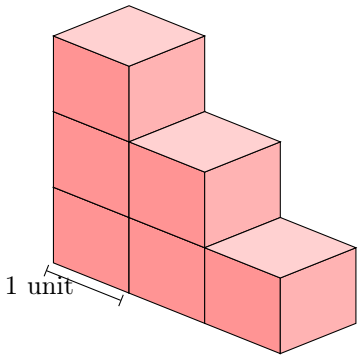
VOLUME

A DEFINITION

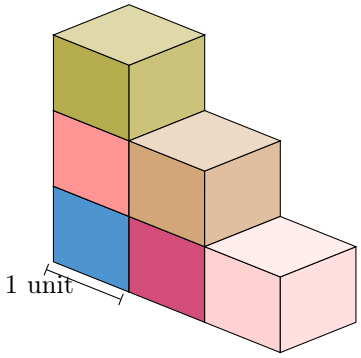
A.1 FINDING VOLUME OF A SHAPE

Ex 1: What is the volume of the red figure?



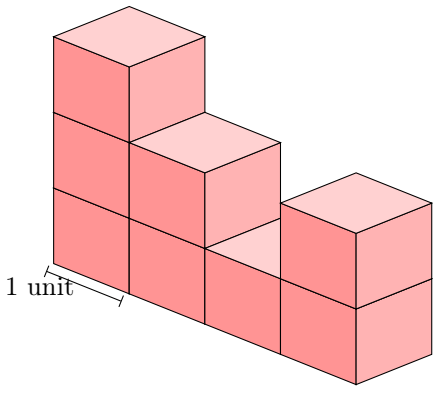
$\boxed{6}$ cubic units

Answer: To find the volume, we count the number of unit cubes inside the shape.



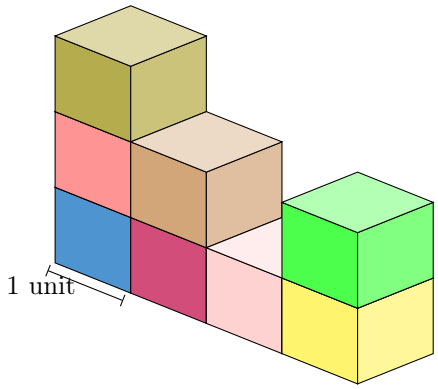
The volume is 6 cubic units.

Ex 2: What is the volume of the red figure?



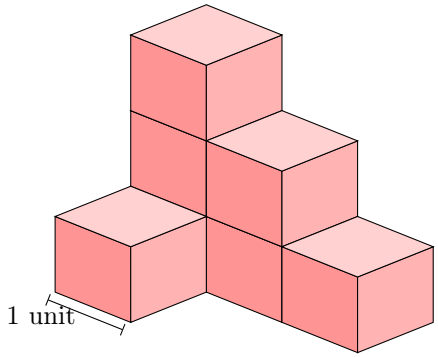
$\boxed{8}$ cubic units

Answer: To find the volume, we count the number of unit cubes inside the shape.



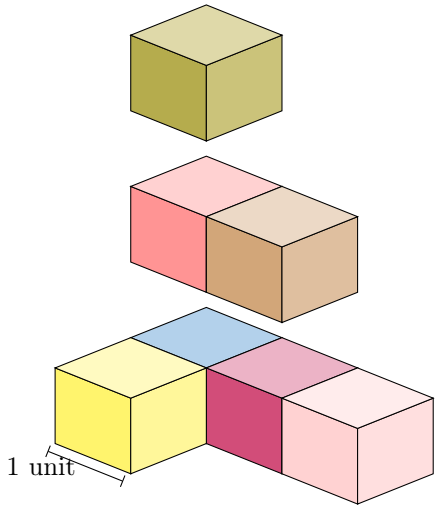
The volume is 8 cubic units.

Ex 3: What is the volume of the red figure?



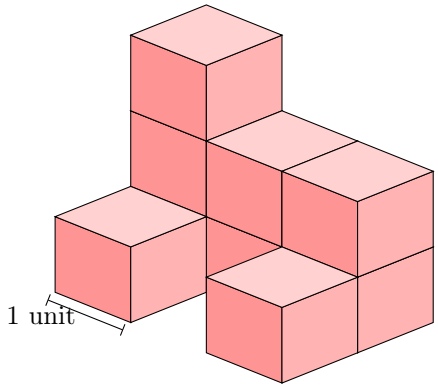
$\boxed{7}$ cubic units

Answer: To find the volume, we count the number of unit cubes inside the shape.



