Sodium Chloride (NaCl) blocks ice formation and affects the freezing point and freezing time of water

SSH Mission I ASLE Class

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Nagasaki Nishi High School

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Presentation Outline

- 1) Introduction
- 2) Materials and Methods
- 3) Results
- 4) Discussion

1) Introduction

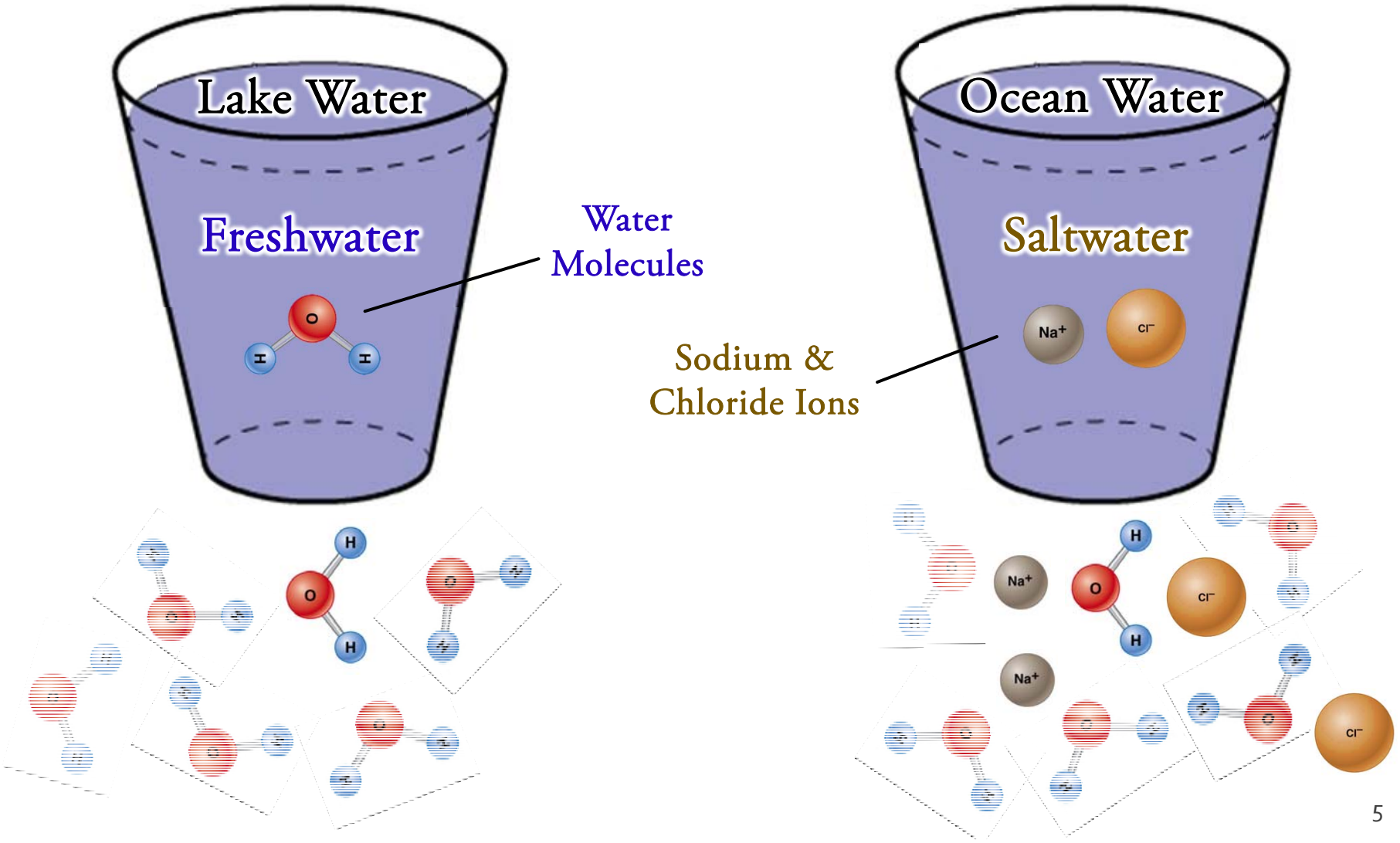
- Observation
- Research Question
  - Why?
- Background Research
  - Lake water vs Ocean water

Introduction

- Lakes freeze in the winter!
- Oceans don't freeze at the same temperature…

- Research Question
  - In the winter, why do lakes freeze and oceans do not?

