Aptitude :: Volume and Surface Area

Important Formulas

1. *CUBOID*

   Let length = l, breadth = b and height = h units. Then

   i. *Volume* = (l x b x h) cubic units.
   ii. *Surface area* = $2(lb + bh + lh)$ sq. units.
   iii. *Diagonal* = $l^2 + b^2 + h^2$ units.
2. *CUBE*

   Let each edge of a cube be of length a. Then,

   i. *Volume* = a^3 cubic units.
   ii. *Surface area* = $6a^2$ sq. units.
   iii. *Diagonal* = $3a$ units.
3. *CYLINDER*

   Let radius of base = r and Height (or length) = h. Then,

   i. *Volume* = $(\pi r^2 h)$ cubic units.
   ii. *Curved surface area* = $(2\pi rh)$ sq. units.
   iii. *Total surface area* = $2\pi r(h + r)$ sq. units.
4. *CONE*

   Let radius of base = r and Height = h. Then,

   i. *Slant height*, $l = h^2 + r^2$ units.
   ii. *Volume* = $\left(\frac{1}{3}\pi r^2 h\right)$ cubic units.
   iii. *Curved surface area* = (πrl) sq. units.
   iv. *Total surface area* = $(\pi rl + \pi r^2)$ sq. units.
5. *SPHERE*

   Let the radius of the sphere be r. Then,

   i. *Volume* = $\left(\frac{4}{3}\pi r^3\right)$ cubic units.

ii. *Surface area* = $(4\pi r^2)$ sq. units.

6. *HEMISPHERE*

Let the radius of a hemisphere be *r*. Then,

i. *Volume* = $\left(\frac{2}{3}\pi r^3\right)$ cubic units.
ii. *Curved surface area* = $(2\pi r^2)$ sq. units.
iii. *Total surface area* = $(3\pi r^2)$ sq. units.

Note: 1 litre = 1000 cm^3.

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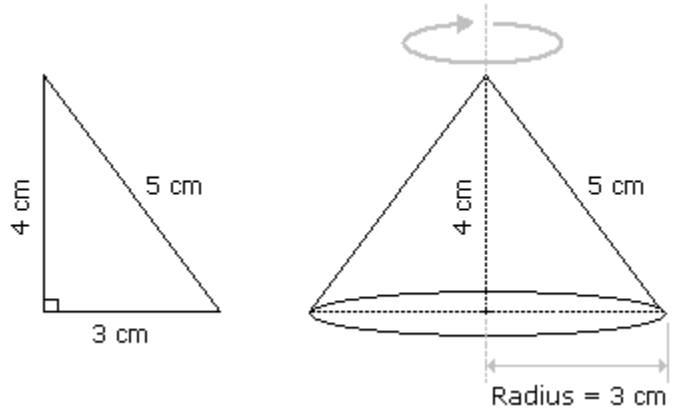
1. A right triangle with sides 3 cm, 4 cm and 5 cm is rotated about the side of 3 cm to form a cone. The volume of the cone so formed is:

A. 12π cm^3 B. 15π cm^3
C. 16π cm^3 D. 20π cm^3
Answer & Explanation

Answer: Option **A**

Explanation:



Clearly, we have $r = 3$ cm and $h = 4$ cm.

$\therefore$ Volume $= \frac{1}{3}\pi r^2 h = \left(\frac{1}{3} \text{x } \pi \text{x } 3^2 \text{ x } 4\right)_{cm^3} = 12\pi$ cm^3.

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2. In a shower, 5 cm of rain falls. The volume of water that falls on 1.5 hectares of ground is:

A. 75 cu. m B. 750 cu. m
C. 7500 cu. m D. 75000 cu. m
Answer & Explanation

Answer: Option **B**

Explanation:

1 hectare = 10,000 m^2

So, Area = (1.5 x 10000) m^2 = 15000 m^2.

Depth $= \frac{5}{100}$m$= \frac{1}{20}$m.

$\therefore$ Volume = (Area x Depth) $= \left(15000 \text{ x } \frac{1}{20}\right) = 750$ m^3.

