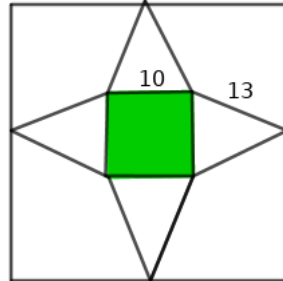


Session 92 | Solids 1 | Worksheet 92

- 1) The outline in a square cardboard for making a square pyramid as given below.

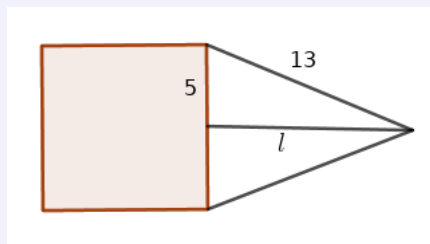


- What is the total length of its edges?
- What is the slant height of the square pyramid?
- What is length of the side of the square paper in which outline is drawn.

Answers

a) Total length of the edges = $4a + 4e = 4 \times 10 + 4 \times 13 = 40 + 52 = 92\text{cm}$

- b) see figure



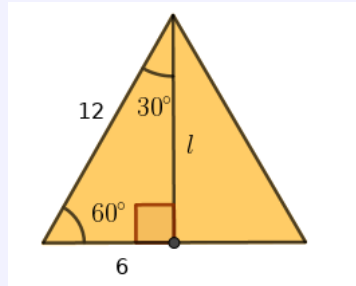
$$l = \sqrt{13^2 - 5^2} = 12\text{cm}$$

c) One side of the square paper = $a + 2l = 10 + 2 \times 12 = 34\text{cm}$

- 2) A wire of length 96cm is cut into eight equal parts . The ends of the pieces are joined to make the pyramid.
- What is the length of the edge of the pyramid?
 - What kind of triangle is its lateral edge?
 - What is its slant height?

Answers

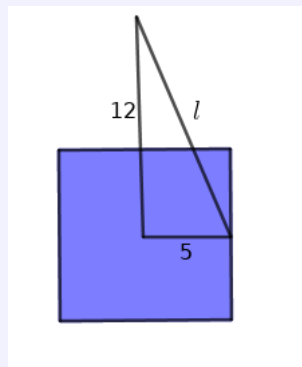
- a) Length of one edge = $\frac{96}{8} = 12\text{cm}$
- b) Lateral faces are equilateral triangles
- c) On drawing slant height on the lateral face we get $30^\circ - 60^\circ - 90^\circ$ right triangle .
 $l = 6\sqrt{3}\text{cm}$



- 3) The base perimeter of a square pyramid is 40 cm, height 12 cm.
- a) What is the base edge of the pyramid?
- b) what is the slant height of the pyramid?
- c) What is the lateral edge of the pyramid?

Answers

- a) Length of base edge = $\frac{40}{4} = 10\text{ cm}$
- b) $l = \sqrt{12^2 + 5^2} = 13\text{cm}$



- c) lateral edge e , slant height l , half of base edge form a right triangle
 $e = \sqrt{13^2 + 5^2} = \sqrt{194}\text{cm}$

- 4) There is a square pyramid having its lateral faces equilateral triangles.Length of one lateral edge is 32cm
- a) What is its base edge?
- b) What is its slant height?
- c) What is the area of one lateral face?
- d) Calculate the total area of its lateral faces

Answers

- All edges are equal .base edge and lateral edge are 32cm
- If l is the slant height and e is the lateral edge , $l, e, \frac{a}{2}$ form a $30^\circ - 60^\circ - 90^\circ$ triangle.
 $l = 16\sqrt{3}\text{cm}$
- One lateral face area $= \frac{1}{2} \times 32 \times 16\sqrt{3} = 256\sqrt{3}\text{sq.cm}$
- Total lateral face area $= 4 \times 256\sqrt{3} = 1024\sqrt{3}\text{sq.cm}$

5) The base diagonal of a square pyramid is 12cm , height 8cm

- What is its base edge?
- What is its base area?
- What is the length of its lateral edge?
- Calculate the total length of its edges.

Answers

- Two base edges and base diagonal form $45^\circ - 45^\circ - 90^\circ$ right triangle . $d = \sqrt{2}a$
 $a = \frac{d}{\sqrt{2}} = \frac{12}{\sqrt{2}} = 6\sqrt{2}\text{cm}$
- Base area $= (6\sqrt{2})^2 = 72\text{sq.cm}$
- Half of the base diagonal , height and lateral edge form a right triangle . $e = \sqrt{6^2 + 8^2} = \sqrt{100} = 10\text{cm}$
- Total length of the edges $= 4a + 4e = 4 \times 6\sqrt{2} + 4 \times 10 = 24\sqrt{2} + 40\text{cm}$

Session 93 | Solids 2 | Worksheet 93

- 1) Height of a square pyramid is 2 more than base edge . Slant height is 13 cm
- If the base edge is a then what is height?
 - Write the relation between slant height , base edge and height
 - Find the length of base edge?
 - Calculate lateral surface area .

Answers

- Height = $a + 2$
- $13^2 = \left(\frac{a}{2}\right)^2 + (a + 2)^2$
- $\frac{a^2}{4} + a^2 + 4a + 4 = 169, \frac{5a^2}{4} + 4a = 165, 5a^2 + 16a - 660 = 0, a = 10.$
Base edge $a = 10\text{cm}$
- Lateral surface area = $4 \times \text{Area of one lateral face} = 4 \times \frac{1}{2} \times 10 \times 13 = 260 \text{ sq.cm}$

- 2) Base area of a square pyramid is 400 sq.cm , lateral surface area 1040 sq.cm
- What is the length of base edge?
 - What is the slant height?
 - Find the height of the pyramid.
 - Calculate the total surface area of the pyramid.

Answers

- $a = \sqrt{400} = 20\text{cm}$
- $2al = 1040, 2 \times 20 \times l = 1040, l = \frac{1040}{40} = 26 \text{ cm}$
- $l^2 = h^2 + \left(\frac{a}{2}\right)^2 \rightarrow 26^2 = h^2 + 10^2, h^2 = 576, h = 24\text{cm}$
- Total surface area = $400 + 1040 = 1440 \text{ sq.cm}$

- 3) A sectoral sheet of central angle 240° is taken from a circular sheet of radius 10cm. Four equal triangles are made from the sector as in the figure.They are joined in such a way as to get a square pyramid.



- a) What is the length of its edge?
 b) What is the slant height of the pyramid ?
 c) Find the height of the pyramid.