Background Research



Hypothesis 1:

- **If** I increase the concentration of salt in water, **then** it will freeze at a lower temperature.

Hypothesis 2:

- **If** I increase the concentration of salt in water, **then** it will take longer to freeze.

Variables

- Independent Variable (独立変数):

→ Concentration (g/250ml) of salt in water

- Dependent Variable(s) (従属変数):

→ Freezing Point (F_p)

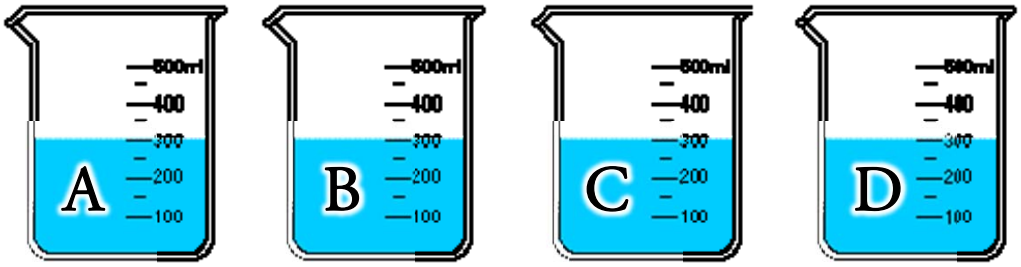
Freezing Time (F_t) ←

2) Materials and Methods

- Materials
- Methods: Freezing point (F_p) and time (F_t)

Materials:

