F=ma/ Resultant Forces

Question Paper

Level	IGCSE
Subject	Physics
Exam Board	CIE
Topic	General Physics
Sub-Topic	F=ma / Resultant Forces
Paper Type	Alternative to Practical
Booklet	Question Paper

Time Allowed: **32 minutes**

Score: **/26**

Percentage: **/100**

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1 The class is determining the mass of an object using two strings.

The apparatus is set up as shown in Fig. 1.1.

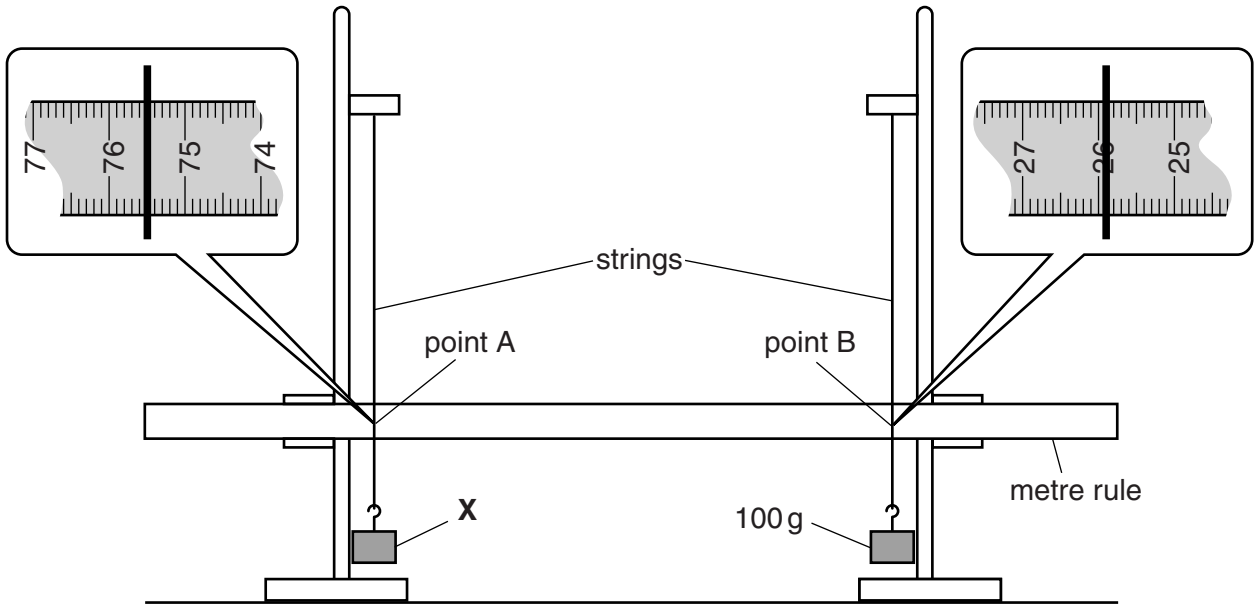

Fig. 1.1

(a) (i) Record the scale reading a_0 at point A, where the string crosses the rule, as indicated in the enlarged section of Fig. 1.1.

a_0 = ...

(ii) Record the scale reading b_0 at point B.

b_0 = ...
[2]

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(b) A loop of string is placed around the vertical strings so that they are pulled closer together, as shown in Fig. 1.2. The loop is horizontal and is just above the rule.

