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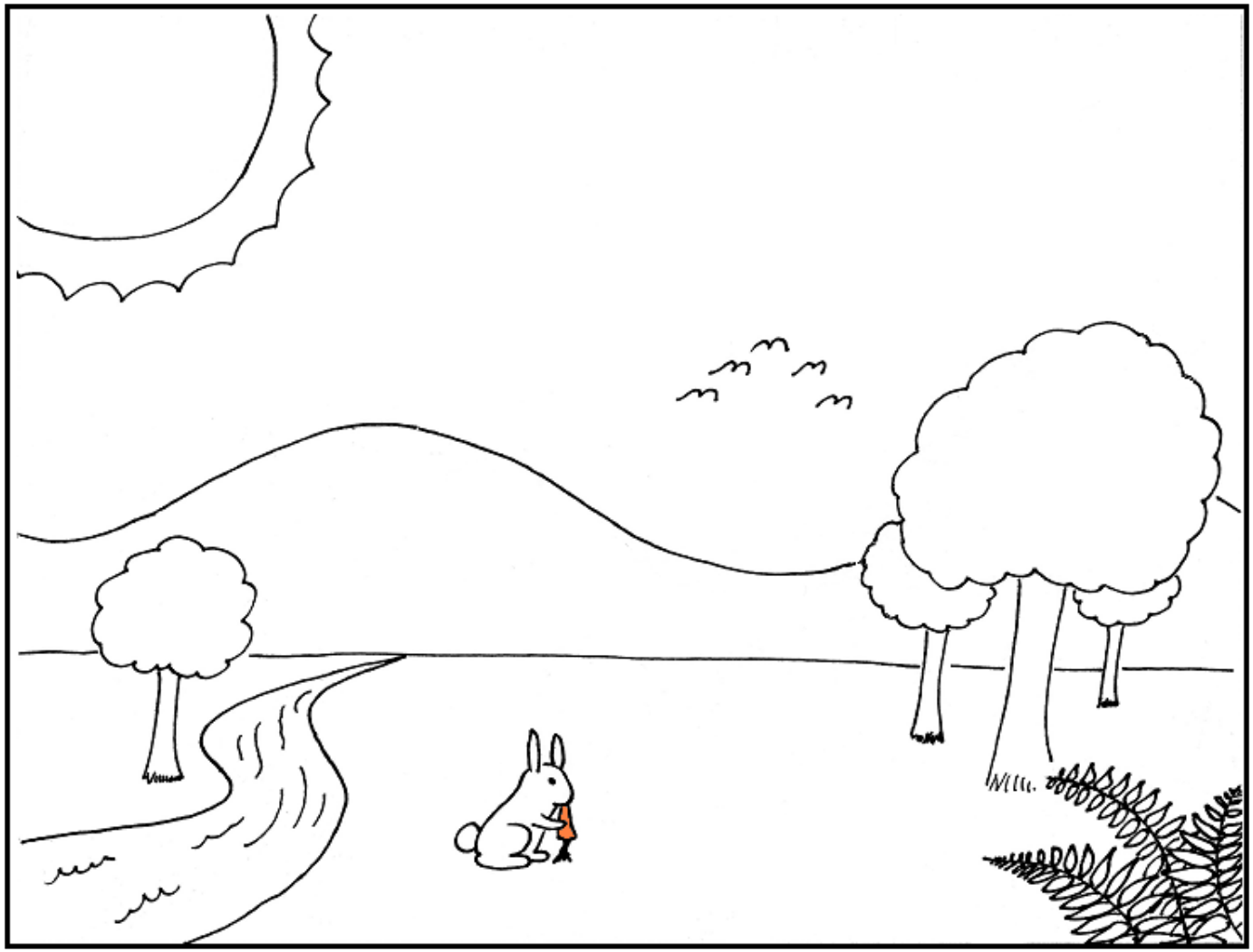
