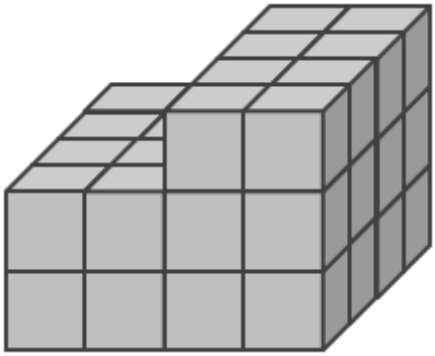
Week 4/5
Term 1
2022

HAWKER COLLEGE
Engage | Inspire | Achieve

Learning Brief

EM3

Goals



This fortnight we are going to:

- Review metric units of mass (and weight), their abbreviations, conversions between them, and appropriate choices of units (EMA09)
- Recognise the need for milligrams (EMA01)
- Convert between grams and milligrams (EMA10)
- Review metric units of volume, their abbreviations, conversions between them and appropriate choices of units (EMA11)
- Recognise relations between volume and capacity and recognising that $1\ cm^3 = 1\ mL$ and $1\ m^3 = 1kL$ (EMA12)
- Use formulas to find the volume and capacity of regular objects such as cubes, rectangular and triangular prisms and cylinders (EMA13)
- Use formulas to find the volume of pyramids and spheres (EMA14)

Theoretical Components

Resources:
PDF file: Week 4 and 5 Notes and Exercises

Knowledge Checklist:

- Conversion factors for volume
- Units of capacity
- Relationship between volume and capacity

Order:

1. Work through the Week 4 and 5 notes and exercises
2. Complete the Portfolio task
3. Complete the reflection at the end of the booklet
4. Show your teacher your completed booklet.

Practical Components

Work through the exercises and show the complete tasks to your teacher.

Be sure to ask for help as you need for the successful completion of all tasks.

Portfolio Task

See the last page of the booklet

ESSENTIAL MATHEMATICS 3

WEEK 4 AND 5 – MASS, VOLUME AND CAPACITY

Mass

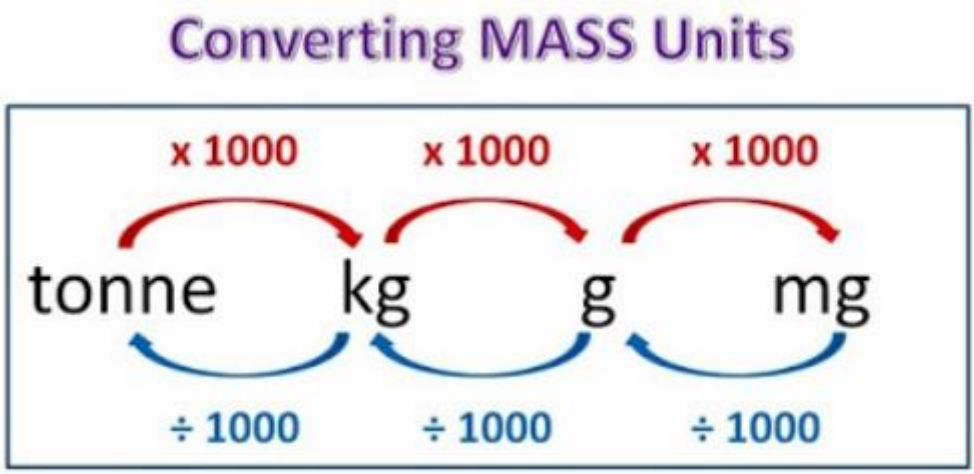
When we use the word **weight**, we actually mean **mass**. Mass is the amount of matter in a body, whereas weight is a measure of the force of gravity on a body. On the surface of the earth, mass and weight are the same; however, on the moon your mass is the same as on the earth, but the effect of gravity is much less, thus your weight is much less.

The units of mass and weight are the same. In the International System of Units (SI) the standard unit of mass is the kilogram, kg.

The common units of mass and some examples are:

- Milligram (mg) — a grain of sand
- Gram (g) — a 5c coin, a paper clip
- Kilogram (kg) — 1 litre of milk or water
- Tonne (t) — a very small car

Conversions



Remember: If you are converting tonnes to grams, you need two steps. First tonnes to kilograms, then kilograms to grams.

