

Promoting scientific Inquiry in gifted students through gifted pull-out programmes

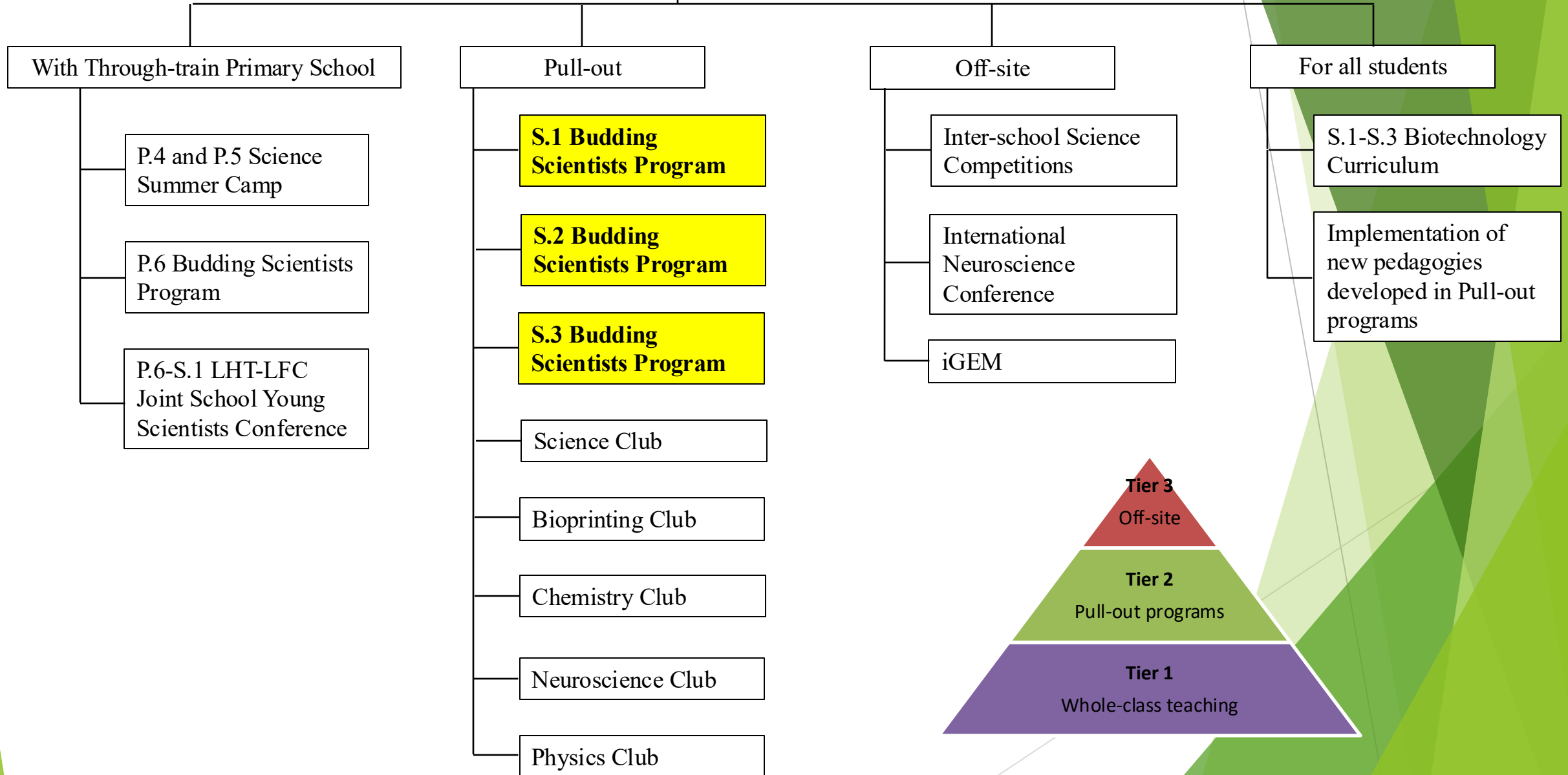


Po Leung Kuk Laws Foundation College
8, To Lok Road, Tseung Kwan O

Our School



Science Gifted Education Program



Why do we have Pull-out Programs for Gifted students in science?