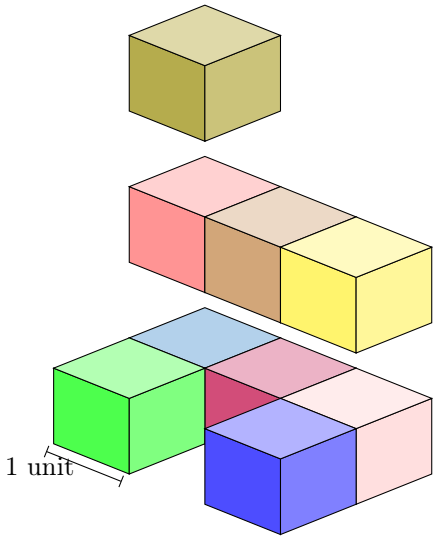
The volume is 7 cubic units.

Ex 4: What is the volume of the red figure?



9 cubic units

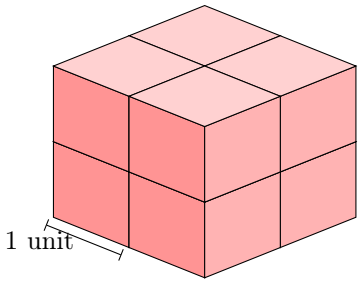
Answer: To find the volume, we count the number of unit cubes inside the shape.



The volume is 9 cubic units.

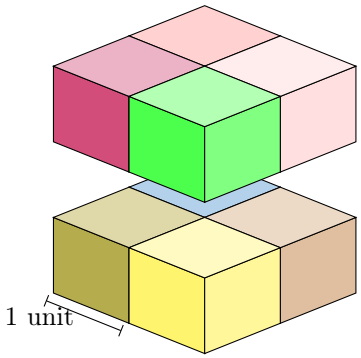
A.2 FINDING VOLUME OF A RECTANGULAR CUBOID

Ex 5: What is the volume of the red figure?



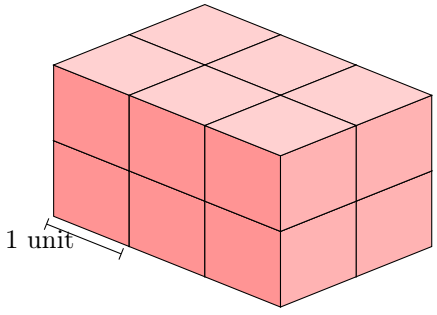
8 cubic units

Answer: To find the volume, we count the number of unit cubes inside the shape.



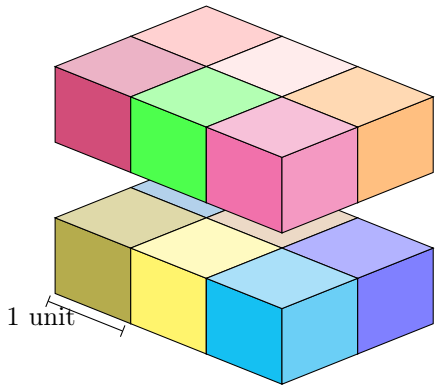
The volume is 8 cubic units.

Ex 6: What is the volume of the red figure?



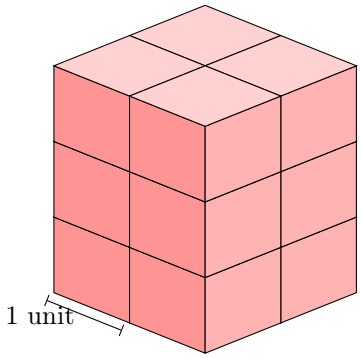
12 cubic units

Answer: To find the volume, we count the number of unit cubes inside the shape.



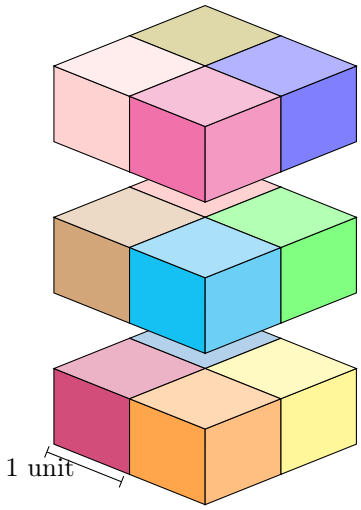
The volume is 12 cubic units.

