

Accuracy and Precision Card Trick

Introduction to Measurement



Introduction

Use this summative activity to reinforce the concepts of accuracy and precision.

Concepts

- Accuracy
- Precision
- Experimental design

Materials

Cards, regular deck

Cards, oversize deck, 3

Safety Precautions

The materials used in this activity are considered nonhazardous. Wash hands thoroughly with soap and water before leaving the laboratory. Follow all laboratory safety guidelines.

Preparation

1. Predetermine which card you would like the student volunteer to pick. In the video the volunteer is to pick the five of hearts from the deck of cards.
2. Shuffle the regular deck of cards and place the five of hearts on the bottom of the deck.
3. Randomly choose three large cards to represent the first set of data—neither precise nor accurate. Place these three cards in one pile.
4. Choose three suits of the same card, on the video this was three different tens, to represent the second set of data—precise but not accurate. Place these three cards into a second pile.
5. Choose three of the same suit and same card, on the video this was three five of hearts, to represent the third set of data—precise and accurate. Place these three cards into a third pile.
6. Choose three cards of the same suit that when averaged equal the chosen card, on the video these were the ten, two, and three of hearts, to represent the fourth set of data—accurate but not precise. Place these three cards into a fourth pile.

Procedure

1. Show the regular deck of cards to the class, being careful to cover the five of hearts on the bottom of the deck.
2. Ask the student volunteer to place a finger into the deck as you cut the cards. *Note:* Always cut the cards from the top of the deck to ensure that the five of hearts is on the bottom of the top deck and above the cut cards.
3. Once the student places his or her finger between the cards, show the five of hearts to the students.
4. Review each pile of oversized cards with the students. Explain how the data reflects the experiment's precision and accuracy and that each is important for a scientific experiment.
 - a. The first pile of oversized cards represents neither precision nor accuracy.
 - b. The second pile of oversized cards is precise since they are all tens but they are not accurate since ten was not the chosen card.
 - c. The third pile of oversized cards is both precise and accurate since it is composed of three five of hearts—the chosen card.
 - d. The fourth pile of oversized cards is accurate since the average of the three cards is the five of hearts, but it is not precise.

Disposal

Please consult your current *Flinn Scientific Catalog/Reference Manual* for general guidelines and specific procedures governing the disposal of laboratory waste. The materials used in this activity may be reused.

Tips

- Card fronts and backs can be printed from online.
- The chosen card can be any card. Set up a different card for each section you teach to really wow the students.

Discussion

Accuracy and precision are two different properties of the error associated with measurement. Accuracy describes how “correct” a measured or calculated value is, that is how close the measured value is to an actual or accepted value. The only way to determine the accuracy of an experimental measurement is to compare it to a “true” value—if one is known! Precision describes the closeness with which several measurements of the same quantity agree. The precision of a measurement is limited by the uncertainty of the measuring device or instrument as well as human error in reading the measurement on the device or instrument. Error in the experimental design or in laboratory technique will lead to inaccurate and/or imprecise data. Good experimental design and proper technique are necessary components of any good science laboratory.

Connecting to the National Standards

This laboratory activity relates to the following National Science Education Standards (1996):

Unifying Concepts and Processes: Grades K–12

Evidence, models, and explanation

Content Standards: Grades 5–8

Content Standard G: History and Nature of Science, nature of science

Content Standards: Grades 9–12

Content Standard G: History and Nature of Science, nature of scientific knowledge

Flinn Scientific—Teaching Chemistry™ eLearning Video Series

A video of the *Accuracy and Precision Card Trick* activity, presented by Mike Roadruck, is available in *Introduction to Measurement* and *There’s Magic in Chemistry* part of the Flinn Scientific—Teaching Chemistry eLearning Video Series.