Salt



4 beakers with water: A, B, C, D

Freezer Incubator

Thermometer

Scale

Graduated Cylinder

Timer

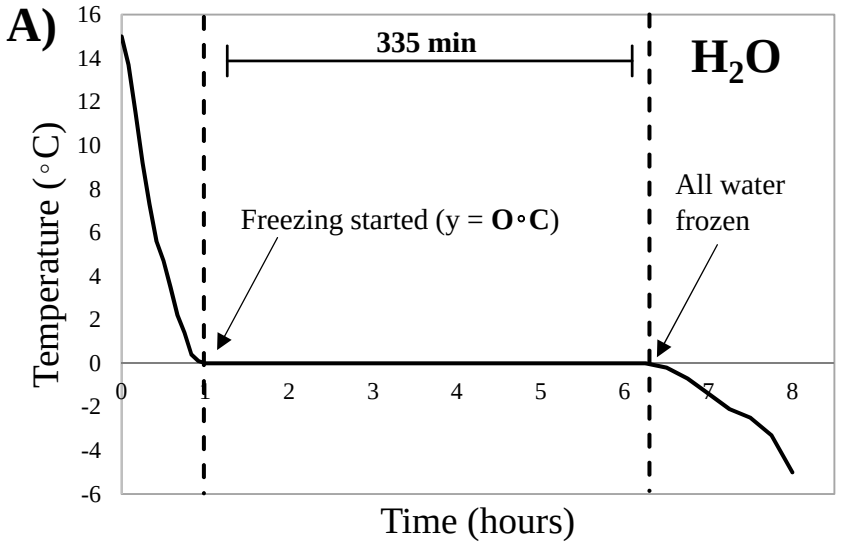

SPEED CONTROL
PILOT
OFF
FAST
MAGNETIC STIRRER
sartorius
Tare
A
B
C
D

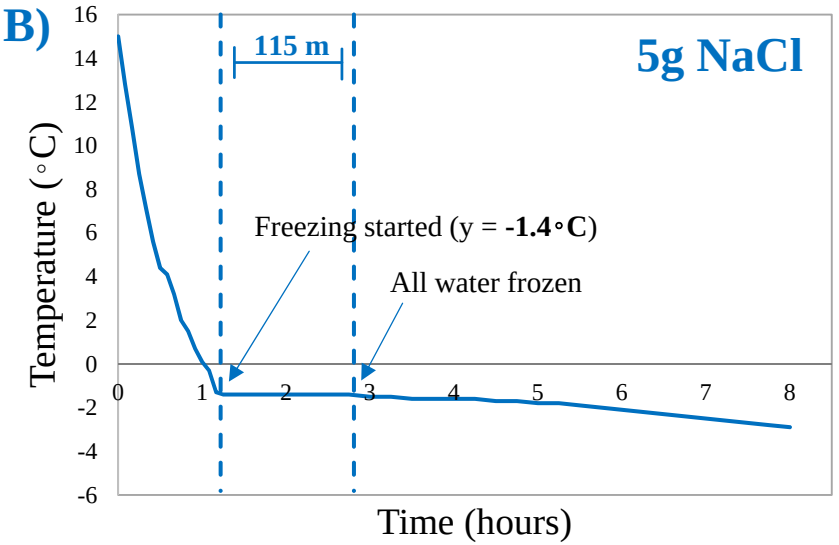

Chameleon Reagent
Sodium chloride
NaCl FW 58.44
1級 塩化ナトリウム
B
61.0 %
20.6 °C
15:46 30
IN / OUT
MAX / MIN
ON / OFF
AND AD-5680
C
57.4 %
20.1 °C
0:06 39
AND AD-5680
A
COMFORT
56.0 %
21.0 °C
0:17 11
AND AD-5680
D
COMFORT
59.4 %
20.7 °C
15:46 48
AND AD-5680

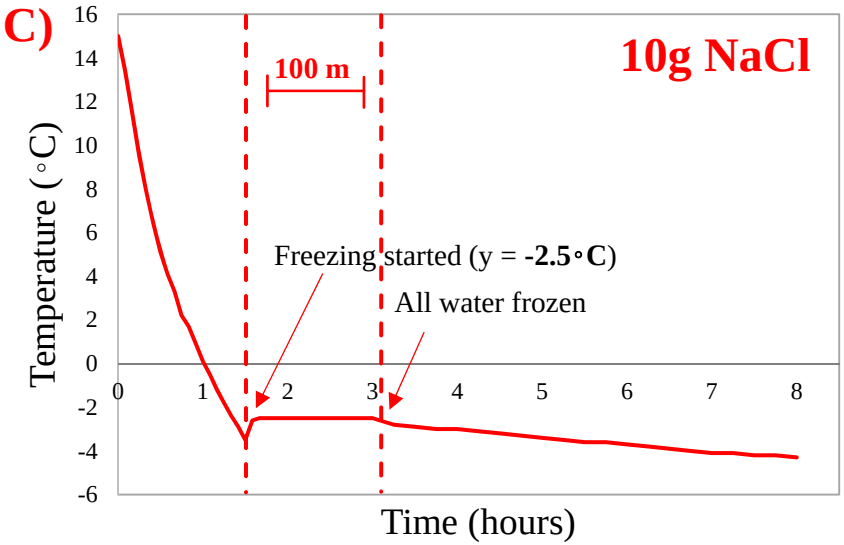
3) Results

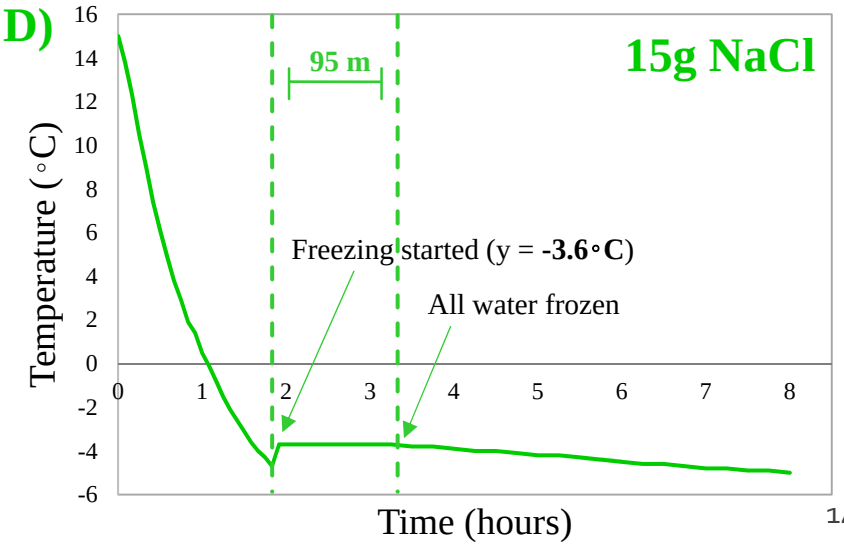
- Freezing Point (F_p)
- Freezing Time (F_t)

