Science Parent Workshop

Greenwood Primary School
30 January 2021

To help us admit you into the session on time, we appreciate if you can:

1. Log in by 8.45am.
2. Rename your log-in identity using this naming convention Form Class_name of child (e.g. 5 Empathy_John Tan)
3. Turn on your camera during the workshop.

Overview

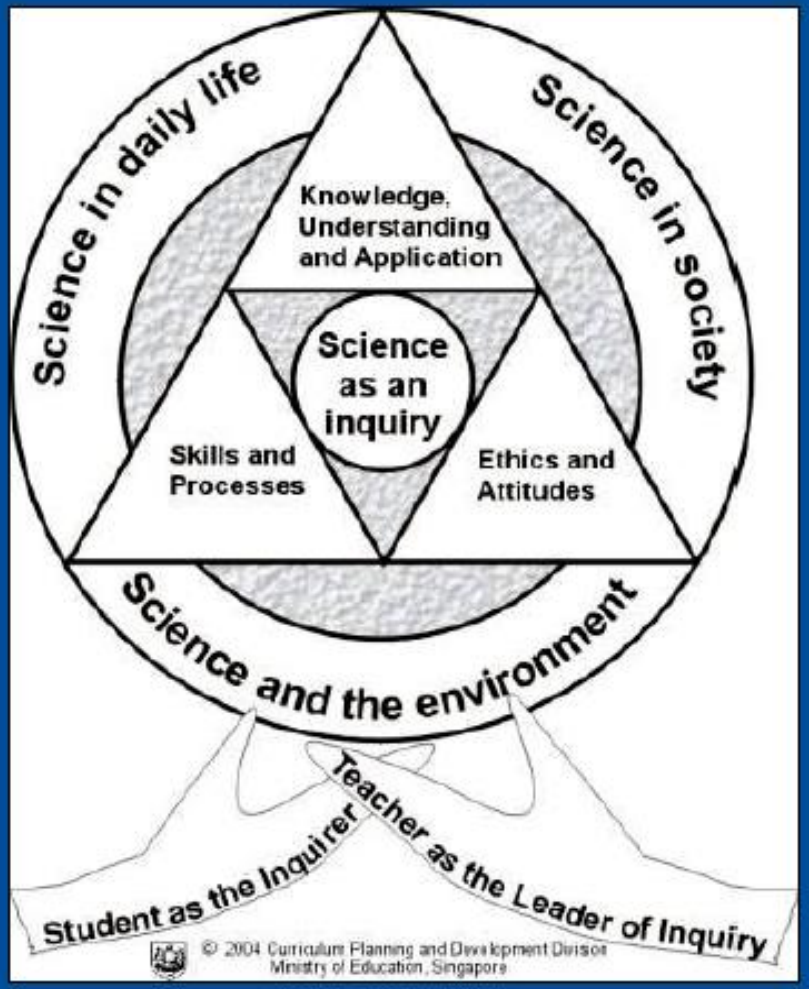
- GWPS SCIENCE CURRICULUM
- THINKING STRATEGY FOR MCQ
- THINKING STRATEGY FOR OE
- ERROR ANALYSIS
- Q & A

2014 Primary Science Syllabus

Syllabus	Year of Implementation			
	2014	2015	2016	2017
Primary Science Standard	P3	P4	P5	P6
Primary Science Foundation	-	-	P5	P6

Primary Education Review & Implementation

Science Curriculum Framework



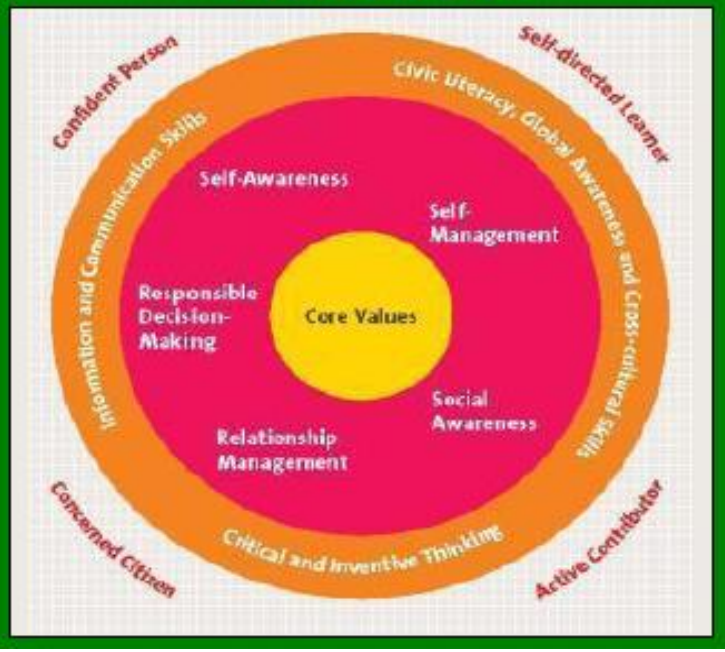
Balancing Knowledge with Skills and Values

Engaging pedagogy to teach skills and values
More holistic assessment to support learning

Investing in a Quality Teaching Force

Equipping teachers well through training and Professional development

21st Century Competencies Framework



Primary Science Syllabus (w.e.f 2014)

Themes	* Lower Block	** Upper Block
Diversity	• Diversity of living and non-living things (General characteristics and classification) • Diversity of materials	
Cycles	• Cycles in plants and animals (Life cycles) • Cycles in matter and water (Matter)	• Cycles in plants and animals (Reproduction) • Cycles in matter and water (Water)
Systems	• Plant System (Plant parts and functions) • Human System (Digestive system)	• Plant System (Respiratory and circulatory systems) • Human System (Respiratory and circulatory systems) • Cell System • Electrical System
Interaction	• Interaction of forces (Magnets)	• Interaction of forces (Frictional force, gravitational force, force in springs) • Interaction within the environment
Energy	• Energy Forms and Uses (Light and Heat)	• Energy Forms and Uses (Photosynthesis) • Energy Conversion

Note:
- *Lower Block (Primary 3 and 4); ** Upper Block (Primary 5 and 6).
- Topics which are underlined are not required for the Foundation Science .

Primary Science Syllabus (w.e.f.2014)

Themes / Topics	Updated / Removed Learning Outcomes
Diversity of Living and Non-living Things	Recognise some broad groups of living things – animals (**amphibians**, birds, fish, insects, mammals, **reptiles**)
Diversity of Materials	Compare physical properties of materials based on: ~~hardness~~ strength, flexibility, ability to float/sink in water, **waterproof**, **transparency**
Cycle of Plants and Animals	Observe and compare the life cycles of animals over a period of time (beetle, butterfly, chicken, cockroach, frog, grasshopper, **mosquito**)
Electrical System	~~Recognise that good conductors of electricity are generally conductors of heat~~
Energy Forms and Uses	~~Recognise that energy is required to make things work or move~~ ~~Show an understanding that food produced by plants becomes the source of energy for animals~~

Primary Science Syllabus (w.e.f. 2014)

Relating *scientific skills and processes* to *essential features of inquiry*

	Engaging with an event, phenomenon or problem through:	Collecting and presenting evidence through:	Reasoning; Making meaning of information and evidence through:
Skills	• Formulating hypothesis • Generating possibilities • Predicting	• Observing • Using apparatus and equipment	• Comparing • Classifying • Inferring • Analysing • Evaluating
	Communicating		
Processes	Creative problem-solving, Investigation and Decision-making		
Essential Features of Inquiry	Question	Evidence	Explain Connect
	Communication		

Changes in Assessment (w.e.f. 2017 PSLE)

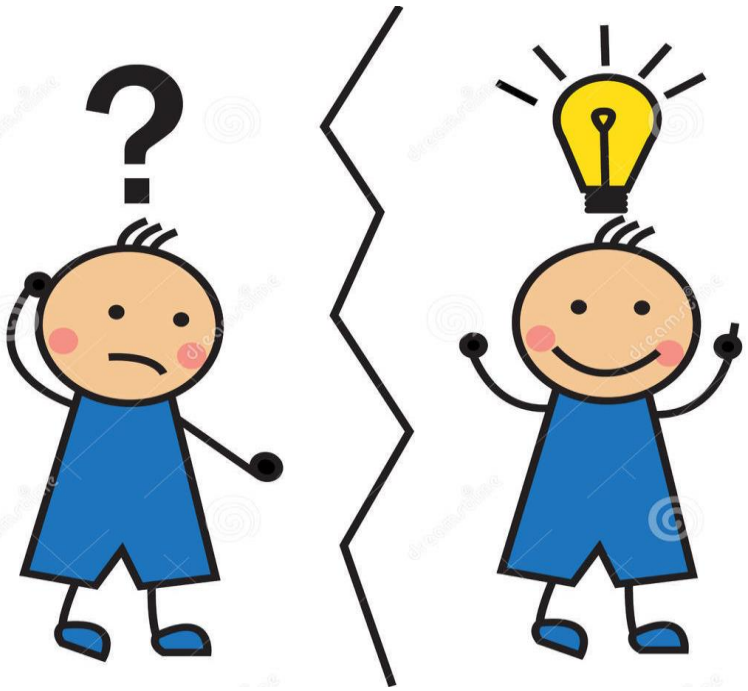
Questions are more applicative in nature and pupils are expected to understand and apply Science concepts learnt and will be required to demonstrate their mastery of a set of skills and processes.

