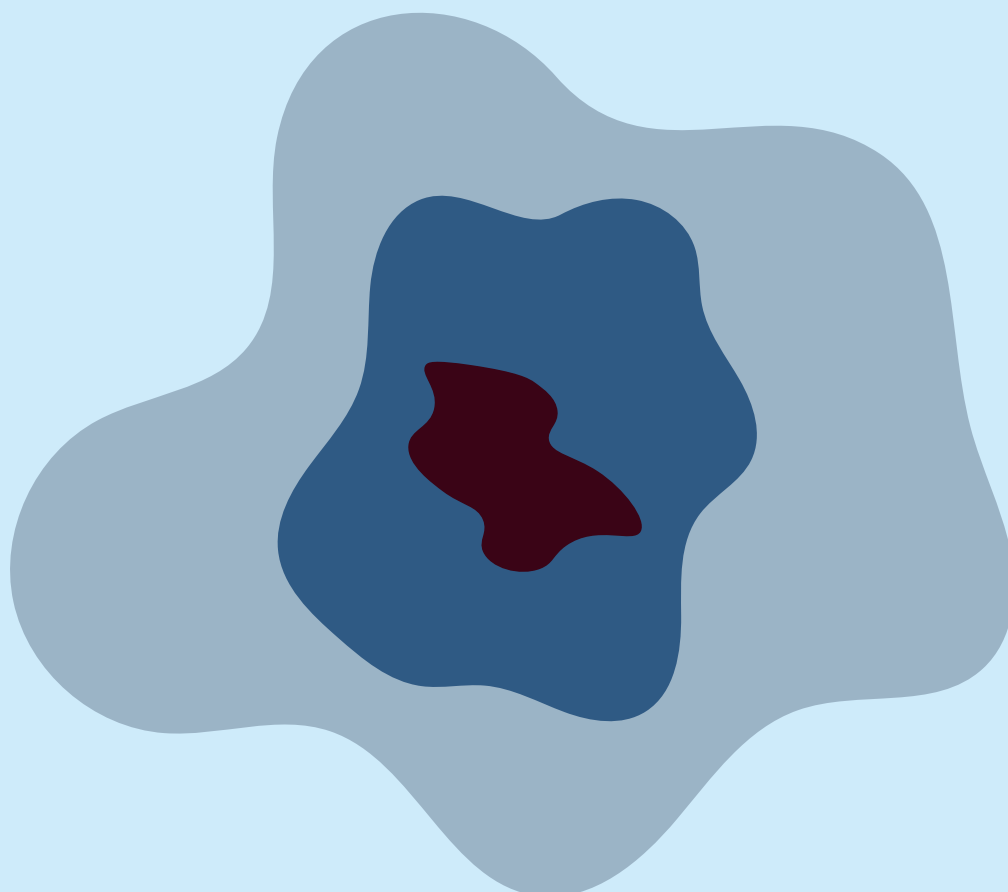


LEVEL 2

ENIGMATHICQ

## ACTIVITY 2

### Oil spill estimates : Volumes




## Mission sheet: Oil spill estimates


### Mission 2: Volume estimates


#### TOOLS


- The map of the oil spill
- Isabel's tools: Volumes
- Labelled tiles
- A calculator

#### TEAM ROLES

 Navigator: Decides with the team where to place the tiles.  
Name: \_\_\_\_\_

 Counter: Keeps track of tiles per zone.  
Name: \_\_\_\_\_

 Recorder: Writes numbers, ideas, and reflections.  
Name: \_\_\_\_\_

 Presenter: Shares the team's model and reasoning.  
Name: \_\_\_\_\_

#### HOW TO

1. As a team, add the layers to each zone, using the information from Isabel's tools.
2. Observe your model together and share what you notice.
3. Discuss the questions below, decide as a team, and agree on your answers.
4. Record your ideas and estimations in the mission sheet.
5. Be ready to explain your team's choices to the class.

#### OBSERVE

Which zone has the greatest thickness?

\_\_\_\_\_

Which zone has the largest surface?

\_\_\_\_\_

Which zone do you expect to contain more oil? Why?

\_\_\_\_\_

To calculate volume in cubic metres, the height must be expressed in metres!

### SURFACE AREA (FROM STEP 1)

Grey zone surface area:

\_\_\_\_m<sup>2</sup>

Blue zone surface area:

\_\_\_\_m<sup>2</sup>

Dark zone surface area:

\_\_\_\_m<sup>2</sup>

### LAYERS = HEIGHT

Grey zone height

1 layer = \_\_\_\_mm = \_\_\_\_m

Blue zone height

2 layers = \_\_\_\_mm = \_\_\_\_m

Dark zone height

4 layers = \_\_\_\_mm = \_\_\_\_m

CALCULATING THE VOLUME: Use the formula:  
SURFACE AREA × HEIGHT = VOLUME

Oil volume in the grey zone:

\_\_\_\_m<sup>2</sup> x \_\_\_\_m = \_\_\_\_m<sup>3</sup>

Oil volume in the blue zone:

\_\_\_\_m<sup>2</sup> x \_\_\_\_m = \_\_\_\_m<sup>3</sup>

Oil volume in the dark zone:

\_\_\_\_m<sup>2</sup> x \_\_\_\_m = \_\_\_\_m<sup>3</sup>

OVERALL

Estimated total volume of oil spilled:

\_\_\_\_m<sup>3</sup>

### INTERPRETATION

The total volume may seem surprising when compared to the large surface.

How can a small oil spill still cover such a wide area?

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### REFLECTION

Which zone do you think is most dangerous for sea life based on your results?

