UNIT-1 PHYSICS AND MEASUREMENT

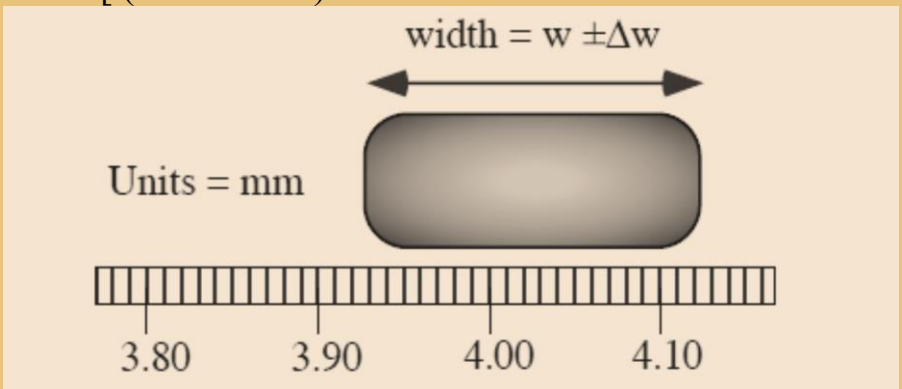
1 Four students measure the same length of string, and their results are as follows:

$L_1 = 38.6\ cm,\ L_2 = 38.7\ cm,\ L_3 = 38.5\ cm$ *and* $L_4 = 38.4\ cm$

Find the average length, [38.55 cm]

2 w = (4.52 ± 0.02) cm, x = (2.0 ± 0.2) cm, y = (3.0 ± 0.6) cm. Find z = x + y - w and its uncertainty. [0.48 ± 0.8] cm

3 What is the width and its absolute uncertainty of the object being measured in the sketch below? [(0.19 ± 0.01) mm



4. Given two masses, m_1 = (100.0 ± 0.4) g and m_1= (49.3 ± 0.3) g, what is their sum? $m_1 + m_2$, and what is their difference? $m_1 - m_2$, Both expressed with uncertainties.

[sum (149.3 ± 0.7) g , difference (50.7 ± 0.7) g]

5. What is the density of a material if m = (12.4 ± 0. 2) kg and V =(6.68 ± 0. 1) m^3 Calculate the uncertainty in the density value. [1.86 ± 0.06]

6 The radius of a circle is x = (3.0 ± 0.2) cm. Find the circumference and its uncertainty. [(18.8 ± 1.3) cm]

7 What is the uncertainty in the calculated area of a circle whose radius is determined to be r = (14.6 ± 0.5) cm? [(6.7 ± 0.5) x10^2 cm^2]

8 What are the volume and its uncertainty for a sphere with a radius of r = (21±1)mm? [(3.9 ± 0.6) x10^4 cm^3

9 A Student measures the displacement 2 cm from the equilibrium of a stretched spring and reports it be with a 1% error. The spring constant k is known to be 10N/m with 0.5% error. Calculate potential energy and, the percentage error in the estimate of the potential energy. Potential energy U = $\frac{1}{2}\ k\ x^2$

[$U = 2\ \times 10^{-3}\ J$, *percentage error in potential energy is* 2.5%

10 A block of building material has been carefully machined to undergo tests. Its Dimensions and mass are as follows:
length = (10 ± 0.2) m
breadth = (5 ± 0.1) m
height = (4 ± 0.1) m
mass = (560 ± 0.2) kg

(a) From this data, calculate the density of this material. [2.8 kg /m^3]

(b) Find the uncertainty in this value of density
[2.8 ± 0.18]

11 The radius of a circle is (5 ± 0.3) cm. What is the percentage uncertainty in the area of the circle?

12 The radius of a sphere is measured to be (1.2 ± 0.1) x 10^{-2} m. calculate the volume of the sphere, quoting the uncertainty in your answer. [(7.2 ± 1.7) x 10^{-6} m^3]

13 The volume of a cylinder is calculated from the product of its base area and height. The measurement of the height has an uncertainty of 5% and the uncertainty of the diameter is 1%. What is the uncertainty of the volume of the cylinder?
[6 %]

14 A rectangle has length L=(2 ± 0.1) cm and w=(3 ± 0.2) cm . Calculate the perimeter of the rectangle with uncertainty. [(10 ± 0.6) cm]

15 A block of building material has been carefully machined to undergo tests. Its dimensions and mass are as follows:
length = 0.050 ± 0.001 m
breadth = 0.100 ± 0.001 m
height = 0.040 ± 0.001 m
mass = 0.560 ± 0.002 kg
(a) From this data, calculate the density of this material.
(b) Find the uncertainty in this value of density.
[density = 2.8 x 10^3 kg/m^3 , (2.8 x 10^3 ± 0.16 x10^3) kg/m^3]