- Pupils take the new syllabus examination where there are ***28 MCQs instead of 30*.**
- More weightage given to ***section B where there would be 1 or 2, 5marks question***
- Focus would be on ***real life application questions***
- Foundation pupils will have ***more MCQs, 18 instead of 16.***
- *P3 paper would be 80 Marks instead of 100 to give them time to adjust to curriculum.*

Knowledge with Understanding	Application of knowledge and Process Skills
40%	60%

Exam	MCQ	Open-ended
Main Stream	56 marks (28 questions)	44marks
Foundation	36 marks (18 questions)	34 marks

Shift in Questions



Knowledge Questions

Knowledge Recall

-*recall definitions, facts, or observations*.

Knowledge with understanding

-*need to observe and use science concept(s)*

Application Questions

To ***apply your knowledge to unfamiliar situations*** or problems.

To ***make inferences*** and ***draw conclusions*** based on the information that you have.

Knowledge or Application?

Which of the following is a function of the skeletal system?

(1) protects organs in the body

(2) protects the muscular system

(3) transports blood around the body

(4) transports food in the digestive system

K

Knowledge Recall

-***recall definitions, facts, or observations***.

Knowledge or Application?

Two cells A and B are shown.

Which of the following gives the correct classification of the cells and the function of part J?

	Plant cell	Animal cell	Function of part J
(1)	-	A, B	controls movement of substances in and out of the cell
(2)	B	A	controls movement of substances in and out of the cell
(3)	B	A	gives the cell a shape
(4)	A, B	-	gives the cell a shape

K

Knowledge with understanding

-need to observe and use science concept(s)

Knowledge or Application?

Aisha conducted an experiment by heating substance P. At the start, P was a solid at 30°C. After 15 minutes of heating, P reached a temperature of 100°C as shown.

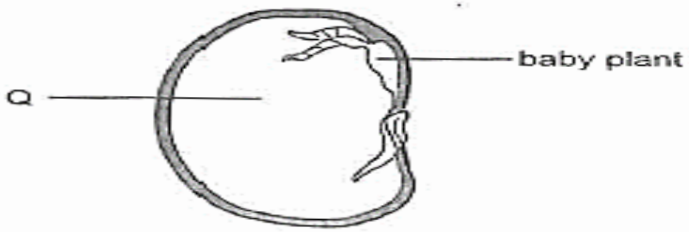
Based on Aisha's experiment, which one of the following is possible?

	Melting point of P (°C)	Boiling point of P (°C)
(1)	20	105
(2)	25	100
(3)	30	95
(4)	50	110

A

Knowledge or Application?

(a) The diagram shows half a seed. Part Q protects the baby plant.



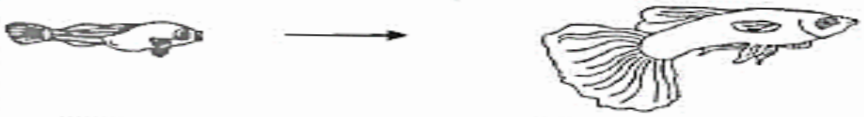
K

State another function of part Q.

_____

_____

(b) Melvin observed stages in the life of fish T and fish W as shown.

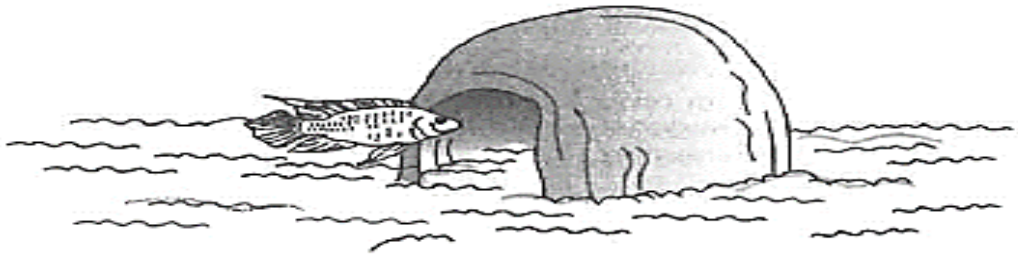
Fish T	 egg → stored food young (stage 1) → young (stage 2) → adult
Fish W	 young → adult (gives birth to young)

Knowledge or Application?

(i) Based on Melvin's observation, state a characteristic of the young of fish T that helps it to survive in stage 1. [1] **K**

(ii) State a characteristic of the young of fish W which gives it an advantage to survive compared to the young of fish T at stage 1. Explain your answer. [1] **K**

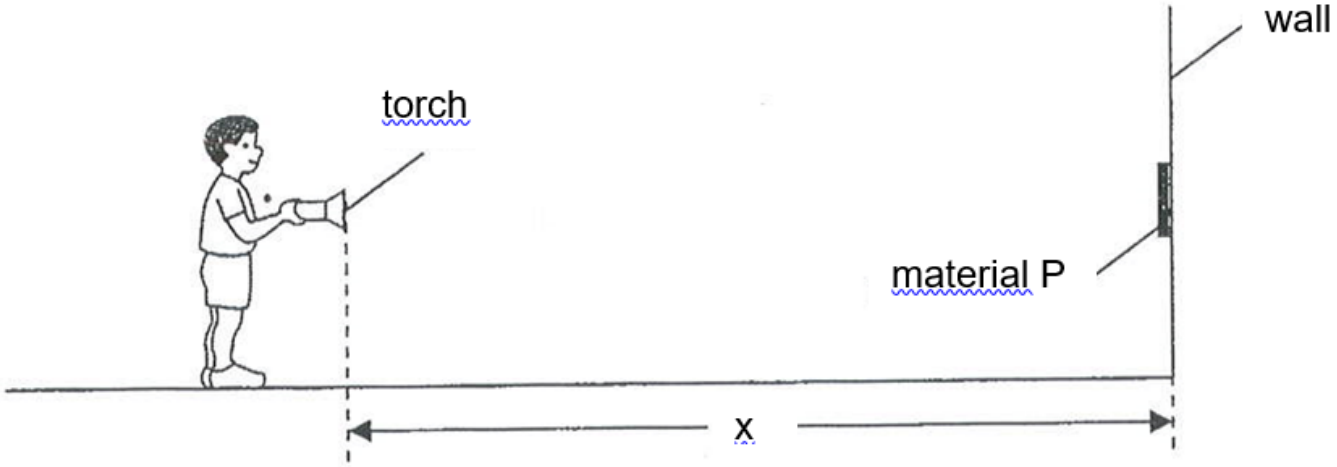
(iii) Fish T lays its eggs inside a cave as shown. It is known to protect its eggs.



Explain how laying eggs in a cave helps fish T to protect its eggs. [1] **A**

Knowledge or Application?

Zainal had three different materials, P, Q and R. He wanted to investigate which material was best at reflecting light. He set up his experiment in a dark room as shown below.



Zainal shone the light from the torch onto each material and walked towards it. When he could see the material, he stopped and measured the distance x between the torch and the wall.

Knowledge or Application?

The results of Zainal's investigation is shown in the table below.

Material	P	Q	R
x / cm	290	330	300

(a) Identify three constant variables in Zainal's investigation.

K

Constant Variable 1 : _____

Constant Variable 2 : _____

Constant Variable 3 : _____

(b) Suggest a reason for carrying out the investigation in a dark room.

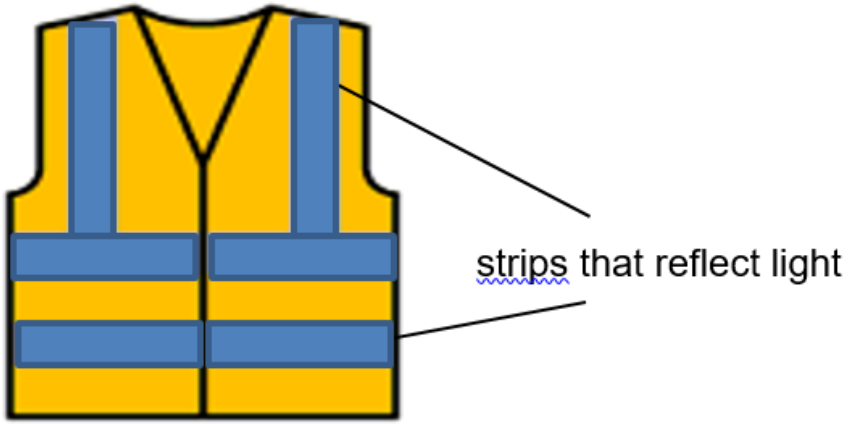
A

_____

_____

Knowledge or Application?