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Answers

- a) All edges are equal. It is equal to radius .Length of one end = 10cm
 b) Lateral faces are equilateral triangles .Slant height = $5\sqrt{3}$ cm
 c) $l^2 = h^2 + (\frac{a}{2})^2$, $(5\sqrt{3})^2 = h^2 + 5^2$, $h^2 = 75 - 25 = 50$, $h = \sqrt{50} = 5\sqrt{2}$ cm

- 4) A steel wire of length 120cm is cut into 8 equal parts, the ends are joined in such a way as to get a square pyramid.
 a) What is the length of its edge?
 b) What is its slant height?
 c) Calculate the area of paper used to cover the pyramid.

Answers

- a) $a = \frac{120}{8} = 15$ cm
 b) $l = \frac{15}{2}\sqrt{3}$ cm
 c) Total surface area =Base area +4×area of one lateral face = $225 + 225\sqrt{3}$ sq.cm.

- 5) Base edge of a square pyramid is a and slant height l .
 a) Write a formula to find the lateral surface area of the pyramid.
 b) Is it possible to make a square pyramid having base area and lateral surface area equal.
 c) If the base edge is 10 and lateral surface area of a square pyramid is two times its base area. What is its height?

Answers

- a) Lateral face area = $4 \times$ area of one lateral face
 lareral face area = $4 \times \frac{1}{2} \times a \times l = 2al$
 b) $a^2 = 2al \rightarrow a = 2l$, $l = \frac{a}{2}$, $h = \sqrt{l^2 - (\frac{a}{2})^2} = \sqrt{l^2 - l^2} = 0$
 Height becomes zero . Pyramid cannot be made .
 c) $2al = 2a^2$, $a = l$
 $l^2 = h^2 + \frac{a^2}{4}$, $a = 10$, $h = 5\sqrt{3}$ cm

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Session 94 | Solids 3 | Worksheet 94

- 1) There is a square pyramid of height 12cm , slant height 13cm.
- What is the length of its base edge ?
 - What is the base area of the pyramid ?
 - Find the lateral face area of the pyramid.
 - Calculate the total surface area of the pyramid.

Answers

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

$$13^2 = 12^2 + \frac{a^2}{4}$$

$$\frac{a^2}{4} = 13^2 - 12^2 = 25, a^2 = 100, a = \sqrt{100} = 10\text{cm}$$
- Base area = 100sq.cm
- Lateral surface area = $2al = 2 \times 10 \times 13 = 260$ sq.cm
- Total surface area = $100 + 260 = 360$ sq.cm

- 2) Height of the square pyramid is h , slant height l and lateral edge e .
- If the base edge is a , write the relations between h, l and e
 - Prove that h^2, l^2, e^2 are in an arithmetic sequence
 - If the slant height is 13 , base edge 10 find height and lateral edge

Answers

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

$$e^2 = l^2 + \left(\frac{a}{2}\right)^2$$
- $$l^2 = h^2 + \left(\frac{a}{2}\right)^2, e^2 = l^2 + \left(\frac{a}{2}\right)^2 \rightarrow h^2 + 2 \times \left(\frac{a}{2}\right)^2.$$

$$h^2, l^2, e^2 \text{ are in arithmetic sequence. } d = \left(\frac{a}{2}\right)^2$$
- $a = 10, l = 13.$
 h^2, l^2, e^2 are in arithmetic sequence .
 $13^2 - h^2 = \frac{10^2}{4}, h^2 = 169 - 25 = 144, h = \sqrt{144} = 12\text{cm}$
 $e^2 - l^2 = \frac{a^2}{4}, e^2 - 13^2 = 25, e^2 = 169 + 25 = 194, e = \sqrt{194} \text{ cm}$

- 3) Base perimeter of a square pyramid is 40cm, total length of the edges is 92cm
- What is the length of base edge?
 - What is base diagonal?
 - Find the height of the pyramid
 - Calculate the total surface area.

Answers

- a) Base edge $a = \frac{40}{4} = 10\text{cm}$
- b) $d = \sqrt{2}a = \sqrt{2} \times 10 = 10\sqrt{2}\text{cm}$
- c) $4a + 4e = 92, 40 + 4e = 92, e = 13\text{cm}$
 $e^2 = h^2 + \left(\frac{d}{2}\right)^2$
 $13^2 = h^2 + \left(\frac{10\sqrt{2}}{2}\right)^2, 169 = h^2 + 50, h^2 = 169 - 50, h^2 = 119, h = \sqrt{119}$
- d) $l = \sqrt{e^2 - \frac{a^2}{2}} = \sqrt{13^2 - 25} = \sqrt{144} = 12$. Total surface area = $a^2 + 2al = 100 + 2 \times 10 \times 12 = 340\text{sq.cm}$

4) Base perimeter of a square pyramid is 40cm , height 12cm

- a) What is the length of base edge ?
- b) Find the volume of the pyramid.
- c) What is the volume of the square prism having same base area and height ?

Answers

- a) $a = 10\text{cm}$
- b) Volume of square pyramid = $\frac{1}{3} \times \text{Base area} \times \text{height}$
Volume = $\frac{1}{3} \times 10^2 \times 12 = 400\text{cubic cm}$
- c) . Volume = $3 \times 400 = 1200\text{cubic cm}$

5) Ratio of the base edges of two square pyramids is 1 : 2. Heights are in the ratio 2 : 3

- a) If the base edge of the first pyramid is a then what is the ratio of their base area?
- b) If the height of the first pyramid is h then what is the height of second pyramid?
- c) What is the ratio of the volume ?
- d) If the volume of the first pyramid is 10 cubic cm then what is the volume of the second pyramid?

Answers

- a) If base edges are $a, 2a$ then base area are $a^2; (2a)^2$.Ratio of base area $\rightarrow a^2 : 4a^2 = 1 : 4$
- b) If height of first is h , height of second is $\frac{3h}{2}$
- c) Base edges $a, 2a$, heights $2h, 3h$.
Ratio of volume $\rightarrow \frac{1}{3} \times a^2 \times 2h : \frac{1}{3} \times (2a)^2 \times 3h$
 $V_1 : V_2 = 1 : 6$
- d) $V_2 = 6 \times V_1 = 60\text{ cubic cm}$

Session 95 | Solids 5 | Worksheet 95

- 1) A sectoral sheet of central angle 120° is cut off from a circular sheet of radius 12cm . It is rolled in such a way as to get a cone.
- What is the slant height of the cone?
 - What is the radius of the cone ?
 - Find the curved surface area of the cone.

Answers

- Slant height $l = 12\text{cm}$
- $lx = 360r$
 $12 \times 120 = 360 \times r, r = 4\text{ cm}$
- Lateral surface area $= \pi rl = \pi \times 4 \times 12 = 48\pi\text{sq.cm}$

- 2) A cone is made by rolling a semicircular metal sheet of radius 10cm
- What is the slant height of the cone.
 - What is the radius of the cone.
 - Find the curved surface area of the cone.
 - Base is made by a suitable circular sheet. What is its total surface area ?