- ❖ Cater learning diversity
- ❖ Arouse further interest in science
- ❖ Equip more-able students with scientific inquiry skills

- ❖ Limited by lesson time

Our Goals

Build up a **student talent pool** (science/STEAM)

Join competitions

Lead student helpers in various school activities

Establish **new pedagogies, experiments**

Smaller-scale, more efficient

To complement the curriculum

Scientific Inquiry

Logical Thinking

Nature of Science

Selection Criteria

- ❖ Top 20 in Integrated Science exam, or nominated by Science teachers
- ❖ Passed our interview which assesses students' scientific communication ability

Characteristics of these students:

- ❖ **Intrinsically motivated** in science
- ❖ Demonstrate outstanding **scientific literacy**
- ❖ Demonstrate **self-learning** ability
- ❖ Interested in joining science-related activities

Try-out 1



Is Global Warming Real?

Try-out 2



Chemical Mystery

Pseudoscience and Social Media



the earth was invented by map makers to sell more maps

6:08 AM · Oct 7, 2019 · Twitter for iPhone



The rise of flat-Earthers in society provides some of the best evidence for the failure of our educational system.

4:23 PM - 18 Jul 2017

33,596 Retweets 82,017 Likes

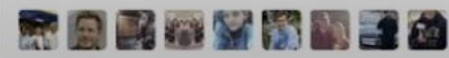


2.7K 34K 82K



If the earth was a spinning globe then how come airplanes can still land w/out crashing? Because the face of the earth is flat. Not a globe.

RETWEETS 1,897 LIKES 1,027



Pseudoscience and Social Media



Rocket test on 22 November 2017



Flat Earth International Conference in Denver, Colorado, November 2018

Pseudoscience during COVID-19



CAROLE SAMAHA @CAROLE_SAMAHA

Are u aware that a high percentage of autism in the world is cause by the vaccine injected for children & filled with mercury? Plse read about it & educate urself then take ur decision to take it or No!indeed lm using my platform as a celebrity, to spread awareness👍

Areej Murad @AreejMurad1
Replying to @CAROLE_SAMAHA
Good for you, but please don't promote that vaccine is kind of fools or "mo2amra" bcz without it billions of people will die or become disable, and so Covid-19, people need to take care of their personal safety from this disease. You're famous and influencer be responsible!!.

4:33 PM - May 30, 2020

242 See the latest COVID-19 information on Twitter

Donald J. Trump @realDonaldTrump

Massive combined inoculations to small children is the cause for big increase in autism....

RETWEETS 605 LIKES 264

3:22 PM - 23 Aug 2012

522 605 264



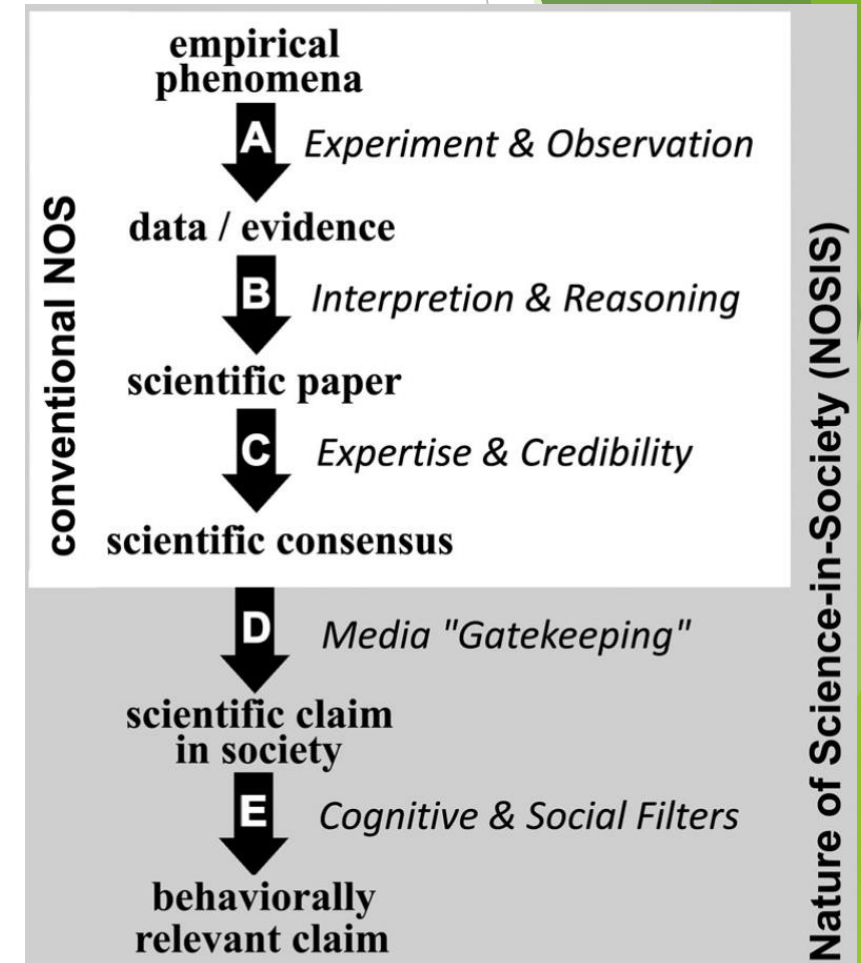
From Scientific literacy to Science Media literacy and Nature of Science

