- | --- |
| System Problem | Solution |
| “Blood” going backwards in the “heart” |  |
| “Blood” going backwards in the “blood vessels” |  |
| Not enough pressure in spots |  |
| Too much pressure in spots |  |
| “Blood” not making it back to the “heart” |  |
| Not a good transfer of oxygen and carbon dioxide in the lungs |  |
| Leaky vessels |  |
| Blood with oxygen and blood with carbon dioxide getting mixed up |  |

**Evaluation**

For each of the following, rate yourself and your group between a 1 (low) and 5 (high). **Explain** why you think you earned that score.

1. Your group’s adherence to the brain storming rules.
2. Appropriate lab behavior and communication.
3. Equal participation and respect of all lab members.
4. The effectiveness of your “circulatory system” (see criteria pg 1)\_

5. Your thoughtfulness and thoroughness in answering the analysis questions.

Names: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Clean Up Procedures**

1. **De-construct all materials making sure not to destroy any.**
2. **Remove all tape (may need to carefully use scissors)**
3. **Neatly re-stock supplies and place full tray back on table (See list below).**
4. **Squeegee water into small, empty bin and dump into sink**
5. **Dry table with paper towels**

**“Pump It Up” Supply List**

**----- Small handful of Rubber Bands**

**----- 5 Small Balloons**

**----- 3 Large Balloons**

**----- 1 dishwashing (thick) glove**

**----- Several straws (about 12)**

**----- 2 m small tubing**

**----- 3 m medium tubing**

**----- 5 m large tubing**

**----- 2 pairs of scissors**

**----- 1 Roll Duct Tape**

**----- 2 plastic bottles (one for building and one for filling… DO NOT destroy the filling bottle)**

**----- 1 Funnel**

**----- 6 “pumps” worth of paper towel neatly rolled up**