Vernier calipers experiment pdf

The accuracy of length measurements can be increased by using a device that uses a sliding scale. Two such instruments based on a vernier scale that you will use in the lab to measure the lengths of the objects are the Vernier Calliper and the Micrometer Screw Meter. These instruments have a main scale (in millimeters) and a sliding or rotating vernier scale. In Figure 1 below, the Vernier scale (below) is divided into 10 equal divisions, so that the lowest number of the instrument is 0.1 mm. The measurement takes into account both the main scale and the Vernier scale measurements. The main scale is the first reading on the main scale immediately to the left of the zero of the Vernier scale (3 mm), while the Vernier scale is the marker on the Vernier scale, which exactly matches a marker on the main scale (0.7 mm). The measured value is therefore 3.7 mm. Figure 1: The measured value here is 3.7 mm. Figure 1: The measured value here is 15.8 mm. This Java applet will help you understand how to read a Vernier scale. The Vernier saddles Found in the laboratory contain a main scale and a sliding scale that allows measurements to be made to the nearest 0.02 mm. This instrument can be used to measure external dimensions of objects (with the main jaws), interior dimensions (with the smaller jaws at the top) and depths (with the handle). Figure 3: The Vernier saddles To measure the outer dimensions of an object, the object is placed between the jaws, which are then moved together until they back up the object. The screw terminal can then be tightened to ensure that the reading does not change during reading. Watch this short movie to see how to do this. Here's a nice saturated applet. The first significant numbers are immediately read to the left of the zero of the Vernier scale, and the remaining digits are taken as the vernier scale division that follows with each main scale division. Some examples: Note that the important area of the Vernier scale in the upper right corner of each figure is magnified. Figure 4: The reading is 37.46 mm. In Figure 4 above, the first significant numbers are taken as the main scale to the left of the Vernier Zero, i.e. 37 mm. The remaining two digits come from the Vernier scale, which yields with each main scale, i.e. 46 on the Vernier scale. Thus, the measured value is 37.46 mm. Figure 5: The reading is 34.60 mm. In Figure 5 above, the first significant numbers are taken as the main scale to the left of the Vernier Zero, i.e. 34 mm. The remaining two digits come from the Vernier scale, which yields with each main scale, i.e. 60 on the Vernier scale. Note that the zero must be included, as the scale between the fiftieth can distinguish between them. Therefore, the measured value is 34.60 mm. Figure 6: The reading is 40.00 mm. Figure 6 shows the zero and the ten on the Vernier scale with the main scale main scale therefore, the reading is 40.00 cm. Try the following for yourself. Figure 7: Click here for the answer. Figure 8: Click here for the answer. Figure 9: Click here for the answer. The micrometer screw meter The micrometer screw meter is used to measure even smaller dimensions than the Vernier callipers. The micrometer screw meter also uses an auxiliary scale (measurement of hundredths of a millimeter) marked on a rotary thin. Basically, it is a screw with an exactly constant pitch (the amount around which the thumb moves forward or backward for a complete rotation). The micrometers in our laboratory have a slope of 0.50 mm (two full rotations are required to close the jaws by 1.00 mm). The rotating thumb is divided into 50 equal divisions. The thumb passes through a frame that has a millimeter scale of 0.5 mm. The jaws can be adjusted by turning the thumb with the small ratchet button. This includes a friction clutch that prevents too much voltage. The thumb must be rotated by two revolutions to open the jaws by 1 mm. Here is a useful applet to learn how to use the micrometer screw meter. Figure 10: The micrometer screw meter To measure an object, the object is placed between the jaws and the thumb is rotated with the ratchet until the object is secured. Note that the ratchet button must be used to secure the object firmly between the jaws, otherwise the instrument could be damaged or give an inconsistent measurement. The manufacturer recommends 3 clicks of the ratchet before reading. The lock can be used to ensure that the thumb does not rotate while you are reading. Watch this short movie to see how to do this. The first significant figure comes from the last graduation, which appears on the sleeve directly to the left of the rotary thinner. Note that an additional half-scale split (0.5 mm) must be included if the mark is visible below the main scale between the thumb and the main scale division on the sleeve. The remaining two significant figures (hundredths of a millimeter) are taken directly from the thumb opposite the main scale. Figure 11: The reading is 7.38 mm. In Figure 11, the last graduated, visible to the left of the thumb, is 7 mm and the thumb with the main scale is 38 hundredths of a millimeter (0.38 mm); therefore the measured value is 7.38 mm. Figure 12: The reading is 7.72 mm. In Figure 12, the last graduation to the left of the thumb is 7.5 mm; Therefore, the reading is 7.5 mm plus the thumb value of 0.22 mm, which results in 7.72 mm. Figure 13: The reading is 3.46 mm. In Figure 13, the main scale value is 3 mm, while the reading on the drum is 0.46 is; Therefore, the reading is 3.46 mm. Figure 14: The reading is 3.56 mm. In Figure 14, the 0.5 mm pitch is visible below the main scale; therefore, the reading is 3.5 mm + 0.06 mm = 3.56 mm. Try the following yourself. Figure 15: Click here for the answer. Figure 16: Click here for the Figure 17: Click here for the answer. If you are using a vernier saddle or a micrometer screw meter, you must always take a zero value, i.e. a measured value with a closed instrument. This is because when you close your brake calipers, you will see that very often (not always) it does not read zero. Only then open the jaws and place the object to be measured firmly between the jaws and take the open reading. Your actual measurement will then be the difference between your open read and your zero value. Record