Results: F_p and F_t

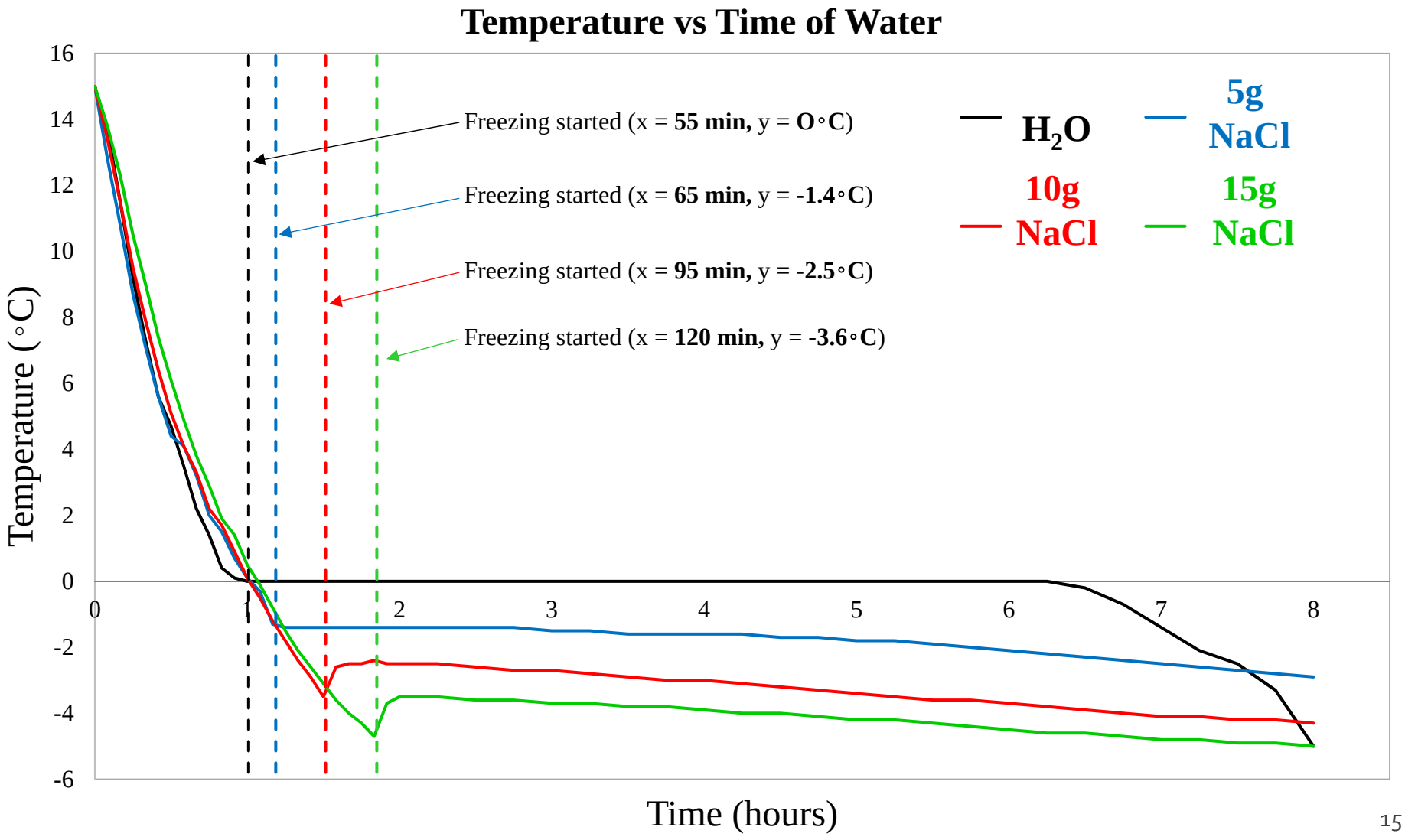








Results together:



