Sphere Questions for NMAT

Instructions

For the following questions answer them individually

Question 1

A cricket ball of radius 20cm is covered in ice of uniform thickness. The ice is melting at a consistent rate of 50cm ^{3} everyday. When the thickness of the ice is 10cm, what is the rate of decrease of the thickness of the ice sphere per day?

A 11%

B 1%

C .01%

D 0.001%

Answer: D

Explanation:

$\frac{4}{3}\pi\ (R_{ball} + R_{ice_n})^3$We are given with a cricket ball of 20 cm covered in ice of unknown cm in a shape of sphere.
when we have 10 of ice;

volume of total sphere would be = volume of (ball+ice)

= $\frac{4}{3}\pi\ (R_{ball} + R_{ice})^3$

=$\frac{4}{3}\pi\ (20 + 10)^3$

=$\frac{4}{3}\pi\ 2700$

=3600π

=113040 cm^3

Melting volume rate = $50\ cm^3$

New volume after melting one day = 113040-50 = 112990

$\frac{4}{3}\pi\ (R_{ball} + R_{ice_n})^3$ = 112990

$(R_{ball} + R_{ice_n})^3 = \frac{112990}{4\pi}\ 3\cdot$

$R_{ice_n} = \left(\frac{112990}{4\pi}\ 3\right)^{\frac{1}{3}} - R_{ball}\cdot$

$R_{ice_n} = 29.99 - R_{ball}\cdot$

New thickness of ice = 9.99

Rate of change = .01/10 =.001%

Question 2

A solid right circular cone of height 12cm and base radius of 9cm is cut at the top to form a frustum. The cut part is melted and used completely to form a sphere of radius 3cm. What is the height of the frustum?

A $4\sqrt[3]{3}$

B $3\sqrt[3]{3}$

C None of the above

D Can't be determined

Answer: C

Explanation:

The volume of the cut part=volume of sphere = $(4/3)\pi(3^3)$ = 36π.
Hence, the volume of the cut-out cone is 36π.
Let h be the height of the cut-out cone and r be the radius of the base.

Hence, $h/r = 12/9 => h = 4/3r$.
Thus, the volume of cut-out cone $= (\pi)/3 * r^2 * (4/3)r = 36\pi$
So, $r^3 = 81$
So, $r = 3\sqrt[3]{3}$. Hence $h = 4\sqrt[3]{3}$.
Hence, length of frustum $hf = 12 - 4\sqrt[3]{3}$.
Hence, correct option is none of the above.

Question 3

A sphere of radius 7 cm is melted to form regular tetrahedrons of side $2\sqrt{2}$ cm each. What volume of the material is wasted? ($\pi = 22/7$)

A 2 cm^3

B 1.27 cm^3

C 3.77 cm^3

D 0 cm^3

Answer: D

Explanation:
The volume of the sphere = (4/3)*(22/7)*(343)
The volume of the tetrahedron = $\sqrt{2} * 2\sqrt{2} * 2\sqrt{2} * 2\sqrt{2}/12$

The volume of the sphere= n x the volume of tetrahedron.

Number of tetrahedrons that can be formed = [(4/3)*(22/7)*(343)]/[$\sqrt{2} * 2\sqrt{2} * 2\sqrt{2} * 2\sqrt{2}/12$] = 539.

Here n is an integer that imply whole volume is used up to make 539 tetrahedron.

Therefore, volume wasted = 0.

Question 4

Assuming the earth to be a perfect sphere and suppose the equator (0 degree latitude) is 25,000 miles in length. What is the approximate length of the 60 degree latitude?

A 15,000 miles

B 16,667 miles

C 12,500 miles

D None of these

Answer: C

Explanation:
The radius of the circular plane containing the 60 degree latitude is (cos 60) * radius of the earth. So, length of the 60 degree latitude is 1/2 the length of equator = 12,500 miles

Question 5

A cylinder of radius 12 cm was filled to the brim. A sphere of radius 3 cm was completely immersed into the cylinder and removed out. By how much has the height of water gone down in the cylinder?

A 1 cm

B 0.5 cm

C 0.25 cm

D None of these

Answer: C

Explanation:
3.14 * 12 * 12 * h = 4/3 * 3.14 * 3 * 3 * 3 So, h = 0.25 cm

Question 6

A bronze sphere of radius 4 cm was melted and the liquid was used to make spheres of radius 1 cm each. How many smaller spheres are made in total if 50% of the bronze is wasted in the process?

Answer:32

Explanation:
Without wastage, the total number of spheres possible is $4^3 = 64$. As, 50% of the bronze is wasted, number of smaller sphere possible is 32.