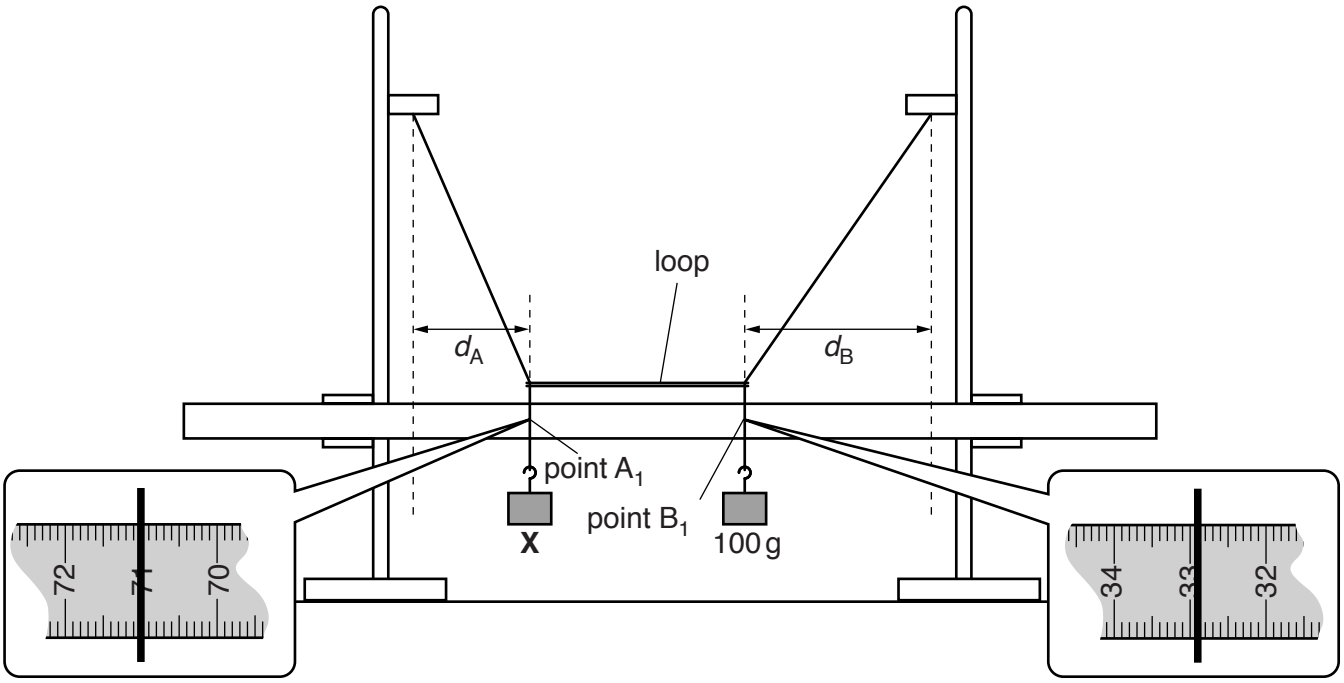

Fig. 1.2

(i) Record the scale reading a_1 at point A_1 as indicated in the enlarged section of Fig. 1.2.

a_1 = ...

(ii) Record the scale reading b_1 at point B_1.

b_1 = ...
[1]

(iii) Calculate and record the distance d_A, shown in Fig. 1.2. Use your results from **(a)(i)** and **(b)(i)**. d_A is the difference between a_0 and a_1.

d_A = ...

(iv) Calculate and record the distance d_B. Use your results from **(a)(ii)** and **(b)(ii)**. d_B is the difference between b_1 and b_0.

d_B = ...
[1]

(c) Calculate the mass M of object **X**, using your results from **(b)(iii)** and **(b)(iv)** and the equation $M = \frac{k\,d_B}{d_A}$ where $k = 100\,\text{g}$.

M = ...[2]

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(d) Explain how you could ensure that the loop is horizontal in **(b)**. You may draw a diagram.

.....

.....

.....[1]

(e) A student suggests that d_A and d_B might be directly proportional to each other.

Briefly describe how this experiment could be extended to investigate the suggestion.

.....

.....

.....[2]

[Total: 9]

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2 The IGCSE class is investigating the effect of a load on a metre rule attached to a forcemeter.

The apparatus is shown in Fig. 1.1.

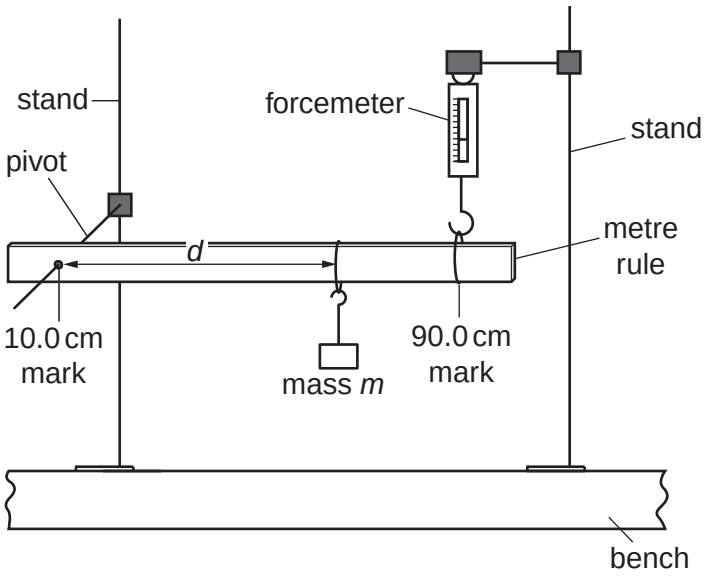

Fig. 1.1

The rule is pivoted near one end at the 10.0 cm mark. Near the other end, at the 90.0 cm mark, the rule is attached to a forcemeter. A mass is hanging from the rule at a distance *d* from the pivot.

