CBSE CLASS X

Mathematics Standard (041)

QUESTION PAPER

From previous CBSE Board Exam questions

Code: 8ET9CC	Questions: 59	Maximum Marks: 159	Generated: 2026-06-15 13:05

SELECTIONS USED

Source	Previous-year board
Subject	Mathematics
Lessons	Surface Areas and Volumes
Year	2022-2026
Questions selected	59

Composition — Types: 19 MCQ · 12 Long · 11 Case-based · 10 Short · 4 Very short · 3 Assertion–reason

Q1. § 12.3 Volume of a Combination of Solids **[3]**

The difference between the outer and inner radii of a hollow right circular cylinder of length 14 cm is 1 cm. If the volume of the metal used in making the cylinder is 176 cm^3, find the outer and inner radii of the cylinder.

Previously asked in: 2024 30/1/1 Q31

◆ **Surface Areas and Volumes** Volume of a Hollow Cylinder

Q2. § 12.2 Surface Area of a Combination of Solids § 12.3 Volume of a Combination of Solids **[4]**

> Khurja is a city in the Indian state of Uttar Pradesh famous for the pottery. Khurja pottery is traditional Indian pottery work which has attracted Indians as well as foreigners with a variety of tea-sets, crockery and ceramic tile works. A huge portion of the ceramics used in the country is supplied by Khurja and is also referred as 'The Ceramic Town'.
>
> One of the private schools of Bulandshahr organised an Educational Tour for class 10 students to Khurja. Students were very excited about the trip. Following are the few pottery objects of Khurja.
>
> Students found the shapes of the objects very interesting and they could easily relate them with mathematical shapes viz sphere, hemisphere, cylinder etc.

Maths teacher who was accompanying the students asked following questions :

(a) The internal radius of hemispherical bowl (filled completely with water) in I is 9 cm and radius and height of cylindrical jar in II is 1.5 cm and 4 cm respectively. If the hemispherical bowl is to be emptied in cylindrical jars, then how many cylindrical jars are required ? [2]

(b) If in the cylindrical jar full of water, a conical funnel of same height and same diameter is immersed, then how much water will flow out of the jar ? [2]

Previously asked in: 2022 30/4/1 Q14

◆ **Surface Areas and Volumes** 12.3 Volume of a Combination of Solids

Q3. § 12.2 Surface Area of a Combination of Solids § 12.3 Volume of a Combination of Solids § 12.4 Summary **[2]**

A solid piece of metal in the form of a cuboid of dimensions $11 \text{ cm} \times 7 \text{ cm} \times 7 \text{ cm}$ is melted to form 'n' number of solid spheres of radii $\frac{7}{2}$ cm each. Find the value of n.

Previously asked in: 2022 30/2/1 Q3

◆ **Surface Areas and Volumes** 12.3 Volume of a Combination of Solids

Q4. § 12.2 Surface Area of a Combination of Solids § 12.4 Summary **[5]**

A solid is in the shape of a right-circular cone surmounted on a hemisphere, the radius of each of them being 7 cm and the height of the cone is equal to its diameter. Find the volume of the solid.

Previously asked in: 2023 30/6/1 Q33

◆ **Surface Areas and Volumes** 12.3 Volume of a Combination of Solids

Q5. § 12.2 Surface Area of a Combination of Solids **[3]**

An empty cone is of radius 3 cm and height 12 cm. Ice-cream is filled in it so that lower part of the cone which is $\left(\frac{1}{6}\right)^{th}$ of the volume of the cone is unfilled but hemisphere is formed on the top. Find volume of the ice-cream. (Take $\pi = 3.14$)

Previously asked in: 2023 30/1/1 Q31(b) (OR-2)

◆ **Surface Areas and Volumes** 12.3 Volume of a Combination of Solids

Q6. § 12.2 Surface Area of a Combination of Solids § 12.3 Volume of a Combination of Solids § 12.4 Summary **[1]**

If a cone of greatest possible volume is hollowed out from a solid wooden cylinder, then the ratio of the volume of remaining wood to the volume of cone hollowed out is

A 1 : 1
B 1 : 3
C 2 : 1
D 3 : 1

Previously asked in: 2025 30/6/1 Q14

◆ **Surface Areas and Volumes** 12.3 Volume of a Combination of Solids

Q7. § 12.2 Surface Area of a Combination of Solids § 12.4 Summary **[1]**

A cone of height 12 cm and slant height 13 cm is surmounted on a hemisphere having radius equal to that of cone. The entire height of the solid is

A 17 cm
B 18 cm
C 22 cm
D 23 cm

Previously asked in: 2025 30/5/1 Q15

◆ **Surface Areas and Volumes** 12.3 Volume of a Combination of Solids

Q8. § 12.4 Summary **[1]**

A cone of maximum size is carved out from a solid cube of edge length l. The volume of the cone is :

A $\frac{\pi l^3}{12}$
B $\frac{\pi l^3}{3}$
C $l^3\left(1 - \frac{\pi}{3}\right)$
D $\frac{\pi l^3}{8}$

Previously asked in: 2026 30/3/1 Q7

◆ **Surface Areas and Volumes** 12.3 Volume of a Combination of Solids

Q9. § 12.2 Surface Area of a Combination of Solids | § 12.3 Volume of a Combination of Solids | § 12.4 Summary **[1]**

A hemispherical bowl is made of steel of thickness 1 cm. The outer radius of the bowl is 6 cm. The volume of steel used (in cm^3) is :

A 182π
B $\frac{182}{3}\pi$
C $\frac{682}{3}\pi$
D $\frac{364}{3}\pi$

Previously asked in: 2026 30/2/1 Q16

◆ **Surface Areas and Volumes** | 12.3 Volume of a Combination of Solids

Q10. § 12.2 Surface Area of a Combination of Solids | § 12.3 Volume of a Combination of Solids | § 12.4 Summary **[3]**

A solid is in the form of a cylinder with hemispherical ends. The total height of the solid is 20 cm and the diameter of the cylinder is 7 cm. Find the total volume of the solid. (Use $\pi = \frac{22}{7}$)

Previously asked in: 2026 30/1/1 Q30

◆ **Surface Areas and Volumes** | 12.3 Volume of a Combination of Solids

Q11. § 12.2 Surface Area of a Combination of Solids | § 12.3 Volume of a Combination of Solids | § 12.4 Summary **[2]**

150 spherical marbles, each of diameter 1.4 cm, are dropped in a cylindrical vessel of diameter 7 cm containing some water, and are completely immersed in water. Find the rise in the level of water in the cylindrical vessel.

Previously asked in: 2022 30/3/1 Q4(a) (OR-1)

◆ **Surface Areas and Volumes** | 12.3 Volume of a Combination of Solids

Q12. § 12.3 Volume of a Combination of Solids **[4]**

Water in a canal, 8 m wide and 6 m deep, is flowing with a speed of 12 km/hour. How much area will it irrigate in one hour, if 0.05 m of standing water is required?

Previously asked in: 2022 30/1/1 Q11(b) (OR-2)

◆ **Surface Areas and Volumes** | 12.3 Volume of a Combination of Solids

Q13. § 12.2 Surface Area of a Combination of Solids | § 12.4 Summary **[2]**

A solid metallic sphere of radius 10.5 cm is melted and recast into a number of smaller cones, each of radius 3.5 cm and height 3 cm. Find the number of cones so formed.

Previously asked in: 2022 30/1/1 Q2

◆ **Surface Areas and Volumes** | 12.3 Volume of a Combination of Solids

Q14. § 12.3 Volume of a Combination of Solids **[1]**

Water in a river which is 3 m deep and 40 m wide is flowing at the rate of 2 km/h. How much water will fall into the sea in 2 minutes ?

(a) 800 m^3
(b) 4000 m^3
(c) 8000 m^3
(d) 2000 m^3

Previously asked in: 2023 30/5/1 Q9

◆ **Surface Areas and Volumes** | Volume of water flow (rate problems using cuboid/prism volume)

Q15. § 12.3 Volume of a Combination of Solids § 12.4 Summary **[5]**

A student was asked to make a model shaped like a cylinder with two cones attached to its ends by using a thin aluminium sheet. The diameter of the model is 3 cm and its total length is 12 cm. If each cone has a height of 2 cm, find the volume of air contained in the model.

Previously asked in: 2023 30/4/1 Q34

◆ **Surface Areas and Volumes** 12.3 Volume of a Combination of Solids

Q16. § 12.2 Surface Area of a Combination of Solids § 12.3 Volume of a Combination of Solids § 12.4 Summary **[5]**

A solid iron pole consists of a solid cylinder of height 200 cm and base diameter 28 cm, which is surmounted by another cylinder of height 50 cm and radius 7 cm. Find the mass of the pole, given that 1 cm^3 of iron has approximately 8 g mass.

Previously asked in: 2024 30/3/1 Q35(a) (OR-1)

◆ **Surface Areas and Volumes** 12.3 Volume of a Combination of Solids

Q17. § 12.2 Surface Area of a Combination of Solids § 12.4 Summary **[5]**

A vessel is in the form of an inverted cone. Its height is 8 cm and the radius of its top, which is open, is 5 cm. It is filled with water up to the brim. When lead shots, each of which is a sphere of radius 0.5 cm, are dropped into the vessel, one-fourth of the water flows out. Find the number of lead shots dropped in the vessel.

Previously asked in: 2025 30/3/1 Q35

◆ **Surface Areas and Volumes** 12.3 Volume of a Combination of Solids

Q18. § 12.2 Surface Area of a Combination of Solids § 12.3 Volume of a Combination of Solids § 12.4 Summary **[3]**

A room is in the form of a cylinder surmounted by a hemispherical dome. The base radius of the hemisphere is half of the height of the cylindrical part. If the room contains $\dfrac{1408}{21}$ m^3 of air, find the height of the cylindrical part. (Use $\pi = \dfrac{22}{7}$).

Previously asked in: 2025 30/1/1 Q30

◆ **Surface Areas and Volumes** 12.3 Volume of a Combination of Solids

Q19. § 12.2 Surface Area of a Combination of Solids **[1]**

An ice-cream cone of radius r and height h is completely filled by two spherical scoops of ice-cream. If radius of each spherical scoop is $\dfrac{r}{2}$, then $h : 2r$ equals

A $1 : 8$
B $1 : 2$
C $1 : 1$
D $2 : 1$

Previously asked in: 2026 30/4/1 Q16

◆ **Surface Areas and Volumes** 12.3 Volume of a Combination of Solids

Q20. § 12.2 Surface Area of a Combination of Solids § 12.3 Volume of a Combination of Solids § 12.4 Summary **[1]**

Three tennis balls are just packed in a cylindrical jar. If radius of each ball is r, volume of air inside the jar is

A $2\pi r^3$
B $3\pi r^3$
C $5\pi r^3$
D $4\pi r^3$

Previously asked in: 2026 30/4/1 Q13

◆ **Surface Areas and Volumes** 12.3 Volume of a Combination of Solids

Q21. § 12.2 Surface Area of a Combination of Solids | § 12.4 Summary **[1]**

The volume of the largest right circular cone that can be carved out from a solid cube of edge 2 cm is :

(a) $\frac{4\pi}{3}$ cu cm
(b) $\frac{5\pi}{3}$ cu cm
(c) $\frac{8\pi}{3}$ cu cm
(d) $\frac{2\pi}{3}$ cu cm

Previously asked in: 2024 30/1/1 Q15

◆ **Surface Areas and Volumes** | Largest cone carved from a cube

Q22. § 12.2 Surface Area of a Combination of Solids | § 12.4 Summary **[1]**

A solid sphere is cut into two hemispheres. The ratio of the surface areas of sphere to that of two hemispheres taken together, is :

(a) $1 : 1$
(b) $1 : 4$
(c) $2 : 3$
(d) $3 : 2$

Previously asked in: 2024 30/1/1 Q13

◆ **Surface Areas and Volumes** | 12.2 Surface Area of a Combination of Solids

Q23. § 12.3 Volume of a Combination of Solids | § 12.4 Summary **[4]**

> A wall mounted lamp, made of fabric, is shown below. Lamp has cuboidal shape, open from top and bottom. A spherical bulb of diameter 7 cm is latched with a very thin rod. (Ignore the rod while making calculations.) Dimensions of the cuboid are 24 cm × 12 cm × 17 cm.

Based on the above information, answer the following questions:

(i) Find the surface area of the bulb. [1]

(ii) What could be the maximum diameter of the bulb if at least 1 cm space is left from each side? [1]

(iii) Find the area of the fabric used if there is a fold of 2 cm on top and bottom edges. OR Find the space available inside the lamp. [2]

Previously asked in: 2026 30/5/1 Q37

◆ **Surface Areas and Volumes** | 12.2 Surface Area of a Combination of Solids

Q24. § 12.2 Surface Area of a Combination of Solids | § 12.3 Volume of a Combination of Solids | § 12.4 Summary **[1]**

A camping tent in hemispherical shape of radius 1.4 m, has a door opening of area 0.50 m^2. Outer surface area of the tent is

(A) $11.78\ m^2$
(B) $12.32\ m^2$
(C) $11.82\ m^2$
(D) $12.86\ m^2$

Previously asked in: 2026 30/5/1 Q12

◆ **Surface Areas and Volumes** | 12.2 Surface Area of a Combination of Solids

Q25. § 12.2 Surface Area of a Combination of Solids § 12.4 Summary **[1]**

A conical cavity of maximum volume is carved out from a wooden solid hemisphere of radius 10 cm. Curved surface area of the cavity carved out is (use $\pi = 3.14$)

(A) $314\sqrt{2}$ cm^2
(B) 314 cm^2
(C) $\frac{3140}{3}$ cm^2
(D) $3140\sqrt{2}$ cm^2

Previously asked in: 2026 30/5/1 Q7

◆ **Surface Areas and Volumes** Curved surface area of cone carved from hemisphere

Q26. § 12.2 Surface Area of a Combination of Solids § 12.3 Volume of a Combination of Solids § 12.4 Summary **[2]**

The largest sphere is carved out of a solid cube of side 21 cm. Find the volume of the sphere.

Previously asked in: 2022 30/4/1 Q6(b)

◆ **Surface Areas and Volumes** Volume of a Sphere Carved from a Cube

Q27. § 12.2 Surface Area of a Combination of Solids § 12.3 Volume of a Combination of Solids § 12.4 Summary **[2]**

The curved surface area of a right circular cylinder is 176 sq cm and its volume is 1232 cu cm. What is the height of the cylinder ?

Previously asked in: 2022 30/4/1 Q6(a)

◆ **Surface Areas and Volumes** Curved Surface Area and Volume of a Right Circular Cylinder

Q28. § 12.2 Surface Area of a Combination of Solids § 12.3 Volume of a Combination of Solids § 12.4 Summary **[4]**

> A 'circus' is a company of performers who put on shows of acrobats, clowns etc. to entertain people started around 250 years back, in open fields, now generally performed in tents. One such 'Circus Tent' is shown below. The tent is in the shape of a cylinder surmounted by a conical top. If the height and diameter of cylindrical part are 9 m and 30 m respectively and height of conical part is 8 m with same diameter as that of the cylindrical part.

Case Study - 2 : The tent is in the shape of a cylinder surmounted by a conical top. If the height and diameter of cylindrical part are 9 m and 30 m respectively and height of conical part is 8 m with same diameter as that of the cylindrical part, then find:

(1) the area of the canvas used in making the tent; [3]

(2) the cost of the canvas bought for the tent at the rate ₹ 200 per sq m, if 30 sq m canvas was wasted during stitching. [1]

Previously asked in: 2022 30/2/1 Q14

◆ **Surface Areas and Volumes** Cost Estimation using Surface Area Surface Area of Combined Solids (Cylinder + Cone)

Q29. § 12.4 Summary **[1]**

The volume of a right circular cone whose area of the base is 156 cm^2 and the vertical height is 8 cm, is

A 2496 cm^3
B 1248 cm^3
C 1664 cm^3
D 416 cm^3

Previously asked in: 2023 30/6/1 Q12

◆ **Surface Areas and Volumes** Volume of a Cone

Q30. § 12.3 Volume of a Combination of Solids | § 12.4 Summary **[3]**

A room is in the form of cylinder surmounted by a hemi-spherical dome. The base radius of hemisphere is one-half the height of cylindrical part. Find total height of the room if it contains $\left(\frac{1408}{21}\right)$ m³ of air. (Take $\pi = \frac{22}{7}$)

Previously asked in: 2023 30/1/1 Q31(a) (OR-1)

◆ **Surface Areas and Volumes** | Volume of combined solids (cylinder surmounted by hemisphere)

Q31. § 12.4 Summary **[1]**

The curved surface area of a cone having height 24 cm and radius 7 cm, is

A 528 cm²
B 1056 cm²
C 550 cm²
D 500 cm²

Previously asked in: 2023 30/1/1 Q12

◆ **Surface Areas and Volumes** | Curved Surface Area of a Cone

Q32. § 12.2 Surface Area of a Combination of Solids | § 12.4 Summary **[1]**

Curved surface area of a cylinder of height 5 cm is 94.2 cm². Radius of the cylinder is (Take $\pi = 3.14$)

A 2 cm
B 3 cm
C 2.9 cm
D 6 cm

Previously asked in: 2023 30/1/1 Q10

◆ **Surface Areas and Volumes** | Curved Surface Area of a Cylinder

Q33. § 12.4 Summary **[5]**

From one face of a solid cube of side 14 cm, the largest possible cone is carved out. Find the volume and surface area of the remaining solid. (Use $\pi = \frac{22}{7}, \sqrt{5} = 2.2$)

Previously asked in: 2025 30/6/1 Q34

◆ **Surface Areas and Volumes** | 12.2 Surface Area of a Combination of Solids | 12.3 Volume of a Combination of Solids

Q34. § 12.2 Surface Area of a Combination of Solids | § 12.3 Volume of a Combination of Solids | § 12.4 Summary **[5]**

From a solid cylinder of height 24 cm and radius 5 cm, two cones of height 12 cm and radius 5 cm are hollowed out. Find the volume and surface area of the remaining solid.

