Engineering Gold
Ski Lubricants Enquiry

Professor Peter Styring is an engineer at Sheffield University. He's also a ski coach. Peter's dream is to see Great Britain win gold at the 2012 Winter Olympics. He believes his self-lubricating skis will give British skiers an edge over the competition. But he isn't giving much away about his world-beating lubricant.

'We can patent the design of the skis, but we can't patent the lubricant. As soon as our competitors get hold of the new skis, they'll quickly work out what's in it. But I don't want people to find out until we've started to sell our skis. What I can tell you is that the lubricant is mainly water – but with some other ingredients.'

Can you carry out an investigation to test lubricants and produce a report for a ski company? Your report should summarise the important points for the company scientists to read. Remember to include a data table giving your results.

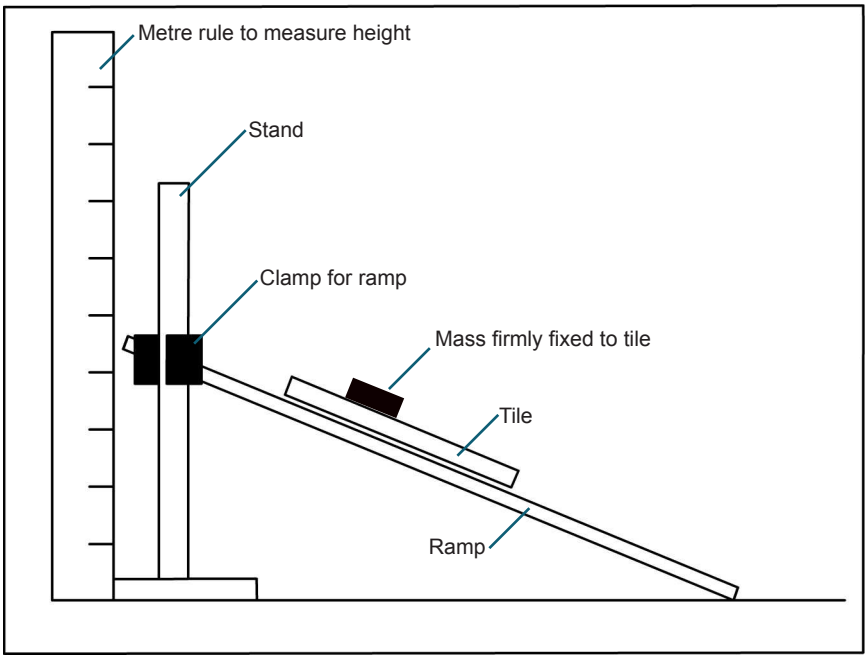
Questions

1. Which lubricant would you recommend to a ski company?
2. Explain your choice. Talk about your data in this answer.
3. Think about the chemical properties of the lubricants. Use your science knowledge to explain why your chosen lubricant should work best on the slopes.
4. Were there any outliers in your data?
5. How do scientists treat outliers in data?
6. How reliable do you think your data is? Explain why you think this.
7. How confident are you about your conclusion? Give reasons for your answer.
8. Try to think of at least two ways to improve the testing method.

Results

Lubricant	Height of ramp when block moved (cm)			
	1st reading	2nd reading	3rd reading	Average
A				
B				
C				
D				
E				

Method



1. Set up the equipment as in the diagram. Your ramp should be flat.
2. Place the tile at the top of your ramp. Very slowly raise the ramp.
3. Stop when the tile starts to move. Measure the height between the end of the ramp and the bench. Set the ramp flat and put the tile back to the start.
4. Repeat this measurement once or twice more.
5. Write your data in the results table.
6. Measure out 5cm³ of lubricant A and spread it onto your tile.
7. Place the tile at the top of your ramp. Raise the ramp slowly. When the tile moves measure the height of your ramp.
8. Repeat this measurement once or twice more. Clean the ramp and tile between each measurement.
9. Repeat with lubricants B to E.
10. Work out the average for your results:

$$\text{Average} = \frac{\text{(1st reading + 2nd reading + 3rd reading)}}{3}$$

Science Facts

Water freezes at 0°C.

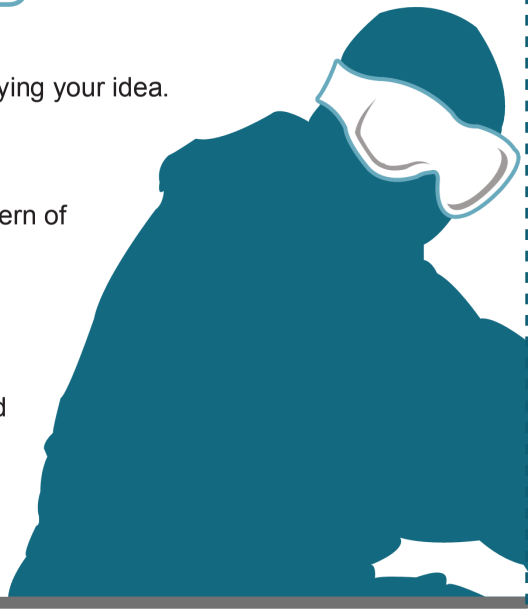
Vegetable oils are very viscous.

Sunflower oil freezes at -17°C.

Detergent helps water and oil to mix.

Glossary

patent
A law that stops someone else from copying your idea.
data
Pieces of information.
outlier
A measurement that does not fit the pattern of other data.
reliable
If repeated measurements of the same thing are close together, then the data is probably reliable. You can have more confidence in conclusions that are based on reliable data.
viscous
Liquids are viscous if they are thick and sticky like golden syrup.



More Clues

Think about ski slopes. Can you measure the steepness of a slope needed to make an object slide down it? Then repeat with added lubricant?

Or measure the speed of a moving object with and without lubricant?

More Clues

Joe tried this investigation last week. Want some advice from his experience?

The measurement of the height is really critical.

I forgot to clean the ramp as well as the tile and it messed up my results.