4) Discussion

- Summary
- Conclusions
- Future Studies

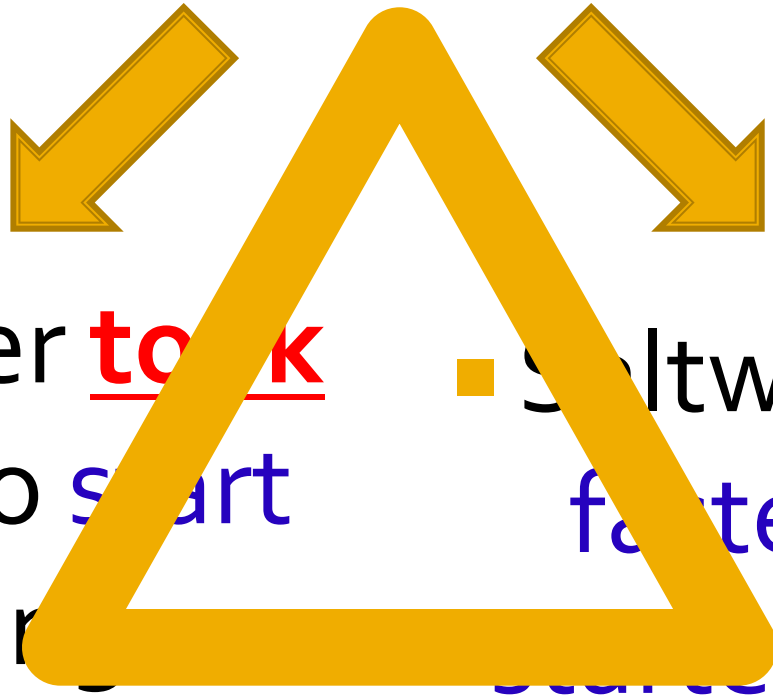
Summary

- Saltwater groups B (5g), C (10g), and D (15g) had lower freezing points (F_p) than freshwater (A)
  - Hypothesis 1 is correct!

- For freezing times, saltwater B, C, and D:
  - Took longer to start freezing and,
  - Froze faster after it started freezing
  - Hypothesis 2 is … (correct/incorrect?)

Freezing Time (F_t) Hypothesis

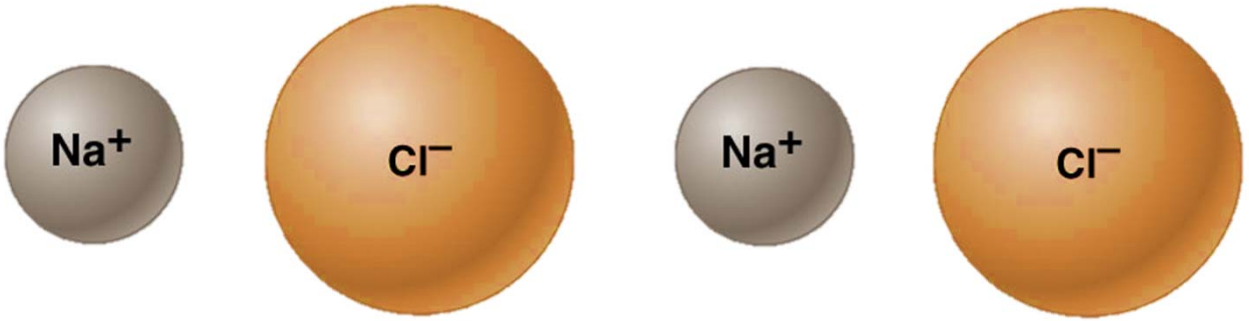
Hypothesis 2 is not specific enough!



- Salt water took longer to start freezing.
- Saltwater froze faster **after** it started freezing.