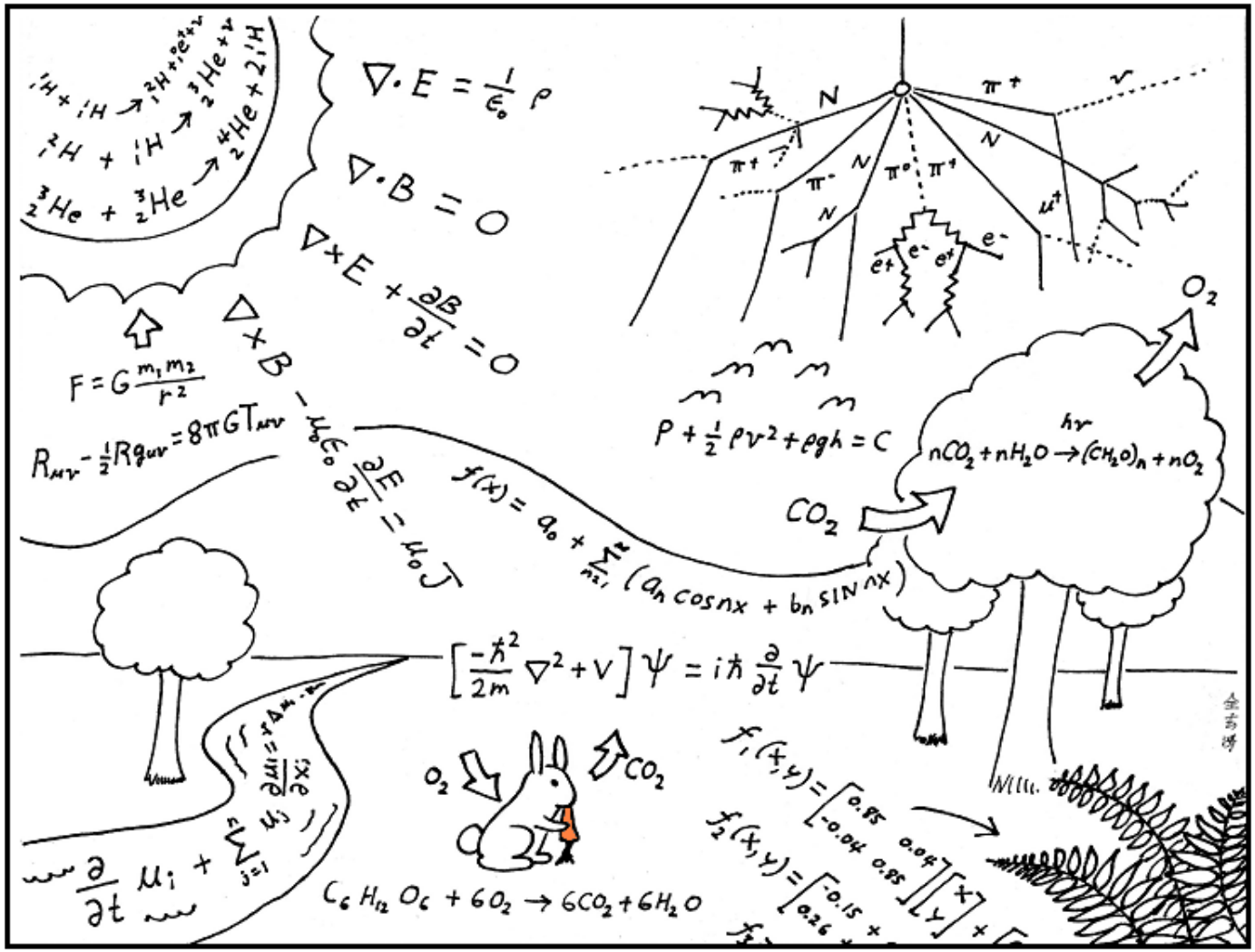
The Six Criteria of Science