Ex 7: What is the volume of the red figure?



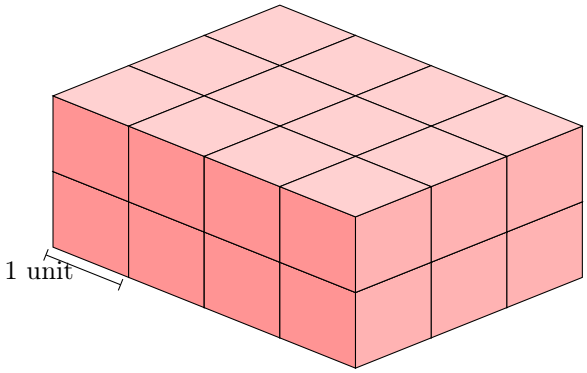
12 cubic units

Answer: To find the volume, we count the number of unit cubes inside the shape.



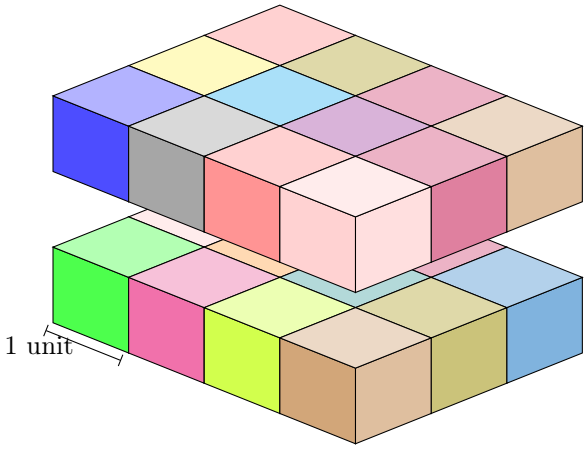
The volume is 12 cubic units.

Ex 8: What is the volume of the red figure?



24 cubic units

Answer: To find the volume, we count the number of unit cubes inside the shape.



The volume is 24 cubic units.

B UNITS OF VOLUME

B.1 CHOOSING UNITS FOR VOLUME

MCQ 9: What unit will be used to measure the volume of your bedroom?

Choose 1 answer:

- ☐ Cubic millimeters
- ☐ Cubic centimeters
- ☒ Cubic meters

Answer: Cubic meters will be used to measure the volume of your bedroom because it's a larger unit, perfect for measuring bigger spaces like a room. Cubic millimeters and cubic centimeters are too small for such a large space.

MCQ 10: What unit will be used to measure the volume of a small toy block?

Choose 1 answer:

- ☐ Cubic millimeters
- ☒ Cubic centimeters
- ☐ Cubic meters

Answer: Cubic centimeters will be used to measure the volume of a small toy block because it's a smaller unit, perfect for measuring small objects like a toy block. Cubic millimeters are too tiny, and cubic meters are too large for such a small object.

MCQ 11: What unit will be used to measure the volume of a grain of rice?

Choose 1 answer:

- ☒ Cubic millimeters
- ☐ Cubic centimeters
- ☐ Cubic meters

Answer: Cubic millimeters will be used to measure the volume of a grain of rice because it's a very small unit, perfect for measuring tiny objects like a grain of rice. Cubic centimeters are too large, and cubic meters are much too big for such a small object.

MCQ 12: What unit will be used to measure the volume of a bottle of milk?

Choose 1 answer:

- ☐ Cubic millimeters
- ☒ Cubic centimeters
- ☐ Cubic meters

Answer: Cubic centimeters will be used to measure the volume of a bottle of milk because it's a smaller unit, perfect for measuring small objects like a bottle of milk. Cubic millimeters are too tiny, and cubic meters are too large for such a small object.

MCQ 13: What unit will be used to measure the volume of a swimming pool?

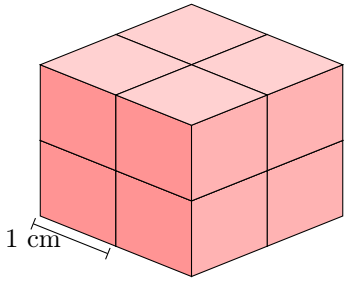
Choose 1 answer:

- ☐ Cubic millimeters
- ☐ Cubic centimeters
- ☒ Cubic meters

Answer: Cubic meters will be used to measure the volume of a swimming pool because it's a larger unit, perfect for measuring bigger spaces like a swimming pool. Cubic millimeters and cubic centimeters are too small for such a large space.

