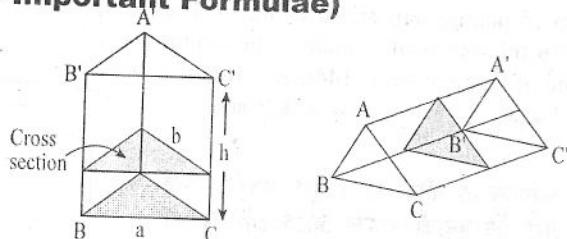


## प्रिज्म र पिरामिड (Prism And Pyramid)

### 7.1 प्रिज्म (Prism)

केहि महत्वपूर्ण सुन्दरहरू

(Some Important Formulae)



- प्रिज्मको सतहको क्षेत्रफल (Surface area of prism) = CSA

प्रिज्मको परिमिति (perimeter of prism) = p

$$\therefore \text{परिमिति (P)} = a + b + c$$

उचाई (height) = h

$$\text{CSA} = ph = \text{perimeter} \times \text{height}$$

छडके सतहको क्षेत्रफल (lateral surface Area) = LSA

आयतकार सतहको क्षेत्रफल (rectangular surface area) = CSA

- प्रिज्मको पुरा सतहको क्षेत्रफल (Total surface area of prism) = TSA

परिमिति (perimeter) = P आधारको क्षेत्रफल

Area of base = A, उचाई वा लम्बाई (height)

$$\text{पुरा सतहको क्षेत्रफल (TSA)} = ph + 2A$$

$$\therefore \text{TSA} = \text{CSA} + 2A$$

cross action Area (A) = Area of base (A)

- प्रिज्मको आयतन (Volume of Prism) = V

प्रिज्मको आयतन (Area of Base) = A

उचाई वा लम्बाई (height or length) = h

$$\therefore \text{आयतन (volume)} = A \times h$$

प्रिज्मका आधारको क्षेत्रफल र परिमिति (Base and perimeter of prism):-

- विषयबाहु त्रिभुज (scalene triangle)

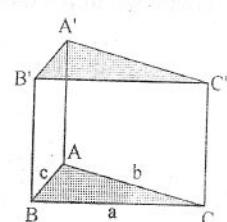
परिमिति (P) =  $a + b + c$  perimeter (p) =  $a + b + c$

$$\text{अर्धपरिमिति (S)} = \frac{a + b + c}{2} \quad \text{semiperimeter (s)} = \frac{a + b + c}{2}$$

$$\text{आधारको क्षेत्रफल (A)} = \sqrt{s(s - a)(s - b)(s - c)}$$

$$\text{Area of Base (A)} = \sqrt{s(s - a)(s - b)(s - c)}$$

$$\text{Area of triangle (A)} = \frac{1}{2} b \times h = (\text{base} \times \text{height})$$



• समवाहु त्रिभुज (Equilateral triangle)

परिमिति ( $P$ ) =  $3a$

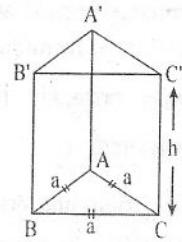
$$\text{आधारको क्षेत्रफल } (A) = \frac{\sqrt{3}}{4} a^2$$

$$\text{Perimeter } (P) = 3a, \text{ Area of base } (A) = \frac{\sqrt{3}}{4} a^2$$

$$\text{अर्ध परिमिति } (S) = \frac{3a}{2} \text{ क्षेत्रफल } (A) = \sqrt{s(s-a)(s-a)(s-a)}$$

$$\text{Semiperimeter } (s) = \frac{3a}{2} \text{ area of}$$

$$\text{Base } (A) = \sqrt{s(s-a)(s-a)(s-a)}$$

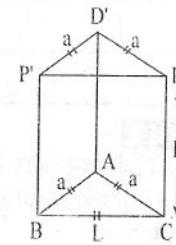


• समद्विबाहु त्रिभुज (IsoScales Triangle)

$$\text{परिमिति } (P) = 2a + b, \text{ र क्षेत्रफल } (A) = \frac{b}{4} \sqrt{4a^2 - b^2}$$

$$\text{Perimeter } (P) = 2a + b \text{ and area } (A) = \frac{b}{4} \sqrt{4a^2 - b^2}$$

$$\text{अर्धपरिमिति } (S) = \frac{2a+b}{2} \text{ क्षेत्रफल } (A) = \sqrt{s(s-a)(s-a)(s-b)}$$



• समकोण त्रिभुज (Right angle triangle):

$$\text{परिमिति } (P) = h + p + b \text{ र }$$

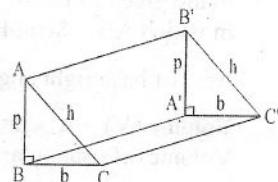
$$\text{क्षेत्रफल } (A) = \frac{1}{2} (b \times p)$$

$$\text{perimeter } (P) = h + p + b \text{ and Area } (A) = \frac{1}{2} (b \times p)$$

$$\text{अर्धपरिमिति } (S) = \frac{h+p+b}{2} \text{ र क्षेत्रफल } (A) = \sqrt{s(s-h)(s-p)(s-b)}$$

$$\text{semiperimeter } (s) = \frac{h+p+b}{2} \text{ Area } (A) = \sqrt{s(s-h)(s-p)(s-b)}$$

पाइथागोरस साध्य (Pythagoras Theorem) :  $h^2 = p^2 + b^2$



### Very Short Questions

- प्रिज्मको पुरा सतहको क्षेत्रफल निकाल्ने सुन्न लेख्नुहोस् ।  
Write the formula to find total surface area of prisms.
- त्रिभुजाकार सतहको प्रिज्मको आयतन निकाल्ने सुन्न लेख्नुहोस् ।  
Write the formula what is the volume of triangular prism.
- आधारको परिमिति 12cm र उचाई 10cm भएको प्रिज्मको आयतकार सतहको क्षेत्रफल निकाल्नुहोस् ।  
What is the area of rectangular surface area of prism. Whose perimeter of base is 12cm and height is 10cm
- समवाहु त्रिभुज आधार भएको र भुजाको लम्बाई  $a$  भएको प्रिज्मको पुरा सतहको क्षेत्रफल कति हुन्छ ?  
What is total surface area of prism in which the base is equilateral triangle having length of side.
- प्रिज्मको आयतकार सतहको क्षेत्रफल निकाल्ने सुन्न लेख्नुहोस् ।  
Write the formula to find the area of rectangular surface of prism.
- विषमवाहु त्रिभुजको आधारमा बनेको प्रिज्मको पुरा सतहको क्षेत्रफल निकाल्ने सुन्न लेख्नुहोस् ।  
Write the formula to find the total surface area of prism, which on the base scalene triangle.

7. समद्विबाहु त्रिभुजको आधारमा बनेको प्रिज्मको पुरासतहको क्षेत्रफल निकाल्ने सुन लेख्नुहोस् ।  
Write the formula to find total surface area of prism on basis on the isosceles triangle .
8. विषमबाहु त्रिभुजको आधारमा बनेको प्रिज्मको आयतन निकाल्ने सुन लेख्नुहोस् ।  
Write the formula to find the volume of prism which formed on the scalene triangle.
9. एउटा त्रिभुजाकार प्रिज्मको आधारको क्षेत्रफल  $\frac{25\sqrt{3}}{4} \text{ cm}^2$  र आयतन  $75\sqrt{3} \text{ cm}^3$  छ, यसको उचाई पता लगाउनुहोस् ।  
In a triangular prism area of base  $\frac{25\sqrt{3}}{4} \text{ cm}^2$  and volume is  $75\sqrt{3} \text{ cm}^3$ , find its height.
10. एउटा त्रिभुजाकार प्रिज्मको आयतन  $576\text{cm}^3$  र उचाई  $12\text{cm}$  छ, भने यसको आधारको क्षेत्रफल निकाल्नुहोस् ।  
Find the area of base of a triangular prism having volume  $576\text{cm}^3$  and height  $12\text{cm}$ .

### Short Questions

**Model 1:**

दिएको त्रिभुजाकार प्रिज्मको आयतन पता लगाउनुहोस् ।

Find the volume of the given triangular prism.

**Solution:**

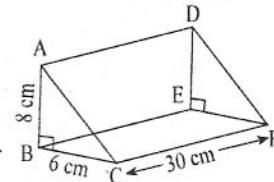
In the given figure of triangular prism, on the right angle triangle base.

In which  $AB = 8\text{cm}$ ,  $BC = 6\text{cm}$  height ( $CF$ ) =  $30\text{cm}$

$$\text{Area of base right angle } \Delta ABC = \frac{1}{2} (AB \times BC) = \frac{1}{2} 8\text{cm} \times 6\text{cm} = 24\text{cm}^2$$

$$\text{Volume (V)} = A \times h = 24\text{cm}^2 \times 30\text{cm} = 720\text{cm}^3$$

$$\text{Volume of triangular prism (V)} = 720\text{cm}^3.$$


**Model 2**

दिएको त्रिभुजाकार प्रिज्मको आयतन पता लगाउनुहोस् ।

Find the volume of the given triangular prism.

**Solution:**

In the given figure of triangular prism on the base of right angled triangle,

In which  $LM = ?$   $MN = 6\text{cm}$   $LN = 10\text{cm}$

Pythagoras theorem

$$LN^2 = MN^2 + LM^2$$

$$\text{or, } (10\text{cm})^2 = (6\text{cm})^2 + LM^2$$

$$\text{or, } 100\text{cm}^2 = 36\text{cm}^2 + LM^2$$

$$\text{or, } 100\text{cm}^2 - 36\text{cm}^2 = LM^2$$

$$64\text{cm}^2 = LM^2$$

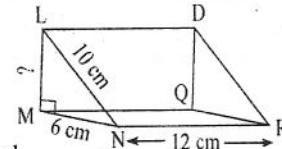
$$\therefore LM = 8\text{cm}$$

$$\text{Area base (A)} = \frac{1}{2} LM \times MN = 24\text{cm}^2$$

height of prism ( $h$ ) =  $12\text{cm}$

$$\text{Volume (V)} = A \times h = 24\text{cm}^2 \times 12\text{cm} = 288\text{cm}^3$$

$$\text{Volume of triangular prism (V)} = 288\text{cm}^3$$

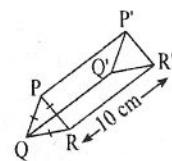

**Model 3:**

दिएको त्रिभुजाकार प्रिज्मको आयतन निकाल्नुहोस् ।

Find the volume of the given triangular prism.

**Solution:**

In the given figure triangular prism on the base of equilateral triangle.



In which  $PQ = QR = PR = 6\text{cm}$

$$\text{Area of base } (A) = \frac{\sqrt{3}}{4} a^2 = \frac{\sqrt{3}}{4} \times (6\text{cm})^2 = \frac{\sqrt{3} \times 36\text{cm}^2}{4} = 9\sqrt{3} \text{ cm}^2$$

Length of prism ( $h$ ) =  $10\text{cm}$

$$\text{Volume } (V) = A \times h = 9\sqrt{3} \text{ cm}^2 \times 10\text{cm}$$

$$\text{Volume triangular prism } (V) = 90\sqrt{3} \text{ cm}^3$$

#### Model 4:

दिएको त्रिभुजाकार प्रिज्मको आयतन पत्ता लगाउनुहोस् ।

In the given figure find the volume of prism.

**Solution:**

In the given figure of triangular prism on the base of isosceles triangle PQR in which  $PQ = c = 6\text{cm}$ ,  $QR = a = 5\text{cm}$  and  $PR = b = 7\text{cm}$

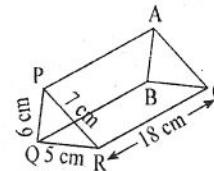
$$\text{semi perimeter } (s) = \frac{a + b + c}{2} = \frac{5\text{cm} + 7\text{cm} + 6\text{cm}}{2} = \frac{18\text{cm}}{2} = 9\text{cm}$$

length of prism ( $h$ ) =  $18\text{cm}$

$$\begin{aligned} \text{Area of base } (A) &= \sqrt{s(s-a)(s-b)(s-c)} = \sqrt{9\text{cm}(9\text{cm}-5\text{cm})(9\text{cm}-7\text{cm})(9\text{cm}-6\text{cm})} \\ &= \sqrt{9\text{cm} \times 4\text{cm} \times 2\text{cm} \times 3\text{cm}} = \sqrt{216\text{cm}^4} = 14.70\text{cm}^2 \end{aligned}$$

$$\text{Volume } (V) = A \times h = 14.70\text{cm}^2 \times 18\text{cm} = 264.54\text{cm}^3$$

$$\text{Volume of triangular prism } (V) = 264.54\text{cm}^3$$



#### Model 5:

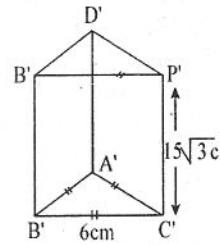
दिएको चित्रमा  $B'C' = 6\text{cm}$  र  $CC' = 15\sqrt{3} \text{ cm}$  छन् भने यसको आयतन निकाल्नुहोस् । In the given figure,  $B'C' = 6\text{cm}$ ,  $CC' = 15\sqrt{3} \text{ cm}$ . find its volume.

**Solution:** Here,  $B'C' = a = 6\text{cm}$ ,  $CC' = h = 15\sqrt{3} \text{ cm}$ .

$$\text{Area of base } (A) = \frac{\sqrt{3}}{4} a^2 = \frac{\sqrt{3}}{4} \times (6\text{cm})^2 = 9\sqrt{3} \text{ cm}^2 \times 15\sqrt{3} \text{ cm}^2$$

$$\text{Volume } (V) = A \times h = 9\sqrt{3} \text{ cm}^2 \times 15\sqrt{3} \text{ cm} = 405\text{cm}^3$$

$$\text{Volume of prism } (V) = 405\text{cm}^3$$



#### Model 6:

दिएको त्रिभुजाकार प्रिज्मको आयतन निकाल्नुहोस् ।

Find the volume of the given triangular prism

**Solution:**

In the given figure of triangular prism

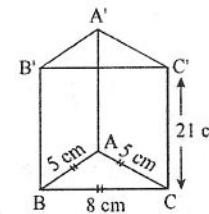
$AB = AC = a = 5\text{cm}$  and  $BC = b = 8\text{cm}$

$$\begin{aligned} \text{Area of base } (A) &= \frac{b}{4} \sqrt{4a^2 - b^2} = \frac{8\text{cm}}{4} \sqrt{4(5)^2 - (8\text{cm})^2} = 2\text{cm} \sqrt{(100 - 64)\text{cm}^2} \\ &= 2\text{cm} \times \sqrt{36\text{cm}^2} = 2\text{cm} \times 6\text{cm} = 12\text{cm}^2 \end{aligned}$$

Height of prism ( $h$ ) =  $21\text{cm}$

$$\text{volume } (V) = A \times h = 12\text{cm}^2 \times 21\text{cm} = 252\text{cm}^3$$

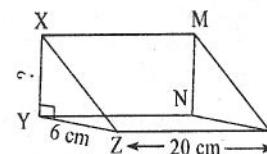
$$\text{Volume of triangular prism } (V) = 252\text{cm}^3$$



#### Model 7:

दिएको ठोस त्रिभुजाकार प्रिज्ममा  $YZ = 6\text{cm}$ ,  $Z_0 = 20\text{cm}$ ,  $XY \perp YZ$  र उस प्रिज्मको आयतन  $720\text{cm}^3$  भए  $XY$  को मान निकाल्नुसहोस् ।

In the given figure solid triangular prism if  $YZ = 6\text{cm}$ ,  $ZR = 20\text{cm}$ ,  $XY \perp YZ$  and volume of the prism is  $720\text{cm}^3$  find the measurement of  $XY$ .



**Solution:**

In the given figure, triangular prism  $XY = ?$   $YZ = 6\text{cm}$ ,  
Prisms formed on the height ( $Z_o$ ) =  $h = 20\text{cm}$   
right angled triangle XYZ base, then

$$\text{Area of } \triangle XYZ = \frac{1}{2} \times (XY \times YZ) = \frac{1}{2} XY \times 6\text{cm} = 3 \times XY\text{cm}$$

$$\text{Volume (V)} = 720\text{cm}^3$$

$$\text{height of prism (h)} = 20\text{cm}$$

$$\therefore V = A \times h$$

$$\text{or, } 720\text{cm}^3 = 3 \times XY\text{cm} \times 20\text{cm}$$

$$\text{or, } 720\text{cm}^3 = 60 \times Y\text{cm}^2$$

$$\text{or, } XY = \frac{720\text{cm}^3}{60\text{cm}^2}$$

$$\therefore XY = 12\text{cm}$$

$$\text{Length of } XY = 12\text{cm}$$

**Model 8:**

दिएको त्रिभुजकार प्रिज्मको पुरासतहको क्षेत्रफल निकाल्नुहोस् ।

Find the total surface area of the given triangular prism.

**Solution:**

In the given figure of triangular prism, on the base of right angle triangle ABC AB = 6cm, DC = DF = 10cm, BC = EF ?

Pythagoras theorem

$$\text{or, } AC^2 = AB^2 + BC^2$$

$$\text{or, } (10\text{cm})^2 = (6\text{cm})^2 + BC^2$$

$$\text{or, } 100\text{cm}^2 - 36\text{cm}^2 = BC^2$$

$$\text{or, } 64\text{cm}^2 = BC^2$$

$$\therefore BC = 8\text{cm}$$

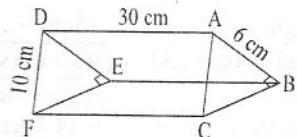
$$\text{Perimeter (p)} = (10 + 8 + 6) \text{ cm} = 24\text{cm}$$

$$\text{Area of base (A)} = \frac{1}{2} AB \times BC = \frac{1}{2} 6\text{cm} \times 8\text{cm} = 24\text{cm}^2$$

$$\therefore \text{Length of prism (h)} = 30\text{cm}$$

$$\therefore \text{TSA} = ph + 2A = 24\text{cm} \times 30\text{cm} + 2 \times 24\text{cm}^2 = 720\text{cm}^2 + 48\text{cm}^2 = 768\text{cm}^2$$

$$\text{Total surface area of prism (TSA)} = 768\text{cm}^2$$



**Model 9:**

दिइएको प्रिज्मको पुरासतहको क्षेत्रफल  $78\sqrt{3}\text{ cm}^2$  छ भने उचाइको मान पता लगाउनुहोस् ।

If the total surface area of prism is  $78\sqrt{3}\text{ cm}^2$  the find the value height.

**Solution:**

In the given figure of triangular prism on the base equilateral triangle  $AB = BC = AC = 2\sqrt{3}$

$$\text{perimeter (P)} = 3 \times 2\sqrt{3} = 6\sqrt{3} \text{ cm}$$

$$\text{Area of base (A)} = \frac{\sqrt{3}}{4} a^2 = \frac{\sqrt{3}}{4} \times (2\sqrt{3} \text{ cm})^2 = \frac{\sqrt{3}}{4} \times 12\text{cm}^2 = 3\sqrt{3} \text{ cm}^2$$

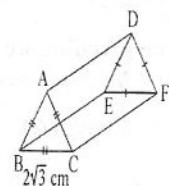
$$\text{Total surface area (TSA)} = 78\sqrt{3} \text{ cm}^2$$

$$\therefore \text{TSA} = ph + 2A$$

$$\text{or, } 78\sqrt{3} \text{ cm}^2 = 6\sqrt{3} \times h + 2 \times 3\sqrt{3} \text{ cm}^2$$

$$\text{or, } 78\sqrt{3} \text{ cm}^2 - 6\sqrt{3} \text{ cm}^2 = 6\sqrt{3} \text{ cm} \times h$$

$$\text{or, } 72\sqrt{3} \text{ cm}^2 = 6\sqrt{3} \text{ cm} \times h$$



$$\therefore h = \frac{72\sqrt{3}\text{cm}^2}{6\sqrt{3}\text{cm}} = 12\text{cm}$$

Height of prism (h) = 12cm

### Model 10:

दिइएको त्रिभुजाकार प्रिज्मको छहके सतहको क्षेत्रफल निकाल्नुहोस् ।

Find the lateral surface area of the given triangular prism.

**Solution:**

In the given figure of triangular prism on the base right angled  $\triangle ABC$  in which  $AB = 12\text{cm}$   $BC = 5\text{cm}$   $AC = ?$

$$\text{or, } AC^2 = (12\text{cm})^2 + (5\text{cm})^2$$

$$\text{or, } AC^2 = 144\text{cm}^2 + 25\text{cm}^2$$

$$\text{or, } AC^2 = 169\text{cm}^2$$

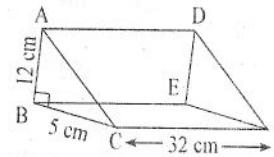
$$\therefore AC = 13\text{cm}$$

$$\text{perimeter (P)} = 13\text{cm} + 12\text{cm} + 5\text{cm} = 30\text{cm}$$

$$\text{height of prism (h)} = 32\text{cm}$$

$$\text{LSA} = Ph = 30\text{cm} \times 32\text{cm} = 960\text{cm}^2$$

$$\text{lateral surface area (LSA)} = 960\text{cm}^2$$



### Model 11:

दिएको त्रिभुजाकार प्रिज्मको आयतकार सतहको क्षेत्रफल  $480\text{cm}^2$  छ । यदि  $XY = 8\text{cm}$   $YZ = 6\text{cm}$  र  $\angle XYZ = 90^\circ$  भए सो प्रिज्मको लम्बाई कति हुन्छ ? पता लगाउनुहोस् ।

In the given figure triangular prism the rectangular surface area is  $480\text{cm}^2$ , of  $XY = 8\text{cm}$   $YZ = 6\text{cm}$   $\angle XYZ = 90^\circ$ , find what is the length of the prism?