Safety vests are often worn by construction workers while they are working. Strips that reflect light are sewn onto the vest so that the workers' visibility is increased.



safety vest

(c) Based on Zainal's results, which material, P, Q or R, should be used to make the strips on the safety vest? Give a reason for your answer.

A

_____

_____

The Greenwood Approach

Philosophy

Science education prepares the students to be able to function and contribute effectively in an increasingly technologically-driven world.

Science is a way of thinking and making sense of the world.

Students should see the pursuit of Science as meaningful and useful.

(adapted from science Syllabus 2014, Pg. 1)

Rationale

Provide students with experiences which build on their interest in and stimulate their curiosity about their environment.

Provide students with basic scientific terms and concepts to help them understand themselves and the world around them.

Provide students with opportunities to develop skills, habits of mind and attitudes necessary for scientific inquiry.

Prepare students towards using scientific knowledge and methods in making personal decisions.

Help students appreciate how science influences people and the environment.

(science Syllabus 2014, Pg. 5)

Scientific Literacy

- Science education for the future involves teaching students more than just the basic concepts of science.

- Students need to be equipped with the skills
- to be able to use scientific knowledge to identify questions, and to draw evidence-based conclusions in order to understand and make decisions about the natural world and the changes made to it through human activity.

Objective

As the Science Department, we strive to inculcate attitudes of a scientist such as, critical thinking skills and curiosity, that will serve the pupils well for the rest of their lives.

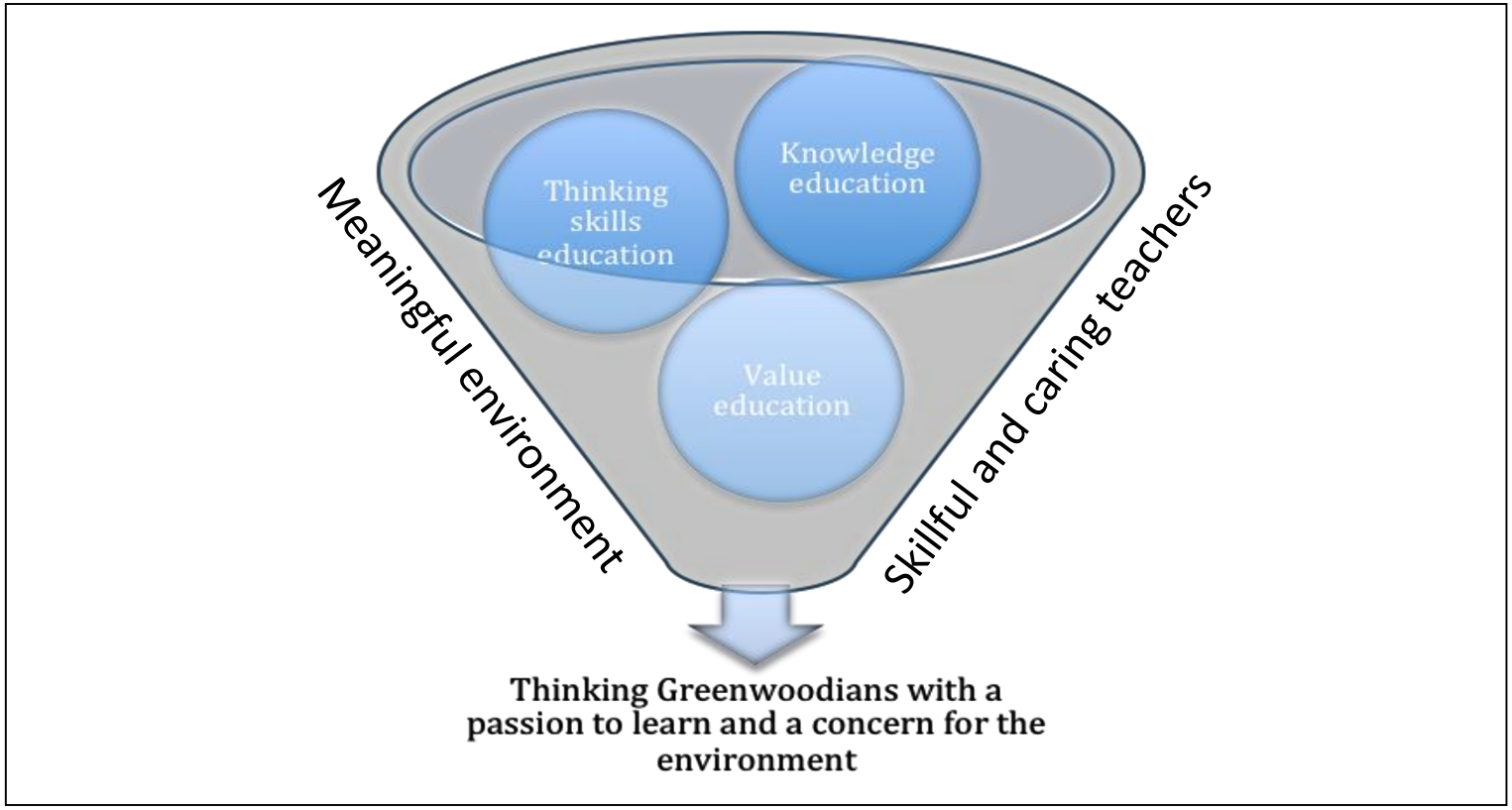
Vision:

Thinking students with a passion to learn and a concern for the environment

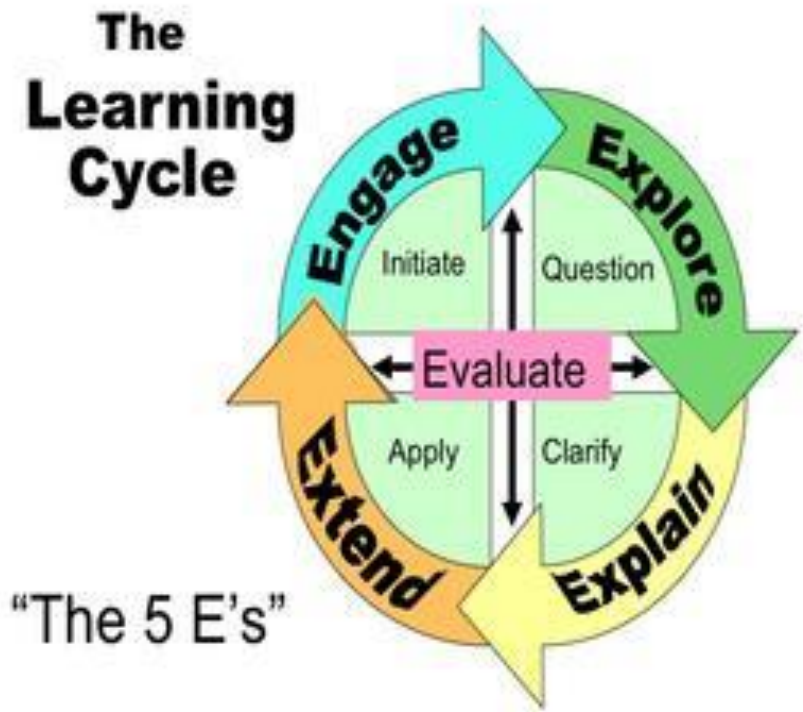
Mission:

