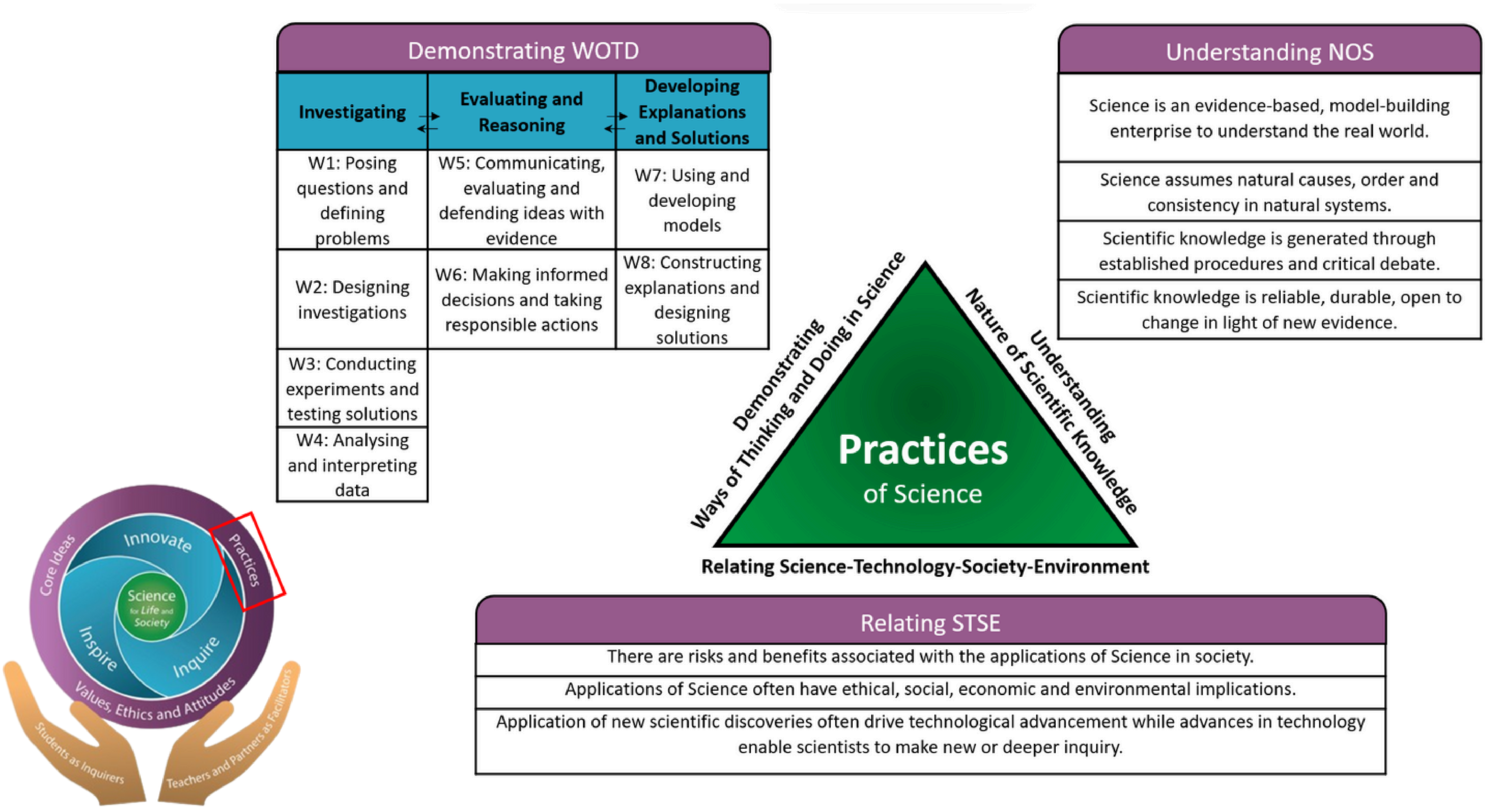
SLS Guide for Science

Leveraging SLS to Enhance Teaching and Learning of Science

- The guide is developed by Educational Technology Division with input from Academy of Singapore Teachers and Curriculum Planning and Development Division.

- This guide demonstrates the potential of the Singapore Student Learning Space (SLS) to enhance the teaching and learning of Science, using different SLS features and different lesson examples. These activities foster and support students' scientific conceptual understanding and the Ways of Thinking and Doing (WOTD) in the Science Curriculum Framework. Teachers can also leverage available resources on Community Gallery and MOE Library to complement lessons and reinforce key or challenging concepts.



Navigation Tips:

- Each segment addresses questions that teachers might have about developing students' conceptual understanding and engaging them in the WOTD. The segments highlight:
  - how teachers can harness the affordances of SLS to enhance their teaching approach,
  - the interactions among students, teacher and students and/or students and content that foster engagement and learning, and
  - the pedagogical affordances of SLS features.
- Please note that the SLS features mentioned in the guide serve as suggestions to inspire teachers to explore possibilities and they are not exhaustive.
- For detailed technical information on each SLS feature, simply click on the embedded link. You will be directed to the relevant page in the SLS User Guide.

How can I **design activities** to facilitate posing questions, designing investigations, conducting investigations/testing solutions and analysing data?

Teachers can engage students and **activate their learning** using Resources such as simulations that allow them to conduct scientific investigations to understand and explore concepts (e.g., varying the independent variable and observing trends and patterns when exploring factors that affect photosynthesis) (Fig. 1.1).

Students can record their data in a table (included in a Free-Response Question) (Fig 1.2) and **work collaboratively** with one another in pairs or in groups to **analyse the data** obtained. They can further **discuss and comment** on the results obtained by other pairs or groups.

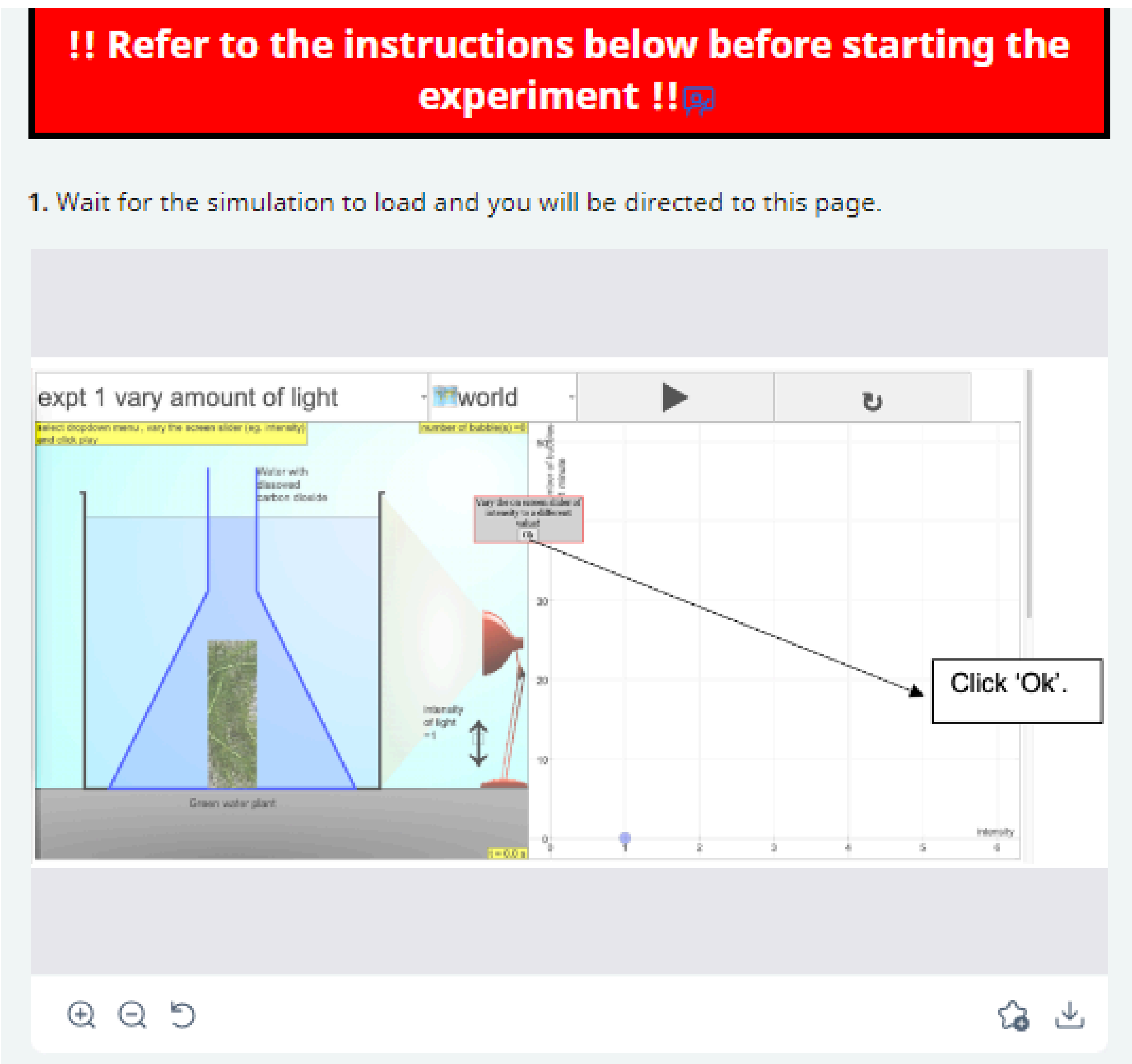
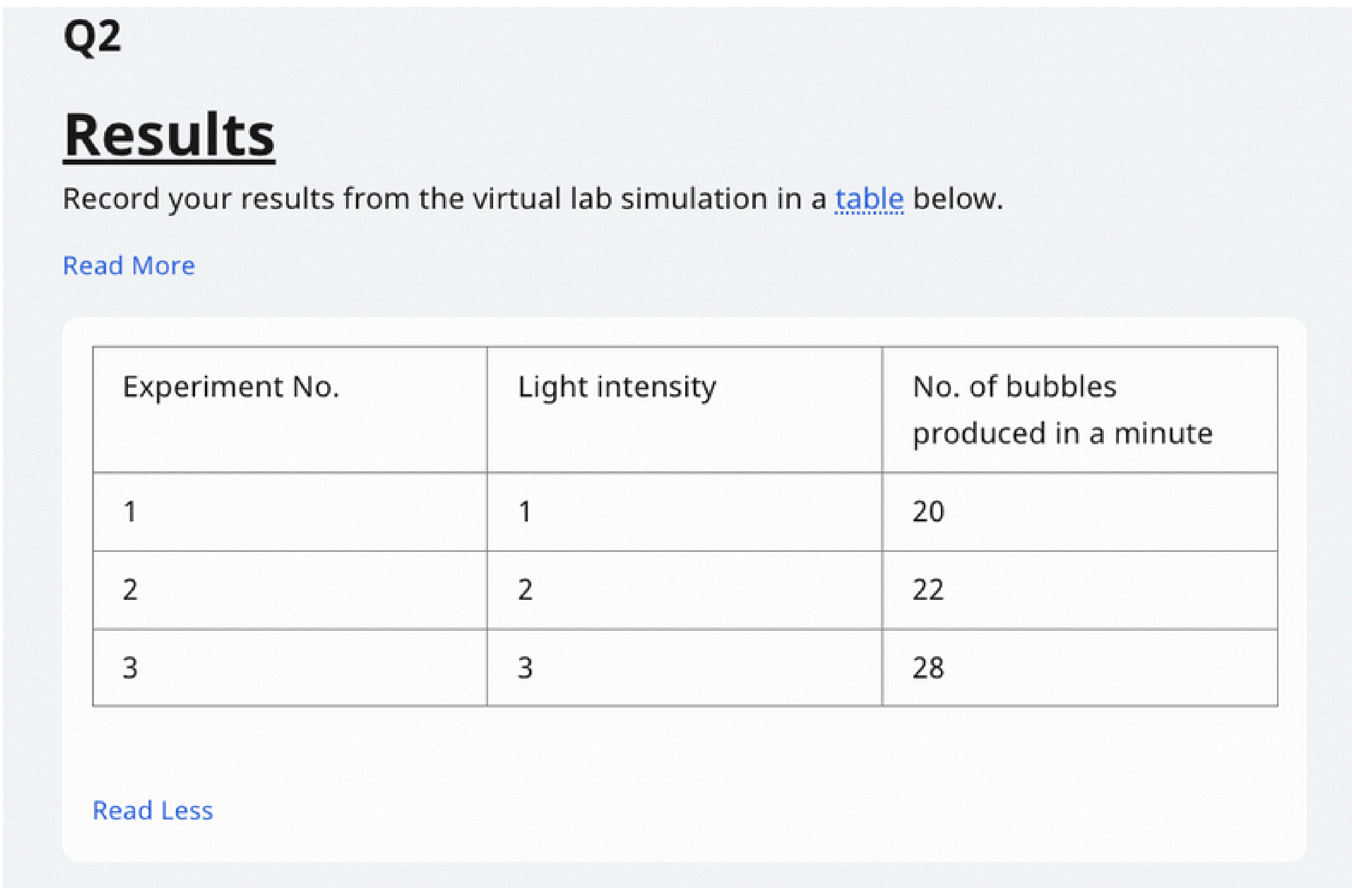