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3. A hall is 15 m long and 12 m broad. If the sum of the areas of the floor and the ceiling is equal to the sum of the areas of four walls, the volume of the hall is:

A.720 B.900
C.1200 D.1800

Answer & Explanation

Answer: Option **C**

Explanation:

$2(15 + 12) \times h = 2(15 \times 12)$

$\Rightarrow h = \frac{180}{27}\text{m} = \frac{20}{3}\text{m}.$

$\therefore$ Volume $= \left(15 \times 12 \times \frac{20}{3}\right)\text{m}^3 = 1200\ \text{m}^3.$

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4. 66 cubic centimetres of silver is drawn into a wire 1 mm in diameter. The length of the wire in metres will be:

A.84 B.90
C.168 D.336

Answer & Explanation

Answer: Option **A**

Explanation:

Let the length of the wire be h.

Radius $= \frac{1}{2}\text{mm} = \frac{1}{20}\text{cm}$. Then,

$\Rightarrow \frac{22}{7} \times \frac{1}{20} \times \frac{1}{20} \times h = 66.$

$\Rightarrow h = \left(\frac{66 \times 20 \times 20 \times 7}{22}\right) = 8400\ \text{cm} = 84\ \text{m}.$

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5. A hollow iron pipe is 21 cm long and its external diameter is 8 cm. If the thickness of the pipe is 1 cm and iron weighs 8 g/cm^3, then the weight of the pipe is:

A.3.6 kg B.3.696 kg
C.36 kg D.36.9 kg

Answer & Explanation

Answer: Option **B**

Explanation:

External radius = 4 cm,

Internal radius = 3 cm.

Volume of iron $= \left(\frac{22}{7} \times [(4)^2 - (3)^2] \times 21 \right) cm^3$

$= \left(\frac{22}{7} \times 7 \times 1 \times 21 \right) cm^3$

$= 462\ cm^3$.

$\therefore$ Weight of iron = (462 x 8) gm = 3696 gm = 3.696 kg.

6. A boat having a length 3 m and breadth 2 m is floating on a lake. The boat sinks by 1 cm when a man gets on it. The mass of the man is:

A.12 kg B.60 kg
C.72 kg D.96 kg
Answer & Explanation

Answer: Option **B**

Explanation:

Volume of water displaced $= (3 \times 2 \times 0.01)\ m^3$

$= 0.06\ m^3$.

$\therefore$ Mass of man = Volume of water displaced x Density of water

= (0.06 x 1000) kg

= 60 kg.

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7. 50 men took a dip in a water tank 40 m long and 20 m broad on a religious day. If the average displacement of water by a man is 4 m^3, then the rise in the water level in the tank will be:

A.20 cm B.25 cm
C.35 cm D.50 cm
Answer & Explanation

Answer: Option **B**

Explanation:

Total volume of water displaced = (4 x 50) m^3 = 200 m^3.

$\therefore$ Rise in water level = $\left(\quad 200 \quad \right)$

40 x 20

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8. The slant height of a right circular cone is 10 m and its height is 8 m. Find the area of its curved surface.

A.30π m^2 B.40π m^2
C.60π m^2 D.80π m^2

Answer & Explanation

Answer: Option **C**

Explanation:

l = 10 m,

h = 8 m.

So, $r = l^2 - h^2 = (10)^2 - 8^2 = 6$ m.

$\therefore$ Curved surface area = $\pi rl = (\pi \times 6 \times 10)$ $m^2 = 60\pi$ m^2.

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9. A cistern 6m long and 4 m wide contains water up to a depth of 1 m 25 cm. The total area of the wet surface is:

A.49 m^2 B.50 m^2
C.53.5 m^2 D.55 m^2

Answer & Explanation

Answer: Option **A**

Explanation:

Area of the wet surface= $[2(lb + bh + lh) - lb]$
$= 2(bh + lh) + lb$
$= [2 (4 \times 1.25 + 6 \times 1.25) + 6 \times 4]$ m^2
$= 49$ m^2.

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10. A metallic sheet is of rectangular shape with dimensions 48 m x 36 m. From each of its corners, a square is cut off so as to make an open box. If the length of the square is 8 m, the volume of the box (in m^3) is:

A.4830 B.5120
C.6420 D.8960

Answer & Explanation

Answer: Option **B**

Explanation:

Clearly, l = (48 - 16)m = 32 m,

b = (36 -16)m = 20 m,

h = 8 m.

$\therefore$ Volume of the box = (32 x 20 x 8) m^3 = 5120 m^3.

11. The curved surface area of a cylindrical pillar is 264 m^2 and its volume is 924 m^3. Find the ratio of its diameter to its height.