Answers

- slant height $l = 10\text{cm}$
- $lx = 360r$
 $10 \times 180 = 360 \times r, r = 5\text{cm}$
- Lateral surface area $= \pi rl = \pi \times 5 \times 10 = 50\pi\text{sq.cm}$
- Total surface area = Lateral surface area + base face $= 50\pi + 25\pi = 75\pi\text{sq.cm}$

- 3) A circular sheet of card board of radius 12cm .It is cut off into two sectors of central angle 120° and 240° .Both of them are rolled into cones.
- Name the measure common to both cones
 - What is the radius of small cone ?
 - What is the radius of the big cone.
 - How radii of the cones are related to the radius of the circular sheet.

Answers

- a) slant height = 12 cm
- b) $lx = 360r_1 \rightarrow 12 \times 120 = 360 \times r_1$
 $r_1 = \frac{12 \times 120}{360} = 4 \text{ cm}$
- c) $lx = 360r_2 \rightarrow 12 \times 240 = 360 \times r_2$
 $r_2 = \frac{12 \times 240}{360} = 8 \text{ cm}$
- d) $r_1 + r_2 = 12$. Sum of the base radii of cones is equal to the radius of the circular sheet

4) A sector of central angle 90° is cut off from a circular sheet of radius 16 cm. It is rolled in such a way as to get a cone.

- a) What is the lateral surface area of the cone?
- b) What is the radius of the cone?
- c) The remaining part of the circular sheet is also rolled to get a cone. What is its base radius?
- d) Which cone has more height? Explain

Answers

- a) Area of sector is $\frac{1}{4}$ of the area of circular sheet.
Area of the sector = $\frac{1}{4} \times \pi \times 16^2 = 64\pi \text{ sq. cm}$
- b) $lx = 360r \rightarrow 16 \times 90 = 360 \times r$
 $r = \frac{16 \times 90}{360} = 4 \text{ cm}$
- c) $lx = 360r \rightarrow 16 \times 270 = 360 \times r$
 $r = \frac{16 \times 270}{360} = 12 \text{ cm}$
- d) Radius, height and slant height form a right triangle. Slant height of both pyramids are equal. It is equal to the hypotenuse of the triangle. Whenever the hypotenuse remains same, length of one perpendicular side increases according to the decrease of other side. Cone made from the sector of central angle has less height.

5) A cone is made by a sectoral sheet taken from a circular sheet. The slant height of the cone is two times its radius.

- a) What is the relation between lateral surface area and base area?
- b) If the base perimeter is $20\pi \text{ cm}$ then what will be its lateral surface area?
- c) What is the central angle of this sector?
- d) The remaining part is also rolled to get a cone. What is the ratio of the heights of cones so formed

Answers

- a) $l = 2r \rightarrow$ lateral surface area = $\pi r l = \pi \times r \times 2r = 2\pi r^2 = 2 \times \text{base area}$
- b) $2\pi r = 20\pi \rightarrow r = 10 \text{ cm}$
 $l = 20 \text{ cm}$. Lateral surface area $\pi \times 10 \times 20 = 200\pi \text{ sq. cm}$
- c) $lx = 360r \rightarrow 2r \times x = 360 \times r$
 $x = 180^\circ$
- d) This is a semicircle. Remaining part is also a semicircle. Ratio of the heights is 1 : 1

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Session 96 | Solids 5 | Worksheet 96

- 1) Establish the relation between angle of the sector, radius of the sector (slant height of the cone) and radius of the cone.

Answers

- ★ Consider a sectoral sheet of central angle x and radius l . The arc length of the sector is $\frac{2\pi l}{360} \times x$
- ★ When the sheet is rolled into a cone the arc length becomes base perimeter of the cone. We can write the equation as follows
- ★ $\frac{2\pi l}{360} \times x = 2\pi r$
Simplifying $lx = 360r$. Here l is the slant height of the cone, r is the radius of the cone .

- 2) Derive the formula to calculate the curved surface area (lateral surface area) of the cone
- 3) A sectoral sheet of central angle 120° is cut off from a circular sheet of radius 12cm . It is rolled in such a way as to get a cone.
- What is the slant height of the cone?
 - What is the radius of the cone ?
 - Find the curved surface area of the cone.

Answers

- Slant height $l = 12\text{cm}$
- $lx = 360r$
 $12 \times 120 = 360 \times r, r = 4 \text{ cm}$
- Lateral surface area $= \pi r l = \pi \times 4 \times 12 = 48\pi \text{sq.cm}$

- 4) A cone is made by rolling a semicircular metal sheet of radius 10cm
- What is the slant height of the cone.
 - What is the radius of the cone.
 - Find the curved surface area of the cone.
 - Base is made by a suitable circular sheet. What is its total surface area ?

Answers

- slant height $l = 10\text{cm}$
- $lx = 360r$
 $10 \times 180 = 360 \times r, r = 5\text{cm}$
- Lateral surface area $= \pi r l = \pi \times 5 \times 10 = 50\pi \text{sq.cm}$
- Total surface area $= \text{Lateral surface area} + \text{base face} = 50\pi + 25\pi = 75\pi \text{sq.cm}$

- 5) A circular sheet of card board of radius 12cm .It is cut off into two sectors of central angle 120° and 240° .Both of them are rolled into cones.
- Name the measure common to both comes
 - What is the radius of small cone ?
 - What is the radius of the big cone.
 - How radii of the cones are related to the radius of the circular sheet.

Answers

- slant height= 12 cm
- $lx = 360r_1 \rightarrow 12 \times 120 = 360 \times r_1$
 $r_1 = \frac{12 \times 120}{360} = 4\text{cm}$
- $lx = 360r_2 \rightarrow 12 \times 240 = 360 \times r_2$
 $r_2 = \frac{12 \times 240}{360} = 8\text{cm}$
- $r_1 + r_2 = 12$.Sum of the base radii of cones is equal to the radius of the circular sheet

- 6) A sector of central angle 90° is cut off from a circular sheet of radius 16cm .It is rolled in such a way as to get a cone.
- What is the lateral surface are of the cone?
 - What is the radius of the cone?
 - The remaining part of the circular sheet is also rolled to get a cone . What is its base radius?
 - Which cone has more height ? Explain

Answers

- Area of sector is $\frac{1}{4}$ of the area of circular sheet.
Area of the sector= $\frac{1}{4} \times \pi \times 16^2 = 64\pi\text{sq.cm}$
- $lx = 360r \rightarrow 16 \times 90 = 360 \times r$
 $r = \frac{16 \times 90}{360} = 4\text{cm}$
- $lx = 360r \rightarrow 16 \times 270 = 360 \times r$
 $r = \frac{16 \times 270}{360} = 12\text{cm}$
- Radius , height and slant height form a right triangle.Slant height of both pyramids are equal.It is equal to the hypotenuse of the triangle.Whenever the hypotenuse remains same , length of one perpendicular side increases according to the decrease of other side. Cone made from the sector of large central angle has less height.

