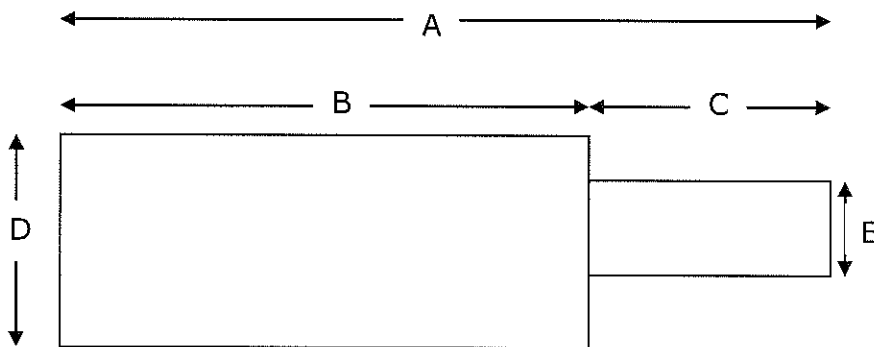


M3LE3 Check Your Understanding Sample Solutions

Instructions: After completing the activity, compare your solutions to the sample solutions provided. Use the Self-Assessment Rubric (located in the Rubrics) to assess your own work. Make any necessary adjustments to your work and be sure to save it for later reference.

- Given the following diagram with measurements and their tolerances, fill in the chart with respect to these tolerances and maximum and minimum limits. All measurements are in centimetres and the objects are not to scale.

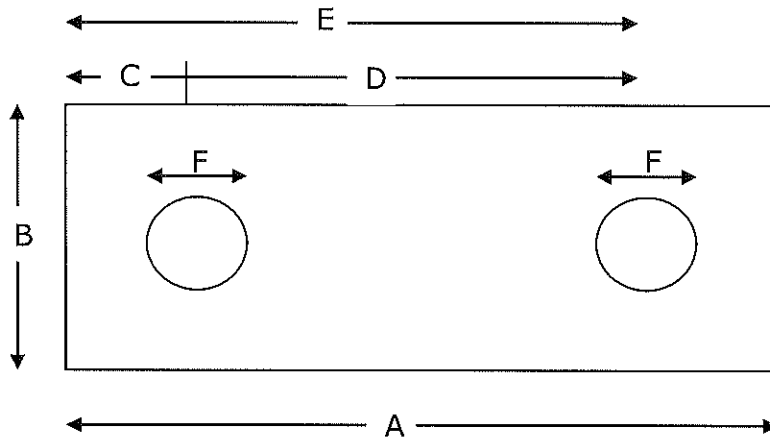


$$A = 74.62 \pm 0.38 \quad B = 50 \pm 0.5 \quad D = 19.9 \pm 0.1 \quad E = 12.48 \pm 0.02$$

Dimension	Basic Size	Upper Limit	Lower Limit	Tolerance
A	74.62	75	74.24	0.76
B	50	50.5	49.5	1
C	24.62	25.5	23.74	1.76
D	19.9	20	19.8	0.2
E	12.48	12.5	12.46	0.4

Note: The upper limit of C is found by taking the upper limit of A minus the lower limit of B. While the lower limit of C is found by taking the lower limit of A minus the upper limit of B.

- Given the following diagram with measurements and their tolerances, fill in the chart with respect to these tolerances and maximum and minimum limits. All measurements are in centimetres and the objects are not to scale.

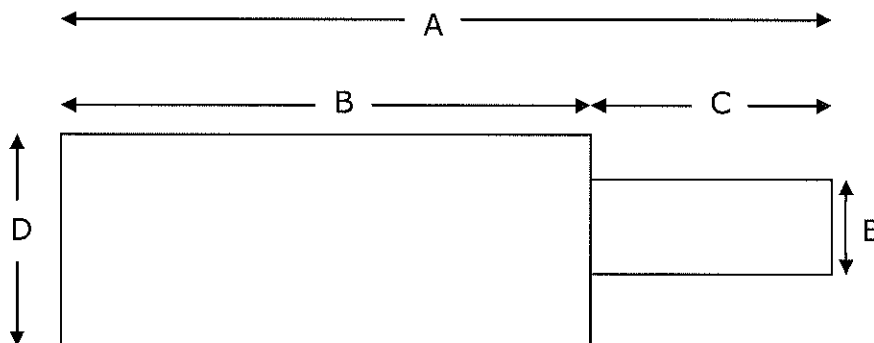


$$A = 90 \pm 1.5 \quad B = 20 \pm 0.25 \quad C = 15 \pm 0.25 \quad E = 70 \pm 0.25 \quad F = 10.01 \pm 0.01$$