- ❖ **NOS teaching focus on different tenets**
 - ❖ science is empirical
 - ❖ science is tentative
 - ❖ there are distinction between law and theory
 - ❖ science blends logic and imagination
 - ❖ scientific knowledge involves subjectivity
 - ❖ scientific knowledge is socially constructed and culturally embedded
 - ❖ there is no single scientific method

(Lederman, 2007)

From Scientific literacy to Science Media literacy and Nature of Science

- ❖ But scientific knowledge generation does NOT end with publishing a scientific paper / consensus making among scientific community.
- ❖ Conveying that knowledge in a broader public is often disregarded in NOS teaching, particularly in our new age of social media
 - ❖ Fake news, false assertion, half-truths...
- ❖ Scientific literate persons must be able to consider the reliability of claims as they change “**from test tubes to YouTube,**” and “**from lab books to Facebook**”



(Höttecke & Allchin, 2020)

Is Global Warming Real?



- ▶ What is Global Warming?
- ▶ Do you believe in Global Warming?


Is Global Warming Real?

Existing Arguments:

- ▶ 1. Global warming is **NOT** happening.
- ▶ 2. Global warming is **happening** and is **caused by human**.
- ▶ 3. Global warming is **happening** but it is a **natural phenomenon** and is **not a threat**.

Read your passage (2 mins)



1 Global warming is not happening
2 September 04, 2022 by Jude Parker
3
4 **Glaciers are growing**
5 Firstly, global warming supporting parties claimed that glaciers on Earth are disappearing, posing
6 a serious problem for millions who rely on glaciers for water and habitat. However, glaciers are
7 actually growing. Reports are coming in from all over the world that for the first time in over 250
8 years, glaciers in Alaska, Canada, New Zealand, Greenland, and now Norway are growing.
9 
10 **Weather is chaotic and unpredictable**
11 Secondly, scientists can't even predict weather. Since modern computer models cannot with any
12 certainty predict the weather two weeks from now, how can we rely upon computer models to
13 predict what the Earth's climate might be like a hundred years from now? They want you to believe
14 that these models can predict the future. However, they are no different from fortune tellers you
15 meet on the street.
16 **Relocation from coastline is not happening**
17 Thirdly, melting of glaciers will lead to rise of water levels, but do we hear any news saying that
18 people living near the coastline have to relocate due to rising water levels? Ten years ago, my
19 teacher told me that Hong Kong will be covered by water soon, but we know it is not happening.

Article A

Blog Events Product Insights Company Other blogs English (US) Sign Up

Peter Smart
Director of Sustainability

Andrew Green
Global Sustainability Manager

Only on Twitter
@Twitter
@OnlyOnTwitter

Global warming is happening. It's 100% caused by human.

BY Peter Smart and Andrew Green
Friday, 22 April 2022

Line

1 Global warming is the long-term heating of Earth's surface observed since the pre-industrial
2 period (between 1850 and 1900). It is a phrase you've probably heard for decades — but in
3 recent years, you may have also heard some skeptics doubting a few things about it. Is global
4 warming real? And are humans really causing it?
5 Yes, global warming must be real and it must be caused by human. According to the
6 American National Aeronautics and Space Administration (NASA), the average global
7 temperature has risen by about 0.8°C since 1880. A more recent record shown by the
8 government also indicated that the average temperature in America in May 2016 was 0.2°C
9 higher than that in May 2015. It is obvious that the global temperature is increasing.
10 As per the United States former president Barack Obama said, global warming is caused by
11 human activities, primarily fossil fuel burning, which increases heat-trapping greenhouse gas
12 levels in Earth's atmosphere.
13 You may have heard someone deny global warming. But they are just a minority. If you need
14 more proof that global warming is really happening, turn to the public belief. According to a
15 survey done in 2022, 98.7% of people believe that the global warming is happening and 97%
16 of people believe that it's caused by human. There are also increasing number of celebrities,
17 including Prince Harry and Leonardo DiCaprio who are committing to climate change actions.
18 It is obvious that global warming is happening and it's caused by human.


