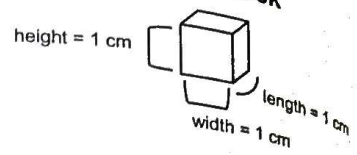
...amount of space a three-dimensional (3-D) object occupies.

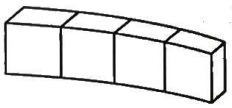
NOTE:
A 3-D object can be measured in three directions, such as length, width and height.

To measure volume, we use cubic centimetres (cm^3):

1 cm^3 block



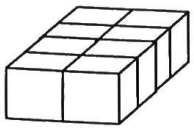
Example: This object, made of centimetre cubes, has a volume of four cubes – or 4 cubic centimetres (written as 4 cm^3):



TEACHER: Use centicubes or other materials to construct the models on this page.

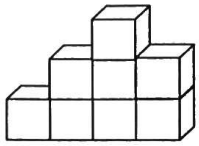
1. Using "centicubes" as your unit of measurement, write the volume of each object:

a)



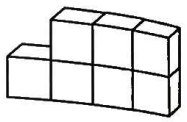
Volume = _____ cubes

b)



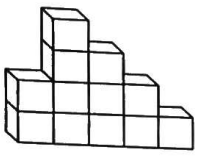
Volume = _____ cubes

c)



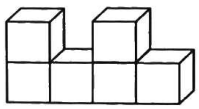
Volume = _____ cubes

d)



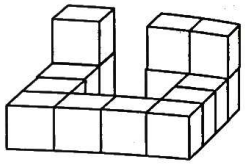
Volume = _____ cubes

e)



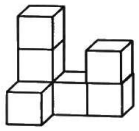
Volume = _____ cubes

f)



Volume = _____ cubes

2. Given a structure made of cubes, you can draw a top view as shown:

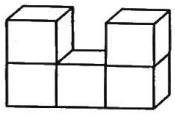


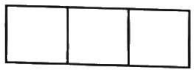
3	1	2
1		

← *The numbers tell you how many cubes are stacked in each position.*

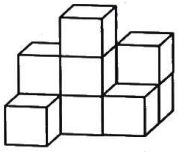
For each figure below, fill in the missing numbers in the top view:

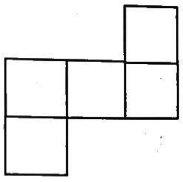
a)



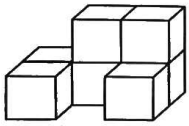


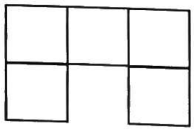
b)



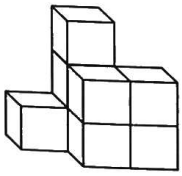


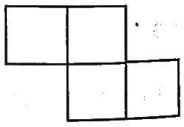
c)



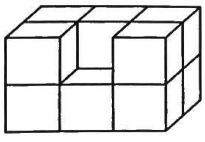


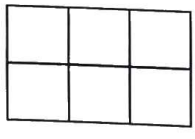
d)



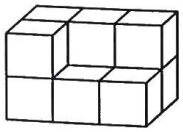


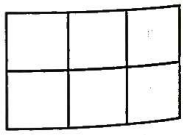
e)





f)



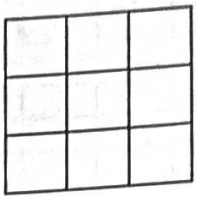


3. A structure made of cubes each with volume 1 cm³ has this top view:

3	2	1
2	4	5

What is the volume of the structure? _____

4. This picture shows the top view of a cube. Fill in the missing numbers:

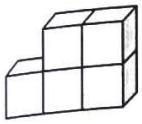


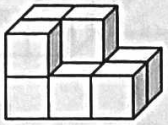
What is the volume of the cube? _____

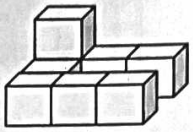
REMEMBER: A cube is as high as it is wide and long.

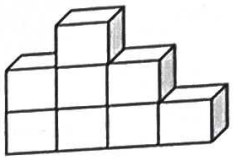
Answer the following questions in your notebook.