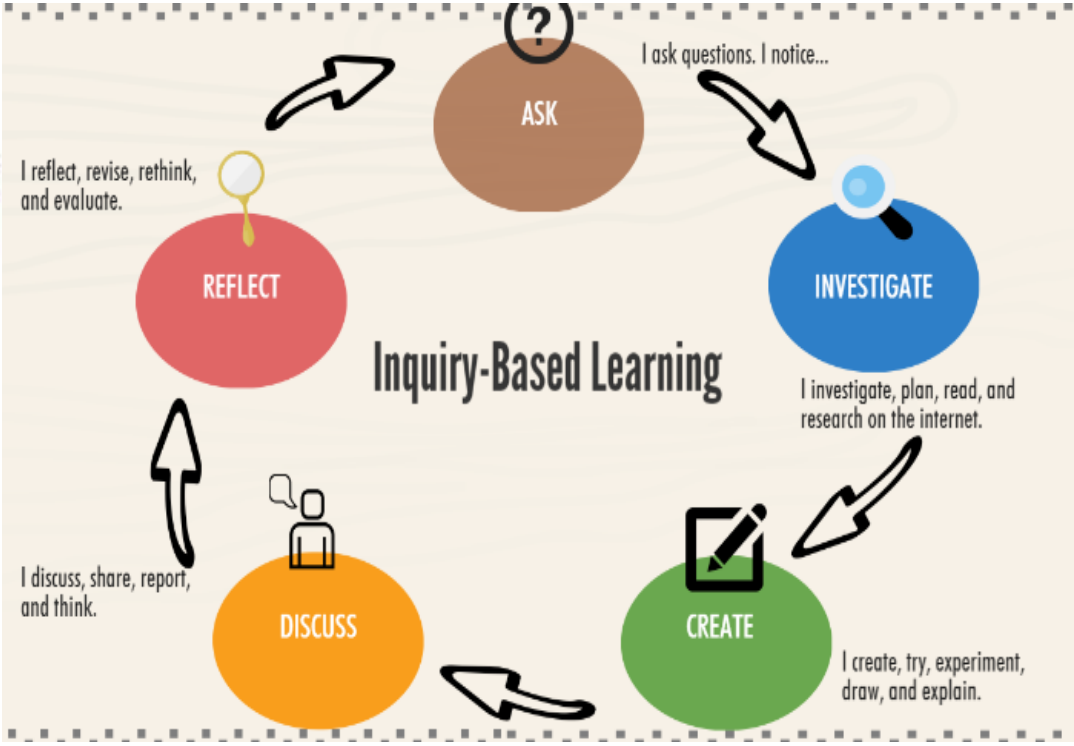
- **To nurture students to have a curious mind and a desire to learn.**
- **To equip students with the skills to carry out critical and innovative thinking.**
- **To develop in students, a concern for the environment.**

Approach


Thinking skills education
Knowledge education
Value education
Meaningful environment
Skillful and caring teachers
Thinking Greenwoodians with a passion to learn and a concern for the environment

Pedagogy


The
Learning
Cycle
Engage
Explore
Initiate
Question
Evaluate
Apply
Clarify
Extend
Explain
"The 5 E's"


ASK
I ask questions. I notice...
INVESTIGATE
I investigate, plan, read, and research on the internet.
CREATE
I create, try, experiment, draw, and explain.
DISCUSS
I discuss, share, report, and think.
REFLECT
I reflect, revise, rethink, and evaluate.
Inquiry-Based Learning

Level wide Programs

School-wide Environmental Education Program (All)

Inquiry Based Learning Booklet (P3-6)

Science Process Skills Package (Skills based 1 per term for P3-5, 1 for P6)

Eureka with Parents (Compiled into a booklet, done termly)

Science Whizzkids (Talent Development program)

JIT (P5 & 6)

- Science Booster
- Science Sparklers

T&L Resources

Activities & Experiments

- Inquiry based (IBL book)

Worksheets

- Consolidation worksheet
  - Knowledge acquisition
  - Readiness for more complex concepts
- Process Skills worksheets [topical (p3-6)and focused(p3-5)]
  - Thinking Skills acquisition
- Misconceptions worksheets/Revision Quizzes (P5/6)
  - Re-teaching and learning

Eureka with Parents

- Extend learning to the natural world (significance)

Primary 3 to 6 (IBL)

- In house Inquiry-Based package put into a IBL book
- Consists of activities that are based on a range of strategies, such as games, investigation and field trip, to facilitate inquiry teaching and learning.
- Alternative Assessments (E.g ***Practical Examination for all levels as a follow up to IBL experiments***)
- We have infused real life application questions in our IBL package as well as in our existing process skills package.

Eureka with Parents

- Questions are now in book
- Teachers to discuss questions with pupils and get them to complete termly.
- 2 good pieces per class, each term would be selected.
- These pieces would be put on Eureka Padlet for school and shared with whole School via Padlet.
- This is to promote discovery of Science through every day phenomenon.

GWPS approaches
RISES Thinking Strategy (MCQ)

- Step by step approach

- Gives pupils a systematic approach to answer multiple choice questions

- Gets them to evaluate their choice of answer critically and link it back to Science concepts

GWPS approaches
RISSA Thinking Strategy (OE)

R : Read the question carefully

I : Identify important information

S : Science Thinking & Concepts

S : Select the right Strategy

(Explain, relationship, comparison)

A : Phrase your answer

(CCC- Context(Evidence), sCience Concept, Conclusion)

GWPS approaches
Error Analysis

- Gets students to be self-reflective.
- Get them to look at their own responses to see what type of misconceptions, errors or incomplete answers they have.
- Gives them an opportunity to be self-directed learners.
- They also become critical thinkers.

GWPS approaches
Hinge Point Questioning

- A **hinge question is a diagnostic tool** which a teacher employs when their students reach the **"hinge" point**.
- Students' **mastery of the concept that has just been taught is contingent on them being able to understand the next concept**. Thus, the teacher need to assess students' levels of mastery before moving on, and this is exactly what a hinge question can do.
- Students' responses provide the teacher with **valuable evidence about what their students know, don't know and need to do next.**

2021 Assessment Term 1

Exam Paper	Booklet A	Booklet B
(P3-5 Non-weighted) Science Practical Duration of Paper: 30 min Total marks: 10 marks **(P3-5 Weighted 1)** Written Paper Duration of Paper: 30min Total marks: 30 marks	20 marks (10 ques)	10 marks (4 ques)

2021 Assessment Term 1

Exam Paper	Booklet A	Booklet B
CA (P6)Weighted Science Practical Duration of Paper: 30 min Total marks: 10 marks Written Paper Duration of Paper: 1h min Total marks: 90 marks	50 marks (25questions)	40 marks

2021 Assessment Term 2

Exam Paper	Booklet A	Booklet B
(P3-5 Weighted 2) <u>Written Paper</u> Duration of Paper: 55 min Total marks: 50 marks	28 marks (14 ques)	22 marks (5-8 ques)

2021 Assessment Term 2

Exam Paper	Booklet A	Booklet B
P6 SA1 Written Paper Duration of Paper: 1h 45min Total marks: 100 marks	56 marks (28 questions)	44marks
P6F SA1 Written Paper Duration of Paper: 1h 15min Total marks: 70 marks	36 marks (18 questions)	34 marks

2021 Assessment Term 4

Exam Paper	Booklet A	Booklet B
P5 SA2/ P6 PRELIM Written Paper Duration of Paper: 1h 45min Total marks: 100 marks	56 marks (28 questions)	44marks
P5F SA2/ P6F Prelim Written Paper Duration of Paper: 1h 15min Total marks: 70 marks	36 marks (18 questions)	34 marks

Important Information

- Keep all Science books and files and remind your child to revise them periodically.
- Remind them to use the strategies taught in school.
- Ensure that your child has sufficient thinking time for each Science question.
- Allow your child to practice thinking skills.
- Ask your child to explain the answers/steps to you to ensure that they have learnt.
- Be encouraging.
- Let them explore the world around them and understand the natural phenomenon

Main problems in answering Science Multiple Choice Questions

- Using the wrong concepts to answer the questions.
- Not taking the time to read and process the information in the question and diagram
- Not interpreting results in tables and graphs correctly
- Not eliminating wrong answers based on Science concepts.

Common Mistakes by Pupils

Pupils' Work

Jack grew some seeds of a plant on three trays inside a room. The experimental conditions and results are shown below.

light not required

Tray	Soil	Presence of light	Appearance of seeds on Day 5
A	wet	no	 seeds germinated
B	dry	yes	 seeds did not germinate
C	wet	yes	 seeds germinated

Based only on the results shown above, what is the correct conclusion for the germination of the seeds?

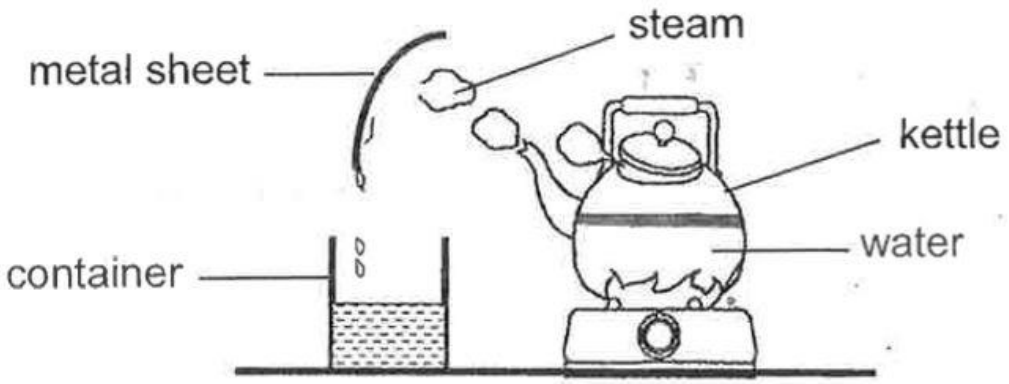
(1) light is required
(2) water is required
(3) air, water and light are required
(4) air, water and warmth are required

(4) (2)

Pupils' Work

- water vapour loses heat and condenses a a cooler surface

1. Paul set up an experiment to observe how condensation takes place.



When the water started to boil in the kettle, he collected water in a container by allowing the steam from the kettle to condense on a metal sheet. After a while, no water droplets were formed on the metal sheet even though the water in the kettle was still boiling. Explain why.