Article B

Science Blog
LIFE SCIENCES PHYSICAL SCIENCES ENVIRONMENT SOCIAL SCIENCES EDUCATION POLICY MEDICINE

Myth Busting – Is Global Warming really a Threat?

November 28, 2022 by Simon Smith

Line

1 **Human benefits from global warming**
2 It was only November, but the chill already cut to the bone in the small village of Dimitrovo, which
3 sits in a rural part of eastern Russia. Fields were all covered with snow and farming was impossible
4 due to the cold weather. With global warming, many villages and towns in Russia can benefit from
5 the increase in temperature so that the crops yield and food production can be greatly increased.
6 
6 **Global warming is naturally occurred**
7 People always argue that human is the cause of global warming. However, they omitted the fact
8 that numerous animals and plants on the planet release carbon dioxide naturally. Data from IPCC¹
9 shows that in one year, about 750 billion tons of carbon dioxide is released to the atmosphere by
10 the nature while human activities produce only 30 billion tons. Therefore, carbon dioxide emission
11 by human is tiny compared to that by nature. We don't need to worry about global warming much.
12 **Global warming stops world hunger**
13 Moreover, carbon dioxide is essential for plants. Plants take in carbon dioxide to carry out
14 photosynthesis to produce glucose, thus carbon dioxide is basically plant food. When the carbon
15 dioxide content in the atmosphere continues to increase, plants will grow bigger and better. As a
16 result, more people can be fed with sufficient food and world hunger can even be solved!
17 To summarise, global warming is not a threat to human. Rather, it is a naturally occurred
18 phenomenon that we human can take many advantages on.
¹IPCC (Intergovernmental Panel on Climate Change) is an international organization for assessing the science relating to climate change.

Article C

Arguments:

- ▶ A. Global warming is NOT happening.
- ▶ B. Global warming is happening and is caused by human.
- ▶ C. Global warming is happening but it is a natural phenomenon, and is not a threat.

Highlight the supporting points !

Myth Busking – Is Global Warming really a Threat?

November 28, 2022

by Simon Smith

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Fallacies 謬誤

- ▶ Logically incorrect argument
- ▶ Unreasonable
- ▶ Misleading

Cherry Picking 以偏概全



- ▶ “Glaciers around the world are increasing, disproving global warming.” **(Article A)**
- ▶ “A more recent record shown by the government also indicated that the average temperature in America in May 2016 was 0.2°C higher than that in May 2015. It is obvious that the global temperature is increasing.” **(Article B)**
- ▶ “With global warming, many villages and towns in Russia can benefit from the increase in temperature...” **(Article C)**

Appeal to inappropriate authority 偽托權威

- ▶ “As per the United States former president Barack Obama said, global warming is caused by human activities, primarily fossil fuel burning, which increases heat-trapping greenhouse gas levels in Earth’s atmosphere.” **(Article B)**
- ▶ “There are also increasing number of celebrities, including Prince Harry and Leonardo DiCaprio who are committing to climate change actions.” **(Article B)**



Argument Ad Populum 訴諸群眾



- ▶ “If you need more proof that global warming is really happening, turn to the public belief. According to a survey done in 2022, 98.7% of people believe that the global warming is happening and 97% of people believe that it’s caused by human.” (Article B)

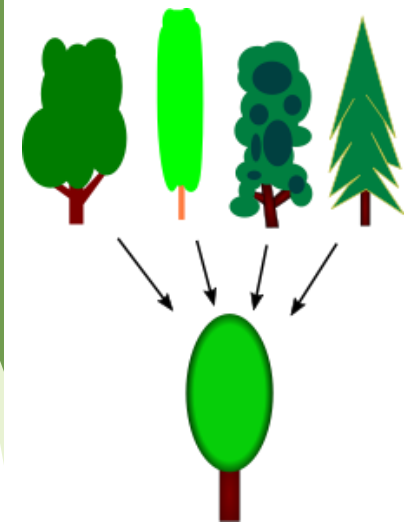
Slippery Slope 滑坡謬誤

- ▶ “When carbon dioxide content in the atmosphere continues to increase, plants will grow bigger and better. As a result, more people can be fed with sufficient food and world hunger can even be solved!” (Article C)