Fig 1.1



Q2

Results

Record your results from the virtual lab simulation in a table below.

Read More

Experiment No.	Light intensity	No. of bubbles produced in a minute
1	1	20
2	2	22
3	3	28

Read Less

Fig 1.2

Alternatives

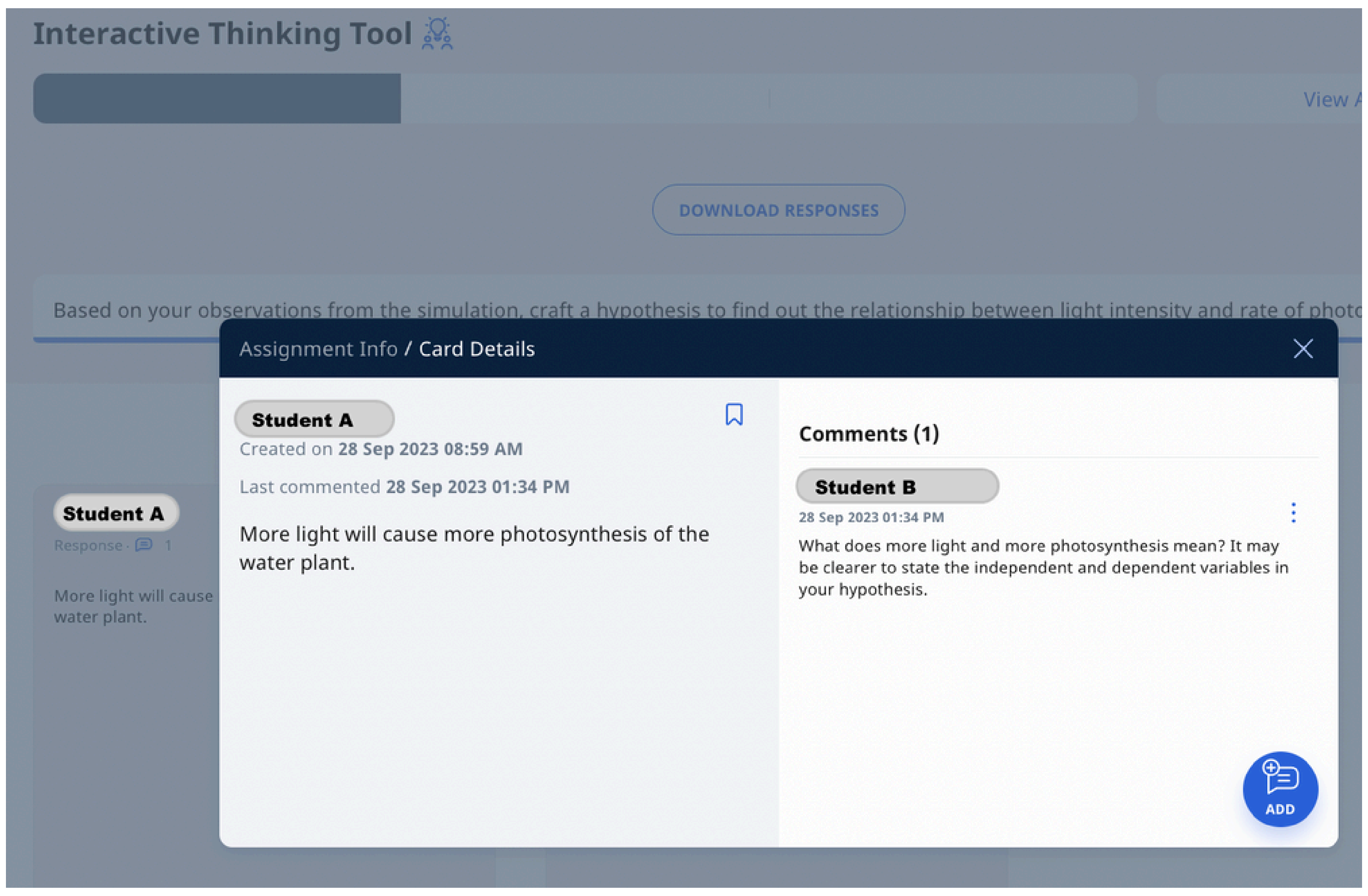
Use Click-and-Drop to help in sequencing their steps when designing an investigation.

Click on the pictures for a larger view.

Investigating (W1 - W4)

Teachers can also use the Interactive Thinking Tool to guide students to formulate and share their hypothesis while the Comments feature allows students to comment on their peers' hypotheses (Fig 1.3).

Students can sketch a graph of their data using the Interactive Thinking Tool with pre-populated axes (Fig 1.4) and they can **discuss on the trend observed** from the graph.



Alternatives

Use Free-Response Question type to prepopulate hypothesis structure to guide students in formulating their hypotheses.

