PROPERTIES OF FLOOR WAX

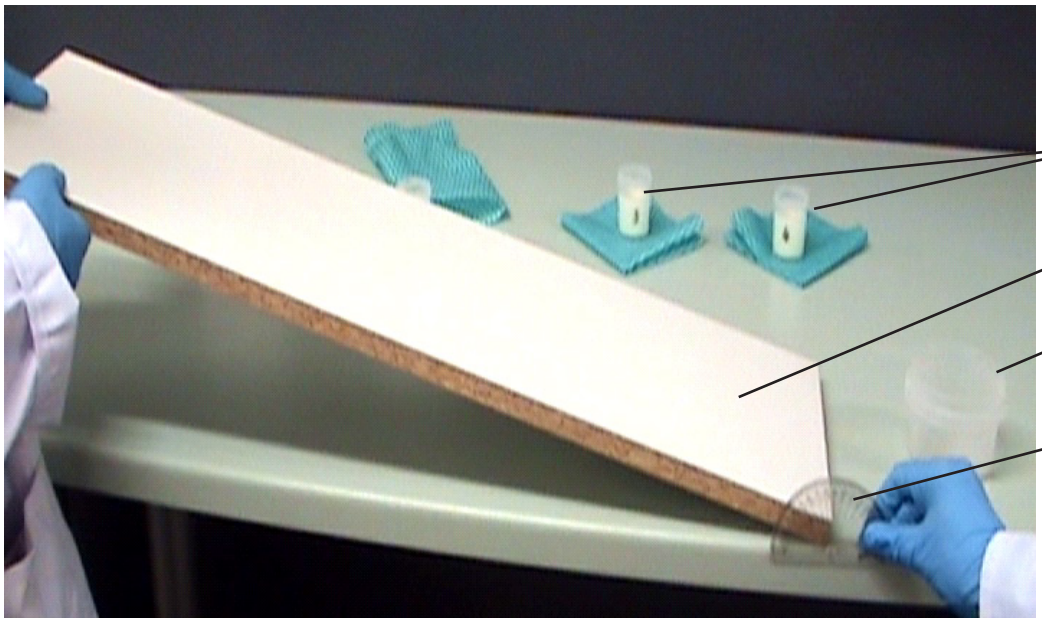
Instructions

- Read these investigation instructions, results and theory.
- Watch the accompanying movie.
- Answer the questions.
- Perform the investigation yourself for enrichment.

Investigation instructions and results

Apparatus

- Four different kinds of floor polish prepared by mixing molten candle wax in paraffin wax. Treatments differ in amount of candle wax dissolved in paraffin to make the polish:
  - A: 4 g candle wax / 20 ml paraffin
  - B: 8 g candle wax / 20 ml paraffin
  - C: 12 g candle wax / 20 ml paraffin
  - D: 16 g candle wax / 20 ml paraffin
- Four planks.
- An object to slide down the planks.
- A protractor.



Method

- Smear some polish onto each plank.
- Place the sliding object on one plank at a time.
- Lift one end of the plank gradually until the object begins to slide.
- Measure the angle the plank makes to the horizontal when in this position.

Results

The effect of a polish's amount of candle wax on the amount of friction it gives

	Mass candle wax / 20ml paraffin (g)	Minimum angle causing sliding (° to horizontal)	
		Raw data (3 repetitions)	Average
A	4	16, 16, 16	16
B	8	20, 16, 18	18
C	12	26, 22, 30	26
D	16	46, 45, 47	46

Background theory

Candle wax is made of long-chained alkanes, and liquid paraffin of short-chained alkanes. Both are sometimes called paraffins, since they are both alkanes. Candle wax can be called paraffin wax. Alkanes are hydrocarbons with only single bonds. Hydrocarbons consist of only carbon and hydrogen atoms. Longer chained hydrocarbons have a higher viscosity than shorter chained hydrocarbons. Viscosity means resistance to flow. Long chained hydrocarbons tangle up with one another, making it difficult for them to flow over one another, making their viscosity high. Their viscosity may be so high that they cannot flow at all: they are solids, not liquids.

Heating a solid can melt it. This decreases its viscosity, changing it from solid to liquid. When candle wax is melted, it can mix with paraffin. This mixture is called a solution.

Friction is a force which resists motion. It results from surfaces rubbing against one another. The amount of friction is affected by how hard the two rubbing surfaces are pressed together, and how rough each surface is. Therefore the friction between an object and the surface it is resting on can be reduced by making the object lighter, tilting the surface, or by making the surfaces smoother. Some polish might make a surface smoother.

Questions

Variables

Complete / Give the:

1 **Independent** variable. _____

(Cause. What the investigator made different between the treatments.)

2 **Indicator** of the **dependent** variable. _____

(Measurement of effect. What the investigator measures to show the investigation outcome.)

3 _____variable. **Amount of friction the polish gives.**

(Effect. Different between the treatments because they had been treated differently from the start.)

4 **Controlled** variables (list at least three). (Must be kept the same between treatments for a fair test.)

_____

_____

Focus question

Complete:

5 How does _____ affect _____?

[independent variable] [dependent variable]

Theory

6 What is friction? _____

7 How can friction between two surfaces be reduced?

_____

8 Why do we want polish with more friction?

_____

9 How does candle wax differ from paraffin?

Candle wax _____

whereas paraffin _____.

Graph

10 Represent the findings graphically. Only plot the average values.

Check. Have you:

Tick if done:

- given a suitable graph heading? ☐
- plotted the independent variable on the x (——) axis? ☐
- plotted the indicator of the dependent variable on the y (|) axis? ☐
- labelled each axis and given units where appropriate? ☐
- accurately plotted data points with small circled dots? ☐
- drawn a smooth trend line? ☐

11 It would be wrong to make this graph's line cut the origin (0,0). Why?

Interpretation

12 Circle the correct option to analyse the data.

Amount of candle wax	Minimum angle causing sliding	Amount of friction polish gives
high → was found to cause →	a [higher / lower] sliding angle → indicates →	[more / less] friction
low → was found to cause →	a [higher / lower] sliding angle → indicates →	[more / less] friction

13 Interpret the results in your own words.

Conclusion

14 Answer the focus question in your own words.

15 Complete for a shorter way of writing the conclusion.

Increasing _____ [independent variable]

[increases / decreases / doesn't affect] _____ [dependent variable]

Discussion

16 Suggest a reason for your findings, referring to the background theory.

_____

_____

_____

Further investigation

Design another investigation of your own, using the guidance given below.
It must have a different focus question from the previous investigation.

Variables

Complete / Give the:

17 **Independent** variable. _____
Dependent variable. **Amount of friction polish gives.**

18 **Controlled** variables. (Must be kept the same between treatments for a fair test.)
Compared to the previous investigation, give one variable which:

a must be constant between treatments here, but not previously

_____

b must not be constant between treatments here, but must be previously

_____

Focus question

Complete:

19 How does _____ affect _____?
[independent variable] [dependent variable]

Method

20 Treatments differ in : _____

A: _____ C: _____

B: _____ D: _____

Table

21 Fill in headings and values showing how you will treat the treatments differently.
Include units in headings where appropriate.
Leave empty spaces where you could fill in data after taking measurements.

A		
B		
C		
D		