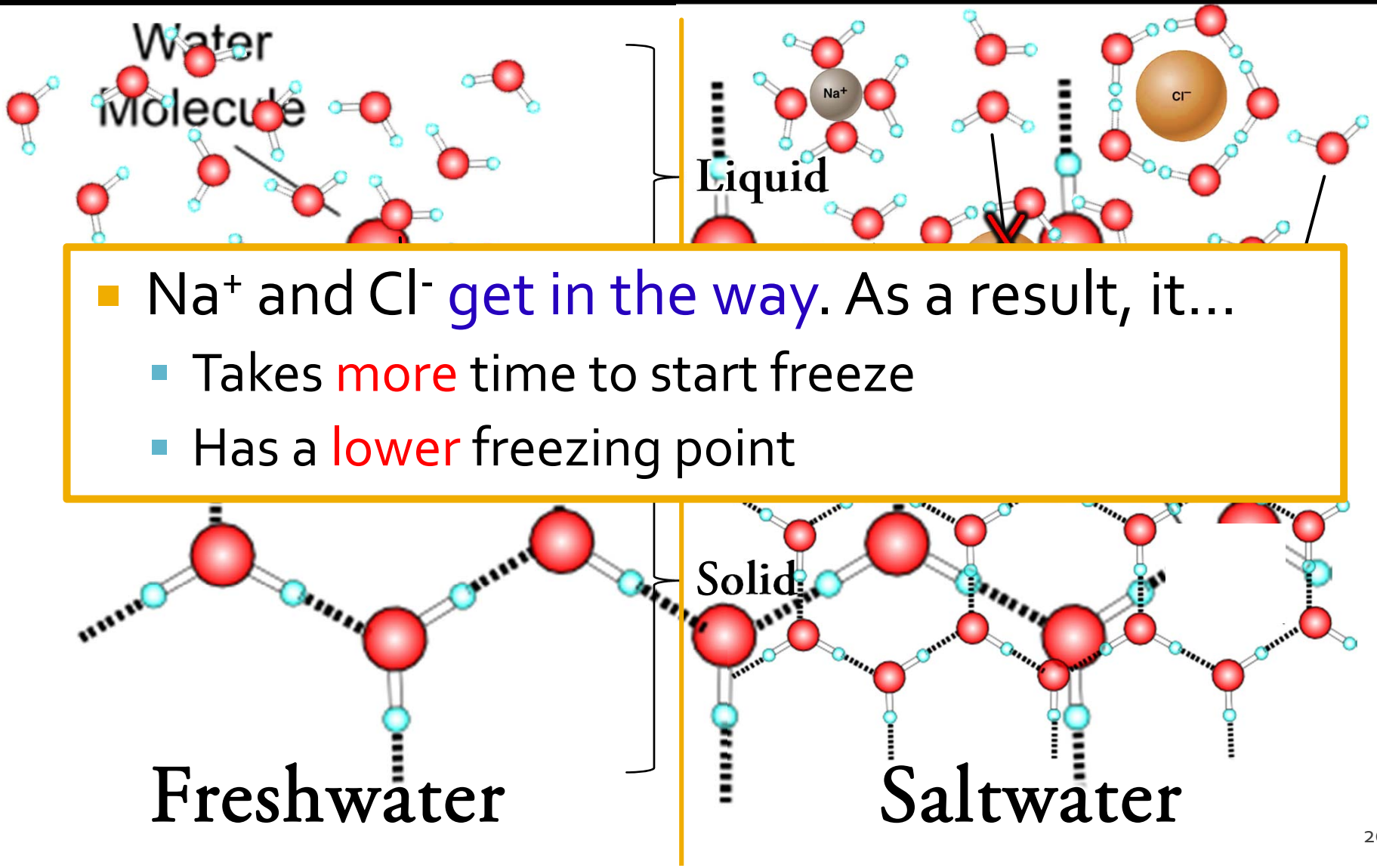
Conclusion

- Salt ions (Na^+ and Cl^-) block ice formation by getting in the way of H_2O molecules