Fig 1.3

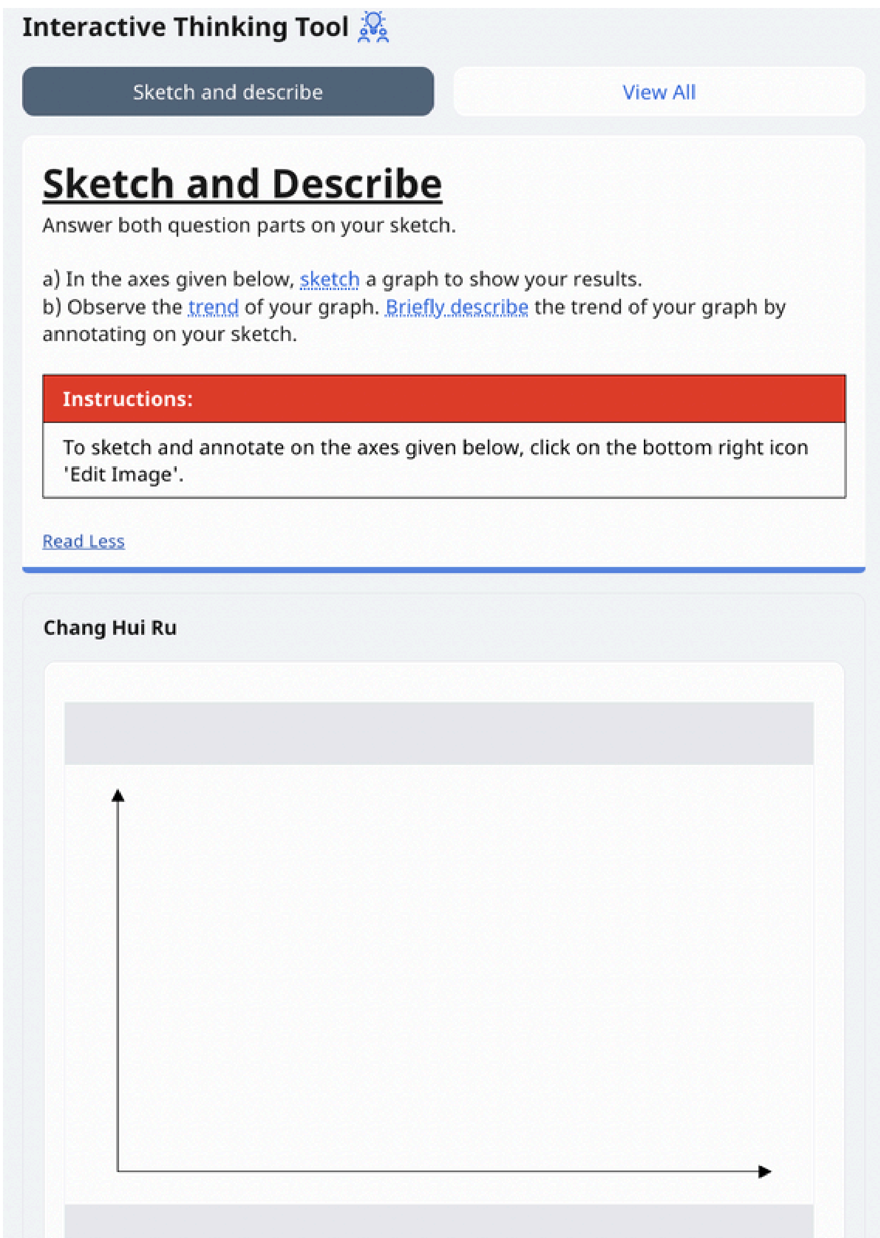


Fig 1.4

Click on the pictures for a larger view.

PEDAGOGICAL AFFORDANCES:

- Simulation software / Virtual labs provide a controlled digital environment for students to plan and design investigations that might not be practical or possible given constraints of the school lab.
- The Interactive Thinking Tool allows students to document their learning, **make their thinking visible** and comment on their peers' responses. It also allows students to collaborate with one another.
- Populating axes and tables, helps students to **organise and represent their data**.

How can I help my students effectively communicate their ideas, substantiate their arguments with evidence, and evaluate their peers' explanations, so as to provide constructive feedback?

Teachers can start the lesson using a Poll to **activate students' prior knowledge** followed by an Interactive Thinking Tool with pre-populated prompts to guide students in **substantiating their claim with evidence and reasoning**. (Fig 2.1).

A Video can be included to help students observe a chemical reaction at the macroscopic level, and an Multiple-Choice Question included to assess their understanding (Fig 2.2).

Students express their choice in the Poll and articulate their reasoning supported with evidence in the Interactive Thinking Tool. This helps to facilitate idea exchange among peers.

Students can replay the videos as needed before responding to the Multiple-Choice Question, which then **offers them instantaneous automated feedback**.

