OALCF Tasks for the Apprenticeship Goal Path: Prepared for the Project, *Developing Best Practices for Increasing, Supporting and Retaining Apprentices in Northern Ontario (2014)*

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OALCF Task Cover Sheet

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Task Title: Finding and Calculating Working Load Limits

Learner Name:
Date Started: **Date Completed:**
Successful Completion: Yes___   No___
Goal Path: Employment___   Apprenticeship ✓   **Secondary School** ✓ **Post Secondary___   Independence___**

Task Description:
Understanding how to calculate Working Load Limits for rope, using formulas. Using the internet to locate information related to rope strength.

Competency:	**Task Group(s):**
A: Find and Use Information	A2: Interpret Documents
B: Communicate Ideas and Information	B2: Write continuous text
C: Understand and Use Numbers	C3: Use Measures
D: Use Digital Technology	D2: Use Digital Technology

Level Indicators:
A2.2:   Interpret simple documents to locate and connect information
B2.1:   Write brief texts to convey simple ideas and factual information
C3.3:   Use measures to make multi-step calculations; use specialized measuring tools
D.2:   Perform well-defined, multi-step digital tasks

Performance Descriptors: see chart on last page

Materials Required:
- Computer and printer   - Pen and paper   - Calculator - optional   - Attached document - Working Load Limits Information and Formula for Fibre Rope

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Learner Tasks

Read the **Working Load Limit Information and Formula for Fibre Rope.**

Task 1:   Use the formulas to calculate the Working Load Limit for the following fibre rope diameters.

   a. ¼″ diameter polypropylene rope

   b. 1-5/8″ diameter polypropylene rope

   c. 3/8″ diameter nylon rope

   d. 1½″ diameter nylon rope

   e. 5/16″ diameter polyethylene rope

   f. ¾″ diameter polyethylene rope

   g. 7/8″ diameter polyester rope

   h. 1″ diameter polyester rope

Task 2:   Find the Break Strengths table in the Consumer Products section of the Cordages.com website. Print the table.

Task 3:   What are the safe working loads for the following types of rope? Use the Break Strengths table on the Cordages.com website.

   a. 5/16" Nylon Twisted
   b. 1/2" Nylon Twisted
   c. 3/16" Polypropylene Twisted
   d. 3/4" Polypropylene Twisted
   e. 1/4" Polyester Braided

Task 4:   Use a search engine to locate definitions for the two terms listed below.

   a. Design Factor
   b. Factor of Safety

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Working Load Limit Information and Formula for Fibre Rope

Working Load Limit (WLL) - is used to determine the maximum strength that a component such as the eyebolt, shackle and sling/rope can safely lift the weight of the load.

Formula for the Working Load Limit

WLL = <u>Breaking strength</u>
      Design Factor
 	
   = <u>Breaking strength</u>
         5
	For example, a rope rated at 1500 lbs. breaking strength has a working load limit of 300 lbs.
	
	<u>1500 lbs</u> = 300 lbs
	    5

There are four popular types of rope and each rope has a certain calculation. Be sure to use the correct formula to ensure the safety of the lift. The four types of rope include:

Nylon

Polypropylene

Polyester

Polyethylene

There are different calculations for each type of fibre rope. The following formulas were used to determine the Working Load Limit (WLL).

Nylon Rope
   1. Change the rope diameter into eighths of an inch.
   2. Square the numerator and multiply by 60
Example:
1/2 inch rope = 4/8 inch diameter
Square the numerator of 4 (4x4) = 16
Multiply 16 by 60 (16 x 60) = 960
WLL = 960 lbs
	Polypropylene Rope
	   1. Change the rope diameter into eighths of an inch.
	   2. Square the numerator and multiply by 40
	Example:
	1/2 inch Polypropylene rope = 4/8 inch diameter
	Square the numerator of 4 (4x4) = 16
	Multiply 16 by 40 (16 x 40) = 640
	WLL = 640 lbs

Polyester Rope
   1. Change the rope diameter into eighths of an inch.
   2. Square the numerator and multiply by 60
Example:
1/2 inch Polyester rope = 4/8 inch diameter
Square the numerator of 4 (4x4) = 16
Multiply 16 by 60 (16 x 60) = 960
WLL = 960 lbs
	Polyethylene Rope
	   1. Change the rope diameter into eighths of an inch.
	   2. Square the numerator and multiply by 35
	Example:
	1 inch polyethylene rope = 8/8 inch diameter
	Square the numerator of 8 (8 x 8) = 64
	Multiply 64 by 35 (64 x 35) = 2240
	WLL = 2240 lbs

Answer Sheet

Task1:   Use the formulas to calculate the Working Load Limit for the following fibre rope diameters.