**Solution:**

In the given figure, of the triangular prism at the right angle triangular base

In which  $XY = 8\text{cm}$ ,  $YZ = 6\text{cm}$   $XZ = ?$

Pythagoras theorem

$$XZ^2 = XY^2 + YZ^2$$

$$\text{or, } XZ^2 = (8\text{cm})^2 + (6\text{cm})^2$$

$$\text{or, } XZ = (64 + 36)\text{ cm}^2$$

$$\text{or, } XZ = 1000\text{cm}^2$$

$$\therefore XZ = 10\text{cm}$$

$$\text{Perimeter (P)} = (6 + 8 + 10)\text{cm} = 24\text{cm} = 24\text{cm}$$

$$\text{Rectangular surface area (LSA)} = 480\text{cm}^2$$

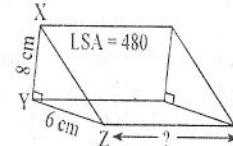
$$\text{LSA} = Ph$$

$$\text{or, } 480\text{cm}^2 = 24\text{cm} \times h$$

$$\text{or, } h = \frac{480\text{cm}^2}{24\text{cm}}$$

$$\therefore h = 20\text{cm}$$

$$\text{Length of prism (h)} = 20\text{cm}$$



### Model 12:

यदि त्रिभुजाकार आयतकार सतहको क्षेत्रफल र उचाई कमश 660cm<sup>2</sup> र 22cm भए यसको आधारको परिमिति निकाल्नुहोस् ।

If the area of rectangular surface and height of a triangular prism are  $660\text{cm}^2$  and  $22\text{cm}$  find the perimeter of base.

**Solution:**

Here, rectangular surface area (LSA) =  $660\text{cm}^2$

height of prism (h) =  $22\text{cm}$

perimeter (P) = ?

$$\therefore \text{LSA} = ph$$

$$\text{or, } 660\text{cm}^2 = P \times 22\text{cm}$$

$$\text{or, } P = \frac{660\text{cm}^2}{22\text{cm}^2}$$

$$\therefore P = 30\text{cm}$$

Perimeter of base (P) =  $30\text{cm}$

**Model 13:**

एउटा प्रिज्मको आधारको क्षेत्रफल र परिमिति कमश  $30\text{cm}^2$  र  $25\text{cm}$  छन् । यदि सो प्रिज्मको पुरा सतहको क्षेत्रफल  $360\text{cm}^2$  सो प्रिज्मको उचाई र छड्के सतहको क्षेत्रफल पत्ता लगाउनुहोस् ।

The area and perimeter of base of a prism are  $30\text{cm}^2$  and  $25\text{cm}$  respectively, if the total surface area of the prism  $360\text{cm}^2$ , find the height and lateral surface area of the prism.

**Solution:**

Here, area of base (A) =  $30\text{cm}^2$

Perimeter (P) =  $25\text{cm}$

Total surface area (TSA) =  $360\text{cm}^2$

$$\text{TSA} = ph + 2A$$

$$\text{or, } 360\text{cm}^2 = 25\text{cm} \times h + 2 \times 30\text{cm}^2$$

$$\text{or, } 360\text{cm}^2 = 25\text{cm} \times h + 60\text{cm}^2$$

$$\text{or, } 300\text{cm}^2 = 25\text{cm} \times h$$

$$\therefore h = \frac{300\text{cm}^2}{25\text{cm}} = 12\text{cm}$$

$$\text{CSA} = ph = 25\text{cm} \times 12\text{cm} = 300\text{cm}^2$$

**Model 14:**

एउटा त्रिभुजाकार सतहको क्षेत्रफल  $432\text{cm}^2$  उचाई  $18\text{cm}$  र आधार भूजाको अनुपातहरू  $3:4:5$  भए भुजाहरूको नाप पत्ता लगाउनुहोस् ।

The area of rectangular face of triangular prism is  $432\text{cm}^2$  height  $18\text{cm}$  and the ratio of the base of sides is  $3:4:5$ . Find the base sides of the prism.

**Solution:**

Here, lateral surface area (LSA) =  $432\text{cm}^2$

its height (h) =  $18\text{cm}$  and

the ratio of sides are  $3:4:5$

then  $a = 3x$   $b = 4x$  and  $c = 5x$

$$\text{perimeter (p)} = a + b + c = 3x + 4x + 5x = 12x$$

$$\text{LSA} = ph$$

$$\text{or, } 432\text{cm}^2 = 12x \times 18\text{cm}$$

$$\text{or, } 432\text{cm}^2 = 216x\text{cm}$$

$$\text{or, } \frac{432\text{cm}^2}{216\text{cm}} = x$$

$$\text{or, } x = 2\text{cm}$$

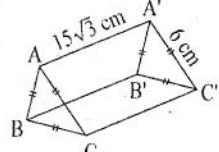
Now,  $a = 3x = 3 \times 2\text{cm} = 6\text{cm}$ ,  $b = 4x = 4 \times 2\text{cm} = 8\text{cm}$  and

$c = 5x = 5 \times 2\text{cm} = 10\text{cm}$

**Practice Yourself**

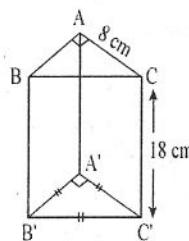
1. दिएको त्रिभुजकाकार प्रिज्मको आयतन पता लगाउनुहोस् ।  
Find the total volume of the given triangular prism.

(i)



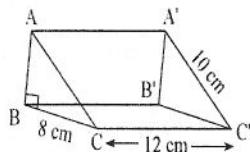
(Ans: 405 cm³)

(ii)



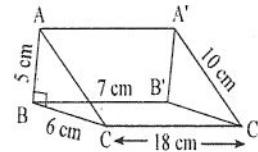
(Ans: 432 cm²)

(iii)



(Ans: 288 cm³)

(iv)

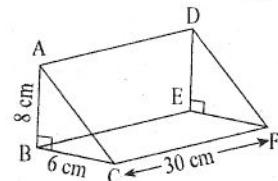


(Ans: 1080 cm³)

2. दिएको त्रिभुजकार प्रिज्मको पुरासतहको क्षेत्रफल निकाल्नुहोस् ।

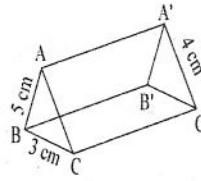
Find the total surface area of given triangular prism.

(i)



(Ans: 192 cm³)

(ii)

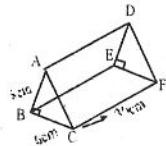


(Ans: 204 cm²)

3. दिएको त्रिभुजाकार प्रिज्मको छड्के सतहको क्षेत्रफल निकाल्नुहोस् ।

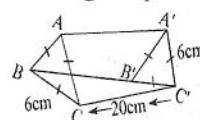
Find the lateral surface area of the given a triangular prism.

(i)



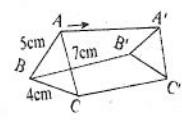
(Ans: 720 cm²)

(ii)



(Ans: 360 cm³)

(iii)



(Ans: 128 cm³)

4. दिएको चित्रमा प्रिज्मको आयतकार सतहको क्षेत्रफल  $120\text{cm}^2$   $AC = 5\text{cm}$   $B'C' = 4\text{cm}$  .  $CC' = m$  भए  $\text{m}$  को मान निकाल्नुहोस् ।

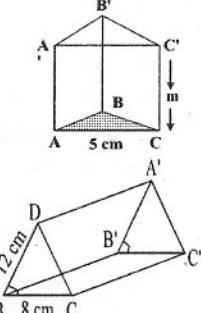
The area of the rectangular surface area of the prism in the given figure is  $120\text{cm}^2$   $AC = 5\text{cm}$   $B'C' = 4\text{cm}$  and  $CC' = m$  find the value of  $m$ .

(Ans: 16 cm)

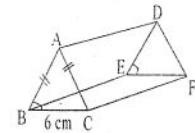
5. दिएको त्रिभुजकार प्रिज्मको आयतन  $1800\text{cm}^3$  छ । जहाँ  $AB = 15\text{cm}$   $BC = 8\text{cm}$  र  $\angle ABC = 90^\circ$  भए उक्त प्रिज्मको उचाई निकाल्नुहोस् ।

The given figure of triangular prism having  $1800\text{cm}^3$  in which  $AB = 15\text{cm}$   $BC = 8\text{cm}$  and  $\angle ABC = 90^\circ$ , find the height of prism.

(Ans: 30cm)



6. एउटा प्रिज्मको आधार भूजा 8cm भएको समवाहु त्रिभुज छ । यसको आयतन  $160\sqrt{3} \text{ cm}^3$  भए उचाई पत्ता लगाउनुहोस् । The base of equilateral triangle based prism is 8cm and its volume is  $160\sqrt{3} \text{ cm}^3$ , find its height.  
(Ans: 10cm)
7. एउटा त्रिभुजकार प्रिज्मको आयतकार सतहको क्षेत्रफल  $540\text{cm}^2$  छ । यदि आधारको परिधि र उचाईको अनुपात  $5:3$  छ । उक्त प्रिज्मको परिमिति र उचाई पत्ता लगाउनुहोस् ।  
The area of the rectangular face of rectangular prism is  $540\text{cm}^2$ . If the ratio of perimeter to its height is  $5:3$ , find the perimeter of base and height of prism.  
(Ans: 30cm, 18cm)
8. एउटा त्रिभुजकार प्रिज्मको पुरा सतहको क्षेत्रफल र बक्सतहको क्षेत्रफल कमश  $592\text{cm}^2$  र  $528\text{cm}^2$  छ । यसको आधारको क्षेत्रफल पत्ता लगाउनुहोस् ।  
Total surface area of a triangular prism is  $592\text{cm}^2$  and lateral surface is  $528\text{cm}^2$ , find the area of base.  
(Ans: 40cm<sup>2</sup>)
9. चित्रमा दिएको एउटा समद्विवाहु त्रिभुज आधार भएको त्रिभुजकार प्रिज्मको आयतकार सतहको क्षेत्रफल  $336\text{cm}^2$  छ । प्रिज्मको आधारको वरावर भूजाको नाप पत्ता लगाउनुहोस् ।  
In the given figure of the lateral surface area of triangular prism on the base isosceles triangular is  $336\text{cm}^2$ , find the measurement of equal sides of the base.  
(Ans: 10cm)
10. एउटा प्रिज्मको आधार  $8\text{cm}$  भएको समवाहु त्रिभुज छ यदि यसको आयतन  $160\sqrt{3} \text{ cm}^3$  भए यसको आयतकार सतहको क्षेत्रफल पत्ता लगाउनुहोस् ।  
If the base of prism of equilateral triangular of side is 8cm, the volume of prism is  $160\sqrt{3} \text{ cm}^3$ , find its lateral surface area.  
(Ans: 240cm<sup>2</sup>)



## 7.2 पीरामीड र सोली (Pyramid and Cone)

### केहि महत्वपूर्ण सुत्रहरू (Some Important formulae)

- पीरामीडको आयतन (Volume of pyramid):-

वर्गाकार आधारमा बनेको पीरामिडमा

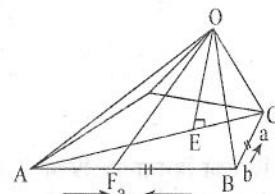
(in pyramid, formed on the square Base)

आधारको लम्बाई (Length of base)  $AB = BC = a$

आधारको क्षेत्रफल (Area of base)  $A = a^2$

ठाढो उचाई (vertical height) =  $OE = h$

$$\text{आयतन (Volume)} = V, \therefore V = \frac{1}{3} a^2 h = \frac{1}{3} Ah$$



- पीरामीडको सतहको क्षेत्रफल (surface area of pyramid)

वर्गाकार आधारमा बनेको पीरामिडमा

(In the pyramid, formed the square base)

आधार भूजाको लम्बाई (length of base side)  $AB = BC = a$

छड्के उचाई (slant height) =  $OP = l$

आधारको क्षेत्रफल (Area of base) =  $A = a^2$

त्रिभुजकार सतहको क्षेत्रफल (Area of triangular surface)

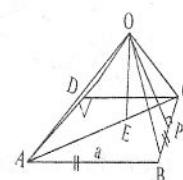
$\text{CSA} = \text{सतहको क्षेत्रफल (Surface area)}$

$$\therefore \text{CSA} = 2(a \times l)$$

पुरासतहको क्षेत्रफल (Total surface Area) =  $\text{TSA}$

$$\therefore \text{TSA} = \text{CSA} + A$$

$$\therefore \text{TSA} = 2(a \times l) + a^2$$



- पीरामिडको चित्रमा (In the given figure of pyramid)

आधारभूजा (base side)  $BC = CD = a$

ठाडो उचाई (vertical height)  $= OE = h$

छड्के उचाई (slant height)  $= OP = l$

किनाराको लम्बाई (length of edge)  $= OD = OA = OB = OC = e$

समकोण  $\Delta OEP$  बाट (from the right angled  $\Delta OEP$ )

पाइथागोरस साध्य अनुसार (pythagoras theorem)

$$PE = \frac{1}{2} BC = \frac{1}{2} a = \frac{a}{2}$$

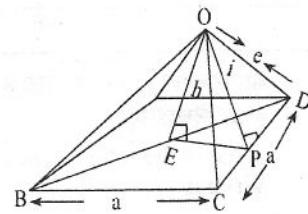
$$\therefore OP^2 = OE^2 + PE^2$$

$$\therefore l^2 = h^2 + \left(\frac{a}{2}\right)^2$$

$$\therefore l = \sqrt{h^2 + \left(\frac{a}{2}\right)^2}$$

$$\therefore h = \sqrt{l^2 - \left(\frac{a}{2}\right)^2}$$

$$\therefore a = 2\sqrt{l^2 - h^2}$$



- समकोण  $\Delta OPD$  बाट (From right angled  $\Delta OPD$ )

पाइथागोरस नियम अनुसार (Pythagoras theorem)

$$OD^2 = OP^2 + PD^2$$

$$\therefore e^2 = l^2 + \left(\frac{a}{2}\right)^2$$

$$\therefore e = \sqrt{l^2 + \left(\frac{a}{2}\right)^2}$$

$$\therefore l = \sqrt{e^2 - \left(\frac{a}{2}\right)^2}$$

$$\therefore a = 2\sqrt{e^2 - l^2}$$

- समकोण  $\Delta OED$  बाट (From right angled  $\Delta OED$ )

$$BD = \sqrt{2a^2} = a\sqrt{2} \quad (\because \text{Pythagoras theorem})$$

$$DE = \frac{1}{2} BD = \frac{1}{2} a\sqrt{2} = \frac{a}{\sqrt{2}}$$

पाइथागोरस साध्य अनुसार (Pythagoras theorem)

$$OD^2 = OE^2 + ED^2$$

$$\text{or, } e^2 = h^2 + \left(\frac{a}{\sqrt{2}}\right)^2$$

$$\therefore e^2 = h^2 + \frac{a^2}{2}$$

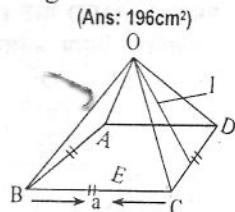
$$\therefore e = \sqrt{h^2 + \frac{a^2}{2}}$$

$$\therefore h = \sqrt{e^2 - \frac{a^2}{2}}$$

$$\therefore a = \sqrt{2(e^2 - h^2)}$$

### Very short Questions

1. आधारभुजा  $x\text{cm}$  र छड्के उचाई  $y\text{ cm}$  भएको वर्गा आधार पीरामीडको पूरासतहको क्षेत्रफल कति हुन्छ ? लेख्नुहोस्।  
What is the total surface area of a square based pyramid having side  $x\text{ cm}$  and slant height  $y\text{cm}$ . Write it.
2. एउटा वर्ग आधार पीरामीडको आधारभुजा  $p\text{cm}$  र छड्के उचाई  $q\text{cm}$  भए सो पीरामीडको बक्सतहका क्षेत्रफल कति हुन्छ ? लेख्नुहोस्। The length of a side of the square based pyramid is  $p\text{cm}$  and slant height is  $q\text{cm}$  . What is the curved surface area of the pyramid ? Write it.
3. आधारभुजा  $a\text{cm}$  र ठाडो उचाई  $b\text{cm}$  भएको वर्ग आधार पीरामीडको आयतन कति हुन्छ ? लेख्नुहोस्। What is the volume of a square based pyramid having side  $a\text{ cm}$ . and vertical height  $b\text{ cm}$ ? . Write it.
4. एउटा समबाहु त्रिभुजाकार आधारको क्षेत्रफल  $A\text{cm}^2$  भएको पिरामीडको  $h\text{cm}$  उचाई भए यसको आयतन कति होला ? If the area of the equilateral triangle base of a pyramid is  $A\text{cm}^2$  and its vertical height is  $h\text{cm}$  . Find what will be its volume?
5. एउटा वर्गाकार आधार भएको पीरामीडको आधारमा क्षेत्रफल  $19\text{cm}^2$  र उचाई  $12\text{cm}$  भए आयतन कति होला ? What is the volume of square based pyramid its base area is  $49\text{cm}^2$  and height  $12\text{cm}$ .
6. संगै दिइएको वर्गाकार आधारको पीरामीडको बक्सतहको क्षेत्रफल कति होला ?  
In the adjoining figure what is the lateral surface area of the square based pyramid.



### Long Questions

**Model 1:**

वर्गाकार आधारमा बनेको पीरामीडको आयतन निकाल्नुहोस्।

Find the volume of the square based pyramid

**Solution:**

Here, in the given figure squared based pyramid.

length of base ( $a$ ) =  $16\text{cm}$

slant height ( $l$ ) =  $17\text{cm}$

Pythagoras theorem

$$l^2 = h^2 + \left(\frac{a}{2}\right)^2$$

$$\text{or, } h = \sqrt{l^2 - \left(\frac{a}{2}\right)^2}$$

$$\text{or, } h = \sqrt{289\text{cm}^2 - 64\text{cm}^2}$$

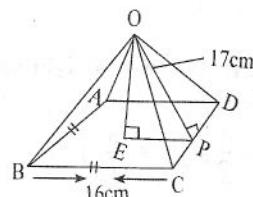
$$\text{or, } h = \sqrt{225\text{cm}^2}$$

$$\therefore h = 15\text{cm}$$

Height of pyramid ( $h$ ) =  $15\text{cm}$

$$\text{Volume (V)} = \frac{1}{3} \times (16\text{cm})^2 \times 15\text{cm} = 256\text{cm}^2 \times 5\text{cm} = 1280\text{cm}^3$$

$$\text{Volume of pyramid (V)} = 1280\text{cm}^3$$





$$\text{or, } 64\text{cm}^2 = \frac{a^2}{4}$$

$$\text{or, } 64 \times 4\text{cm}^2 = a^2$$

$$\text{or, } 256\text{cm}^2 = a^2$$

$$\therefore a = 16\text{cm}$$

Length of base (a) = 16cm

$$\text{Volume (V)} = \frac{1}{3} a^2 h = \frac{1}{3} (16\text{cm})^2 \times 15\text{cm} = 256\text{cm}^2 \times 5\text{cm} = 1280 \text{ cm}^3$$

$$\text{Volume of pyramid (V)} = 1280\text{cm}^3$$

#### **Model 4:**

दिइएको देखाइएको वर्गाकार आधारमा पीरामिडको त्रिभुजाकार सतहको क्षेत्रफल  $80\text{cm}^2$  उक्त पीरामिडको आयतन निकाल्नुहोस्। जहाँ आधारको लम्बाई  $8\text{cm}$  छ।

The area of triangular surface of the squared based pyramid. Shown in the diagram is  $80\text{cm}^2$  find the volume of pyramid. When the length of base is  $8\text{cm}$ .

#### **Solution:**

Here, in the given figure of squared based pyramid

$$\text{Triangular surface area (LSA)} = 80\text{cm}^2$$

Length of base (a) =  $8\text{cm}$

$$\therefore \text{LSA} = 2(a \times l)$$

$$80\text{cm}^2 = 2(8\text{cm} \times l)$$

$$\text{or, } 80\text{cm}^2 = 16\text{cm} \times l$$

$$\text{or, } l = \frac{80\text{cm}^2}{16\text{cm}}$$

$$\therefore l = 5\text{cm}$$

Slant height ( $l$ ) =  $5\text{cm}$

$$l^2 = h^2 + \left(\frac{a}{2}\right)^2$$

$$\text{or, } (5\text{cm})^2 = h^2 + \left(\frac{8\text{cm}}{2}\right)^2$$

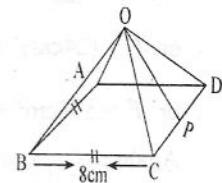
$$\text{or, } 25\text{cm}^2 = h^2 + 16\text{cm}^2$$

$$\text{or, } 9\text{cm}^2 = h^2$$

$$\therefore h = 3\text{cm}$$

$$\text{Volume (V)} = \frac{1}{3} a^2 \times h = \frac{1}{3} (8\text{cm})^2 \times 3\text{cm} = 64\text{cm}^3$$

$$\therefore \text{Volume of pyramid (V)} = 64\text{cm}^3$$



#### **Model 5:**

दिएको चित्रमा एउटा वर्गाकार आधारमा बनेको पीरामिडको आधार भूजाको लम्बाई  $14\text{cm}$  र पीरामीडको आयतन  $1568\text{cm}^3$  भए पीरामीडको पुरा सतहको क्षेत्रफल निकाल्नुहोस्।

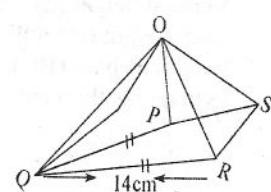
In the given figure if the height of a side of the base of pyramid having squared base is  $14\text{ cm}$  and volume of the pyramid is  $1568\text{cm}^3$  find the total surface area of the pyramid.

#### **Solution:**

In the given, on the squared based pyramid

$$\text{Length of base (a)} = 14\text{cm}, \text{volume of pyramid (V)} = 1568 \text{ cm}^3$$

$$\therefore V = \frac{1}{3} a^2 h$$



$$\text{or, } 1586 \text{ cm}^3 = \frac{1}{3} (14 \text{ cm})^2 \times h$$

$$\text{or, } 1586 \text{ cm}^3 = \frac{1}{3} 196 \text{ cm}^2 \times h$$

$$\text{or, } 1586 \times 3 \text{ cm}^3 = 196 \text{ cm}^2 \times h$$

$$\text{or, } h = \frac{1586 \times 3 \text{ cm}^3}{196 \text{ cm}^2}$$

$$\therefore h = 24 \text{ cm}$$

Height (h) = 24cm

$$\text{Pythagoras theorem } l^2 = h^2 + \left(\frac{a}{2}\right)^2$$

$$\text{or, } l^2 = (24 \text{ cm})^2 + \left(\frac{14}{2} \text{ cm}\right)^2$$

$$\text{or, } l^2 = 576 \text{ cm}^2 + 49 \text{ cm}^2$$

$$\text{or, } l^2 = 625 \text{ cm}^2$$

$$\therefore l = 25 \text{ cm}$$

Length of side (a) = 25cm

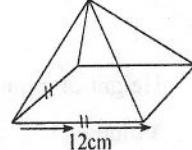
$$\text{TSA} = 2(a \times l) + a^2 = 2(14 \text{ cm} \times 25 \text{ cm}) + (14 \text{ cm})^2 = 700 \text{ cm}^2 + 196 \text{ cm}^2 = 896 \text{ cm}^2$$

Total surface area of pyramid (TSA) = 896cm<sup>2</sup>

### Model 6:

दिएको चित्रमा वर्गाकार आधारमा भएको ठोस पीरामिडको पूरासतहको क्षेत्रफल 384cm<sup>2</sup> र आधारको लम्बाई 12cm छ भने पिरामिडको आयतन निकाल्नुहोस्।

In the figure, the total surface area of the squared based solid pyramid is 384cm<sup>2</sup> and side of the base is 12cm find the volume of the pyramid.