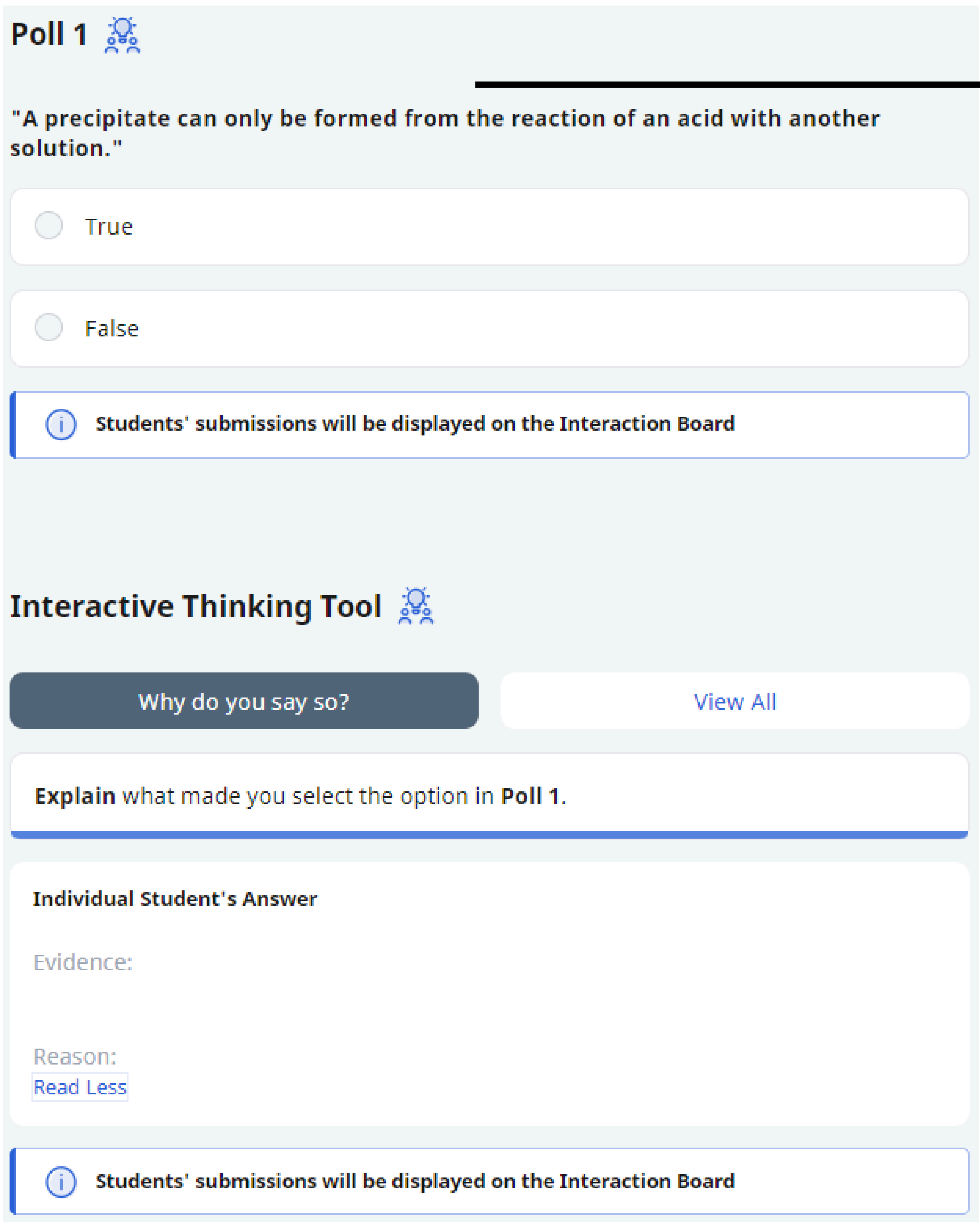


Fig 2.1

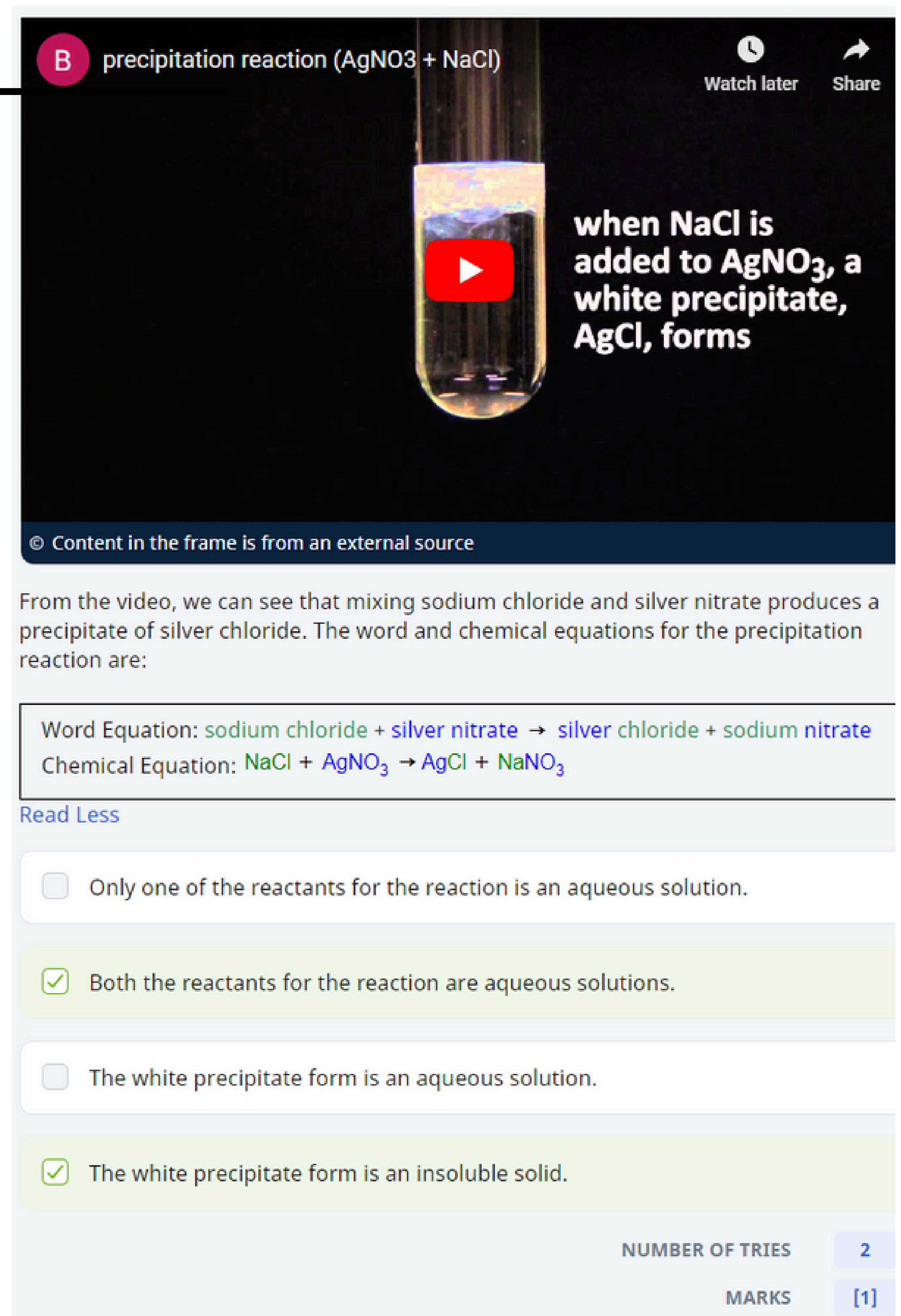


Fig 2.2

Click on the pictures for a larger view.

A simulation can be embedded in SLS to enable students to visualise the interactions at the sub-microscopic level during a chemical reaction (Fig 2.3).

To help students **think more critically**, teachers can include a table within a Free-Response Question to structure students' reflections and guide them to describe/record their observations, translating what they see at the sub-microscopic level into symbolic representation (Fig 2.4).

Teachers and students can use symbols and conventions to create chemical notations and write chemical equations to **communicate their ideas, solutions and justification** using ChemType (Fig 2.5). ChemType supports handwritten input which are auto-translated to computer notations.

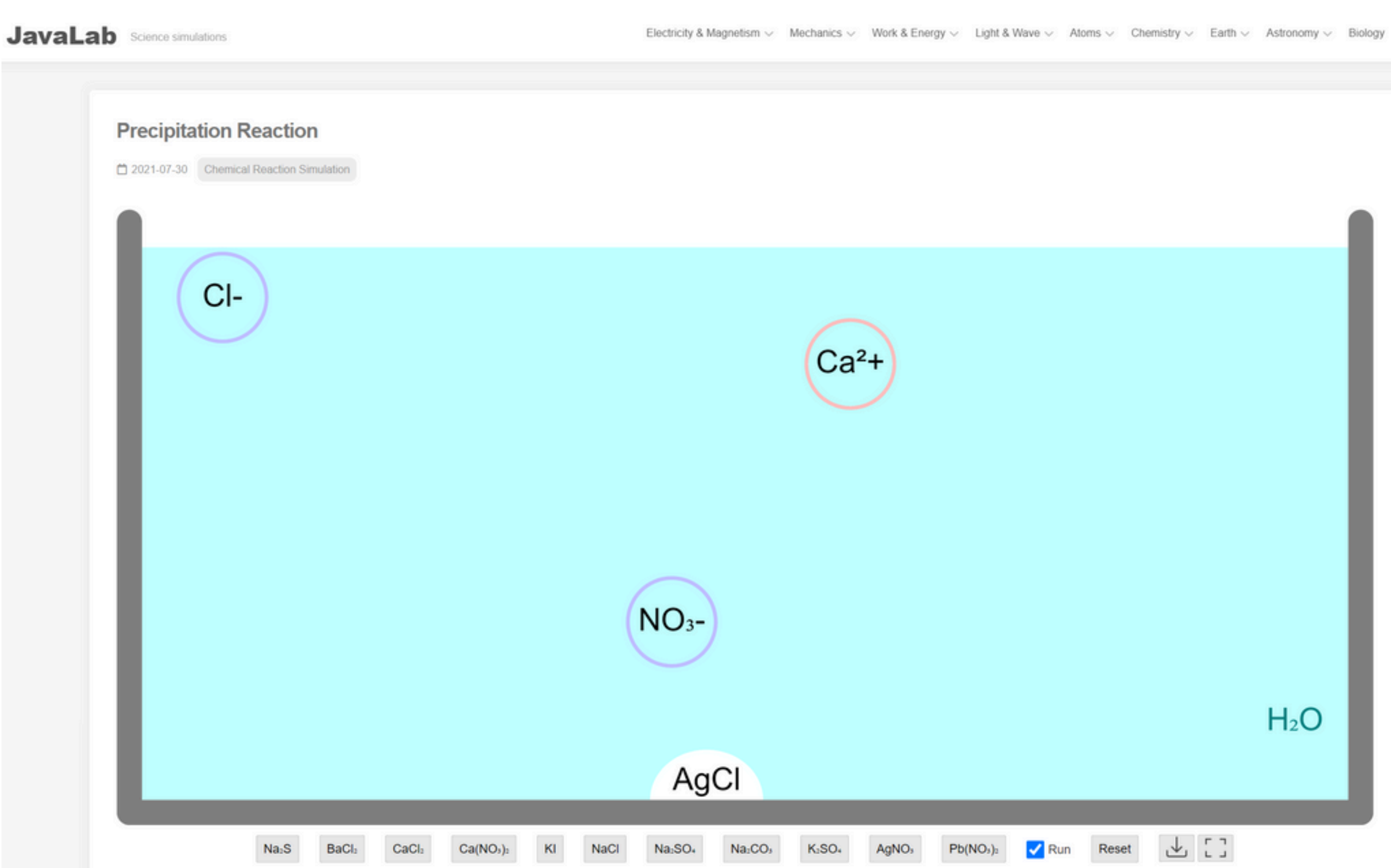
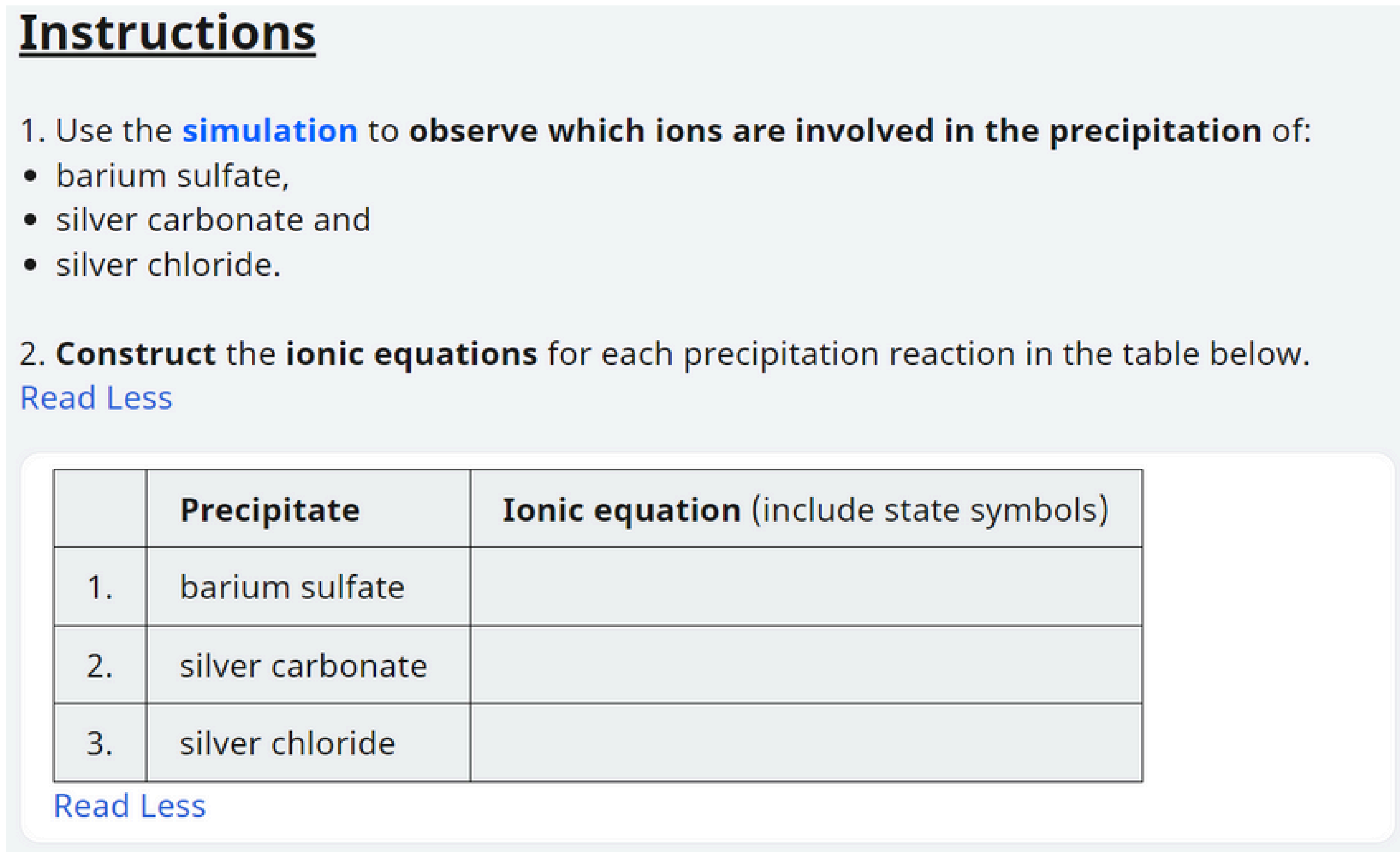