Previously asked in: 2025 30/5/1 Q34(b)

◆ **Surface Areas and Volumes** | 12.2 Surface Area of a Combination of Solids | 12.3 Volume of a Combination of Solids

Q35. § 12.2 Surface Area of a Combination of Solids | § 12.3 Volume of a Combination of Solids | § 12.4 Summary **[5]**

From one of the faces of a solid wooden cube of side 14 cm, maximum number of hemispheres of diameter 1.4 cm are scooped out. Find the total number of hemispheres that can be scooped out. Also, find the total surface area of the remaining solid.

Previously asked in: 2025 30/5/1 Q34(a)

◆ **Surface Areas and Volumes** | 12.2 Surface Area of a Combination of Solids

Q36. § 12.3 Volume of a Combination of Solids | § 12.4 Summary **[5]**

A wooden cubical die is formed by forming hemispherical depressions on each face of the cube such that face 1 has one depression, face 2 has two depressions and so on. The sum of number of hemispherical depressions on opposite faces is always 7. If the edge of the cubical die measures 5 cm and each hemispherical depression is of diameter 1.4 cm, find the total surface area of the die so formed.

Previously asked in: 2025 30/4/1 Q34

◆ **Surface Areas and Volumes** | 12.2 Surface Area of a Combination of Solids

Q37. § 12.2 Surface Area of a Combination of Solids | § 12.4 Summary **[1]**

On the top face of the wooden cube of side 7 cm, hemispherical depressions of radius 0.35 cm are to be formed by taking out the wood. The maximum number of depressions that can be formed is :

(a) 400
(b) 100
(c) 20
(d) 10

Previously asked in: 2025 30/4/1 Q11

◆ **Surface Areas and Volumes** | Maximum number of hemispherical depressions on a cube face

Q38. § 12.2 Surface Area of a Combination of Solids | § 12.3 Volume of a Combination of Solids | § 12.4 Summary **[4]**

> A model of Leafy Ball Fountain is made to be kept on the tabletop. Water gently cascades down the ball into a decorative cylindrical pool where it is recycled. The diameter of spherical ball is 21 cm. Cylindrical pool – Outer diameter is 50 cm and inner diameter is 40 cm. Height of solid base is 14 cm. Height of water filled is 7 cm.

Observe the figure and answer the following questions:

(i) Determine the total height of the fountain. [1]

(ii) Find the volume of the ball. [1]

(iii) If one-third of the ball is submerged in the water, find the volume of the water filled in the pool. [2]

Previously asked in: 2026 30/3/1 Q38

◆ **Surface Areas and Volumes** | 12.2 Surface Area of a Combination of Solids | 12.3 Volume of a Combination of Solids

Q39. § 12.2 Surface Area of a Combination of Solids | § 12.4 Summary **[2]**

A toy is in the form of a cone mounted on a hemisphere of radius 7 cm. The total height of the toy is 31 cm. Find the total surface area of the toy.

Previously asked in: 2026 30/3/1 Q25

◆ **Surface Areas and Volumes** | 12.2 Surface Area of a Combination of Solids

Q40. § 12.4 Summary **[4]**

> On a Sunday your parents took you to a fair. You could see lot of toys displayed and you wanted them to buy a Rubik's cube and a strawberry ice-cream for you.

Based on the information given above, answer the following questions :

(i) Find the length of the diagonal of Rubik's cube if each edge measures 6 cm. [1]

(ii) Find the volume of Rubik's cube if the length of the edge is 7 cm. [1]

(iii) What is the curved surface area of hemisphere (ice-cream) if the base radius is 7 cm ? [2]

Previously asked in: 2026 30/2/1 Q38

◆ **Surface Areas and Volumes** | 12.2 Surface Area of a Combination of Solids | Diagonal of a Cube | Volume of a Cube

Q41. § 12.4 Summary **[1]**

Assertion (A) : The surface area of the cuboid formed by joining two cubes of sides 4 cm each, end-to-end, is 160 cm^2.
Reason (R): The surface area of a cuboid of dimensions $l \times b \times h$ is $(lb + bh + hl)$.
Select the correct answer from the options (A), (B), (C) and (D).

A Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
B Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
C Assertion (A) is true, but Reason (R) is false.
D Assertion (A) is false, but Reason (R) is true.

Previously asked in: 2026 30/2/1 Q19

◆ **Surface Areas and Volumes** | 12.2 Surface Area of a Combination of Solids

Q42. § 12.2 Surface Area of a Combination of Solids | § 12.4 Summary **[1]**

The total surface area of a solid hemisphere of diameter '$2d$' is :

(a) $3\pi d^2$
(b) $2\pi d^2$
(c) $\frac{1}{2}\pi d^2$
(d) $\frac{3}{4}\pi d^2$

Previously asked in: 2026 30/1/1 Q16

◆ **Surface Areas and Volumes** | Total Surface Area of a Hemisphere

Q43. § 12.2 Surface Area of a Combination of Solids | § 12.3 Volume of a Combination of Solids | § 12.4 Summary **[4]**

> John planned a birthday party for his younger sister with his friends. They decided to make some birthday caps by themselves and to buy a cake from a bakery shop. For these two items, they decided the following dimensions:
> Cake: Cylindrical shape with diameter 24 cm and height 14 cm.
> Cap: Conical shape with base circumference 44 cm and height 24 cm.

Based on the above information, answer the following questions:

(a) How many square cm paper would be used to make 4 such caps? [2]

(b) The bakery shop sells cakes by weight (0.5 kg, 1 kg, 1.5 kg, etc.). To have the required dimensions, how much cake should they order, if 650 cm^3 equals 100 g of cake? [2]

Previously asked in: 2022 30/3/1 Q14

◆ **Surface Areas and Volumes** | 12.3 Volume of a Combination of Solids | Curved Surface Area of a Cone (making conical caps)

Q44. § 12.4 Summary **[2]**

Three cubes of side 6 cm each, are joined as shown in Figure 1. Find the total surface area of the resulting cuboid.

Previously asked in: 2022 30/3/1 Q4(b) (OR-2)

◆ **Surface Areas and Volumes** 12.2 Surface Area of a Combination of Solids

Q45. § 12.2 Surface Area of a Combination of Solids § 12.3 Volume of a Combination of Solids § 12.4 Summary **[4]**

From a solid cylinder of height 30 cm and radius 7 cm, a conical cavity of height 24 cm and same radius is hollowed out. Find the total surface area of the remaining solid.

Previously asked in: 2022 30/1/1 Q11(a) (OR-1)

◆ **Surface Areas and Volumes** 12.2 Surface Area of a Combination of Solids

Q46. § 12.4 Summary **[4]**

> A golf ball is spherical with about 300–500 dimples that help increase its velocity while in play. Golf balls are traditionally white but available in colours also. In the given figure, a golf ball has diameter 4·2 cm and the surface has 315 dimples (hemi-spherical) of radius 2 mm.

Based on the above, answer the following questions :

- **(i)** Find the surface area of one such dimple. [1]
- **(ii)** Find the volume of the material dug out to make one dimple. [1]
- **(iii)** Find the total surface area exposed to the surroundings. OR Find the volume of the golf ball. [2]

Previously asked in: 2023 30/5/1 Q36

◆ **Surface Areas and Volumes** 12.2 Surface Area of a Combination of Solids 12.3 Volume of a Combination of Solids

Q47. § 12.2 Surface Area of a Combination of Solids § 12.4 Summary **[4]**

> In a coffee shop, coffee is served in two types of cups. One is cylindrical in shape with diameter 7 cm and height 14 cm and the other is hemispherical with diameter 21 cm.

Based on the above, answer the following questions:

- **(i)** Find the area of the base of the cylindrical cup. [1]
- **(ii)** What is the capacity of the hemispherical cup? [2]
- **(iii)** What is the curved surface area of the cylindrical cup? [1]

Previously asked in: 2023 30/2/1 Q37

◆ **Surface Areas and Volumes** Area of base of a cylinder (πr^2) Curved Surface Area of a cylinder ($2\pi rh$) Volume (capacity) of a hemisphere ($2/3\ \pi r^3$)

Q48. § 12.2 Surface Area of a Combination of Solids § 12.4 Summary **[1]**

The total surface area of a solid hemisphere whose diameter is d is:

(a) $3\pi d^2$
(b) $2\pi d^2$
(c) $\frac{1}{2}\pi d^2$
(d) $\frac{3}{4}\pi d^2$

Previously asked in: 2023 30/2/1 Q10

◆ **Surface Areas and Volumes** Total Surface Area of a Hemisphere

Q49. § 12.2 Surface Area of a Combination of Solids § 12.4 Summary **[5]**

A wooden article was made by scooping out a hemisphere from each end of a solid cylinder, as shown in the figure. If the height of the cylinder is 5·8 cm and its base is of radius 2·1 cm, find the total surface area of the article.

Previously asked in: 2024 30/5/1 Q35

◆ **Surface Areas and Volumes** 12.2 Surface Area of a Combination of Solids

Q50. § 12.2 Surface Area of a Combination of Solids § 12.3 Volume of a Combination of Solids **[4]**

> Tamper-proof tetra-packed milk guarantees both freshness and security. This milk ensures uncompromised quality, preserving the nutritional values within and making it a reliable choice for health-conscious individuals.
>
> 500 mL milk is packed in a cuboidal container of dimensions 15 cm × 8 cm × 5 cm. These milk packets are then packed in cuboidal cartons of dimensions 30 cm × 32 cm × 15 cm.

Based on the above given information, answer the following questions :

- **(i)** Find the volume of the cuboidal carton. [1]
- **(ii)** Find the total surface area of a milk packet. OR How many milk packets can be filled in a carton ? [2]
- **(iii)** How much milk can the cup (as shown in the figure) hold ? [1]

Previously asked in: 2024 30/4/1 Q38

◆ **Surface Areas and Volumes** Packing / Number of Containers Problem Total Surface Area of a Cuboid Volume of a Combination of Solids (Cup) Volume of a Cuboid

Q51. § 12.2 Surface Area of a Combination of Solids § 12.4 Summary **[1]**

The ratio of total surface area of a solid hemisphere to the square of its radius is :

A $2\pi : 1$
B $4\pi : 1$
C $3\pi : 1$
D $1 : 4\pi$

Previously asked in: 2024 30/4/1 Q9

◆ **Surface Areas and Volumes** 12.2 Surface Area of a Combination of Solids

Q52. § 12.2 Surface Area of a Combination of Solids § 12.4 Summary **[5]**

A medicine capsule is in the shape of a cylinder with two hemispheres stuck to each of its ends. The length of the entire capsule is 14 mm and the diameter of the capsule is 4 mm, find its surface area. Also, find its volume.

Previously asked in: 2024 30/3/1 Q35(b) (OR-2)

◆ **Surface Areas and Volumes** 12.2 Surface Area of a Combination of Solids 12.3 Volume of a Combination of Solids

Q53. § 12.3 Volume of a Combination of Solids § 12.4 Summary **[4]**

> The word 'circus' has the same root as 'circle'. In a closed circular area, various entertainment acts including human skill and animal training are presented before the crowd.
>
> A circus tent is cylindrical upto a height of 8 m and conical above it. The diameter of the base is 28 m and total height of tent is 18.5 m.

The word 'circus' has the same root as 'circle'. In a closed circular area, various entertainment acts including human skill and animal training are presented before the crowd. A circus tent is cylindrical upto a height of 8 m and conical above it. The diameter of the base is 28 m and total height of tent is 18.5 m. Based on the above, answer the following questions:

- **(i)** Find slant height of the conical part. [1]
- **(ii)** Determine the floor area of the tent. [1]
- **(iii)** Find area of the cloth used for making tent. OR Find total volume of air inside an empty tent. [2]

Previously asked in: 2024 30/2/1 Q37

◆ **Surface Areas and Volumes** 12.2 Surface Area of a Combination of Solids Volume of a Combination of Solids

Q54. § 12.4 Summary **[1]**

Assertion (A): Two cubes each of edge length 10 cm are joined together. The total surface area of newly formed cuboid is 1200 cm².

Reason (R): Area of each surface of a cube of side 10 cm is 100 cm².

(A) Both Assertion (A) and Reason (R) are true. Reason (R) is the correct explanation of Assertion (A).
(B) Both Assertion (A) and Reason (R) are true. Reason (R) does not give correct explanation of (A).
(C) Assertion (A) is true but Reason (R) is not true.
(D) Assertion (A) is not true but Reason (R) is true.

Previously asked in: 2024 30/2/1 Q20

◆ **Surface Areas and Volumes** 12.2 Surface Area of a Combination of Solids

Q55. § 12.3 Volume of a Combination of Solids § 12.4 Summary **[1]**

If the volumes of two cubes are in the ratio $8 : 125$, then the ratio of their surface areas is:

A $8 : 125$
B $4 : 25$
C $2 : 5$
D $16 : 25$

Previously asked in: 2025 30/3/1 Q12

◆ **Surface Areas and Volumes** Ratio of Surface Areas and Volumes of Cubes

Q56. § 12.2 Surface Area of a Combination of Solids § 12.3 Volume of a Combination of Solids § 12.4 Summary **[4]**

> A skilled carpenter decided to craft a special rolling pin for the local baker. He carefully joined three cylindrical pieces of wood — two small ones on the ends and one larger in the centre — to create a perfect tool. The baker loved the rolling pin, as it rolled out the smoothest dough for breads and pastries.
>
> The length of the bigger cylindrical part is 12 cm and diameter is 7 cm and the length of each smaller cylindrical part is 5 cm and diameter is 2·1 cm.

Based on the above information, answer the following questions :

(i) Find the volume of the bigger cylindrical part. [1]

(ii) Find the curved surface area of the bigger cylindrical part. [1]

(iii) Find the ratio of the volume of the bigger cylindrical part to the total volume of the two smaller (identical) cylindrical parts. [2]

Previously asked in: 2025 30/2/1 Q38

◆ **Surface Areas and Volumes** 12.2 Surface Area of a Combination of Solids 12.3 Volume of a Combination of Solids

Q57. § 12.4 Summary **[1]**

Assertion (A): If we join two hemispheres of same radius along their bases, then we get a sphere.

Reason (R): Total Surface Area of a sphere of radius r is $3\pi r^2$.

Select the correct answer from the codes (A), (B), (C) and (D) given below.

A Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
B Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
C Assertion (A) is true, but Reason (R) is false.
D Assertion (A) is false, but Reason (R) is true.

Previously asked in: 2025 30/1/1 Q20

◆ **Surface Areas and Volumes** 12.2 Surface Area of a Combination of Solids

Q58. § 12.4 Summary **[3]**

The internal and external radii of a hollow hemisphere are $5\sqrt{2}$ cm and 10 cm respectively. A cone of height $5\sqrt{7}$ cm and radius $5\sqrt{2}$ cm is surmounted on the hemisphere as shown in the figure. Find the total surface area of the object in terms of π. (Use $\sqrt{2} = 1.4$)

Previously asked in: 2026 30/4/1 Q29 (OR-2)

◆ **Surface Areas and Volumes** 12.2 Surface Area of a Combination of Solids

Q59. § 12.3 Volume of a Combination of Solids **[3]**

To protect plants from heat, a shed of iron rods covered with green cloth is made. The lower part of the shed is a cuboid mounted by semi-cylinder as shown in the figure. Find the area of the cloth required to make this shed, if dimensions of the cuboid are $14 \text{ m} \times 25 \text{ m} \times 16 \text{ m}$.

Previously asked in: 2026 30/4/1 Q29 (OR-1)

◆ **Surface Areas and Volumes** 12.2 Surface Area of a Combination of Solids

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CBSE CLASS X

Mathematics Standard (041)

ANSWER KEY

From previous CBSE Board Exam questions

Code: 8ET9CC	Questions: 59	Maximum Marks: 159	Generated: 2026-06-15 13:05

Q1. § 12.3 Volume of a Combination of Solids **[3]**

The difference between the outer and inner radii of a hollow right circular cylinder of length 14 cm is 1 cm. If the volume of the metal used in making the cylinder is 176 cm^3, find the outer and inner radii of the cylinder.