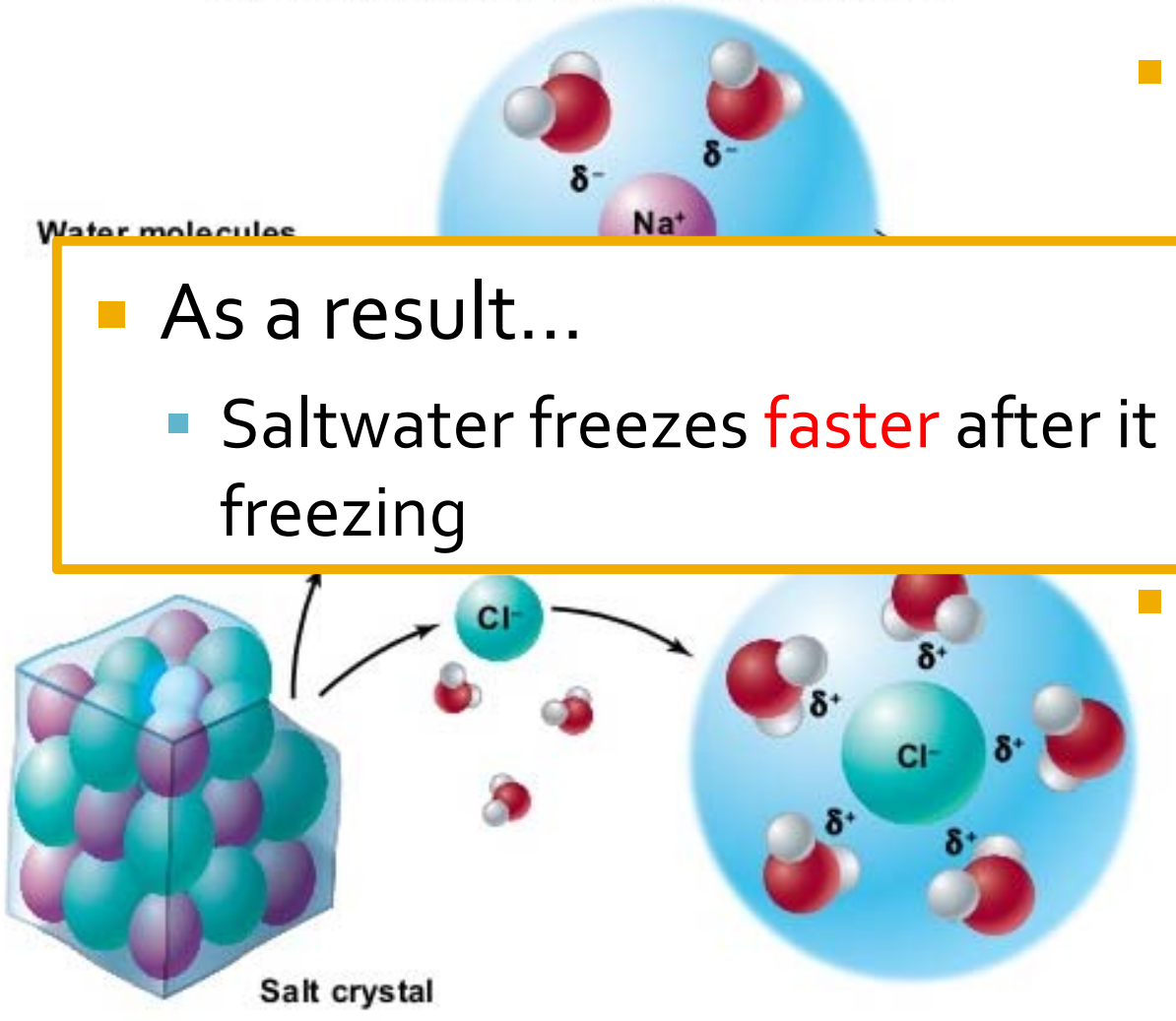
- This is called **Freezing Point Depression**
  - 凝固点降下（ぎょうこてんこうか）

Liquid (Water) to Solid (Ice)



