

2017 SCORING GUIDELINES

Question 2

Distribution
of points

12 points total

(a)

i. 3 points

For drawing a diagram of an experimental setup to measure the coefficient of friction that is feasible in a school physics lab

1 point

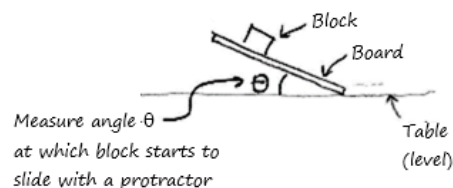
For indicating the measurements necessary for calculating the coefficient of friction

1 point

For indicating equipment necessary for measuring the quantities required to calculate the coefficient of friction

1 point

Example:



ii. 3 points

For a description that is consistent with the diagram in part (a)(i), in enough detail that another student could replicate the experiment

1 point

For a description that is a conceptually valid method to find quantities that would allow a calculation of a friction coefficient

1 point

For including a valid method for reducing experimental error

1 point

Example:

With the block at rest on the board, slowly lift one end of board until the block just begins to slide. Measure the angle between board and table and repeat several times with block at different locations on the board (with multiple trials at each location).

(b) 3 points

Note: In order to earn full credit for part (b), all terms (variables) must be indicated in the diagram and/or procedure of part (a).

For using Newton's second law (or reasoning in terms of zero net force) in one dimension, parallel to the board's surface, either explicitly or implicitly

1 point

For using Newton's second law (or reasoning in terms of zero net force) in one dimension, perpendicular to the board's surface, either explicitly or implicitly

1 point

Note: Replacing the normal force with mg is "implicit" use of Newton's second law in the perpendicular direction for a horizontal surface. For a tilted surface, the appropriate trigonometric term should be included.

For a correct derived expression of the coefficient of static friction in terms of quantities indicated in part (a)

1 point

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Question 2 (continued)

Distribution
of points

(c) 2 points

Correct answer: "The static and kinetic coefficients are not equal."

Reasoning cannot earn credit if the incorrect selection is made.

For identifying group 5's results as outliers, or indicating the presence of an outlier

1 point

For a conclusion that coefficients are not the same, justified by either removing the outlier or noting the coefficients are different for each group

1 point

(d) 1 point

For a valid argument that indicates the coefficient of static friction is a property of the two surfaces, and is consistent with the selected answer

1 point

Example 1: Selects "Remain the same"

Referring to the equation in part (b), coefficient does not depend on mass.

Example 2: Selects "Remain the same"

The coefficient depends on the nature of the surfaces involved, not the masses or normal force of the objects involved.

Example 3: Selects "Decrease"

The increased normal force will cause smoothing of the surfaces, decreasing the coefficient of friction.

Example 4: Selects "Increase"

The increased normal force will cause the surfaces to become gouged, increasing the coefficient of friction.