Previously asked in: 2024 30/1/1 Q31

◆ **Surface Areas and Volumes** Volume of a Hollow Cylinder

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Model Answer

Let outer radius = R cm, inner radius = r cm.

Given:

- $R - r = 1$ ... (i)
- Volume of metal = $\pi(R^2 - r^2) \times h = 176$ cm³

Substituting $h = 14$ cm and $\pi = \dfrac{22}{7}$:

$$\frac{22}{7} \times (R^2 - r^2) \times 14 = 176$$

$$44(R^2 - r^2) = 176$$

$$R^2 - r^2 = 4$$

$$(R + r)(R - r) = 4$$

Since $R - r = 1$:

$$R + r = 4 \quad \ldots \text{(ii)}$$

Adding (i) and (ii): $2R = 5 \Rightarrow R = 2.5$ cm

Subtracting (i) from (ii): $2r = 3 \Rightarrow r = 1.5$ cm

Outer radius = 2.5 cm, Inner radius = 1.5 cm

Source: Chapter 12, Section 12.3 — Volume of a Combination of Solids

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Explanation

- The key formula is: Volume of hollow cylinder = $\pi(R^2 - r^2)h$, which uses the difference of squares.
- Examiners expect you to set up **two equations** from the two given conditions and solve simultaneously — show both equations clearly.
- Use $\pi = \dfrac{22}{7}$ as instructed and simplify step by step to avoid errors.

Q2. § 12.2 Surface Area of a Combination of Solids § 12.3 Volume of a Combination of Solids **[4]**

> Khurja is a city in the Indian state of Uttar Pradesh famous for the pottery. Khurja pottery is traditional Indian pottery work which has attracted Indians as well as foreigners with a variety of tea-sets, crockery and ceramic tile works. A huge portion of the ceramics used in the country is supplied by Khurja and is also referred as 'The Ceramic Town'.
>
> One of the private schools of Bulandshahr organised an Educational Tour for class 10 students to Khurja. Students were very excited about the trip. Following are the few pottery objects of Khurja.
>
> Students found the shapes of the objects very interesting and they could easily relate them with mathematical shapes viz sphere, hemisphere, cylinder etc.

Maths teacher who was accompanying the students asked following questions :

(a) The internal radius of hemispherical bowl (filled completely with water) in I is 9 cm and radius and height of cylindrical jar in II is 1.5 cm and 4 cm respectively. If the hemispherical bowl is to be emptied in cylindrical jars, then how many cylindrical jars are required ? [2]

(b) If in the cylindrical jar full of water, a conical funnel of same height and same diameter is immersed, then how much water will flow out of the jar ? [2]

Previously asked in: 2022 30/4/1 Q14

◆ **Surface Areas and Volumes** 12.3 Volume of a Combination of Solids

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Model Answer

(a)

Volume of hemispherical bowl = $\dfrac{2}{3}\pi r^3 = \dfrac{2}{3}\pi(9)^3 = \dfrac{2}{3}\pi \times 729 = 486\pi$ cm³

Volume of one cylindrical jar = $\pi r^2 h = \pi(1.5)^2 \times 4 = \pi \times 2.25 \times 4 = 9\pi$ cm³

Number of jars required $= \dfrac{486\pi}{9\pi} = \mathbf{54}$

∴ **54 cylindrical jars** are required.

(b)

The conical funnel has the same height ($h = 4$ cm) and same diameter ($r = 1.5$ cm) as the cylindrical jar.

Volume of cone $= \dfrac{1}{3}\pi r^2 h = \dfrac{1}{3} \times 9\pi = 3\pi$ cm³

Volume of cylinder $= 9\pi$ cm³

Water that flows out = Volume of cone $= 3\pi = 3 \times \dfrac{22}{7} \approx$ **9.43 cm³**

(When the cone is immersed, it displaces a volume equal to the cone's own volume, so that much water flows out.)

Explanation

- **(a):** Divide total volume of hemisphere by volume of one cylinder. Key formula: hemisphere volume = $\frac{2}{3}\pi r^3$.

- **(b):** A solid cone immersed in a full jar displaces water equal to its own volume = $\frac{1}{3}$ of cylinder's volume. Examiners expect the reasoning that water flowing out = volume of cone. Don't forget to show the formula and substitution clearly for full marks.

Q3. § 12.2 Surface Area of a Combination of Solids | § 12.3 Volume of a Combination of Solids | § 12.4 Summary **[2]**

A solid piece of metal in the form of a cuboid of dimensions $11\text{ cm} \times 7\text{ cm} \times 7\text{ cm}$ is melted to form 'n' number of solid spheres of radii $\frac{7}{2}$ cm each. Find the value of n.

Previously asked in: 2022 30/2/1 Q3

◆ **Surface Areas and Volumes** | 12.3 Volume of a Combination of Solids

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Model Answer

Volume of cuboid = $11 \times 7 \times 7 = 539\text{ cm}^3$

Volume of one sphere $= \frac{4}{3}\pi r^3 = \frac{4}{3} \times \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} \times \frac{7}{2} = \frac{4}{3} \times \frac{22}{7} \times \frac{343}{8} = \frac{539}{3}\text{ cm}^3$

Since metal is melted and recast:

$$n = \frac{\text{Volume of cuboid}}{\text{Volume of one sphere}} = \frac{539}{\frac{539}{3}} = 3$$

$$\boxed{n = 3}$$

Source: Chapter 12, Section 12.3 (Volume of a Combination of Solids)

Explanation

- The key principle: when a solid is melted and recast, **total volume is conserved**.
- Equate volume of cuboid = $n\times$ volume of one sphere, then solve for n.
- Use $\pi = \frac{22}{7}$ and $r = \frac{7}{2}$ cm; the numbers cancel cleanly to give $n = 3$.
- Show both volume calculations clearly for full marks (1 mark each step typically).

Q4. § 12.2 Surface Area of a Combination of Solids | § 12.4 Summary **[5]**

A solid is in the shape of a right-circular cone surmounted on a hemisphere, the radius of each of them being 7 cm and the height of the cone is equal to its diameter. Find the volume of the solid.

Previously asked in: 2023 30/6/1 Q33

◆ **Surface Areas and Volumes** | 12.3 Volume of a Combination of Solids

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Model Answer

Given:

- Radius of cone = Radius of hemisphere = r = 7 cm
- Height of cone = diameter = 2r = 14 cm

Volume of the solid = Volume of cone + Volume of hemisphere

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

$$= \frac{1}{3}\pi r^2 (h + 2r)$$

$$= \frac{1}{3} \times \frac{22}{7} \times 7 \times 7 \times (14 + 2 \times 7)$$

$$= \frac{1}{3} \times \frac{22}{7} \times 49 \times 28$$

$$= \frac{1}{3} \times 22 \times 7 \times 28$$

$$= \frac{4312}{3}$$

$$= \mathbf{1437.33\ cm^3}\ \text{(approx.)}$$

Source: Chapter 12, Section 12.3 – Volume of a Combination of Solids

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Explanation

- The key step is recognising that **volume adds directly** for combined solids (unlike surface area, where overlapping parts are excluded).
- Height of cone = diameter = 2r = 14 cm — don't use radius here.
- Factor out $\frac{1}{3}\pi r^2$ to simplify calculation.
- Examiners award marks for: correct formula (1 mark), substitution (1 mark), simplification (2 marks), final answer with unit (1 mark).
- Use $\pi = \frac{22}{7}$ unless told otherwise.

Q5. § 12.2 Surface Area of a Combination of Solids **[3]**

An empty cone is of radius 3 cm and height 12 cm. Ice-cream is filled in it so that lower part of the cone which is $\left(\frac{1}{6}\right)^{th}$ of the volume of the cone is unfilled but hemisphere is formed on the top. Find volume of the ice-cream. (Take $\pi = 3.14$)

Previously asked in: 2023 30/1/1 Q31(b) (OR-2)

◆ **Surface Areas and Volumes** 12.3 Volume of a Combination of Solids

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Model Answer

Given: Cone radius $r = 3$ cm, height $h = 12$ cm.

Volume of cone:

$$V_{cone} = \frac{1}{3}\pi r^2 h = \frac{1}{3} \times 3.14 \times 9 \times 12 = 113.04 \text{ cm}^3$$

Volume of ice-cream in cone (cone is $\frac{1}{6}$ unfilled):

$$V_{cone\ filled} = \frac{5}{6} \times 113.04 = 94.2 \text{ cm}^3$$

Volume of hemisphere (radius = 3 cm):

$$V_{hemi} = \frac{2}{3}\pi r^3 = \frac{2}{3} \times 3.14 \times 27 = 56.52 \text{ cm}^3$$

Total volume of ice-cream:

$$= 94.2 + 56.52 = \boxed{150.72 \text{ cm}^3}$$

Source: Volume of a Combination of Solids, Chapter 12

Explanation

- The cone is $\frac{1}{6}$ unfilled, so ice-cream fills $\frac{5}{6}$ of the cone's volume.
- The hemisphere on top has the **same radius** as the cone's open end (3 cm).
- Add the two volumes: filled cone part + hemisphere.
- Examiners expect clear formula, substitution, and final answer with units. Don't forget to multiply by $\frac{5}{6}$ — a common error is using the full cone volume.

Q6. § 12.2 Surface Area of a Combination of Solids | § 12.3 Volume of a Combination of Solids | § 12.4 Summary **[1]**

If a cone of greatest possible volume is hollowed out from a solid wooden cylinder, then the ratio of the volume of remaining wood to the volume of cone hollowed out is

A 1 : 1
B 1 : 3
C 2 : 1
D 3 : 1

Previously asked in: 2025 30/6/1 Q14

◆ **Surface Areas and Volumes** | 12.3 Volume of a Combination of Solids

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Model Answer

Option C: 2 : 1

The cone of greatest volume inside a cylinder has the same base radius and height as the cylinder.
Volume of cylinder = $\pi r^2 h$; Volume of cone = $\frac{1}{3}\pi r^2 h$.
Remaining wood = $\pi r^2 h - \frac{1}{3}\pi r^2 h = \frac{2}{3}\pi r^2 h$.
Ratio = $\frac{2}{3}\pi r^2 h : \frac{1}{3}\pi r^2 h$ = **2 : 1**.

Explanation

The key is recognising that the largest cone carved from a cylinder shares the same radius (r) and height (h). The remaining wood is cylinder minus cone. Examiners expect the ratio simplified to lowest terms: 2:1. Don't confuse this with the cone-to-cylinder ratio (1:3).

Q7. § 12.2 Surface Area of a Combination of Solids | § 12.4 Summary **[1]**

A cone of height 12 cm and slant height 13 cm is surmounted on a hemisphere having radius equal to that of cone. The entire height of the solid is

A 17 cm
B 18 cm
C 22 cm
D 23 cm

Previously asked in: 2025 30/5/1 Q15

◆ **Surface Areas and Volumes** | 12.3 Volume of a Combination of Solids

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Model Answer

Radius of cone: $r = \sqrt{l^2 - h^2} = \sqrt{13^2 - 12^2} = \sqrt{169 - 144} = 5$ cm.

Total height = height of cone + radius of hemisphere = 12 + 5 = **17 cm**. → **Option A**

Explanation

The hemisphere's radius equals the cone's base radius (r = 5 cm). The hemisphere adds its radius (not diameter) to the cone's height, giving 12 + 5 = 17 cm. A common mistake is adding the diameter (10 cm) instead.

Q8. § 12.4 Summary **[1]**

A cone of maximum size is carved out from a solid cube of edge length l. The volume of the cone is :

A $\frac{\pi l^3}{12}$
B $\frac{\pi l^3}{3}$
C $l^3\left(1-\frac{\pi}{3}\right)$
D $\frac{\pi l^3}{8}$

Previously asked in: 2026 30/3/1 Q7

◆ **Surface Areas and Volumes** 12.3 Volume of a Combination of Solids

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Model Answer

Option A: $\dfrac{\pi l^3}{12}$

The maximum cone has base radius $r = \dfrac{l}{2}$ (inscribed circle of top face) and height $h = l$.

$$V = \frac{1}{3}\pi r^2 h = \frac{1}{3}\pi\left(\frac{l}{2}\right)^2 \times l = \frac{\pi l^3}{12}$$

Explanation

- The largest cone carved from a cube of edge l has its circular base inscribed in one face of the cube, giving radius $= l/2$, and height $= l$ (the edge length).
- Substitute into $V = \frac{1}{3}\pi r^2 h$ to get $\frac{\pi l^3}{12}$.
- A common mistake is taking $r = l$; remember the radius is **half** the edge since the circle is inscribed in the square face.

Q9. § 12.2 Surface Area of a Combination of Solids § 12.3 Volume of a Combination of Solids § 12.4 Summary **[1]**

A hemispherical bowl is made of steel of thickness 1 cm. The outer radius of the bowl is 6 cm. The volume of steel used (in cm^3) is :

A 182π
B $\frac{182}{3}\pi$
C $\frac{682}{3}\pi$
D $\frac{364}{3}\pi$

Previously asked in: 2026 30/2/1 Q16

◆ **Surface Areas and Volumes** 12.3 Volume of a Combination of Solids

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Model Answer

Outer radius $R = 6$ cm, inner radius $r = 6 - 1 = 5$ cm.

Volume of steel = Volume of outer hemisphere − Volume of inner hemisphere

$$= \frac{2}{3}\pi R^3 - \frac{2}{3}\pi r^3 = \frac{2}{3}\pi(6^3 - 5^3) = \frac{2}{3}\pi(216 - 125) = \frac{2}{3}\pi \times 91 = \frac{182}{3}\pi \text{ cm}^3$$

Answer: (B) $\frac{182}{3}\pi$

Explanation

The key idea: the bowl is hollow, so subtract the volume of the inner hemisphere from the outer one. Thickness = 1 cm gives inner radius = outer radius − 1 = 5 cm. Use $V = \frac{2}{3}\pi r^3$ for a hemisphere. Many students mistakenly use full sphere formula — remember it's a **hemispherical** bowl, so use $\frac{2}{3}\pi r^3$.

Q10. § 12.2 Surface Area of a Combination of Solids | § 12.3 Volume of a Combination of Solids | § 12.4 Summary **[3]**

A solid is in the form of a cylinder with hemispherical ends. The total height of the solid is 20 cm and the diameter of the cylinder is 7 cm. Find the total volume of the solid. (Use $\pi = \frac{22}{7}$)

Previously asked in: 2026 30/1/1 Q30

◆ **Surface Areas and Volumes** | 12.3 Volume of a Combination of Solids

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Model Answer

Given: Total height = 20 cm, Diameter = 7 cm → Radius (r) = 3.5 cm

The solid has a cylinder with two hemispherical ends.

Height of cylinder = Total height − 2 × radius of hemisphere

$$= 20 - 2 \times 3.5 = 13 \text{ cm}$$

Total Volume = Volume of cylinder + Volume of 2 hemispheres

$$= \pi r^2 h + 2 \times \frac{2}{3}\pi r^3 = \pi r^2 h + \frac{4}{3}\pi r^3$$

$$= \frac{22}{7} \times (3.5)^2 \times 13 + \frac{4}{3} \times \frac{22}{7} \times (3.5)^3$$

$$= \frac{22}{7} \times 12.25 \times 13 + \frac{4}{3} \times \frac{22}{7} \times 42.875$$

$$= 500.5 + 179.67 = 680.17 \text{ cm}^3 \approx 680.17 \text{ cm}^3$$

Total volume of the solid ≈ 680.17 cm³

Source: Chapter 12, Section 12.3 — Volume of a Combination of Solids

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Explanation

- The key step students miss: the cylinder's height is **not** 20 cm. Subtract both hemispherical radii (2 × 3.5 = 7 cm) from the total height to get the cylinder's height = 13 cm.
- Two hemispheres together = one full sphere, so use $\frac{4}{3}\pi r^3$.
- Write the formula first, then substitute — examiners award marks for each correct step (formula, substitution, calculation).

Q11. § 12.2 Surface Area of a Combination of Solids § 12.3 Volume of a Combination of Solids § 12.4 Summary **[2]**

150 spherical marbles, each of diameter 1.4 cm, are dropped in a cylindrical vessel of diameter 7 cm containing some water, and are completely immersed in water. Find the rise in the level of water in the cylindrical vessel.

Previously asked in: 2022 30/3/1 Q4(a) (OR-1)

◆ **Surface Areas and Volumes** 12.3 Volume of a Combination of Solids

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Model Answer

Radius of each marble $r = \dfrac{1.4}{2} = 0.7$ cm

Volume of 150 marbles $= 150 \times \dfrac{4}{3}\pi r^3 = 150 \times \dfrac{4}{3} \times \dfrac{22}{7} \times (0.7)^3$

$= 150 \times \dfrac{4}{3} \times \dfrac{22}{7} \times 0.343 = 154$ cm³

Radius of cylindrical vessel $R = \dfrac{7}{2} = 3.5$ cm

Let rise in water level $= h$

Volume of water displaced $=$ Volume of marbles

$\pi R^2 h = 154$

$\dfrac{22}{7} \times 3.5 \times 3.5 \times h = 154$

$38.5 \times h = 154$

$h = \dfrac{154}{38.5} = 4$ cm

The rise in the level of water = 4 cm.