A.3 : 7 B.7 : 3
C.6 : 7 D.7 : 6
Answer & Explanation

Answer: Option **B**

Explanation:

$\frac{\pi r^2 h}{2\pi rh} = \frac{924}{264} \Rightarrow r = \left(\frac{924}{264} \text{x } 2\right) = 7$ m.

And, $2\pi rh = 264 \Rightarrow h = \left(264 \text{ x } \frac{7}{22} \text{x } \frac{1}{2} \text{x } \frac{1}{7}\right) = 6$m.

$\therefore$ Required ratio = $\frac{2r}{h} = \frac{14}{6} = 7 : 3$.

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12. A cistern of capacity 8000 litres measures externally 3.3 m by 2.6 m by 1.1 m and its walls are 5 cm thick. The thickness of the bottom is:

A.90 cm B.1 dm
C.1 m D.1.1 cm
Answer & Explanation

Answer: Option **B**

Explanation:

Let the thickness of the bottom be x cm.

Then, [(330 - 10) x (260 - 10) x (110 - x)] = 8000 x 1000

$\Rightarrow$320 x 250 x (110 - x) = 8000 x 1000

$\Rightarrow (110 - x) = \frac{8000 \times 1000}{320 \times 250} = 100$

$\Rightarrow x = 10$ cm = 1 dm.

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13. What is the total surface area of a right circular cone of height 14 cm and base radius 7 cm?

A.344.35 cm^2 B.462 cm^2
C.498.35 cm^2 D.None of these
Answer & Explanation

Answer: Option **C**

Explanation:

h = 14 cm, r = 7 cm.

So, $l = (7)^2 + (14)^2 = 245 = 75$ cm.

$\therefore$ Total surface area= $\pi rl + \pi r^2$

$= \left(\frac{22}{7} \times 7 \times 75 + \frac{22}{7} \times 7 \times 7\right) cm^2$

$= [154(5 + 1)]\ cm^2$

$= (154 \times 3.236)\ cm^2$

$= 498.35\ cm^2$.

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14. A large cube is formed from the material obtained by melting three smaller cubes of 3, 4 and 5 cm side. What is the ratio of the total surface areas of the smaller cubes and the large cube?

A.2 : 1 B.3 : 2
C.25 : 18 D.27 : 20
Answer & Explanation

Answer: Option **C**

Explanation:

Volume of the large cube = $(3^3 + 4^3 + 5^3) = 216\ cm^3$.

Let the edge of the large cube be a.

So, $a^3 = 216 \Rightarrow a = 6$ cm.

$\therefore$ Required ratio = $\left(\frac{6 \times (3^2 + 4^2 + 5^2)}{6 \times 6^2}\right) = \frac{50}{36} = 25 : 18.$

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15. How many bricks, each measuring 25 cm x 11.25 cm x 6 cm, will be needed to build a wall of 8 m x 6 m x 22.5 cm?

A.5600 B.6000
C.6400 D.7200
Answer & Explanation

Answer: Option **C**

Explanation:

$$\text{Number of bricks} = \frac{\text{Volume of the wall}}{\text{Volume of 1 brick}} = \left(\frac{800 \text{ x } 600 \text{ x } 22.5}{25 \text{ x } 11.25 \text{ x } 6}\right) = 6400.$$

Directions to Solve

Each of the questions given below consists of a statement and / or a question and two statements numbered I and II given below it. You have to decide whether the data provided in the statement(s) is / are sufficient to answer the given question. Read the both statements and

- Give answer (A) if the data in Statement I alone are sufficient to answer the question, while the data in Statement II alone are not sufficient to answer the question.
- Give answer (B) if the data in Statement II alone are sufficient to answer the question, while the data in Statement I alone are not sufficient to answer the question.
- Give answer (C) if the data either in Statement I or in Statement II alone are sufficient to answer the question.
- Give answer (D) if the data even in both Statements I and II together are not sufficient to answer the question.
- Give answer(E) if the data in both Statements I and II together are necessary to answer the question.

1. What is the volume of 32 metre high cylindrical tank?
   I. The area of its base is 154 m^2.
   II. The diameter of the base is 14 m.

A. I alone sufficient while II alone not sufficient to answer
B. II alone sufficient while I alone not sufficient to answer
C. Either I or II alone sufficient to answer
D. Both I and II are not sufficient to answer
E. Both I and II are necessary to answer

Answer & Explanation

Answer: Option **C**

Explanation:

Given, height = 32 m.

I gives, area of the base = 154 m^2.