Fig 2.3



Instructions

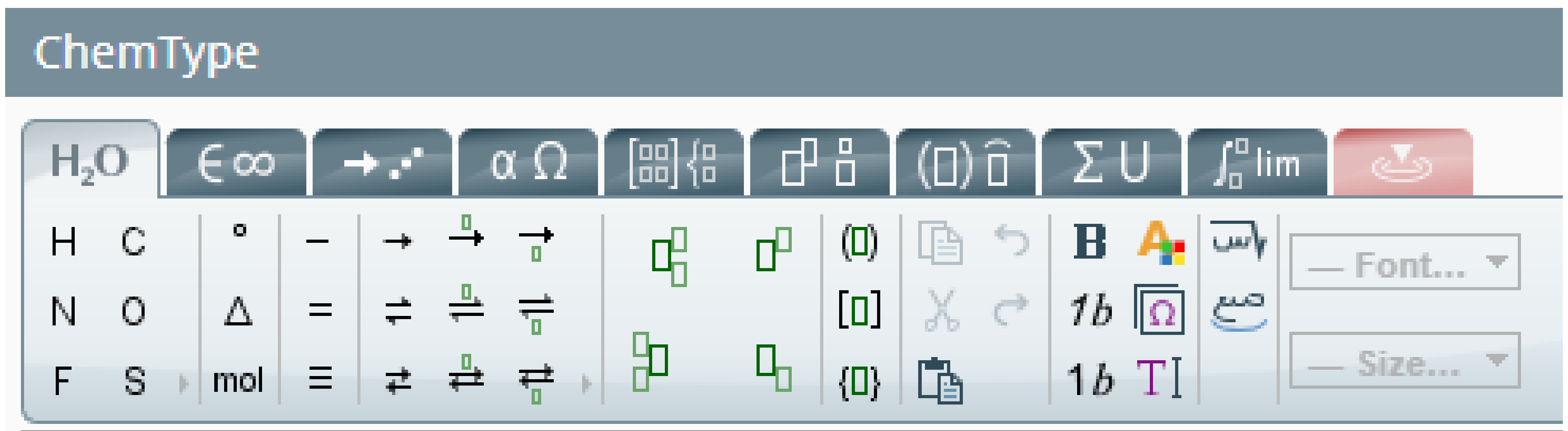
1. Use the **simulation** to **observe which ions are involved in the precipitation** of:
- barium sulfate,
- silver carbonate and
- silver chloride.

2. **Construct** the **ionic equations** for each precipitation reaction in the table below.
Read Less

	Precipitate	**Ionic equation** (include state symbols)
1.	barium sulfate	
2.	silver carbonate	
3.	silver chloride	

Read Less

Fig 2.4



	Precipitate	Ionic Equation
1.	barium sulfate	$Ba^{2+}(aq) + SO_4^{2-}(aq) \rightarrow BaSO_4(s)$
2.	silver carbonate	$2Ag^{+}(aq) + CO_3^{2-}(aq) \rightarrow Ag_2CO_3(s)$
3.	silver chloride	$Ag^{+}(aq) + Cl^{-}(aq) \rightarrow AgCl(s)$

Fig 2.5

Click on the pictures for a larger view.

Using a 2-Column Interactive Thinking Tool with pre-populated prompts (Fig 2.6a), students record their explanations and substantiate them with evidence (Fig 2.6b). Teachers can **guide students in providing constructive peer feedback** (e.g., sentence starters), which can in turn help students refine their explanations (Fig 2.6c).

Students have a choice to type, draw or upload images/videos to **articulate their ideas, understanding and explanations** (Fig 2.7) when responding to the Interactive Thinking Tool. They can review their peers' explanations and provide Comments. This enables students to refine their knowledge, drawing on scientific concepts and evidence to evaluate their claims (Fig 2.8).

Alternatives

Using Forum and Discussion promotes the sharing and exchange of perspectives.

