Ergonomic Packing - High School
Student Worksheet

Name: ___________________________                      Date: ___________________________

Part I: Introduction

1. What is ergonomics? **The practice of designing products and systems that accommodate the physical limitations of the human body.**

2. Why it is important for engineers to consider ergonomics when designing systems? **For people to use them safely and comfortably.**

3. Give an example of something you had trouble with because it wasn’t ergonomically designed. ___________________________

Part II: Group Activity- First Run

In groups of 4-6, you are going to evaluate the ergonomics and productivity of a medical supply distribution station in two runs. In the first run your group will collect and analyze data. In the second run you will use the data, along with your experience of picking orders, to propose, implement, and evaluate a new system design.

Each group has an assigned “Medical Supply Station” and 8 orders. An order is a list of items that staff at a healthcare facility must gather for daily operations.

In each group there is one Data Collector and one Time Keeper. The remaining students are Pickers. Determine who will have each role and write your names below. (Roles can be changed for the second run.)

Data Collector: ___________________________                      Time Keeper: ___________________________

Pickers: ___________________________

Pickers: One picker “picks” at a time. Items must be “picked” in the order they appear. In order to “pick” an item you must place the palm of your hand on the paper which has the item pictured. As you do so, call out the name of each item to help the data collector tally the items “picked”. For picking more than one of a certain item, place your palm on the paper, bring it to your side, and then back to the paper. When you finish an order, direct the next picker to begin. When all pickers have completed one order, each picker will have another turn until all 8 orders have been filled.

Data Collector: As each of the items is “picked”, place a tally mark in the corresponding box in the Tally Chart of the Data Sheet. The pickers will call out the name of each item as it is picked to help you keep a tally. Continue doing this until all 8 orders have been picked.

Time Keeper: Begin the stopwatch when the first picker begins the first order. Stop the watch when the last order has been filled. Record the time it took (to the nearest second) to pick all 8 orders on the following page. You may also serve as an assistant to the data collector, making sure items are being tallied properly.
Part III: Data Analysis

1. What is the Total Time recorded by your Time Keeper? ______________

2. Convert the Total Time to seconds. ______________ seconds
   
   1 minute = 60 seconds

3. Calculate the Average Time per order to the nearest hundredth of a second. ______________ seconds
   
   Average Time = Total Time ÷ Number of Orders

4. Copy the information gathered by the Data Collector into your Tally Chart. Use numbers instead of tally marks for convenience.

5. On your Tally Chart, highlight the 6 most picked items in yellow and the 6 least picked items in pink. You will use these colors to help redesign the layout of the station later.

6. Below the Tally Chart is a table labeled Ergonomic “Weights” which gives a numerical value to each product/location of the Medical Supply Station. How do you think these values were determined?____
   
   __________________________________________________________

7. Calculate the **ergonomic score** for each product/location. To do so, multiply the total number of tally marks (or the number) in the Tally Chart by the corresponding weight specified in the Ergonomic “Weights” table for each product/location. Record the ergonomic score of each item in its corresponding location in the last table, labeled Summary of Ergonomic Scores.

8. Calculate the **total ergonomic score** by adding all the scores from the individual boxes in the Summary of Ergonomic Scores table.

   **Total Ergonomic Score** = ______________

9. The **lower** (higher/lower) the Total Ergonomic Score the better the ergonomic design.
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Part IV: Group Activity- Second Run

Using your observation or experience of the first run, the data collected, and your calculations, design a new layout of the Medical Supply Station with your group to improve productivity (decrease the time it takes to pick the orders) and to better the Ergonomic Design (decrease the Total Ergonomic Score). Refer to the color coding of your Tally Chart to easily determine which items were “picked” most frequently.

Move the pictures on the wall to reflect the reconfiguration and record the new positions in the Tally Chart for the second run on the back of your Data Sheet. Write the names of the items at the bottom of each box to leave room for tally marks.

Once the items are rearranged, repeat the order picking data collection performed in the first run. Remember group members may change roles if wanted.

Part V: Data Analysis and Comparison

1. What is the Total Time recorded by your Time Keeper? __________

2. Convert the Total Time to seconds. __________ seconds

3. Calculate the Average Time per order to the nearest hundredth of a second. __________ seconds
   \[ \text{Average Time} = \frac{\text{Total Time}}{\text{Number of Orders}} \]

4. Is this reconfiguration more efficient than that of the first run? __________
   How did you determine that? __________ Is this the result you expected? _____

5. By what percent, to the nearest tenth, did efficiency increase (or decrease)? __________
   \[ \text{Percent Change} = \left| \frac{\text{Average Time of First Run} - \text{Average Time of Second Run}}{\text{Average Time of First Run}} \right| \]

6. Copy the information gathered by the Data Collector into your Tally Chart. Use numbers instead of tally marks for convenience.

7. Calculate the \textit{ergonomic score} of each product/location in the Summary of Ergonomic Scores table.

8. Calculate the \textit{total ergonomic score} of this new design. __________
   How does it compare to the one from the first design? __________
   What does this difference signify? __________

9. By what percent, to the nearest tenth, did the ergonomic score improve? __________
   \[ \text{Percent Change} = \left| \frac{\text{Total Ergonomic Score of First Run} - \text{Total Ergonomic Score of Second Run}}{\text{Total Ergonomic Score of First Run}} \right| \]