a. 1/4 inch diameter Polypropylene Rope
   i. Convert to eighths 1/4 = 2/8
   ii. Square the numerator 2 x 2 =4
   iii. Multiply 4 x 40 = 160
   iv. WLL for 1/4 inch diameter is **160 lbs**

b. 1 5/8 inch diameter Polypropylene Rope
   i. Convert to eighths 1 5/8 = 13/8
   ii. Square the numerator 13 x 13 = 169
   iii. Multiply 169 x 40 = 6760 lbs
   iv. WLL for 1 5/8 inch diameter is **6760 lbs**

c. 3/8 inch diameter Nylon Rope
   i. Convert to eighths 3/8 = 3/8
   ii. Square the numerator 3 x 3 = 9
   iii. Multiply 9 x 60 = 540
   iv. WLL for 3/8 inch diameter is **540 lbs**

d. 1 1/2 inch diameter Nylon Rope
   i. Convert to eighths 1 1/2 = 12/8
   ii. Square the numerator 12 x 12 =144
   iii. Multiply 144 x 60 = 8640 lbs
   iv. WLL for 1 1/2 inch diameter is 8640 lbs

e. 5/16 inch diameter Polyethylene Rope
   i. Convert to eighths 5/16 = 2.5/8
   ii. Square the numerator 2.5 x 2.5 = 6.25
   iii. Multiply 6.25 x 35 = 218.75
   iv. WLL for 5/16 inch diameter is **218.75 lbs**

f. 3/4 inch diameter Polyethylene Rope
   i. Convert to eighths 3/4 = 6/8
   ii. Square the numerator 6 x 6 = 36

        iii.   Multiply 36 x 35 = 1260

        iv.   WLL for 3/4 inch diameter is 1260 lbs

  g. 7/8 inch diameter Polyester Rope

        i.   Convert to eighths 7/8 = 7/8

        ii.   Square the numerator 7 x 7 = 49

        iii.   Multiply 49 x 60 = 2940

        iv.   WLL for 7/8 inch diameter is 2940 lbs

  h. 1 inch diameter Polyester Rope

        i.   Convert to eighths 1 = 8/8

        ii.   Square the numerator 8 x 8 = 64

        iii.   Multiply 64 x 60 = 3840

        iv.   WLL for 1 inch diameter is 3840 lbs

Task 2:   Find the Break Strengths table in the Consumer Products section of the Cordages.com website. Print the table.

    1.   Open the internet

    2.   Use a search engine, such as Google to search Cordages.com

    3.   On the home page of Cordages.com click on the Consumer Products page

    4.   On the Consumer Products page click on the Break Strengths link

    5.   A table of strengths for different types of rope will open

    6.   Select print from the menu and print the table

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Task 3:   What are the safe working loads for the following types of rope. Use the Break Strengths table on the Cordages. com website.

     a. 5/16" Nylon Twisted - safe working load is 184 lbs
     b. 1/2" Nylon Twisted - safe working load is 454 lbs
     c. 3/16" Polypropylene Twisted - 52 lbs
     d. 3/4" Polypropylene Twisted - 612 lbs
     e. 1/4" Polyester Braided - 51 lbs

Task 4:   Use a search engine to locate definitions for the two terms listed below.

     a. Design Factor

The design factor is what the item is required to be able to withstand (second "use").

The design factor is defined for an application (generally provided in advance and often set by regulatory code or policy) and is not an actual calculation. The safety factor is a ratio of maximum strength to intended load for the actual item that was designed.

     b. Factor of Safety

The safety factor is how much the designed part actually will be able to withstand (first "use" from above).

Factor of safety (FoS), also known as (and used interchangeably with) safety factor (SF), is a term describing the structural capacity of a system beyond the expected loads or actual loads.

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Task Title: Finding and Calculating Working Load Limits for Fibre Rope

	Performance Descriptors	Needs Work	Completes task with support from practitioner	Completes task independently
A2.2	• performs limited searches using one or two search criteria			
	• extracts information from tables and forms			
	• uses layout to locate information			
	• makes connections between parts of documents			
B2.1	• writes simple texts to request, remind or inform			
	• conveys simple ideas and factual information			
	• uses sentence structure, upper and lower case and basic punctuation			
C3.3	• calculates using numbers expressed as whole numbers, fractions, decimals, percentages and integers			
	• manages unfamiliar elements (e.g. context, content) to complete tasks			
	• chooses and performs required operations; makes inferences to identify required operations			
	• selects appropriate steps to solutions from among options			
	• interprets, represents and converts measures using whole numbers, decimals, percentages, ratios and fractions			
	• organizes and displays numerical information (e.g. graphs, tables)			

	• uses strategies to check accuracy (e.g. estimating, using a calculator, repeating a calculation, using the reverse operation)				
D.2	• selects and follows appropriate steps to complete tasks				
	• makes low-level inferences to interpret icons and text				
	• begins to identify sources and evaluate information				
	• performs simple searches using keywords (e.g. internet, software help menu)				

This task: was successfully completed___   needs to be tried again___

Learner Comments

_____   _____

Instructor (print)   **Learner Signature**