Exercise 1

1. What units would be most appropriate for measuring the mass of:

   a. a pencil b. a student c. a hamburger

   d. a bus e. a human hair f. a mobile phone

2. For each of these conversions, state whether you need to multiply or divide.

a. g to kg b. g to mg c. kg to t

d. kg to g e. t to g f. mg to kg

3. Complete the following conversions of the units.

a. 3 kg = g b. 12 t = kg

c. 1500 g = kg d. 2400 kg = t

e. 850 kg = g f. 900 g = kg

4. A hospital pharmacist ordered 2000 tablets. Each tablet has a mass of 5 mg.
   a. What is the total mass of the tablets in mg?

   b. What is the total mass in grams?

5. List two items whose mass you would measure in:

   a. tonnes

   b. kilograms

   c. grams

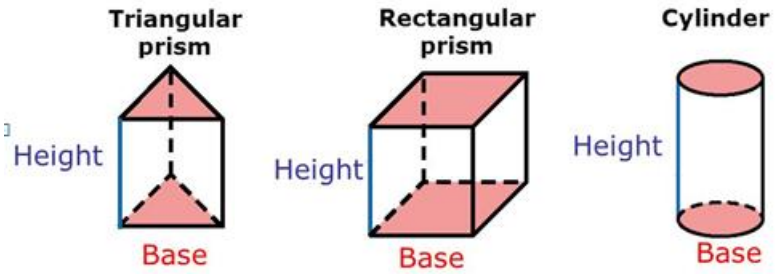
   d. milligrams

6. The mass of an empty coal truck before it is loaded is 2000 kg. At the start of a day it is loaded with coal, and the coal makes up 80% of the total mass. At the first delivery, the driver unloads a quarter of the coal.

   What is the total mass of coal left on the truck after the driver made the first delivery?

Volume

We have looked at the surface area of solids, now we will look at the amount of space **inside** a solid.

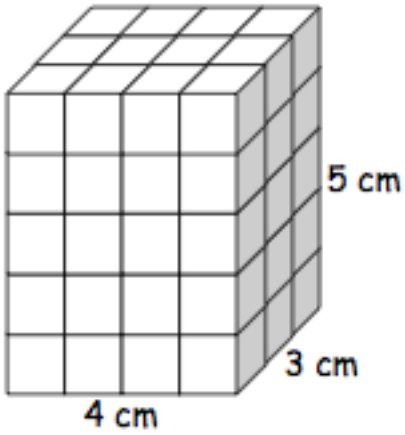


Prisms

The volume of both rectangular and triangular prisms (in fact any prism) is found by counting the number of cubes that would fit inside the prism. **Multiplying the area of the base by the height** will also find the number of cubes that would fit inside the solid.

Example 1

Count the number of cubes in the rectangular prism by multiplying the three dimensions (length x width x height)

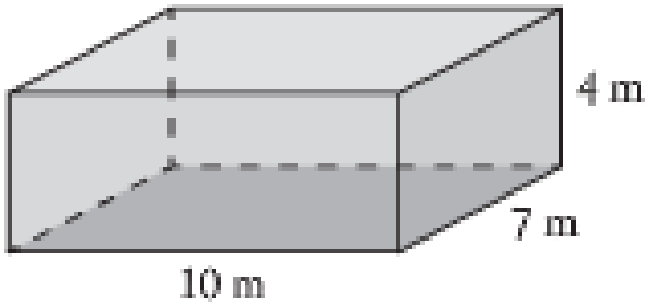


Solution

Volume = 4 x 3 x 5
Volume = 60 cm^3

Example 2

Calculate the volume of this rectangular prism.



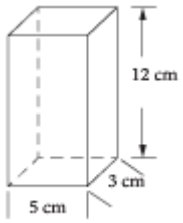
Solution

Volume = Area of base x height
The area of the rectangular base is 10 x 7 = 70 m^2
Volume = Area x height = 70 x 4 = 280 m^3

Exercise 2

1. Calculate the volume of the following rectangular prisms.

a.



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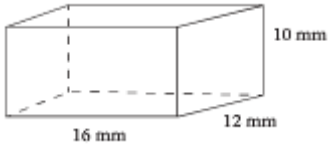
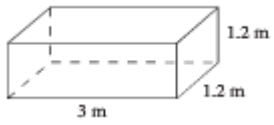


c.



