SYSTEMATIC AND RANDOM ERROR

1 The measurement of a physical quantity may be subject to random errors and to systematic errors. 9702/01/O/N/06

Which statement is correct?

A Random errors can be reduced by taking the average of several measurements.

B Random errors are always caused by the person taking the measurement.

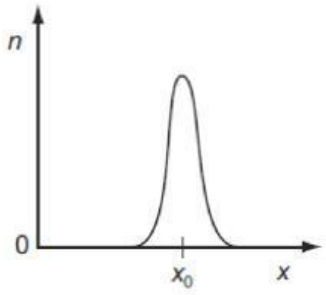
C A systematic error cannot be reduced.

D A systematic error results in a different reading each time the measurement is taken.

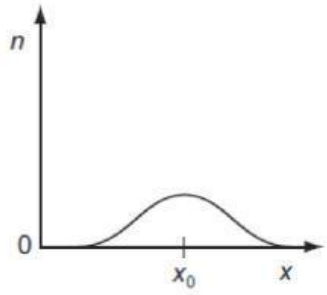
2 A fixed quantity x_0 is measured many times in an experiment that has experimental uncertainty. A graph is plotted to show the number n of times that a particular value x is obtained. 9702/11/O/N/10

Which graph could be obtained if the measurement of x_0 has a large systematic error but a small random error?

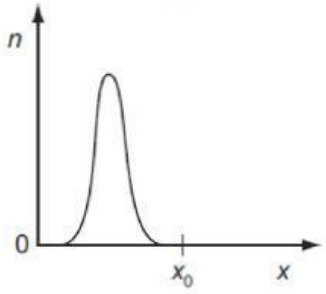
A



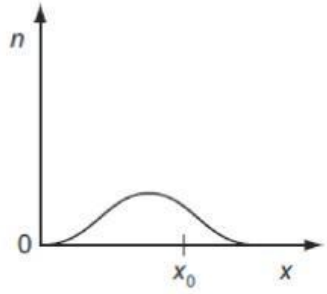
B



C



D



3 Measurements are subject to systematic error and random error. 9702/13/O/N/15

Which measurements have high accuracy and low precision?

A high random error and high systematic error

B high random error and low systematic error

C low random error and high systematic error

D low random error and low systematic error

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4 9702/23/M/J/11, Q1

(a) For each of the following, tick [✓] one box to indicate whether the experimental technique would reduce random error, systematic error or neither. The first row has been completed as an example.

	random error	systematic error	neither
keeping your eye in line with the scale and the liquid level for a single reading of a thermometer		✓	
averaging many readings of the time taken for a ball to roll down a slope			
using a linear scale on an ammeter			
correcting for a non-zero reading when a micrometer screw gauge is closed			

[2]

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(b) The measurement of a particular time interval is repeated many times. The readings are found to vary. The results are shown in Fig. 1.1.

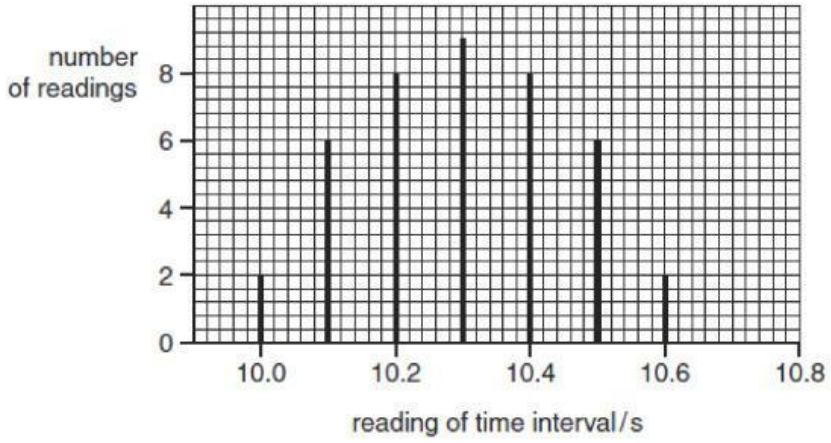


Fig. 1.1

The true value of the time interval is 10.1 s.

(i) State how the readings on Fig. 1.1 show the presence of

1. a systematic error,

.....

.....[1]

2. a random error.

.....

.....[1]

(ii) State the expected changes to Fig. 1.1 for experimental measurements that are

1. more accurate,

.....

.....[1]

2. more precise.

.....

.....[1]

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