How most people see the world…



How scientists see the world…



For something to be considered scientific, it must fulfil the six criteria of science:

1. **C**onsistent
2. **O**bservable
3. **N**atural
4. **P**redictable
5. **T**estable
6. **T**entative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One - Consistent

- The results of repeated observations and / or experiments concerning a naturally occurring event (phenomenon) are reasonably the same when performed and repeated by competent investigators.
- The event is free from self - contradiction, it is consistent in its applications.
- The weight of the evidence is compatible with well established observations and limits.

One - Consistent

Reality Check

- Which of the following is a scientific statement, and which one is not a scientific statement?

1. Green plants will grow towards a light source.

2. Walking under a ladder will cause bad luck.

- Using the idea of *Consistency*, how can we determine which statement above is a scientific one?


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Two - Observable

- The event under study, or evidence of the occurrence of the event, can be observed and explained. The observations are limited to the basic human senses or to extensions of the senses by such things as electron microscopes and telescopes.

- If the phenomenon cannot be reproduced through controlled conditions, natural evidence of the event's occurrence must be available for investigation.

Two - Observable

Reality Check

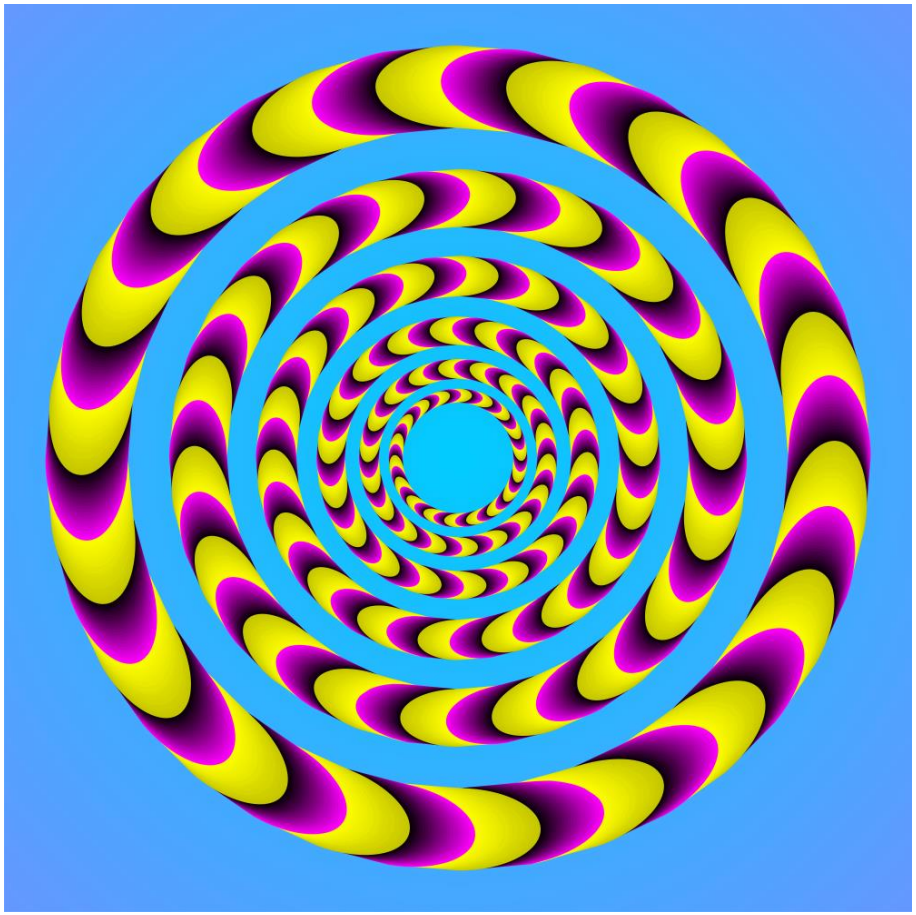
- Which of the following is a scientific statement, and which one is not a scientific statement?