- 7) A cone is made by a sectoral sheet taken from a circular sheet.The slant height of the cone is two times its radius.
- What is the relation between lateral surface area and base area?
 - If the base perimetre is $20\pi\text{cm}$ then what will be its lateral surface area ?
 - What is the central angle of this sector?

d) The remaining part is also rolled to get a cone. What is the ratio of the heights of cones so formed

Answers

a) $l = 2r \rightarrow$ lateral surface area $= \pi r l = \pi \times r \times 2r = 2\pi r^2 = 2 \times$ base area

b) $2\pi r = 20\pi \rightarrow r = 10\text{cm}$

$l = 20\text{cm}$.Lateral surface area $\pi \times 10 \times 20 = 200\pi\text{sq.cm}$

c) $lx = 360r \rightarrow 2r \times x = 360 \times r$

$x = 180^\circ$

d) This is a semicircle. Remaining part is also a semicircle. Ratio of the height is 1 : 1

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Session 97 | Solids 6 | Worksheet 97

- 1) A cone of radius r_1 is made by using a sector of a circular sheet of radius R . The remaining part of the sheet is rolled in such a way as to get another cone of radius r_2
- Which measure is common in both cones?
 - Write the relation between the radius, slant height and central angle of the sector in the case of first cone.
 - Write the relation between the radius, slant height and central angle of the sector in the case of second cone.
 - prove that $R = r_1 + r_2$

Answers

- Common measure is slant height. Slant height of both cones is R
- If the central angle of the sector for first cone is x then $Rx = 360r_1$
- The central angle of the sector for second cone is $360 - x$ and $R(360 - x) = 360r_2$
- Adding these equations, $Rx + R(360 - x) = 360r_1 + 360r_2 \rightarrow R = r_1 + r_2$

- 2) A cone is made by taking a sector from a circular sheet. The slant height of the cone is 25cm and its radius 110cm
- What is the radius of the circular sheet?
 - What is the central angle of the sector?
 - What is the central angle of the remaining part?
 - What is the radius of the cone made by rolling the remaining part?

Answers

- 25cm
- $lx = 360r \rightarrow 25 \times x = 360 \times 10, x = \frac{360 \times 10}{25} = 144^\circ$
- Central angle of sector = $360 - 144 = 216^\circ$
- Radius of the cone $25 - 10 = 15\text{cm}$

- 3) The base perimeter of a cone is 20π cm, slant height 18cm . It is rolled to get a cone.
- What is the radius of the sector?
 - What is the radius of the cone?
 - What is the central angle of the sector?
 - Find the lateral surface (Curved surface area) area of the cone?

Answers

- a) 18cm
- b) $2\pi r = 20\pi, r = 10\text{cm}$
- c) $lx = 360r \rightarrow 18 \times x = 360 \times 10, x = \frac{360 \times 10}{18} = 200^\circ$
- d) Curved surface area $\pi rl = 180\pi \text{sq.cm}$

4) A sector of central angle 288° and radius 25cm is taken from a circular sheet .

- a) What is the radius of the cone?
- b) What is the height of the cone ?
- c) Find the lateral surface area of the cone?
- d) What is the radius of the cone made by rolling the remaining part?

Answers

- a) $lx = 360r \rightarrow 288 \times 25 = 360 \times r, r = \frac{288 \times 25}{360} = 20 \text{ cm}$
- b) $l^2 = h^2 + r^2, 25^2 = h^2 + 20^2 \rightarrow h^2 = 625 - 400 = 225, h = \sqrt{225} = 15\text{cm}$
- c) Lateral surface area $\pi rl = \pi \times 20 \times 25 = 500\pi \text{ sq.cm}$
- d) Radius of the remaining part $25 - 20 = 5\text{cm}$

5) A cone of maximum size is carved from a square prism of base edge 10cm and height 12cm.

- a) What is the radius of the cone?
- b) What is the slant height of the cone?
- c) What is the lateral surface area of the cone?
- d) Find the total surface area of the cone?

Answers

- a) 5cm
- b) $h = 12\text{cm}, r = 5\text{cm}$
 $l = \sqrt{5^2 + 12^2} = 13 \text{ cm}$
- c) Lateral surface area $= \pi rl = 65\pi \text{sq.cm}$
- d) Total surface area = Base area + Lateral surface area
 $= 25\pi + 65\pi = 90\pi \text{sq.cm}$

Session 98 | Solids 7 | Worksheet 98

- 1) Radius of a cone is 5cm, height 12cm
- what is the slant height of the cone?
 - What is the total surface area of the cone?
 - What is the volume of the cone ?
 - In a cone , radius and height are equal. If the volume and curved surface area are equal then what is its radius ? What is its slant height?

Answers

- a) $l^2 = r^2 + h^2 \rightarrow l = \sqrt{r^2 + h^2} = \sqrt{5^2 + 12^2} = \sqrt{169} = 13\text{cm}$
- b) Total surface area $\pi r^2 + \pi r l = \pi \times 5^2 + \pi \times 5 \times 13 = 25\pi + 65\pi = 90\pi$
- c) Volume $= \frac{1}{3}\pi r^2 h = \frac{1}{3}\pi \times 5^2 \times 12 = 100\pi\text{cubic cm}$
- d) If $r = h$ then slant height $l = \sqrt{2}r$.Volume $= \frac{1}{3} \times \pi \times r^2 \times r = \frac{1}{3}\pi \times r^3$
 Total surface area of the cone $= \pi \times r \times \sqrt{2}r$.
 $\frac{1}{3}\pi r^3 = \pi r \times \sqrt{2}r \rightarrow r = 3\sqrt{2}\text{cm}$
 slant height $= \sqrt{2} \times 3\sqrt{2} = 6\text{cm}$

- 2) The base perimeter of a cone is $30\pi\text{cm}$, height 20 cm
- What is the radius and slant height of the cone ?
 - What is the total surface area?
 - Find the volume of the cone?
 - What is the volume of a cylindrical vessel of radius and height equal to that of the cone.

Answers

- a) $2\pi r = 30\pi, r = 15\text{cm}$
 slant height $l = \sqrt{r^2 + h^2} = \sqrt{15^2 + 20^2} = \sqrt{625} = 25\text{cm}$
- b) Total surface area $\pi r^2 + \pi r l = 225\pi + 375\pi = 600\pi\text{sq.cm}$
- c) Volume $= \frac{1}{3}\pi r^2 \times h = \frac{1}{3} \times \pi \times 15^2 \times 20 = 1500\pi\text{cubic cm}$
- d) Volume becomes 3 times .Volume $= 4500\pi\text{cubic cm}$

- 3) Diametre and height of a cone are equal.
- What is the relation between radius and slant height?
 - What is the ratio of radius , height and slant height?
 - If the radius is 6 cm then what is its volume?
 - If the radius is 6 cm then what is the total surface area ?