### Solution:

Here, length of base (a) = 12cm

Total surface area (TSA) = 384cm<sup>2</sup>

$$\therefore \text{TSA} = 2(a \times l) + a^2$$

$$\text{or, } 384 \text{ cm}^2 = 2(12 \text{ cm} \times l \text{ cm}) + (12 \text{ cm})^2$$

$$\text{or, } 384 \text{ cm}^2 = 24 \text{ cm} + 144 \text{ cm}^2$$

$$\text{or, } 384 \text{ cm}^2 = 24 \text{ cm} + 144 \text{ cm}^2$$

$$\text{or, } (384 - 144) \text{ cm}^2 = 24 \text{ cm}$$

$$\text{or, } 240 \text{ cm}^2 = 24 \text{ cm}$$

$$\therefore l = 10 \text{ cm}$$

Slant height (l) = 10cm

Pythagoras theorem

$$\therefore l^2 = h^2 + \left(\frac{a}{2}\right)^2$$

$$\text{or, } h = \sqrt{l^2 - \left(\frac{a}{2}\right)^2}$$

$$\text{or, } h = \sqrt{(10 \text{ cm})^2 - \left(\frac{12}{2} \text{ cm}\right)^2}$$

$$\text{or, } h = \sqrt{100 \text{ cm}^2 - 36 \text{ cm}^2}$$

$$\text{or, } h = \sqrt{64 \text{ cm}^2}$$

$$\therefore h = 8 \text{ cm}$$

Vertical height (h) = 8cm

$$\text{Volume (V)} = \frac{1}{3} a^2 h = \frac{1}{3} \times (12 \text{ cm})^2 \times 8 \text{ cm} = \frac{1 \times 144 \times 8 \text{ cm}^3}{3} = 384 \text{ cm}^3$$

$\therefore$  Volume of pyramid (V) = 384cm<sup>3</sup>

**Model 7:**

संगैको चित्र एउटा वर्गाकार आधारमा भएको पीरामिड हो । यसको छड्के उचाई 13cm र पुरासतहको क्षेत्रफल  $360\text{cm}^2$  भए पीरामीडको आयतन निकाल्नुहोस् ।

The adjoining figure is a squared based pyramid if its slant height is 13cm and its total surface area is  $360\text{cm}^2$ , find the volume of pyramid.

**Solution:**

Here, in the given figure, squared based pyramid

$$\text{Slant height } (l) = 13\text{cm}$$

$$\text{TSA} = 2(a \times l) + a^2$$

$$\text{or, } 360\text{cm}^2 = 2a \times 13\text{cm} + a^2$$

$$\text{or, } 360\text{cm}^2 = 26\text{cm} = a + a^2$$

$$\text{or, } a^2 + 26a - 360 = 0$$

$$\text{or, } a^2 + (36 - 10)a - 360 = 0$$

$$\text{or, } a^2 + 36a - 10a - 360 = 0$$

$$\text{or, } a(a + 36) - 10(a + 36) = 0$$

$$\therefore (a + 36)(a - 10) = 0$$

$$\text{Either } a + 36 = 0$$

$$\therefore a = -36 \text{ (impossible)}$$

$$\text{or, } a - 10 = 0$$

$$\therefore a = 10$$

Length of side (a) = 10cm

$$\text{Pythagoras theorem } l^2 = h^2 + \left(\frac{a}{2}\right)^2$$

$$\text{or, } (13\text{cm})^2 = h^2 + \left(\frac{10}{2} \text{ cm}\right)^2$$

$$\text{or, } 169\text{cm}^2 = h^2 + 25\text{cm}^2$$

$$\text{or, } (169 - 25) \text{ cm}^2 = h^2$$

$$\text{or, } 144\text{cm}^2 = h^2$$

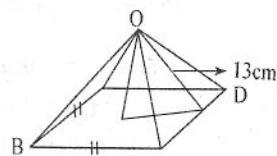
$$\text{or, } (12\text{cm})^2 = h^2$$

$$\therefore h = 12\text{cm}$$

$$\text{Height of pyramid (h)} = 12\text{cm}$$

$$\text{Volume (V)} = \frac{1}{3} (10\text{cm})^2 \times 12\text{cm} = 100\text{cm}^2 \times 4\text{cm} = 400\text{cm}^3$$

$$\text{Volume of pyramid (V)} = 400\text{cm}^3$$

**Model 8:**

एउटा वर्गाकार आधार भएको ठाडो उचाई र छड्के उचाइको अनुपात 4:5 र पुरा सतहको क्षेत्रफल  $96\text{cm}^2$  भए पीरामीडको आयतन पत्ता लगाउनुहोस् ।

If the ratio of vertical height and slant height of a squared based pyramid is 4:5 and its total surface area is  $96\text{cm}^2$ , find the volume of pyramid.

**Solution:**

Here, The ratio of vertical height and slant height is 4:5 then  $h:l = 4:5$

$$\therefore h = 4x \quad l = 5x$$

Phythagoras Theorem

$$\therefore l^2 = h^2 + \left(\frac{a}{2}\right)^2$$

$$\text{or, } (5x)^2 = (4x)^2 + \frac{a^2}{4}$$

$$\text{or, } 25x^2 = 16x^2 + \frac{a^2}{4}$$

$$\text{or, } 9x^2 = \frac{a^2}{4} = 36x^2 a^2$$

$$\text{or, } (6x)^2 = a^2$$

$$\therefore a = 6x$$

$$\text{Height (h)} = 4x = 4 \times 1\text{cm} = 4\text{cm}$$

$$\text{Length of side (a)} = 6x = 6 \times 1\text{cm} = 6\text{cm}$$

$$\text{Volume (V)} = \frac{1}{3} a^2 h = \frac{1}{3} (6\text{cm})^2 \times 4\text{cm} = \frac{1 \times 36\text{cm}^2 \times 4\text{cm}}{3} = 48\text{cm}^3$$

$$\text{Volume of pyramid (V)} = 48\text{cm}^3$$

$$\text{Total surface Area (TSA)} = 96\text{cm}^2$$

$$\text{TSA} = 2(a \times l) + a^2$$

$$\text{TSA} = 2(6x \times 5x) + (6x)^2$$

$$\text{or, } 96\text{cm}^2 = 60x^2 + 36x^2$$

$$\text{or, } 96\text{cm}^2 = 96x^2$$

$$\text{or, } x^2 = 1\text{cm}^2$$

$$\therefore x = 1\text{cm}$$

**Mode 9:**

वर्गाकार आधारमा बनेको एउटा पीरामीडको पुरासतहको क्षेत्रफल  $720 \text{ m}^2$  र छड्के उचाई  $30\text{m}$  भए पीरामीडको आयतन पत्ता लगाउनुहोस् ।

The lateral surface area of square based pyramid is  $720 \text{ m}^2$  and the slant height  $30\text{m}$ , find the volume of pyramid.

**Solution:**

$$\text{Here, Lateral surface area (LSA)} = 720 \text{ m}^2$$

$$\text{Slant height of pyramid (l)} = 30 \text{ m}$$

$$\text{Now, CSA} = 2(a + l)$$

$$\text{or, } 720 \text{ m}^2 = 2(a \times 30\text{m})$$

$$\text{or, } 720 \text{ m}^2 = 60 \text{ m} \times a$$

$$\text{or, } a = \frac{720 \text{ m}^2}{60\text{m}}$$

$$\therefore a = 12\text{m}$$

Pythagoras theorem

$$l^2 = h^2 + \left(\frac{a}{2}\right)^2$$

$$\text{or, } h = \sqrt{l^2 - \left(\frac{a}{2}\right)^2}$$

$$\text{or, } h = \sqrt{(30\text{m})^2 - \left(\frac{12\text{m}}{2}\right)^2}$$

$$\text{or, } h = \sqrt{864 \text{ m}^2}$$

$$\therefore h = 29.39 \text{ m}$$

$$\begin{aligned} \text{Again, Volume (V)} &= \frac{1}{3} a^2 h = \frac{1}{3} (12\text{m})^2 \times 29.39\text{m} = \frac{1}{3} \times 144 \text{ m}^2 \times 29.39\text{m} \\ &= \frac{4232.16 \text{ m}^3}{3} = 1410.72 \text{ m}^3 \end{aligned}$$

$$\therefore \text{Volume of pyramid (V)} = 1410.72 \text{ m}^3$$

**Model 10:**

वर्गाकार आधारमा भएको पीरामीडको पुरासतहको क्षेत्रफल पत्ता लगाउनुहोस् ।

Find the total surface area of the square based pyramid.

**Solution:**

In the given figure of square based pyramid length base ( $a$ ) =  $12 \text{ cm}$

Vertical height ( $h$ ) =  $8\text{cm}$

According to the phygoras theorem

$$\text{or, } l^2 = h^2 + \left(\frac{a}{2}\right)^2$$

$$\text{or, } l = \sqrt{h^2 + \left(\frac{a}{2}\right)^2}$$

$$\text{or, } l = \sqrt{(8\text{m})^2 - \left(\frac{12\text{m}}{2}\right)^2}$$

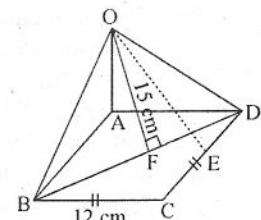
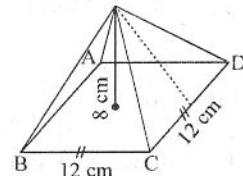
$$\text{or, } l = \sqrt{64 + 36\text{cm}^2}$$

$$\text{or, } l = \sqrt{100 \text{ cm}^2}$$

$$\text{or, } l = 10 \text{ cm}$$

$$\begin{aligned} \text{Total suface area (TSA)} &= 2(a \times l) + a^2 = 2(12\text{cm} \times 10 \text{ cm}) + (10\text{cm})^2 \\ &= 240 \text{ cm}^2 + 100 \text{ cm}^2 = 240 \text{ cm}^2 \end{aligned}$$

$$\therefore \text{Total suface area of pyramid (TSA)} = 240 \text{ cm}^2$$

**Model 11:**

वर्गाकार आधारमा भएको पीरामीडको पुरासतहको क्षेत्रफल पत्ता लगाउनुहोस् ।

Find the total surface area of the square based pyramid.

**Solution:**

In the given figure of square based pyramid.

Slant height ( $l$ ) =  $17\text{cm}$  and vatical height ( $h$ ) =  $15 \text{ cm}$

According to the pythagoras theorem

$$\text{or, } l^2 = h^2 + \left(\frac{a}{2}\right)^2$$

$$\text{or, } a = 2\sqrt{l^2 - h^2}$$

$$\text{or, } a = 2\sqrt{(17\text{cm})^2 - (15\text{m})^2}$$

$$\text{or, } a = 2\sqrt{64\text{cm}^2}$$

$$\text{or, } a = 2 \times 8 \text{ cm}$$

$$\therefore a = 16 \text{ cm}$$

Length of base (a) = 16 cm

$$\text{TSA} = 2(a \times l) + a^2 = 2(16 \text{ m} \times 17 \text{ cm}) + (16 \text{ cm})^2 = 544 \text{ m}^2 + 256 \text{ m}^2 = 800 \text{ cm}^2$$

$$\therefore \text{Total surface area of pyramid (TSA)} = 800 \text{ cm}^2$$

### Model 12:

दिइएको वर्गाकार आधारमा भएको पीरामीडको पुरासतहको क्षेत्रफल पत्ता लगाउनुहोस् ।

Find the total surface area of square based pyramid.

**Solution:**

In the given figure of square base pyramid

Length of edge (e) = 25cm

Slant height (l) = 24 cm

According to the pythagoras theorem

$$e^2 = l^2 + \left(\frac{a}{2}\right)^2$$

$$\text{or, } a = 2\sqrt{(25\text{cm})^2 - (24\text{m})^2}$$

$$\text{or, } a = 2\sqrt{49\text{cm}^2}$$

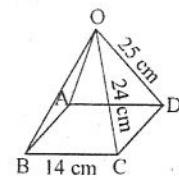
$$\text{or, } 2 \times 7 \text{ cm}$$

$$\therefore a = 14 \text{ cm}$$

Length of base (a) = 14 cm

$$\text{TSA} = 2(a \times l) + a^2 = 2(14 \text{ cm} \times 24 \text{ cm}) + (14 \text{ cm})^2 = 672 \text{ cm}^2 + 196 \text{ cm}^2 = 868 \text{ cm}^2$$

$$\text{Total suface area of pyramid (TSA)} = 868 \text{ cm}^2$$



### Model 13:

संगैको चित्रमा वर्गाकार आधार भएको पिरामीडको आधारको भुजाको लम्बाई 12 cm र पुरासतहको क्षेत्रफल  $384 \text{ cm}^2$  भए पीरामीडको उचाई पत्ता लगाउनुहोस् ।

In the side of the base of the square based pyramid is 12 cm and area is  $383 \text{ cm}^2$  find the height of the pyramid.

**Solution:**

Here, Length of base (a) = 12 cm

Total surface area (TSA) =  $384 \text{ cm}^2$

$$\therefore \text{TSA} = 2(a \times l) + a^2$$

$$\text{or, } 384 \text{ cm}^2 = 2(12 \times l) + (12 \text{ cm})^2$$

$$\text{or, } 384 \text{ cm}^2 = 24 \text{ cm} \times l + 144 \text{ cm}^2$$

$$\text{or, } (384 - 144) \text{ cm}^2 = 24 \text{ cm} \times l$$

$$\text{or, } 240 \text{ cm}^2 = 24 \text{ cm} \times l$$

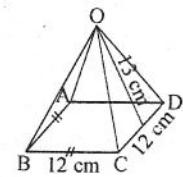
$$\text{or, } l = \frac{240 \text{ cm}^2}{24 \text{ cm}}$$

$$\therefore l = 10 \text{ cm}$$

Slant height (l) = 10 cm

According to the Pythagoras Theorem

$$l^2 = h^2 + \left(\frac{a}{2}\right)^2$$



$$\text{or, } (10 \text{ cm})^2 = h^2 + \left(\frac{12}{2} \text{ cm}\right)^2$$

$$\text{or, } 100 \text{ cm}^2 = h^2 + 36 \text{ cm}^2$$

$$\text{or, } 100 \text{ cm}^2 - 36 \text{ cm}^2 = h^2$$

$$\text{or, } 64 \text{ cm}^2 = h^2$$

$$\text{or, } (8 \text{ cm})^2 = h^2$$

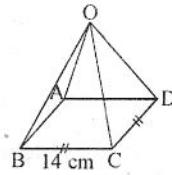
$$\therefore h = 8 \text{ cm}$$

Vertical height of pyramid (h) = 8 cm

#### Model 14:

दिएको चित्रमा एउटा वर्गाकार आधार भएको पीरामीडको आधारको भुजाको लम्बाई 14 cm र पीरामीडको आयतन 1568 cm<sup>3</sup> भए पीरामीडको पुरासतहको क्षेत्रफल निकाल्नुहोस्।

In the given figure of the length of a side of the base of the pyramid having square base is 14 cm and the volume of pyramid is 1568 cm<sup>3</sup>, find the total surface area.



#### Solution:

Here, in the given figure of pyramid length of side (a) = 14 cm

$$\text{Volume (V)} = 1568 \text{ cm}^3$$

$$\therefore V = \frac{1}{3} a^2 \times h$$

$$\text{or, } 1568 \text{ cm}^3 = \frac{1}{3} \times (14 \text{ cm})^2 \times h$$

$$\text{or, } 1568 \text{ cm}^3 = \frac{1}{3} \times 196 \text{ cm}^2 \times h$$

$$\text{or, } 1568 \times 3 \text{ cm}^3 = 196 \text{ cm}^2 \times h$$

$$\text{or, } h = \frac{1568 \times 3 \text{ cm}^3}{196 \text{ cm}^2}$$

$$\text{or, } h = 24 \text{ cm}$$

Vertical height (h) = 24 cm

According to the Pythagoras Therom

$$\therefore l^2 = h^2 + \left(\frac{a}{2}\right)^2$$

$$\text{or, } l = \sqrt{(24 \text{ cm})^2 + \left(\frac{14 \text{ cm}}{2}\right)^2}$$

$$\therefore l = \sqrt{576 \text{ cm}^2 + 49 \text{ cm}^2}$$

$$\text{or, } l = 25 \text{ cm}$$

$$\therefore \text{TSA} = 2(a \times l) + a^2 = 2(14 \text{ cm} \times 25 \text{ cm}) + (14 \text{ cm})^2 = 700 \text{ cm}^2 + 196 \text{ cm}^2 = 896 \text{ cm}^2$$

Total surface area of pyramid (TSA) = 896 cm<sup>2</sup>

#### Model 15:

वर्गाकार आधारमा बनेको एउटा पीरामीडको ठाडो उचाई र आधारको लम्बाई 2:3 को अनुपातमा छन्। यदि उक्त पीरामीडको पूरा सतहको क्षेत्रफल 384 cm<sup>2</sup> भए छूटके उचाई पता लगाउनुहोस्।

The vertical height and length of side of a square based pyramid are in the ratio of 2:3, if the total surface area of the pyramid is 384 cm<sup>2</sup>, find the slant height of the pyramid.

#### Solution:

Here, in the given figure of pyramid on the square based the ratio of vertical height and length side is 2:3 then h = 2x and a = 3x

According to the Pythagoras theorem

$$l^2 = h^2 + \left(\frac{a}{2}\right)^2$$

$$\text{or, } l = \sqrt{(2x)^2 - \left(\frac{3x}{2}\right)^2}$$

$$\text{or, } l = \sqrt{4x^2 - \frac{4x^2}{4}}$$

$$\text{or, } l = \sqrt{\frac{16x^2 + 9x^2}{4}}$$

$$\text{or, } l = \sqrt{\frac{25x^2}{4}}$$

$$\therefore l = \frac{5x}{2}$$

$$\text{Now, } \text{TSA} = 2(a \times l) + a^2$$

$$\text{or, } 384 \text{ cm}^2 = 2(3x \times \frac{5x}{2}) + (3x)^2$$

$$\text{or, } 384 \text{ cm}^2 = 15x^2 + 9x^2$$

$$\text{or, } 384 \text{ cm}^2 = 24x^2$$

$$\therefore x = 4 \text{ cm}$$

$$\text{Slant height } (l) = \frac{5x}{2} = \frac{5 \times 4 \text{ cm}}{2} = 10 \text{ cm}$$

### Model 16:

दिइएको चित्रमा वर्गाकार आधारमा बनेको पीरामीडको छड्के उचाई 13 cm र पुरासतहको क्षेत्रफल 36 cm<sup>2</sup> भए आधारको परिमिती निकाल्नुहोस् ।

**Solution:**

Here, In the given figure of square based pyramid slant height ( $l$ ) = 13 cm

And total surface area (TSA) = 360 cm<sup>2</sup>

Now, TSA = 2(a × l) + a<sup>2</sup>

$$\text{or, } 360 \text{ cm}^2 = 2(a \times 13 \text{ cm}) + a^2$$

$$\text{or, } 260 \text{ cm}^2 = 26a + a^2$$

$$\text{or, } a^2 = 26a - 360 - 360 = 0$$

$$\text{or, } a^2 + (36 - 10)a - 360 = 0$$

$$\text{or, } a^2 = 36a - 10a - 360 = 0$$

$$\text{or, } a(a + 3a) - 10(a + 36) = 0$$

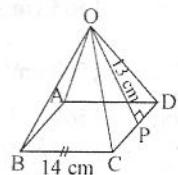
$$\therefore (a + 36)(a - 10) = 0$$

$$\text{Either } a = 36 = 0 \quad \therefore a = -36$$

$$a - 10 = 0 \quad \therefore a = 10$$

Length of base (a) = 10 cm

Perimeter of square based (P) = 4a = 4 × 10 cm = 40 cm



### Model 17:

चित्रमा देखाइएको क्रिप्टलको आयतन पत्ता लगाउनुहोस् ।

Find the volume of the crystals shown in the figure.

**Solution:**

In the given figure of crystals

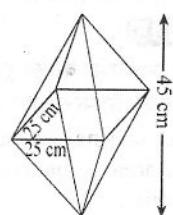
Length of base (a) = 25 cm

Total height (h) = 45 cm

If  $h_1$  and  $h_2$  are the height of upper and lower pyramid respectively then

$$h_1 + h_2 = 45 \text{ cm}$$

Similary,  $V_1$  and  $V_2$  volumes of upper and lower pyramid respectively, then



$$\begin{aligned}
 V_1 &= \frac{1}{3} a^2 h_1 \quad \text{and} \quad V_2 = \frac{1}{3} a^2 h_2 \\
 \therefore V &= V_1 + V_2 = \frac{1}{3} a^2 h_1 + \frac{1}{3} a^2 h = \frac{1}{3} a^2 (h_1 + h_2) = \frac{1}{3} (25\text{cm})^2 \times 45\text{ cm} = \frac{1}{3} 625 \times 45\text{ cm}^2 \\
 &= 625 \times 15\text{ cm}^3 = 9375\text{ cm}^3 \\
 \text{Volume of combined pyramid (V)} &= 9375\text{ cm}^3
 \end{aligned}$$

**Model 18:**

चित्रमा दिएको ठोस किप्लको पुरासतहको क्षेत्रफल पत्ता लगाउनुहोस् ।

Find the total surface area of the crystal in the given figure.

**Solution:**

In the given figure of crystal on the square based.