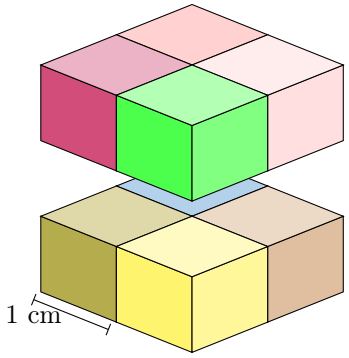
B.2 FINDING VOLUME OF A RECTANGULAR CUBOID

Ex 14: What is the volume of the red figure?



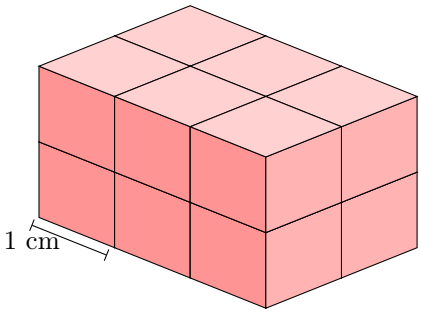
8 **cm^3**

Answer: To find the volume, we count the number of cubes inside the shape. Each cube is 1 cm by 1 cm by 1 cm, so each cube is 1 cm³.



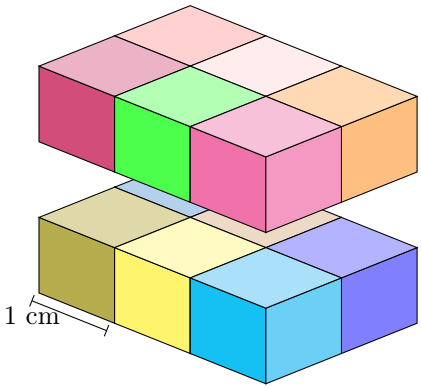
The volume is 4+4=8 cm³.

Ex 15: What is the volume of the red figure?



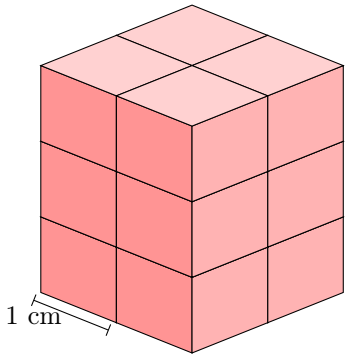
12 **cm³**

Answer: To find the volume, we count the number of cubes inside the shape. Each cube is 1 cm by 1 cm by 1 cm, so each cube is 1 cm³.



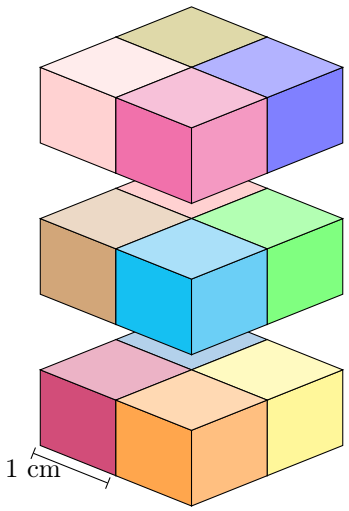
The volume is 6+6=12 cm³.

Ex 16: What is the volume of the red figure?



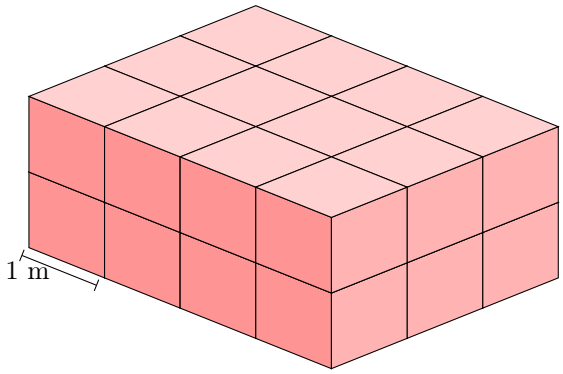
12 **cm³**

Answer: To find the volume, we count the number of cubes inside the shape. Each cube is 1 cm by 1 cm by 1 cm, so each cube is 1 cm³.