Answers

- a) $h = 2r, l = \sqrt{r^2 + (2r)^2} = \sqrt{5r^2} = \sqrt{5}r$
- b) $r : h : l = r : 2r : \sqrt{5}r$
 $r : h : l = 1 : 2 : \sqrt{5}$
- c) If radius is 6cm then height 10cm .Volume = $\frac{1}{3}\pi \times 6^2 \times 10 = 360\pi$ cubic cm
- d) If radius is 6cm then $l = \sqrt{5} \times 6 = 6\sqrt{5}$ cm.
Total surface area = $\pi \times 6^2 + \pi \times 6 \times 6\sqrt{5} = 36 + 36\sqrt{6}$
 $= 36(1 + \sqrt{6})$ sq.cm

4) Radius of a cone is r and height h .

- a) What will be the change in volume if radius and height are doubled?
- b) What will be the change in volume if radius is doubled and height is halved?
- c) How many solid cones can be made by melting a solid cone of radius 10cm and height 6cm with half the radius and height of the melted cone?

Answers

- a) $V = \frac{1}{3}\pi r^2 h$.
radius $2r$, height $2h$ Volume = $\frac{1}{3}\pi(2r)^2 \times (2h) = 8 \times \frac{1}{3}\pi r^2 h = 8V$
Volume becomes 8times
- b) If radius is $2r$ and height $\frac{h}{2}$ then
volume $\frac{1}{3}\pi \times (2r)^2 \times \frac{h}{2} = 2 \times \frac{1}{3}\pi r^2 h = 2V$
Volume becomes 2 times .
- c) When radius and height become halved then volume become $\frac{1}{8}$ part . 8 cones can be made.

5) A conical measuring vessel is made by rolling a sectoral sheet of central angle 288° and radius 10cm.

- a) What is the radius of the vessel?
- b) What is the height of the vessel?
- c) What is the capacity of the vessel in litres ?

Answers

- a) $lx = 360r \rightarrow 10 \times 288 = 360 \times r$
 $r = \frac{10 \times 288}{360} = 8$ cm
- b) $h = \sqrt{l^2 - r^2} = \sqrt{10^2 - 8^2} = 6$ cm
- c) Volume = $\frac{1}{3}\pi \times r^2 \times h = \frac{1}{3} \times \pi \times 8^2 \times 6 = 128\pi$ cubic cm
1000cubic cm = 1litre
Volume = $\frac{128 \times 3.14}{1000} = 0.4$ litre

Session 98 | Solids 8 | Worksheet 98

- 1) Radius of a cone is 21cm , height 28cm.
- Calculate slant height.
 - Find the lateral surface area .
 - Calculate the total surface area
 - Calculate the volume of the cone..

Answers

- $l^2 = r^2 + h^2, l^2 = 21^2 + 28^2 = 1225, l = \sqrt{1225} = 35 \text{ cm}$
- Lateral surface area $= \pi r l = \pi \times 21 \times 35 = 735\pi \text{ sq.cm}$
- Total surface area $= \pi r^2 + \pi r l = \pi \times 21^2 + \pi \times 21 \times 35 = 441\pi + 735\pi = 1176\pi \text{ sq.cm}$
- Volume $= \frac{1}{3}\pi r^2 h = \frac{1}{3} \times \pi \times 21^2 \times 28 = 4116\pi \text{ cubic cm}$

- 2) Ratio of radius and height of a cone are 3 : 4. Volume of the cone is 301.44 cubic cm
- Find the radius of the cone.
 - Find the height of the cone.
 - Calculate the slant height of the cone.
 - Calculate the lateral surface area of the cone.

Answers

- $r : h = 3 : 4, r = 3x, h = 4x$
 $\frac{1}{3} \times \pi r^2 h = 301.44, \frac{1}{3} \times 3.14 \times (3x)^2 \times (4x) = 301.44$
 $x^3 = \frac{301.44 \times 3 \times 7}{22 \times 9 \times 4} = 8$
 $x = 2, r = 3x = 6 \text{ cm}$
- Height $h = 4x = 8 \text{ cm}$
- $l = \sqrt{r^2 + h^2} = \sqrt{100} = 10 \text{ cm}$
- Lateral surface area $= \pi \times r \times l = 60\pi \text{ sq.cm}$

3) Lateral surface area of a cone is 4070 sq.cm , diametre 70 cm

2

- Find the slant height of the cone .
- Find the height of the cone?
- Calcualte the volume of the cone.

Answers

- $\pi r l = 4070, \frac{22}{7} \times 35 \times l = 4070, l = \frac{4070 \times 35}{22 \times 5} = 37 \text{ cm}$
- $h = \sqrt{l^2 - r^2} = \sqrt{37^2 - 35^2} = \sqrt{144}, h = 12 \text{ cm}$
- Volume = $\frac{1}{3} \times \pi \times r^2 \times h = \frac{1}{3} \times \pi \times 35^2 \times 12 = 4900\pi \text{ cubic cm}$

4) The height of a cone is 24cm , its lateral surface area 550 sq.cm

- What is the radius of the cone?
- Find the height of the cone?
- Calcualte the volume of the cone?

Answers

- $\pi r l = 550, \frac{22}{7} \times r l = 550, r l = 175.$
 $r^2 l^2 = 175^2, r^2 (r^2 + h^2) = 175^2$
If $r^2 = x$ then, $x(x + 24^2) = 175^2$
 $x^2 + 576x = 30625, x^2 + 576x - 30625 = 0$
 $x = 49 \rightarrow r^2 = 49, r = 7$
- $r l = 175, l = \frac{175}{7} = 25 \text{ cm}$
- Volume = $\frac{1}{3} \pi r^2 h = \frac{1}{3} \times \pi \times 7^2 \times 24 = 49 \times 8 \times \pi = 392\pi \text{ cubic cm}$

5) A semicircular sheet of radius 28cm is rolled in such a way as to get a cone.

- What is the slant height of the cone?
- Find the radius of the cone?
- Find the height of the cone?
- Calcualte the volume of the cone

Answers

- Slant height = 14cm
- $l x = 360r \rightarrow 14 \times 180 = 360 \times r, r = \frac{14 \times 180}{360} = 7 \text{ cm}$
- $h = \sqrt{l^2 - r^2} = \sqrt{14^2 - 7^2} = 12.12. h = \sqrt{147} = 12.12 \text{ cm}$
- Volume = $\frac{1}{3} \pi r^2 h = \frac{1}{3} \times \pi \times 7^2 \times 12.12 = 621.6 \text{ cubic cm}$

1

Session 100 | Solids 9 | Worksheet 100

- 1) Calculate the following measures of sphere with radius 3cm
 - a) Find the total surface area of the sphere.
 - b) Calculate the volume of the sphere
 - c) Calculate the curved surface area of the hemisphere taken from this sphere .
 - d) If it is solid sphere find the total surface area of the hemisphere.