Oversimplification / Generalization

- ▶ “... about 750 billion tons of carbon dioxide is released to the atmosphere by the nature while human activities produce only 30 billion tons. Therefore, carbon dioxide emission by human is tiny compared to that by nature.” **(Article C)**





Fallacies 謬誤

- ▶ Logically incorrect argument
- ▶ Unreasonable
- ▶ Misleading

Grouping

- ▶ 3 students per group

A



B



C



Arguments:

- ▶ A. Global warming is NOT happening.
- ▶ B. Global warming is happening and is caused by human.
- ▶ C. Global warming is happening but it is a natural phenomenon, and is not a threat.

Debate on passage A (5 mins)

A. Global warming is NOT happening.



Student B & Student C:

- ▶ Read Article A
- ▶ Point out the logical errors
- ▶ Write them on the WS

Student A:

- ▶ Try your best to defend your stance

Debate on passage B (5 mins)

B. Global warming is happening and is caused by human.



Student A & Student C:

- ▶ Read Article B
- ▶ Point out the logical errors
- ▶ Write them on the WS

Student B:

- ▶ Try your best to defend your stance

Debate on passage B (5 mins)

C. Global warming is happening but it is a natural phenomenon, and is not a threat.



Student A & Student B:

- ▶ Read Article C
- ▶ Point out the logical errors
- ▶ Write them on the WS

Student C:

- ▶ Try your best to defend your stance

Prepare for presentation (5 mins)

- ▶ Each group is required to give a **one minute presentation** of a fallacy that you found out.

Try-out 2: Chemical mystery



Conventional approach for teaching the topic

- ▶ Students are told to memorise the solubility rule.
- ▶ Laboratory work are often designed to verify the rules and it involves lots of washing of the test tubes and droppers.

- The cognitive demand is focused more on recalling than on analytical thinking.
- We believe that the instructional sequence matters that can change student agency!
- Also, are there alternative methods for conducting the laboratory work that minimize washing and reduce the use of chemicals?



Conventional approach for teaching the topic

- ▶ Students are told to memorise the solubility rule.
- ▶ Laboratory work are often designed to verify the rules and it involves lots of washing of the test tubes and droppers.



Try-out 2: Chemical mystery

Rules of
Pattern



Induction

Investigation 1:
Reactions between
chemical salts

Evidence
(Facts)

Deduction

Investigation 2:
Identify
unknown solutions

Investigation 1 – Reactions between chemical salts

Laminate the paper/insert the paper into a plastic folder. Wear eye protection.

	1 drop $\text{Pb}(\text{NO}_3)_2$	1 drop AgNO_3	1 drop MgCl_2	1 drop Na_2CO_3	1 drop KI	1 drop NaOH	1 drop CaCl_2
1 drop CuSO_4							
1 drop CaCl_2							
1 drop NaOH							
1 drop KI							
1 drop Na_2CO_3							
1 drop MgCl_2							
1 drop AgNO_3							