the result of your Vernier measurement Let's say that you make a measurement with an object between the jaws of a Vernier saddle and you see the following: Say that you decide that the best estimate of the measured value l is 1 37.46 mm. What about the standard uncertainty u(l1) at this reading? If you are using a triangular probability density function, you can decide that you are 100% sure that the reading is not 37.42 mm, and that 100% are certain that the reading is not 37.50 mm. Then mm = 0.0163 mm If you remove the object and read the vernier saddles with closed jaws, you can decide that the best estimate of the closed reading l0 = 0.04 mm with standard incerentity u(l 0) = 0.0204 mm What should you record as the best estmate of the length of the object you are measuring? The best estimate of length l = l 1 - l0 = 37.46 - 0.04 = 37.42 mm with a standard uncertainty = = 0.0261 mm Therefore l = 37.420 ± 0.026 mm (65% confidence level). Answers Figure 7: 30.88 mm Figure 8: 8.10 mm Figure 9: 121.68 mm Figure 15: 5.80 mm Figure 16: 3.09 mm Figure 17: 0.29 mm A vernier scale or a Vernier soriper is a measuring instrument used for precise measurement of linear dimensions. It is a useful tool to measure spherical and cylindrical objects. It has two main scales known as the main scale and the vernier scale, which are divided into small divisions. Both scales have two jaws that are perenning to the scale. The zeros of the main scale and the Vernier scale match when the jaws are made to touch each other. The jaws and metallic strips are designed to measure the diameter of the objects. In this experiment, we learn to measure the diameter of a small spherical/cylindrical body with Vernier Calliper. Aim To use Verniers Calliper to measure the diameter of a small spherical/cylindrical body. Equipment/Materials Required A spherical body such as a pendulum bob or a glass marble Verniers Caliper Magnifying Glass theory The smallest distance that can be measured along the distance is the smallest number. It is the difference between a main scale division and a Vernier scale division. Used (n(V.S.D)=(n-1)M.S.D.) Formula Used Least-Number of Verniers Calliper ,(='frac'magnitude','the',small,,division',on',the',main' Corrected diameter = medium observed diameter - zero error diagram Vernier Calliper procedure Keep the jaws of the Vernier calliper closed. Making Make that the zero of the main scale perfectly matches the zero of the Vernier scale. If it does not match the null error for all observations. Use a magnifying glass to find the distribution of the main scale that matches the distribution of the Vernier scale. Make a note of the number of divisions that match each other. To avoid parallax errors, position your eye directly above the division sign. Loosen the movable jaw by gently loosening the screw. Slide it enough to hold the ball or cylindrical body between the jaws AB without excessive pressure. Align the perfectly vertical to the diameter of the body. Tighten the screw carefully to clamp the instrument to the body in this position. Note the position of the zero of the Vernier scale versus the zero of the main scale. Normally it will not match perfectly with any of the divisions on the main scale. Record the main scale split to the left of the vernier scale's zero markers. Pay attention to the exact match of the Vernier scale division with that of the main scale division in the Vernier window from the left end to the right. Make a note of the number N. Multiply the obtained N by the lowest number of the instrument and add the product to the main scale mentioned in step 4. Make sure you convert the product to proper units for a valid supplement. Repeat steps 3-6 to maintain the body's positions at different positions on its curved surface. Be sure to take three reading sets at a time. Record the observations in a table column with the correct read. Do not apply a correction if necessary. Find the arithmetic mean of the corrected measurements of the diameter of the body. Observations Lowest Number of Vernier Callipers Main Scale Division = 1 mm = 0.1 cmNumber of Venier Scale Division N = 10 10 Vernier Scale Division = 9 Main Scale Division 1 Vernier Scale Division = 0.9 Main Scale Division Vernier Constant = 1 Main Scale Division - 1 Vernier Scale Division = ((() 1 - 0.9) Main scale divisions = 0.1 main scale divisions Vernier constant = 0.1 mm = 0.01 cm (True, Reading=Observed,Read(pm zero,error)) Table for measuring the diameter of a small/spherical body S. No. main scale value, M (cm/mm) Number of simultaneous vernier division, N Vernier scale, V = N × VC (cm/mm) Measured diameter, M + V (cm/mm) 1 2 3 4 (zero, error =... cm) Mean observed diameter = ... cm Corrected diameter = Mean observed diameter - zero error result The diameter of the given ball/cylinder is _____ cm. Viva Voice What is the principle of a nier? Answer: The Vernier scale uses the alignment of line segments that are moved by a small amount to create fine Perform. How is the least number of Vernier callipers calculated? Answer: The lowest number, also known as a vernier constant, is the difference between a main scale division (1 mm) and a vernier scale (0.9 mm). It can also be calculated by the smallest unit on the main scale by the totals totals the vernier scale. Answer: Vernier constant is the ratio of the smallest division of the main scale to the number of divisions of the Vernier scale. What is parallax error and how can it be avoided? Answer: Parallax is an effect in which the direction and position of the object differ from different lines of sight. What precautions should be taken when using Verniers? Answer: The precautions are to be taken below, while verniers: If the Vernier scale does not slide smoothly over the main scale, apply bold or machine oil. Keep an eye directly above the division mark to avoid parallax errors. Screw the vernier tightly without excessive pressure to avoid damage to the threads of the screw. What nadiere Calliper? Answer: The use of Vernier callipers is as follows: Used in Scientific Laboratories Used in the Steel Industry Used in the Aerospace Industry Used in the Steel Industry Stay tuned with BYJU'S to get the latest notification on CBSE along with CBSE curriculum, sample papers, labeling scheme and more. More.