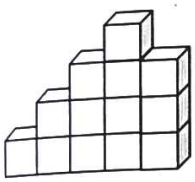
5. On grid paper, draw a top view for each of the following structures (use cubes to help):

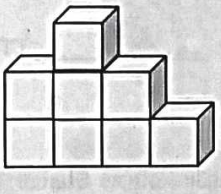
a) 

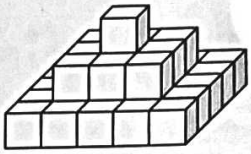
b) 

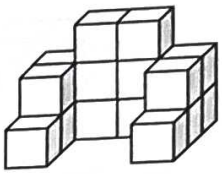
c) 

d) 

e) 

f) 

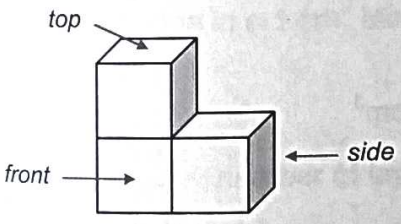
g) 

h) 

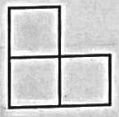
6. Using centicubes, build two different shapes that have the volume of exactly 10 cubic centimetres. Draw a top view of each of your shapes.

7. How many different rectangular prisms can you build with 8 cubes? Draw a top view for each of your shapes.

8. Given a structure made with cubes, you can draw a front, top and side view as shown:



front view:

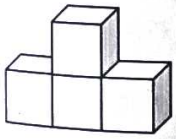


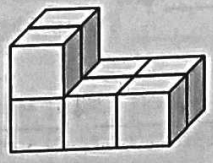
top view:

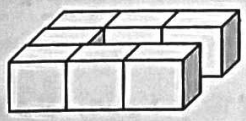
side view:

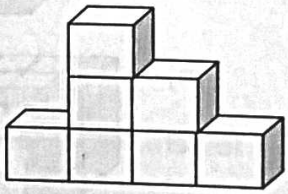
Draw a front, top and side view for the following structures:

HINT: **Use cubes to help you.**

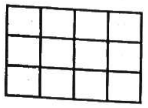
a) 

b) 

c) 

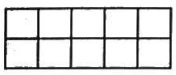
d) 

1. Use the number of blocks in the shaded column to write an addition statement and a multiplication statement for each area:

a) 

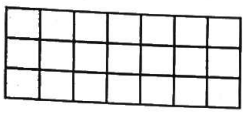
3 + 3 + 3 + 3 + = 12

3 × 4 = 12

b) 

___ + ___ + ___ + ___ + ___ = ___

___ × ___ = ___

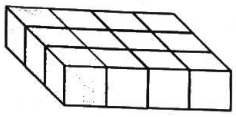
c) 

___ + ___ + ___ + ___ + ___ + ___ + ___ = ___

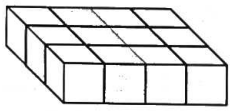
___ × ___ = ___

2. How many 1 cm^3 blocks are in each shaded row?

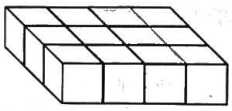
NOTE: Blocks are not shown to scale.

a) 

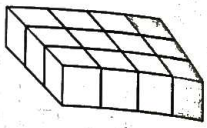
_____ blocks

b) 

_____ blocks

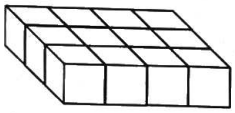
c) 

_____ blocks

d) 

_____ blocks

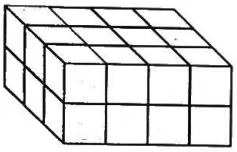
3. a) Write an addition statement for the volume of the shape:



___ + ___ + ___ + ___ = _____ cm^3

b) Based on your answer in part a), write a multiplication statement for the same volume:

___ × ___ = _____ cm^3

4. 