1. Some plants eat meat.

2. Extraterrestrial beings have visited Earth.

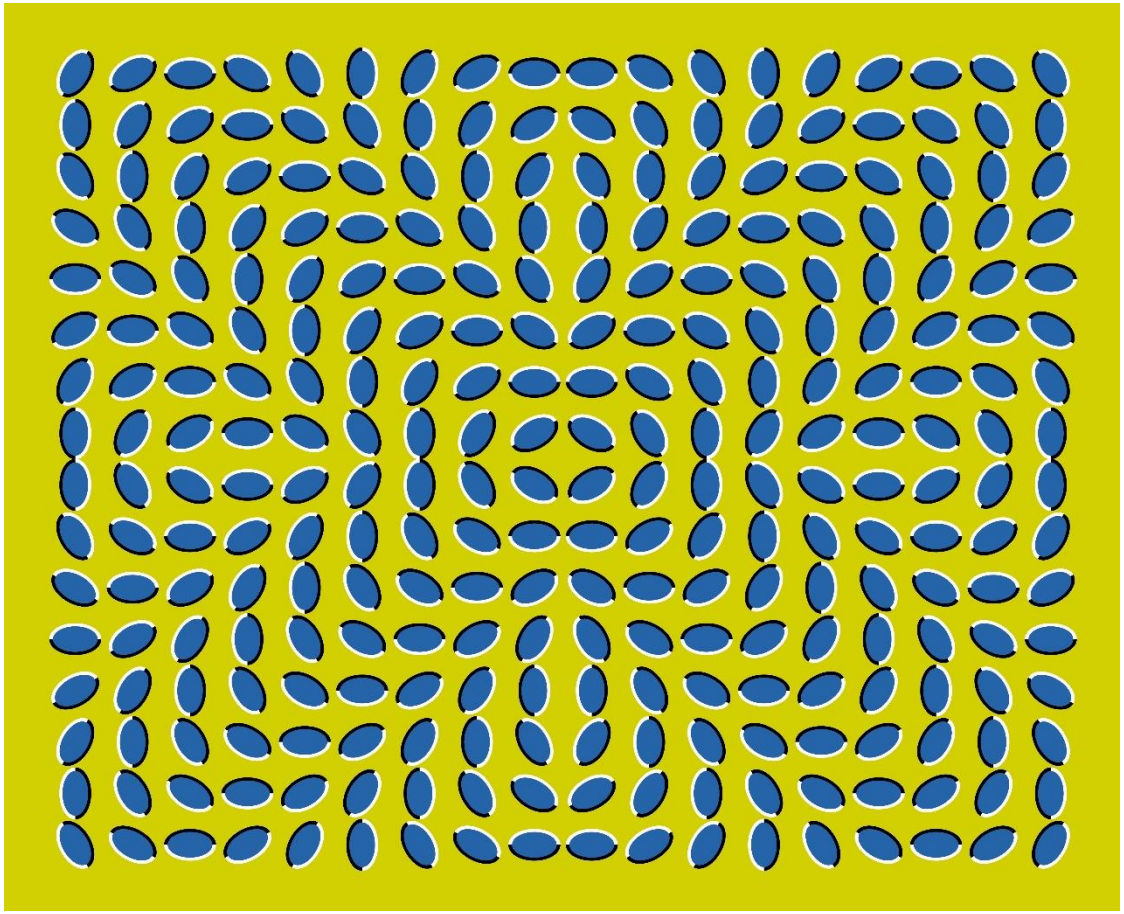
- Using the idea of *Observability*, how can we assess which statement above is a scientific one?

Two - Observable



- Can you always trust your senses? What do you observe – is this image static or moving?

Two - Observable



- Can you always trust your senses? What do you observe – is this image static or moving?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Three - Natural

- A natural cause (mechanism) must be used to explain why or how the naturally occurring event happens.

- Scientists may not use supernatural explanations as to why or how naturally occurring events happen because reference to the supernatural is outside of the realm of science.

- Scientists cannot conduct controlled experiments in which they have designed the intervention of a supernatural entity into the test.

Three - Natural

Reality Check

- Which of the following is a scientific statement, and which one is not a scientific statement?

1. Green plants convert sunlight into energy.

2. The tooth fairy leaves a one dollar coin under a child's pillow in exchange for the tooth that she takes.

- Using the idea of *Natural*, how can we assess which statement above is a scientific one?


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Four - Predictable

- The natural cause (mechanism) of the naturally occurring event can be used to make specific predictions.
- Each prediction can be tested to determine if the prediction is true of false.

Four - Predictable

Reality Check

- Which of the following is a scientific statement, and which one is not a scientific statement?

1. Without sunlight (or comparable artificial light), green plants will die.

2. If you are a *Scorpio*, then the alignment of Saturn and Venus means that today is a good day to be open and honest with your friends.

- Using the idea of *Predictability*, how can we assess which statement above is a scientific one?

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Five - Testable

- The natural cause (mechanism) of the naturally occurring event must be testable through the processes of science, controlled experimentation being one possible method.
- Reference to supernatural events or causes are not relevant tests.