Length of base ( $a$ ) = 12 cm, slant height of upper part ( $l_1$ ) = 15 cm

Surface area of upper part ( $CSA_1$ ) =  $2(a \times l_1) = 2(12\text{ cm} \times 15\text{ cm}) = 360\text{ cm}^2$

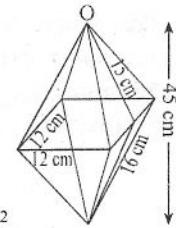
Again, slant of lower part ( $l_2$ ) = 16 cm

surface area of lower part ( $CSA_2$ ) =  $2(a \times l^2)$

$$= 2(12\text{ cm} \times 16\text{ cm}) = 384\text{ cm}^2$$

Total surface area ( $TSA$ ) =  $CSA_1 + CSA_2 = 360\text{ cm}^2 + 384\text{ cm}^2 = 744\text{ cm}^2$

Total surface area of crystal ( $TSA$ ) = 744 cm<sup>2</sup>

**Model 19:**

दिएको ठोस वस्तुको पूरा सतहको क्षेत्रफल 96cm<sup>2</sup> छ । यदि 1cm<sup>3</sup> = 109m भए उक्त ठोस वस्तुको जम्पा तौल कर्ति होला ? The given figure of solid has total surface area is 96cm<sup>2</sup>. If 1cm<sup>3</sup> = 109m, what is the total weight of this solid.

**Solution:** Here, Total surface of

Pyramid ( $TSA$ ) = 96cm<sup>2</sup>, its length of base ( $a$ ) = 6cm

$$\therefore TSA = 2(a \times l) + a^2$$

$$\text{or, } 96\text{cm}^2 = 2(6\text{cm} \times l) + (6\text{cm})^2$$

$$\text{or, } 96\text{cm}^2 = 72\text{cm} \times l + 36\text{cm}^2$$

$$\text{or, } 96\text{cm}^2 - 36\text{cm}^2 = 12\text{cm} \times l$$

$$\text{or, } 60\text{cm}^2 = 12\text{cm} \times l$$

$$\therefore l = 5\text{cm}.$$

Pythagoras theorem.

$$l^2 = h^2 + \left(\frac{a}{2}\right)^2$$

$$\text{or, } h = \sqrt{l^2 - \left(\frac{a}{2}\right)^2}$$

$$\text{or, } h = \sqrt{25 - (3\text{cm})^2}$$

$$\text{or, } h = \sqrt{25 - 9\text{cm}^2}$$

$$\text{or, } h = \sqrt{16\text{cm}^2}$$

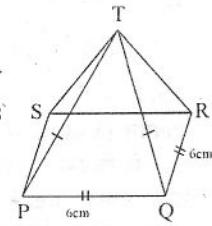
$$\therefore h = 4\text{cm}.$$

$$\therefore \text{Volume of pyramid (V)} = \frac{1}{3} a^2 \times h$$

$$= \frac{1}{3} \times (6\text{cm})^2 \times 4\text{cm}$$

$$= \frac{36 \times 4\text{cm}^3}{3}$$

$$= 48\text{cm}^3$$



According to the questions

$$1\text{cm}^3 = 10\text{cm}$$

$$48\text{cm}^3 = 10 \times 489\text{m} = 4809\text{m}$$

weight of solid pyramid = 4809m.

- a. समवाहु त्रिभुजको आधारमा रहेको पीरामीडको क्षेत्रफल र आयतन  
(Surface area and volume of an equilateral triangle based pyramid)

- सतहको क्षेत्रफल (Surface Area):

आधार भुजाको लम्बाई (Length base side) =  $AB = BC = CA = a$

छड्के उचाई (Slant height) =  $OP = l$

समवाहु त्रिभुजको आधारको क्षेत्रफल (Area of base equilateral triangle) =  $A$

$$\therefore A = \frac{\sqrt{3}}{4} a^2 \quad \text{or,} \quad \therefore A = \sqrt{s(s-a)(s-a)(s-a)}$$

$$\text{Where } s = \frac{3a}{2}$$

सतहको क्षेत्रफल (Surface Area) = CSA

$$\therefore CSA = \frac{3}{2} (a \times l)$$

- पूरासतहको क्षेत्रफल (Total surface area) = TSA

$$\therefore TSA = \frac{3}{2} (a \times l) + A \text{ or } TSA = 2(a \times l) + \frac{\sqrt{3}}{4} a^2$$

$$TSA = CSA + A$$

- आयतन (Volume):

दिइएको चित्रमा (In the given figure) आधार भुजाको लम्बाई ( $OA$ ) = ( $AB$ ) = ( $OC$ ) =  $a$   
ठाडो उचाई (Vertical height) =  $OE = h$

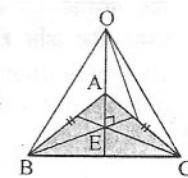
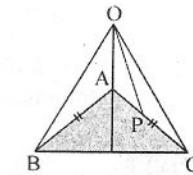
आधार समवाहु त्रिभुजको क्षेत्रफल (Area of base of equilateral Triangle)

$$= (A) = \frac{\sqrt{3}}{4} a^2$$

आयतन (Volumen) =  $V = \frac{1}{3} A \times h = \frac{1}{3} \text{ area of base} \times \text{height}$

$$\therefore V = \frac{1}{3} \times \frac{\sqrt{3}}{4} a^2 \times h$$

$$\therefore V = \frac{\sqrt{3}}{4} a^2 h$$



#### Model 1:

प्रत्येक भुजा 7cm भएको समवाहु त्रिभुजकार आधार भएको पीरामीडको उचाई 15 cm भने सो पीरामीडको आयतन निकाल्नुहोस्।

A pyramid, whose base is an equilateral triangles of side 7cm and height is 15 cm. Find its volume.

#### Solution:

In the given figure of pyramid on the equilateral triangle base.

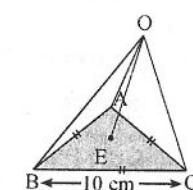
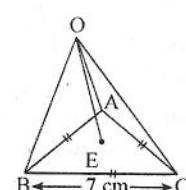
Length base ( $a$ ) = 7 cm

Vertical height ( $h$ ) = 15 cm

$$\text{Now, Volume (V)} = \frac{\sqrt{3}}{12} a^2 h = \frac{\sqrt{3}}{12} (7\text{cm})^2 \times 15 \text{ cm} = \frac{\sqrt{3} \times 49 \times 15 \text{ cm}^3}{12}$$

$$= \frac{1273.057344 \text{ cm}^3}{12} = 106.08 \text{ cm}^3$$

$$\text{Volume of pyramid (V)} = 106.08 \text{ cm}^3$$



**Model 2:**

दिइएको समबाहु त्रिभुजको आधार भएको पिरामिडको त्रिभुजकार सतहको क्षेत्रफल निकाल्नुहोस् ।  
Find the lateral surface area of equilateral triangle base pyramid.

**Solution:**

In the given figure of equilateral triangle base pyramid.

Length of base (a) = 10 cm slant height (l) = 18 cm

$$\text{LSA} = \frac{3}{2} (a \times l) = \frac{3}{2} (10 \text{ cm} \times 18 \text{ cm})$$

$$= 3 \times 10 \times 18 \text{ cm}^2 = 270 \text{ cm}^2$$

Lateral surface area of pyramid (LSA) = 270 cm<sup>2</sup>

**Model 3:**

दिइएको समबाहु त्रिभुज आधार भएको पिरामिडको पुरा सतहको क्षेत्रफल निकाल्नुहोस् ।  
Find the total surface area of given equilateral triangle based pyramid.

**Solution:**

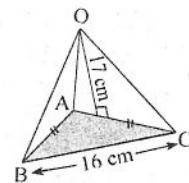
In the given figure of pyramid on the equilateral triangle base

Length of base (a) 16 cm

Slant height (l) = 17 cm

$$\begin{aligned} \text{TSA} &= \frac{3}{2} (a \times l) + \frac{\sqrt{3}}{12} a^2 = \frac{3}{2} (16 \text{ cm} \times 17 \text{ cm}) + \frac{\sqrt{3}}{12} (16 \text{ cm})^2 \\ &= 3 \times 8 \times 17 \text{ cm}^2 + \frac{\sqrt{3} \times 256 \text{ cm}^2}{4} = 408 \text{ cm}^2 + 110.85 \text{ cm}^2 = 518.85 \text{ cm}^2 \end{aligned}$$

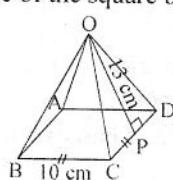
Total surface area of pyramid (TSA) = 518.85 cm<sup>2</sup>


**Practices Yourself**

1. दिइएको वर्गाकार आधारमा बनेको पीरामीडको आयतन निकाल्नुहोस् ।

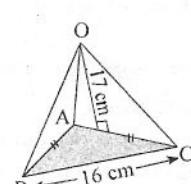
Find the volume of the square based pyramid.

(i)



Ans: 40cm<sup>3</sup>

(ii)

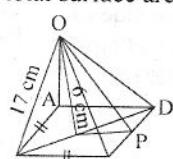


Ans: 1082.7cm<sup>3</sup>

2. वर्गाकार आधारमा बनेको पीरामीडको पुरा सतहको क्षेत्रफल निकाल्नुहोस् ।

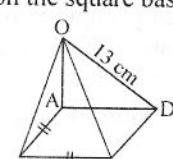
Find the total surface area of pyramid on the square based pyramid.

(i)



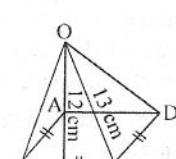
Ans: 576cm<sup>3</sup>

(ii)



Ans: 340cm<sup>3</sup>

(iii)



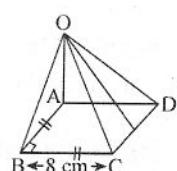
Ans: 756cm<sup>2</sup>

3. चित्रमा दिइएको वर्गाकार आधारमा बनेको पीरामीडको त्रिभुजका सतहका

क्षेत्रफल 80 cm<sup>2</sup> भए आयतन निकाल्नुहोस् ।

The area of triangle surface of the square based pyramid given in the diagram is 80 cm<sup>2</sup> find the volume of pyramid.

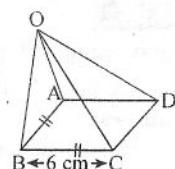
(Ans: 64 cm<sup>3</sup>)



4. संगैको चित्रमा वर्गाकार आधार भएको पीरामीडको पुरा सतहको क्षेत्रफल  $96 \text{ cm}^2$  र वर्गाकार किनाराको लम्बाई  $6 \text{ cm}$  भए उक्त पीरामीडको छड्के उचाई ठाडो उचाई र आयतन पत्ता लगाउनुहोस् ।

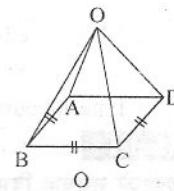
In the given figure, the total surface area of the given square based pyramid is  $96 \text{ cm}^2$  and the side of the square base  $6\text{cm}$ , find the slant height vertical height and volume of pyramid.

(Ans:  $5 \text{ cm}$ ,  $4 \text{ cm}$ ,  $48 \text{ cm}^3$ )



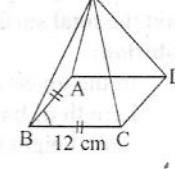
5. दिइएको वर्गाकार आधार भएको पीरामीडमा  $\triangle OBC$  को क्षेत्रफल  $175 \text{ cm}^2$  र आधार  $ABCD$  को क्षेत्रफल  $196 \text{ cm}^2$  भए सो पीरामिडको आयतन निकाल्नुहोस् ।

In the given figure square based pyramid area of  $\triangle OBC$  is  $175 \text{ cm}^2$  and area of base  $ABCD$  is  $196 \text{ cm}^2$ , find the volume of the pyramid. (Ans:  $1568 \text{ cm}^3$ )



6. हरेक किनाराहरु बराबर भएको पिरामिडको एउटा त्रिभुजाकार सतहको क्षेत्रफल  $144\sqrt{3} \text{ cm}^2$  भए पुरा सतहको क्षेत्रफल र आयतन पत्ता लगाउनुहोस् ।

The lateral surface of a triangle surface is  $144\sqrt{3} \text{ cm}^2$  find the total surface area and volume of pyramid.



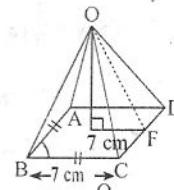
7. वर्गाकार आधारमा बनेको पीरामीडको आयतन  $1508 \text{ cm}^3$  र आधार भुजाको लम्बाई  $7 \text{ cm}$  भए उक्त पीरामीडको त्रिभुजाकार सतहको क्षेत्रफल पत्ता लगाउनुहोस् ।

The volume of the square based pyramid with volume is  $1508 \text{ cm}^3$  and length of the side of the base is  $7 \text{ cm}$  find the area of triangle faces of the pyramid.

(Ans:  $297.74 \text{ cm}^2$ )

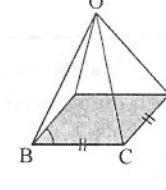
8. दिइएको पीरामीडको छड्के उचाई  $13 \text{ cm}$  र पुरासतहको क्षेत्रफल  $360 \text{ cm}^2$  भए पीरामीडको आयतन पत्ता लगाउनुहोस् ।

If the slant height and total surface area are  $13 \text{ cm}$  and  $360 \text{ cm}^2$  respectively find the volume of pyramid. (Ans:  $400 \text{ cm}^3$ )



9. वर्गाकार आधार भएको एउटा पीरामीडको छड्के उचाई र आधार भुजाको अनुपात  $5:6$  छ । पुरासतहको क्षेत्रफल  $1536 \text{ cm}^2$  भए पीरामिडको आयतन पत्ता लगाउनुहोस् ।

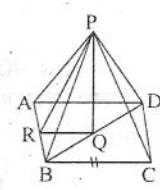
In the square based pyramid the ratio of slant height and side of base is  $5:6$  and total surface area is  $1536 \text{ cm}^2$  find the volume of pyramid. (Ans:  $3076 \text{ cm}^3$ )



10. दिइएको चित्रमा पीरामीडको आधारको लम्बाई र छड्के उचाईको अनुपात  $6:5$  छ ।

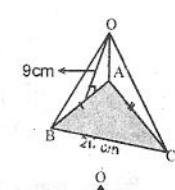
पुरासतहको क्षेत्रफल  $8564 \text{ cm}^2$  भए ठाडो उचाई र आयतन पत्ता लगाउनुहोस् ।

The adjoining figure is a square based pyramid in which ratio of the side of base and slant height is  $6:5$  and the total surface area of pyramid is  $864 \text{ cm}^2$ . Find the vertical height and volume of pyramid. (Ans:  $12\text{cm}$   $129 \text{ cm}^3$ )



11. दिइएको समवाहु आधार भएको पीरामीडको त्रिभुजाकार सतह र पुरासतहको क्षेत्रफल पत्ता लगाउनुहोस् ।

Find the lateral surface area and total surface of equilateral triangle base pyramid in the given figure. (Ans:  $300\text{cm}^2$ ,  $473.20\text{cm}^2$ )

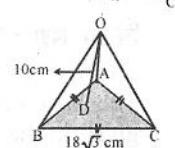


12. दिइएको समवाहु त्रिभुज आधार भएको पीरामीडको आयतन पत्ता लगाउनुहोस् ।

Find the volume of given equilateral triangle base pf pyramid.

(Ans:  $1402.96\text{cm}^3$ )

13. दिइएको चित्र वर्गाकार आधारमा बनेको पीरामीड हो । जसमा त्रिभुजाकार सतहको क्षेत्रफल  $544\text{cm}^2$  र आधारभुजा  $16\text{cm}$  भए पीरामीडको आयतन पत्ता लगाउनुहोस् ।



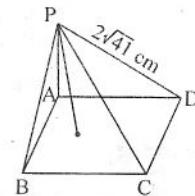
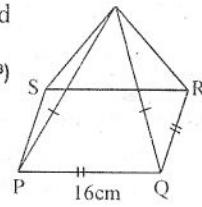
In the given figure of the triangular surface area of the square based pyramid is  $544\text{cm}^2$  and length of base is 16cm, Find the volume.

(Ans:  $1280\text{cm}^3$ )

14. दिइएको चित्रमा एउटा वर्गाकार आधारमा भएको पीरामीड हो। यसको आधारमा भुजा लम्बाई (BC) 16cm र छड्के किनाराको लम्बाई (PD)  $\sqrt{41}\text{ cm}$  भए सो पीरामीडको आयतन पत्ता लगाउनुहोस्।

The given figure of the solid square base pyramid if the length of side of the base (BC) is 16cm and the length of lateral edge (PD)  $2\sqrt{41}\text{cm}$ , find the volume of pyramid.

(Ans:  $512\text{cm}^3$ )

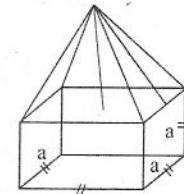


- b. घन र षड्मुखा आधारमा बनको पीरामीडको सतहको क्षेत्रफल र आयतन

Surface area and volume of cube and cuboid based of formed of pyramid.

- सतहको क्षेत्रफल (Surface Area):
 

घनको आकारमा रहेको पीरामीडमा लम्बाई (Length) = a उचाई (h) = a  
 छड्के उचाई (Slant height) = l  
 र ठाडो उचाई (vertical height) = h  
 घनको सतहको क्षेत्रफल (CSA<sub>1</sub>) =  $4a^2$
- पीरामीडको सतहको क्षेत्रफल (CSA<sub>2</sub>) =  $2(a \times l)$   
 बक सतहको क्षेत्रफल = CSA  
 $\therefore \text{CSA} = \text{CSA}_1 + \text{CSA}_2 = 4a^2 + 2al = 2a(2a + 1)$
- पुरासतहको क्षेत्रफल (Total surface area) :
 
$$\begin{aligned} \text{TSA} &= \text{CSA} + \text{Area of base (A)} \\ &= 2a(2a + 1) + a^2 \end{aligned}$$



- घनको आयतन (Volume of cube) = V<sub>1</sub>  
 $\therefore V_1 = a^3$

- पीरामीडको आयतन (Volume of pyramid) = V<sub>2</sub> =  $\frac{1}{3} a^2 h$

पुरा आयतन (Total volume) = V

$$\therefore V = V_1 + V_2$$

- c. षड्मुखा आधारको पीरामीड (Cuboid based of pyramid)

सतहको क्षेत्रफल (Surface area)

षड्मुखा सतहको क्षेत्रफल (surface of caboid) = CSA<sub>1</sub> + 4ah

पीरामीडको सतहको क्षेत्रफल (Surface Area of pyramid) = CSA<sub>2</sub> =  $2(a \times l)$

सतहको क्षेत्रफल (surface area) = CSA

$$\therefore \text{CSA} = \text{CSA}_1 + \text{CSA}_2 = 4ah + 2(a \times l)$$

पुरासतहको क्षेत्रफल (Total surface of pyramid) = TSA

$$\text{CSA}_1 = 4ah \quad \text{CSA}_2 = 2(a \times l)$$

आधारको क्षेत्रफल (Area of Base) = A = a<sup>2</sup>

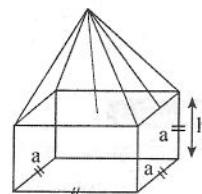
$$\text{TSA} = \text{CSA}_1 + \text{CSA}_2 + A$$

$$= 4ah + 2(a \times l) + a^2$$

आयतन (Volume) = V

षड्मुखाको आयतन (Volume of Cuboid) = V<sub>1</sub>

$$\therefore V = V_1 + V_2 = a^2 h_1 + \frac{1}{3} a^2 h_2$$



## Long Questions

### **Model :1**

दिइएको ठोस वस्तुको आयतन पत्ता लगाउनुहोस् । (Find the volume of given solid object.)

**Solution:** In the given figure cube based of pyramid

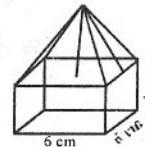
$$\text{Length of base (a)} = 6\text{cm}$$

$$\text{Volume of cube (V}_1) = a^3 = (6\text{ cm})^3 = 216 \text{ cm}^3$$

$$\text{Vertical height of pyramids (h}_1) = 15\text{ cm} - 6\text{cm} = 9\text{ cm}$$

$$\text{Volume pyramid (V}_2) = \frac{1}{3} a^2 h_1 = \frac{1}{3} (6\text{cm})^2 \times 9\text{ cm} = 36 \text{ cm}^2 \times 3\text{cm} = 108 \text{ cm}^3$$

$$\text{Volume of combined object (V)} = 216 \text{ cm}^3 + 108 \text{ cm}^3 = 324 \text{ cm}^3$$



### **Model :2**

दिइएको ठोस वस्तुको आयतन पत्ता लगाउनुहोस् ।

Find the volume of the given soild object.

**Solution:**

In the given figure of solid object.

$$\text{Length (a)} = 12\text{ cm}$$

$$\text{Breath (b)} = 10\text{ cm}$$

$$\text{Height (h)} = 8\text{ cm}$$

$$\text{Volume of cuboid (V}_1) = 12\text{ cm} \times 10\text{ cm} \times 8\text{ cm} = 960 \text{ cm}^3$$

$$\text{Height of pyramid (h}_1) = ? \text{ slant height (l}0 = \sqrt{157} \text{ cm}$$

$$l^2 = h_1^2 + \left(\frac{a}{2}\right)^2$$

$$\text{or, } h_1 = \sqrt{\left(\sqrt{157} \text{ cm}\right)^2 - \left(\frac{12 \text{ cm}}{2}\right)^2}$$

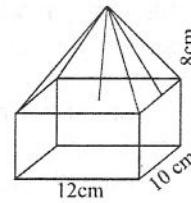
$$\text{or, } h_1 = \sqrt{157 \text{ cm}^2 - 36 \text{ cm}^2}$$

$$\text{or, } h_1 = \sqrt{121 \text{ cm}^2}$$

$$\therefore h_1 = 11 \text{ cm}$$

$$\text{Volume of pyramid (V}_2) = \frac{1}{3} a^2 h_1 = \frac{1}{3} (12 \text{ cm})^2 \times 11 \text{ cm} = \frac{1 \times 144 \times 11 \text{ cm}^3}{3} = 528 \text{ cm}^3$$

$$\text{Volume of combined solids object (V)} = V_1 + V_2 = 960 \text{ cm}^3 + 528 \text{ cm}^3 = 1488 \text{ cm}^3$$



### **Model 3:**

दिइएको ठोसवस्तुको पुरा सतहको क्षेत्रफल पत्ता लगाउनुहोस् । जुन प्रिज्म र पीरामीडले बनेको छ ।

Find the total surface area of the given solid figure which is combination of prism and pyramid.