Source: Surface Areas and Volumes, Section 12.3

Explanation

The key concept is **volume conservation**: volume of water raised = total volume of marbles submerged. Use $V_{\text{sphere}} = \dfrac{4}{3}\pi r^3$ and $V_{\text{cylinder}} = \pi R^2 h$, then equate them. Examiners expect clear working for each step and the final answer with units.

Q12. § 12.3 Volume of a Combination of Solids **[4]**

Water in a canal, 8 m wide and 6 m deep, is flowing with a speed of 12 km/hour. How much area will it irrigate in one hour, if 0.05 m of standing water is required?

Previously asked in: 2022 30/1/1 Q11(b) (OR-2)

◆ **Surface Areas and Volumes** 12.3 Volume of a Combination of Solids

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Model Answer

Given:

- Width of canal = 8 m, Depth = 6 m
- Speed of water = 12 km/h = 12000 m/h
- Standing water required = 0.05 m

Volume of water flowing in 1 hour:

Volume = length × breadth × height

$$= 12000 \times 8 \times 6 = 576000 \text{ m}^3$$

Area irrigated:

Volume of water = Area irrigated × height of standing water

$$576000 = \text{Area} \times 0.05$$

$$\text{Area} = \frac{576000}{0.05} = 1,15,20,000 \text{ m}^2 = \mathbf{1152} \text{ hectares}$$

Source: Chapter 12, Volume of a Combination of Solids

Explanation

- The key idea: water flowing through the canal for 1 hour forms a **cuboid** of dimensions (speed × time) × width × depth. Its volume equals the volume spread over the irrigated area.
- Use **Volume of canal water = Area × standing water height**, then solve for Area.
- Examiners award marks for: correct volume calculation (1 mark), setting up the equation (1 mark), correct area in m² (1 mark), and converting to hectares (1 mark). Always convert to hectares at the end (1 hectare = 10,000 m²).

Q13. § 12.2 Surface Area of a Combination of Solids § 12.4 Summary **[2]**

A solid metallic sphere of radius 10.5 cm is melted and recast into a number of smaller cones, each of radius 3.5 cm and height 3 cm. Find the number of cones so formed.

Previously asked in: 2022 30/1/1 Q2

◆ **Surface Areas and Volumes** 12.3 Volume of a Combination of Solids

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Model Answer

Volume of sphere = $\frac{4}{3}\pi r^3 = \frac{4}{3} \times \frac{22}{7} \times (10.5)^3 = \frac{4}{3} \times \frac{22}{7} \times 1157.625 = 4851 \text{ cm}^3$

Volume of one cone = $\frac{1}{3}\pi r^2 h = \frac{1}{3} \times \frac{22}{7} \times (3.5)^2 \times 3 = \frac{1}{3} \times \frac{22}{7} \times 12.25 \times 3 = 38.5 \text{ cm}^3$

Number of cones = $\frac{4851}{38.5} = \boxed{126}$

Source: Chapter 12, Section 12.3

Explanation

- The key principle: volume of sphere = total volume of all cones formed (no material is lost in recasting).
- Use $r = 10.5$ cm for sphere; $r = 3.5$ cm, $h = 3$ cm for each cone.
- Examiner expects the formula, substitution, and final answer clearly shown — all three steps earn the 2 marks.

Q14. § 12.3 Volume of a Combination of Solids **[1]**

Water in a river which is 3 m deep and 40 m wide is flowing at the rate of 2 km/h. How much water will fall into the sea in 2 minutes ?

(a) 800 m^3
(b) 4000 m^3
(c) 8000 m^3
(d) 2000 m^3

Previously asked in: 2023 30/5/1 Q9

◆ **Surface Areas and Volumes** Volume of water flow (rate problems using cuboid/prism volume)

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Model Answer

(b) 4000 m³

Distance covered in 2 min = $2000 \times \dfrac{2}{60} = \dfrac{200}{3}$ m. Volume = $3 \times 40 \times \dfrac{200}{3} = 8000$ m³.

Wait — recalculating: distance = $2\text{ km/h} \times \dfrac{2}{60}\text{ h} = \dfrac{2}{15}\text{ km} = \dfrac{200}{3}$ m.

Volume $= 3 \times 40 \times \dfrac{200}{3} = 8000$ m³. → **(c) 8000 m³**

Explanation

The river cross-section acts as the base (depth × width = 3 × 40 = 120 m²). In 2 minutes at 2 km/h, water travels $2000 \times \frac{2}{60} = \frac{200}{3}$ m. Volume = 120 × 200/3 = **8000 m³**. Option (c) is correct. A common mistake is forgetting to convert km/h to m/min before multiplying.

Q15. § 12.3 Volume of a Combination of Solids · § 12.4 Summary **[5]**

A student was asked to make a model shaped like a cylinder with two cones attached to its ends by using a thin aluminium sheet. The diameter of the model is 3 cm and its total length is 12 cm. If each cone has a height of 2 cm, find the volume of air contained in the model.

Previously asked in: 2023 30/4/1 Q34

◆ **Surface Areas and Volumes** · 12.3 Volume of a Combination of Solids

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Model Answer

Given: Diameter = 3 cm → radius (r) = 1.5 cm; Total length = 12 cm; Height of each cone = 2 cm.

Height of cylinder = 12 − 2 − 2 = **8 cm**

The model consists of **1 cylinder + 2 cones**.

Volume of cylinder:

$$V_{\text{cyl}} = \pi r^2 h = \frac{22}{7} \times (1.5)^2 \times 8 = \frac{22}{7} \times 2.25 \times 8 = \frac{396}{7} = 56.57\ \text{cm}^3$$

Volume of 2 cones:

$$V_{2\ \text{cones}} = 2 \times \frac{1}{3}\pi r^2 h = \frac{2}{3} \times \frac{22}{7} \times (1.5)^2 \times 2 = \frac{2}{3} \times \frac{22}{7} \times 4.5 = \frac{66}{7} = 9.43\ \text{cm}^3$$

Total volume of air in the model:

$$V = 56.57 + 9.43 = \boxed{66\ \text{cm}^3}$$

Source: Surface Areas and Volumes, Section 12.3 (Exercise 12.2, Q.2)

Explanation

- The key step is finding the **cylinder's height** by subtracting both cone heights from total length: 12 − 2 − 2 = 8 cm.
- Volume of the whole model = Volume of cylinder + Volume of **two** cones (not one). Students often forget to double the cone volume.
- The answer simplifies neatly to exactly **66 cm³** — examiners expect this clean value.
- Use $\pi = \dfrac{22}{7}$ as instructed in Exercise 12.2.

Q16. § 12.2 Surface Area of a Combination of Solids § 12.3 Volume of a Combination of Solids § 12.4 Summary **[5]**

A solid iron pole consists of a solid cylinder of height 200 cm and base diameter 28 cm, which is surmounted by another cylinder of height 50 cm and radius 7 cm. Find the mass of the pole, given that 1 cm^3 of iron has approximately 8 g mass.

Previously asked in: 2024 30/3/1 Q35(a) (OR-1)

◆ **Surface Areas and Volumes** 12.3 Volume of a Combination of Solids

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Model Answer

Given:

- Lower cylinder: height $h_1 = 200$ cm, base diameter $= 28$ cm $\Rightarrow r_1 = 14$ cm
- Upper cylinder: height $h_2 = 50$ cm, radius $r_2 = 7$ cm
- $\pi = \dfrac{22}{7}$

Volume of lower cylinder:

$$V_1 = \pi r_1^2 h_1 = \frac{22}{7} \times 14 \times 14 \times 200 = 123200 \text{ cm}^3$$

Volume of upper cylinder:

$$V_2 = \pi r_2^2 h_2 = \frac{22}{7} \times 7 \times 7 \times 50 = 7700 \text{ cm}^3$$

Total volume of pole:

$$V = V_1 + V_2 = 123200 + 7700 = 130900 \text{ cm}^3$$

Mass of pole:

$$\text{Mass} = 130900 \times 8 = 1047200 \text{ g} = 1047.2 \text{ kg}$$

∴ **The mass of the iron pole is 1047.2 kg.**

Source: Chapter 12, Section 12.3 – Volume of a Combination of Solids

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Explanation

- The pole is a combination of two cylinders, so **total volume = sum of individual volumes** (no part is shared/removed).
- Use $r_1 = 14$ cm (half of diameter 28 cm) carefully — a common error is using diameter directly in the formula.
- The textbook (Exercise 12.2, Q.6) has a similar problem with slightly different dimensions; the method is identical.
- Final answer must be converted from grams to kg (divide by 1000) for a sensible unit.
- Examiners award marks step-by-step: formula, substitution, each volume, total volume, and final mass — show all steps clearly.

Q17. § 12.2 Surface Area of a Combination of Solids | § 12.4 Summary **[5]**

A vessel is in the form of an inverted cone. Its height is 8 cm and the radius of its top, which is open, is 5 cm. It is filled with water up to the brim. When lead shots, each of which is a sphere of radius 0.5 cm, are dropped into the vessel, one-fourth of the water flows out. Find the number of lead shots dropped in the vessel.

Previously asked in: 2025 30/3/1 Q35

◆ **Surface Areas and Volumes** | 12.3 Volume of a Combination of Solids

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Model Answer

Given: Height of cone (h) = 8 cm, radius (r) = 5 cm, radius of each lead shot = 0.5 cm

Step 1: Volume of water in the cone (= volume of cone)

$$V_{\text{cone}} = \frac{1}{3}\pi r^2 h = \frac{1}{3} \times \frac{22}{7} \times 5 \times 5 \times 8 = \frac{2200}{21} \approx \frac{2200}{21}\ \text{cm}^3$$

Step 2: Volume of water that flows out (one-fourth)

$$V_{\text{water out}} = \frac{1}{4} \times \frac{2200}{21} = \frac{550}{21}\ \text{cm}^3$$

Step 3: Volume of each lead shot (sphere, r = 0.5 cm)

$$V_{\text{shot}} = \frac{4}{3}\pi r^3 = \frac{4}{3} \times \frac{22}{7} \times (0.5)^3 = \frac{4}{3} \times \frac{22}{7} \times \frac{1}{8} = \frac{11}{21}\ \text{cm}^3$$

Step 4: Number of lead shots

The volume of lead shots dropped = volume of water displaced = $\frac{550}{21}$ cm³

$$n = \frac{550/21}{11/21} = \frac{550}{11} = \boxed{100}$$

The number of lead shots dropped into the vessel is 100.

Source: Chapter 12, Section 12.3 (Volume of a Combination of Solids), Exercise 12.2, Q.5

Explanation

- The key concept: the volume of lead shots that sink into the vessel equals the volume of water displaced (which flows out). So: **n × V(one shot) = ¼ × V(cone)**.
- Examiners award marks at each step — writing the formula, substituting correctly, computing V(cone), V(water out), V(shot), and the final division. Don't skip steps.
- Use $\pi = \frac{22}{7}$ throughout (as instructed in the exercise) so fractions cancel neatly to give exactly 100.
- A common error is forgetting the $\frac{1}{4}$ — the shots displace only the water that *flows out*, not the entire cone's volume.

Q18. § 12.2 Surface Area of a Combination of Solids | § 12.3 Volume of a Combination of Solids | § 12.4 Summary **[3]**

A room is in the form of a cylinder surmounted by a hemispherical dome. The base radius of the hemisphere is half of the height of the cylindrical part. If the room contains $\dfrac{1408}{21}$ m^3 of air, find the height of the cylindrical part. (Use $\pi = \dfrac{22}{7}$).

Previously asked in: 2025 30/1/1 Q30

◆ **Surface Areas and Volumes** | 12.3 Volume of a Combination of Solids

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Model Answer

Let the height of the cylindrical part = h m.

Then, base radius of hemisphere = $r = \dfrac{h}{2}$ m.

Total volume of room = Volume of cylinder + Volume of hemisphere

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

$$= \pi \left(\frac{h}{2}\right)^2 h + \frac{2}{3}\pi \left(\frac{h}{2}\right)^3$$

$$= \frac{\pi h^3}{4} + \frac{2\pi h^3}{24} = \frac{\pi h^3}{4} + \frac{\pi h^3}{12} = \frac{3\pi h^3 + \pi h^3}{12} = \frac{4\pi h^3}{12} = \frac{\pi h^3}{3}$$

Given volume $= \dfrac{1408}{21}$ m³:

$$\frac{\pi h^3}{3} = \frac{1408}{21}$$

$$\frac{22}{7} \times \frac{h^3}{3} = \frac{1408}{21}$$

$$h^3 = \frac{1408}{21} \times \frac{21}{22} = \frac{1408}{22} = 64$$

$$h = 4 \text{ m}$$

The height of the cylindrical part is 4 m.

Source: Chapter 12, Section 12.3 — Volume of a Combination of Solids

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Explanation

- Key setup: since the base radius of the hemisphere equals the radius of the cylinder, and $r = h/2$, express everything in terms of h.
- Volume = $\pi r^2 h + \frac{2}{3}\pi r^3$ (cylinder + hemisphere). Combine carefully to get $\frac{\pi h^3}{3}$.
- Substituting $\pi = \frac{22}{7}$ and the given volume simplifies to $h^3 = 64$, so $h = 4$ m.
- Show all algebraic steps clearly — 3-mark questions reward working, not just the final answer.

Q19. § 12.2 Surface Area of a Combination of Solids **[1]**

An ice-cream cone of radius r and height h is completely filled by two spherical scoops of ice-cream. If radius of each spherical scoop is $\frac{r}{2}$, then $h : 2r$ equals

A $1 : 8$
B $1 : 2$
C $1 : 1$
D $2 : 1$

Previously asked in: 2026 30/4/1 Q16

◆ **Surface Areas and Volumes** 12.3 Volume of a Combination of Solids

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Model Answer

Volume of cone = Volume of two spherical scoops

$$\frac{1}{3}\pi r^2 h = 2 \times \frac{4}{3}\pi\left(\frac{r}{2}\right)^3 = 2 \times \frac{4}{3}\pi \cdot \frac{r^3}{8} = \frac{\pi r^3}{3}$$

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

Answer: B) 1 : 2

Explanation

Set volume of cone equal to total volume of the two scoops. Each scoop has radius $r/2$, so its volume is $\frac{4}{3}\pi(r/2)^3 = \frac{\pi r^3}{6}$; two scoops give $\frac{\pi r^3}{3}$. Equate with $\frac{1}{3}\pi r^2 h$ to get $h = r$, so $h : 2r = r : 2r = 1 : 2$.

Q20. § 12.2 Surface Area of a Combination of Solids | § 12.3 Volume of a Combination of Solids | § 12.4 Summary **[1]**

Three tennis balls are just packed in a cylindrical jar. If radius of each ball is r, volume of air inside the jar is

A $2\pi r^3$
B $3\pi r^3$
C $5\pi r^3$
D $4\pi r^3$

Previously asked in: 2026 30/4/1 Q13

◆ **Surface Areas and Volumes** | 12.3 Volume of a Combination of Solids

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Model Answer

Option (D) $4\pi r^3$

Volume of cylinder (radius r, height $6r$) $= \pi r^2 \times 6r = 6\pi r^3$.

Volume of 3 spheres $= 3 \times \dfrac{4}{3}\pi r^3 = 4\pi r^3$.

Volume of air $= 6\pi r^3 - 4\pi r^3 = \mathbf{4\pi r^3}$.

Source: Chapter 12, Section 12.3

Explanation

- Three balls stacked in a cylinder means the cylinder's height = $3 \times 2r = 6r$ and radius = r.
- Subtract total sphere volume from cylinder volume to get air space.
- Examiners expect the setup (cylinder dimensions), the subtraction, and the correct answer. Do not confuse diameter with radius when setting up cylinder height.

Q21. § 12.2 Surface Area of a Combination of Solids § 12.4 Summary **[1]**

The volume of the largest right circular cone that can be carved out from a solid cube of edge 2 cm is :

(a) $\frac{4\pi}{3}$ cu cm
(b) $\frac{5\pi}{3}$ cu cm
(c) $\frac{8\pi}{3}$ cu cm
(d) $\frac{2\pi}{3}$ cu cm

Previously asked in: 2024 30/1/1 Q15

◆ **Surface Areas and Volumes** Largest cone carved from a cube

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Model Answer

(d) $\frac{2\pi}{3}$ cu cm

For a cube of edge 2 cm, the largest cone has radius $r = 1$ cm and height $h = 2$ cm.

$$V = \frac{1}{3}\pi r^2 h = \frac{1}{3}\pi(1)^2(2) = \frac{2\pi}{3} \text{ cu cm}$$

Explanation

The largest cone carved from a cube of edge a has its base circle fitting the face of the cube, so radius $r = a/2$, and height = edge = a. Here $a = 2$ cm, giving $r = 1$ cm, $h = 2$ cm. Apply the cone volume formula directly. A common mistake is taking $r = 2$ cm (the full edge) instead of half the edge.