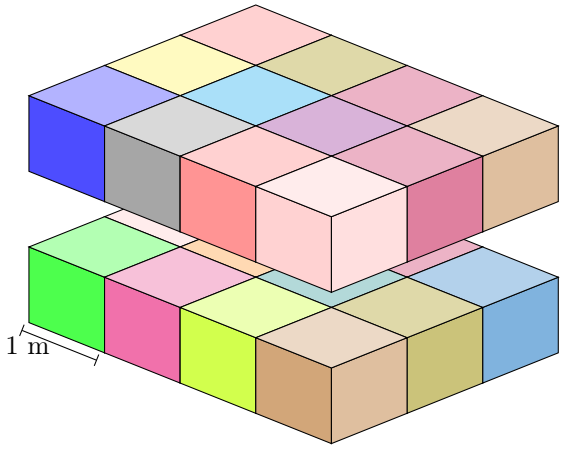
The volume is 4+4+4=12 cm³.

Ex 17: What is the volume of the red figure?



24 **m³**

Answer: To find the volume, we count the number of cubes inside the shape. Each cube is 1 m by 1 m by 1 m, so each cube is 1 m³.



The volume is 12+12=24 m³.

C CONVERSION OF VOLUME UNITS

C.1 CONVERTING VOLUME UNITS

Ex 18: Convert:

$$3\,\text{cm}^3 = \boxed{3000}\ \text{mm}^3.$$

Answer:

- *Multiplication Method:*

$$3\,\text{cm}^3 = 3 \times 1\,000\,\text{mm}^3 \quad (1\,\text{cm}^3 = 1\,000\,\text{mm}^3)$$
$$= 3\,000\,\text{mm}^3$$

- *Conversion Table Method:*

m^3						cm^3			mm^3		
								3	0	0	0

So,

$$3\,\text{cm}^3 = 3\,000\,\text{mm}^3$$

Ex 19: Convert:

$$12\,000\,\text{mm}^3 = \boxed{12}\ \text{cm}^3.$$

Answer:

- *Division Method:*

$$12\,000\,\text{mm}^3 = 12\,000 \div 1000\,\text{cm}^3 \quad (1000\,\text{mm}^3 = 1\,\text{cm}^3)$$
$$= 12\,\text{cm}^3$$

- *Conversion Table Method:*

m^3						cm^3			mm^3		
							1	2	0	0	0

So,

$$12\,000\,\text{mm}^3 = 12\,\text{cm}^3$$

Ex 20: Convert:

$$4\,\text{m}^3 = \boxed{4000000}\ \text{cm}^3.$$

Answer:

- *Multiplication Method:*

$$4\,\text{m}^3 = 4 \times 1\,000\,000\,\text{cm}^3 \quad (1\,\text{m}^3 = 1\,000\,000\,\text{cm}^3)$$
$$= 4\,000\,000\,\text{cm}^3$$

- *Conversion Table Method:*

m^3						cm^3			mm^3		
		4	0	0	0	0	0	0			

So,

$$4\,\text{m}^3 = 4\,000\,000\,\text{cm}^3$$

Ex 21: Convert:

$$15\,000\,000\,\text{cm}^3 = \boxed{15}\ \text{m}^3.$$

Answer:

- *Division Method:*

$$15\,000\,000\,\text{cm}^3 = 15\,000\,000 \div 1\,000\,000\,\text{m}^3\ (1\,000\,000\,\text{cm}^3 = 1\,\text{m}^3)$$
$$= 15\,\text{m}^3$$

- *Conversion Table Method:*

m^3						cm^3			mm^3		
	1	5	0	0	0	0	0	0			

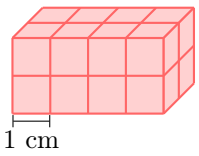
So,

$$15\,000\,000\,\text{cm}^3 = 15\,\text{m}^3$$

D VOLUME OF A RECTANGULAR CUBOID

D.1 FINDING VOLUMES OF A RECTANGULAR CUBOIDS

Ex 22: What is the volume of the red figure?

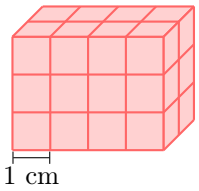


$$\boxed{16}\ \text{cm}^3$$

Answer: length=4 cm, width=2 cm and height=2 cm.

$$V = \text{length} \times \text{width} \times \text{height}$$
$$= 4\,\text{cm} \times 2\,\text{cm} \times 2\,\text{cm}$$
$$= 16\,\text{cm}^3$$

Ex 23: What is the volume of the red figure?