**Solution:**

In the given figure of combined solid object.

$$\text{Length of prism (a)} = 12 \text{ cm} \text{ (Which square based)}$$

$$\text{Height (h}_1) = 6 \text{ cm}$$

$$\text{Curve surface area of prism (CSA}_1) = ph = 4a \times h = 4 \times 12 \text{ cm} \times 6\text{cm} = 288 \text{ cm}^2$$

$$\text{Vertical height of pyramid (h}_2) = 14 \text{ cm} - 6 \text{ cm} = 8 \text{ cm}$$

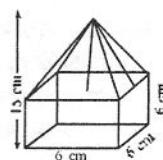
Pythagoras theram

$$l^2 = h_2^2 + \left(\frac{a}{2}\right)^2$$

$$\text{or, } l = \sqrt{(8 \text{ cm})^2 - \left(\frac{12 \text{ cm}}{2}\right)^2}$$

$$\text{or, } l = \sqrt{64 \text{ cm}^2 + 36 \text{ cm}^2}$$

$$\text{or, } l = \sqrt{100 \text{ cm}^2}$$



or,  $l = 10 \text{ cm}$

Area of prism ( $A$ ) =  $a^2 = (12 \text{ cm})^2 = 144 \text{ cm}^2$

Curvet surface area of pyramid ( $CSA$ ) =  $2(a \times l) = 2(12 \text{ cm} \times 10 \text{ cm}) = 240 \text{ cm}^2$

Total surface area ( $TSA$ ) =  $CSA_1 + CSA_2 + A = 288 \text{ cm}^2 + 240 \text{ cm}^2 + 144 \text{ cm}^2 = 672 \text{ cm}^2$

#### Model 4

दिइएको ठोस वस्तुको आयतन पता लगाउनुहोस् ।

Find the volume of given solid object.

**Solution:** In the given figure of combined solid object.

Height of pyramid ( $h_1$ ) = 8 cm

Total height of combined solid object ( $h$ ) = 28 cm

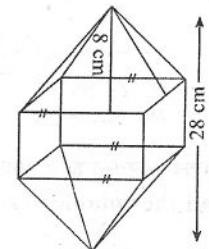
Now, height of prism ( $h_2$ ) =  $(28 - 16) \text{ cm} = 12 \text{ cm}$

In cube prism, height ( $a$ ) = 12 cm

$$\begin{aligned}\text{Now, volume of two equal pyramid } (V_1) &= 2 \left( \frac{1}{3} a^2 \times h_1 \right) = 2 \left( \frac{1}{3} (12 \text{ cm})^2 \times 8 \text{ cm} \right) \\ &= 2 \left[ \frac{1}{3} \times 144 \times 8 \right] \text{ cm}^3 = 768 \text{ cm}^3\end{aligned}$$

Volume of cube prism ( $V_2$ ) =  $a^3 = (12 \text{ cm})^3 = 1728 \text{ cm}^3$

∴ Volume of combined solid object ( $V$ ) =  $V_1 + V_2 = 768 \text{ cm}^3 + 1728 \text{ cm}^3 = 2496 \text{ cm}^3$



#### Model 5:

दिइएको ठोस वस्तु प्रिज्म र पीरामीडले बनेको छ । उक्त वस्तुको आयतन पता लगाउनुहोस् ।

Find the volume of the given solid object which is made up of pyramid.

**Solution:** In the right angle triangle based of prism.

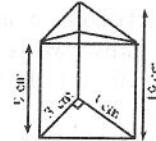
Area of base ( $A$ ) =  $\frac{1}{2} (3 \text{ cm} \times 8 \text{ cm}) = 12 \text{ cm}^2$

Height of prism ( $V_1$ ) =  $A \times h_1 = 12 \text{ cm} \times 9 \text{ cm} = 108 \text{ cm}^3$

Height of pyramid ( $h_2$ ) =  $19 \text{ cm} - 9 \text{ cm} = 10 \text{ cm}$

Volume of pyramid ( $V_2$ ) =  $\frac{1}{3} A \times h_2 = \frac{1}{3} 12 \text{ cm}^2 \times 10 \text{ cm} = 4 \times 10 \text{ cm}^3 = 40 \text{ cm}^3$

Volume of combined solid object ( $V$ ) =  $V_1 + V_2 = 108 \text{ cm}^3 + 40 \text{ cm}^3 = 148 \text{ cm}^3$

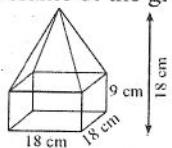


#### Practice Yourself

1. दिइएको ठोसवस्तुको आयतन पता लगाउनुहोस् ।

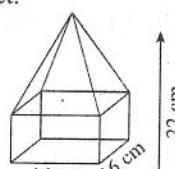
Find the volume of the given solid object.

(i)



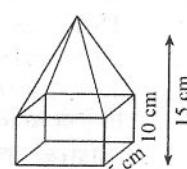
Ans:  $3888 \text{ cm}^3$

(ii)



Ans:  $4608 \text{ cm}^3$

(iii)

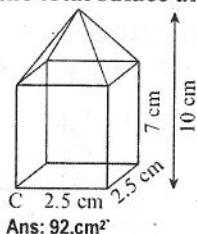


Ans:  $350 \text{ cm}^3$

2. दिएको ठोसवस्तुको पुरासतहको क्षेत्रफल पता लगाउनुहोस् ।

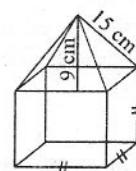
**Find the total surface area of the given combined solid object.**

(i)



Ans: 92.cm<sup>2</sup>

(ii)

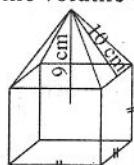


Ans: 3600cm<sup>2</sup>

3. दिएको ठोसवस्तुको आयतन पता लगाउनुहोस् ।

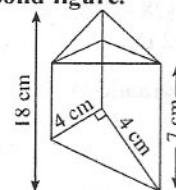
**Find the volume of the given combined solid figure.**

(i)



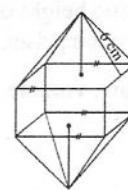
Ans: 15.84cm<sup>3</sup>

(ii)



Ans:

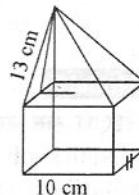
(iii)



Ans: 768cm<sup>3</sup>

4. दिएको ठोस वस्तु एउटा पीरमीड र आधार वर्ग भएको प्रिज्मबाट बनेको छ, जहां पीरमीड छड्के उचाईक 13 cm र प्रिज्मको आधार भुजाको लम्बाई 10 cm छ । यदि उक्त ठोस वस्तुको आयतन 900 cm<sup>3</sup> छ भने प्रिज्मको उचाई पता लगाउनुहोस् ।

The given solid object is formed by the combination of pyramid and a square prism where the slant height is 13 cm and the side of the base of the prism is 10cm. If the volume of the object is 900 cm<sup>3</sup>, find the height of prism.



- d. सोलीको सतहको क्षेत्रफल र आयतन (**Surface Area of Volume of Cone**)

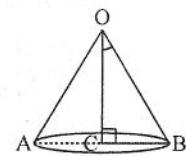
- सोलीको सतहको क्षेत्रफल (Surface Area of cone)

OB = सोलीको छड्के उचाई (Slant height) = l

OC = ठाडो उचाई (vertical height) = h

AC = अर्धव्यास (Radius) = r

AB = व्यास (diameter) = d



- वक्सतहको क्षेत्रफल (Curve surface Area) = CSA

$$\therefore \text{CSA} = \pi rl$$

- पुरासतहको क्षेत्रफल (Total surface Area) = TSA

$$\therefore \text{TSA} = \text{CSA} + \text{Area of base (A)} [\text{Area of base (A)} = \pi r^2]$$

$$\therefore \text{TSA} = \pi rl + \pi r^2$$

$$\therefore \text{TSA} = \pi r(l + r)$$

सोलीको आयतन (Volume of cone):

$$\text{आधारको क्षेत्रफल (Area of base) } = A = \pi r^2$$

$$\text{ठाडो उचाई (Vertical height) } = h$$

- आयतन (Volume) = V

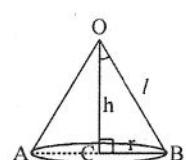
$$\therefore V = \frac{1}{3} A \times h \quad \therefore V = \frac{1}{3} \pi r^2 h$$

- समकोण  $\triangle OBC$  बाट

From right angle  $\triangle OBC$

According to the Pythagoras theorem

$$OB^2 = OC^2 + OB^2$$



$$\text{or, } l^2 = h^2 + r^2$$

$$\therefore l^2 = h^2 + r^2$$

$$l = \sqrt{h^2 + r^2}, \quad r = \sqrt{l^2 - h^2}, \quad h = \sqrt{l^2 - r^2}$$

- दिएको सोलीको चित्रमा

In the given figure of cone

OB = छड्के उचाई (Slant height) = l

CB = अर्धव्यास (Radius) = r

OC = उचाई (height) = h

माथिल्लो सोलीको आयतन (Volume of upper cone) =  $V_1$

$$\therefore V_1 = \frac{1}{3} \pi r^2 h_1$$

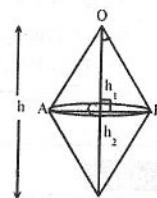
तल्लो सोलीको आयतन (Volume of lower cone) =  $V_2$

$$\therefore V_2 = \frac{1}{3} \pi r^2 h_2$$

$\therefore$  आयतन (Volume) = V

$$\therefore V = V_1 + V_2 = \frac{1}{3} \pi r^2 h_1 + \frac{1}{3} \pi r^2 h_2 = \frac{1}{3} \pi r^2 (h_1 + h_2)$$

$$\therefore \text{संयुक्त ठोस वस्तुको आयतन (Volume)} = V = \frac{1}{3} \pi r^2 (h_1 + h_2)$$



### बक्सतहको क्षेत्रफल र पुरासतहको क्षेत्रफल (Curved surface Area /Total surface Area)

साझा अर्धव्यास (Common radius) = r

सोलीको माथिल्लो भाग

(In upper part of Cone)

छड्के उचाई (Slant) =  $l_1$  र अर्धव्यास (Radius) = r

बक्सतहको क्षेत्रफल ( $CSA_1$ ) =  $\pi r l_1$

Furred surface Area ( $CSA_1$ ) =  $\pi r l_1$

सोलीको तल्लो भाग (In Lower part of cone):-

छड्के उचाई (Slant height)  $l_2$  =  $l_2$  अर्धव्यास (Radius) = r

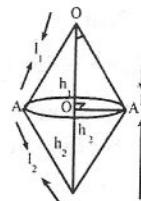
बक्सतहको क्षेत्रफल ( $CSA_2$ ) =  $\pi r l_2$

Curued surface area( $CSA_2$ ) =  $\pi r l_2$

संयुक्त वस्तुको बक्सतहको क्षेत्रफल ( $CSA$ ) =  $CSA_1 + CSA_2$

Curedled surface area of solid object( $CSA$ ) =  $CSA_1 + CSA_2$

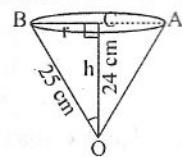
$$\therefore CSA = CSA_1 + CSA_2 = \pi r l_1 + \pi r l_2 = \pi r (l_1 + l_2)$$



### Very short Questions

- आधारको क्षेत्रफल र उचाईको रूपमा एउटा सोलीको आयतन निकाल्ने सुन लेख्नुहोस।  
Write the formula of finding volume of cone in terms of area of base and height.
- यदि छड्के उचाई h र अर्धव्यास r भएको सोलीको पुरासतहको क्षेत्रफल कति होला ?  
If slant height l and radius r, what is total surface area of cone.
- यदि TSA र CA कमश सोलीको पुरासतहको क्षेत्रफल र बक्सतहको क्षेत्रफल जनाउँदै भने आधारको क्षेत्रफल कति हुन्छ ?  
TSA and CSA denoted area the total surface area and curved surface area of cone, respectively what is the area of base ?
- यदि आधारको क्षेत्रफल A र बक्सतहको क्षेत्रफल CSA ले जनाउँदै भने सोलीको पुरा सतहको क्षेत्रफल कति होला ?  
If the denoted area of base A and curved surface area CSA, whatis the total surface area of cone.
- एउटा सोलीको बक्सतहको क्षेत्रफल र पुरासतहको क्षेत्रफल निकाल्नुहोस।  
If the curved surface area and total surface of a cone are  $6/6\text{cm}^2$  and  $880\text{cm}^2$  respectivelly. Find the total area of its base.

6. यदि एउटा सोलीको आधारको क्षेत्रफल एक तिहाई बराबर  $22\text{cm}^2$  र उचाई 24cm भए यसको आयतन कतिहोला ?  
If the one - third of base area of a cone is equal to  $22\text{cm}^2$  and the height is 24cm. What is its volume.



### Short Questions

**Model 1:**

दिइएको ठोस सोलीको आयतन निकाल्नुहोस् ।

**Find the volume of the given solid cone.**

**Solution:**

In the given figure of cone

Slant height ( $l$ ) = 25 cm

and vertical height ( $h$ ) = 24 cm

From the phygoras therem

$$\therefore l^2 = h^2 + r^2$$

$$\text{or, } r = \sqrt{l^2 - h^2}$$

$$\text{or, } r = \sqrt{(25\text{cm})^2 - (14\text{cm})^2}$$

$$\text{or, } r = \sqrt{(625 - 196) \text{cm}^2}$$

$$\text{or, } r = \sqrt{429 \text{cm}^2}$$

$$\therefore r = 7 \text{ cm}$$

Radius of base ( $r$ ) = 7cm

$$\text{Volume (V)} = \frac{1}{3} \pi r^2 h = \frac{1}{3} \times \frac{22}{7} \times (7\text{cm})^2 \times 24 \text{ cm} = \frac{1 \times 22 \times 49 \text{ cm}^2 \times 24 \text{ cm}}{3 \times 7}$$

$$= 22 \times 7 \times 8 \text{ cm}^3 = 1232 \text{ cm}^3$$

$$\text{Volume of cone (V)} = 1232 \text{ cm}^3$$

**Model 2:**

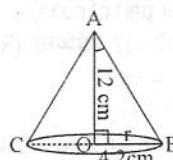
दिइएको ठोस सोलीको आयतन निकाल्नुहोस् ।

**Find the volume of the given solid cone.**

**Solution:** In the given figure solid cone.

Vertical height ( $h$ ) = 12 cm

Radius ( $r$ ) = 4.2 cm



$$\text{Volume (V)} = \frac{1}{3} \pi r^2 h = \frac{1}{3} \times \frac{22}{7} \times (4.2\text{cm})^2 \times 12 \text{ cm} = \frac{22 \times 17.64 \times 49 \times 12 \text{ cm}^3}{21}$$

$$= \frac{4656.96 \text{ cm}^3}{21} = 221.76 \text{ cm}^3$$

$$\text{Volume of cone (V)} = 221.76 \text{ cm}^3$$

**Model 3:**

दिइएको ठोस सोलीको आयतन पत्ता लगाउनुहोस् ।

**Find the volume of cone.**

**Solution:**

Here, in the given figure of cone,

Slant height ( $l$ ) = 13 cm

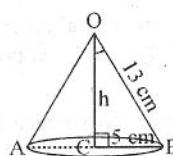
Radius base ( $r$ ) = 50m

from the Pythagoras theorem

$$\therefore l^2 = h^2 + r^2$$

$$\text{or, } h = \sqrt{(13 \text{ cm})^2 - (5 \text{ cm})^2}$$

$$\text{or, } h = \sqrt{169 \text{ cm}^2 - 25 \text{ cm}^2}$$



$$\text{or, } h = \sqrt{144 \text{ cm}^2}$$

$$\therefore h = 12 \text{ cm}$$

Vertical height (h) = 12 cm

$$\begin{aligned} \text{Volume (V)} &= \frac{1}{3} \pi r^2 h = \frac{1}{3} \times \frac{22}{7} \times (5\text{cm})^2 \times 12 \text{ cm} = \frac{22 \times 25 \times 12 \text{ cm}^3}{21} = \frac{6600 \text{ cm}^3}{21} \\ &= 314.29 \text{ cm}^3 \end{aligned}$$

$$\text{Volume of cone (V)} = 314.29 \text{ cm}^3$$

#### **Model 4:**

एउटा सोलीको आयतन  $308 \text{ cm}^3$  र वृत्ताकार सतहको क्षेत्रफल  $154 \text{ cm}^2$  भए उक्त सोलीको छड्के उचाई निकाल्नुहोस् ।

Find the slant height of the cone whose volume is  $308 \text{ cm}^3$  and area of circular base is  $154 \text{ cm}^2$ .

**Solution:** Here, Volume of cone (V) =  $308 \text{ cm}^3$ , Area of base (A) =  $154 \text{ cm}^2$

$$\text{Volume (V)} = \frac{1}{3} A \times h$$

$$\text{or, } 308 \text{ cm}^3 = \frac{1}{3} 154 \text{ cm}^2 \times h$$

$$\text{or, } \frac{308 \times 3 \text{ cm}^3}{154 \text{ cm}^2} = h$$

$$\text{or, } \frac{924 \text{ cm}^3}{154 \text{ cm}^2} = h$$

$$\therefore h = 6 \text{ cm}$$

Area of circular base

$$\therefore A = \pi r^2$$

$$\text{or, } 154 \text{ cm}^2 = \frac{22}{7} \times r^2$$

$$\text{or, } 154 \text{ cm}^2 \times 7 = 22r^2$$

$$\text{or, } r^2 = \frac{154 \times 7 \text{ cm}^2}{22}$$

$$\text{or, } r^2 = 49 \text{ cm}^2$$

$$\therefore r = 7 \text{ cm}$$

From Pythagoras theorem

$$\therefore l^2 = h^2 + r^2$$

$$\text{or, } l = \sqrt{(6\text{cm})^2 + (7\text{cm})^2}$$

$$\text{or, } l = \sqrt{(36+49)\text{cm}^2}$$

$$\text{or, } l = \sqrt{85\text{cm}^2}$$

$$\therefore l = 9.22\text{cm}$$

$$\text{Slant height of cone (l)} = 9.22\text{cm}$$

#### **Model 5:**

संगे दिइएको सोलीको अर्धव्यास र उचाई बराबर छ । यदि यसको आयतन  $9702 \text{ cm}^3$  छ भने यसको आधारको अर्धव्यास पत्ता लगाउनुहोस् ।

In the given figure of cone its radius and height are equal. If the volume of the cone is  $9702 \text{ cm}^3$ , find the radius of base.

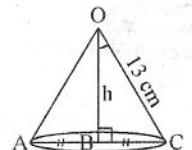
**Solution:** Here, Radius of base (r) = height (h)

$$\text{Volume (V)} = 9702 \text{ cm}^3$$

$$\therefore V = \frac{1}{3} \pi r^2 h$$

$$\text{or, } 9702 \text{ cm}^3 = \frac{1}{3} \times \frac{22}{7} \times r^2 \times r \quad (\text{h} = r)$$

$$\text{or, } 9702 \text{ cm}^3 = \frac{22r^3}{21}$$



$$\text{or, } 9702 \text{ cm}^3 = 21 = 22 r^3$$

$$\text{or, } r^3 = \frac{9702 \times 21 \text{ cm}^3}{22}$$

$$\text{or, } r^3 = \frac{203742 \text{ cm}^3}{22}$$

$$\text{or, } r^3 = 9261 \text{ cm}^3$$

$$\text{or, } = (21 \text{ cm})^3$$

$$\therefore r = 21 \text{ cm}$$

$$\text{Radius of base cone (r) = 21 cm}$$

#### Model 6:

एउटा सोलीको बक्सतहको क्षेत्रफल  $550 \text{ cm}^2$  र छड्के उचाई  $25 \text{ cm}$  भए सोलीको उचाई पत्ता लगाउनुहोस् ।

The curve surface area of cone is  $550 \text{ cm}^2$  and its slant height is  $25 \text{ cm}$ , find the height of cone.

**Solution:**

Here, curve surface Area (CSA) =  $550 \text{ cm}^2$

Slant height ( $l$ ) =  $25 \text{ cm}$

$$\therefore \text{CSA} = \pi r l$$

$$\text{or, } 550 \text{ cm}^2 = \frac{22}{7} \times r \times 25 \text{ cm}$$

$$\text{or, } 550 \text{ cm}^2 = \frac{550 \times r \text{ cm}}{7}$$

$$\text{or, } 550 \text{ cm}^2 \times 7 = 550 \times r \text{ cm}$$

$$\text{or, } = \frac{550 \text{ cm}^2 \times 7}{550 \text{ cm}} = r$$

$$\therefore r = 7 \text{ cm}$$

Pythagoras theorem

$$\text{or, } l^2 = h^2 + r^2$$

$$\text{or, } h = \sqrt{(25 \text{ cm})^2 - (7 \text{ cm})^2}$$

$$\text{or, } h = \sqrt{(625 - 49) \text{ cm}^2}$$

$$\text{or, } h = \sqrt{576 \text{ cm}^2}$$

$$\therefore h = 24 \text{ cm.}$$

$$\text{Vertical height of Cone (h) = 24 cm}$$

#### Model 7:

एउटा सोलीको पुरासतहको क्षेत्रफल र बक्सतहको क्षेत्रफल कमश  $968 \text{ cm}^2$  र  $352 \text{ cm}^2$  भए सोलीको अर्धब्यास पत्ता लगाउनुहोस् ।

If the total surface area and curve surface area of a cone are  $968 \text{ cm}^2$  and  $352 \text{ cm}^2$  respectively, find the radius of cone.

**Solution:** Here, total surface area (TSA) =  $968 \text{ cm}^2$

Curve surface area (CSA) =  $352 \text{ cm}^2$

$$\therefore \text{TSA} = \text{CSA} + A$$

$$\text{or, } 968 \text{ cm}^2 = 352 \text{ cm}^2 + \pi r^2$$

$$\text{or, } 968 \text{ cm}^2 - 352 \text{ cm}^2 = \frac{22}{7} \times r^2$$

$$\text{or, } 616 \text{ cm}^2 = \frac{22r^2}{7}$$

$$\text{or, } 616 \text{ cm}^2 = 22r^2$$

$$\text{or, } r^2 = \frac{616 \times 7 \text{ cm}^2}{22}$$

$$\text{or, } r^2 = \frac{4312 \text{ cm}^2}{22}$$

$$\text{or, } r^2 = 196 \text{ cm}^2$$

$$\text{or, } r^2 = (14 \text{ cm})^2$$

$$\therefore r^2 = 14 \text{ cm}$$

Radius of base (r) = 14cm

### **Model: 8**

आधारको अर्धव्यास 5cm भएको एउटा सोलीको पुरासतहको क्षेत्रफल  $282 \frac{6}{7} \text{ cm}^2$  भए सोलीको उचाई पत्ता लगाउनुहोस् ।

The total surface area of a cone with radius of its base 5cm is  $282 \frac{6}{7} \text{ cm}^2$ . Find the height of the cone.