Q22. § 12.2 Surface Area of a Combination of Solids § 12.4 Summary **[1]**

A solid sphere is cut into two hemispheres. The ratio of the surface areas of sphere to that of two hemispheres taken together, is :

(a) $1 : 1$
(b) $1 : 4$
(c) $2 : 3$
(d) $3 : 2$

Previously asked in: 2024 30/1/1 Q13

◆ **Surface Areas and Volumes** 12.2 Surface Area of a Combination of Solids

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Model Answer

(c) 2 : 3

Surface area of sphere = $4\pi r^2$. Each hemisphere has CSA $= 2\pi r^2$ and a flat circular face $= \pi r^2$, so TSA of one hemisphere $= 3\pi r^2$. Total for two hemispheres $= 6\pi r^2$. Ratio $= 4\pi r^2 : 6\pi r^2 = 2 : 3$.

Explanation

When the sphere is cut, each hemisphere gains a flat circular face (πr^2). So the two hemispheres together have surface area $2(2\pi r^2 + \pi r^2) = 6\pi r^2$, not $4\pi r^2$. The sphere's surface area stays $4\pi r^2$. The key mistake students make is forgetting to add the two flat faces. Always account for newly exposed surfaces when a solid is cut.

Q23. § 12.3 Volume of a Combination of Solids | § 12.4 Summary **[4]**

> A wall mounted lamp, made of fabric, is shown below. Lamp has cuboidal shape, open from top and bottom. A spherical bulb of diameter 7 cm is latched with a very thin rod. (Ignore the rod while making calculations.) Dimensions of the cuboid are 24 cm × 12 cm × 17 cm.

Based on the above information, answer the following questions:

- **(i)** Find the surface area of the bulb. [1]
- **(ii)** What could be the maximum diameter of the bulb if at least 1 cm space is left from each side? [1]
- **(iii)** Find the area of the fabric used if there is a fold of 2 cm on top and bottom edges. OR Find the space available inside the lamp. [2]

Previously asked in: 2026 30/5/1 Q37

◆ **Surface Areas and Volumes** | 12.2 Surface Area of a Combination of Solids

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Model Answer

(i) Surface area of the bulb:

Diameter = 7 cm, so radius = 3.5 cm

Surface area = $4\pi r^2 = 4 \times \frac{22}{7} \times 3.5 \times 3.5 = 154 \text{ cm}^2$

(ii) Maximum diameter of bulb leaving 1 cm from each side:

The smallest dimension of the base = 12 cm.
Maximum diameter = 12 − 1 − 1 = **10 cm**

(iii) Area of fabric used (with 2 cm fold on top and bottom):

The fold adds 2 cm on each of the two open ends, so effective height = 17 + 2 + 2 = 21 cm.

Lateral surface area of cuboid (open top & bottom) = Perimeter of base × height
= 2(24 + 12) × 21
= 2 × 36 × 21
= **1512 cm²**

OR

Space available inside the lamp:

Volume of cuboid = 24 × 12 × 17 = 4896 cm³

Volume of bulb = $\frac{4}{3}\pi r^3 = \frac{4}{3} \times \frac{22}{7} \times 3.5^3 = \frac{4}{3} \times \frac{22}{7} \times 42.875 = 179.67 \approx 179.67 \text{ cm}^3$

Space available = 4896 − 179.67 = **4716.33 cm³**

Source: Mensuration, Surface Areas and Volumes

Explanation

- **(i)** Standard formula $4\pi r^2$; remember to halve the diameter for radius.
- **(ii)** Use the **smallest** base dimension (12 cm) to restrict bulb size; subtract 1 cm from **each** side.
- **(iii) Main option:** The fold increases the fabric height by 2 cm on both top and bottom (total +4 cm). Since the lamp is open top and bottom, only lateral faces are covered — use Perimeter × new height.

- **OR option:** Subtract bulb volume from cuboid volume. Use $\frac{4}{3}\pi r^3$ for sphere. Examiners award full marks for either option attempted correctly.

Q24. § 12.2 Surface Area of a Combination of Solids § 12.3 Volume of a Combination of Solids § 12.4 Summary **[1]**

A camping tent in hemispherical shape of radius 1.4 m, has a door opening of area 0.50 m^2. Outer surface area of the tent is

(A) $11.78\ \mathrm{m}^2$
(B) $12.32\ \mathrm{m}^2$
(C) $11.82\ \mathrm{m}^2$
(D) $12.86\ \mathrm{m}^2$

Previously asked in: 2026 30/5/1 Q12

◆ **Surface Areas and Volumes** 12.2 Surface Area of a Combination of Solids

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Model Answer

(A) 11.78 m²

CSA of hemisphere = $2\pi r^2 = 2 \times \dfrac{22}{7} \times 1.4 \times 1.4 = 12.32\ \mathrm{m}^2$

Outer surface area = $12.32 - 0.50 = \mathbf{11.82}$ — wait:

$2 \times \frac{22}{7} \times 1.96 = 12.32\ \mathrm{m}^2$; subtracting door area: $12.32 - 0.50 = 11.82\ \mathrm{m}^2$

(C) 11.82 m²

Explanation

The tent is hemispherical, so its curved surface area = $2\pi r^2 = 2 \times \frac{22}{7} \times (1.4)^2 = 12.32\ \mathrm{m}^2$. The door opening (0.50 m²) is cut out from this surface, so outer surface area = $12.32 - 0.50 = 11.82\ \mathrm{m}^2$. Key point: subtract only the door area, not the base (hemispherical tent has no floor canvas).

Q25. § 12.2 Surface Area of a Combination of Solids § 12.4 Summary **[1]**

A conical cavity of maximum volume is carved out from a wooden solid hemisphere of radius 10 cm. Curved surface area of the cavity carved out is (use $\pi = 3.14$)

(A) $314\sqrt{2}$ cm^2
(B) 314 cm^2
(C) $\frac{3140}{3}$ cm^2
(D) $3140\sqrt{2}$ cm^2

Previously asked in: 2026 30/5/1 Q7

◆ **Surface Areas and Volumes** Curved surface area of cone carved from hemisphere

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Model Answer

For maximum volume, the cone carved from a solid hemisphere has radius = 10 cm and height = 10 cm.

Slant height $l = \sqrt{r^2 + h^2} = \sqrt{10^2 + 10^2} = 10\sqrt{2}$ cm

CSA of conical cavity $= \pi r l = 3.14 \times 10 \times 10\sqrt{2} = 314\sqrt{2}$ cm²

(A) $314\sqrt{2}$ **cm²**

Source: Chapter 12, Section 12.2

Explanation

- The largest cone that fits inside a hemisphere of radius R has base radius $r = R$ and height $h = R$ (the apex touches the curved surface and the base coincides with the flat face).
- Only the **curved** (lateral) surface area of the cone is asked — use $\pi r l$, not total surface area.
- Slant height $l = \sqrt{R^2 + R^2} = R\sqrt{2}$, giving CSA $= \pi R \cdot R\sqrt{2} = \pi R^2\sqrt{2} = 3.14 \times 100 \times \sqrt{2} = 314\sqrt{2}$ cm².

Q26. § 12.2 Surface Area of a Combination of Solids § 12.3 Volume of a Combination of Solids § 12.4 Summary **[2]**

The largest sphere is carved out of a solid cube of side 21 cm. Find the volume of the sphere.

Previously asked in: 2022 30/4/1 Q6(b)

◆ **Surface Areas and Volumes** Volume of a Sphere Carved from a Cube

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Model Answer

For the largest sphere carved from a cube of side 21 cm, the diameter of the sphere = side of cube = 21 cm, so radius $r = \dfrac{21}{2} = 10.5$ cm.

$$\text{Volume of sphere} = \frac{4}{3}\pi r^3 = \frac{4}{3} \times \frac{22}{7} \times (10.5)^3$$
$$= \frac{4}{3} \times \frac{22}{7} \times 1157.625 = 4851 \text{ cm}^3$$

Explanation

The key step is recognising that the largest sphere that fits inside a cube has its diameter equal to the side of the cube. Then apply the standard formula $V = \frac{4}{3}\pi r^3$ with $\pi = \frac{22}{7}$. Examiners award one mark for identifying $r = 10.5$ cm and one mark for the correct calculation.

Q27. § 12.2 Surface Area of a Combination of Solids | § 12.3 Volume of a Combination of Solids | § 12.4 Summary **[2]**

The curved surface area of a right circular cylinder is 176 sq cm and its volume is 1232 cu cm. What is the height of the cylinder ?

Previously asked in: 2022 30/4/1 Q6(a)

◆ **Surface Areas and Volumes** | Curved Surface Area and Volume of a Right Circular Cylinder

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Model Answer

Given: CSA of cylinder = 176 cm^2, Volume = 1232 cm^3

CSA = $2\pi rh = 176$ ... (i)

Volume = $\pi r^2 h = 1232$ ... (ii)

Dividing (ii) by (i):

$$\frac{\pi r^2 h}{2\pi rh} = \frac{1232}{176}$$

$$\frac{r}{2} = 7 \implies r = 14 \text{ cm}$$

Substituting in (i):

$$2 \times \frac{22}{7} \times 14 \times h = 176$$

$$88h = 176 \implies h = 2 \text{ cm}$$

The height of the cylinder is 2 cm.

Explanation

- This question tests your ability to use two formulas simultaneously: CSA = $2\pi rh$ and Volume = $\pi r^2 h$.
- The key step is dividing Volume by CSA to eliminate h and find r first, then back-substitute to get h.
- Show both steps clearly for full marks — examiners award 1 mark for finding r and 1 mark for finding h.

Q28. § 12.2 Surface Area of a Combination of Solids | § 12.3 Volume of a Combination of Solids | § 12.4 Summary **[4]**

> A 'circus' is a company of performers who put on shows of acrobats, clowns etc. to entertain people started around 250 years back, in open fields, now generally performed in tents. One such 'Circus Tent' is shown below. The tent is in the shape of a cylinder surmounted by a conical top. If the height and diameter of cylindrical part are 9 m and 30 m respectively and height of conical part is 8 m with same diameter as that of the cylindrical part.

Case Study - 2 : The tent is in the shape of a cylinder surmounted by a conical top. If the height and diameter of cylindrical part are 9 m and 30 m respectively and height of conical part is 8 m with same diameter as that of the cylindrical part, then find:

(1) the area of the canvas used in making the tent; [3]

(2) the cost of the canvas bought for the tent at the rate ₹ 200 per sq m, if 30 sq m canvas was wasted during stitching. [1]

Previously asked in: 2022 30/2/1 Q14

◆ **Surface Areas and Volumes** | Cost Estimation using Surface Area | Surface Area of Combined Solids (Cylinder + Cone)

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Model Answer

Given: Radius (r) = 15 m, Height of cylinder (H) = 9 m, Height of cone (h) = 8 m

(1) Area of canvas used:

Slant height of cone: $l = \sqrt{r^2 + h^2} = \sqrt{15^2 + 8^2} = \sqrt{225 + 64} = \sqrt{289} = 17$ m

Curved Surface Area of cylinder = $2\pi rH = 2 \times \frac{22}{7} \times 15 \times 9 = \frac{5940}{7}$ m²

Curved Surface Area of cone = $\pi rl = \frac{22}{7} \times 15 \times 17 = \frac{5610}{7}$ m²

Total canvas area = $\frac{5940+5610}{7} = \frac{11550}{7} = \mathbf{1650\ m^2}$

(2) Cost of canvas:

Total canvas needed = 1650 + 30 = 1680 m²

Cost = 1680 × ₹200 = **₹3,36,000**

Explanation

- The tent has **no base**, so only the curved surfaces are counted — CSA of cylinder + CSA of cone.
- The slant height $l = \sqrt{r^2 + h^2}$ is a must-calculate step; examiners deduct marks if skipped.
- In part (2), remember to **add the wasted canvas (30 m²)** before multiplying by rate — a common error students make.
- Use $\pi = \frac{22}{7}$ unless told otherwise; it gives clean numbers here.

Q29. § 12.4 Summary **[1]**

The volume of a right circular cone whose area of the base is 156 cm^2 and the vertical height is 8 cm, is

A 2496 cm^3
B 1248 cm^3
C 1664 cm^3
D 416 cm^3

Previously asked in: 2023 30/6/1 Q12

◆ **Surface Areas and Volumes** Volume of a Cone

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Model Answer

Option D: 416 cm^3

Volume of cone = $\frac{1}{3} \times \text{Base Area} \times h = \frac{1}{3} \times 156 \times 8 = \frac{1248}{3} = 416 \text{ cm}^3$

Explanation

The formula for volume of a cone is $V = \frac{1}{3} \times \pi r^2 \times h$. Since base area ($\pi r^2$) is directly given as 156 cm^2, substitute directly: $\frac{1}{3} \times 156 \times 8 = 416$ cm^3. No need to find radius separately.

Q30. § 12.3 Volume of a Combination of Solids § 12.4 Summary **[3]**

A room is in the form of cylinder surmounted by a hemi-spherical dome. The base radius of hemisphere is one-half the height of cylindrical part. Find total height of the room if it contains $\left(\frac{1408}{21}\right)$ m³ of air. (Take $\pi = \frac{22}{7}$)

Previously asked in: 2023 30/1/1 Q31(a) (OR-1)

◆ **Surface Areas and Volumes** Volume of combined solids (cylinder surmounted by hemisphere)

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Model Answer

Let the base radius of hemisphere = r, then height of cylinder $h = 2r$ (given $r = \frac{h}{2}$).

Total volume of air = Volume of cylinder + Volume of hemisphere

$$\frac{1408}{21} = \pi r^2 h + \frac{2}{3}\pi r^3$$

$$\frac{1408}{21} = \pi r^2(2r) + \frac{2}{3}\pi r^3 = 2\pi r^3 + \frac{2}{3}\pi r^3 = \frac{8}{3}\pi r^3$$

$$\frac{1408}{21} = \frac{8}{3} \times \frac{22}{7} \times r^3$$

$$r^3 = \frac{1408}{21} \times \frac{3 \times 7}{8 \times 22} = \frac{1408 \times 21}{21 \times 176} = \frac{1408}{176} = 8$$

$$r = 2 \text{ m}$$

Total height = $h + r = 2r + r = 3r = 3 \times 2 = \boxed{6 \text{ m}}$

Source: Chapter 12, Section 12.3 – Volume of a Combination of Solids

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Explanation

- The key condition is: radius of hemisphere = half the height of cylinder, i.e., $r = h/2$, so $h = 2r$.
- Total volume = cylinder + hemisphere (not half-sphere surface — full volumes add up).
- Simplify to a single variable r, substitute $\pi = 22/7$, and solve for r.
- Total height = height of cylinder + radius of hemisphere (since the dome sits on top) = $2r + r = 3r$.
- Examiners expect the setup equation, substitution, and final answer clearly labelled.

Q31. § 12.4 Summary **[1]**

The curved surface area of a cone having height 24 cm and radius 7 cm, is

A 528 cm^2
B 1056 cm^2
C 550 cm^2
D 500 cm^2

Previously asked in: 2023 30/1/1 Q12

◆ **Surface Areas and Volumes** Curved Surface Area of a Cone

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Model Answer

Slant height $l = \sqrt{r^2 + h^2} = \sqrt{7^2 + 24^2} = \sqrt{49 + 576} = \sqrt{625} = 25$ cm

CSA of cone $= \pi r l = \dfrac{22}{7} \times 7 \times 25 = 550$ cm^2

Answer: C — 550 cm^2

Explanation

The key step is finding slant height l using $l = \sqrt{r^2 + h^2}$ before applying the CSA formula $\pi r l$. Students often mistakenly use height instead of slant height — always compute l first. Here $r = 7, h = 24$ gives the Pythagorean triple 7-24-25.

Q32. § 12.2 Surface Area of a Combination of Solids § 12.4 Summary **[1]**

Curved surface area of a cylinder of height 5 cm is 94.2 cm^2. Radius of the cylinder is (Take $\pi = 3.14$)

A 2 cm
B 3 cm
C 2.9 cm
D 6 cm

Previously asked in: 2023 30/1/1 Q10

◆ **Surface Areas and Volumes** Curved Surface Area of a Cylinder

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Model Answer

Using CSA of cylinder = $2\pi r h$:

$94.2 = 2 \times 3.14 \times r \times 5$

$r = \dfrac{94.2}{31.4} = 3$ cm

Answer: B) 3 cm

Explanation

Substitute the CSA formula $2\pi r h = 94.2$, plug in $\pi = 3.14$ and $h = 5$, then solve for r. The denominator $2 \times 3.14 \times 5 = 31.4$, giving $r = 3$ cm exactly. Watch units and don't confuse CSA with TSA (which adds the two circular bases).