Five - Testable

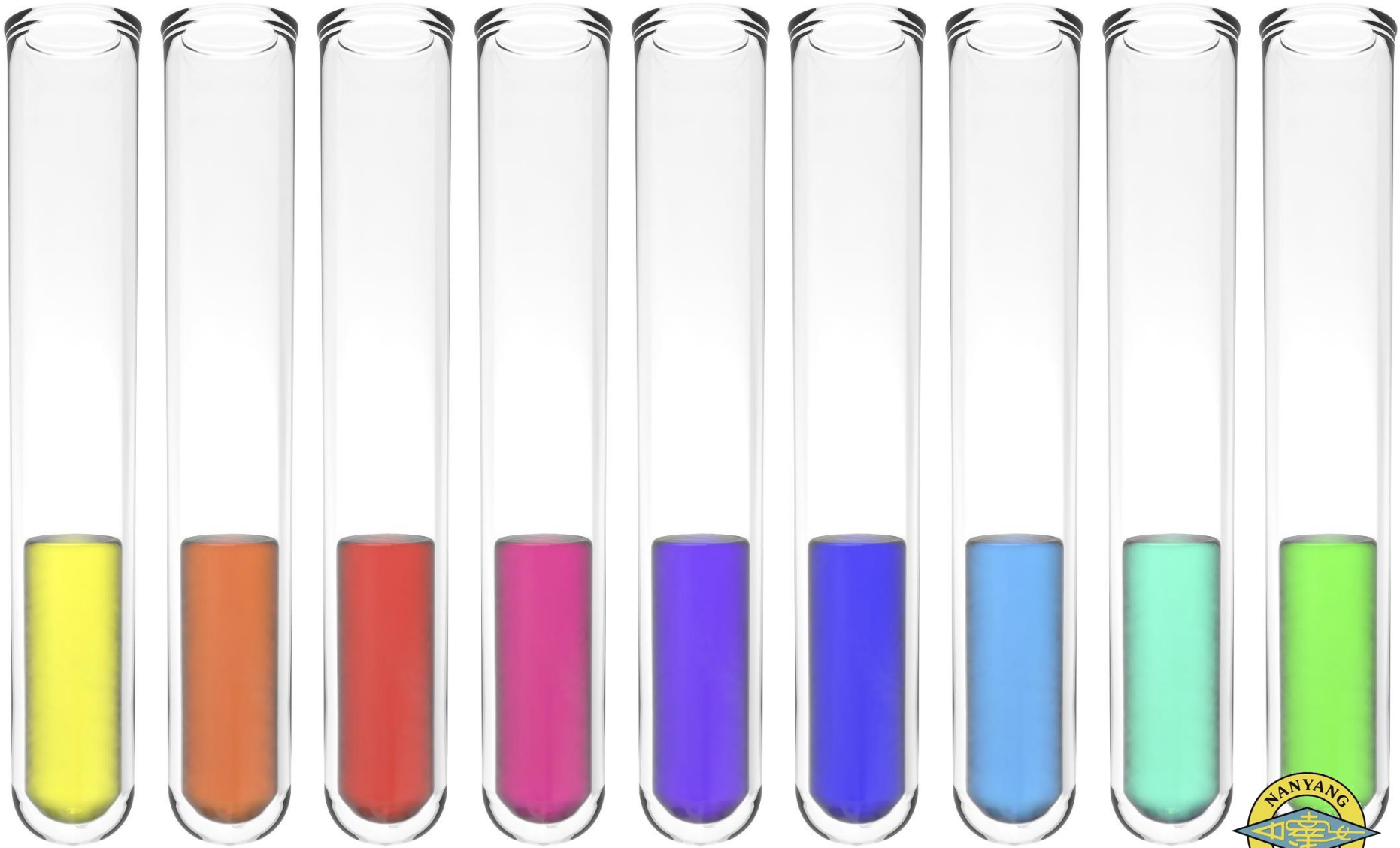
Reality Check

- Which of the following is a scientific statement, and which one is not a scientific statement?

1. The Bermuda Triangle causes ships and planes to sink and disappear.

2. Life comes from life and cannot come from non-life.

- Using the idea of *Testability*, how can we assess which statement above is a scientific one?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Six - Tentative

- Scientific theories are subject to revision and correction, even to the point of the theory being proven wrong.

- Scientific theories have been modified and will continue to be modified, getting better and better (closer to reality) to consistently explain observations of naturally occurring events.