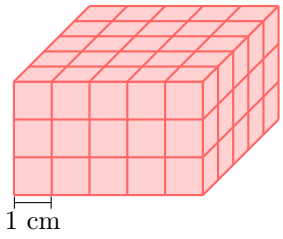


$$\boxed{24}\ \text{cm}^3$$

Answer: Length = 4 cm, width = 3 cm and height = 2 cm.

$$V = \text{length} \times \text{width} \times \text{height}$$
$$= 4\,\text{cm} \times 3\,\text{cm} \times 2\,\text{cm}$$
$$= 24\,\text{cm}^3$$

Ex 24: What is the volume of the red figure?

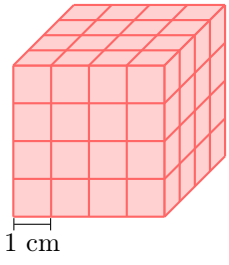


$$\boxed{75}\ \text{cm}^3$$

Answer: Length = 5 cm, width = 3 cm and height = 5 cm.

$$V = \text{length} \times \text{width} \times \text{height}$$
$$= 5\,\text{cm} \times 3\,\text{cm} \times 5\,\text{cm}$$
$$= 75\,\text{cm}^3$$

Ex 25: What is the volume of the red figure?

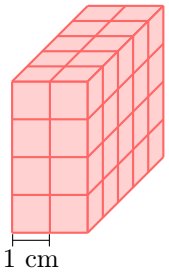


$\boxed{64}$ cm³

Answer: Length = 4 cm, width = 4 cm and height = 4 cm.

$$\begin{aligned} V &= \text{length} \times \text{width} \times \text{height} \\ &= 4\,\text{cm} \times 4\,\text{cm} \times 4\,\text{cm} \\ &= 64\,\text{cm}^3 \end{aligned}$$

Ex 26: What is the volume of the red figure?

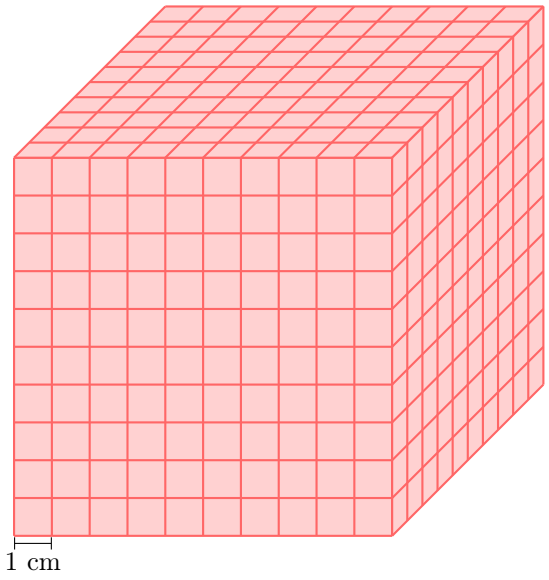


$\boxed{40}$ cm³

Answer: Length = 2 cm, width = 4 cm and height = 5 cm.

$$\begin{aligned} V &= \text{length} \times \text{width} \times \text{height} \\ &= 2\,\text{cm} \times 4\,\text{cm} \times 5\,\text{cm} \\ &= 40\,\text{cm}^3 \end{aligned}$$

Ex 27: What is the volume of the red figure?



$\boxed{1000}$ cm³

Answer: Length = 10 cm, width = 10 cm and height = 10 cm.

$$\begin{aligned} V &= \text{length} \times \text{width} \times \text{height} \\ &= 10\,\text{cm} \times 10\,\text{cm} \times 10\,\text{cm} \\ &= 1000\,\text{cm}^3 \end{aligned}$$

D.2 SOLVING PROBLEMS

Ex 28: A rectangular swimming pool is 8 m long, 5 m wide, and 2 m deep. The water costs 10 dollars per cubic meter.
What is the volume of the swimming pool?

$\boxed{80}$ m³

What is the cost to fill the swimming pool with water?