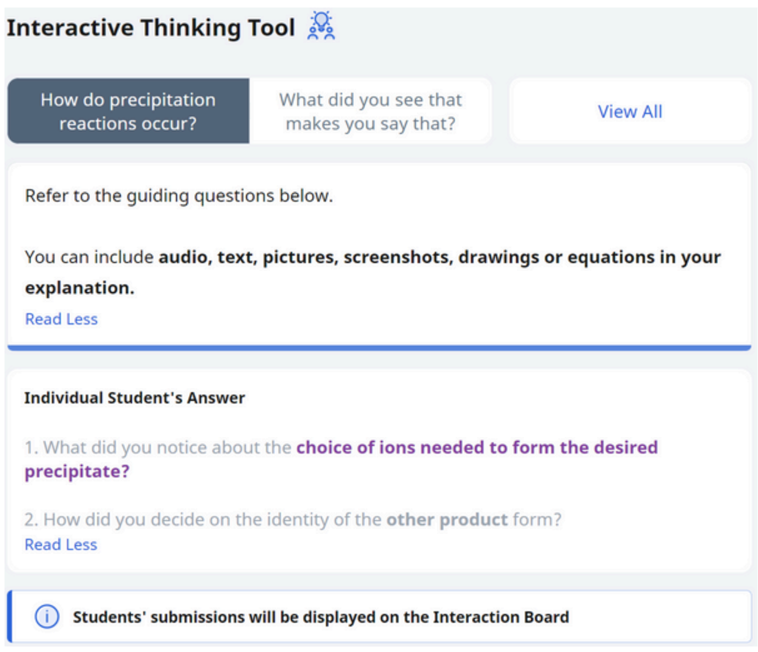


Fig 2.6a

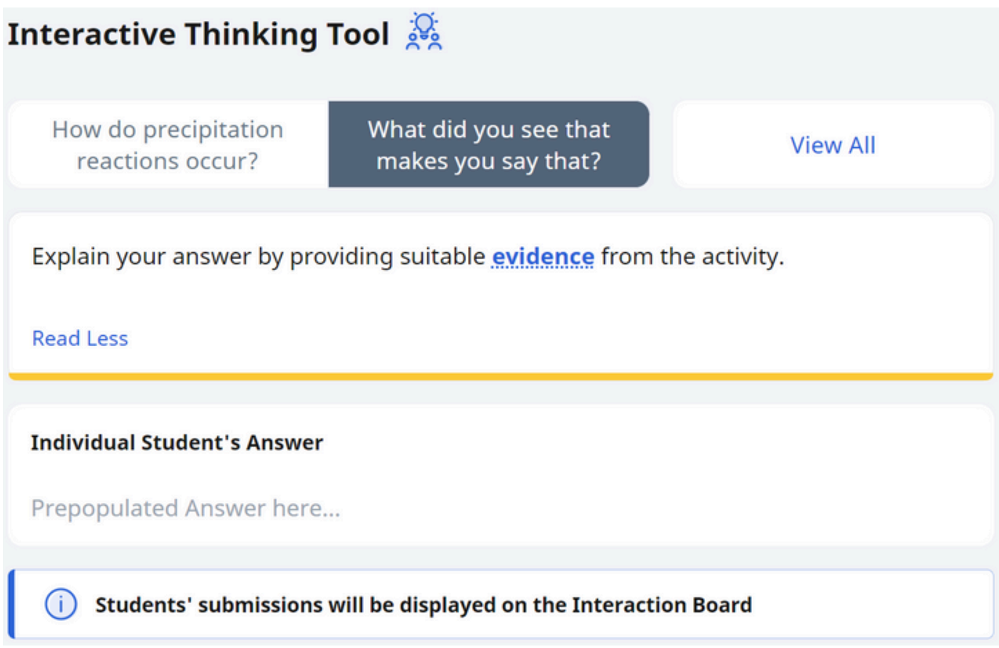


Fig 2.6b

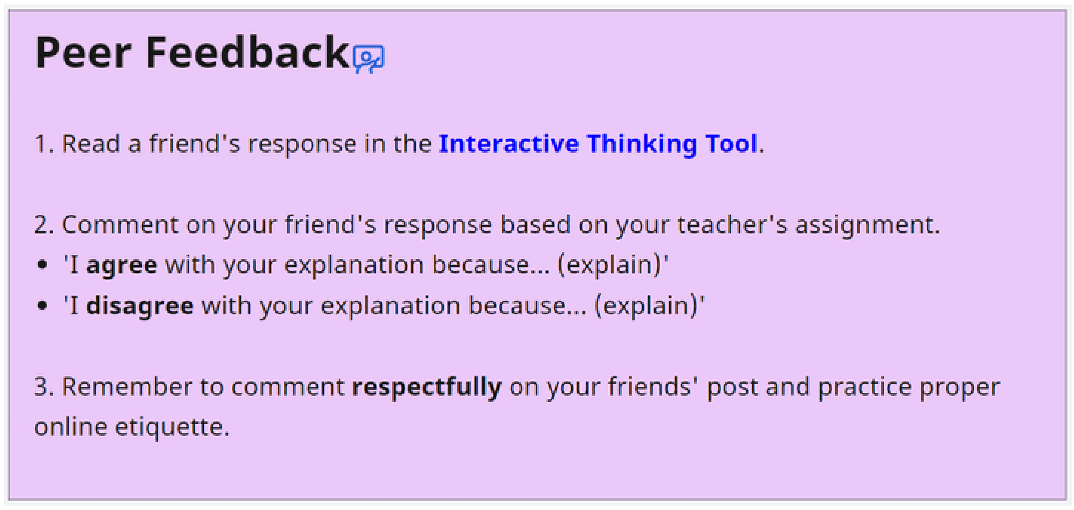


Fig 2.6c

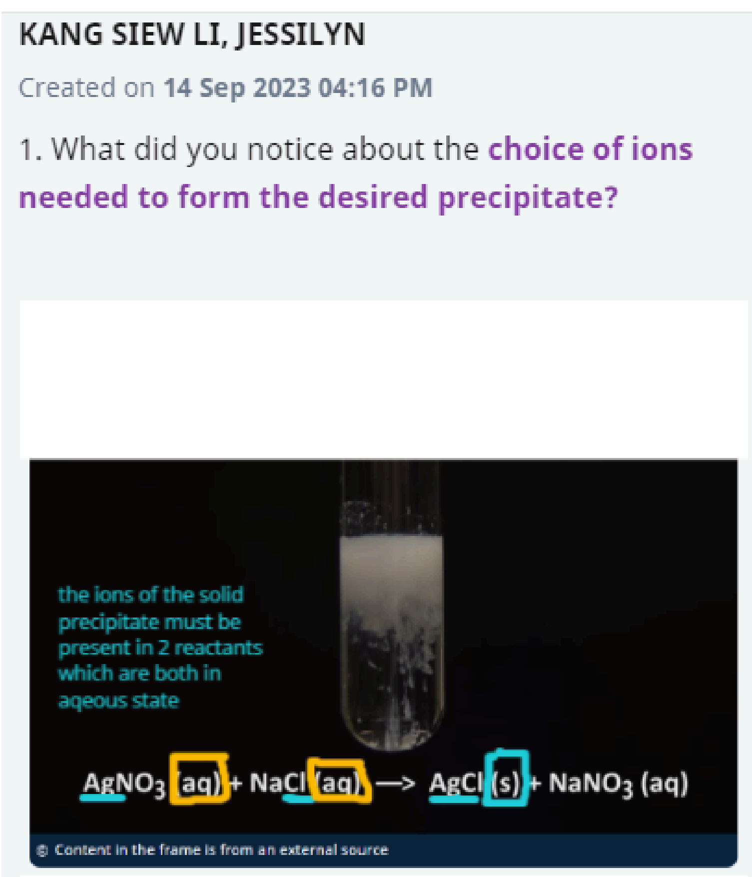


Fig 2.7

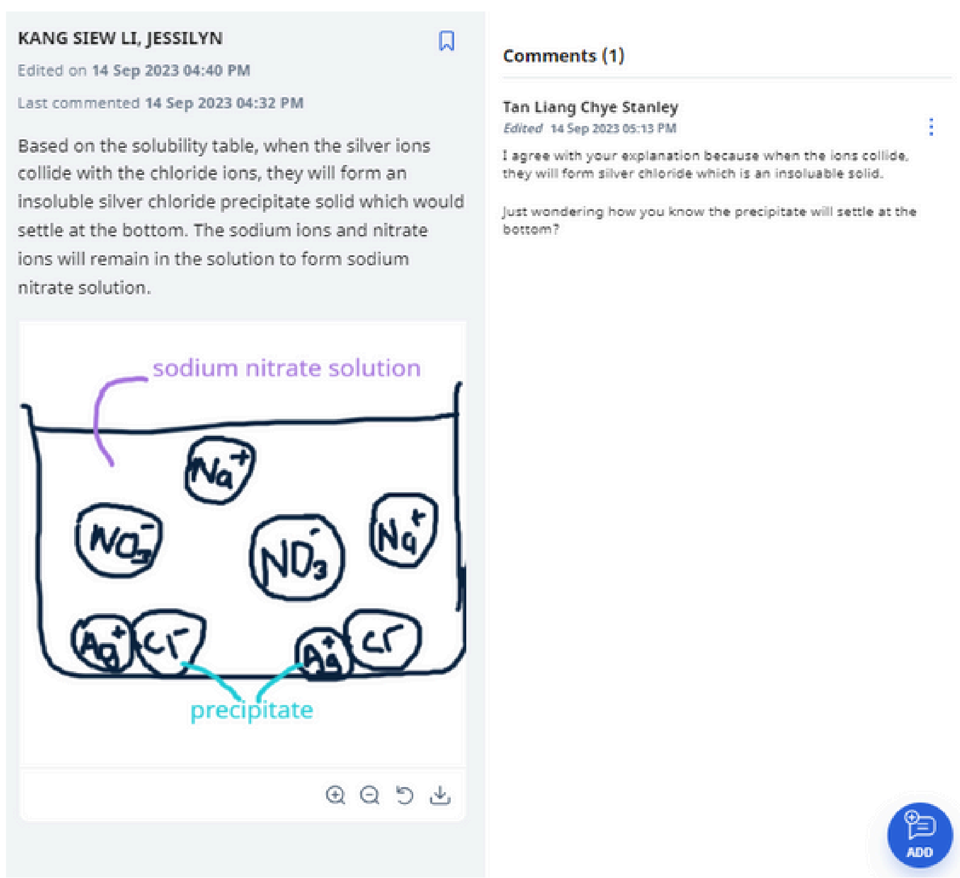


Fig 2.8

DI by Product

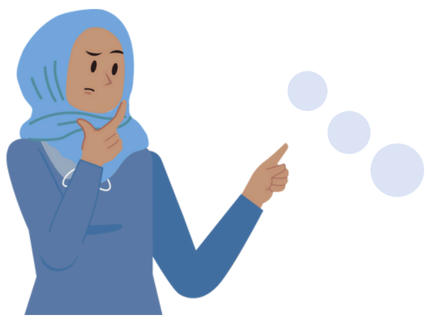
Do you know you can allow students to provide their input by typing, recording of audio or even drawing?

Click on the pictures for a larger view.

PEDAGOGICAL AFFORDANCES:

- Integrating various forms of media, such as images, videos, and interactive elements enhances the learning materials. Each mode/representation highlights different aspects of a concept bringing clarity to the student.
- Using tools like ChemType to input chemical notations, allows students to **express their observations more precisely and with the appropriate representation**.
- Allowing students to choose their preferred mode to express their ideas and reasoning within scientific contexts is an important process to **enable them to take ownership of their learning** and to **communicate effectively**.

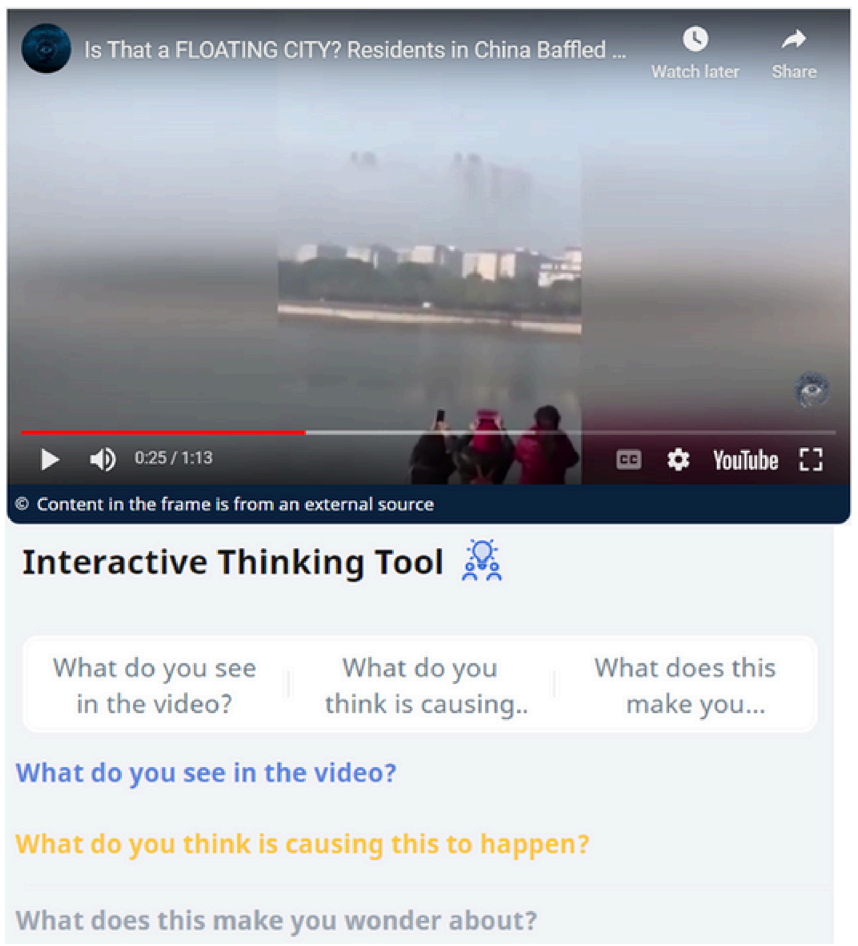
Developing Explanations and Solutions (W7 - W8)



How can I help my students to **generate explanations** for natural phenomena **using models**?

Teachers can **spark curiosity** by embedding YouTube Videos of an interesting natural phenomenon (e.g., floating city video).