Answers

- a) Total surface area $4\pi r^2 = 4\pi \times 3^2 = 36\pi \text{sq.cm}$
- b) Volume = $\frac{4}{3}\pi r^3 = \frac{4}{3} \times \pi \times 3^3 = 36\pi \text{cm}$
- c) Curved surface area of the hemisphere = $18\pi \text{sq.cm}$
- d) $4\pi r^2 = 36\pi, \pi r^2 = 9\pi$
Total surface area of the hemisphere $3\pi r^2 = 27\pi \text{sq.cm}$

- 2) Volume and surface area of a sphere are equal in number.
 - a) What is its radius
 - b) Calculate the volume or total surface area
 - c) How many spheres of radius 1cm can be made by melting this solid sphere ?

Answers

- a) $4\pi r^2 = \frac{4}{3}\pi r^3 \rightarrow 3r^2 = r^3, r = 3$
- b) Volume = $\frac{4}{3}\pi 3^3 = 36\pi$, Total surface area = $36\pi \text{sq.cm}$
- c) Volume of melted sphere = $\frac{4}{3}\pi \times 3^3$
Volume of the small sphere = $\frac{4}{3}\pi \times 1^3$
Number of spheres = $\frac{\frac{4}{3}\pi \times 3^3}{\frac{4}{3}\pi \times 1^3} = 27$

- 3) Find the volume of the sphere accoring the changes of radius as given below
 - a) What will be the change in volume if radius is doubled?
 - b) What will be the change in volume if radius is halved?
 - c) The volume of a sphere is 10 cubic cm. What will be the volume of the sphere of diametre two times the first one.

Answers

- a) Initial radius r , Initial volume V
 $V = \frac{4}{3}\pi r^3$.
When radius is doubled volume = $\frac{4}{3}\pi (2r)^3 = 2^3 \times \frac{4}{3}\pi r^3 = 8V$
Volume becomes 8 times
- b) When radius becomes $\frac{r}{2}$, volume = $\frac{4}{3} \times \pi \times (\frac{r}{2})^3 = \frac{1}{8} \times V$.
becomes $\frac{1}{8}$ part
- c) When diametre doubles , radius becomes two times . Volume = 80cubic cm

4) A sphere of maximum side is carved from a wooden cube of side 6cm

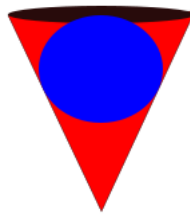
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- What is the radius of the sphere?
- Calculate the surface area of the sphere.
- calculate the volume of the sphere .

Answers

- Side of the cube and diameter of the sphere are equal . $r = 3$
- Total surface area $4\pi r^2 = 4 \times \pi \times 3^2 = 36\pi$ sq.cm
- Volume = 36π cubic cm

5) A sphere is fixed inside a conical vessel of diametre 10cm and height 12cm. It touches the curved surface of the cone and its base.



- What is the slant height of the cone ?
- Find the radius of the sphere?
- Calculate the volume of the sphere ?
- What fraction of the inner volume of the cone is occupied by the sphere?

Answers

- $l = \sqrt{h^2 + r^2} = \sqrt{12^2 + 5^2} = 13$ cm
- When the solid is divided by two equal parts along the diameter we can see a triangle and its incircle.
Perimeter of the triangle $13 + 13 + 10 = 36$ cm
 $s = 18$. Area of triangle $= \frac{1}{2} \times 10 \times 12 = 60$ sq.cm
 $r = \frac{A}{s} = \frac{60}{18} = \frac{10}{3}$ cm
- Volume of sphere $= \frac{4}{3} \times \pi \times \left(\frac{10}{3}\right)^3 = \frac{4000\pi}{81}$ cubic cm
- Volume of cone $\frac{1}{3}\pi \times 5^2 \times 12 = 100\pi$.
 $\frac{4000\pi}{81} \div 100\pi = \frac{40}{81}$ part .

1

Session 101 | Solids 10 | Worksheet 100

- 1) There is a sphere of radius 1 cm. It is melted and recast into small spheres of radius $\frac{1}{2}$ cm.
- What part of the volume of the melted sphere is the volume of the small sphere?
 - What part of the surface area of the melted sphere is the surface area of the small sphere?
 - How many spheres of radius $\frac{1}{2}$ can be made?
 - What is the difference between the surface area of big sphere and sum of the surface area of small spheres.

Answers

- Volume of the sphere of radius 1 cm is $\frac{4}{3}\pi \times 1^3 = \frac{4}{3}\pi$
 Volume of the sphere of radius $\frac{1}{2}$ is $\frac{4}{3}\pi \times \left(\frac{1}{2}\right)^3 = \frac{1}{8} \times \frac{4}{3}\pi$
 $\frac{1}{8}$ part of the volume of big sphere is the volume of a small sphere.
- Surface area of the sphere of radius 1 cm is 4π .
 Surface area of the sphere of radius $\frac{1}{2}$ is $4\pi \times \left(\frac{1}{2}\right)^2 = \frac{1}{4} \times 4\pi$
 Surface area of a small sphere is $\frac{1}{4}$ of the surface area of big sphere.
- 8 spheres
- total surface area of 8 small spheres is $8 \times \frac{1}{4} \times 4\pi = 2 \times 4\pi$.
 The difference of the surface area of big sphere and all small spheres is $4\pi - 2 \times 4\pi = -4\pi$

- 2) Total surface area of a solid sphere is 64π sq.cm
- What is the radius of the sphere?
 - What is the volume of the sphere?
 - The sphere is split up into two hemispheres. What is the total surface area of a hemisphere?

Answers

- $4\pi r^2 = 64\pi, r^2 = 16, r = 4$ cm
- Volume of the sphere = $\frac{4}{3}\pi r^3 = \frac{4}{3}\pi \times 4^3 = \frac{256\pi}{3}$ cubic cm
- Total surface area of the hemisphere = $3\pi r^2 = 3\pi \times 4^2 = 48\pi$ sq.cm

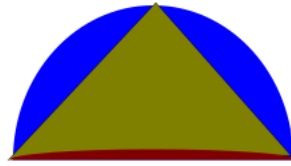
- 3) Total surface area of a solid hemisphere is 27π sq.cm
- What is the radius of the hemisphere?
 - What is the curved surface area of this hemisphere?
 - What is the total surface area of the sphere made by joining two such hemispheres?

