

# Friction

Name & Set



- 1 Friction can be either a nuisance or a help depending on the situation.  
(a) Give two examples in which friction is a **nuisance** in the proper functioning of a bicycle. For each of example explain how friction is a nuisance, and how the effects of friction can be **reduced**.

Example 1 \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ [3]

Example 2 \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ [3]

- (b) Give two examples in which friction is of **help** in the proper functioning of a bicycle. For each of example explain how friction is helpful and how the effects of this useful friction can be **increased**.

Example 1 \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ [3]

Example 2 \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ [3]

3 (a) In each of the following situations, state whether friction is a nuisance or useful. Give a reason for your answer.

(i) rock climbing \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_ [2]

(ii) skiing \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_ [2]

(iii) a bicycle chain \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_ [2]

(iv) writing with a pencil \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_ [2]

(v) walking \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_ [2]

4 How is friction reduced in a hovercraft?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ [2]

5 Explain the following

(i) It's much more difficult to push a boat across a sandy beach than to push it through water

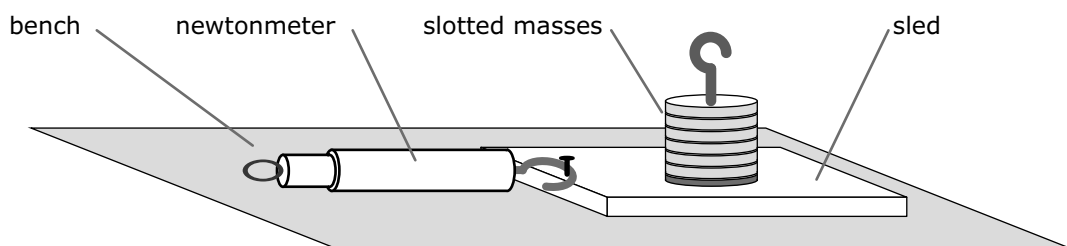
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ [2]

(ii) Oil is applied to hinges

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ [2]

6 Here is a diagram of the apparatus used in an experiment to measure the friction force between a wooden sled and the surface of a laboratory bench.

**Apparatus**



**Method**

- Several slotted masses are put on the sled
- The sled is then pulled with a newtonmeter so that it moves at constant speed.
- The force exerted by the newtonmeter is recorded.
- A slotted mass is removed reducing the force with which the sled presses against the bench and the new friction force is measured.
- The experiment continues like this until all the slotted masses are removed from the sled.

**Results**

Here are the results obtained.

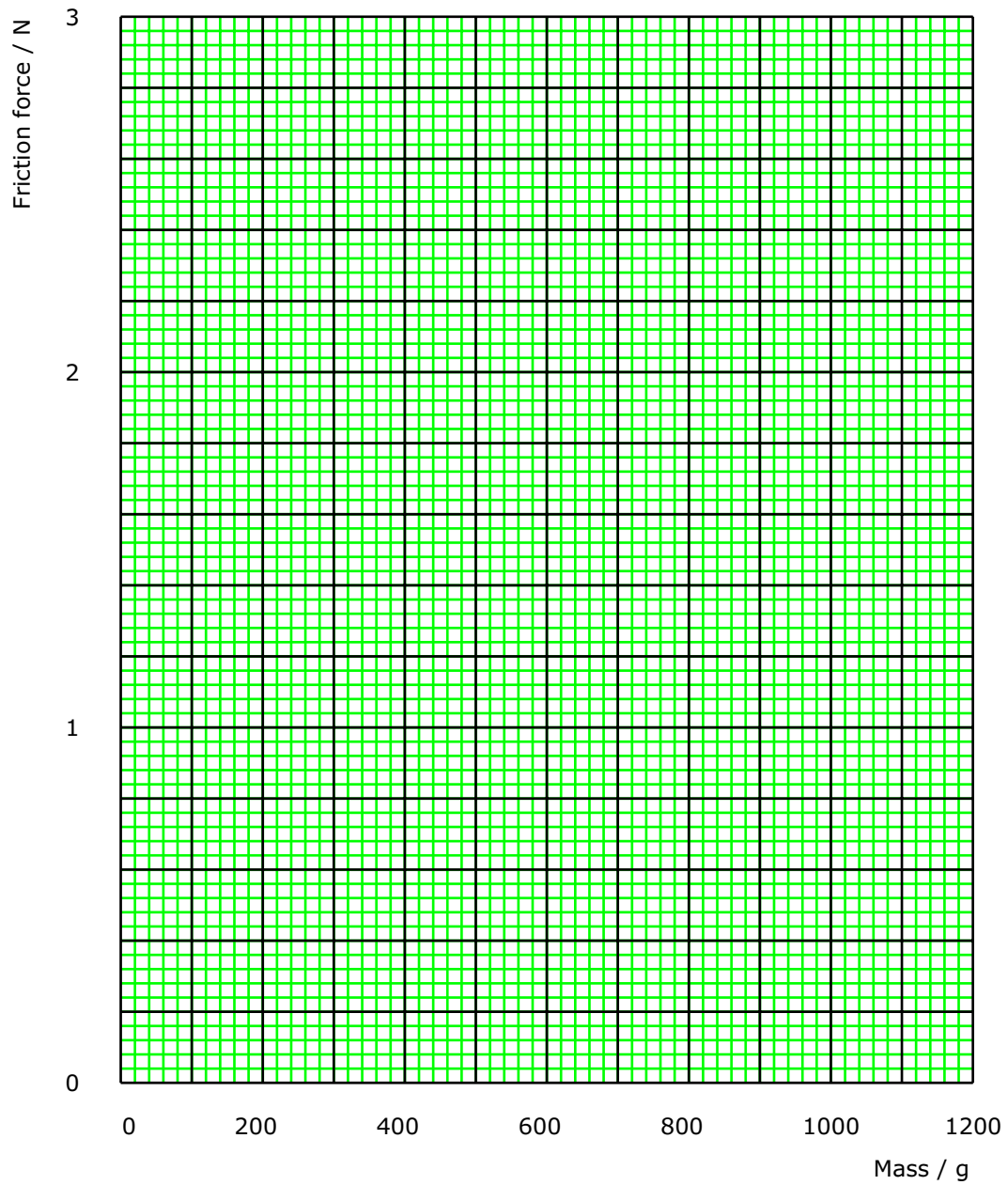
The mass of the sled was 140 grams

Complete the table by filling in the column headed 'total mass'.

[3]

Mass on sled (grams)	Total mass (grams)	Friction Force (Newtons)
1000		2.9
900		2.6
800		2.4
700		2.3
600		2.1
500		1.9
400		1.5
300		1.3
200		1

Plot a graph of total mass (sled + slotted masses) (x-axis) against the frictional force (y-axis) and draw the line of best fit through the points. [4]



What can you conclude from the graph about the effect of increasing the weight of the sled on the friction force?

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[2]