

## Cylinders Problems

1. A cylindrical tank of radius  $R$  and height  $H$  must be redesigned to hold approximately twice as much liquid. Which of the following changes would be farthest from the new design requirements?
  - A. A 100% increase in  $R$  and a 50% decrease in  $H$
  - B. A 30% decrease in  $R$  and a 300% increase in  $H$
  - C. A 10% decrease in  $R$  and a 150% increase in  $H$
  - D. A 40% increase in  $R$  and no change in  $H$
  - E. A 50% increase in  $R$  and a 20% decrease in  $H$
2. A closed cylindrical tank contains  $36\pi$  cubic feet of water and is filled to half its capacity. When the tank is placed upright on its circular base on level ground, the height of the water in the tank is 4 feet. When the tank is placed on its side on level ground, what is the height, in feet, of the surface of the water above the ground?
  - (A) 2
  - (B) 3
  - (C) 4
  - (D) 6
  - (E) 9
3. Cylindrical tennis-ball cans are being packed into cartons. If each can has a radius of 2 inches and a height of 12 inches, and the dimensions of each carton are 14 inches by 16 inches by 20 inches, what is the maximum number of tennis-ball cans that can fit in each carton?
  - A. 12
  - B. 15
  - C. 20
  - D. 24
  - E. 40
4. A rectangular box has dimensions  $12 \times 10 \times 8$  inches. What is the largest possible value of right cylinder that can be placed inside the box?
  - A.  $180\pi$
  - B.  $200\pi$
  - C.  $300\pi$
  - D.  $320\pi$
  - E.  $450\pi$

5. A certain rectangular crate measures 8 feet by 10 feet by 12 feet. A cylindrical gas tank is to be made for shipment in the crate and will stand upright when the crate is placed on one of its six faces. What should the radius of the tank be if it is to be of the largest possible volume?
- A. 4  
B. 5  
C. 6  
D. 8  
E. 10
6. The inside dimensions of a rectangular wooden box are 6 inches by 8 inches by 10 inches. A cylindrical canister is to be placed inside the box so that it stands upright when the closed box rests on one of its six faces. Of all such canisters that could be used, what is the radius, in inches, of the one that has the maximum volume?
- (A) 3  
(B) 4  
(C) 5  
(D) 6  
(E) 8
7. A rectangular steel container has three equal dimensions of 8 inches. If a cylindrical canister is to be placed inside the box so that it stands upright when the box rests on one of its six faces, what is the maximum possible volume, in cubic inches, of the canister?
- (A) 128  
(B) 64  
(C)  $128(3.14)$   
(D) 512  
(E)  $512(3.14)$
8. A cylindrical can has a radius of 4 centimeters and a height of 12 centimeters. What is the area, in square centimeters, of a rectangular label that completely covers the curved surface of the can without over-lapping?
- A) 16 pi  
B) 64 pi  
C) 96 pi  
D) 192 pi  
E) 576 pi

9. When a cylindrical tank is filled with water at a rate of 22 cubic meters per hour, the level of water in the tank rises at a rate of 0.7 meters per hour. Which of the following best approximates the radius of the tank in meters?
- A.  $\sqrt{10}/2$   
 B.  $\sqrt{10}$   
 C. 4  
 D. 5  
 E. 10
10. A cylindrical water tower with radius 5 m and height 8 m is  $3/4$  full at noon. Every minute,  $.08\pi$  m<sup>3</sup> is drawn from tank, while  $.03\pi$  m<sup>3</sup> is added. Additionally, starting at 1pm and continuing each hour on the hour, there is a periodic drain of  $4\pi$  m<sup>3</sup>. From noon, how many hours will it take to drain the entire tank?
- A.  $20 \frac{2}{7}$   
 B.  $20 \frac{6}{7}$   
 C. 21  
 D.  $21 \frac{3}{7}$   
 E. 22
11. Helga and Rob like corn on the cob. Each prefers to eat the genetically modified type corn, which has perfect cylindrical shape. Helga likes to eat her corn by chewing circular strips of equal width. Rob prefers to go along the height of the cylinder, munching straight strips of the same width as Helga's strips. If Helga eats half as many circular strips as Rob eats straight strips, what is the ratio between the height and the radius of the corn on the cob?
- (A) 1:2  
 (B) 2:1  
 (C) 1: $\pi$   
 (D)  $\pi$ :1  
 (E)  $1:\sqrt{\pi}$
12. A closed cylindrical tank contains  $20\pi$  cubic feet of water and is filled to half its capacity. When the tank is placed upright on its circular base on level ground, the height of the water in the tank is 5 feet. When the tank is placed on its side on level ground, what is the height, in feet, of the surface of the water above the ground?  
 (Note: "pi" is the constant to calculate the area in a circle. Does someone know its code in the keyboard?)
- (A) 1  
 (B) 1.5  
 (C) 2  
 (D) 2.5  
 (E) 3

13. For a certain cylinder, the diameter equals the height. If every length in this cylinder is decreased by 60%, then to the nearest integer, by what percent does the volume decrease?

(A) 22%  
(B) 40%  
(C) 60%  
(D) 84%  
(E) 94 %

14. A container in the shape of a right circular cylinder is  $\frac{1}{2}$  full of water. If the volume of water in the container is 36 cubic inches and the height of the container is 9 inches, what is the diameter of the base of the cylinder, in inches?

(A)  $\frac{16}{9\pi}$   
(B)  $\frac{4}{\pi}$   
(C)  $\frac{12}{\pi}$   
(D)  $\sqrt{\frac{2}{\pi}}$   
(E)  $4\sqrt{\frac{2}{\pi}}$

15. A full stationary oil tank that is a right circular cylinder has a radius of 100 feet and a height of 25 feet. Oil is pumped from the stationary tank to an oil truck that has a tank that is a right circular cylinder until the truck's tank is completely filled. If the truck's tank has a radius of 5 feet and a height of 10 feet, how far did the oil level drop in the stationary tank?