$\therefore$ Volume = (Area of the base x Height) = (154 x 32) m^3.

Thus, I alone gives the answer.

II gives, radius of the base = 7 m.

$\therefore$ Volume = $\pi r^2 h = \left(\frac{22}{7} \text{ x } 7 \text{ x } 7 \text{ x } 32\right) m^3 = 4928\ m^3$.

Thus, II alone gives the answer.

∴ Correct answer is (C).

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2. Is a given rectangular block, a cube?
I. At least 2 faces of the rectangular block are squares.
II. The volume of the block is 64.
A. I alone sufficient while II alone not sufficient to answer
B. II alone sufficient while I alone not sufficient to answer
C. Either I or II alone sufficient to answer
D. Both I and II are not sufficient to answer
E. Both I and II are necessary to answer
Answer & Explanation

Answer: Option **D**

Explanation:

I gives, any two of *l*, *b*, *h* are equal.

II gives, *lbh* = 64.

From I and II, the values of *l*, *b*, *h* may be (1 ,1 , 64), (2 ,2 ,16), (4, 4, 4).

Thus, the block may be a cube or cuboid.

∴ Correct answer is (D).

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3. What is the capacity of a cylindrical tank?
I. Radius of the base is half of its height which is 28 metres.
II. Area of the base is 616 sq. metres and its height is 28 metres.
A. I alone sufficient while II alone not sufficient to answer
B. II alone sufficient while I alone not sufficient to answer
C. Either I or II alone sufficient to answer
D. Both I and II are not sufficient to answer
E. Both I and II are necessary to answer
Answer & Explanation

Answer: Option **C**

Explanation:

I gives, h = 28 m and r = 14.

∴ Capacity = $\pi r^2 h$, which can be obtained.

Thus, I alone gives the answer.

II gives, πr^2 = 616 m^2 and h = 28 m.

∴ Capacity = (πr^2 x h) = (616 x 28) m^3.

Thus, II alone gives the answer.

∴ Correct answer is (C).

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4. What is the height of a circular cone?
   I. The area of that cone is equal to the area of a rectangle whose length is 33 cm.
   II. The area of the base of that cone is 154 sq. cm.
   A. I alone sufficient while II alone not sufficient to answer
   B. II alone sufficient while I alone not sufficient to answer
   C. Either I or II alone sufficient to answer
   D. Both I and II are not sufficient to answer
   E. Both I and II are necessary to answer
   Answer & Explanation

Answer: Option **D**

Explanation:

II gives the value of r.

But, in I, the breadth of rectangle is not given.

So, we cannot find the surface area of the cone.

Hence, the height of the cone cannot be determined.

∴ Correct answer is (D).

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5. What is the volume of a cube?
   I. The area of each face of the cube is 64 square metres.

II. The length of one side of the cube is 8 metres.

A. I alone sufficient while II alone not sufficient to answer
B. II alone sufficient while I alone not sufficient to answer
C. Either I or II alone sufficient to answer
D. Both I and II are not sufficient to answer
E. Both I and II are necessary to answer

Answer & Explanation

Answer: Option **C**

Explanation:

Let each edge be a metres. Then,

I. $a^2 = 64 \Rightarrow a = 8$ m $\Rightarrow$ Volume = $(8 \times 8 \times 8)$ $m^3 = 512$ m^3.

Thus, I alone gives the answer.

II. $a = 8$ m $\Rightarrow$ Volume = $(8 \times 8 \times 8)$ $m^3 = 512$ m^3.

Thus, II alone gives the answer.

$\therefore$ Correct answer is (C).

Directions to Solve

Each of the questions given below consists of a question followed by three statements. You have to study the question and the statements and decide which of the statement(s) is/are necessary to answer the question.

1. What is the capacity of the cylindrical tank?
   I. The area of the base is 61,600 sq. cm.
   II. The height of the tank is 1.5 times the radius.
   III. The circumference of base is 880 cm.

A. Only I and II
B. Only II and III
C. Only I and III
D. Any two of the three
E. Only II and either I or III

Answer & Explanation

Answer: Option **E**

Explanation:

Capacity = $\pi r^2 h$.

I gives, $\pi r^2 = 61600$. This gives r.

II gives, $h = 1.5\, r$.

Thus, I and II give the answer.

Again, III gives $2\pi r = 880$. This gives r.

So, II and III also give the answer.

$\therefore$ Correct answer is (E).