↳ no cooler surface

(1) The metal sheet was getting too hot.
(2) The metal sheet was getting too cool.
(3) The water in the kettle was getting too hot.
(4) The water in the kettle was getting too cool.

C
(1)

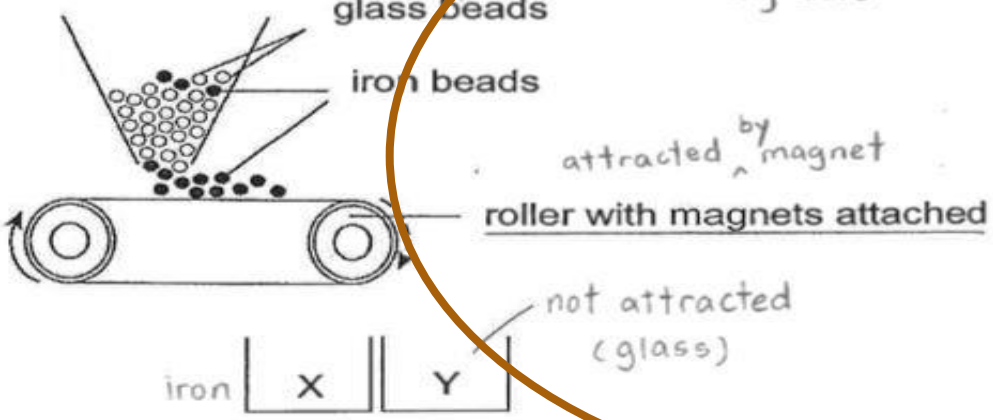
Pupils' Work

A factory uses the machine below to separate iron beads from glass beads.

magnetic

non-magnetic

cannot be attracted by magnet



What items will be collected in containers X and Y?

	Container X	Container Y
(1)	glass beads	iron beads
(2)	glass beads	glass beads
(3)	iron beads	iron beads
(4)	iron beads	glass beads

(4)

Attributes of a Scientist

- Analyses the situation by asking questions
- Gathers information based on data
- Makes association based on previous scientific research
- Infer, predict, evaluate or conclude

The Greenwood Approach

RISES Strategy

Read
the question

Information
gathering

Science
concepts & thinking

Eliminate
wrong options

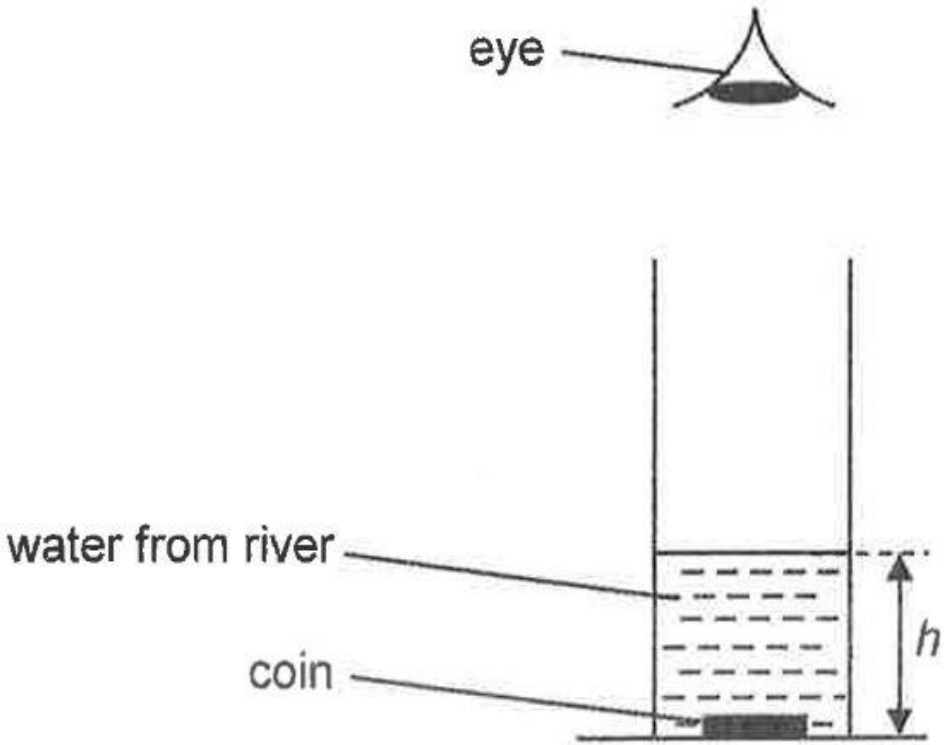
Support
answer with reason

Examples on how to use the **RISES** strategy

Upper Block - Example 1

Amy conducted an experiment using muddy water from different parts of a river, P, Q, R and S.

She placed a coin at the bottom of a container and poured in water taken from P until the coin could no longer be seen as shown in the set-up below. Then she recorded the height 'h' of the water.



Upper Block - Example 1

She repeated the experiment with the water taken from Q, R and S. The results are shown in the table below.

Part of river	h (cm)
P	15
Q	5
R	30
S	18

muddiest

least muddy

Upper Block - Example 1

Amy learnt that plants in the water grew well when there was sunlight. At which part of the river would there be least number of plants in the water?