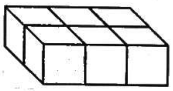
a) How many blocks are shaded? _____

b) Write an addition statement for the volume:

___ + ___ + ___ + ___ = _____ cm^3

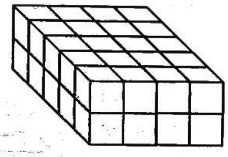
c) Write a multiplication statement for the same volume: ___ × 4 = ___ cm^3

5. Write an addition or multiplication statement for each volume:

a) 

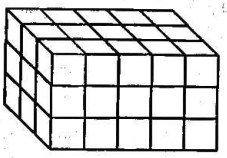
___ + ___ + ___ = _____ cm^3

___ × 3 = _____ cm^3

b) 

___ + ___ + ___ + ___ = _____ cm^3

___ × ___ = _____ cm^3

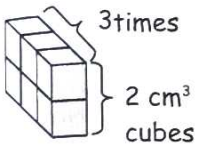
c) 

___ + ___ + ___ + ___ + ___ = _____ cm^3

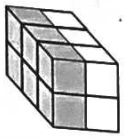
___ × ___ = _____ cm^3

ME8-33: Volume of Rectangular Prisms (Introduction) *(continued)*

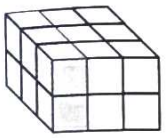
6. Write a multiplication statement for the total volume of the rectangular prism by first counting the number of 1 cm^3 blocks that are shaded:

a) 

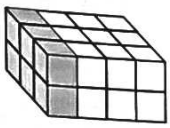
$2\ cm^3 \times 3 = 6\ cm^3$

b) 

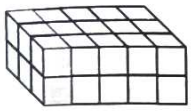
blocks in each row: $2\ cm^3 \times 3$ × number of rows: $2 = 12\ cm^3$

c) 

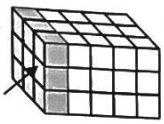
$2\ cm^3 \times 3 \times \_\_\_ = \_\_\_\ cm^3$

d) 

$2\ cm^3 \times 3 \times \_\_\_ = \_\_\_\ cm^3$

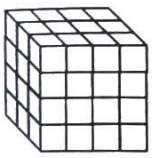
e) 

$2\ cm^3 \times 3 \times \_\_\_ = \_\_\_\ cm^3$

f) 

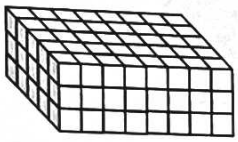
$3\ cm^3 \times 3 \times \_\_\_ = \_\_\_\ cm^3$

7. Find the surface area of the left-most layer:

a) 

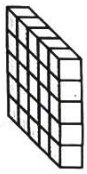
surface area:

$= \_\_\_ cm \times \_\_\_ cm = \_\_\_ cm^2$

b) 

surface area:

$= \_\_\_ cm \times \_\_\_ cm = \_\_\_ cm^2$

c) 

surface area"

$= \_\_\_ cm \times \_\_\_ cm = \_\_\_ cm^2$

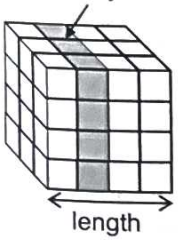
8. For each prism in Question 7, find the volume of the left-most layer of blocks:

a) $\_\_\_\ cm^3$ b) $\_\_\_\ cm^3$ c) $\_\_\_\ cm^3$

9. For each prism in Question 7, compare the surface area and the volume of the left-most layer. Are the numbers the same or different? _____

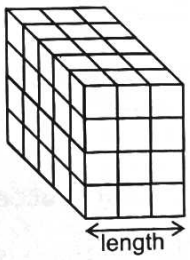
10. 

Each edge in a 1 cm^3 block is 1 cm long:

a) 

number of layers = _____

length of side = _____

b) 

number of layers = _____

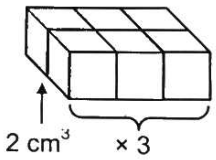
length of side = _____

11. Compare the **length** of each prism in Question 10 with the **number of layers**. Are the numbers the same or different? _____

12. The volume of a right rectangular prism made of cm^3 cubes is: (number of layers in prism) × (number of cubes in each layer). In your notebook, explain why this formula gives the same answer as (length of prism) × (surface area of left face of prism).