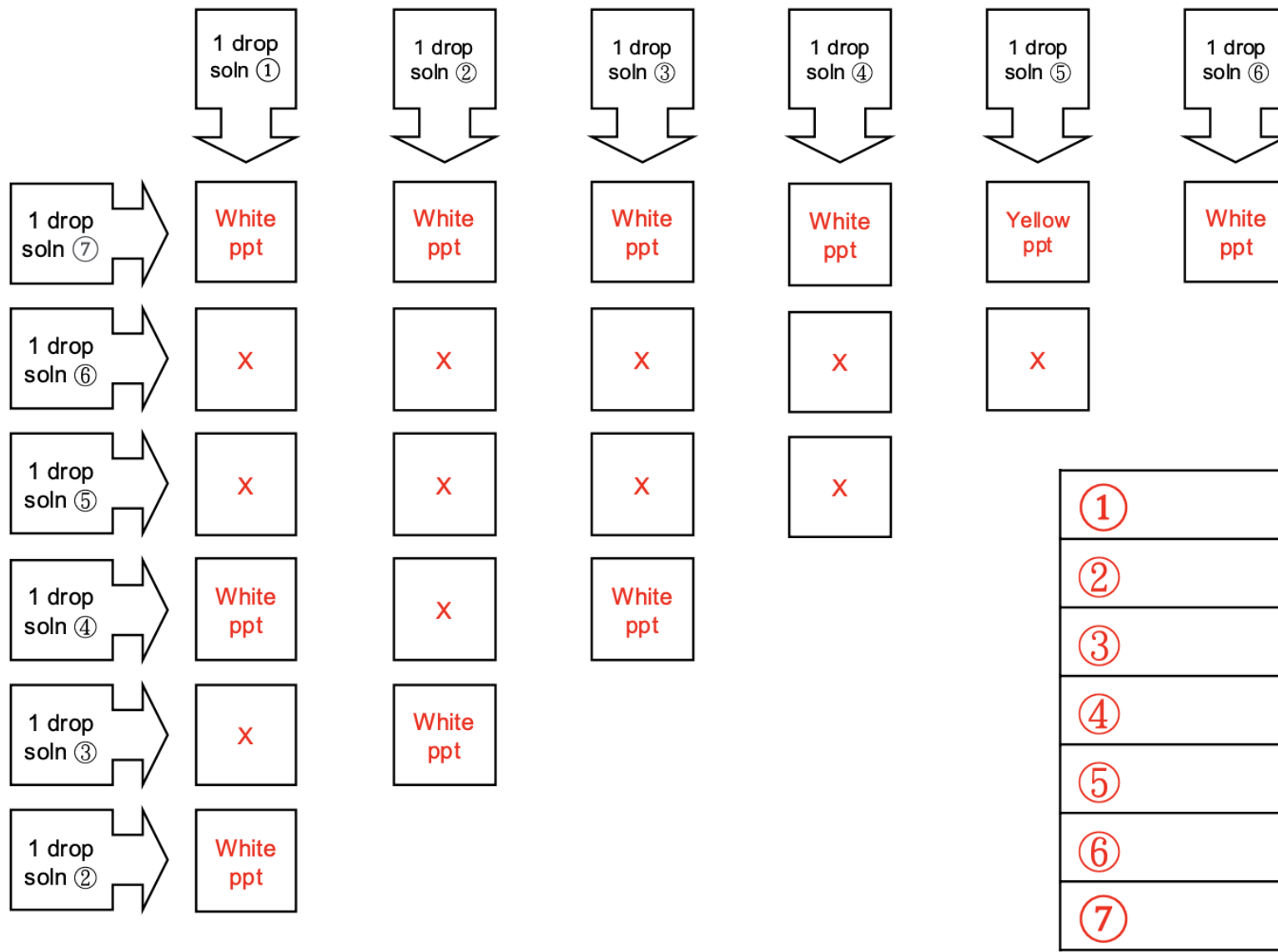
Take a photo/notes of your observations and then wipe away the drops with a paper towel.



Paper-based spot plate

- Laminated / packeted by a copy safe
- Use eye-drop bottle for adding chemicals
- Cleaned by wipe a tissue paper

Sample data



Sample data

We observed students use different strategies to solve the problem:

- For example, the formation of a yellow precipitate indicates the presence of PbI_2 , suggesting that solutions 5 and 7 could be KI and $\text{Pb}(\text{NO}_3)_2$.
- To confirm their identities, solution 5 did not form a precipitate with any other solution, while solution 7 formed precipitates with all others.
- It confirms that solution 5 is KI and solution 7 is $\text{Pb}(\text{NO}_3)_2$.

	1 drop soln ①	1 drop soln ②	1 drop soln ③	1 drop soln ④	1 drop soln ⑤	1 drop soln ⑥	1 drop soln ⑦
1 drop soln ①		White ppt	White ppt	White ppt	White ppt	Yellow ppt	White ppt
1 drop soln ②	X		X	X	X	X	X
1 drop soln ③	X	X		X	X	X	X
1 drop soln ④	White ppt	X	White ppt		X	X	X
1 drop soln ⑤	X	White ppt	X	X		X	X
1 drop soln ⑥	White ppt	X	X	X	X		X
1 drop soln ⑦	White ppt	X	X	X	X	X	

①
②
③
④
⑤
⑥
⑦

The End