By using the "See-Think-Wonder" template from the Interactive Thinking Tool, teachers can encourage students to **observe, interpret, and ask questions** (Fig 3.1).



Chunking - as a scaffold

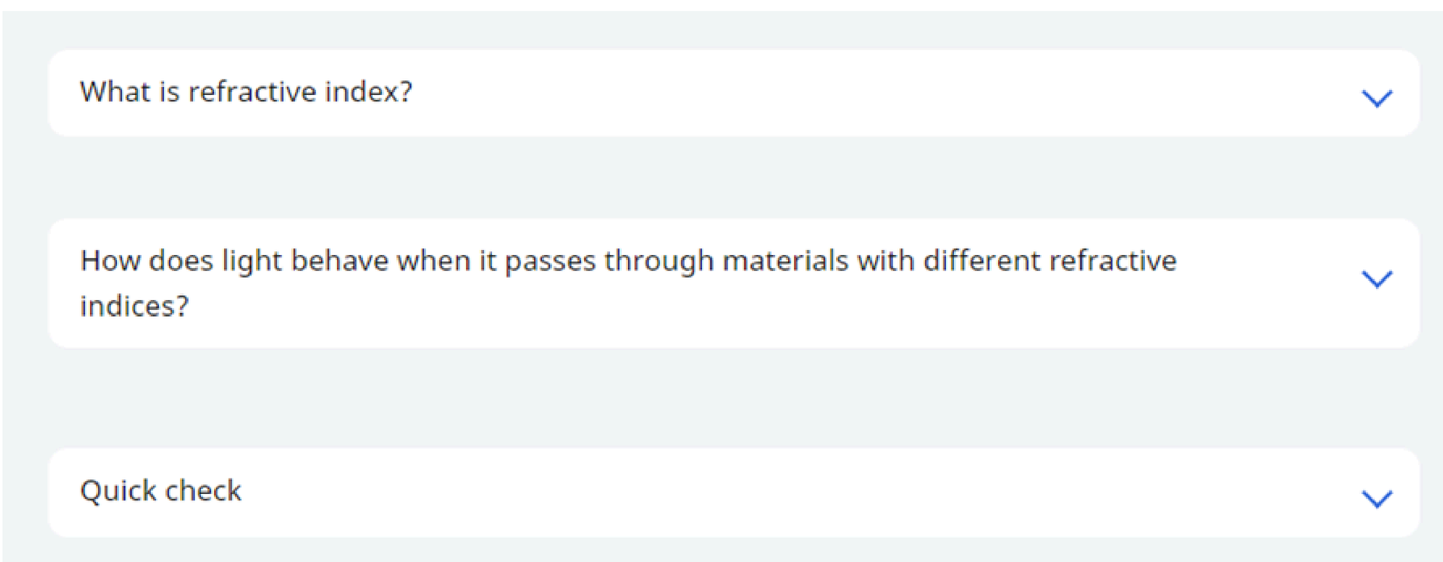
Do you know you can set the preferred start and end time for the video playback? Visual chunking helps students understand and process information quickly and clearly.

Fig 3.1

Click on the picture for a larger view.

Teachers can Upload Files such as pictures and videos, and/or embed simulations from Whitelisted Websites, with guiding questions in the Accordions display to **teach students about models** (e.g., the Ray Model of Light) (Fig. 3.2).

Using the Accordions display feature, students can view the ray model information one section at a time, preventing them from feeling overwhelmed and **aiding concentration** (Fig 3.3).



Accordions display feature

Accordions display can be used to display key concepts allowing students to focus, lowering cognitive load.

Fig 3.2

Click on the picture for a larger view.

Developing Explanations and Solutions (W7 - W8)

Resources on SLS

Do you know there are many useful simulations and interactives in the [MOE Library]() that you can use when designing your lessons?

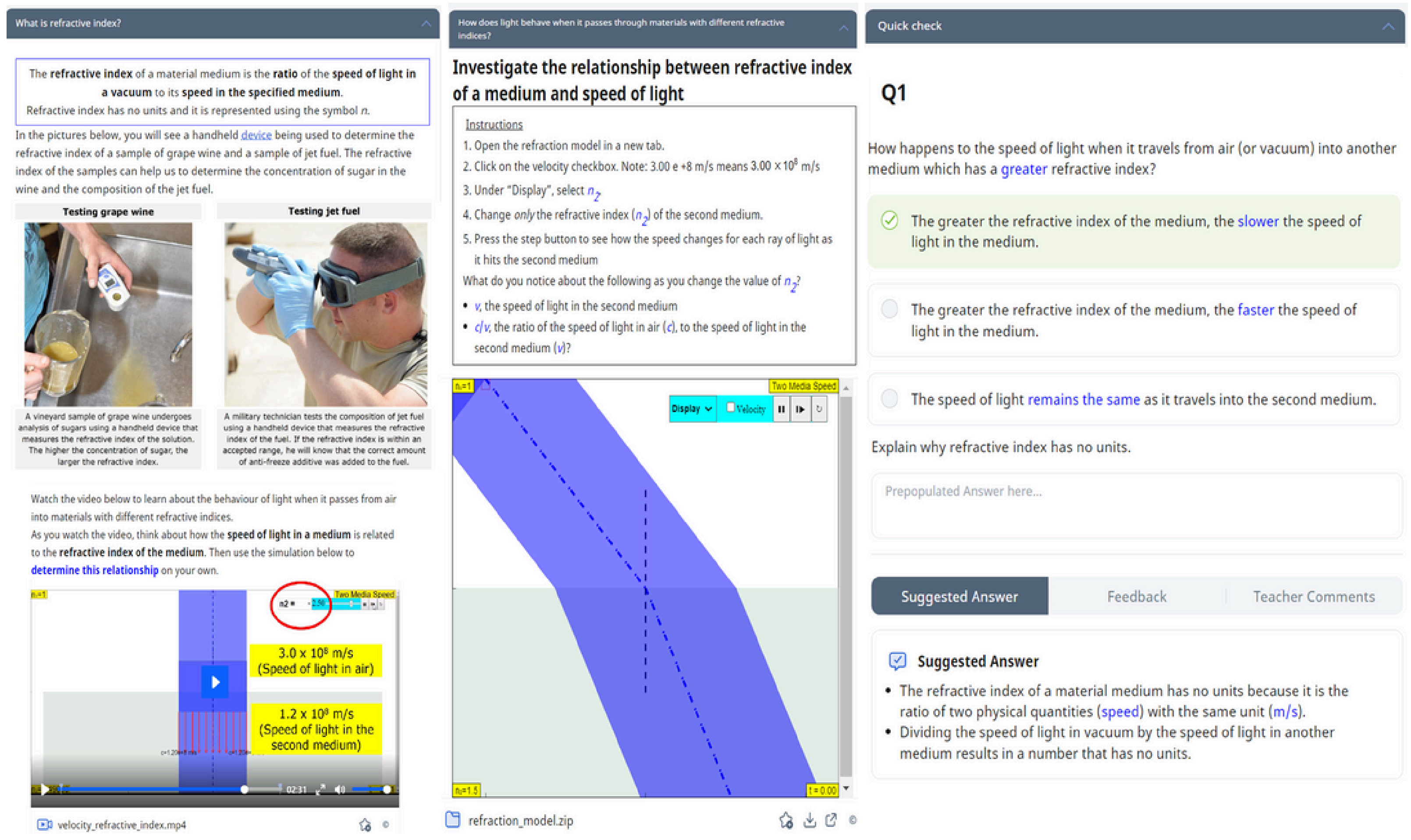
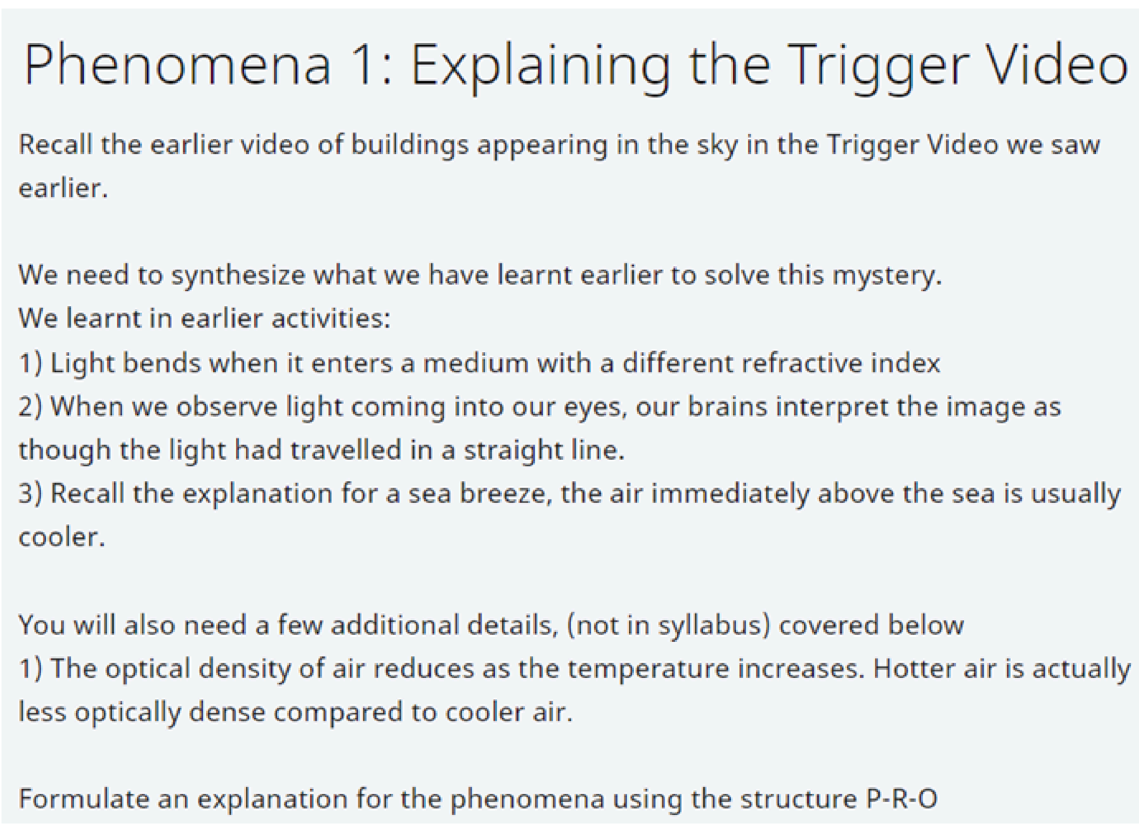


Fig 3.3

Click on the picture for a larger view.