Dimension	Basic Size	Upper Limit	Lower Limit	Tolerance
A	90	91.5	88.5	3
B	20	20.25	19.75	0.5
C	15	15.25	14.75	0.5
D	55	55.5	54.5	1.0
E	70	70.25	69.75	0.5
F	10.01	10.02	10	0.02

Note: The upper limit of D is found by taking the upper limit of E minus the lower limit of C, and the lower limit of D is found by taking the lower limit of E minus the upper limit of C.

3. Using the measurements and tolerances for the object below, find the indicated values in the chart. All measurements are in centimetres and the objects are not to scale.



$$A = 74.62 \pm 0.38 \quad B = 50 \pm 0.5 \quad D = 19.9 \pm 0.1 \quad E = 12.48 \pm 0.02$$

$$\text{Thickness} = 4.985 \pm 0.015$$

Measurement	Basic Measurement	Minimum Limit	Maximum Limit	Tolerance
Area of top view	1302.26cm ²	1275.9cm ²	1328.75cm ²	52.85cm ²
Volume	6491.8 cm ³	6341.2 cm ³	6643.8 cm ³	302.5 cm ³

This is a composite object that is made up of 2 rectangular prisms. To find the area of the top view you will need to calculate $B \times D + C \times E$.

$$\begin{aligned} \text{Area top view(basic)} &= (50\text{cm} \times 19.9\text{cm}) + (24.62\text{cm} \times 12.48\text{cm}) \\ &= 995\text{cm}^2 + 307.26\text{cm}^2 = 1302.26\text{cm}^2 \end{aligned}$$

$$\begin{aligned} \text{Area top view(minimum)} &= (49.5\text{cm} \times 19.8\text{cm}) + (23.74\text{cm} \times 12.46\text{cm}) \\ &= 980.1\text{cm}^2 + 295.8\text{cm}^2 = 1275.9\text{cm}^2 \end{aligned}$$

$$\begin{aligned} \text{Area top view(maximum)} &= (50.5\text{cm} \times 20\text{cm}) + (25.5\text{cm} \times 12.5\text{cm}) \\ &= 1010\text{cm}^2 + 318.75\text{cm}^2 = 1328.75\text{cm}^2 \end{aligned}$$

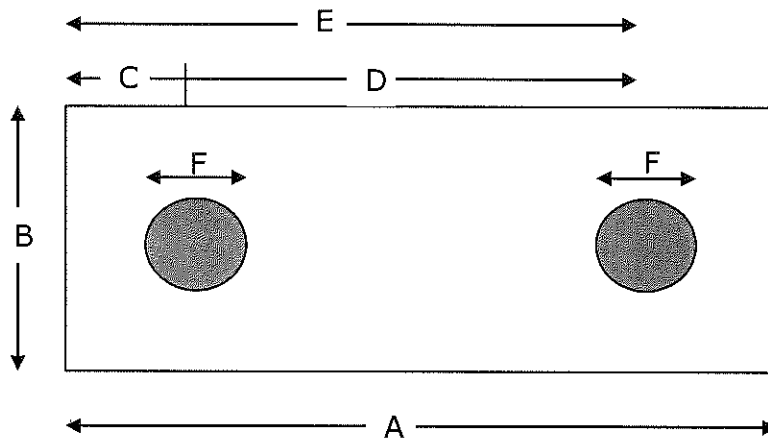
Since we are just adding a new dimension to the object, we can multiply the area of the top view by the thickness to get the volume.