... volume by counting the number of 1 cm^3 blocks:

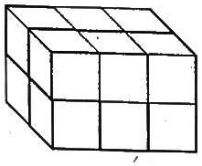
a)



$2\ cm^3 \times \underline{3}$

$= \underline{6}\ cm^3$

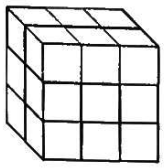
b)



$2\ cm^3 \times 3 \times \underline{\quad}$

$= \underline{\quad}\ cm^3$

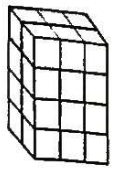
c)



$2\ cm^3 \times 3 \times \underline{\quad}$

$= \underline{\quad}\ cm^3$

d)



$2\ cm^3 \times 3 \times \underline{\quad}$

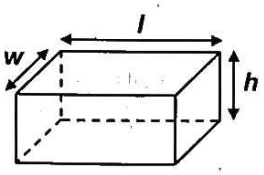
$= \underline{\quad}\ cm^3$

3. a) Look at each rectangular prism from Question 2. Complete the following chart:

Shape	Surface area of top	Height	Volume
A			
B			
C			
D			

b) Say how to calculate the volume of a rectangular prism from the surface area of the top layer and the height of the prism:

4. A rectangular prism has length *l*, width *w* and height *h*:



a) Write a formula for the surface area of the top (using *l* and *w*): _____

b) Write a formula for the volume of the prism (using *l*, *w* and *h*) : _____

5. Complete the following statements by using the words **length**, **width** and **height**:
In a right-rectangular prism...

a) ... the surface area of the top × height = volume

b) ... the surface area of the right side × _____ = volume

c) ... the surface area of the bottom × _____ = volume

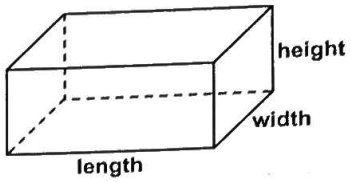
d) ... the surface area of the back × _____ = volume

e) ... the surface area of the left side × _____ = volume

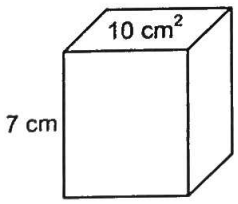
f) ... the surface area of the front × _____ = volume

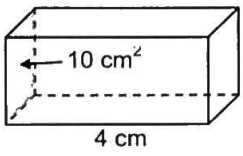
g) ... the surface area of the top = _____ × _____

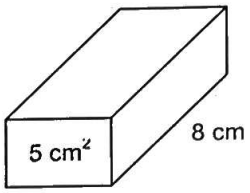
h) ... from a) and g), the volume is: _____ × _____ × _____

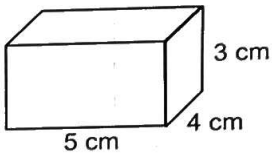


6. Find the volume of each right rectangular prism. Include the units in your answer:

a)


b)


c)


d)


Answer the following questions in your notebook.

7. Write one possible set of lengths, widths and heights for a rectangular prism with volume.
   a) 12 cm^3 b) 8 cm^3 c) 18 m^3

8. The area of the base of a right rectangle prism is 8 cm^2 and its volume is 32 cm^3. What is its height?

9. Find the length and width of all rectangles with perimeter twelve (and sides with lengths that are whole numbers). Which rectangle has the least area?

10. The volume of a rectangular prism is 24 cm^3 and its height is 2 cm. What can be the dimensions of the base of the prism?

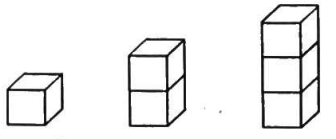
11. Find 3 possible lengths, widths and heights in a rectangular prism with volume 24 cm^3. Which one would require the least amount of material to construct?

12. The picture shows the top view of a rectangular prism made of cm^3:

3	3	3
3	3	3

   a) What is its surface area in cm^2?
   b) What is its volume in cm^3?

13. a) Write a rule that tells you how to calculate the surface area of the figures from the figure number (each cube has length, width and height 1 cm)
   b) Use your rule to predict the surface area of the 20th figure.