(a) A student moves the mass to a distance *d* = 70.0 cm from the pivot. He adjusts the height of the forcemeter until the rule is again horizontal. He records the reading *F* on the forcemeter.

He repeats the procedure using *d* values of 60.0 cm, 50.0 cm, 40.0 cm, 30.0 cm, 20.0 cm and 10.0 cm. The forcemeter readings are shown in Table 1.1.

Table 1.1

d /	*F* /
	2.9
	2.5
	2.2
	1.8
	1.5
	1.2
	0.8

(i) Record the *d* values in the table.

(ii) Complete the column headings in the table. [2]

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(b) The student thinks that F is directly proportional to d.

(i) Suggest the graph that you could plot to test this idea. You are not asked to plot the graph.

..... against .....

(ii) State the properties of the line that would indicate that F is directly proportional to d.

1. .....

2. .....

[3]

(c) A spirit level is a piece of equipment that is placed on a surface to check whether the surface is horizontal.

Suggest why a spirit level balanced on the rule is not suitable for checking whether the rule is horizontal in this experiment.

.....

.....[1]

(d) Describe briefly how you would check that the rule is horizontal in this experiment. You may draw a diagram.

.....

.....

.....[1]

[Total: 7]

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3 The IGCSE class is studying the acceleration of a toy car that is pulled along a track by a force *F*.

The arrangement is shown in Fig. 1.1.

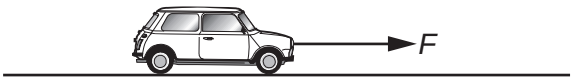


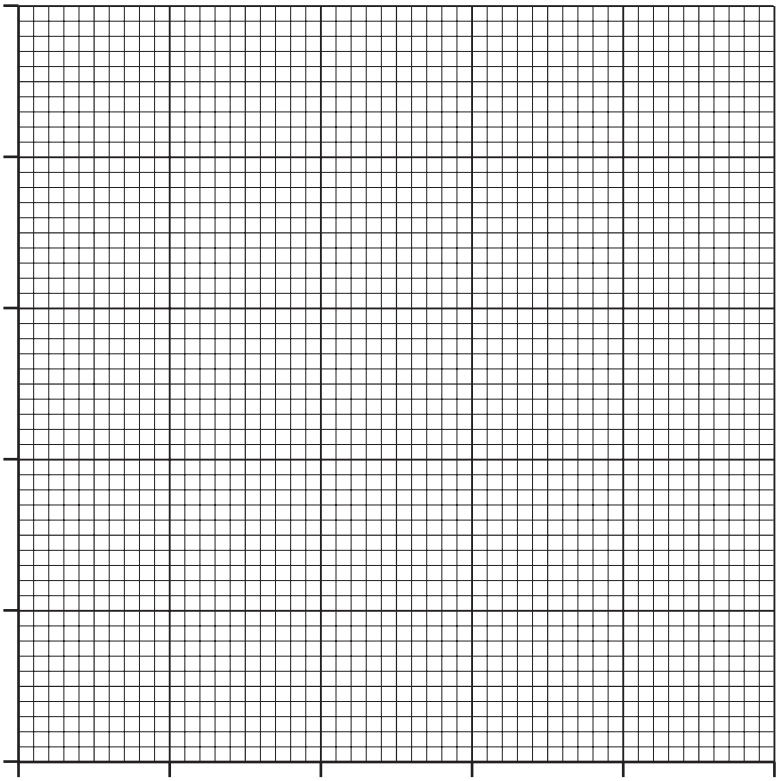
Fig. 1.1

A student uses a force *F* of 0.5 N to pull a toy car along a track and electronically measures the acceleration *a*. He records the results in a table. He repeats the procedure using a range of different forces up to 2.5 N. The readings are shown in Table 1.1.

Table 1.1

$\frac{F}{\text{N}}$	$\frac{a}{\text{m/s}^2}$
0.5	0.35
1.0	0.72
1.5	1.02
2.0	1.44
2.5	1.74

(a) Plot a graph of $\frac{F}{\text{N}}$ (*y*-axis) against $\frac{a}{\text{m/s}^2}$ (*x*-axis).



[5]

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(b) Theory suggests that the acceleration is directly proportional to the force applied to the toy car. State whether the results support this suggestion and justify your statement by reference to the graph.

statement .....

justification .....

..... [2]

(c) The gradient of the graph is equal to the mass of the toy car. From the graph, determine the mass *m* of the toy car. Show clearly how you obtained the necessary information.

m = ... [3]

[Total: 10]