$$\begin{aligned} \text{Basic Volume} &= (\text{Area}_{\text{base}} \times \text{thickness}) \\ &= 1302.26\text{cm}^2 \times 4.985\text{cm} = 6491.8\text{cm}^3 \end{aligned}$$

$$\begin{aligned} \text{Minimum Volume} &= (\text{Area}_{\text{base}} \times \text{thickness}) \\ &= 1275.9\text{cm}^2 \times 4.97\text{cm} = 6341.2\text{cm}^3 \end{aligned}$$

$$\begin{aligned} \text{Maximum Volume} &= (\text{Area}_{\text{base}} \times \text{thickness}) \\ &= 1328.75\text{cm}^2 \times 5\text{cm} = 6643.8\text{cm}^3 \end{aligned}$$

4. Using the measurements and tolerances for the object below, find the indicated values in the chart. All measurements are in centimetres and the objects are not to scale.



$A = 90 \pm 1.5$ $B = 20 \pm 0.25$ $C = 15 \pm 0.25$ $E = 70 \pm 0.25$ $F = 10.01 \pm 0.01$
 Thickness = 4.3 ± 0.02

Measurement	Basic Measurement	Minimum Limit	Maximum Limit	Tolerance
Area of one circle	78.7 cm^2	78.53 cm^2	78.85 cm^2	0.32 cm^2
Area of non-shaded	1642.6 cm^2	1590.18 cm^2	1695.82 cm^2	105.64 cm^2
Volume of non-shaded Object	7063.18 cm^3	6805.95 cm^3	7325.92 cm^3	520 cm^3

Note that in the diagram the measurement given for the circle is the diameter, so to find the radius you need to divide the diameter by 2.

$$\text{Area of one circle(basic)} = \pi r^2 = \pi(5.005)^2 = 78.7 \text{ cm}^2$$

$$\text{Area of one circle(minimum)} = \pi r^2 = \pi(5)^2 = 78.53 \text{ cm}^2$$

$$\text{Area of one circle(maximum)} = \pi r^2 = \pi(5.01)^2 = 78.85 \text{ cm}^2$$

$$\begin{aligned} \text{Area of non-shaded(basic)} &= 90 \text{ cm} \times 20 \text{ cm} - 2(78.7) \text{ cm}^2 \\ &= 1800 \text{ cm}^2 - 157.4 \text{ cm}^2 = 1642.6 \text{ cm}^2 \end{aligned}$$

$$\begin{aligned} \text{Area of non-shaded(minimum)} &= 88.5 \text{ cm} \times 19.75 \text{ cm} - 2(78.85) \text{ cm}^2 \\ &= 1747.88 \text{ cm}^2 - 157.7 \text{ cm}^2 = 1590.18 \text{ cm}^2 \end{aligned}$$

$$\begin{aligned} \text{Area of non-shaded(maximum)} &= 91.5 \text{ cm} \times 20.25 \text{ cm} - 2(78.53) \text{ cm}^2 \\ &= 1852.88 \text{ cm}^2 - 157.06 \text{ cm}^2 = 1695.82 \text{ cm}^2 \end{aligned}$$

The volume of the non-shaded object is a rectangular prism with two cylinders removed.

$$\begin{aligned}\text{Volume of non-shaded(basic)} &= 90\text{cm} \times 20\text{cm} \times 4.3\text{cm} - 2(78.7)\text{cm}^2 \times 4.3\text{cm} \\ &= 7740\text{cm}^3 - 676.82\text{cm}^3 = 7063.18\text{cm}^3\end{aligned}$$

$$\begin{aligned}\text{Volume of non-shaded(minimum)} & \\ &= 88.5\text{cm} \times 19.75\text{cm} \times 4.28\text{cm} - 2(78.85)\text{cm}^2 \times 4.28\text{cm} \\ &= 7480.91\text{cm}^3 - 674.96\text{cm}^3 = 6805.95\text{cm}^3\end{aligned}$$

$$\begin{aligned}\text{Volume of non-shaded(maximum)} & \\ &= 91.5\text{cm} \times 20.25\text{cm} \times 4.32\text{cm} - 2(78.53)\text{cm}^2 \times 4.32\text{cm} \\ &= 8004.42\text{cm}^3 - 678.5\text{cm}^3 = 7325.92\text{cm}^3\end{aligned}$$