ME8-35: Volume of Rectangular Prisms

1. Find the volumes of the rectangular prisms from the top views shown below:

a)

5	5	5
5	5	5

Width: _____
Length: _____
Height: _____
Volume = _____

b)

3	3
3	3

Width: _____
Length: _____
Height: _____
Volume = _____

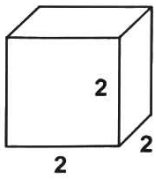
c)

2	2	2	2	2
2	2	2	2	2

Width: _____
Length: _____
Height: _____
Volume = _____

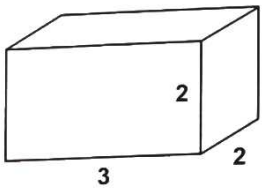
2. Find the volume of each box with the indicated dimensions (assume all units are in metres):
HINT: V = H × L × W

a)



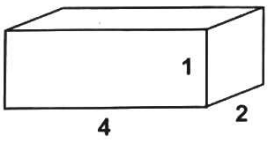
Width: _____
Length: _____
Height: _____
Volume = _____

b)



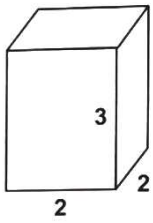
Width: _____
Length: _____
Height: _____
Volume = _____

c)



Width: _____
Length: _____
Height: _____
Volume = _____

d)



Width: _____
Length: _____
Height: _____
Volume = _____

3. Find all the possible lengths, widths and heights for a box with the given volume so that the measurements are in whole numbers:
HINT: There are 6 possibilities for part b).

a) Volume = 3 cm^3

Height	Width	Length

b) Volume = 4 cm^3

Height	Width	Length

4. In your notebook, draw the top view of a rectangular prism with the given dimensions. Then calculate the volume:

a) Width 3 cm; Length 4 cm; Height 5 cm

b) Width 4 cm; Height 4 cm; Length 19 cm

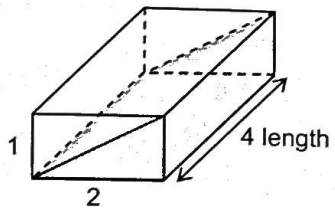
2. a) What fraction of the volume of each rectangular prism (r.p.) below is the volume of the triangular prism (t.p.)? _____

b) What would you divide the volume of each rectanglular prism to find the volume of the t.p.?

_____

c) Fill in the blanks:

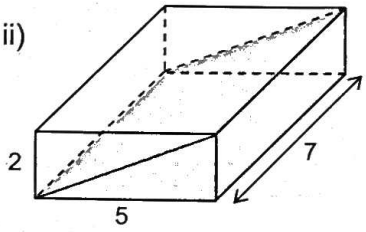
i)



volume of r.p. = _____

volume of t.p. = _____

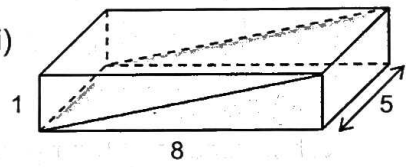
ii)



volume of r.p. = _____

volume of t.p. = _____

iii)



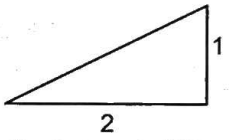
volume of r.p. = _____

volume of t.p. = _____

3. Recall that the area of a triangle is: $\frac{1}{2}$ × base × height *or* (base × height) ÷ 2

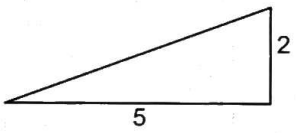
a) Look at the triangular prisms in Question 2 c). Calculate the area of each triangular base:

i)



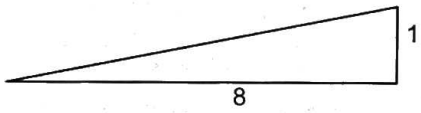
Area of triangular base = _____

ii)



Area of triangular base = _____

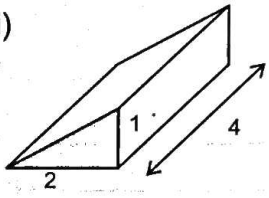
iii)



Area of triangular base = _____

b) Multiply the area of each triangular base by the length of the prism:

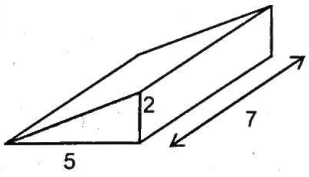
i)



_____ × _____

Area of base Length

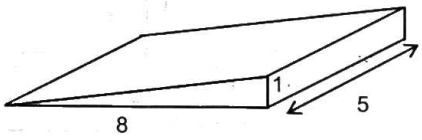
ii)



_____ × _____

Area of base Length

iii)



_____ × _____

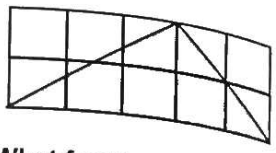
Area of base Length

c) Compare the numbers you calculated in Question 3 b) i), ii), iii) with the volumes of the r.t.p. you calculated in Question 2 c) i), ii), iii).