Teachers can use the [Interactive Thinking Tool]() to **engage students collaboratively** to formulate an explanation for the observed phenomena (Fig 3.4).

Answering frames (e.g., "Premise-Reasoning-Outcome P-R-O" frame) can be included to **help students formulate their explanation** (Fig 3.5).



Phenomena 1: Explaining the Trigger Video

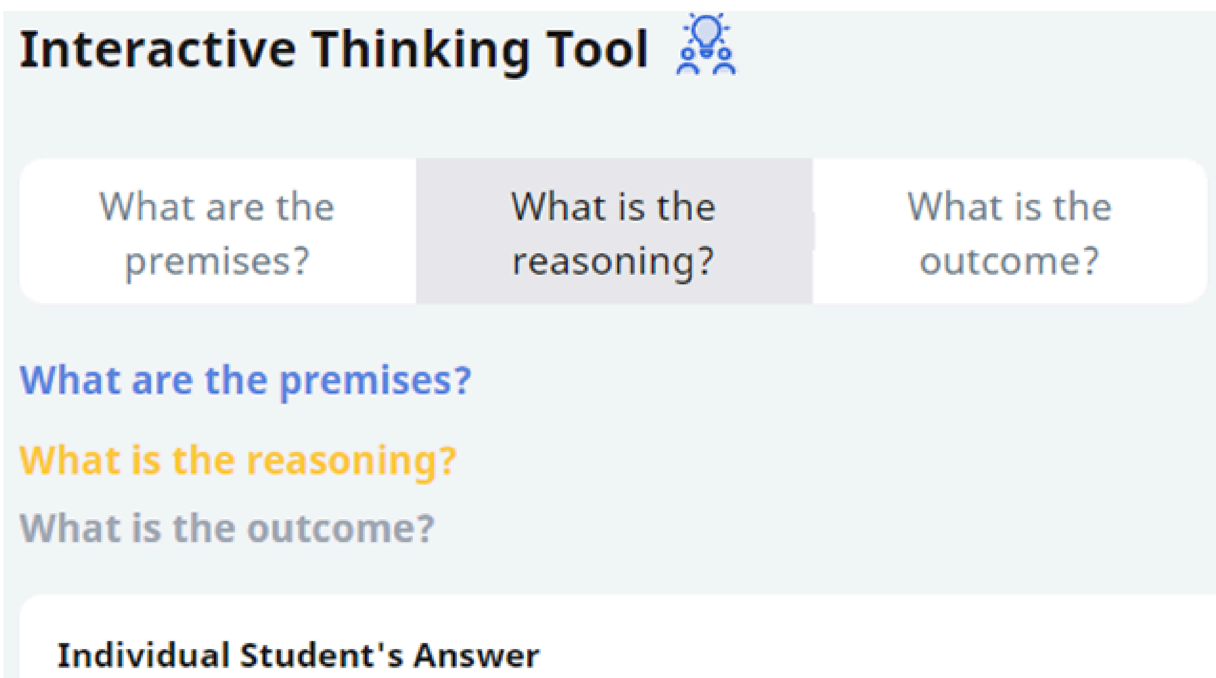
Recall the earlier video of buildings appearing in the sky in the Trigger Video we saw earlier.

We need to synthesize what we have learnt earlier to solve this mystery.
We learnt in earlier activities:
1) Light bends when it enters a medium with a different refractive index
2) When we observe light coming into our eyes, our brains interpret the image as though the light had travelled in a straight line.
3) Recall the explanation for a sea breeze, the air immediately above the sea is usually cooler.

You will also need a few additional details, (not in syllabus) covered below
1) The optical density of air reduces as the temperature increases. Hotter air is actually less optically dense compared to cooler air.

Formulate an explanation for the phenomena using the structure P-R-O

Fig 3.4



Interactive Thinking Tool

What are the premises?	What is the reasoning?	What is the outcome?

What are the premises?
What is the reasoning?
What is the outcome?

Individual Student's Answer

Fig 3.5

Click on the pictures for a larger view.

Teachers can introduce another scientific phenomenon (e.g., a mirage on the road) for students to **apply their understanding** of the model to explain this phenomenon. This can be using Free-Response Questions (Fig 3.6) with minimal scaffolds provided.

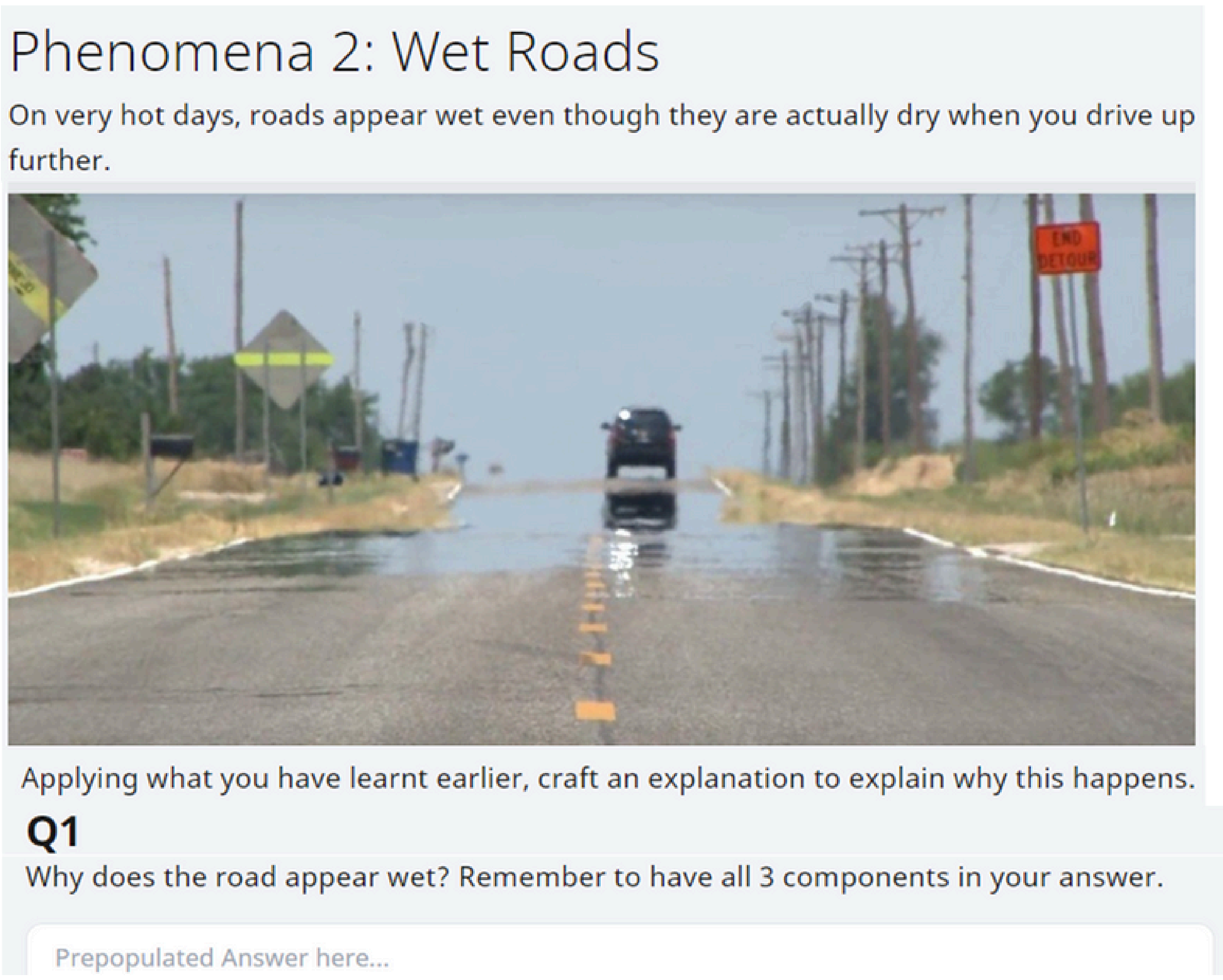


Fig 3.6

Click on the picture for a larger view.

Additional tips when using Free-Response Questions

Do you know that for Free-Response Questions, you can include the recommended time as well as response size that best suited for the question.

PEDAGOGICAL AFFORDANCES:

- Technologies such as video can engage students by providing **visual and dynamic representations** of scientific phenomena **making abstract ideas more concrete and cohesive**.
- Teachers have access to a wide variety of resources in SLS including videos, simulations, interactive models, and explanatory texts that can **meet various learning needs**.
- Technology enables students to **visualise scientific models** through simulations, increasing their understanding of the concept.