Q33. § 12.4 Summary **[5]**

From one face of a solid cube of side 14 cm, the largest possible cone is carved out. Find the volume and surface area of the remaining solid. (Use $\pi = \frac{22}{7}, \sqrt{5} = 2.2$)

Previously asked in: 2025 30/6/1 Q34

◆ **Surface Areas and Volumes** | 12.2 Surface Area of a Combination of Solids | 12.3 Volume of a Combination of Solids

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Model Answer

Given: Cube side = 14 cm; largest cone carved from one face has radius r = 7 cm, height h = 14 cm.

Volume of remaining solid:

Volume of cube = $14^3 = 2744 \text{ cm}^3$

Volume of cone = $\dfrac{1}{3}\pi r^2 h = \dfrac{1}{3} \times \dfrac{22}{7} \times 7^2 \times 14 = \dfrac{1}{3} \times \dfrac{22}{7} \times 49 \times 14 = \dfrac{1}{3} \times 2156 = 718.67 \text{ cm}^3$

Volume of remaining solid = 2744 − 718.67 = 2025.33 cm³

Surface area of remaining solid:

Slant height of cone: $l = \sqrt{r^2 + h^2} = \sqrt{49 + 196} = \sqrt{245} = 7\sqrt{5} = 7 \times 2.2 = 15.4 \text{ cm}$

Surface area = 5 faces of cube + base of cube (with circular hole) + CSA of cone

$$= 5 \times 14^2 + (14^2 - \pi r^2) + \pi r l$$

$$= 5 \times 196 + (196 - \tfrac{22}{7} \times 49) + \tfrac{22}{7} \times 7 \times 15.4$$

$$= 980 + (196 - 154) + 338.8$$

$$= 980 + 42 + 338.8$$

Surface area of remaining solid = 1360.8 cm²

Source: Chapter 12, Surface Areas and Volumes (Sections 12.2 & 12.3)

Explanation

- The **largest cone** carved from a face of a cube of side 14 cm has **r = 7 cm** (half the face) and **h = 14 cm** (full side).
- **Volume** = Volume of cube − Volume of cone. Straightforward subtraction.
- **Surface area** is trickier: the **5 untouched faces** contribute fully; the **6th face** loses the circular base of the cone, so add $(14^2 - \pi r^2)$; then add the **curved surface area of the cone** $(\pi r l)$. The circular base of the cone is *not* added separately because it is open (carved out).
- Examiners award marks at each step: identifying r & h, slant height, each area component, and final addition — show all steps clearly.

Q34. § 12.2 Surface Area of a Combination of Solids | § 12.3 Volume of a Combination of Solids | § 12.4 Summary **[5]**

From a solid cylinder of height 24 cm and radius 5 cm, two cones of height 12 cm and radius 5 cm are hollowed out. Find the volume and surface area of the remaining solid.

Previously asked in: 2025 30/5/1 Q34(b)

◆ **Surface Areas and Volumes** | 12.2 Surface Area of a Combination of Solids | 12.3 Volume of a Combination of Solids

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Model Answer

Given: Cylinder: height = 24 cm, radius = 5 cm. Two cones hollowed out: height = 12 cm each, radius = 5 cm each.

Volume of remaining solid:

Volume of cylinder = $\pi r^2 h = \frac{22}{7} \times 5^2 \times 24 = \frac{22 \times 25 \times 24}{7} = \frac{13200}{7}$ cm³

Volume of one cone = $\frac{1}{3}\pi r^2 h = \frac{1}{3} \times \frac{22}{7} \times 25 \times 12 = \frac{2200}{7}$ cm³

Volume of two cones = $2 \times \frac{2200}{7} = \frac{4400}{7}$ cm³

Volume of remaining solid = $\frac{13200 - 4400}{7} = \frac{8800}{7} \approx$ **1257.14 cm³**

Surface Area of remaining solid:

The visible surfaces are: curved surface of cylinder + curved surfaces of two cones (the circular ends of the cylinder remain open as cone bases coincide).

CSA of cylinder = $2\pi rh = 2 \times \frac{22}{7} \times 5 \times 24 = \frac{5280}{7}$ cm²

Slant height of cone: $l = \sqrt{r^2 + h^2} = \sqrt{25 + 144} = \sqrt{169} = 13$ cm

CSA of two cones = $2 \times \pi rl = 2 \times \frac{22}{7} \times 5 \times 13 = \frac{2860}{7}$ cm²

Total Surface Area = $\frac{5280 + 2860}{7} = \frac{8140}{7} \approx$ **1162.86 cm²**

Source: Chapter 12, Sections 12.2 and 12.3

Explanation

- **Volume:** Subtract both cone volumes from the cylinder volume. Since the two cones are hollowed out internally, their base circles are inside — no circular flat areas remain on the ends of the cylinder.
- **Surface Area:** Only the curved surfaces count. The top and bottom circular faces of the cylinder are entirely removed (each cone's base = the cylinder's circular end), so no πr^2 terms are added. The slant height $l = 13$ cm is key — calculate it via Pythagoras.
- A common mistake is adding $2\pi r^2$ (circular ends of cylinder); avoid it here since both ends are fully hollowed by the cones.

Q35. § 12.2 Surface Area of a Combination of Solids | § 12.3 Volume of a Combination of Solids | § 12.4 Summary **[5]**

From one of the faces of a solid wooden cube of side 14 cm, maximum number of hemispheres of diameter 1.4 cm are scooped out. Find the total number of hemispheres that can be scooped out. Also, find the total surface area of the remaining solid.

Previously asked in: 2025 30/5/1 Q34(a)

◆ **Surface Areas and Volumes** | 12.2 Surface Area of a Combination of Solids

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Model Answer

Step 1: Number of hemispheres

Side of cube = 14 cm, diameter of hemisphere = 1.4 cm, so radius r = 0.7 cm.

Number of hemispheres along one edge = $\frac{14}{1.4} = 10$

Total hemispheres on one face = $10 \times 10 = \mathbf{100}$

Step 2: Total Surface Area of remaining solid

TSA = (Surface area of cube) − (Area of 100 circular bases on one face) + (CSA of 100 hemispheres)

- TSA of cube $= 6 \times 14^2 = 1176 \text{ cm}^2$
- Area of 100 circular holes $= 100 \times \pi r^2 = 100 \times \frac{22}{7} \times (0.7)^2 = 100 \times 1.54 = 154 \text{ cm}^2$
- CSA of 100 hemispheres $= 100 \times 2\pi r^2 = 2 \times 154 = 308 \text{ cm}^2$

$$\text{TSA} = 1176 - 154 + 308 = \mathbf{1330} \text{ cm}^{\mathbf{2}}$$

Source: Surface Area of a Combination of Solids, Chapter 12

Explanation

- The key idea is that scooping removes the flat circular area from the face but adds the curved surface of each hemisphere.
- Formula used: TSA of remaining solid = TSA of cube − $(100 \times \pi r^2) + (100 \times 2\pi r^2)$
- Examiners award marks for: correct count (100), correct formula setup, and accurate arithmetic. Show each step clearly.

Q36. § 12.3 Volume of a Combination of Solids § 12.4 Summary **[5]**

A wooden cubical die is formed by forming hemispherical depressions on each face of the cube such that face 1 has one depression, face 2 has two depressions and so on. The sum of number of hemispherical depressions on opposite faces is always 7. If the edge of the cubical die measures 5 cm and each hemispherical depression is of diameter 1.4 cm, find the total surface area of the die so formed.

Previously asked in: 2025 30/4/1 Q34

◆ **Surface Areas and Volumes** 12.2 Surface Area of a Combination of Solids

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Model Answer

Given:

- Edge of cube = 5 cm
- Diameter of each hemispherical depression = 1.4 cm, so radius r = 0.7 cm
- Opposite faces sum to 7: pairs are (1,6), (2,5), (3,4) → total depressions = 1+2+3+4+5+6 = **21**

Total Surface Area of the die:

TSA = TSA of cube − (area of 21 circular bases) + (CSA of 21 hemispheres)

Each circular base area = πr^2 and CSA of one hemisphere = $2\pi r^2$, so each depression contributes: $2\pi r^2 - \pi r^2 =$ $\boldsymbol{\pi r^2}$ (net addition per depression).

TSA of cube = $6 \times (5)^2$ = **150 cm²**

Net area added per depression = $\pi r^2 = \frac{22}{7} \times 0.7 \times 0.7$ = **1.54 cm²**

Total change = 21×1.54 = **32.34 cm²**

$$\text{Total Surface Area} = 150 + 32.34 = \boxed{182.34\ \text{cm}^2}$$

Source: Surface Area of a Combination of Solids, Chapter 12

Explanation

- The key idea (from Chapter 12) is: when a depression is made, you **subtract** the flat circular base (πr^2) but **add** the curved surface of the hemisphere ($2\pi r^2$). Net gain per depression = πr^2.
- Opposite faces summing to 7 is just standard die convention — use it only to confirm total = 21 (sum 1 to 6).
- Don't forget to count ALL 21 depressions across all 6 faces.
- Examiners award marks for: correct formula setup, correct r value, correct count (21), and final answer.

Q37. § 12.2 Surface Area of a Combination of Solids § 12.4 Summary **[1]**

On the top face of the wooden cube of side 7 cm, hemispherical depressions of radius 0.35 cm are to be formed by taking out the wood. The maximum number of depressions that can be formed is :

(a) 400
(b) 100
(c) 20
(d) 10

Previously asked in: 2025 30/4/1 Q11

◆ **Surface Areas and Volumes** Maximum number of hemispherical depressions on a cube face

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Model Answer

The top face of the cube has area = 7 × 7 = 49 cm^2.
Each depression has diameter = 2 × 0.35 = 0.70 cm, so each occupies a square of side 0.70 cm.

Number of depressions = $\dfrac{49}{0.70 \times 0.70} = \dfrac{49}{0.49} = 100$

Answer: (b) 100

Explanation

Each hemispherical depression occupies a circular area of diameter 0.70 cm. For packing purposes, treat each as fitting in a 0.70 cm × 0.70 cm square on the face. Divide total face area (49 cm^2) by area per depression (0.49 cm^2) to get the maximum count of 100. This is a straightforward area-division problem linked to Chapter 12 concepts of combining/removing solids.

Q38. § 12.2 Surface Area of a Combination of Solids | § 12.3 Volume of a Combination of Solids | § 12.4 Summary **[4]**

> A model of Leafy Ball Fountain is made to be kept on the tabletop. Water gently cascades down the ball into a decorative cylindrical pool where it is recycled. The diameter of spherical ball is 21 cm. Cylindrical pool – Outer diameter is 50 cm and inner diameter is 40 cm. Height of solid base is 14 cm. Height of water filled is 7 cm.

Observe the figure and answer the following questions:

(i) Determine the total height of the fountain. [1]

(ii) Find the volume of the ball. [1]

(iii) If one-third of the ball is submerged in the water, find the volume of the water filled in the pool. [2]

Previously asked in: 2026 30/3/1 Q38

◆ **Surface Areas and Volumes** | 12.2 Surface Area of a Combination of Solids | 12.3 Volume of a Combination of Solids

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Model Answer

(i) Total height of the fountain:

Total height = Height of solid base + Height of water filled + Radius of ball
= 14 + 7 + 10.5 = **31.5 cm**

(ii) Volume of the ball:

Radius of ball = 21/2 = 10.5 cm

$$V = \frac{4}{3}\pi r^3 = \frac{4}{3} \times \frac{22}{7} \times (10.5)^3 = \frac{4}{3} \times \frac{22}{7} \times 1157.625 = \mathbf{4851\ cm}^3$$

(iii) Volume of water filled in the pool:

Volume of water = Volume of cylindrical annular region – Volume of submerged part of ball

Inner radius = 20 cm, Outer radius = 25 cm → Inner pool radius = 20 cm

$$\text{Volume of water region (cylinder)} = \pi r^2 h = \frac{22}{7} \times (20)^2 \times 7 = 8800\ \text{cm}^3$$

Volume of ball submerged = $\dfrac{1}{3} \times 4851 = 1617\ \text{cm}^3$

$$\text{Volume of water} = 8800 - 1617 = \mathbf{7183\ cm}^3$$

Source: Mensuration – Spheres and Cylinders

Explanation

- **Part (i):** The ball sits on top of the water level, so total height adds the radius of the ball (not the diameter) to the base and water heights.
- **Part (ii):** Standard formula $\frac{4}{3}\pi r^3$; use $r = 10.5$ cm and $\pi = \frac{22}{7}$.
- **Part (iii):** The water fills the inner cylindrical region (radius 20 cm, height 7 cm) minus the portion of the ball dipped in. One-third of ball volume = $\frac{4851}{3}$ = 1617 cm^3. Subtract from the cylindrical water volume. Examiners expect both steps shown clearly for full 2 marks.

Q39. § 12.2 Surface Area of a Combination of Solids § 12.4 Summary **[2]**

A toy is in the form of a cone mounted on a hemisphere of radius 7 cm. The total height of the toy is 31 cm. Find the total surface area of the toy.

Previously asked in: 2026 30/3/1 Q25

◆ **Surface Areas and Volumes** 12.2 Surface Area of a Combination of Solids

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Model Answer

Given: radius of hemisphere = radius of cone = r = 7 cm, total height = 31 cm

Height of cone, h = 31 − 7 = 24 cm

Slant height of cone: $l = \sqrt{r^2 + h^2} = \sqrt{7^2 + 24^2} = \sqrt{49 + 576} = \sqrt{625} = 25$ cm

Total surface area of toy = CSA of hemisphere + CSA of cone

$$= 2\pi r^2 + \pi r l$$

$$= \pi r(2r + l) = \frac{22}{7} \times 7 \times (14 + 25)$$

$$= 22 \times 39 = \mathbf{858\ cm^2}$$

Source: Chapter 12, Section 12.2

Explanation

- The toy's surface consists of only the **curved surface of the hemisphere** and the **curved surface of the cone** — the flat circular base is hidden where they join, so it is not included.
- Key step: height of cone = total height − radius of hemisphere (since the hemisphere's height equals its radius).
- Examiner expects the slant height calculation clearly shown, then the final formula $\pi r(2r + l)$ applied correctly.

Q40. § 12.4 Summary **[4]**

> On a Sunday your parents took you to a fair. You could see lot of toys displayed and you wanted them to buy a Rubik's cube and a strawberry ice-cream for you.

Based on the information given above, answer the following questions :

- **(i)** Find the length of the diagonal of Rubik's cube if each edge measures 6 cm. [1]
- **(ii)** Find the volume of Rubik's cube if the length of the edge is 7 cm. [1]
- **(iii)** What is the curved surface area of hemisphere (ice-cream) if the base radius is 7 cm ? [2]

Previously asked in: 2026 30/2/1 Q38

◆ **Surface Areas and Volumes** | 12.2 Surface Area of a Combination of Solids | Diagonal of a Cube | Volume of a Cube

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Model Answer

(i) Diagonal of a cube = $\sqrt{3} \times \text{edge}$

$$= \sqrt{3} \times 6 = 6\sqrt{3} \text{ cm}$$

(ii) Volume of a cube = $(\text{edge})^3$

$$= (7)^3 = 343 \text{ cm}^3$$

(iii) Curved Surface Area of hemisphere = $2\pi r^2$

$$= 2 \times \frac{22}{7} \times 7 \times 7$$

$$= 2 \times 22 \times 7 = 308 \text{ cm}^2$$

The curved surface area of the hemisphere (ice-cream) is **308 cm²**.

Source: Surface Areas and Volumes, NCERT Class 10 Mathematics

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Explanation

- **(i)** The space diagonal of a cube with edge a is $a\sqrt{3}$. Students sometimes confuse face diagonal ($a\sqrt{2}$) with space diagonal — use $\sqrt{3}$ here.
- **(ii)** Volume of cube = side³. Straightforward substitution; unit must be cm³.
- **(iii)** CSA of hemisphere = $2\pi r^2$ (not $3\pi r^2$, which is total surface area). Being a 2-mark question, show the formula, substitution, and final answer clearly with units.

Q41. § 12.4 Summary **[1]**

Assertion (A) : The surface area of the cuboid formed by joining two cubes of sides 4 cm each, end-to-end, is 160 cm^2.
Reason (R): The surface area of a cuboid of dimensions $l \times b \times h$ is $(lb + bh + hl)$.
Select the correct answer from the options (A), (B), (C) and (D).

A Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
B Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
C Assertion (A) is true, but Reason (R) is false.
D Assertion (A) is false, but Reason (R) is true.

Previously asked in: 2026 30/2/1 Q19

◆ **Surface Areas and Volumes** 12.2 Surface Area of a Combination of Solids

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Model Answer

(D) Assertion (A) is false, but Reason (R) is true.

When two cubes of side 4 cm are joined end-to-end, the cuboid formed has dimensions 8 cm × 4 cm × 4 cm. Its surface area = 2(lb + bh + hl) = 2(32 + 16 + 32) = **160 cm²** — so A is actually **true**.

Wait — re-checking: the correct formula for TSA of cuboid is **2(lb + bh + hl)**, but Reason (R) states it as **(lb + bh + hl)** without the factor 2, which is **incorrect**.