**Solution:**

Radius of base cone (r) = 5 cm

$$\text{Total surface area of (TSA)} = 282 \frac{6}{7} \text{ cm}^2$$

$$\text{TSA} = \pi r (l + r)$$

$$\text{or, } \frac{1980}{7} \text{ cm}^2 = \frac{22}{7} \times 5 \text{ cm} (l + 5 \text{ cm})$$

$$\text{or, } \frac{1980}{7} \text{ cm}^2 = \frac{110 \text{ cm}}{7} (l + 5 \text{ cm})$$

$$\text{or, } 1980 \text{ cm}^2 = 110 \text{ cm} \times l + 550 \text{ cm}^2$$

$$\text{or, } 1980 \text{ cm}^2 - 550 \text{ cm}^2 = 110 \text{ cm} \times l$$

$$\text{or, } 1430 \text{ cm}^2 = 110 \text{ cm} \times l$$

$$\text{or, } l = \frac{1430 \text{ cm}^2}{110 \text{ cm}}$$

$$\therefore l = 13 \text{ cm}$$

Slant height (l) = 13 cm

From the Pythagoras theorem

$$l^2 = h^2 + r^2$$

$$\text{or, } h = \sqrt{l^2 - r^2} = \sqrt{(13 \text{ cm})^2 - (5 \text{ cm})^2} = \sqrt{(169 - 25) \text{ cm}^2} = \sqrt{144 \text{ cm}^2} = 12 \text{ cm}$$

Vertical height (h) = 12 cm

### **Model 9**

एउटा सोलीको अर्धव्यास र छड्के उचाई को अनुपात 1:3 छ भने अर्धव्यास पत्ता लगाउनुहोस् ।

The ratio of the radius and slant height of the a cone is 1:3. Find the radius

**Solution:** Hence, the ratio of radius and slant height is 1:3 then  $x = x$  and  $l = 3x$

$$\text{Curve surface area (CSA)} = 192\pi \text{ cm}^2$$

$$\text{CSA} = \pi r l$$

$$\text{or, } 192\pi \text{ cm}^2 = \pi \times x \times 3x$$

$$\text{or, } 192\pi \text{ cm}^2 = \pi \times 3x^2$$

$$\text{or, } x^2 = \frac{192 \text{ cm}^2}{3}$$

$$\text{or, } x^2 = 64 \text{ cm}^2$$

$$\text{or, } x = (8 \text{ cm})^2$$

$$\therefore x = 8 \text{ cm}$$

**Model 10:**

उचाइ र आयतन क्रमशः  $24\text{ cm}$  र  $1232\text{ cm}^3$  भएको सोलीको पुरासतहको क्षेत्रफल पत्ता लगाउनुहोस् ।

Find the total surface area of a cone whose vertical height and volume are  $24\text{ cm}$  and  $1232\text{ cm}^3$  and respectively.

**Solution:**

Here, vertical height of cone ( $h$ ) =  $24\text{ cm}$

Its volume ( $V$ ) =  $1232\text{ cm}^3$

$$\therefore V = \frac{1}{3} \pi r^2 h$$

$$\text{or, } 1232\text{ cm}^3 = \frac{1}{3} \times \frac{22}{7} \times r^2 \times 24\text{ cm}$$

$$\text{or, } 1232\text{ cm}^3 = \frac{176 r^2 \text{ cm}}{7}$$

$$\text{or, } 1232\text{ cm}^3 \times 7 = 176 r^2 \text{ cm}$$

$$\text{or, } r^2 = \frac{1232 \times 7 \text{ cm}^3}{176 \text{ cm}}$$

$$\text{or, } r^2 = \frac{8624}{176} \text{ cm}^2$$

$$\text{or, } r^2 = 49 \text{ cm}^2$$

$$\therefore r = 7 \text{ cm}$$

Radius of base ( $r$ ) =  $7\text{ cm}$

**Model 11:**

एउटा सोलीको अर्ध परिमिति  $33\text{ cm}$  तथा व्यासार्थ र छड्के उचाइको योगफल  $30\text{ cm}$  भने यसको पुरासतहको क्षेत्रफल पत्ता लगाउनुहोस् ।

If the semi - circumference of the base of a right circular cone is  $33\text{ cm}$  and the sum of its slant height and radius is  $30\text{ cm}$ , find its total surface area.

**Solution:**

$$\text{Here, semi perimeter (S)} = \frac{2\pi r}{2}$$

$$\text{or, } 33\text{ cm} = \pi r$$

$$\text{or, } 33\text{ cm} = \frac{22}{7} \times r$$

$$\text{or, } \frac{33 \times 7\text{ cm}}{22} = r$$

$$\therefore r = \frac{21}{2} \text{ cm} = 10.5 \text{ cm}$$

Radius of base ( $r$ ) =  $10.5\text{ cm}$

Sum of slant height and radius ( $l + r$ ) =  $30\text{ cm}$

$$\text{TSA} = \pi r(l + r) = \frac{22}{7} \times 10.5 \text{ cm} \times 30 \text{ cm} = \frac{22 \times 10.5 \times 30 \text{ cm}^2}{7} = \frac{6930 \text{ cm}^2}{7} = 990 \text{ cm}^2$$

Total surface area of cone (TSA) =  $990\text{ cm}^2$

**Model 12:**

एउटा वृत्ताकार सोलीको अर्धव्यास र उचाइको अनुपात  $7:12$  छ । यदि यसको आयतन  $616\text{ cm}^3$  भए व्रकसतहको क्षेत्रफल पत्ता लगाउनुहोस् ।

The radius and height of right circular cone are in the ratio  $7:12$ . If the volume is  $616\text{ cm}^3$  find the area of its curved surface.

**Solution:**

Here, the ratio of radius and height is 7:12 then  $r = 7x$ ,  $h = 12x$

$$\text{Volume (V)} = 616 \text{ cm}^3$$

$$\therefore V = \frac{1}{3} \pi r^2 h$$

$$\text{or, } 616 \text{ cm}^3 = \frac{1}{3} \times \frac{22}{7} \times (7x)^2 \times 12x$$

$$\text{or, } 616 \text{ cm}^3 = \frac{22 \times 49 x^2 \times 12x}{21}$$

$$\text{or, } 616 \text{ cm}^3 = 616 x^3$$

$$\text{or, } \frac{616 \text{ cm}^3}{616} = x^3$$

$$\text{or, } x^3 = 1 \text{ cm}^3$$

$$\therefore x = 1 \text{ cm}$$

$$\text{Now, } r = 7x = 7 \times 1 \text{ cm} = 7 \text{ cm}$$

$$h = 12x = 12 \times 1 \text{ cm} = 12 \text{ cm}$$

From the Pythagoras theorem

$$l^2 = h^2 + r^2$$

$$\text{or, } l = \sqrt{(12 \text{ cm})^2 + (7 \text{ cm})^2}$$

$$\text{or, } l = \sqrt{144 \text{ cm}^2 + 49 \text{ cm}^2}$$

$$\text{or, } l = \sqrt{193 \text{ cm}^2}$$

$$\therefore l = 13.89 \text{ cm}$$

$$\therefore \text{CSA} = \pi r l = \frac{22}{7} \times 7 \text{ cm} \times 13.89 \text{ cm} = 305.58 \text{ cm}^2$$

$$\text{Curve surface area of Cone (CSA)} = 305.59 \text{ cm}^2$$

**Model 13:**

दिइएको ठोस सोलीको पुरासतहको क्षेत्रफल पत्ता लगाउनुहोस् ।

Find the total surface area of the given solid cone.

**Solution:**

Here, slant height ( $l$ ) = 5 cm

$$\angle OAB = \angle OAC = 30^\circ$$

From the right angle  $\triangle AOB$

$$\sin 30^\circ = \frac{OB(r)}{AB(l)}$$

$$\text{or, } \frac{1}{2} = \frac{OB(r)}{5 \text{ cm}(l)}$$

$$\text{or, } \frac{5}{2} \text{ cm} = OB(r)$$

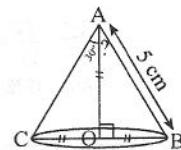
$$\therefore r = 2.5 \text{ cm}$$

$$\text{radius of cone (r)} = 2.5 \text{ cm}$$

$$\text{TSA} = \pi r(l+r) = \frac{22}{7} \times 2.5 \text{ cm} (5 \text{ cm} + 2.5 \text{ cm}) = \frac{22 \times 25 \times 7.5 \text{ cm}^2}{7} = \frac{412.50 \text{ cm}^2}{7}$$

$$= 58.93 \text{ cm}^2$$

$$\text{Total surface area of cone (TSA)} = 59.93 \text{ cm}^2$$



**Model 14:**

दिइएको ठोस वस्तुको आयतन पत्ता लगाउनुहोस् ।

Find the volume of given solid object.

**Solution:** Here, in the given figure common radius ( $r$ ) = 7 cm and total height ( $h$ ) = 24 cm where  $h_1$  and  $h_2$  are height of upper and lower cone respectively.

$$\therefore h_1 + h_2 = 24 \text{ cm}$$

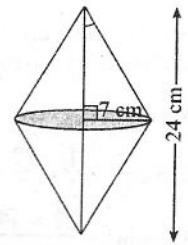
$$\text{Volume of upper cone } (V_1) = \frac{1}{3} \pi r^2 h_1 \text{ volume of lower cone}$$

$$(V_1) = \frac{1}{3} \pi r^2 h_2 \quad \therefore V = V_1 + V_2$$

$$\therefore V = V_1 + V_2$$

$$\begin{aligned} \therefore V &= \frac{1}{3} \pi r^2 h_1 + \frac{1}{3} \pi r^2 h_2 = \frac{1}{3} \pi r^2 (h_1 + h_2) = \frac{1}{3} \times \frac{22}{7} \times (7 \text{ cm})^2 \times 24 \text{ cm} \\ &= \frac{1 \times 22 \times 49 \text{ cm}^2 \times 14 \text{ cm}}{3 \times 7} = 1232 \text{ cm}^3 \end{aligned}$$

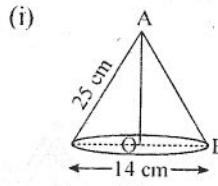
$$\therefore \text{Volume of combined solid object } (V) = 1232 \text{ cm}^3$$



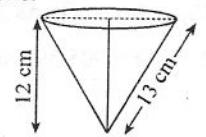
**Practice Yourself**

1. दिइएको ठोस सोलीको आयतन निकाल्नुहोस् ।

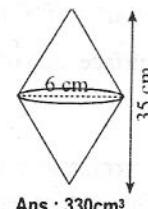
Find the volume of the given solid cone.



Ans :  $1232\text{cm}^3$



Ans :  $314.28\text{cm}^3$

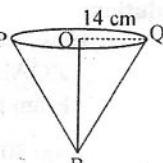


Ans :  $330\text{cm}^3$

2. यदि दिइएको सोलीको आयतन  $1848 \text{ cm}^3$  र यसको अर्धव्यास  $14 \text{ cm}$  भए यसको उचाई किति होला ।

If the volume of the given cone is  $1848 \text{ cm}^3$  and its radius is  $14 \text{ cm}$ , what is its height?

(Ans: 9 cm)



3. एउटा सोलीको आयतन र ठाडो उचाई कमश  $23100 \text{ cm}^3$  र  $50 \text{ cm}$  भए यसको आधारको व्यास पत्ता लगाउनुहोस् । If the volume and vertical height of a cone are  $23100 \text{ cm}^3$  and  $50 \text{ cm}$  respectively. Find the diameter of its base.

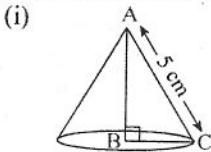
(Ans: 42 cm)

4. सोलीको अर्धव्यास र उचाई बराबर छ । यदि यसको आयतन  $9702 \text{ cm}^3$  छ भने यसको उचाई पत्ता लगाउनुहोस् । If the radius and height are equal of a cone, if its volume is  $9702 \text{ cm}^3$ , find its height.

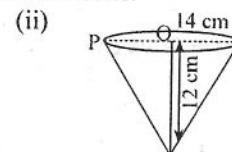
(Ans: 21 cm)

5. दिइएको ठोस सोलीको वक्सतहको क्षेत्रफल प्रत्ता लगाउनुहोस् ।

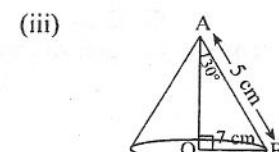
Find the curved surface area of given solid cone.



Ans  $47.14\text{cm}^2$



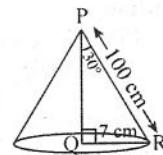
Ans :  $424.28\text{cm}^2$



Ans :  $550\text{cm}^2$

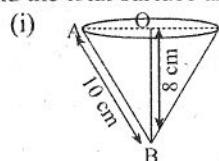
6. दिएको सोलीको बक्सतहको क्षेत्रफल  $8800 \text{ cm}^2$  छ । यदि यसको छड्के उचाई 100 cm भए सो सोलीको उचाई PQ को मान पत्ता लगाउनुहोस् ।

The curved surface area of the given cone is  $8800 \text{ cm}^2$ , if its slant height is 100 cm. Find the height PQ of cone. (Ans: 96 cm)

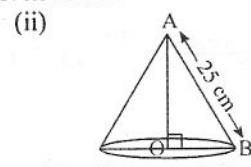


7. दिएको सोलीको पुरासतहको क्षेत्रफल निकाल्नुहोस् ।

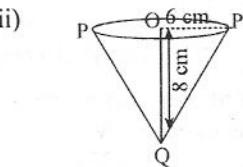
Find the total surface area of given cones.



Ans :  $301.71 \text{ cm}^2$



Ans :  $704 \text{ cm}^2$



Ans :  $301.71 \text{ cm}^2$

8. आधारको परिधि 44 cm तथा अर्धव्यास र छड्के उचाईको योगफल 32 cm छ भने सोलीको पुरासतहको क्षेत्रफल पत्ता लगाउनुहोस् ।

Find the total surface area of cone the circumference of base is 44 cm and the sum of its radius and slant height is 32 cm. (Ans:  $704 \text{ cm}^2$ )

9. एउटा सोलीको पुरासतहको क्षेत्रफल र आधारको व्यास कमश 300  $\pi \text{ cm}^2$  र 24 cm छ भने यसको छड्के उचाई पत्ता लगाउनुहोस् ।

Find the slant height of a cone the total surface area and diameter of the base of cone are  $300 \pi \text{ cm}^2$  and 24 cm respectively. (Ans: 13 cm)

10. एउटा सोलीको पुरासतहको क्षेत्रफल  $814 \text{ cm}^2$  छ । यदि सोलीको छड्के उचाई र आधारको अर्धव्यास को योगफल 37 cm भए सोलीको छड्के उचाई प्रत्ता लगाउनुहोस् ।

The total surface area of cone is  $81 \text{ cm}^2$ . If the sum of its slant height and radius of its base is 37 cm find the slant height. (Ans: 24 cm)

11. सोलीको पुरा सतहको क्षेत्रफल र बक्सतहको क्षेत्रफल कमश  $704 \text{ cm}^2$  र  $550 \text{ cm}^2$  भए सोलीको छड्के उचाई पत्ता लगाउनुहोस् ।

The total surface area and curved surface area of a cone are  $704 \text{ cm}^2$  and  $550 \text{ cm}^2$  respectively, find the slant height of cone. (Ans: 25 cm)

12. एउटा सोलीको बक्सतहको क्षेत्रफल यसैको पुरासतहको क्षेत्रफल को  $\frac{2}{3}$  छ । यदि सोलीको पुरा सतहको क्षेत्रफल  $462 \text{ cm}^2$  भए यसको अर्धव्यास पत्ता लगाउनुहोस् ।

The curved surface area of a cone is  $\frac{2}{3}$  of its total surface area. if total surface area of the cone is  $462 \text{ cm}^2$ , find the radius. (Ans: 7 cm)

13. एउटा सोलीको आयतन  $324\pi \text{ cm}^3$  र आधारको अर्धव्यास 9cm भए बक्सतहको क्षेत्रफल पत्ता लगाउनुहोस् ।

The volume of cone is  $324\pi \text{ cm}^3$  and radius of base is 9 cm, find the curved surface area. (Ans:  $424.28 \text{ cm}^2$ )

**संयुक्त ठोसहरू (वैलना वस्तुको सोली र अर्धगोला सोली**

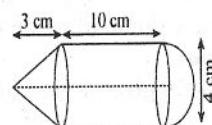
**Combined Solids Cylinder , Cone and Hemisphere Cone)**

### Long Questions

#### Model 1:

चित्रमा दिएको ठोस वस्तुको आयतन निकाल्नुहोस् ।

Find the volume of the given solid object in the figure.



**Solution:**

In the given figure of combined solid object.

Common diameter ( $d$ ) = 4 cm,

$$\text{Radius } (d) = \frac{d}{2} = \frac{4 \text{ cm}}{2} = 2 \text{ cm}$$

Height of cylinder ( $h_1$ ) = 10 cm

Volume of cylinder =  $V_1$

$$\therefore V_1 = \pi r^2 h_1$$

$$= \frac{22}{7} \times (2 \text{ cm})^2 \times 10 \text{ cm} = \frac{22 \times 4 \times 10 \text{ cm}^3}{7} = \frac{880}{7} \text{ cm}^3 = 125.71 \text{ cm}^3$$

Height of cone ( $h_2$ ) = 3 cm

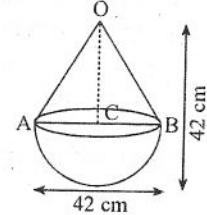
Volume of cone =  $V_2$

$$V_2 = \frac{1}{3} \pi r^2 h_2 = \frac{1}{3} \times \frac{22}{7} \times (2 \text{ cm})^2 \times 3 \text{ cm} = \frac{1 \times 22 \times 4 \times 3 \text{ cm}^3}{21} \\ = 12.57 \text{ cm}^3$$

Volume of combined solid of object =  $V$

$$\therefore V = V_1 + V_2 = 125.71 \text{ cm}^3 + 12.57 \text{ cm}^3 = 138.28 \text{ cm}^3$$

$$\therefore \text{Volume of combined solid object } (V) = 138.28 \text{ cm}^3$$

**Model 2:**

दिएको चित्रमा ठोस वस्तुको आयतन पत्ता लगाउनुहोस्।

Find the volume of combined solid object.

**Solution:**

In the given figure of combined solid object.

Total height ( $h$ ) = 54 cm

Height of cylinder ( $h_1$ ) = 30 m

then height cone ( $h_2$ ) =  $(54 - 30) = 24 \text{ cm}$

Slant height of cone ( $l$ ) = 25 cm

Now, pythagoras therem.

$$\therefore l^2 = h_2^2 + r^2$$

$$\text{or, } r = \sqrt{l^2 - h_2^2}$$

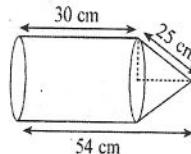
$$\text{or, } r = \sqrt{(25 \text{ cm})^2 - (24 \text{ cm})^2}$$

$$\text{or, } r = \sqrt{(625 - 576) \text{ cm}^2}$$

$$\text{or, } r = \sqrt{49 \text{ cm}^2}$$

$$\therefore r = 7 \text{ cm}$$

Radius of cone ( $r$ ) = 7 cm



$$\text{Volume of cylinder } (V_1) = \pi r^2 h_1 = \frac{22}{7} \times (7 \text{ cm})^2 \times 30 \text{ cm} = \frac{22 \times 49 \times 30 \text{ cm}^3}{7} \\ = \frac{32340 \text{ cm}^3}{7} = 4620 \text{ cm}^3$$

$$\text{Volume of cone } (V_2) = \frac{1}{3} \pi r^2 h_2 = \frac{1}{3} \times \frac{22}{7} \times (7 \text{ cm})^2 \times 24 \text{ cm} \\ = \frac{1 \times 22 \times 49 \times 24 \text{ cm}^3}{21} = \frac{25872 \text{ cm}^3}{21} = 1232 \text{ cm}^3$$

$$\text{Volume of combined solid object } (V) = V_1 + V_2 = (4620 + 1232) \text{ cm}^3 = 5852 \text{ cm}^3$$

**Model 3:**

चित्रमा दिएको ठोस वस्तुको आयतन निकाल्नुहोस्।

Find the volume of given combined solid object in figure.

**Solution:**

In the given figure of combined solid object.

Total height of solid object ( $h$ ) = 42 cm

Diameter ( $d$ ) = 42 cm

$$\text{Radius } (r) = \frac{d}{2} = \frac{42}{2} \text{ cm} = 21 \text{ cm}$$

$$\text{Volume of hemisphere } (V_1) = \frac{2}{3} \pi r^3 = \frac{2}{3} \times \frac{22}{7} \times (21 \text{ cm})^3$$

$$= \frac{2 \times 22 \times 9261 \text{ cm}^3}{21} = \frac{407484}{21} \text{ cm}^3 = 19404 \text{ cm}^3$$

Height of cone ( $h_1$ ) = (42 cm - 21 cm) = 21 cm

$$\text{Volume of cone } (V_2) = \frac{1}{3} \pi r^2 h_1 = \frac{1}{3} \times \frac{22}{7} \times (21 \text{ cm})^2 \times 21 \text{ cm} = \frac{22 \times 441 \times 21}{21} \text{ cm}^3 = 9702 \text{ cm}^3$$

$$\begin{aligned} \text{Total volume of combined solid object } (V) &= V_1 + V_2 = 19404 \text{ cm}^3 + 9702 \text{ cm}^3 \\ &= 29106 \text{ cm}^3 \end{aligned}$$

#### Model 4:

चित्रमा दिएको ठोस वस्तुको आयतन निकाल्नुहोस्।

Find the volume of given combined solid object in figure.

**Solution:**

In the given figure of combined solid object.