$\boxed{800}$ dollars

Answer:

- The volume of the rectangular swimming pool is:

$$\begin{aligned} V &= \text{length} \times \text{width} \times \text{height} \\ &= 8\,\text{m} \times 5\,\text{m} \times 2\,\text{m} \\ &= 80\,\text{m}^3 \end{aligned}$$

- The cost to fill the swimming pool with water is calculated by:

$$\begin{aligned} \text{Cost} &= \text{Volume} \times \text{cost per m}^3 \\ &= 80\,\text{m}^3 \times 10\,\text{dollars per m}^3 \\ &= 800\,\text{dollars} \end{aligned}$$

Ex 29: A container has a volume of 20 m³. A box is 2 m long, 1 m wide, and 0.5 m high.
What is the volume of the box?

$\boxed{1}$ m³

How many boxes can fit inside the container?

$\boxed{20}$ boxes

Answer:

- The volume of the box is:

$$\begin{aligned} V &= \text{length} \times \text{width} \times \text{height} \\ &= 2\,\text{m} \times 1\,\text{m} \times 0.5\,\text{m} \\ &= 1\,\text{m}^3 \end{aligned}$$

- The number of boxes that can fit inside the container is calculated by:

$$\begin{aligned} \text{Number of boxes} &= \text{Volume of container} \div \text{Volume of one box} \\ &= 20\,\text{m}^3 \div 1\,\text{m}^3 \\ &= 20\,\text{boxes} \end{aligned}$$

Ex 30: A storage room has a volume of 150 m³. A water tank is 5 m long, 2 m wide, and 3 m high.
What is the volume of the water tank?

$\boxed{30}$ m³

How many water tanks can fit inside the storage room?

$\boxed{5}$ water tanks

Answer:

- The volume of the water tank is:

$$\begin{aligned} V &= \text{length} \times \text{width} \times \text{height} \\ &= 5\,\text{m} \times 2\,\text{m} \times 3\,\text{m} \\ &= 30\,\text{m}^3 \end{aligned}$$

- The number of water tanks that can fit inside the storage room is calculated by:

$$\begin{aligned} \text{Number of water tanks} &= \text{Volume of room} \div \text{Volume of one tank} \\ &= 150\,\text{m}^3 \div 30\,\text{m}^3 \\ &= 5\,\text{water tanks} \end{aligned}$$

Ex 31: A rectangular fish tank is 2 m long, 1 m wide, and 1 m deep. The water costs 15 dollars per cubic meter.
What is the volume of the fish tank?

$$\boxed{2}\ \text{m}^3$$

What is the cost to fill the fish tank with water?

$$\boxed{30}\ \text{dollars}$$

Answer:

- The volume of the rectangular fish tank is:

$$\begin{aligned} V &= \text{length} \times \text{width} \times \text{height} \\ &= 2\,\text{m} \times 1\,\text{m} \times 1\,\text{m} \\ &= 2\,\text{m}^3 \end{aligned}$$

- The cost to fill the fish tank with water is calculated by:

$$\begin{aligned} \text{Cost} &= \text{Volume} \times \text{cost per m}^3 \\ &= 2\,\text{m}^3 \times 15\,\text{dollars per m}^3 \\ &= 30\,\text{dollars} \end{aligned}$$

E CAPACITY

E.1 CHOOSING UNITS FOR CAPACITY

MCQ 32: What unit best measures the capacity of a bathtub?
Choose 1 answer:

☐ 220 mL

☐ 2 200 mL

☒ 220 L

Answer: 220 L best measures the capacity of a bathtub because it's a larger unit, suitable for a big container like a bathtub. 220 mL and 2 200 mL are too small for such a large volume.

MCQ 33: What unit best measures the capacity of a dosage of medicine?
Choose 1 answer:

☒ 5 mL

☐ 0.5 L

☐ 5 L

Answer: 5 mL best measures the capacity of a dosage of medicine because it's a small unit, perfect for tiny amounts like a medicine dose. 0.5 L and 5 L are too large for such a small volume.

MCQ 34: What unit best measures the capacity of a wine glass?
Choose 1 answer:

☐ 150 L

☒ 15 cL

☐ 1.5 L

Answer: 15 cL best measures the capacity of a wine glass because it's a small unit, suitable for a small container like a wine glass. 150 L is much too large, and 1.5 L is also too big for such a small volume.

MCQ 35: What unit best measures the capacity of a soup bowl?
Choose 1 answer:

☒ 40 cL

☐ 40 mL

☐ 40 L

Answer: 40 cL best measures the capacity of a soup bowl because it's a suitable unit for a small container like a bowl. 40 mL is too small, and 4 L is too large for a typical soup bowl.