Answers

- $3\pi r^2 = 27\pi \rightarrow r^2 = 9, r = 3$ cm
- Curved surface area of the hemisphere = $2\pi r^2 = 18\pi$ sq.cm
- When two hemispheres are joined in their circular faces it makes a sphere of surface area 36π sq.cm

4) A cone of maximum size is carved from a hemisphere of radius 10cm

2

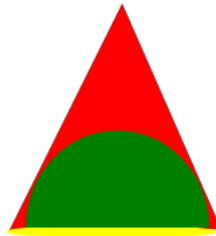


- What is the height of the cone?
- What is the slant height of the cone?
- Find the total surface area of the cone?
- Find the volume of the cone?
- What part of the volume of the hemisphere is the volume of the cone?

Answers

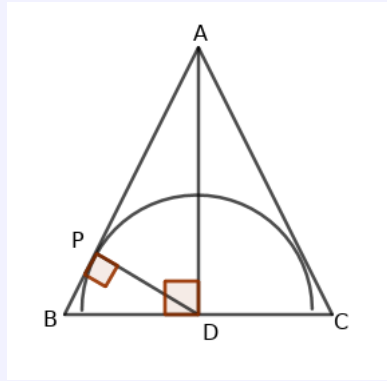
- $h = 10\text{cm}$
- $l = \sqrt{2} \times r = 10\sqrt{2}\text{cm}$
- Total surface area $= \pi r^2 + \pi r l = \pi \times 10^2 + \pi \times 10 \times 10\sqrt{2} = 100\pi(1 + \sqrt{2})\text{sq.cm}$
- Volume of the cone $= \frac{1}{3}\pi \times 10^2 \times 10 = \frac{1000}{3}\pi\text{cubic cm}$
- Volume of the hemisphere is $\frac{2}{3}\pi r^3$. Volume of the cone is $\frac{1}{3}\pi r^3$. Since $h = r$
The volume of the cone is $\frac{1}{2}$ the volume of the sphere.

5) A hemisphere is carved from a solid cone of radius 15cm and height 20 cm.



- What is the slant height of the cone?
- What is the radius of the hemisphere ?
- Calculate the surface area of the hemisphere
- Calculate the volume of the hemisphere

Answers



- a) $AB = \sqrt{20^2 + 15^2} = \sqrt{625} = 25\text{cm}$
- b) Let r be the radius of the semicircle.
 $\triangle BPD$ and $\triangle BDA$ are similar.
 $\frac{BD}{AB} = \frac{AD}{PD}$
 $\frac{15}{25} = \frac{r}{20}, r = 12\text{cm}$
- c) Surface area of the hemisphere $= 3\pi r^2 = 3\pi \times 12^2 = 432\pi\text{sq.cm}$
- d) Volume $= \frac{2}{3}\pi \times 12^3 = 1152\pi\text{cubic cm}$

Session 102 | Solids 11 | Worksheet 101

1) Total surface area of a solid sphere is 100 sq.cm . It splits up into two hemispheres .

- What is the curved surface area of the hemisphere ?
- What is the total surface area of the hemisphere?

Answers

- $4\pi r^2 = 100 \rightarrow \pi r^2 = 25$
 Curved surface area = $2\pi r^2 = 2 \times 25 = 50\text{sq.cm}$
- Total surface area of the hemisphere = $3\pi r^2 = 3 \times 25 = 75\text{sq.cm}$

2) A cylindrical vessel of radius 4cm contains water to the height 10cm. A small solid sphere of radius 2 cm is immersed in it.

- Find the volume of the sphere.
- Calculate the level to which water rises.
- A child said: If a sphere of double the radius is immersed the level also rises twice. Is this statement true? Justify

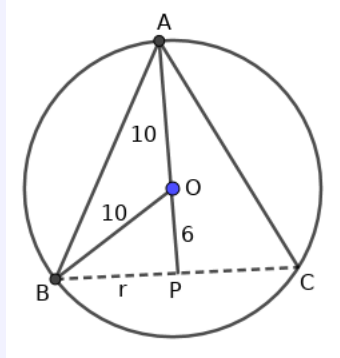
Answers

- Volume of the sphere = $\frac{4}{3}\pi r^3 = \frac{4}{3}\pi \times 2^3 = \frac{32\pi}{3}$ cubic cm
- Volume of sphere is equal to the volume of water risen .Let h be the level of water rises .
 $\pi \times 4^2 \times h = \frac{32\pi}{3}$
 $h = \frac{32}{3 \times 16} = \frac{2}{3} = 0.66\text{sq.cm}$
- If radius is r then volume $V = \frac{4}{3}\pi r^3$. If radius is $2r$ then volume $\frac{4}{3}\pi (2r)^3 = 8 \times V$
 When radius doubles valume become 8 times . Water level rises $8 \times 0.66 = 5.28\text{cm}$

3) A cone of height 16cm and maximum base area is carved from a solid sphere of radius 10cm.

- calculate the radius of the cone?
- Find the slant height of the cone?
- Calculate the volume of the cone?

Answers



- a) If radius of the cone is r cm
 $10^2 = r^2 + 6^2 \rightarrow r^2 = 64, r = 8$ cm
- b) Slant height $l, l^2 = 8^2 + 16^2 = 64 + 256 = 320, l = \sqrt{320} = 8\sqrt{5}$ cm
- c) Volume of cone $= \frac{1}{3}\pi \times r^2 h = \frac{1}{3} \times \pi \times 8^2 \times 16 = \frac{1024}{3}\pi$ cubic cm

4) Ratio of the volume of two spheres is $64 : 27$. The sum of the radii is 21 cm

- a) What is the ratio of their radii?
 b) Calculate the radius of each cone?
 c) What is the ratio of the surface area of the cones?

Answers

- a) $\frac{4}{3}\pi r_1^3 : \frac{4}{3}\pi r_2^3 = 64 : 27$
 $\frac{r_1^3}{r_2^3} = \frac{64}{27}, r_1 : r_2 = 4 : 3$
- b) $r_1 + r_2 = 21 \rightarrow 4r + 3r = 21, 7r = 21, r = 3$
 Radius $r_1 = 12$ cm, $r_2 = 9$ cm
- c) Ratio of the surface area is equal to ratio of the radii
 Ratio of total surface area $= 12^2 : 9^2 = 144 : 81 = 16 : 9$

5) Radius of a cone and s hemisphere are equal. Volume of cone and hemisphere are equal.

- a) What is the ratio of the heights?
 b) If the radius of the sphere is 10cm then what is its height?
 c) If the radius of the sphere is 2cm then what is its curved surface area ?
 d) Find the ratio of the surface area of the cone and hemisphere.