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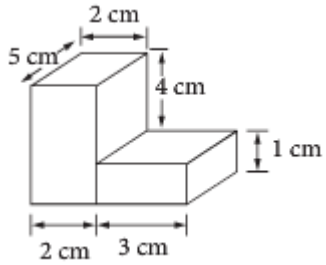
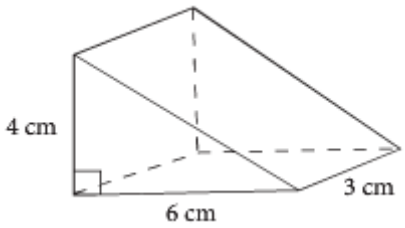


2. Sometimes, when we are calculating the volume of this triangular prism, it is easier to think of the volume formula as V = area of the front x depth.

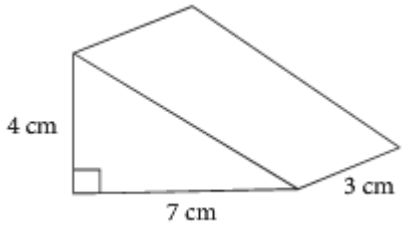


   a. Calculate the area of the front triangle.

   b. Multiply the area of the triangle by 3 cm to calculate the volume of the prism.

3. Calculate the volumes of these triangular prisms.

a.



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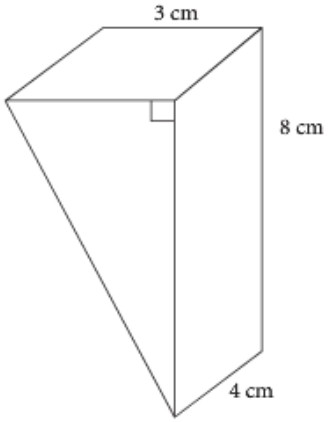
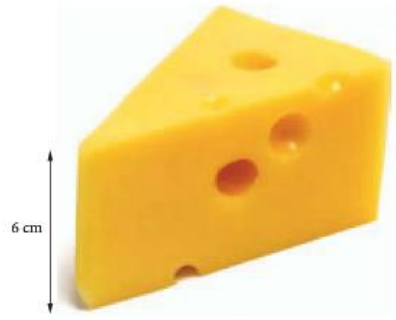


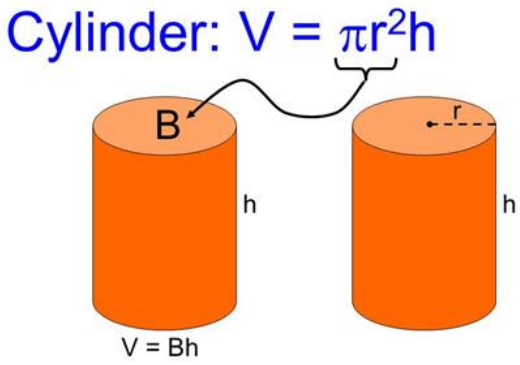
c.

d.



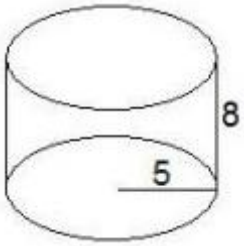
Area of the base = 32 cm^2

Cylinders



Example 3

Find the volume of the cylinder.



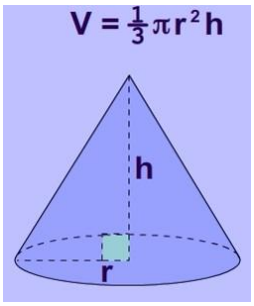
Solution

Area of a circle = πr^2
Area of a circle = $\pi \times 5^2$
Area of a circle = $\pi \times 25$
Area of a circle = 78.54

Volume = area of a circle x height
Volume = 78.54×8
Volume = 628.3 cm^3

Cones

The volume of a cone is given by: $\boldsymbol{V = \frac{\pi r^2 h}{3}}$



Spheres

The volume of a sphere is given by: $\boldsymbol{V = \frac{4\pi r^3}{3}}$

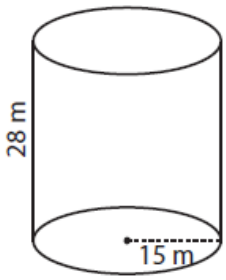
Volume of Sphere

$$= \frac{4}{3}\pi r^3$$

Exercise 3

1. Find the volume of the following cylinders.

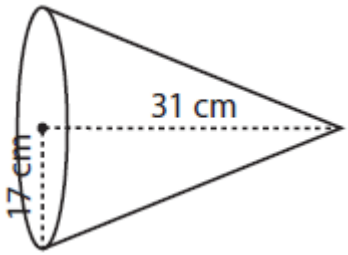
a.



b. d = 8 cm, h = 10 cm

2. Find the volumes of the following cones.

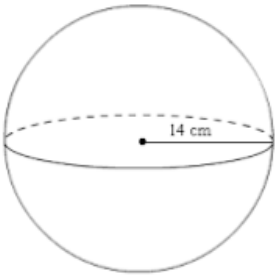
a.



