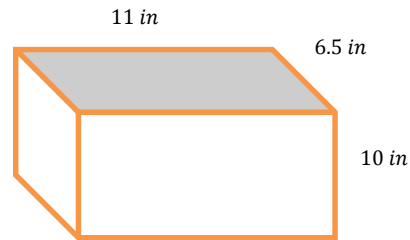


## Lesson 25: Volume and Surface Area

### Classwork

#### Opening Exercise

What is the surface area and volume of the right rectangular prism?



#### Example 1: Volume of a Fish Tank

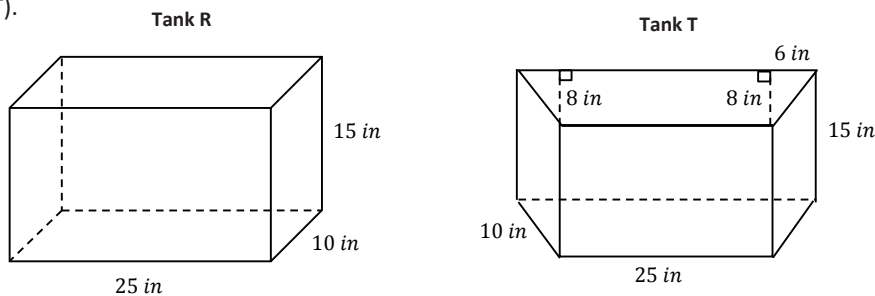
Jay has a small fish tank. It is the same shape and size as the right rectangular prism shown in the Opening Exercise.

- The box it came in says that it is a *three* gallon tank. Is this claim true? Explain your reasoning. Recall that  $1 \text{ gal} = 231 \text{ in}^3$ .
- The pet store recommends filling the tank to within 1.5 inches of the top. How many gallons of water will the tank hold if it is filled to the recommended level?
- Jay wants to cover the back, left, and right sides of the tank with a background picture. How many square inches will be covered by the picture?

- d. Water in the tank evaporates each day, causing the water level to drop. How many gallons of water have evaporated by the time the water in the tank is four inches deep? Assume the tank was filled to within 1.5 inches of the top to start.

### Exercise 1: Fish Tank Designs

Two fish tanks are shown below, one in the shape of a right rectangular prism (R) and one in the shape of a right trapezoidal prism (T).



- a. Which tank holds the most water? Let  $Vol(R)$  represent the volume of the right rectangular prism and  $Vol(T)$  represent the volume of the right trapezoidal prism. Use your answer to fill in the blanks with  $Vol(R)$  and  $Vol(T)$ .

\_\_\_\_\_ < \_\_\_\_\_

- b. Which tank has the most surface area? Let  $SA(R)$  represent the surface area of the right rectangular prism and  $SA(T)$  represent the surface area of the right trapezoidal prism. Use your answer to fill in the blanks with  $SA(R)$  and  $SA(T)$ .

\_\_\_\_\_ < \_\_\_\_\_

- c. Water evaporates from each aquarium. After the water level has dropped  $\frac{1}{2}$  inch in each aquarium, how many cubic inches of water are required to fill up each aquarium? Show work to support your answers.

**Exercise 2: Design Your Own Fish Tank**

Design at least three fish tanks that will hold approximately 10 gallons of water. All of the tanks should be shaped like right prisms. Make at least one tank have a base that is not a rectangle. For each tank, make a sketch, and calculate the volume in gallons to the nearest hundredth.

Challenge Problem: Each tank is to be constructed from glass that is  $\frac{1}{4}$  in. thick. Select one tank that you designed and determine the difference between the volume of the total tank, including the glass and the volume inside the tank. Do not include a glass top on your tank.

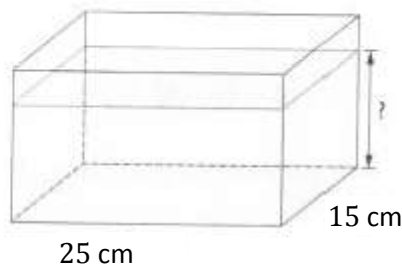
### Problem Set

- The dimensions of several rectangular fish tanks are listed below. Find the volume in cubic centimeters, the capacity in liters, and the surface area in square centimeters for each tank ( $1 \text{ L} = 1,000 \text{ cm}^3$ ). What do you observe about the change in volume compared with the change in surface area between the small tank and the extra-large tank?

Tank Size	Length (cm)	Width (cm)	Height (cm)
Small	24	18	15
Medium	30	21	20
Large	36	24	25
Extra Large	40	27	30

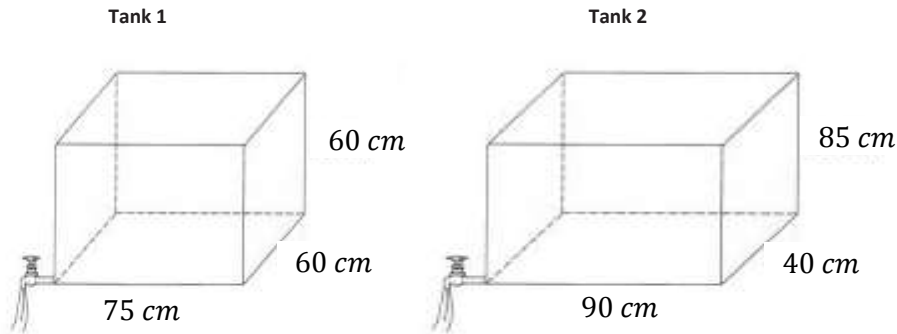
Tank Size	Volume ( $\text{cm}^3$ )	Capacity (l)	Surface Area ( $\text{cm}^2$ )
Small			
Medium			
Large			
Extra Large			

- A rectangular container 15 cm long by 25 cm wide contains 2.5 L of water.