Answers

a) Radius of the semicircle and height are equal.

Let r be the radius r , Height of cone h

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

$$h : r = 2 : 1$$

b) Height = 20cm

c) If radius is 2 , the curved surface area of the hemisphere is $2\pi r^2 = 8\pi$

Radius of the cone 2cm , height 4cm . slant height $l = \sqrt{4^2 + 2^2} = 2\sqrt{5}$ cm

Curved surface area $\pi r l = \pi \times 2 \times 2\sqrt{5} = 4\sqrt{5}\pi$ sq.cm

d) Ratio of the curved surface area of hemisphere and cone is $= 8 : 4\sqrt{5} = 2 : \sqrt{5}$

Session 103 | Solids 12 | Worksheet 103

- 1) A solid is made by fixing a hemisphere in the base of a cone . The height of the cone is 12 cm. Cone and hemisphere have same base area.Total height of the solid is 17cm.



- What is the radius of the hemisphe?
- What is the slant height of the cone?
- Calculate the surface area of the solid.
- Calculate the volume of the solid.

Answers

a) $r = 17 - 12 = 5\text{cm}$

b) $l = \sqrt{12^2 + 5^2} = \sqrt{169} = 13\text{cm}$

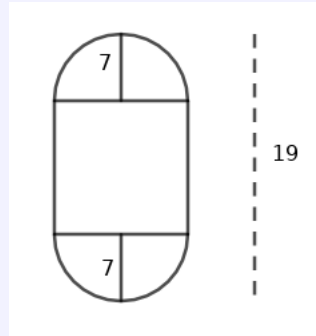
c) Curved surface area of the solid $= 2\pi r^2 + \pi r l = 2\pi \times 5^2 + \pi \times 5 \times 13 = 50\pi + 65\pi = 115\pi\text{sq.cm}$

d) Volume $= \frac{1}{3}\pi r^2 h + \frac{2}{3}\pi r^3$
 $\frac{1}{3}\pi \times 5^2 \times 12 + \frac{2}{3}\pi \times 5^3 = 100\pi + \frac{250\pi}{3} = \frac{550\pi}{3}\text{cubic cm}$

- 2) Hemispheres are fixed at the ends of a cylinder.Radius of the hemispheres and cylinder are equal.Total height of the solid is 19 cm.If the common radius is 7 cm then

- What is the height of the cylinder?
- Calculate the total surface area of the solid.
- Calculate the volume of the solid.

Answers



- a) $h = 19 - 14 = 5\text{cm}$
- b) Total surface area $= 2 \times 2\pi r^2 + 2\pi r h = 4\pi \times 7^2 + 2\pi \times 7 \times 5 = 196\pi + 70\pi = 266\pi\text{sq.cm}$
- c) Two hemispheres make a sphere .
 Volume $= \frac{4}{3}\pi r^3 + \pi \times r^2 h = \frac{4}{3}\pi \times 7^3 + \pi \times 7^2 \times 5 = \frac{1372\pi}{3} + 245\pi$
 $\frac{1372\pi + 735\pi}{3} = \frac{2107\pi}{3}$

3) A cone is fixed at one end and a hemisphere at other end of a cylinder. Common radius is 4.2 cm and total height is 23.2 cm. Height of the cylinder is 14 cm

- a) What is the height of the cone?
 b) Calculate the volume of the cone
 c) Calculate the volume of the cone.
 d) Calculate the volume of the cylinder.
 e) Find the total volume of the combination.

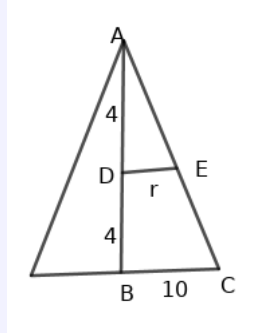
Answers

- a) Height of the cone $= 23.2 - (4.2 + 14) = 5\text{cm}$
- b) Volume of the cone $= \frac{1}{3}\pi \times r^2 h = \frac{1}{3}\pi \times 4.2^2 \times 5 = 29.4\pi\text{cubic cm}$
- c) Volume of the hemisphere $= \frac{2}{3} \times \pi \times 4.2^3 = 49.39\pi\text{ cubic cm}$
- d) Volume of cylinder $= \pi r^2 h = \pi \times 4.2^2 \times 14 = 246.96\pi\text{cubic cm}$
- e) Volume of solid $= 29.4\pi + 49.39\pi + 246.96\pi = 1022.85\text{cubic cm}$

4) A cone of radius 10cm and height 8 cm is divided equally by a plane parallel to the base half of its height.

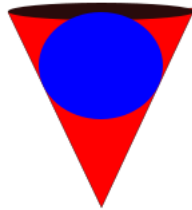
- a) What is the radius of the small cone taken from the big cone?
 b) Calculate the volume of the small cone .
 c) What is the volume of the remaining part ?ബാക്കിവരുന്ന ഭാഗത്തിന്റെ വ്യാപ്തം കണക്കാക്കുക
 d) What is the ratio of the volume of two parts .

Answers



- a) $\triangle ABC, \triangle ADE$ are similar .
 $\frac{4}{8} = \frac{r}{10} \rightarrow r = 5$ cm
- b) Volume of small cone $= \frac{1}{3}\pi r^2 h = \frac{1}{3} \times \pi \times 5^2 \times 4 = \frac{100\pi}{3}$ cubic cm
- c) Volume of big cone $\frac{1}{3}\pi r^2 h = \frac{1}{3} \times \pi \times 10^2 \times 8 = \frac{800\pi}{3}$
 Volume of remaining part $\frac{800\pi}{3} - \frac{100\pi}{3} = \frac{700\pi}{3}$ cubic cm
- d) $\frac{100\pi}{3} : \frac{700\pi}{3} = 1 : 7$

- 5) A sphere is fixed inside a cone in such a way that the sphere touches the lateral face and base of the cone. The base radius of the cone is 6 cm and height 8 cm



- a) What is the slant height of the cone?
 b) What is the radius of the sphere ?
 c) What is the volume of the sphere?
 d) Calculate the volume of the cone.

Answers

Divide the solid along its diameter of the base. Now we can see a triangle and incircle. Using the relation $A = rs$ we can find r

- a) $l = \sqrt{6^2 + 8^2} = \sqrt{100} = 10$ cm
- b) $s = \frac{10+10+12}{2} = 16, A = \frac{1}{2} \times 12 \times 8 = 48$
 $r = \frac{A}{s} = \frac{48}{16} = 3$ cm
- c) Volume of sphere $= \frac{4}{3}\pi r^3 = 36\pi$ cubic cm
- d) Volume of cone $= \frac{1}{3}\pi r^2 h = \frac{1}{3} \times \pi \times 6^2 \times 8 = 96\pi$ cubic cm