(1) P

(2) Q muddiest ✓

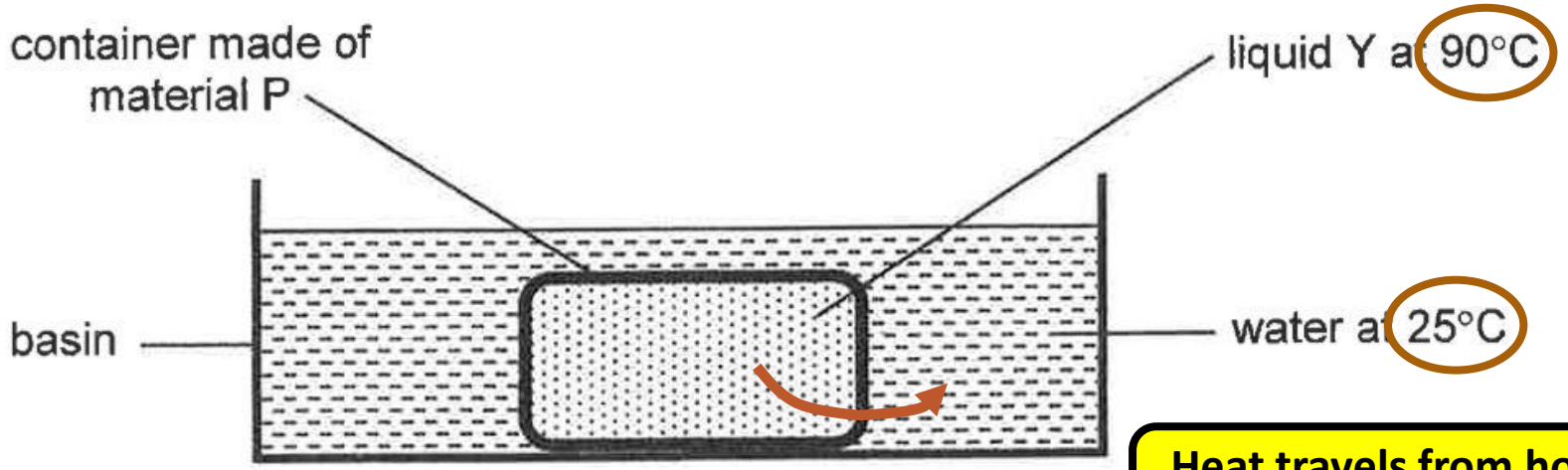
(3) R least muddy ✗

(4) S

muddiest as least amount of sunlight can pass through

Upper Block - Example 2

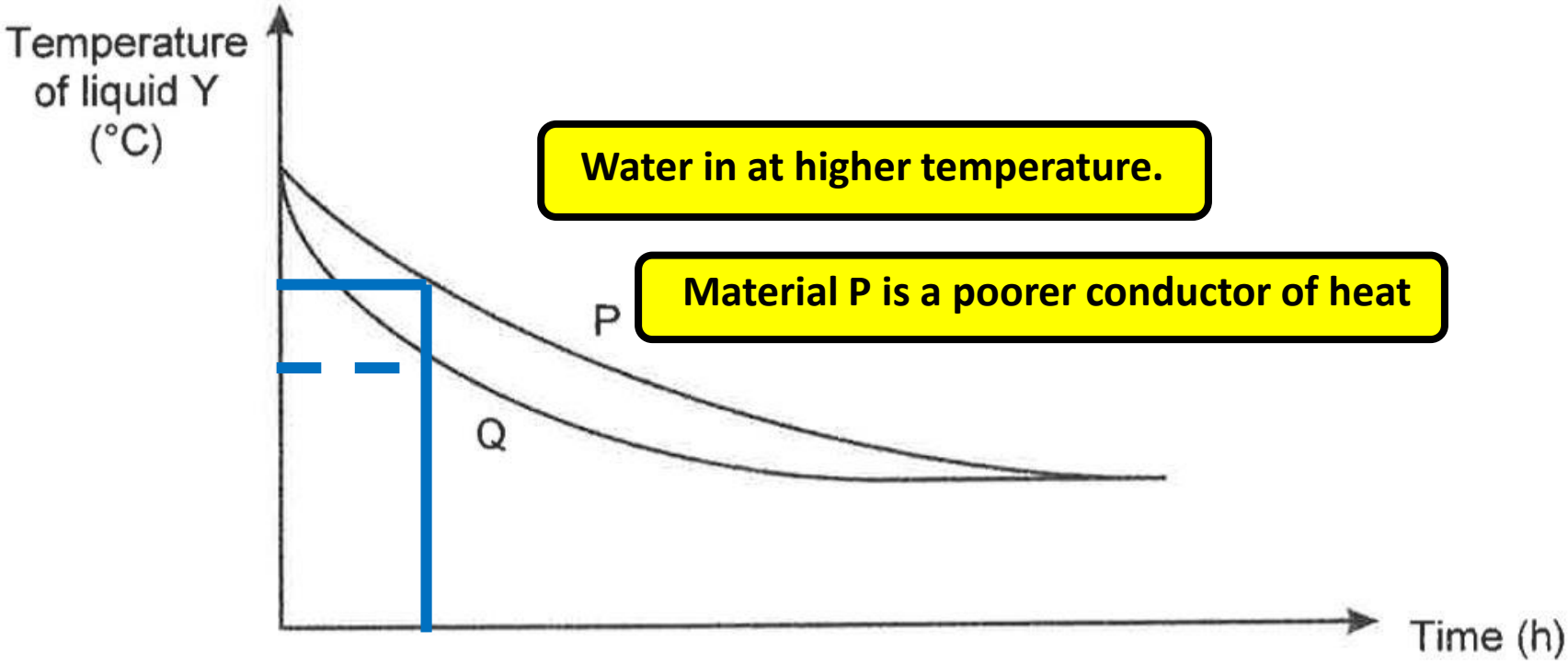
Hisham conducted an experiment using the set-up below.



He measured the temperature of liquid Y in the container over a period of time.

Upper Block - Example 2

He repeated the experiment using a container made of material Q. His results are shown in the graph below.



Upper Block - Example 2

Hisham wanted to bring hot food and cold drinks for a picnic.
He wanted to keep the food hot and the drinks cold.
Which material(s) would be most suitable for the containers?

Poorer conductor of heat. Heat from the hot food will be conducted away slower.

Poorer conductor of heat. Heat from the warmer surroundings will be conducted to the cold drinks slower.

	Material for container carrying	
	hot food	cold drinks
(1)	P ✓	P ✓
(2)	P ✓	Q
(3)	Q ✗	P
(4)	Q ✗	Q

Mentimeter code:
3241442

BOOKLET B (OEQ)

Main problems in answering Science Open-ended Questions

- Not taking the time to read and process the information in the question.
- Not able to identify the key information
- Not using Science concepts to answer
- Not linking concepts to the question

Types of Open-ended Questions

State / Name / Identify / Suggest	Only a direct answer is required
Describe / How	Give detailed and relevant details
Explain / Give a reason	Back up with Science concepts
Infer	Logical deduction based on Scientific concepts

Types of Open-ended Questions

What can you conclude	Analyse data and give a relationship
What do you think will happen	Predict based on data and Scientific concepts
Similarity **Difference**	**Both / All** **Mention both sides using "while" or "but"**
Relationship	Identify the 2 variables and the cause and effect

Types of Open-ended Questions

What can you conclude	Analyse data and give a relationship
What do you think will happen	Predict based on data and Scientific concepts
Similarity **Difference**	**Both / All** **Mention both sides using "while" or "but"**
Relationship	Identify the 2 variables and the cause and effect

How to do well for open-ended questions?

Think like a Scientist:

- make associations
- apply critical thinking skills
- apply Science concepts to new unfamiliar situations

The Greenwood Approach

GWPS approaches
RISSA Thinking Strategy (OE)

R : Read the question carefully

I : Identify important information

S : Science Thinking & Concepts

S : Select the right Strategy

(Explain, relationship, comparison)

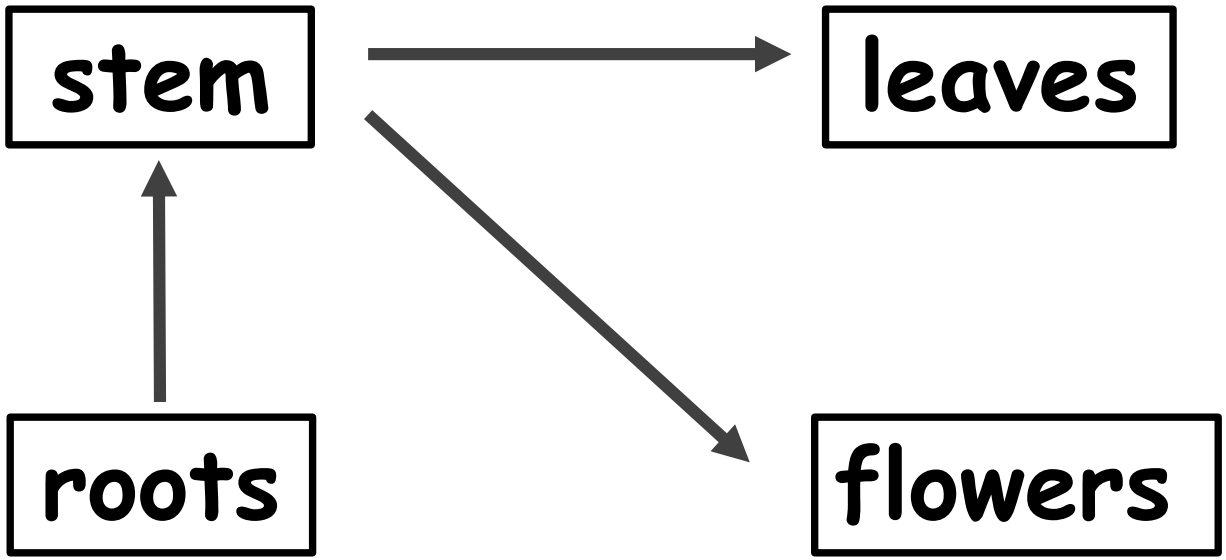
A : Phrase your answer

Why RISSA?

- A structure to help pupils frame their thinking
- Guided and more systematic approach to answering open-ended questions

Upper Block - Example 1

(a) Four parts of a plant are shown below. Draw arrows (⟶) in the diagram below o show how water is transported in a plant.



Upper Block - Example 1

(b) Describe the process of photosynthesis in green plants.

water + carbon dioxide $\xrightarrow{\text{presence of light}}$ sugar + oxygen

The chlorophyll in green plants captures (sun)light to convert water and carbon dioxide into food and oxygen.

Upper Block - Example 1

food and water – carrying tubes

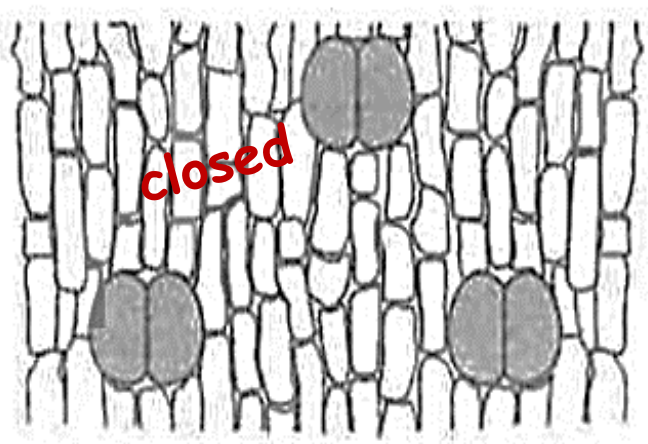
(c) Insect R eats its way into a tree trunk This affects the growth of the roots of trees. Explain why.

The food-carrying tubes will be damaged and food made in the leaves cannot be transported to the roots and they will die after some time.