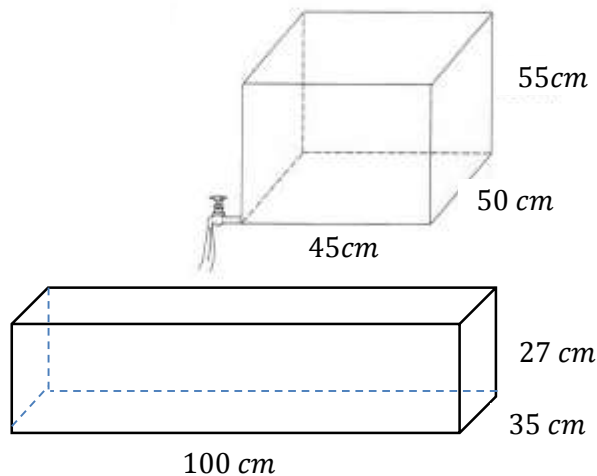


- Find the height of the water level in the container. ( $1 \text{ L} = 1,000 \text{ cm}^3$ )
  - If the height of the container is 18 cm, how many more liters of water would it take to completely fill the container?
  - What percentage of the tank is filled when it contains 2.5 liters of water?
- A rectangular container measuring 20 cm by 14.5 cm by 10.5 cm is filled with water to its brim. If  $300 \text{ cm}^3$  are drained out of the container, what will be the height of the water level?

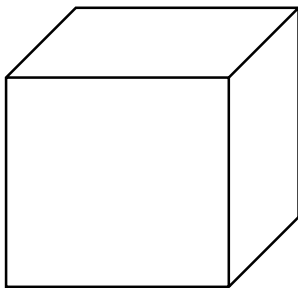
4. Two tanks are shown below. Both are filled to capacity, but the owner decides to drain them. Tank 1 is draining at a rate of 8 liters per minute. Tank 2 is draining at a rate of 10 liters per minute. Which tank empties first?



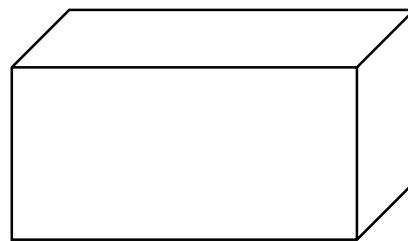
5. Two tanks are shown below. One tank is draining at a rate of 8 liters per minute into the other one, which is empty. After 10 minutes, what will be the height of the water level in the second tank?



6. Two tanks with equal volumes are shown below. The tops are open. The owner wants to cover one tank with a glass top. The cost of glass is \$0.05 per square inch. Which tank would be less expensive to cover?



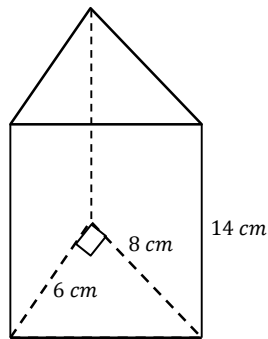
Dimensions: 12 in. long by 8 in. wide by 10 in. high



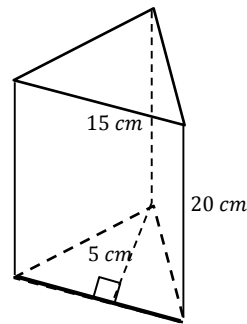
Dimensions: 15 in. long by 8 in. wide by 8 in. high

7. Each prism below is a gift box sold at the craft store.

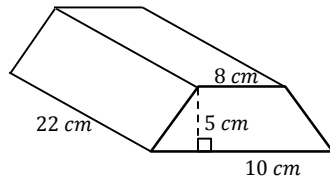
(a)



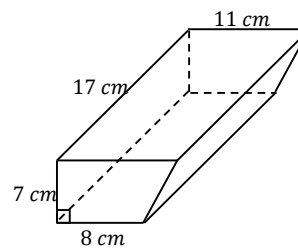
(b)



(c)



(d)



- What is the volume of each prism?
  - Jenny wants to fill each box with jelly beans. If one ounce of jelly beans is approximately  $30 \text{ cm}^3$ , estimate how many ounces of jelly beans Jenny will need to fill all four boxes? Explain your estimates.
8. Two rectangular tanks are filled at a rate of 0.5 cubic inches per minute. How long will it take each tank to be half full?
- Tank 1 Dimensions: 15 inches by 10 inches by 12.5 inches
  - Tank 2 Dimensions:  $2\frac{1}{2}$  in. by  $3\frac{3}{4}$  in. by  $4\frac{3}{8}$  in.