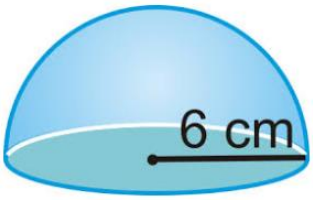
b. d = 4 cm, h = 14 cm

3. Find the volume of the following shapes.

a.



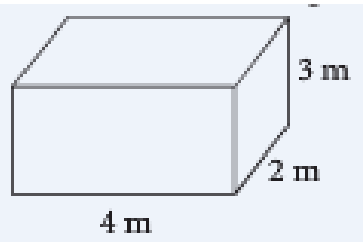
b.



4. Given that the diameter of the earth is 12,742 km, what is its volume?

Conversion factors can be big

The diagram shows a rectangular prism. Fill out the blanks in the following paragraphs.

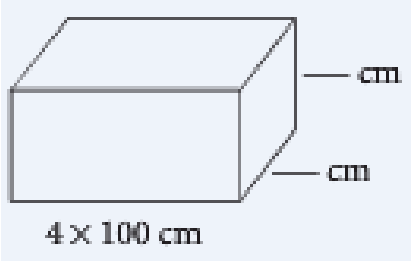


Volume = 4 m x 2 m x 3 m

Volume = _____ m^3

The conversion fact between m and cm is 100.

Convert the dimensions of the above prism to cm.



The new volume = 4 x 100 cm x _____ x _____

The new volume = _____ cm^3

This means _____ m^3 = _____ cm^3

The conversion factor between cm and m is 100.

The conversion factor between cm^3 and m^3 is _____.

Exercise 4

For the following two questions, use the techniques above.

1. Find the conversion factor between mm^3 to cm^3
    a. Find the volume of a 2 cm by 4 cm by 5 cm rectangular prism in cm^3

    b. Convert the dimensions to mm (the conversion factor is 10)

    c. Find the new volume in mm^3

    d. What is the conversion factor?

2. Find the conversion factor between m^3 to km^3
    a. Find the volume of a 1 km by 1 km by 1 km cube in km^3

    b. Convert the dimensions to m (the conversion factor is 1000)

    c. Find the new volume in m^3

    d. What is the conversion factor?

3. Use the information in this table to complete the following volume conversions.

Volume unit	**Abbreviation**	**Size description**
cubic metre	m^3	1 000 000 cm^3
cubic centimetre	cm^3	1 cm^3 = one millionth of a cubic metre 1 cm^3 = 1000 mm^3
cubic millimetre	mm^3	1 mm^3 = one thousandth of a cubic centimetre 1000 mm^3 = 1 cm^3

a. 5 cm^3 = mm^3

b. 2 m^3 = cm^3

c. 500 mm^3 = cm^3

d. 0.25 m^3 = cm^3

e. 24000 cm^3 = m^3

f. 36000 mm^3 = cm^3

4. What units would you use (mm^3, cm^3, m^3, km^3) to measure the volume of the following objects.
   a. a mobile phone
   b. our maths classroom

5. In Exercise 3, we found the volume of the earth in km^3. Convert this volume to m^3.

Volume and capacity

Volume measures the amount of space inside a container while capacity measures the amount of liquid a container will hold.

In the metric system, it is easy to convert between the units of volume and capacity.

Volume unit	How much it holds
1 cm^3	1 mL
1000 cm^3	1 L
1 m^3	1000 L

Example 4

Convert the following:
a. 5 cm^3 to mL
b. 1850 mL to L
c. The volume of a large fish pond is 3.4 m^3. How many litres does it hold?