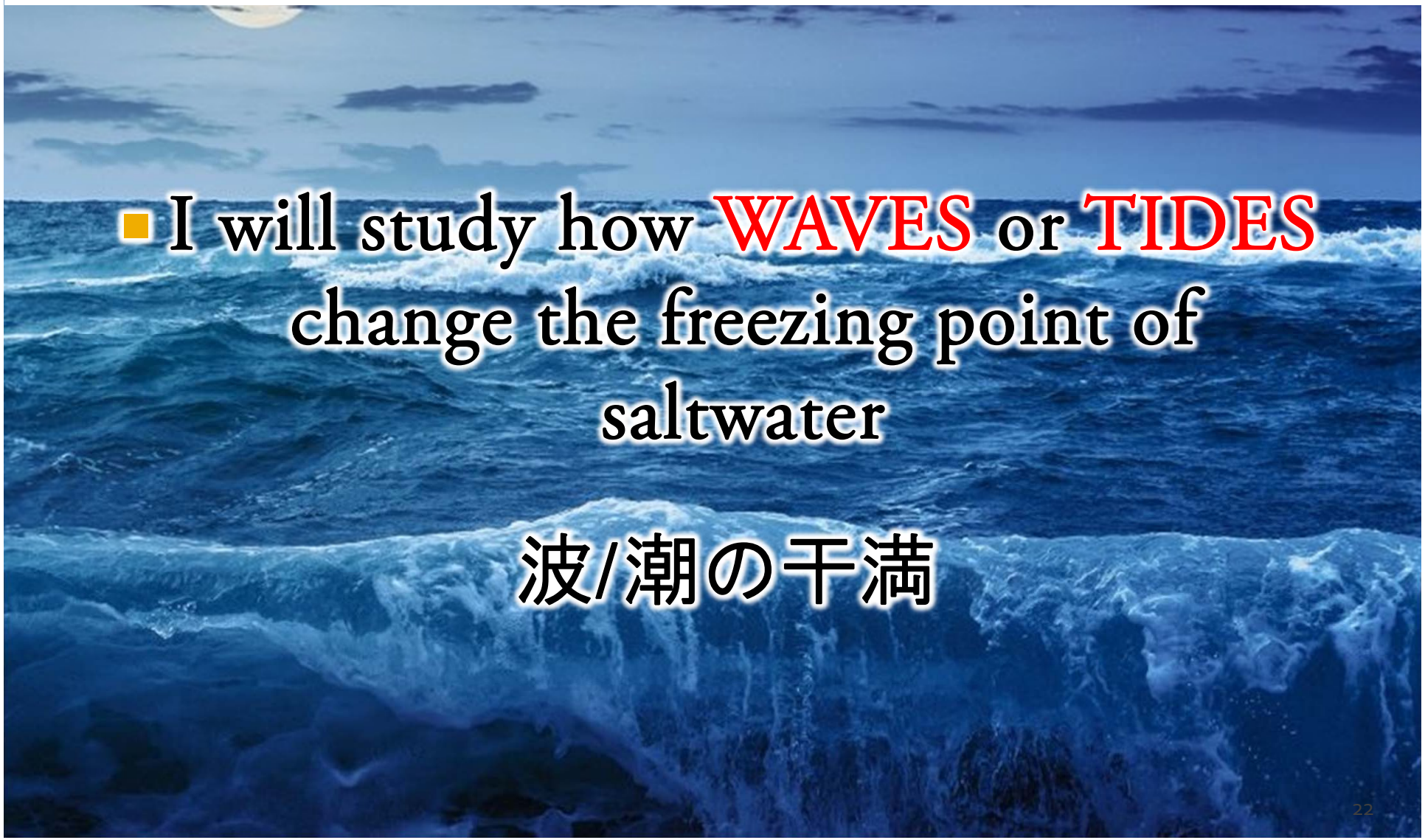
- Na^+ and Cl^- get in the way. As a result, it…
  - Takes more time to start freeze
  - Has a lower freezing point

Conclusion: Shorter F_t



- First, ice must find a place to start freezing
- As a result…
  - Saltwater freezes faster after it has started freezing
- These shells can act as places where ice can form

Future Studies



- I will study how WAVES or TIDES change the freezing point of saltwater

波/潮の干満

Questions