Slant height of cone ( $l$ ) = 10 cm,

Vertical height ( $h$ ) = 8 cm

Now, Pythagoras theorem

$$\therefore l^2 = h^2 + r^2$$

$$\text{or, } r = \sqrt{l^2 - h^2}$$

$$\text{or, } r = \sqrt{(10 \text{ cm})^2 - (8 \text{ cm})^2}$$

$$\text{or, } r = \sqrt{(100 - 64) \text{ cm}^2}$$

$$\text{or, } r = \sqrt{36 \text{ cm}^2}$$

$$\therefore r = 6 \text{ cm}$$

Common radius ( $r$ ) = 6 cm

$$\begin{aligned} \text{Volume of cone } (V_1) &= \frac{1}{3} \pi r^2 h_1 = \frac{1}{3} \times \frac{22}{7} \times (6 \text{ cm})^2 \times 8 \text{ cm} = \frac{22 \times 36 \times 8 \text{ cm}^3}{21} = \frac{6336 \text{ cm}^3}{21} \\ &= 301.71 \text{ cm}^3 \end{aligned}$$

$$\begin{aligned} \text{Volume of hemisphere } (V_2) &= \frac{2}{3} \pi r^3 = \frac{2}{3} \times \frac{22}{7} \times (6 \text{ cm})^3 = \frac{2 \times 22 \times 256 \text{ cm}^3}{21} \\ &= \frac{9504 \text{ cm}^3}{21} = 452.57 \text{ cm}^3 \end{aligned}$$

Total volume of combined solid object ( $V$ )

$$= V_1 + V_2 = 301.71 \text{ cm}^3 + 452.57 \text{ cm}^3 = 754.28 \text{ cm}^3$$

#### Model 5:

सँगै दिएको ठोस वस्तुको वक्सतहको क्षेत्रफल पत्ता लगाउनुहोस्।

Find the curved surface area of the given solid object.

**Solution:**

In the given figure of solid object.

Diameter of base ( $d$ ) = 6 cm,

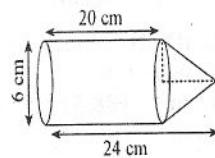
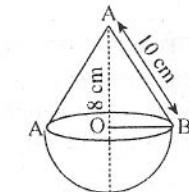
$$\text{Radius } (r) = \frac{d}{2} = \frac{6 \text{ cm}}{2} = 3 \text{ cm}$$

Height of cylinder ( $h_1$ ) = 20 cm

Total height ( $h$ ) = 24 cm

Curved surface area of cylinder = CSA<sub>1</sub>

$$\therefore \text{CSA}_1 = 2\pi rh_1$$



$$= 2 \times \frac{22}{7} \times 3 \text{ cm} \times 20 \text{ cm} = 264 \text{ cm}^2$$

Now, height of cone ( $h_2$ ) = (24 - 20) cm = 4 cm  
from the pythagoras theorem

$$l^2 = h_2^2 + r^2$$

$$\text{or, } l = \sqrt{(4\text{cm})^2 + (3\text{ cm})^2}$$

$$\text{or, } l = \sqrt{25 \text{ cm}^2}$$

$$\therefore l = 5 \text{ cm}$$

Curve surface area of cone =  $\text{CSA}_2$

$$\therefore \text{CSA}_2 = \pi rl = \frac{22}{7} \times 3 \text{ cm} \times 5 \text{ cm} = \frac{330 \text{ cm}^2}{7} = 47.14 \text{ cm}^2$$

Curved surface area of combined solid object  
 $(\text{CSA}) = \text{CSA}_1 + \text{CSA}_2$

$$= 2640 \text{ cm}^2 + 47.14 \text{ cm}^2 = 2687.14 \text{ cm}^2$$

### Model 6 :

दिएको ठोस वस्तुको पुरासतहको क्षेत्रफल पता लगाउनुहोस् ।

Find the total surface area of the given solid object.

**Solution:** In the given figure of solid object.

diameter of base ( $d$ ) = 12 cm

$$\text{radius (r)} = \frac{12 \text{ cm}}{2} = 6 \text{ cm}$$

height of cylinder ( $h_1$ ) = 80 cm

Total height ( $h$ ) = 88 cm

curved surface area of cylinder =  $\text{CSA}_1$

$$\therefore \text{CSA}_1 = 2\pi rh_1 = 2 \times \frac{22}{7} \times 6 \text{ cm} \times 80 \text{ cm} = \frac{21120 \text{ cm}^2}{7} = 3017.14 \text{ cm}^2$$

Now, height of cone ( $h_2$ ) = (88 - 80) cm = 8 cm

$\therefore$  From Pythagoras theorem

$$l^2 = h_2^2 + r^2$$

$$\text{or, } l = \sqrt{(8 \text{ cm})^2 + (9 \text{ cm})^2}$$

$$\text{or, } l = \sqrt{64 \text{ cm}^2 + 36 \text{ cm}^2}$$

$$\text{or, } l = \sqrt{100 \text{ cm}^2}$$

$$\therefore l = 10 \text{ cm}$$

Curved surface area of cone =  $\text{CSA}_2$

$$\therefore \text{CSA}_2 = \pi rl = \frac{22}{7} \times 6 \text{ cm} \times 10 \text{ cm} = \frac{1320 \text{ cm}^2}{7} = 188.57 \text{ cm}^2$$

Area of base ( $A$ ) =  $\pi r^2$

$$= \frac{22}{7} \times (6 \text{ cm})^2 = \frac{22 \times 36 \text{ cm}^2}{7} = \frac{792 \text{ cm}^2}{7} = 113.14 \text{ cm}^2$$

Total surface area of solid object =  $\text{TSA}$

$$\text{TSA} = \text{CSA}_1 + \text{CSA}_2 + A$$

$$= 3017.14 \text{ cm}^2 + 188.57 \text{ cm}^2 + 113.14 \text{ cm}^2$$

$$= 3318.85 \text{ cm}^2$$

### Model 7 :

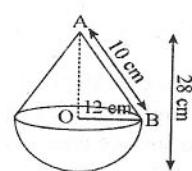
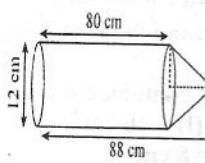
दिएको ठोस वस्तुको पुरासतहको क्षेत्रफल पता लगाउनुहोस् ।

Find the total surface area of the given solid object.

**Solution:**

In the given figure of solid object.

Total height of solid object ( $h$ ) = 28 cm



Common radius ( $r$ ) = 12 cm

Height of cone ( $h_1$ ) = (28 - 12) cm = 16 cm

From Pythagoras theorem

$$l^2 = h_1^2 + r^2$$

$$\text{or, } l = \sqrt{(16 \text{ cm})^2 + (12 \text{ cm})^2}$$

$$\text{or, } l = \sqrt{250 \text{ cm}^2 + 144 \text{ cm}^2}$$

$$\therefore l = \sqrt{400 \text{ cm}^2} \\ = 20 \text{ cm}$$

$$\text{Curved surface area of cone (CSA}_1\text{)} = \pi r l = \frac{22}{7} \times 12 \text{ cm} \times 20 \text{ cm} = \frac{5280 \text{ cm}^2}{7} = 754.29 \text{ cm}^2$$

$$\text{Curved area of hemisphere (CSA}_2\text{)} = 2\pi r^2 = 2 \times \frac{22}{7} \times (12 \text{ cm})^2$$

$$= \frac{44 \times 144 \text{ cm}^2}{7} = \frac{6336 \text{ cm}^2}{7} = 905.14 \text{ cm}^2$$

Total surface area of combined solid object [ TSA ]

$$\therefore \text{TSA} = \text{CSA}_1 + \text{CSA}_2$$

$$= 754.29 \text{ cm}^2 + 905.14 \text{ cm}^2 = 1600.04 \text{ cm}^2$$

### Model 8:

वेलनाको आधारको क्षेत्रफल  $125 \text{ cm}^2$  र वेलनाको उचाई  $3 \text{ cm}$  छ । यदि दिएको पुरा ठोस वस्तुको आयतन  $625 \text{ cm}^3$  भए ठोस वस्तुको उचाई पत्ता लगाउनुहोस् ।

The base area of cylinder is  $125 \text{ cm}^2$  and height of cylinder is  $3 \text{ cm}$ . If the volume of the whole solid is  $625 \text{ cm}^3$ , find the height of the solid.

**Solution:**

In the given combined solid object

Area of base ( $A$ ) =  $125 \text{ cm}^2$

Total volume of combined

Solid object ( $V$ ) =  $625 \text{ cm}^3$ ,

height of cylinder ( $h_1$ ) =  $3 \text{ cm}$

Volume of cylinder ( $V_1$ ) =  $\pi r^2 h_1$  and

Volume of cone ( $V_2$ ) =  $\frac{1}{3} \pi r^2 h_2$

Now,  $V = V_1 + V_2$

$$\text{or, } 625 \text{ cm}^3 = A \times h_1 + \frac{1}{3} \times 125 \text{ cm}^2 \times h_2$$

$$\text{or, } 625 \text{ cm}^3 = 375 \text{ cm}^3 + \frac{1}{3} 125 \text{ cm}^2 \times h_2$$

$$\text{or, } 625 \text{ cm}^3 = 375 \text{ cm}^3 + \frac{1}{3} 125 \text{ cm}^2 \times h_2$$

$$\text{or, } (625 - 375) \text{ cm}^3 = \frac{1}{3} 125 \text{ cm}^2 \times h_2$$

$$\text{or, } 250 \text{ cm}^3 \times 3 = 125 \text{ cm}^2 \times h_2$$

$$\text{or, } 2 \times 3 \text{ cm} = h_2$$

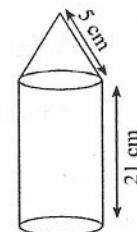
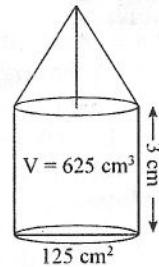
$$\therefore h_2 = 6 \text{ cm}$$

$$\text{Total height of solid object (h)} = 3 \text{ cm} + 6 \text{ cm} = 9 \text{ cm}$$

### Model 9:

दिएको चित्र वेलना र सोलीबाट बनेको संयुक्त हो । सो वस्तुको वक्सतहको क्षेत्रफल  $141 \pi \text{ cm}^2$ , भए यसको साफ्का अर्धव्यास पत्ता लगाउनुहोस् ।

Given figure a solid combined with cylinder and a cone if the curved surface area of given solid is  $141 \pi \text{ cm}^2$ , find the common radius.



**Solution:**

In the given figure of combined solid object curve surface area (CSA) =  $141 \pi \text{ cm}^2$

Height of cylinder ( $h_1$ ) = 21 cm,

Slant height of cone ( $l$ ) = 5 cm

Curved surface area of cylinder ( $\text{CSA}_1$ ) =  $2\pi r h_1$

Curved surface area of cone ( $\text{CSA}_2$ ) =  $\pi r l$

$$\therefore \text{CSA} = \text{CSA}_1 + \text{CSA}_2$$

$$\text{or, } 141 \pi \text{ cm}^2 = 210 r h_1 + \pi r l$$

$$\text{or, } 141 \pi \text{ cm}^2 = \pi r (2h_1 + l)$$

$$\text{or, } 141 \pi \text{ cm}^2 = \pi \times r (2 \times 21 \text{ cm} + 5 \text{ cm})$$

$$\text{or, } 141 \text{ cm}^2 = (42 + 5) \text{ cm} \times r$$

$$\text{or, } 141 \text{ cm}^2 = 47 \text{ cm} \times r$$

$$\text{or, } r = \frac{141 \text{ cm}^2}{47}$$

$$\therefore r = 3 \text{ cm}$$

Common radius of solid object ( $r$ ) = 3 cm

**Model0:**

संगैको चित्रमा ठोस वस्तुको उचाई 24 cm छ । सोलीको उचाई  $r$  वैलनाको उचाईको अनुपात 3:5 भए ठोस वस्तुको आयतन निकाल्नुहोस् ।

The total height of solid object given along side figure is 24 cm. If height of cone and cylinder are in the ratio 3:5 find the volume of solid object.

**Solution:**

In the given figure of solid object.

Diameter of base ( $d$ ) = 14 cm

$$\text{Radius (r)} = \frac{d}{2} = \frac{14 \text{ cm}}{2} = 7 \text{ cm}$$

Total height ( $h$ ) = 24 cm If  $h_1$  and  $h_2$  are height cone and cylinder respectively.

Then the ratio of  $h_1:h_2 = 3:5$ ,  $h_1 = 3x$   $h_2 = 5x$

$$\therefore h_1 + h_2 = 24 \text{ cm}$$

$$\text{or, } 3x + 5x = 24 \text{ cm}$$

$$\text{or, } 8x = 24 \text{ cm}$$

$$\therefore x = 3 \text{ cm}$$

$$\text{Now, } h_1 = 3x = 3 \times 3 \text{ cm} = 9 \text{ cm}, \quad h_2 = 5x = 5 \times 3 \text{ cm} = 15 \text{ cm}$$

$$\text{Volume of cone (V}_1) = \frac{1}{3} \pi r^2 h_1 = \frac{1}{3} \times \frac{22}{7} \times (7 \text{ cm})^2 \times 9 \text{ cm} = \frac{22 \times 49 \text{ cm}^2 \times 9 \text{ cm}}{21}$$

$$= \frac{9702 \text{ cm}^3}{21} = 462 \text{ cm}^3$$

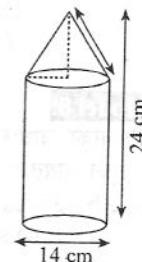
$$\text{Volume of cylinder (V}_2) = \pi r^2 h_2 = \frac{22}{7} \times (7 \text{ cm})^2 \times 15 \text{ cm} = \frac{22 \times 49 \text{ cm}^2 \times 15 \text{ cm}}{7}$$

$$= \frac{16171 \text{ cm}^3}{7} = 2310 \text{ cm}^3$$

Total volume of combined solid object =  $V$

$$\therefore V = V_1 + V_2 = 462 \text{ cm}^3 + 2310 \text{ cm}^3 = 2772 \text{ cm}^3$$

Total volume of solid object ( $V$ ) = 2772 cm<sup>3</sup>



**Model 11:**

यदि संगैको ठोस वस्तुको पुरा सतहको क्षेत्रफल  $3432 \text{ cm}^2$  भए सोलीको उचाई पता लगाउनुहोस् ।  
If the total surface area of adjoining solid object is  $3432 \text{ cm}^2$ , find the height of cone.

**Solution:**

In the given figure of solid object.

$$\text{Slant height of cone (l)} = 50 \text{ cm}$$

$$\text{Total surface area of solid object (TSA)} = 3432 \text{ cm}^2$$

$$\text{Curved surface area of cone (CSA}_1\text{)} = \pi r l$$

$$\text{Curve surface area of hemisphere (CSA}_2\text{)} = 2\pi r^2$$

$$\text{TSA} = \text{CSA}_1 + \text{CSA}_2$$

$$\text{or, } 3432 \text{ cm}^2 = \pi r l + 2\pi r^2$$

$$\text{or, } 3432 \text{ cm}^2 = \frac{22}{7} \times r \times 50 \text{ cm} + 2 \times \frac{22}{7} r^2$$

$$\text{or, } 3432 \text{ cm}^2 = \frac{1100 \text{ cm}^2}{7} + \frac{44r^2}{7}$$

$$\text{or, } 3432 \times 7 \text{ cm}^2 = 1100 r + 44 r^2$$

$$\text{or, } 3432 \times 7 \text{ cm}^2 = 44(25r + r^2)$$

$$\text{or, } \frac{3432 \times 7 \text{ cm}^2}{44} = 25r + r^2$$

$$\text{or, } 546 = 25r + r^2$$

$$\text{or, } r^2 + 25r - 546 = 0$$

$$\text{or, } r^2 + 39r - 14r - 546 = 0$$

$$\text{or, } r(r + 39) - 14(r + 39) = 0$$

$$\text{or, } (r + 39)(r - 14) = 0$$

either,  $r + 39 = 0 \Rightarrow r = -39$  (impossible)

$$\text{or, } r - 14 = 0$$

$$\therefore r = 14$$

$$\text{Common radius (r)} = 14 \text{ cm}$$

From the Pythagoras theorem

$$l^2 = h^2 + r^2$$

$$\text{or, } h = \sqrt{l^2 + r^2}$$

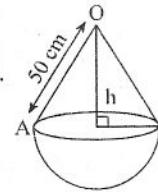
$$\text{or, } h = \sqrt{(50 \text{ cm})^2 - (14 \text{ cm})^2}$$

$$\text{or, } h = \sqrt{(2500 - 196) \text{ cm}^2}$$

$$\text{or, } h = \sqrt{2304 \text{ cm}^2}$$

$$\therefore h = 48 \text{ cm}$$

$$\therefore \text{Height of cone (h)} = 48 \text{ cm}$$

**Model 12**

दिएको चित्रमा सोलीको उचाई  $10 \text{ cm}$  र अर्धगोलाको वक्सतहको क्षेत्रफल  $308 \text{ cm}^2$  भए ठोस वस्तुको आयतन पता लगाउनुहोस् ।

If the height of cone is  $10 \text{ cm}$ , and curved surface area of hemisphere is  $308 \text{ cm}^2$ , find the volume of combined solid object.

**Solution:**

In the given figure of combined solid object.

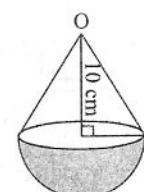
$$\text{height of cone (h)} = 10 \text{ cm}$$

$$\text{Curved surface area of hemisphere (CSA}_1\text{)} = 368 \text{ cm}^2$$

$$\therefore \text{CSA} = 2\pi R^2$$

$$\text{or, } 308 \text{ cm}^2 = 2 \times \frac{22}{7} \times r^2$$

$$\text{or, } 308 \times 7 \text{ cm}^2 = 44 r^2$$



$$\text{or, } \frac{2156 \text{ cm}^2}{44} = r^2$$

$$\text{or, } r^2 = 49 \text{ cm}^2$$

$$\therefore r = 7 \text{ cm}$$

$$\begin{aligned}\text{Volume of cone (V}_1) &= \frac{1}{3} \pi r^2 h = \frac{1}{3} \times \frac{22}{7} \times (7 \text{ cm})^2 \times 10 \text{ cm} \\ &= \frac{22 \times 49 \times 10 \text{ cm}^3}{21} = \frac{10780}{21} \text{ cm}^3 = 513.33 \text{ cm}^3\end{aligned}$$

$$\begin{aligned}\text{Volume of hemisphere (V}_1) &= \frac{2}{3} \pi r^3 \\ &= \frac{2}{3} \times \frac{22}{7} \times (7 \text{ cm})^3 = \frac{44 \times 343}{21} \text{ cm}^3 = \frac{15092}{21} \text{ cm}^3 = 718.66 \text{ cm}^3\end{aligned}$$

$$\begin{aligned}\text{Total volume of combined solid object (V)} &= V_1 + V_2 = 513.33 \text{ cm}^3 + 718.66 \text{ cm}^3 \\ &= 1232 \text{ cm}^3\end{aligned}$$

### Model 13:

दिएको चित्रमा वेलनाको उचाई यसको अर्धव्यासको 3 गुणा छ । सोलीको उचाई यसको आधारको अर्धव्यास संग बराबर छ । यदि ठोस वस्तुको आयतन  $4312 \text{ cm}^3$  भए ती ठोस वस्तुको पुरा सतहको क्षेत्रफल पता लगाउनुहोस् ।

In the adjoining figure the height of cylinder is three times its radius and the height of the equal to the radius of its base. if the volume of the solid object is  $4312 \text{ cm}^3$ . Find the total surface area of solid object.

**Solution:**

In the given figure of combined solid object.

Here,  $h_1 = r$  and  $r = h_2$  Total volumr of solid object (V) =  $4312 \text{ cm}^3$

$$\text{Volume of hemisphere (V}_1) = \frac{2}{3} \pi r^3$$

$$\text{Volume of cylinder (V}_2) = \pi r^2 h$$

$$\text{Volume of cone (V}_3) = \frac{1}{3} \pi r^2 h_2$$

$$V = V_1 + V_2 + V_3$$

$$\text{or, } 4312 \text{ cm}^3 = \frac{2}{3} \pi r^3 + \pi r^2 h_1 + \frac{1}{3} \pi r^2 h_2$$

$$\text{or, } 4312 \text{ cm}^3 = \frac{2}{3} \times \frac{22}{7} \times r^2 + \frac{22}{7} (r^2 \times 3r) + \frac{1}{3} \times \frac{22}{7} r^2 \times r$$

$$\text{or, } 4312 \text{ cm}^3 = \frac{44}{21} r^3 + \frac{66 r^3}{7} + \frac{22 r^3}{21}$$

$$\text{or, } 4312 \text{ cm}^3 = \frac{44 r^3 + 198 r^3 + 22 r^3}{21}$$

$$\text{or, } 4312 \text{ cm}^3 \times 21 = 264 r^3$$

$$\text{or, } \frac{4312 \times 21}{264} \text{ cm}^3 = r^3$$

$$\text{or, } \frac{90552}{264} \text{ cm}^3 = r^3$$

$$\text{or, } 343 \text{ cm}^3 = r^3$$

$$\therefore r = 7 \text{ cm}$$

$$h_1 = 3r = 21 \text{ cm}$$

$$h_2 = r = 7 \text{ cm}$$



Now, From pythagoras theorem,

$$L^2 = h_2^2 + r^2$$

$$l = \sqrt{7^2 + 7^2} = \sqrt{98\text{cm}^2} = 9.90\text{cm}$$

Curve surface area of Cylinder(CSA<sub>1</sub>) =  $2\pi rlh$ , ]

Curve surface area of Cone (CSA<sub>2</sub>) =  $\pi rl$

Curve surface area of hemisphere(CSA<sub>3</sub>) =  $2\pi r^2$

$$\therefore \text{TSA} = \text{CSA}_1 + \text{CSA}_2 + \text{CSA}_3 = 2\pi rlh + \pi rl + 2\pi r^2$$

$$= 2 \times \frac{22}{7} \times 7\text{cm} \times 21\text{cm} + \frac{22}{7} \times 7\text{cm} \times 9.90\text{cm} + 2 \times \frac{22}{7} \times 49\text{cm}^2$$

$$= 924\text{ cm}^2 + 217.80\text{ cm}^2 + 308\text{cm}^2 = 1449.8\text{cm}^2$$

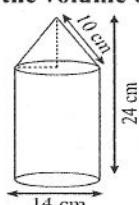
Total surface area of combined solid object is 1449.80 cm<sup>2</sup>

### Practice Yourself

1. चित्रमा दिइएको सयुक्त बनोट वस्तुको आयतन निकाल्नुहोस्।

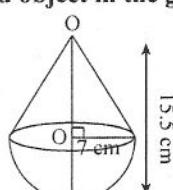
Find the volume of combined solid object in the given figure.

