**Unit 9 Volume Project: Designing Streetlights**

New streetlights will be installed along a section of the highway. The criteria for the dimension of the streetlight posts must be:

* at least 7.5 meters tall
* at least 20 centimeters wide
* must be at least 2.5 centimeters thick with a hollowed-out core to contain the electrical wiring

The city needs help figuring out the design of the posts, the material they should use, and the amount they need to spend.

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| Your objective is to:   1. Create a potential design for the streetlight using either a cylindrical post or a square prism post and your choice of core 2. Select a material to make the post out of (your choice from the reference table) 3. Calculate the cost of making the post using our geometric concepts of area, volume, and density 4. Type it all up in a written project |

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| **Your written project should include:**  ⬜Part 1: Introduction & Plan  ⬜Part 2: Information & Measurement (Diagram AND table must be included)  ⬜Part 3: Mathematical Processes & Interpretation of Results  ⬜ Part 4: Validity  ⬜Part 5: Conclusion & Reflection |



**Written Project Outline:**

1. **Part 1: Introduction & Plan**
   1. Did you title your project?
   2. Did you clearly state what the purpose of this task is?
   3. What steps (mathematical techniques) are you going to take to make your recommendation and justify each one?
      1. “I need to calculate \_\_\_\_\_\_\_ so that I can find \_\_\_\_\_\_.”
2. **Part 2: Information & Measurement (must include DIAGRAM & UNITS)**
   1. What does you post look like? What geometric 3D solid (square prism or cylinder) are you using to model your post? What geometric 3D solid will your core be?
      1. Three dimensional diagram
      2. Horizontal cross section diagram
      3. Vertical cross section diagram
   2. What are the dimensions of your post? What are the dimensions of your core?
   3. What material from the reference sheet have you chosen to build your post?
   4. What is the density of this material? *Look at the reference sheet.*
      1. Did you cite where you got this information?
   5. What is the cost per weight of this material? *Look at the reference sheet.*
      1. Did you cite where you got this information?
3. **Part 3: Mathematical Processes & Interpretation of Results**
   1. What is the area of the base (cross-sectional area) of your post?
   2. What is the total volume of the post?
      1. Does your volume account for the hollowed core?
   3. What is the total mass of your post?
      1. Are your units properly calculated?
   4. What is the total cost of your post?
      1. Are your units properly calculated?
   5. Why do you recommend your post’s design?
      1. Your answer must take into consideration visual appeal, material

features/properties + cost

1. **Part 4: Limitations & Validity**
   1. What are the potential counterarguments someone could have against your project?
   2. Discuss potential ways to save money on the design of your post. How could this change your project?
   3. At this point in time, the city is only looking for the best design based on cost. When actually building the streetlights, what other factors should they take into account besides cost?
2. **Part 5: Conclusion & Reflection**
   1. Did you stick to your original plan outlined in your introduction?
   2. What were you successful in achieving throughout and/or at the end of this task?
   3. What did you find the most challenging part of this process?
   4. What might you do differently next time?

**Due Dates:**

* Handwritten rough draft including all 5 parts is due in class to Ms. Guarnaccia on Monday April 30th
* Typed final draft (12 point font, double spaced) is due on Monday May 7th
* If you have any questions about the project or any concerns, you must send an email to Ms. Guarnaccia at [guarnacciabeca@gmail.com](mailto:guarnacciabeca@gmail.com)

**Reference Table for Density & Cost of Material:**

*If you would like to use a material not on the list, you may research and cite the density and information for that material in MLA format as I did below in the footnotes.*

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| --- | --- | --- |
| **Material** | **Density[[1]](#footnote-1) (g/cm3)** | **Cost[[2]](#footnote-2) (dollars/kg)** |
| Wood | 0.50 | $1.00 |
| Magnesium | 1.74 | $2.25 |
| Glass | 2.50 | $1.35 |
| Aluminium | 2.70 | $1.80 |
| Titanium | 4.54 | $16.25 |
| Zinc | 7.13 | $3.37 |
| Steel | 7.80 | $0.25 |
| Iron | 7.87 | $65.05 |
| Brass | 8.50 | $2.20 |
| Nickel | 8.89 | $6.10 |
| Copper | 8.96 | $2.25 |
| Silver | 10.49 | $551.06 |
| Lead | 11.36 | $1.20 |
| Gold | 19.32 | $43,678.80 |

**Relevant Conversions:**

100 centimeters = 1 meter

1000 grams = 1 kilogram

**Rubric and Criteria for Success**

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| --- | --- | --- | --- | --- | --- | --- |
|  | 0 | 1 | 2 | 3 | 4 | 5 |
| Criterion A | Does not contain clear statement of task | Contains a clear statement of task | Contains title, clear statement of task, and description of plan | Contains title, clear statement of task, and specific, detailed plan | N/A | N/A |
| Criterion B | Does not contain relevant information or measurements | Contains relevant information or measurements | Relevant information or measurements is organized in an appropriate form OR is sufficient in quality and quantity | Relevant information or measurements is organized in an appropriate form AND is sufficient in quality and quantity | N/A | N/A |
| Criterion C | Does not contain any mathematical processes | At least two simple mathematical processes (area and volume calculations) have been carried out | At least two simple mathematical processes (area and volume calculations) have been carried out correctly | All simple mathematical processes (area, volume, and mass) have been carried out correctly. | The simple relevant mathematical processes have been carried out correctly (area, volume, and mass) and one relevant further process (cost) has been carried out. | All processes (area, volume, mass, and cost) are relevant and completely correct. |
| Criterion D | Does not contain any interpretations or conclusions | Contains at least one interpretation or conclusion | Contains a meaningful discussion of interpretations and/or conclusions | Contains a meaningful discussion of interpretations and conclusions that are consistent with the mathematical processes used | N/A | N/A |
| Criterion E | No awareness shown that validity plays a part in the project | An indication, with reasons, if and where validity plays a part in the project. | N/A | N/A | N/A | N/A |
| Criterion F | No attempt has been made to structure the project | Some attempt has been made to structure the project | Structured in a logical manner so that it is easily followed | Well structured in accordance with the stated plan and is communicated in a coherent manner | N/A | N/A |
| Criterion G | Does not contain correct mathematical notation or terminology | Contains some correct mathematical notation or terminology | Contains correct mathematical notation and terminology throughout | N/A | N/A | N/A |

Score: \_\_\_\_\_\_\_\_\_ / 20 Converted Score: \_\_\_\_\_\_\_\_\_ / 20

1. *Density Table of Various Materials*, AmBrSoft, 23 Oct. 2014, www.ambrsoft.com/CalcPhysics/Density/Table\_2.htm. [↑](#footnote-ref-1)
2. Edited by Roy Lance, *Modules in Mechanics of Materials*, MIT, 1996, web.mit.edu/course/3/3.11/www/modules/. [↑](#footnote-ref-2)