TSA = 2(8×4 + 4×4 + 4×8) = 2(32+16+32) = 160 cm² ✓ (Assertion is true)
Reason gives formula without factor 2 → **Reason is false**.

Correct answer: (C) Assertion (A) is true, but Reason (R) is false.

Source: Surface Areas and Volumes, Chapter 12, Exercise 12.1

Explanation

- The cuboid formed: l = 8 cm, b = 4 cm, h = 4 cm → TSA = 2(lb + bh + hl) = 160 cm² → **Assertion is TRUE**.
- The correct formula for TSA of a cuboid is **2(lb + bh + hl)**. Reason (R) omits the factor of 2, writing only (lb + bh + hl) → **Reason is FALSE**.
- So the answer is **(C)**. This is a classic trap — verify both the assertion by calculation AND check the reason formula carefully.

Q42. § 12.2 Surface Area of a Combination of Solids § 12.4 Summary **[1]**

The total surface area of a solid hemisphere of diameter '$2d$' is :

(a) $3\pi d^2$
(b) $2\pi d^2$
(c) $\frac{1}{2}\pi d^2$
(d) $\frac{3}{4}\pi d^2$

Previously asked in: 2026 30/1/1 Q16

◆ **Surface Areas and Volumes** Total Surface Area of a Hemisphere

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Model Answer

(a) $3\pi d^2$

Diameter = $2d$, so radius $r = d$.
TSA of solid hemisphere $= 2\pi r^2 + \pi r^2 = 3\pi r^2 = 3\pi d^2$.

Explanation

TSA of a solid hemisphere = curved surface area ($2\pi r^2$) + circular base area (πr^2) = $3\pi r^2$. Here $r = d$, so the answer is $3\pi d^2$. Don't forget the flat circular base — a common mistake.

Q43. § 12.2 Surface Area of a Combination of Solids § 12.3 Volume of a Combination of Solids § 12.4 Summary **[4]**

John planned a birthday party for his younger sister with his friends. They decided to make some birthday caps by themselves and to buy a cake from a bakery shop. For these two items, they decided the following dimensions:
Cake: Cylindrical shape with diameter 24 cm and height 14 cm.
Cap: Conical shape with base circumference 44 cm and height 24 cm.

Based on the above information, answer the following questions:

(a) How many square cm paper would be used to make 4 such caps? [2]

(b) The bakery shop sells cakes by weight (0.5 kg, 1 kg, 1.5 kg, etc.). To have the required dimensions, how much cake should they order, if 650 cm^3 equals 100 g of cake? [2]

Previously asked in: 2022 30/3/1 Q14

◆ **Surface Areas and Volumes** 12.3 Volume of a Combination of Solids Curved Surface Area of a Cone (making conical caps)

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Model Answer

(a) Paper used for 4 caps:

Base circumference = 44 cm → $2\pi r = 44$ → r = 7 cm

Slant height, $l = \sqrt{r^2 + h^2} = \sqrt{7^2 + 24^2} = \sqrt{49 + 576} = \sqrt{625} = 25$ cm

Curved surface area of 1 cap = πrl = (22/7) × 7 × 25 = 550 cm^2

Paper for 4 caps = 4 × 550 = **2200 cm^2**

(b) Weight of cake to order:

Radius of cake = 24/2 = 12 cm, height = 14 cm

Volume = $\pi r^2 h$ = (22/7) × 12 × 12 × 14 = 6336 cm^3

Weight = 6336 ÷ 650 × 100 g = **974.8 g ≈ 1 kg**

They should order a **1 kg** cake.

Source: Surface Areas and Volumes, NCERT Class 10 Maths

Explanation

- For the cap, only the **curved surface area** (πrl) is used — no base, since caps are open at the bottom.
- Always find slant height l using $\sqrt{r^2 + h^2}$ before computing CSA of a cone.
- For part (b), compute the full cylinder volume, convert to grams, then round **up** to the nearest 0.5 kg (since they need *at least* that much cake). 974.8 g exceeds 0.5 kg, so they must order 1 kg.

Q44. § 12.4 Summary **[2]**

Three cubes of side 6 cm each, are joined as shown in Figure 1. Find the total surface area of the resulting cuboid.

Previously asked in: 2022 30/3/1 Q4(b) (OR-2)

◆ **Surface Areas and Volumes** 12.2 Surface Area of a Combination of Solids

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Model Answer

When three cubes of side 6 cm are joined end-to-end, the resulting cuboid has:

- Length = 6 × 3 = **18 cm**, Breadth = **6 cm**, Height = **6 cm**

Total Surface Area = 2(lb + bh + hl)
= 2(18×6 + 6×6 + 6×18)
= 2(108 + 36 + 108)
= 2 × 252
= **504 cm²**

Source: Surface Areas and Volumes, Chapter 12

Explanation

- The key step is finding the new dimensions of the cuboid: only the length changes (6×3 = 18 cm); breadth and height remain 6 cm each.
- Apply the standard TSA formula for a cuboid: 2(lb + bh + hl). Examiners award 1 mark for correct dimensions/setup and 1 mark for the correct final answer.
- A common error is adding the TSA of three separate cubes — remember, the joined faces are internal and must not be counted.

Q45. § 12.2 Surface Area of a Combination of Solids § 12.3 Volume of a Combination of Solids § 12.4 Summary **[4]**

From a solid cylinder of height 30 cm and radius 7 cm, a conical cavity of height 24 cm and same radius is hollowed out. Find the total surface area of the remaining solid.

Previously asked in: 2022 30/1/1 Q11(a) (OR-1)

◆ **Surface Areas and Volumes** 12.2 Surface Area of a Combination of Solids

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Model Answer

Given: Solid cylinder: height (H) = 30 cm, radius (r) = 7 cm; Conical cavity: height (h) = 24 cm, radius = 7 cm.

Slant height of cone:

$$l = \sqrt{r^2 + h^2} = \sqrt{7^2 + 24^2} = \sqrt{49 + 576} = \sqrt{625} = 25 \text{ cm}$$

Total Surface Area of remaining solid:

= CSA of cylinder + Area of top circular base + CSA of cone (inner)

$$= 2\pi rH + \pi r^2 + \pi rl$$

$$= \pi r(2H + r + l)$$

$$= \frac{22}{7} \times 7 \times (2 \times 30 + 7 + 25)$$

$$= 22 \times (60 + 7 + 25)$$

$$= 22 \times 92$$

$$= \boxed{2024 \text{ cm}^2}$$

Source: Chapter 12, Section 12.2 – Surface Area of a Combination of Solids

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Explanation

- **What surfaces remain visible:** (1) curved surface of the full cylinder (outer), (2) the top circular base of the cylinder (the bottom base now has the cone opening into it, so only the top face is a flat circle), (3) the slant/inner surface of the hollowed cone.
- The **bottom base of the cylinder is removed** when the cone is hollowed out from it — the cone shares the same base, so no flat base area is added there.
- Slant height must be calculated using Pythagoras: $l = \sqrt{r^2 + h^2}$.
- Examiner expects the formula written out clearly, substitution shown, and a neat final answer in cm².

Q46. § 12.4 Summary **[4]**

A golf ball is spherical with about 300–500 dimples that help increase its velocity while in play. Golf balls are traditionally white but available in colours also. In the given figure, a golf ball has diameter 4·2 cm and the surface has 315 dimples (hemi-spherical) of radius 2 mm.

Based on the above, answer the following questions :

(i) Find the surface area of one such dimple. [1]

(ii) Find the volume of the material dug out to make one dimple. [1]

(iii) Find the total surface area exposed to the surroundings. OR Find the volume of the golf ball. [2]

Previously asked in: 2023 30/5/1 Q36

◆ **Surface Areas and Volumes** | 12.2 Surface Area of a Combination of Solids | 12.3 Volume of a Combination of Solids

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Model Answer

Given: Diameter of golf ball = 4.2 cm → Radius R = 2.1 cm; Radius of each dimple r = 2 mm = 0.2 cm; Number of dimples = 315

(i) Surface area of one dimple (hemispherical):

$$= 2\pi r^2 = 2 \times \frac{22}{7} \times (0.2)^2 = 2 \times \frac{22}{7} \times 0.04 = \frac{1.76}{7} \approx 0.2514 \text{ cm}^2$$

(ii) Volume of material dug out for one dimple:

$$= \frac{2}{3}\pi r^3 = \frac{2}{3} \times \frac{22}{7} \times (0.2)^3 = \frac{2}{3} \times \frac{22}{7} \times 0.008 \approx 0.01676 \text{ cm}^3$$

(iii) Total surface area exposed to surroundings:

Surface area of ball = $4\pi R^2 = 4 \times \frac{22}{7} \times (2.1)^2 = 4 \times \frac{22}{7} \times 4.41 = 55.44 \text{ cm}^2$

Area of 315 circular holes removed = $315 \times \pi r^2 = 315 \times \frac{22}{7} \times 0.04 = 39.6 \text{ cm}^2$

Curved area of 315 dimples added = $315 \times 2\pi r^2 = 315 \times 0.2514 = 79.2 \text{ cm}^2$

Total surface area $= 55.44 - 39.6 + 79.2 = \mathbf{95.04} \text{ cm}^2$

OR

Volume of golf ball:

$$V = \frac{4}{3}\pi R^3 = \frac{4}{3} \times \frac{22}{7} \times (2.1)^3 = \frac{4}{3} \times \frac{22}{7} \times 9.261 = 38.808 \text{ cm}^3$$

Explanation

- **Part (i):** Curved surface area of hemisphere = $2\pi r^2$ (not $3\pi r^2$, as the base circle is not counted — the dimple opens onto the ball's surface).
- **Part (ii):** Volume of hemisphere = $\frac{2}{3}\pi r^3$.
- **Part (iii):** Total exposed area = (sphere's surface) – (315 flat circles cut away) + (315 hemispherical curved surfaces added). Examiners specifically look for all three components.
- For the **OR**, simply apply $\frac{4}{3}\pi R^3$ with R = 2.1 cm. Both options are 2-mark questions; show substitution clearly for full marks.

Q47. § 12.2 Surface Area of a Combination of Solids § 12.4 Summary **[4]**

> In a coffee shop, coffee is served in two types of cups. One is cylindrical in shape with diameter 7 cm and height 14 cm and the other is hemispherical with diameter 21 cm.

Based on the above, answer the following questions:

(i) Find the area of the base of the cylindrical cup. [1]

(ii) What is the capacity of the hemispherical cup? [2]

(iii) What is the curved surface area of the cylindrical cup? [1]

Previously asked in: 2023 30/2/1 Q37

◆ **Surface Areas and Volumes** | Area of base of a cylinder (πr²) | Curved Surface Area of a cylinder (2πrh) | Volume (capacity) of a hemisphere (2/3 πr³)

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Model Answer

(i) Area of base of cylindrical cup:

Radius = 7/2 = 3.5 cm

Area of base = $\pi r^2 = \frac{22}{7} \times 3.5 \times 3.5 = \mathbf{38.5}\ \textbf{cm}^2$

(ii) Capacity of hemispherical cup:

Radius = 21/2 = 10.5 cm

Capacity = $\frac{2}{3}\pi r^3 = \frac{2}{3} \times \frac{22}{7} \times 10.5 \times 10.5 \times 10.5$

$= \frac{2}{3} \times \frac{22}{7} \times 1157.625 = \mathbf{2425.5}\ \textbf{cm}^3$

(iii) Curved surface area of cylindrical cup:

Radius = 3.5 cm, Height = 14 cm

CSA = $2\pi rh = 2 \times \frac{22}{7} \times 3.5 \times 14 = \mathbf{308}\ \textbf{cm}^2$

Source: Surface Areas and Volumes, Chapter 12

Explanation

- For (i), only the base circle area is needed — not total surface area.
- For (ii), a hemisphere's volume is $\frac{2}{3}\pi r^3$; "capacity" means volume, so use this formula.
- For (iii), CSA of cylinder = $2\pi rh$ (excludes top and bottom circles).
- Always halve the diameter to get radius before substituting. Use $\pi = \frac{22}{7}$ unless told otherwise.

Q48. § 12.2 Surface Area of a Combination of Solids § 12.4 Summary **[1]**

The total surface area of a solid hemisphere whose diameter is d is:

(a) $3\pi d^2$
(b) $2\pi d^2$
(c) $\frac{1}{2}\pi d^2$
(d) $\frac{3}{4}\pi d^2$

Previously asked in: 2023 30/2/1 Q10

◆ **Surface Areas and Volumes** Total Surface Area of a Hemisphere

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Model Answer

(d) $\dfrac{3}{4}\pi d^2$

Since radius $r = \dfrac{d}{2}$, TSA of solid hemisphere $= 3\pi r^2 = 3\pi \left(\dfrac{d}{2}\right)^2 = \dfrac{3}{4}\pi d^2$.

Explanation

TSA of a solid hemisphere = curved surface area + circular base = $2\pi r^2 + \pi r^2 = 3\pi r^2$. Substituting $r = d/2$ gives $\frac{3}{4}\pi d^2$. Students often forget to include the flat circular base, which leads to the wrong option (b).

Q49. § 12.2 Surface Area of a Combination of Solids § 12.4 Summary **[5]**

A wooden article was made by scooping out a hemisphere from each end of a solid cylinder, as shown in the figure. If the height of the cylinder is 5·8 cm and its base is of radius 2·1 cm, find the total surface area of the article.

Previously asked in: 2024 30/5/1 Q35

◆ **Surface Areas and Volumes** 12.2 Surface Area of a Combination of Solids

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Model Answer

Given: Height of cylinder (h) = 5.8 cm, radius (r) = 2.1 cm

When a hemisphere is scooped out from each end, the article exposes:

- Curved Surface Area (CSA) of the cylinder
- CSA of two hemispheres (one from each end)

(The flat circular ends of the cylinder are removed along with the scooping.)

Total Surface Area = CSA of cylinder + 2 × CSA of hemisphere

$$= 2\pi rh + 2 \times 2\pi r^2$$

$$= 2\pi r(h + 2r)$$

$$= 2 \times \frac{22}{7} \times 2.1 \times (5.8 + 2 \times 2.1)$$

$$= 2 \times \frac{22}{7} \times 2.1 \times (5.8 + 4.2)$$

$$= 2 \times \frac{22}{7} \times 2.1 \times 10$$

$$= 2 \times 22 \times 0.3 \times 10$$

$$= 132 \text{ cm}^2$$

∴ **Total surface area of the article = 132 cm²**

Source: Chapter 12, Section 12.2 — Surface Area of a Combination of Solids

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Explanation

- The key insight: when hemispheres are **scooped out** from each end, the flat circular ends of the cylinder disappear, but the curved surfaces of the hemispheres are now part of the outer surface. So TSA = CSA of cylinder + 2 × CSA of hemisphere (not TSA of hemisphere, since the flat face is open/removed).
- Examiners award marks for: correct formula, correct substitution, correct simplification, and the final answer with units.
- Note: $2\pi r \times 2r = 4\pi r^2$ represents both hemispheres combined = one full sphere's surface area. Factoring as $2\pi r(h + 2r)$ saves calculation steps.

Q50. § 12.2 Surface Area of a Combination of Solids § 12.3 Volume of a Combination of Solids **[4]**

> Tamper-proof tetra-packed milk guarantees both freshness and security. This milk ensures uncompromised quality, preserving the nutritional values within and making it a reliable choice for health-conscious individuals.
>
> 500 mL milk is packed in a cuboidal container of dimensions 15 cm × 8 cm × 5 cm. These milk packets are then packed in cuboidal cartons of dimensions 30 cm × 32 cm × 15 cm.

Based on the above given information, answer the following questions :

- **(i)** Find the volume of the cuboidal carton. [1]
- **(ii)** Find the total surface area of a milk packet. OR How many milk packets can be filled in a carton ? [2]
- **(iii)** How much milk can the cup (as shown in the figure) hold ? [1]

Previously asked in: 2024 30/4/1 Q38

◆ **Surface Areas and Volumes** | Packing / Number of Containers Problem | Total Surface Area of a Cuboid | Volume of a Combination of Solids (Cup) | Volume of a Cuboid

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Model Answer

(i) Volume of the cuboidal carton:

Volume = l × b × h = 30 × 32 × 15 = **14,400 cm³**

(ii) Total surface area of a milk packet:

TSA = 2(lb + bh + lh)
= 2(15×8 + 8×5 + 15×5)
= 2(120 + 40 + 75)
= 2 × 235
= **470 cm²**

OR

Number of milk packets in a carton:

Volume of carton = 14,400 cm³
Volume of one milk packet = 15 × 8 × 5 = 600 cm³

Number of packets = 14,400 ÷ 600 = **24 packets**

(iii) Milk the cup can hold:

The passage states each milk packet contains **500 mL** of milk. Since the cup holds the contents of one packet, the cup can hold **500 mL** of milk.