MCQ 36: What unit best measures the capacity of a car's fuel tank?
Choose 1 answer:

☐ 60 mL

☒ 60 L

☐ 600 L

Answer: 60 L best measures the capacity of a car's fuel tank because it's a larger unit, suitable for a big container like a fuel tank. 60 mL is much too small, and 600 L is too large for a typical car's fuel tank.

MCQ 37: What unit best measures the capacity of a pitcher?
Choose 1 answer:

☐ 2.5 mL

☒ 2.5 L

☐ 25 L

Answer: 2.5 L best measures the capacity of a pitcher because it's a suitable unit for a medium-sized container like a pitcher. 2.5 mL is too small, and 25 L is too large for a typical pitcher.

E.2 CONVERTING CAPACITY UNITS

Ex 38: Convert:

$$3\,\text{L} = \boxed{300}\ \text{cL}.$$

Answer:

$$\begin{aligned} 3\,\text{L} &= 3 \times 100\,\text{cL} \quad (1\,\text{L} = 100\,\text{cL}) \\ &= 300\,\text{cL} \end{aligned}$$

Ex 39: Convert:

$$1.5\,\text{L} = \boxed{150}\ \text{cL}.$$

Answer:

$$\begin{aligned} 1.5\,\text{L} &= 1.5 \times 100\,\text{cL} \quad (1\,\text{L} = 100\,\text{cL}) \\ &= 150\,\text{cL} \end{aligned}$$

Ex 40: Convert:

$$20\,\text{cL} = \boxed{0.2}\ \text{L}.$$

Answer:

$$\begin{aligned} 20\,\text{cL} &= 20 \div 100\,\text{L} \quad (100\,\text{cL} = 1\,\text{L}) \\ &= 0.2\,\text{L} \end{aligned}$$

Ex 41: Convert:

$$250\,\text{cL} = \boxed{2.5}\ \text{L}.$$

Answer:

$$\begin{aligned} 250\,\text{cL} &= 250 \div 100\,\text{L} \quad (100\,\text{cL} = 1\,\text{L}) \\ &= 2.5\,\text{L} \end{aligned}$$

Ex 42: Convert:

$$2\,\text{L} = \boxed{2000}\ \text{mL}.$$

Answer:

$$\begin{aligned} 2\,\text{L} &= 2 \times 1\,000\,\text{mL} \quad (1\,\text{L} = 1\,000\,\text{mL}) \\ &= 2\,000\,\text{mL} \end{aligned}$$

Ex 43: Convert:

$$30\,\text{mL} = \boxed{3}\ \text{cL}.$$

Answer:

$$\begin{aligned} 30\,\text{mL} &= 30 \div 10\,\text{cL} \quad (10\,\text{mL} = 1\,\text{cL}) \\ &= 3\,\text{cL} \end{aligned}$$

E.3 CONVERTING BETWEEN METRIC VOLUME AND CAPACITY UNITS

Ex 44: Convert:

$$5\,\text{m}^3 = \boxed{5000}\ \text{L}.$$

Answer:

$$\begin{aligned} 5\,\text{m}^3 &= 5 \times 1\,000\,\text{L} \quad (1\,000\,\text{L} = 1\,\text{m}^3) \\ &= 5\,000\,\text{L} \end{aligned}$$

Ex 45: Convert:

$$500\,\text{L} = \boxed{0.5}\ \text{m}^3.$$

Answer:

$$\begin{aligned} 500\,\text{L} &= 500 \div 1\,000\,\text{m}^3 \quad (1\,000\,\text{L} = 1\,\text{m}^3) \\ &= 0.5\,\text{m}^3 \end{aligned}$$

Ex 46: Convert:

$$3.4\,\text{m}^3 = \boxed{3400}\ \text{L}.$$

Answer:

$$\begin{aligned} 3.4\,\text{m}^3 &= 3.4 \times 1\,000\,\text{L} \quad (1\,000\,\text{L} = 1\,\text{m}^3) \\ &= 3\,400\,\text{L} \end{aligned}$$

Ex 47: Convert:

$$2\,\text{L} = \boxed{0.002}\ \text{m}^3.$$

Answer:

$$\begin{aligned} 2\,\text{L} &= 2 \div 1\,000\,\text{m}^3 \quad (1\,000\,\text{L} = 1\,\text{m}^3) \\ &= 0.002\,\text{m}^3 \end{aligned}$$