A. 2.5 ft  
B. 1ft  
C. 0.5 ft  
D. 0.25 ft  
E. 0.025 ft

16. What is the greatest distance between two points in a cylinder where the area of the base is  $9\pi$  and height is 5?

- A.  $\sqrt{34}$
- B.  $\sqrt{48}$
- C.  $\sqrt{61}$
- D.  $\sqrt{76}$
- E.  $\sqrt{106}$

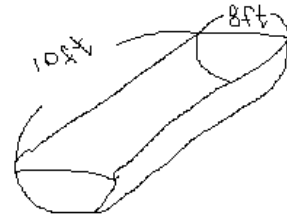
17. A soda can, in the shape of a right circular cylinder, is  $\frac{3}{4}$  full of soda. If the volume of soda in the can is  $72\pi$  cubic inches and the diameter of the can is 8 inches, then what is the height, in inches, of the can?

- A. 1.5
- B. 3
- C. 4
- D. 4.5
- E. 6

18. The figure above shows the shape and dimensions of the inside of a container that has a flat rectangular top and semicircular ends perpendicular to the top. When the container is loaded to its exact capacity with slag that weighs 50 pounds per cubic foot, what will be the approximate weight, in tons, of the slag in the container?

(1 ton = 2000 pounds)

- A. 2
- B. 4
- C. 6
- D. 8
- E. 10



19. If cylinder A has three times the height and one-third the diameter of cylinder B, what is the ratio of the volume of A to the volume of B?

- A 3:1
- B 1:1
- C 1:3
- D 1:9
- E 1:27

20. If a cylinder P has height twice that of cylinder Q; and radius of P is half of that of Q, what is the ratio between volumes of cylinders P and Q?

- 1. 1:8
- 2. 1:4
- 3. 1:2
- 4. 1:1
- 5. 2:1

21. Water is leaking out from a cylinder container at the rate of  $0.31 \text{ m}^3$  per minute. 10 minutes later, the water level decreases 0.25 meter, what is value of the radius?

- (A) 0.5
- (B) 1.0
- (C) 1.5
- (D) 2.0
- (E) 2.5

22. A right circular cone is inscribed in a hemisphere so that the base of the cone coincides with the base of the hemisphere. What is the ratio of the height of the cone to the radius of the hemisphere?

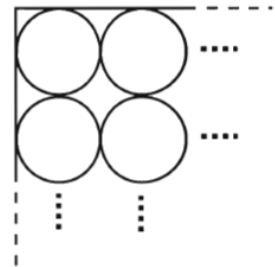
- (A)  $\sqrt{3}:1$
- (B) 1:1
- (C)  $\frac{1}{2}:1$
- (D)  $\sqrt{2}:1$
- (E) 2:1

23. A 10-by-6 inch piece of paper is used to form the lateral surface of a cylinder. If the entire piece of paper is used to make the lateral surface, which of the following must be true of the two possible cylinders that can be formed?

- A. The volume of the cylinder with height 10 is  $\frac{60}{\pi}$  cubic inches greater than the volume of the cylinder with height 6.
- B. The volume of the cylinder with height 6 is  $\frac{60}{\pi}$  cubic inches greater than the volume of the cylinder with height 10.
- C. The volume of the cylinder with height 10 is  $60\pi$  cubic inches greater than the volume of the cylinder with height 6.
- D. The volume of the cylinder with height 6 is  $60\pi$  cubic inches greater than the volume of the cylinder with height 10.
- E. The volume of the cylinder with height 6 is  $\frac{240}{\pi}$  cubic inches greater than the volume of the cylinder with height 10.

24. The inside of a rectangular carton is 48 centimeters long, 32 centimeters wide, and 15 centimeters high. The carton is filled to capacity with  $k$  identical cylindrical cans of fruit that stand upright in rows and columns, as indicated in the figure above. If the cans are 15 centimeters high, what is the value of  $k$ ?

- (1) Each of the cans has a radius of 4 centimeters.
- (2) Six of the cans fit exactly along the length of the carton.



25. What is the number of cans that can be packed in a certain carton?

- (1) The interior volume of this carton is 2,304 cubic inches.
- (2) The exterior of each can is 6 inches high and has a diameter of 4 inches.

26. How many cylindrical cans with a radius of 2 inches and a height of 6 inches can fit into a rectangular box?

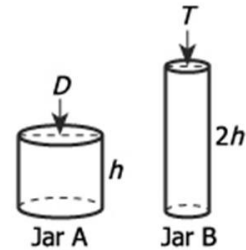
(1) The volume of the box is 240 cubic inches.

(2) The length of the box is 3 inches.

27. A supermarket sells a certain brand of jelly in two jars of different sizes, as shown above. Jar A is a right circular cylinder with inside diameter  $D$  and inside Height  $h$ ; Jar B is a right circular cylinder with inside diameter  $T$  and inside height  $2h$ . Assuming each jar is filled to capacity, which jar of jelly will cost less per unit volume?

(1) The relationship between the diameters of Jar A and Jar B is  $3T = 2D$ .

(2) Jar A costs \$1.59 and Jar B costs 1.39



28. A right circular cylinder of 72 cubic meters is completely filled with water. If water evaporates from the cylinder at a constant rate of two liters per hour per one square meter of surface, how long will it take for 30 liters of water to evaporate?

(1) The height of the cylinder is 2 meters.

(2) The radius of the base of the cylinder is  $6\pi$  meters.