(i)



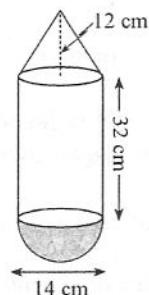
(Ans: 4628.59cm<sup>3</sup>)

(ii)



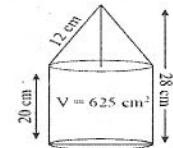
(Ans: 2028.18cm<sup>3</sup>)

(iii)



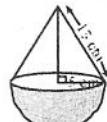
(Ans: 4414.67cm<sup>3</sup>)

(iv)



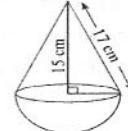
(Ans: 2564.57cm<sup>3</sup>)

(v)



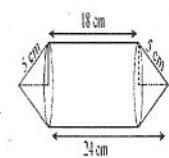
(Ans: 576.19 cm<sup>3</sup>)

(vi)



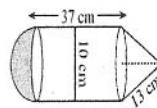
(Ans: 259.6cm<sup>3</sup>)

(vii)

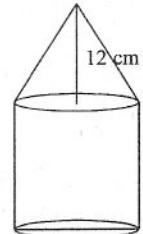


(Ans: 358.21 cm<sup>3</sup>)

(viii)



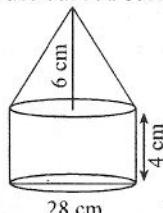
(Ans: 2147.62 cm<sup>3</sup>)



2. चित्रमा दिएको सयुक्त वस्तुको वक्सतहको क्षेत्रफल पता लगाउनुहोस्।

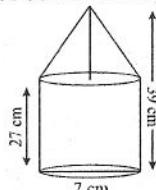
Find the curved surface area of combined solid object in the given figure.

(i)



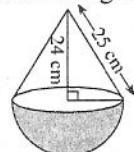
Ans: 1022.18cm<sup>2</sup>

(ii)



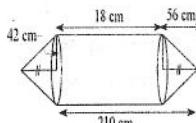
Ans: 424.28cm<sup>2</sup>

(iii)



Ans : 858cm<sup>2</sup>

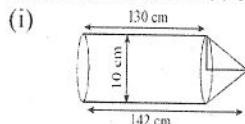
(iv)



Ans :

3. चित्रमा दिएको सयुक्त ठोस वस्तुको पुरासतहको क्षेत्रफल पत्ता लगाउनुहोस् ।

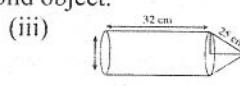
Find the total surface area of the given figure combined solid object.



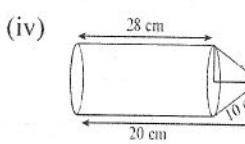
Ans:  $1266.10 \text{ cm}^2$



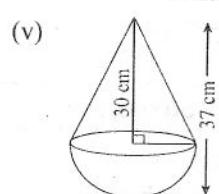
Ans:  $2112 \text{ cm}^2$



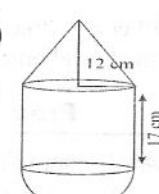
Ans:  $2112 \text{ cm}^2$



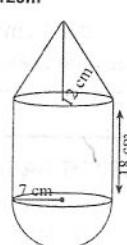
Ans:  $1056 \text{ cm}^2$



Ans:  $985.6 \text{ cm}^2$



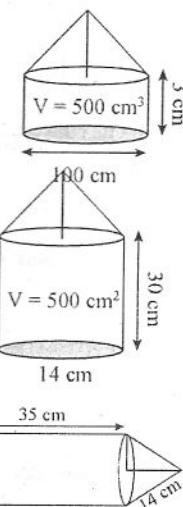
Ans:  $2247.14 \text{ cm}^2$



4. दिइएको चित्रमा सयुक्त ठोस वस्तुको आधारको क्षेत्रफल  $100 \text{ cm}^2$  र वेलनाको उचाई  $3 \text{ cm}$  छ। यदि ठोस वस्तुको आयतन  $500 \text{ cm}^3$  भए उक्त ठोस वस्तुको पुरा उचाई पत्ता लगाउनुहोस् ।

The area of base of combined solid figure is  $100 \text{ cm}^2$  of the given figure and height of cylinder is  $3 \text{ cm}$ . If volume of combined solid object is  $500 \text{ cm}^3$ , find the total height of solid object.

(Ans:  $9 \text{ cm}$ )



5. संगैको चित्रमा दिएको सयुक्त ठोस वस्तुको उचाई  $30 \text{ cm}$  छ। यदि सोलीको उचाई र वेलनाको उचाई  $2:3$  को अनुपातमा भए ठोस वस्तुको आयतन पत्ता लगाउनुहोस् ।

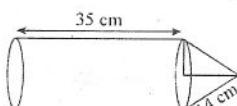
The total height of the combined solid object given alongside is  $30 \text{ cm}$ . If the height of cone and cylinder are in the ratio  $2:3$  find the volume of the combined solid object.

(Ans:  $2772 \text{ cm}^3$ )

6. दिएको चित्रको वक्सतहको क्षेत्रफल  $1848 \text{ cm}^2$  भए साभा अर्धव्यास पत्ता लगाउनुहोस् ।

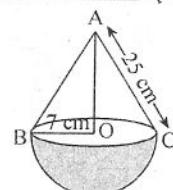
The curved surface of the given figure  $1848 \text{ cm}^2$ , find the radius of base.

(Ans:  $7 \text{ cm}$ )



7. चित्रमा देखाइएको सयुक्त ठोसको पूरा सतहको क्षेत्रफल  $858 \text{ cm}^2$  भए आयतन पत्ता लगाउनुहोस् ।

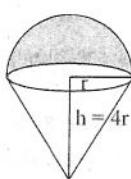
The total surface area of the combined solid object shown in the given figure is  $858 \text{ cm}^2$  find the volume. Ans:  $1950\frac{2}{5} \text{ cm}^3$



8. चित्रमा देखाइएको ठोस वस्तुको सोलीको उचाई त्यसैको अर्धव्यासको 4 गुणा र ठोस वस्तुको आयतन  $54 \pi \text{ cm}^3$  भए पुरासतहको क्षेत्रफल पत्ता लगाउनुहोस् ।

In the combined solid object of shown in the given figure. If the height of cone is 4 times of the radius and volume of solid object is  $54 \pi \text{ cm}^3$ , find the total surface area.

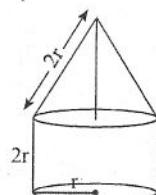
(Ans:  $173.10 \text{ cm}^2$ )



9. दिइएको चित्रमा वेलनाको उचाई र सोलीको छड्के उचाई अर्धव्यास को दोब्बर छ । यदि पुरासतहको क्षेत्रफल  $1078 \text{ cm}^2$  भए वक्सतहको क्षेत्रफल पत्ता लगाउनुहोस् ।

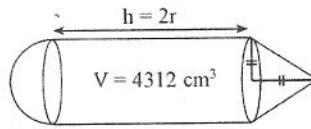
In the given figure the height of cylinder and slant height of cone is two times of the radius of the base. If the total surface area of solid object is  $1078 \text{ cm}^2$ , find the curved surface area.

(Ans:  $924 \text{ cm}^2$ )



10. सँगैको चित्रमा संयुक्त ठोस वस्तुमा वेलनाको उचाई अर्धव्यासको 2 गुणा र सोलीको उचाई र अर्धव्यास बराबर छ । यदि वस्तुको आयतन  $4312 \text{ cm}^3$  भए पुरा सतहको क्षेत्रफल पत्ता लगाउनुहोस् ।

In along side figure figure of combined solid, object, the height of cylinder is 2 times of radius and its radius is equal to the height of cone. If the volume of solid object is  $4312 \text{ cm}^3$ . Find the total surface area of the solid object. (Ans:  $1449.14 \text{ cm}^2$ )



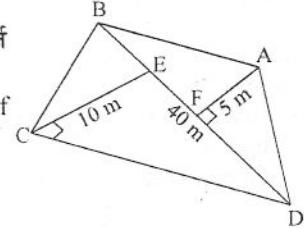
### 7.3 ज्यामितीय वस्तुहरू (Geometrical Bodies)

#### Long Questions

##### Model 1:

सँगै दिएको ज्यामितीय चित्र एउटा घरको आँगन छ । सो आँगन प्लास्टर गर्ने प्रतिवर्गमीटर  $\text{Rs } 300$  लाग्दछ । आँगन प्लास्टर गर्ने लाग्ने जम्मा खर्च निकाल्नुहोस् ।

The adjoining geometrical figure in the laws of the house the rate of plastering the lawn is  $\text{Rs } 300/\text{m}^2$  find the total cost of plastering the lawn.



##### Solution:

In the given figure lawn of the house.

$BD$  diagonal ( $d$ ) =  $40\text{m}$ , height of the diagonal ( $BD$ ) height ( $CE$ ) =  $h_1 = 10\text{m}$  and height ( $AE$ ) =  $h_2 = 5\text{m}$

$$\text{Area of quadrilateral (A)} = \frac{1}{2} d (h_1 + h_2) = \frac{1}{2} 40\text{m} (10\text{m} + 5\text{m}) = 20\text{m} \times 15\text{m} = 300\text{m}^2$$

Rate of plastering ( $R$ ) =  $\text{Rs } 300/\text{m}^2$

$$\text{Total cost of plastering (T)} = R \times A = \text{Rs } 300/\text{m}^2 \times 300\text{cm}^2 = \text{Rs } 90000$$

##### Model 2:

पेम्बाले छोरी डोल्माको विवाह भोजको लागि 150 जनालाई व्यवस्था गरेछन् । पेम्बाले उक्त कार्यका लागि उनले सोली आकारको टेन्टमा बन्ने व्यवस्था मिलाउछन् । टेन्टमा बस्ने प्रत्येक व्यक्तिको लागि 4 वर्ग मी. ठाउँ र सास फेर्न 20 घ.मी. हावा चाहिन्छ । सोली आकारको टेन्टको उचाई किति हुन्छ पत्ता लगाउनुहोस् ।

In a marriage ceremony of Pemba's daughter he has to make arrangements for accommodation of 150 persons for this purpose plans to build a conical in such a way that each person have  $4\text{m}^2$  of the space on the ground and  $20\text{m}^3$  of air to breathe, what should be the height of the tent ? Find it.

##### Solution:

Total number of person ( $N$ ) = 150

Area of each person =  $4\text{m}^2$

Area of conical ( $A$ ) =  $150 \times 4\text{cm}^2$

Area of base ( $A$ ) =  $\pi r^2$

$$\text{or, } 600\text{m}^2 = \frac{22}{7} \times r^2$$

$$\text{or, } 600\text{m}^2 \times 7 = 22r^2$$

$$\text{or, } r^2 = \frac{600\text{cm}^2 \times 7}{22}$$

$$\therefore r^2 = \frac{4200\text{m}^2}{22}$$

Volume of each man =  $20\text{m}^3$

$$\begin{aligned} \text{Total volume cubical Tent (V)} &= 150 \times 20\text{m}^3 \\ &= 3000 \text{m}^3 \end{aligned}$$

$$\therefore V = \frac{1}{3} \pi r^2 h$$

$$\text{or, } 3000 \text{ m}^3 = \frac{1}{3} \times \frac{22}{7} \times \frac{4200}{22} \text{ m}^2 \times h$$

$$\text{or, } 3000 \text{ m}^3 = 200 \text{ m}^2 \times h$$

$$\text{or, } h = \frac{3000 \text{ m}^3}{200 \text{ m}^2}$$

$$\therefore h = 15 \text{ m}$$

Height of conical tent (h) = 15m

**Model 3:**

एउटा वेलनाकार ट्याकी माथिको भाग अर्धगोलाकार छ उक्त ट्याकीको कुल उचाई 4.5m र आधारको परिधि 22m छ भने ट्याकीकी मा कति पानी अटाउँछ ? पत्ता लगाउनुहोस् ।

The upper part of a cylinder tank in hemispherical. If the height of the tank is 4.5m and circumference of base 22m how many liters of water, the tank can hold ?

**Solution:**

In the given figure total height (h) = 4.5m,  
circumference of base (C) = 22m

$$\therefore C = 2\pi r$$

$$a = 22 \text{ m} = 2 \times \frac{22}{7} \times r$$

$$\text{or, } 22 \times 7 \text{ m} = 2 \times 22 \times r$$

$$\therefore r = \frac{7 \text{ m}}{2} = 3.5 \text{ m}$$

$$\text{height of cylinder (h)}_1 = (4.5 \text{ m} - 3.5 \text{ m}) = 1.0 \text{ m}$$

$$\text{Volume of cylinder (V}_1) = \pi r^2 h_1 = \frac{22}{7} \times (3.5 \text{ m})^2 \times 1 \text{ m} = \frac{22 \times 12.25 \times 1}{7} \text{ m}^3 = \frac{269.5 \text{ m}^3}{7}$$

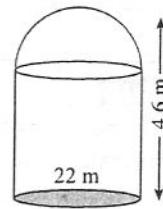
$$= 38.5 \text{ m}^3$$

$$\text{Volume of hemisphere (V}_2) = \frac{2}{3} \pi r^3 = \frac{2}{3} \times \frac{22}{7} \times (3.5 \text{ m})^3 = \frac{44 \times 42.875 \text{ m}^3}{21} = \frac{1886.5 \text{ m}^3}{21}$$

$$= 89.83 \text{ m}^3$$

$$\text{Total volume of tank (V)} = V_1 + V_2 = 38.5 \text{ m}^3 + 89.83 \text{ m}^3 = 128.3 \text{ m}^3$$

$$\text{Capacity of water in tank} = 1000 \times 128.33 = 128330 \text{ liter.}$$

**Model 4:**

2.8cm व्यास र 1.5mm मोटाई भएको केही सिक्काहरू एकमाथि अर्को राख्दा वेलनाकार बनाउँदा आयतन 18.48cm<sup>3</sup> हुन्छ भने यसका सिक्का संख्या पत्ता लगाउनुहोस् ।

A certain number of one rupees coin each of diameter 2.8cm and thickness 1.5mm are place one upon another to form cylinder of the volume 18.48cm<sup>3</sup> find the number of coins forming the cylinder.

**Solution:**

Here, diameter of each coin (d) = 2.8cm

$$\text{Radius (r)} = \frac{d}{2} = \frac{2.8 \text{ cm}}{2} = 1.4 \text{ cm}$$

$$\text{thickness of each coin (h)} = 1.5 \text{ mm} = \frac{1.5 \text{ cm}}{10} = 0.15 \text{ cm}$$

$$\text{Volume of each coin (V}_1) = \pi r^2 h = \frac{22}{7} (2.4 \text{ cm})^2 \times 0.15 = \frac{22 \times 1.96 \times 0.15 \text{ cm}^3}{7}$$

$$= \frac{6.468 \text{ cm}^3}{7} = 0.924 \text{ cm}^3$$

$$\text{New, volume of cylindrical coin (V)} = 18.48 \text{ cm}^3$$

$$\text{Number of coin (N)} = \frac{V}{V_1} = \frac{18.48\text{cm}^3}{0.924\text{cm}^3} = 20$$

The required number of coin = 20

#### **Model 5:**

एउटा सडक 5km लामो र 16m चौडा छ । दुवै क्षेत्रमा हिहनको लागि प्रत्येक  $\frac{1}{8}$  भाग बाटोको चौडाई छ । यदि फुटपाथ 30cm उचाइको छ भने प्रति घनमिटर रु 39 को दरले बाटो बनाउने खर्च निकाल्नुहोस् ।

A street is 5km long and 16m wide, there are two foot paths one and each side each covering  $\frac{1}{8}$  that of the street of the foot parts be raised 30cm, find the cost estimate at Rs 39m<sup>2</sup>.

#### **Solution:**

Here, length of street ( $l$ ) = 5km =  $5 \times 1000 = 5000\text{m}$

wide of pats ( $b$ ) = 16m

wide of foot path ( $w$ ) =  $\frac{1}{8}$  of 16 =  $\frac{1}{8} \times 16 = 2\text{m}$

height of foot path =  $\frac{30}{100} \text{ m} = \frac{3}{10} \text{ m}$

Now, volume of two foot path ( $V$ ) =  $2(5000\text{m} \times 2\text{m} \times \frac{3}{10} \text{ m})$

=  $2(1000 \times 2 \times \frac{3}{10}) \text{ cm}^3 = 6000\text{m}^3$

Rate of construct foot path ( $R$ ) = Rs 39m<sup>3</sup>

$T = V \times C$

$T = 6000\text{m}^3 \times \text{Rs } 39\text{m}^3 = \text{Rs } 23,4000$

Cost stimate of construct of foot path is Rs 2,34000

#### **Model 6:**

दिइएको अर्ध गोलाकार क्षेत्रहरूमा भएको ठोस वस्तुको पुरासतहको क्षेत्रफल कर्ति हुन्छ ? प्रति वर्ग से.मी. रु 10 का दरले चाँदी लेपन गर्न कर्ति खर्च लाग्छ ? पत्ता लगाउनुहोस् ।

Find the total surface area of given cylindrical and hemispherical object and what is cost of plating its surface with silver at the rate of Rs 10 per cm<sup>2</sup>.

#### **Solution:**

In the given figure of combined solid objects height of cylinder ( $h$ ) =

60cm, total height = 70cm

$$\text{Common radius (r)} = \frac{(70\text{cm} - 60\text{cm})}{2} = \frac{10\text{cm}}{2} = 5\text{cm}$$

$$\text{surface area of two hemisphere (CSA}_1\text{)} = 2(2\pi r^2) = 2(2 \times \frac{22}{7} \times (5\text{cm})^2)$$

$$= \frac{88 \times 25\text{cm}^2}{7} = 314.29\text{cm}^2$$

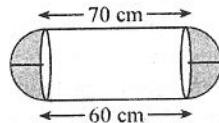
$$\text{curved surface area (CSA}_2\text{)} = 2\pi rh = 2 \times \frac{22}{7} \times 5\text{cm} \times 6\text{cm} = \frac{13200\text{cm}^2}{7} = 1885.71\text{cm}^2$$

$$\text{Surface area of solid object (CSA)} = \text{CSA}_1 + \text{CSA}_2 = 314.29\text{cm}^2 + 1885.71\text{cm}^2 = 2200\text{cm}^2$$

$$\text{Rate of painting by silver (R)} = \text{Rs } 10\text{cm}^2$$

$$\text{Total cost (T)} = R \times \text{CAS} = \text{Rs } 10 \times 2200 = \text{Rs } 22000$$

$$\text{Total cost of plating by silver is Rs } 22000.$$



**Model 7:**

6 फीट अग्लो सोली आकारको छानो भएको एउटा बेलनाकार टेन्ट छ । यदि आधारको व्यास 16फीट र पुरा उचाई 13 फीट भए प्रति वर्गफीट रु. 30 का दरले उक्त टेन्ट बनाउन लाग्ने वस्तुको खर्च कति पर्दछ ? पत्ता लगाउनुहोस्।

A cylindrical tent having a conical roof of height 6ft it is made. If the diameter is 16ft and the its total height is 13ft ,find the total cost of material to make this tent at the rate of Rs. 30.

**Solution:**

Here, in the given figure

Height of cone ( $h_2$ ) = 6ft.

Total height ( $h$ ) = 13ft.

height of cylinder ( $h_1$ ) = ( 13 - 6)ft. = 7ft.

diameter of base ( $d$ ) = 16ft.

Radius ( $r$ )  $\frac{d}{2} = \frac{16\text{ft}}{2} = 8\text{ft}$ .

From the Pythagoras therorem.

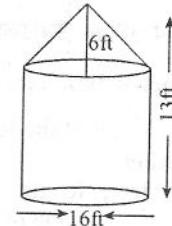
$$l^2 = h^2 + r^2$$

$$l = \sqrt{(h_2)^2 + r^2} = \sqrt{(6\text{ft})^2 + (8\text{ft})^2} = \sqrt{(36 + 64)\text{ft}^2} = \sqrt{100\text{ft}^2} = 10\text{ft.}$$

$$\begin{aligned} \text{CSA} &= \text{CSA}_1 + \text{CSA}_2 = 2\pi rh + \pi rl = 2 \times \frac{22}{7} \times 8 \times 7 \text{ ft}^2 + \frac{22}{7} \times 8 \times 10 \text{ ft}^2 \\ &= 352 \text{ ft}^2 + 251.43 \text{ ft}^2 = 603.43 \text{ ft}^2 \end{aligned}$$

Rate of tent = Rs. 30 ft

$$\text{cost of Tent} + \pi = \text{Rs. } 30 \times 603.43 = \text{Rs. } 18,102.90$$

**Model 8 :**

दिइएको संगोंको चित्रमा एउटा घरको गेटमा दुईवटा वर्गाकार आधार पीलरहरू र पिलरमाथि दुईवटा पीरामीडहरू राखिएको छ । 6 ft अग्लो पिलर माथि 1 ft अग्लो पीरामीड छ । उक्त पीलरमा प्रति वर्ग फीट रु 52 को दरले टायल लगाउन जम्मा कति खर्च लाग्छ पत्ता लगाउनुहोस् ।

In the adjoining given figure on the square based two poller and two pyramid on the piller of a house on the gate height of piller is 6ft and height of pymaid is 1 ft. Find the total cost of fitting tile at the rate of Rs 52 per square ft.

**Solution:**

Here, on the square based prism

Length of base ( $a$ ) = 1 ft and height of piller ( $h$ ) = 6ft

Surface area of piller ( $\text{CSA}_1$ ) =  $Ph$

$$= 4 \times 1 \text{ ft} \times 6 \text{ ft} = 24 \text{ ft}^2$$

In the square based pyramid height ( $h_1$ ) = 1 ft

$$l = \sqrt{h^2 + \left(\frac{a}{2}\right)^2} = \sqrt{(6\text{ft})^2 + \left(\frac{1}{2}\right)^2}$$

$$l = \sqrt{1 + 0.25} \text{ ft}^2 = \sqrt{1.25 \text{ ft}^2} = 1.12 \text{ ft}$$

$$\text{Surface area of pyramid CSA} = 2(a \times l) = 2(1\text{ft} \times 1.12\text{ft}) = 2.24 \text{ ft}^2$$

$$\text{Surface area of two piller (coff)} = 2(\text{CSA}_1) = 2(24 + 2.24) \text{ ft}^2 = 2 \times 26.24 \text{ ft}^2$$

$$l = 52.48 \text{ ft}^2$$

Now rate of Tile ( $R$ ) = Rs 52/ft<sup>2</sup>

$$\text{Total cost}(T) = R \times \text{CSA} = \text{Rs } 52/\text{ft}^2 \times 52.48 \text{ ft}^2 = \text{Rs } 2728.96$$

Total cost of tile fitting of two piller ( $T$ ) = Rs 2728.96

