

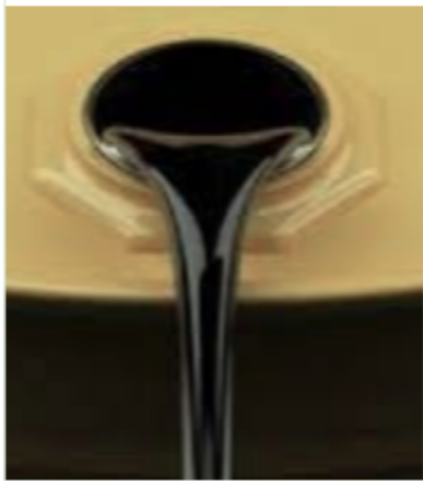
Transporting Liquid Oil

Name _____

The Problem: Utah Oil Wells Produce Black and Yellow Waxy Crude

Black and yellow wax are thick crude oils with a higher paraffinic content than most crude oils found in North America. These waxy crudes are viscous and have a high pour point, which means they become semi-solid at lower temperatures.

Waxy Crude Oil Before Hardening



Waxy Crude Oil After Hardening



The process for refining waxy crudes presents some challenges. Although black wax is well suited for making gasoline, lubricants, and diesel fuel, refining must occur close to the source, because waxy crudes solidify quickly. Currently, black and yellow crudes must be heated in the field and transported in insulated trucks. Producers are interested in finding inexpensive ways to insulate the oil to keep it a liquid. <https://deq.utah.gov/legacy/pollutants/p/petroleum/black-yellow-wax.htm>

Write down three questions you have about this design problem.

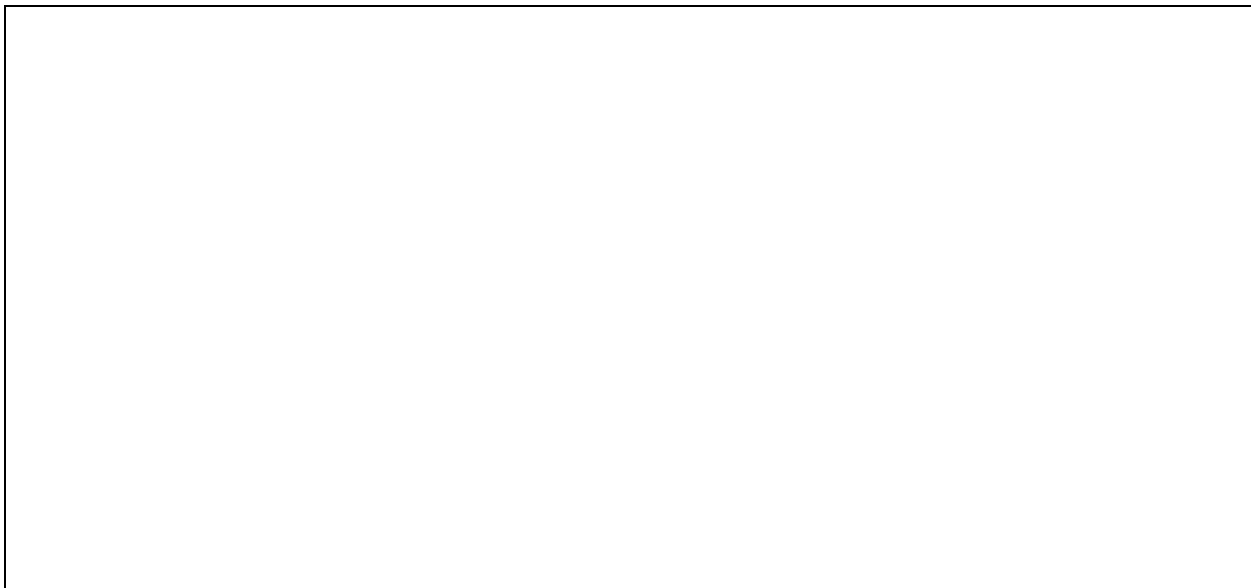
- 1.
- 2.
- 3.

Testing Insulators

Type of Insulator: _____

Time	Temperature of Material #1	Temperature of Material #2
Starting		
30 seconds		
1:00		
1:30		
2:00		
2:30		
3:00		
3:30		
4:00		
4:30		
5:00		
10:00		

Create a line graph of the temperatures from your investigation. Be sure to include labels, have the dependent variable on the Y-axis, and evenly space out the integers on the axes.



After looking at the class data chart, write an explanation of the results. Include evidence from your investigation in your explanation.

After looking at examples of insulators. Write down some similarities and differences of common insulators.

Similarities	Differences

Oil Transportation Insulator

Names of group members: _____

Ask: How can we keep heat from transferring from the oil?

Criteria:

Constraints:

Research:
Starting Temperature of oil

Imagine: Sketch an insulator you could design for the cup.

Plan: After sharing your design with your group, draw a detailed design of your plan. Include labels and dimensions where necessary.

Test:

Time	Temperature
1 minute	
2 minutes	
3 minutes	
4 minutes	
5 minutes	
6 minutes	
7 minutes	
8 minutes	
9 minutes	
10 minutes	

Improve: What were your results? How can you make your insulator more effective?

Get another design sheet and improve your insulator.

Based on your results, how quickly must Utah oil producers move the oil before it hardens?