 **Lab Report 7:**

**Raise It Up**

***Question:***

How can you create a compact system of linked levers to raise a weight a certain height?

***Hypothesis:*** [**2**]

***Design Brief and Criteria:***

Design and build a compact linkage system (using any classes of levers) that will raise a weight, using only the materials available.

* The linkage system must raise a 0.25-N weight a height of 20 cm.
* The system must include at least two levers.
* All parts of the system must stay within the size of a “box” 0.5 m long, 0.5 m wide, and 0.5 m high.

***Materials:***

30 popsicle sticks or similar 0.25-N mass (25g)

Glue Thin rope or twine

Apron Metre stick

10 paper fasteners Newton spring scale

Other

***Procedure:***

1. Using a detailed technical drawing, design a linkage system according to the above criteria. On your diagram, indicate materials, size, classes of levers, and how they will work.
2. With your teacher’s approval, build the system according to your design. Be sure your linkage system fits within the size limits.
3. Redesign the system if it does not fit the size limits.
4. Test your system to see if it raises the 0.25-N weight the minimum height.

***Observations:***

1. Draw a detailed technical drawing of your linkage system. Be sure to label the parts of your linkage system and indicate materials, size, classes of levers, and how they will work. **(6)**
2. Calculate and record the mechanical advantage of your system. Refer back to your notes on how to calculate mechanical advantage. **(3)**
3. Draw the system of linked levers you designed from a different view. **(5)**
4. Does this diagram help to illustrate any feature better than your first diagram did? Explain why or why not. **(3)**
5. Why would different diagrams of the same product be important? Explain. **(3)**

***Analysis:***

1. What other materials might have made the linkage system easier to build? Why would you think this? **(2)**
2. Which type of lever takes up more space, a Class 1 lever or a Class 2 lever? Defend your answer. **(2)**
3. How could you improve the mechanical advantage of your system? **(2)**

***Conclusion:***

How can you create a compact system of linked levers to raise a weight a certain height? **(2)**

***Evaluation:***

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| **Category** | **Level 4** | **Level 3** | **Level 2** | **Level 1** | **%** |
| **Observations** | The relationship between the procedure and what was observed is discussed in detail. All information is accurate. | The relationship between the procedure and what was observed is discussed. Most information is accurate. |  |  | 25 |
| **Diagrams** | Clear, accurate diagrams are included and make the experiment easier to understand. Diagrams are labeled neatly and accurately. | Diagrams are included and labeled neatly and accurately. |  |  | 25 |
| **Analysis** | The patterns in the observations are discussed and logically analyzed. Predictions are made about what might happen if part of the lab were changed or how the experimental design could be changed. | The patterns in the observations are discussed and logically analyzed. Some predictions are made. |  |  | 25 |
| **Conclusion** | Conclusion includes whether the findings supported the hypothesis, possible sources of error, and what was learned from the experiment. | Conclusion includes whether the findings supported the hypothesis and what was learned from the experiment. |  |  | 25 |