

Physics of Sports

Lesson 1: Measurements and Accuracy Teacher's Guide

Connections:

Previous Lesson	Current Lesson	Next Lesson
Units (Length / mass / Time)	Measurements and Accuracy in Sports	Quality Assurance and Physics

Objectives:	<ul style="list-style-type: none"> To understand the role of measurements. To use simple measurement devices to measure and/or estimate physical quantities. To convert units and compare to established values. Understand the importance of numerical accuracy and significant digits
Resources required:	<ul style="list-style-type: none"> A ping-pong ball A ruler A pair of scissors Some pieces of cardboard or poster board – 3" x 3" will do Student's Worksheet Lesson 1
Useful data:	<p>Table dimensions</p> <ul style="list-style-type: none"> Length = 274 cm Width = 152.5 cm Height = 76 cm Net height = 15.25 cm <p>The Olympics size ping-pong balls have:</p> <ul style="list-style-type: none"> Diameter = 4 cm = 0.04 m Wall thickness varies but is approximately 0.04 cm.
Video(s):	<p>Start by showing a short video clip where Ping Pong Table Parts (Measurements) and dimensions have been discussed</p> <p>Ask the students to note down all the dimensions mentioned in the video.</p> <p>https://www.youtube.com/watch?v=a60KI1CVFd4</p>
Mathematics Review:	<p>Ask students if they can recall what is the volume of a sphere?</p> <p>Use that knowledge to calculate the volume of the ball:</p> $V = \frac{4}{3}\pi(\text{radius})^3 \approx (\text{diameter})^3 / 2$ <p>Ask students what is the surface area of a sphere?</p> <p>Use that knowledge to calculate the surface area of the ball</p> $S_A = 4\pi(\text{radius})^2 = \pi(\text{diameter})^2 \approx 3(\text{diameter})^2$

Discussion Questions	<p>The activity starts with some questions:</p> <ol style="list-style-type: none"> 1. Which system of units is used by the presenter in the video? 2. How is that related to SI system in which the table dimensions are known (see the values given above) 3. Identify the units used (length) and find the conversion factor in the book (1 foot = 0.3048 m). 4. Ask student to convert the units and compare to the values available in this sheet. 5. Provide them a ping-pong ball and ask them to find ways to measure its diameter (for example they can hold the ball between two flat and parallel surfaces and measure the distance between those surfaces). <p>A number of follow-up questions can now be asked to prepare for the next class:</p> <ol style="list-style-type: none"> 1. What did you learn from the video and later calculations? 2. Why do you think these measurements are important? How are they relevant to the success of the sport? 3. What will happen if you use a table that does not meet the standards? What tests might you use to find out if the table meets the standards? 4. What other factors about the table should be checked? Different characteristics of the table change the physical properties and how the ball will react to it. For example, a very smooth table will have less friction whereas a rough table will have more. Use the student's responses to examine physical properties.
Fun fact	<p>The sport originated in Victorian England, where it was played among the upper-class as an after-dinner parlor game. It had several different names, including 'whiff-whaff', and it has been suggested that makeshift versions of the game were developed by British military officers in India or South Africa, who brought it back with them. A row of books was stood up along the center of the table as a net, two more books served as rackets and were used to continuously hit a golf-ball.</p> <p>https://en.wikipedia.org/wiki/Table_tennis</p>