Solution

a. 1 cm^3 holds 1 mL, the number of cm^3 and mL are always the same.
Therefore, 5 cm^3 holds 5 mL.

b. When changing mL to L, we are changing to a bigger unit. The conversion factor between mL and L is 1000. We divide by the conversion fact when we are changing to a larger unit.
1850 mL = 1850 ÷ 1000
1850 mL = 1.85 L

c. Each m^3 holds 1000 L. We multiply the number of m^3 by 1000.
3.4 m^3 = 3.4 x 1000
3.4 m^3 = 3400 L
The fish pond holds 3400 L of water.

Exercise 5

1. Convert each measurement to mL.

   a. 8 cm^3 b. 1.5 L c. 425 cm^3

2. Convert each measurement to litres.

   a. 2000 cm^3 b. 3500 mL c. 250 mL

3. Each can in a box of 24 cans of soft drink holds 375 ml. How many litres of soft drink are contained in the box?

4. Match the correct capacity (A to J) with the items listed (1 to 10).

1	car petrol tank	**A**	200 mL
2	a cup of flour	**B**	23 kL
3	bathtub	**C**	5 mL
4	bucket of water	**D**	70 L
5	can of drink	**E**	1250 mL
6	glass of water	**F**	1.875 ML
7	Olympic swimming pool	**G**	250 mL
8	bottle of lemonade	**H**	9 L
9	teaspoon	**I**	375 mL
10	water storage tank	**J**	180 L

5. Match the word (1 to 9) to its correct meaning (A to I).

1	area	**A**	A 3-dimensional object with flat sides and identical ends.
2	capacity	**B**	The distance around the outside of a shape.
3	cube	**C**	The amount of space occupied by a solid object.
4	litre	**D**	Measures the amount of liquid a container can hold.
5	mass	**E**	A way we measure liquid. One unit is equivalent to 1000 cm^3.
6	perimeter	**F**	The amount of matter contained in an object. It usually measured in grams, kilograms or tonnes.
7	prism	**G**	A solid shape with flat sides. At each end the surface is the same triangle.
8	triangular prism	**H**	The amount of surface or region occupied by a flat object.
9	volume	**I**	A solid shape with flat sides. All the sides have the same length.

6. Find the volume of this solid in cubic meters. Show your working.

Cylinder height = 15 m

Cone height = 3 m

Diameter = 4 m

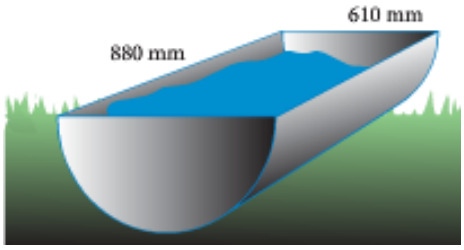
7. The tank on this truck consists of two hemispheres and a cylinder. The diameter is 2.9 m and the length of the cylinder is 9.5 m. Calculate the volume of the tank in megalitres.

Hint: What is the conversion factor between litres and megalitres? (google this)

Portfolio Task Week 4/5

Answer the following question using the necessary formulae and show all working neatly and clearly.

Ethan runs a farm. He uses half-cylinder water troughs, as shown, for the animals.



1. Calculate the volume of one water trough in cubic metres.

2. How much water is needed to fill one trough?

3. There are 25 water troughs on the farm. How much water is needed to fill all the troughs?

4. Ethan uses a cylindrical tank on a trailer to fill the water troughs. Calculate the volume of the tank if its diameter is 1,560 mm and its height is 1,210 mm.

5. Can this tank hold enough water to fill all the troughs? If not, how many trips will Ethan have to make?

MARKING RUBRIC

CRITERIA	EXPECTATIONS	POSS	MULT	GIVEN	TOTAL
Practical	Student completes practical work, including exercises and Mathspace task, of the brief to an acceptable standard set by the teacher.	**2**	**3**		**/6**
Portfolio Task	Student completes the investigation task of the week to an acceptable standard set by the teacher.	**2**	**2**		**/4**
Reasoning and Communications	Student responses are accurate and appropriate in presentation of mathematical ideas, with clear and logical working out shown.	**4**	**-**		**/4**
Concepts and Techniques	Student submitted work selects and applies appropriate mathematical techniques to solve practical problems and demonstrates proficiency in the use of mathematical facts, techniques and formulae.	**4**	**-**		**/4**
	Submission Guidelines				
Timeliness	Student submits the exercises, Mathspace task and investigation by the set deadline. See scoring guidelines for specific details.	**2**	**-**		**/2**
				FINAL	**/20**

Student Reflection:

How did you go with this week's work? What was interesting? What did you find easy? What do you need to work on?