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### METHOD

Does a thicker zone always contain more oil?  
Why or why not?

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Can a wide but thin zone contain more oil than a smaller, thicker one?

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### CLOSING REFLECTION

One thing I discovered...

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One question I still have...

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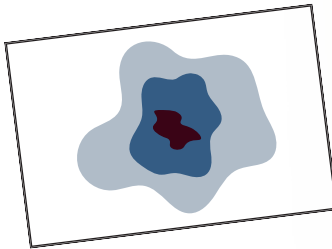
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One idea from my teammate that helped us...

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## Isabel's tools: Volumes!

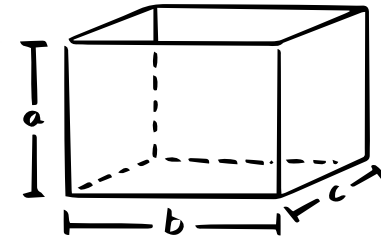
When we want to estimate how much oil has been spilled, we need to remember something important: oil is not only spread on the surface of the sea, it also has depth!



Surface tells us how wide the oil spill is, but it does not tell us how much oil there actually is.  
When we want to talk about quantity, we need a way to describe volume.

Volume helps us describe how much oil there is. It combines:

- how wide an area is
- and how high it is

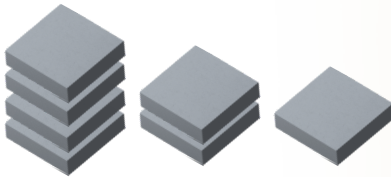
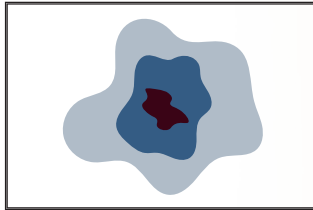


Look at the square tiles you used before. How could the same square help us show height, too?

This time, we will place the tiles in layers!  
Each tile still represents the same surface area.  
What changes is the number of layers, which represents how deep the oil is in each zone!

The map of the oil spill shows three different zones. These zones do not have the same depth or **height**. Now, build the layers on your model:

- In the grey zone, place 1 layer
- In the blue zone, place 2 layers
- In the dark zone, place 4 layers

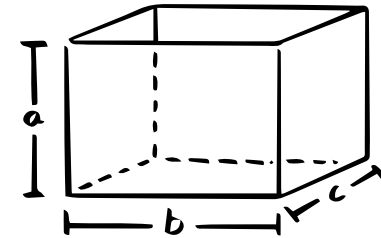


One layer of one square is about 0.25 mm thick.

- What is the height of the oil in the grey zone?  
\_\_\_\_\_ mm
- What is the height of the oil in the blue zone?  
\_\_\_\_\_ mm
- What is the height of the oil in the dark zone?  
\_\_\_\_\_ mm

Now, volume is calculated by combining surface and height!

$$\text{Volume} = \text{Surface} \times \text{Height}$$



In this activity:

- The surface was calculated in step 1 with the help of tiles for each zone
- The height comes from the layers you just determined

The volume you estimate can be expressed in cubic metres (m<sup>3</sup>).

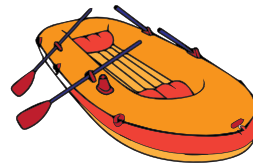
Note: oil is a liquid; so it spreads extremely thin! This means it is normal to get a very small number when you will measure the height in metres!!



## Mission sheet: Oil spill estimates

### Mission 2, Step 2:

### Planning the clean-up!




#### TOOLS

- The completed mission sheet of mission 2
- The cut up clean-up boats
- A calculator

#### PLANNER RULES

- You have 8 rescue teams
- 1 team can clean  $0.15 \text{ m}^3$  of oil per day
- Each zone can receive a maximum of 3 teams per day
- The operation lasts 4 days

#### TEAM ROLES

 Planner – decides how many teams to send where


Name: \_\_\_\_\_

 Counter – checks the totals each day

Name: \_\_\_\_\_

 Recorder – writes the plan & reasons

Name: \_\_\_\_\_

 Presenter – shares the strategy with the class

Name: \_\_\_\_\_

#### OBSERVE

Look back at the volumes ( $\text{m}^3$ ) your team calculated for each zone.

Which zone has the most oil?

Which has the least?

#### DO!

Put the boats on the table to visualise how you can plan the operation!

#### THINK & DISCUSS

Which decisions were the hardest to make? Why?

If you had more time or more teams, what would you change?



Planning the clean-up!



| Zone  | Day 1     | Day 2     | Day 3     | Day 4     | Total team days | Total volume cleaned (m <sup>3</sup> ) |
|-------|-----------|-----------|-----------|-----------|-----------------|--|
| Gray  | ___ teams | ___ teams | ___ teams | ___ teams |                 |  |
| Blue  | ___ teams | ___ teams | ___ teams | ___ teams |                 |  |
| Dark  | ___ teams | ___ teams | ___ teams | ___ teams |                 |  |
| Total | ___ teams | ___ teams | ___ teams | ___ teams |                 |  |






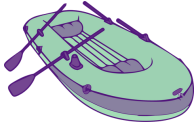






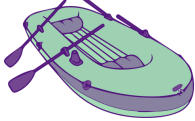


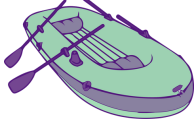



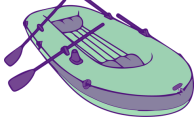








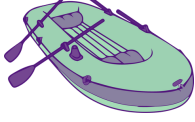


TEAMS DAY1

TEAMS DAY 2

TEAMS DAY 3

TEAMS DAY 4

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