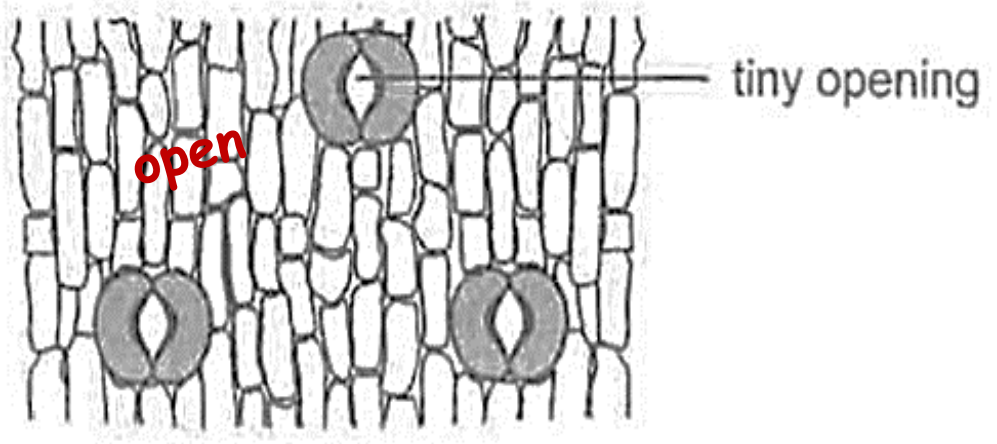
The water-carrying tubes will be damaged and water cannot be transported to the leaves. The leaves cannot make food to be transported to the roots and they will die after some time

Upper Block - Example 1

Plant T grows in a desert. It is able to store air in the leaves. Carl observed the cells of a leaf of plant T during the day and night as shown.



Day (45 °C)



Night (9 °C)

Upper Block - Example 1

(c) Based on Carl's observations, explain how plant T is adapted for photosynthesis in a desert.

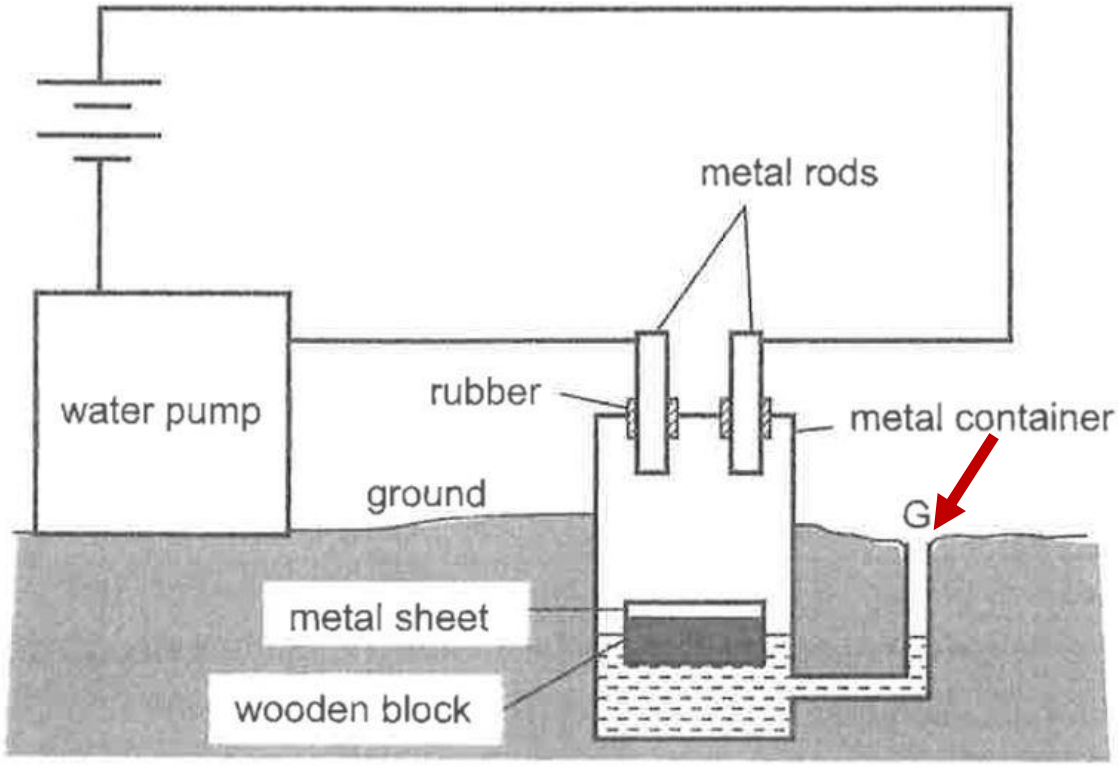
water, carbon dioxide, light

During the day, when it is hotter, the stomata are closed to reduce water loss.

During the night (when it is cooler) the stomata open to take in carbon dioxide for photosynthesis (the next day).

Upper Block - Example 2

Mr Koh wants to remove water from the ground using a water pump when it rains heavily. He uses the set-up shown below to turn on the water pump.



Rainwater enters the container through a hole at G.

Upper Block - Example 2

(a) State a property of rubber that allows the set-up to work properly.

no explanation is required.

Rubber is a non-conductor of electricity.

Upper Block - Example 2

(b) Describe and explain how the water pump is turned on when it rains heavily.

more water

When it rains heavily, water enters the metal container through G and **water level rises**, pushing the wooden block / metal sheet upwards. The metal sheet will then **touch** the metal rods to **form a closed circuit**, allowing electric current to flow through to enable the water pump to work.

Upper Block - Example 2

(c) Without using different apparatus, suggest one way to turn on the water pump when it rains less heavily. Explain your answer.

Suggestion

Lower the position of the metal rods.

Add more water.

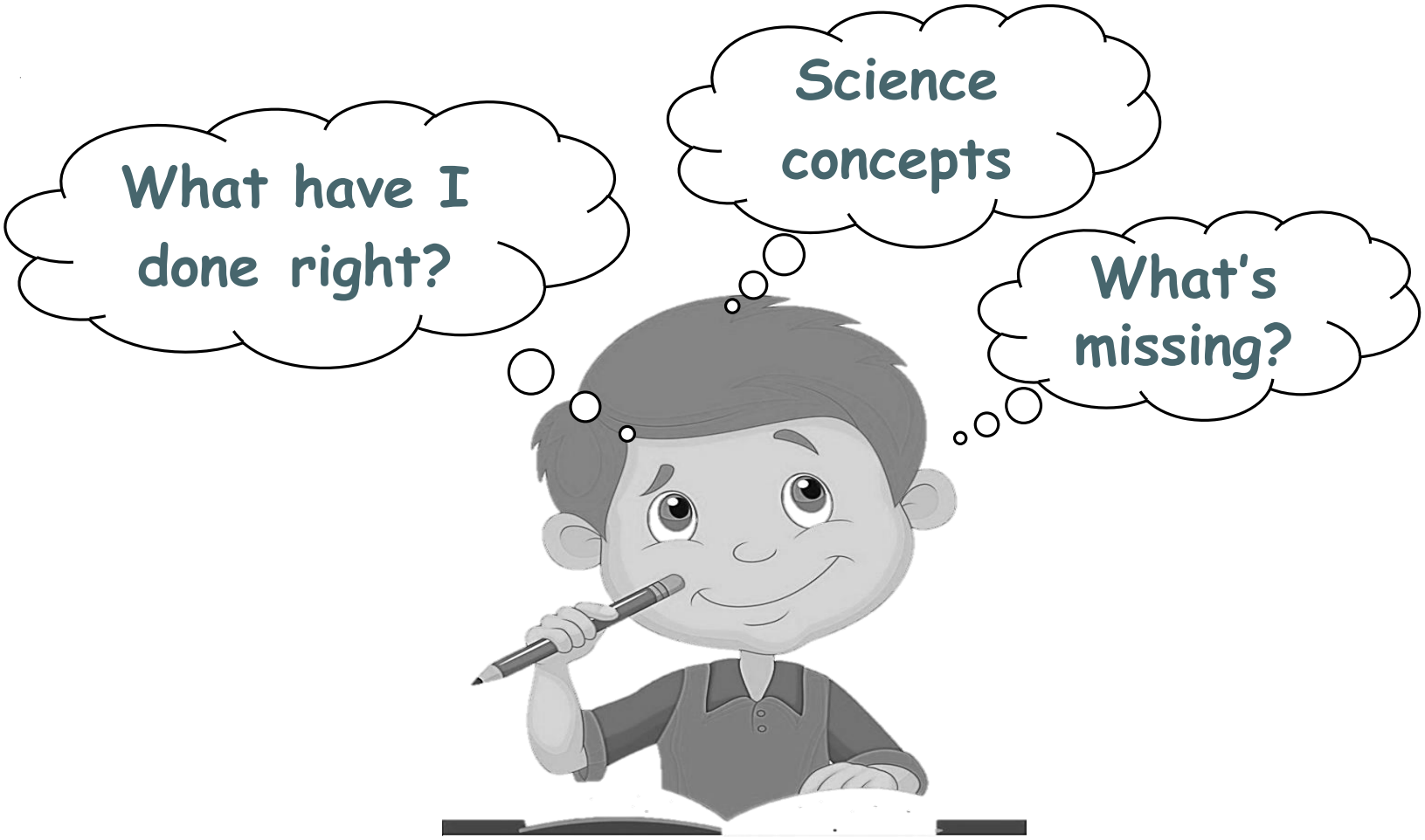
Raise height of metal container.