Six - Tentative

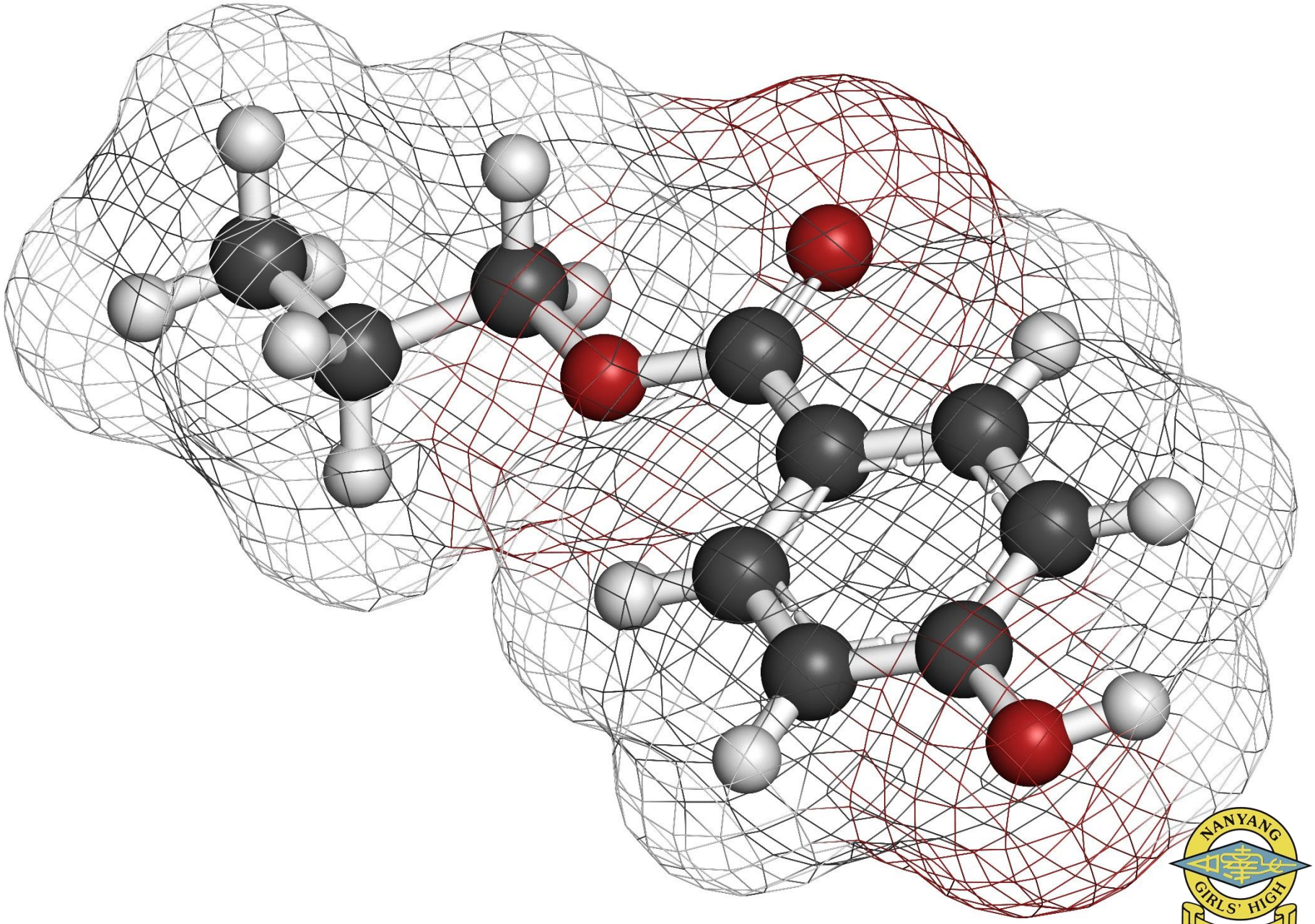
Reality Check

- Which of the following is a scientific statement, and which one is not a scientific statement?

1. The discovery of new subatomic particles has caused our understanding of atoms to change.

2. We know that the world began about 6000 years ago, and nothing will change that.

- Using the idea of *Tentativeness*, how can we assess which statement above is a scientific one?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Emerging Science

Emerging science or *protoscience* may be defined as a *near science*. A protoscience tends to conform to most of the criteria of science (consistent, observable, natural, predictable, testable and tentative) but typically falls short in one or more of the criteria. A protoscience differs from a science in that consistent observations and predictions may be limited by knowledge and / or technology.

Non-Science

Non-science may be defined as an area of knowledge which does not meet the criteria of science (consistent, observable, natural, predictable, testable and tentative). Non-science topic areas may be very logical and based on good reasoning, but simply do not fall within the realm of science. They would include any belief system, *e.g.*, religious beliefs, philosophy, personal opinions or attitudes, a sense of aesthetics, or ethics.

False Science

False science or *pseudoscience* may be defined as a non-science which is portrayed and advertised as a legitimate science by its followers and supporters. A good example of a pseudoscience is astrology.

Summary

Science is a limited discipline that studies only *naturally* occurring events, while offering *natural* explanations for the phenomenon under study. The data must be *consistent*, *observable*, *predictable*, and *testable*, while any conclusions or theories must be *tentative*.

Presentation on
The Nature of Science – The Six Criteria of Science

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