Source: Case Study passage, Mensuration (Surface Areas and Volumes)

Explanation

- **(i)** is straightforward — apply the volume formula directly.
- **(ii)** TSA formula must be written and each step shown. The OR alternative uses ratio of volumes — both are standard 2-mark approaches.
- **(iii)** The figure-based answer relies on the passage's stated capacity of 500 mL per packet; if the cup holds one packet's worth, the answer is 500 mL. (If your actual figure shows a cup with given dimensions like a

cylinder/cone, apply the relevant volume formula instead and state the result in mL using 1 cm³ = 1 mL.)

Q51. § 12.2 Surface Area of a Combination of Solids § 12.4 Summary **[1]**

The ratio of total surface area of a solid hemisphere to the square of its radius is :

A $2\pi : 1$
B $4\pi : 1$
C $3\pi : 1$
D $1 : 4\pi$

Previously asked in: 2024 30/4/1 Q9

◆ **Surface Areas and Volumes** 12.2 Surface Area of a Combination of Solids

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Model Answer

Total surface area of a solid hemisphere = $2\pi r^2 + \pi r^2 = 3\pi r^2$

Ratio = $3\pi r^2 : r^2 = 3\pi : 1$

Answer: (C) $3\pi : 1$

Explanation

The total surface area of a solid hemisphere has two parts: the curved surface area ($2\pi r^2$) and the flat circular base (πr^2), giving $3\pi r^2$. Dividing by r^2 gives the ratio $3\pi : 1$. Students often forget to include the base area — that's the most common mistake here.

Q52. § 12.2 Surface Area of a Combination of Solids § 12.4 Summary **[5]**

A medicine capsule is in the shape of a cylinder with two hemispheres stuck to each of its ends. The length of the entire capsule is 14 mm and the diameter of the capsule is 4 mm, find its surface area. Also, find its volume.

Previously asked in: 2024 30/3/1 Q35(b) (OR-2)

◆ **Surface Areas and Volumes** 12.2 Surface Area of a Combination of Solids 12.3 Volume of a Combination of Solids

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Model Answer

Given: Total length of capsule = 14 mm, Diameter = 4 mm → Radius (r) = 2 mm

Length of cylindrical part = 14 − 2r − 2r = 14 − 2(2) − 2(2) = 14 − 4 − 4 = 6 mm

(Each hemisphere contributes a length equal to its radius.)

Surface Area:

TSA of capsule = CSA of cylinder + CSA of 2 hemispheres

$$= 2\pi rh + 2 \times 2\pi r^2$$

$$= 2 \times \frac{22}{7} \times 2 \times 6 + 2 \times 2 \times \frac{22}{7} \times 2 \times 2$$

$$= \frac{528}{7} + \frac{352}{7} = \frac{880}{7} \approx 160 \text{ mm}^2$$

Volume:

Volume of capsule = Volume of cylinder + Volume of 2 hemispheres

$$= \pi r^2 h + 2 \times \frac{2}{3}\pi r^3 = \pi r^2 h + \frac{4}{3}\pi r^3$$

$$= \frac{22}{7} \times 4 \times 6 + \frac{4}{3} \times \frac{22}{7} \times 8$$

$$= \frac{528}{7} + \frac{704}{21} = \frac{1584}{21} + \frac{704}{21} = \frac{2288}{21} \approx 109.0 \text{ mm}^3$$

Surface Area ≈ 160 mm²; Volume ≈ 109 mm³

Source: Chapter 12, Section 12.2 & 12.3

Explanation

- The capsule consists of **one cylinder + two hemispheres**. The two hemispheres together form one complete sphere.
- The cylindrical height = total length − diameter of both hemispheres = 14 − 2(2) − 2(2) = 6 mm. Students commonly make errors here.
- **Surface area** = CSA of cylinder + CSA of 2 hemispheres (= full sphere surface area $4\pi r^2$). The flat circular ends are not visible/counted because hemispheres cover them.
- **Volume** = Volume of cylinder + Volume of full sphere ($\frac{4}{3}\pi r^3$).

- Note: The textbook Exercise 12.1 Q.6 uses diameter = 5 mm; this question uses **diameter = 4 mm** — use r = 2 mm throughout.

Q53. § 12.3 Volume of a Combination of Solids | § 12.4 Summary **[4]**

> The word 'circus' has the same root as 'circle'. In a closed circular area, various entertainment acts including human skill and animal training are presented before the crowd.
>
> A circus tent is cylindrical upto a height of 8 m and conical above it. The diameter of the base is 28 m and total height of tent is 18.5 m.

The word 'circus' has the same root as 'circle'. In a closed circular area, various entertainment acts including human skill and animal training are presented before the crowd. A circus tent is cylindrical upto a height of 8 m and conical above it. The diameter of the base is 28 m and total height of tent is 18.5 m. Based on the above, answer the following questions:

- **(i)** Find slant height of the conical part. [1]
- **(ii)** Determine the floor area of the tent. [1]
- **(iii)** Find area of the cloth used for making tent. OR Find total volume of air inside an empty tent. [2]

Previously asked in: 2024 30/2/1 Q37

◆ **Surface Areas and Volumes** | 12.2 Surface Area of a Combination of Solids | Volume of a Combination of Solids

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Model Answer

Given: Diameter = 28 m → Radius (r) = 14 m, Height of cylinder (h_1) = 8 m, Total height = 18.5 m → Height of cone (h_2) = 18.5 − 8 = 10.5 m

(i) Slant height of conical part:

$$l = \sqrt{r^2 + h_2^2} = \sqrt{14^2 + 10.5^2} = \sqrt{196 + 110.25} = \sqrt{306.25} = 17.5 \text{ m}$$

(ii) Floor area of tent:

$$= \pi r^2 = \frac{22}{7} \times 14 \times 14 = 616 \text{ m}^2$$

(iii) Area of cloth used (CSA of cylinder + CSA of cone):

$$= 2\pi r h_1 + \pi r l = \pi r(2h_1 + l) = \frac{22}{7} \times 14 \times (16 + 17.5) = 44 \times 33.5 = \mathbf{1474} \text{ m}^{\mathbf{2}}$$

OR Total volume of air:

$$= \pi r^2 h_1 + \frac{1}{3}\pi r^2 h_2 = \pi r^2 \left(h_1 + \frac{h_2}{3}\right) = \frac{22}{7} \times 196 \times (8 + 3.5) = 616 \times 11.5 = \mathbf{7084} \text{ m}^{\mathbf{3}}$$

Source: Mensuration (Cylinders and Cones), Class 10 Mathematics

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Explanation

- **Slant height** uses Pythagoras: $l = \sqrt{r^2 + h_{cone}^2}$. Remember to find cone's height separately (Total – Cylinder height).
- **Floor area** is just the base circle (πr^2) — not curved surface.
- For **cloth area**, only curved surfaces are counted (no base); combine CSA of cylinder and cone.

- For **volume**, add volume of cylinder + volume of cone. Factorising πr^2 saves calculation time and reduces errors.

Q54. § 12.4 Summary **[1]**

Assertion (A): Two cubes each of edge length 10 cm are joined together. The total surface area of newly formed cuboid is 1200 cm².

Reason (R): Area of each surface of a cube of side 10 cm is 100 cm².

(A) Both Assertion (A) and Reason (R) are true. Reason (R) is the correct explanation of Assertion (A).
(B) Both Assertion (A) and Reason (R) are true. Reason (R) does not give correct explanation of (A).
(C) Assertion (A) is true but Reason (R) is not true.
(D) Assertion (A) is not true but Reason (R) is true.

Previously asked in: 2024 30/2/1 Q20

◆ **Surface Areas and Volumes** 12.2 Surface Area of a Combination of Solids

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Model Answer

(D) Assertion (A) is not true but Reason (R) is true.

When two cubes of edge 10 cm are joined, the cuboid formed is 20 cm × 10 cm × 10 cm. TSA = 2(20×10 + 10×10 + 20×10) = 2(200+100+200) = **1000 cm²**, not 1200 cm². Reason (R) is correct: each face of a 10 cm cube = 10×10 = 100 cm².

Explanation

When two cubes are joined end-to-end, two faces (one from each cube) are hidden, so the total surface area decreases. Original TSA of two cubes = 2 × 600 = 1200 cm², but joining removes 2 faces of 100 cm² each, giving 1200 − 200 = **1000 cm²**. The Assertion states 1200 cm², which is wrong. Reason (R) is independently correct (area of each face = 100 cm²), so answer is **(D)**.

Q55. § 12.3 Volume of a Combination of Solids § 12.4 Summary **[1]**

If the volumes of two cubes are in the ratio $8 : 125$, then the ratio of their surface areas is:

A $8 : 125$
B $4 : 25$
C $2 : 5$
D $16 : 25$

Previously asked in: 2025 30/3/1 Q12

◆ **Surface Areas and Volumes** Ratio of Surface Areas and Volumes of Cubes

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Model Answer

Option B: 4 : 25

If volume ratio = 8 : 125, then side ratio = $\sqrt[3]{8} : \sqrt[3]{125}$ = 2 : 5. Surface area ratio = $2^2 : 5^2$ = **4 : 25**.

Explanation

Key concept: Volume of cube $\propto a^3$ and surface area $\propto a^2$. Find the cube root of the volume ratio to get the side ratio, then square it for the surface area ratio. Don't confuse volume ratio directly with surface area ratio.

Q56. § 12.2 Surface Area of a Combination of Solids § 12.3 Volume of a Combination of Solids § 12.4 Summary **[4]**

> A skilled carpenter decided to craft a special rolling pin for the local baker. He carefully joined three cylindrical pieces of wood — two small ones on the ends and one larger in the centre — to create a perfect tool. The baker loved the rolling pin, as it rolled out the smoothest dough for breads and pastries.
>
> The length of the bigger cylindrical part is 12 cm and diameter is 7 cm and the length of each smaller cylindrical part is 5 cm and diameter is 2·1 cm.

Based on the above information, answer the following questions :

(i) Find the volume of the bigger cylindrical part. [1]

(ii) Find the curved surface area of the bigger cylindrical part. [1]

(iii) Find the ratio of the volume of the bigger cylindrical part to the total volume of the two smaller (identical) cylindrical parts. [2]

Previously asked in: 2025 30/2/1 Q38

◆ **Surface Areas and Volumes** 12.2 Surface Area of a Combination of Solids 12.3 Volume of a Combination of Solids

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Model Answer

Given:

- Bigger cylinder: length (h) = 12 cm, diameter = 7 cm → radius (R) = 3.5 cm
- Smaller cylinder: length (h) = 5 cm, diameter = 2.1 cm → radius (r) = 1.05 cm

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(i) Volume of bigger cylindrical part:

$$V = \pi R^2 h = \frac{22}{7} \times (3.5)^2 \times 12 = \frac{22}{7} \times 12.25 \times 12 = 462 \text{ cm}^3$$

(ii) Curved Surface Area of bigger cylindrical part:

$$\text{CSA} = 2\pi Rh = 2 \times \frac{22}{7} \times 3.5 \times 12 = 264 \text{ cm}^2$$

(iii) Ratio of volume of bigger part to total volume of two smaller parts:

Volume of one smaller cylinder $= \pi r^2 h = \frac{22}{7} \times (1.05)^2 \times 5 = \frac{22}{7} \times 1.1025 \times 5 = 17.325 \text{ cm}^3$

Total volume of two smaller cylinders $= 2 \times 17.325 = 34.65 \text{ cm}^3$

$$\text{Ratio} = \frac{462}{34.65} = \frac{46200}{3465} = \frac{40}{3}$$

$$\boxed{\text{Required ratio} = 40 : 3}$$

Source: Surface Areas and Volumes, CBSE Class 10 Mathematics

Explanation

- **Always halve the diameter** to get radius before substituting into formulae.

- Use $\pi = \frac{22}{7}$ unless told otherwise; it simplifies cleanly here.
- For CSA, use $2\pi rh$ (not total surface area, which includes circular ends).
- For the ratio in part (iii), compute total volume of **both** smaller cylinders combined, then simplify the ratio fully — examiners expect the final simplified form (40:3).

Q57. § 12.4 Summary **[1]**

Assertion (A): If we join two hemispheres of same radius along their bases, then we get a sphere.

Reason (R): Total Surface Area of a sphere of radius r is $3\pi r^2$.

Select the correct answer from the codes (A), (B), (C) and (D) given below.

A Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
B Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
C Assertion (A) is true, but Reason (R) is false.
D Assertion (A) is false, but Reason (R) is true.

Previously asked in: 2025 30/1/1 Q20

◆ **Surface Areas and Volumes** 12.2 Surface Area of a Combination of Solids

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Model Answer

(C) Assertion (A) is true, but Reason (R) is false.

Assertion is correct — joining two hemispheres of the same radius along their bases gives a sphere. However, the TSA of a sphere of radius r is $4\pi r^2$, not $3\pi r^2$. So Reason is false.

Explanation

- The Assertion is a basic geometric fact (two hemispheres → sphere). ✓
- The standard formula for TSA of a sphere is $4\pi r^2$. The Reason incorrectly states $3\pi r^2$ (which is the TSA of a **hemisphere** = $2\pi r^2 + \pi r^2 = 3\pi r^2$).
- Since A is true but R is false, the answer is **(C)**.

Q58. § 12.4 Summary **[3]**

The internal and external radii of a hollow hemisphere are $5\sqrt{2}$ cm and 10 cm respectively. A cone of height $5\sqrt{7}$ cm and radius $5\sqrt{2}$ cm is surmounted on the hemisphere as shown in the figure. Find the total surface area of the object in terms of π. (Use $\sqrt{2} = 1.4$)

Previously asked in: 2026 30/4/1 Q29 (OR-2)

◆ **Surface Areas and Volumes** 12.2 Surface Area of a Combination of Solids

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Model Answer

Given:

- Internal radius of hemisphere, r = 5√2 cm
- External radius of hemisphere, R = 10 cm
- Cone: height h = 5√7 cm, base radius = 5√2 cm (= r)

Slant height of cone:

$$l = \sqrt{r^2 + h^2} = \sqrt{(5\sqrt{2})^2 + (5\sqrt{7})^2} = \sqrt{50 + 175} = \sqrt{225} = 15 \text{ cm}$$

Total Surface Area = CSA of cone + CSA of outer hemisphere + CSA of inner hemisphere + Ring area (annular base)

- CSA of cone = $\pi r l = \pi(5\sqrt{2})(15) = 75\sqrt{2}\,\pi$
- CSA of outer hemisphere = $2\pi R^2 = 2\pi(10)^2 = 200\pi$
- CSA of inner hemisphere = $2\pi r^2 = 2\pi(5\sqrt{2})^2 = 100\pi$
- Annular ring area = $\pi(R^2 - r^2) = \pi(100 - 50) = 50\pi$

TSA $= 75\sqrt{2}\,\pi + 200\pi + 100\pi + 50\pi$

$$= 75(1.4)\pi + 350\pi = 105\pi + 350\pi = \boxed{455\pi \text{ cm}^2}$$

Source: Surface Area of a Combination of Solids, Chapter 12

Explanation

- The visible surfaces are: **CSA of cone** (top), **CSA of outer hemisphere** (outside), **CSA of inner hemisphere** (inside hollow), and the **annular ring** at the base (the flat circular border between inner and outer radius).
- The base of the cone coincides with the inner hollow opening, so no extra circular base is added for the cone.
- Key step: slant height l = 15 cm (clean calculation — check this first in the exam).
- Use √2 = 1.4 only at the final step: 75√2 = 75 × 1.4 = 105.
- Examiners award marks for identifying all four surface components correctly and computing l accurately.

Q59. § 12.3 Volume of a Combination of Solids **[3]**

To protect plants from heat, a shed of iron rods covered with green cloth is made. The lower part of the shed is a cuboid mounted by semi-cylinder as shown in the figure. Find the area of the cloth required to make this shed, if dimensions of the cuboid are $14 \text{ m} \times 25 \text{ m} \times 16 \text{ m}$.

Previously asked in: 2026 30/4/1 Q29 (OR-1)

◆ **Surface Areas and Volumes** 12.2 Surface Area of a Combination of Solids

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Model Answer

Given: Cuboid: 14 m × 25 m × 16 m; Semi-cylinder mounted on top (diameter = 14 m, so radius = 7 m, length = 25 m)

The cloth covers:

- Two side walls of cuboid (excluding top): 2 × (25 × 16) = 800 m^2
- Two end walls (rectangles minus semicircles) + two semicircular ends of cylinder:

2 × (14 × 16) + 2 × ½πr^2 = 448 + 22/7 × 7 × 7 = 448 + 154 = 602 m^2

- Curved surface of semi-cylinder: πrl = 22/7 × 7 × 25 = 550 m^2

Total area of cloth = 800 + 602 + 550 = 1952 m^2

Source: Surface Area of a Combination of Solids, Chapter 12, Section 12.2

Explanation

- The **top face of the cuboid is replaced by the semi-cylinder**, so it is not included.
- The **two end walls** are rectangles (14 × 16) each, but the semi-circular portion at the top of each end is part of the semi-cylinder's flat ends — add two semicircles (= one full circle = πr^2).
- The **curved surface of the semi-cylinder** = ½ × $2\pi rl$ = πrl.
- Examiner expects all three components identified and added correctly. Show each step clearly for full marks.

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