Explanation

Less water is needed to allow the metal sheet to contact the metal rod and close the circuit.

Mentimeter code:
3241442

Error Analysis Package



Research Findings

- In traditional classroom cultures, error-making is not seen in positive light.
- Pupils' learn better from observing others, imitating one another's experiences compared to direct reinforcement.
- Reduces anxiety in learning – analysing errors in examples or other pupils' work is less critical emotionally than analysing their own solution.
- Shifts focus from passive to active learners, who are more involved in the learning process.
- Pupils benefit from being able to give feedback and start to question their own work as well.

No Science concept shown

No conclusion made

No comparison made

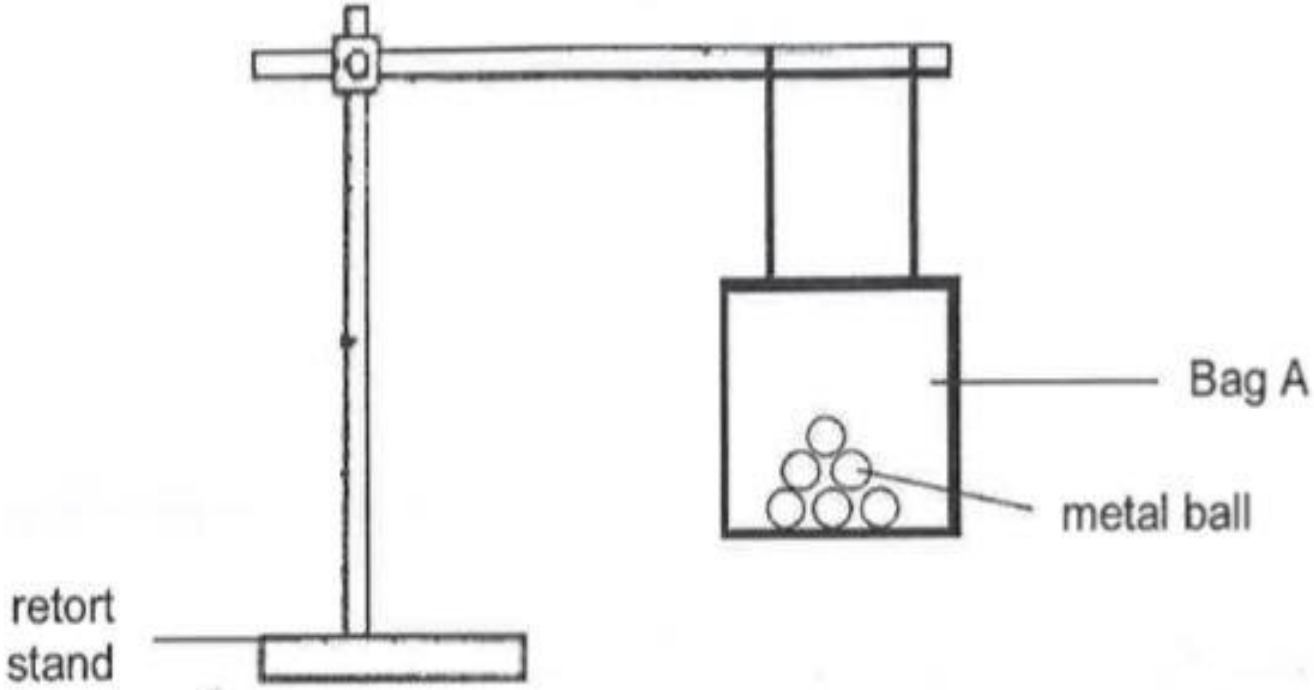
Just stating an observation

General statement given

Not linked to context given

Question 1

Jaden set up an experiment to find out which bag, A, B or C, is the strongest. He added similar metal balls of the same mass into Bag A till it broke.



What do you think ?

He repeated the experiment using Bag B and Bag C which were made of different materials. He recorded his observation in the table below.

	Number of metal balls added before the bag broke
Bag A	19
Bag B	5 least
Bag C	28 most

Which bag would be the most suitable for Jaden to carry heavy books with? Explain your answer. [1]

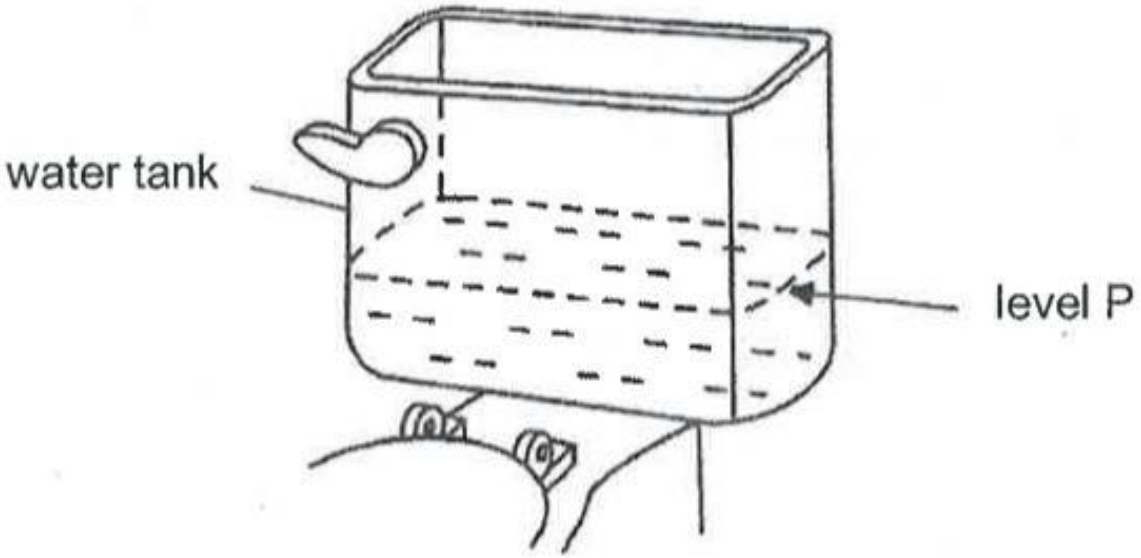
Bag C. Bag C carry the most metal ball before breaking. Hence it is the most suitable (why?) for Jaden to carry his heavy books. ½

No Science concept shown

Bag C. As it can carry the **most number** of metal balls before breaking, it is the **strongest material** to carry Jaden's books.

Question 2

The diagram below shows the water tank used in a toilet bowl flushing system.



The tank will be refilled after flushing and will stop filling when the water reaches Level P. Henry wanted to save water by reducing the amount of water used for flushing.

What do you think?

His mother suggested putting stones into the water tank. Explain how the addition of stones into the water tank would help to reduce the amount of water used for flushing? [1]

Wrong Science concept

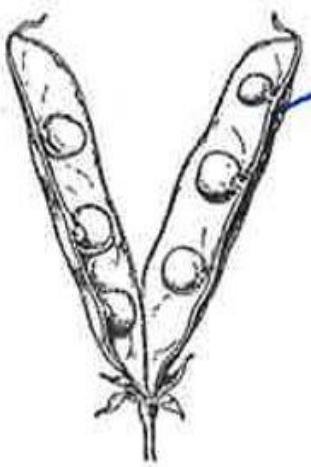
0

The stones help to increase the water level as it is heavy.

The stones will **occupy space** in the water tank. **Less water** will be **needed to fill up the water tank to level P.**

Question 3

Animal Y can also help to prevent overcrowding of plant M.



pot splits open

hooks - like structure

fruits dispersed by animals

wing - like structure

A B C

What do you think?

Which one of the fruits, A, B and C, is most likely to be from plant M? Explain your answer. [1]

Fruit B. Fruit B will be able to hook on to animal Y's hair. so?

No comparison in distance shown to prevent overcrowding
Not linked to context given

Fruit B. It has **hook-like structure to cling onto fur of animals**. As the animals move about, the fruits are dropped further away from one another thus preventing overcrowding.

Education is not the learning of facts, but the training of the mind to think.

Albert Einstein

Spirit Science


Q
A


Thank you

Feedback:

https://go.gov.sg/w1jj8u