What do you notice?

ME8-36: Volume of Triangular Prisms *(continued)*

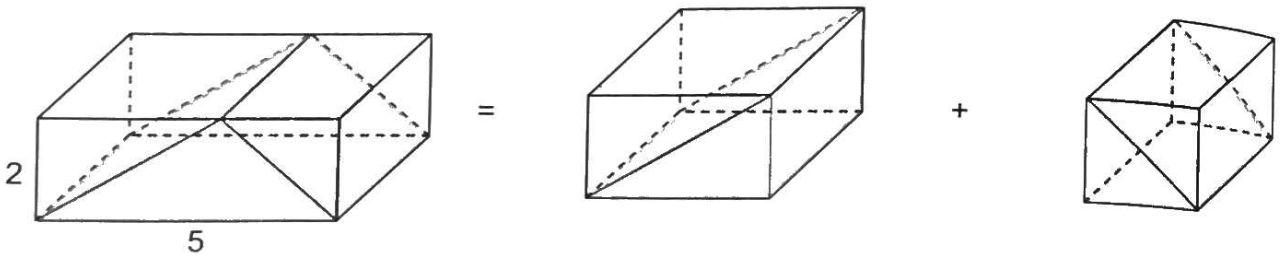
4. You can divide any triangle into two right triangles.



What fraction of the area of the rectangle is the triangle? _____

HINT: Divide the rectangle into 2 smaller rectangles that contain the right triangles. What fraction of the area of each smaller rectangle is the right triangle?

5.

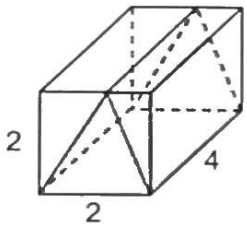


What fraction of the r.p. is the t.p.? _____

HINT: You can divide the r.p. into two smaller t.p.

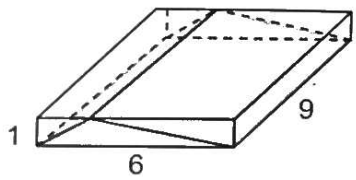
6. Find the volume of each r.p., then the volume of t.p.:

a)



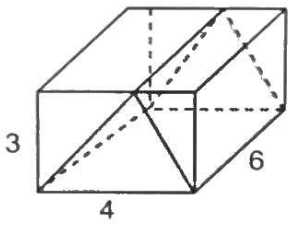
fraction shaded _____
volume of r.p. _____
volume of t.p. _____

b)



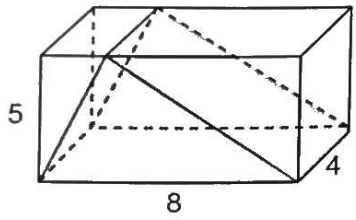
fraction shaded _____
volume of r.p. _____
volume of t.p. _____

c)



fraction shaded _____
volume of r.p. _____
volume of t.p. _____

d)

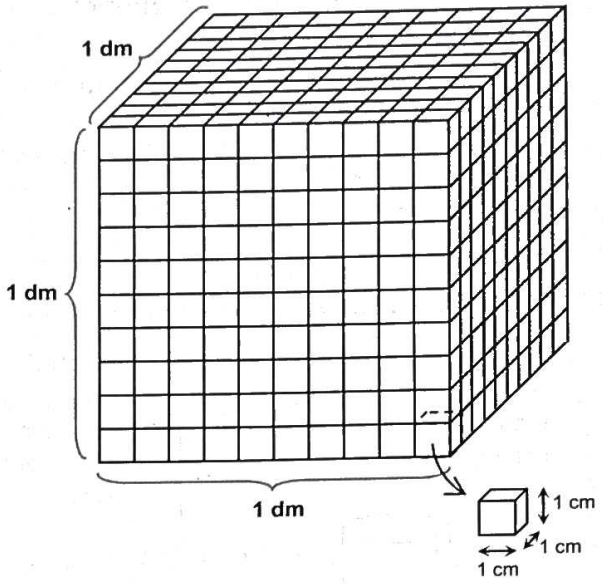


fraction shaded _____
volume of r.p. _____
volume of t.p. _____

BONUS:

7. Find the surface area of the figure in Question 6 a).

1. Each of the small cubes in Figure 1 has sides 1 cm and volume 1 cm^3 (not drawn to scale).



a) How many 1 cm^3 cubes cover the front layer of the large cube? _____

b) How many 1 cm^3 cubes fit into the large cube?

_____

c) What is the volume of the large cube in cm^3?

_____

d) How long are the sides of the large square in dm? _____

e) A dm^3 is _____ times larger than a cm^3.

Answer the following questions in your notebook.

2. Follow the steps in part a) to answer each question:

a) Change 27 000 cm^3 to dm^3.

The new units are **1000** *times* **bigger**.
So **divide** *by* **1000**.
So 27 000 cm^3 = 27 dm^3

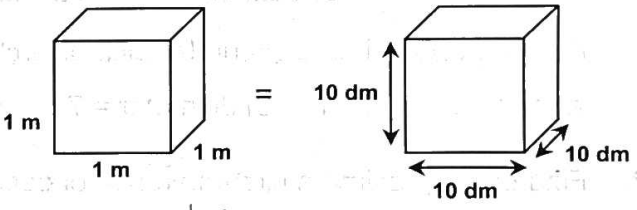
b) Change 370 cm^3 to dm^3.

c) Change 29 dm^3 to cm^3.

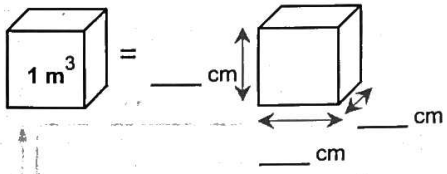
d) Change .53 dm^3 to cm^3.

e) Change 1.4 cm^3 to dm^3.

3. Ken says 1 m^3 = 10 dm × 10 dm × 10 dm.
So 10 × 10 × 10 = 1000 dm^3 will fit into 1 m^3.
Use Ken's reasoning to fill in the blanks below:



a)

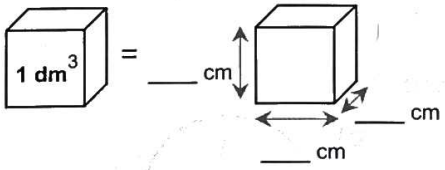


1 m^3 = _____ × _____ × _____ cm^3

= _____ cm^3

m^3 are _____ times larger than cm^3

b)

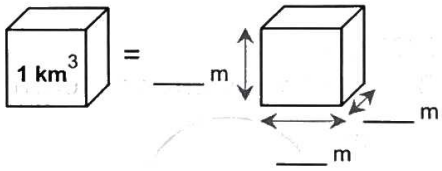


1 dm^3 = _____ × _____ × _____ cm^3

= _____ cm^3

dm^3 are _____ times larger than cm^3

c)



1 km^3 = _____ × _____ × _____ m^3

= _____ m^3

km^3 are _____ times larger than m^3

4. Change the following units. Parts k) to p) are challenging:

a) 2 m^3 to dm^3
b) 40 000 dm^3 to m^3
c) 52 cm^3 to dm^3
d) 7 dm^3 to cm^3
e) 72 365 dm^3 to m^3
f) 2342 cm^3 to m^3
g) 8 cm^3 to dm^3
h) 3.7 dm^3 to cm^3
i) 2400 cm^3 to m^3
j) .000 001 m^3 to cm^3
k) 4 km^3 to m^3
l) 2 736 254 m^3 to km^3
m) 5.2 dm^3 to mm^3
n) 3.85 m^3 to mm^3
o) .02 m^3 to mm^3
p) 174 mm^3 to m^3