Science (S1-3) Curriculum Support Materials
Creativity Problem-solving in Science (S1-3)

Background

Considering science as a creative process as well as creativity as an integral component for science learning, it is imperative that the students are engaged in this process to nurture their potentials in scientific creativity. Students' creativity in learning science is important for helping them think laterally and deal with their everyday problems logically. Science involves experimentation, testing hypothesis, building evidences, and theoretical discussions as it undergoes an engagement with constant process of reviewing and renewal. Students are encouraged to actively engage into science which involves integration of knowledge, imagination, brainstorming, categorising, distinguishing, conceptualizing and more. Nurturing in students scientific creativity is depicting a pivotal importance for fostering innovation, such as proposing inventions, making breakthroughs and scientific discoveries.

The activities

The activities included in this material are fairly synoptic in nature and would cover a range of scientific concepts to be learnt in science at junior secondary level. These activities were designed to promote students thinking laterally and develop in them the skills to imagine, brainstorm, integrate, distinguish and categorise different items, as well as to facilitate them to provide scientific explanation in a logical manner. The types of activities are tabulated below :

Activity	Name	Time required
I	"Pair Up"	10 minutes
II	"The odd one out"	10 minutes
III	"Form Groups"	10 minutes
IV	"Tell me why"	40 minutes
V	"Which is better"	40 minutes
VI	"Suggest an explanation"	40 minutes

Use

The curriculum material in this booklet could be used as in-lesson activities or an stimulus for revision towards the end of topics in Science (S1-3). The students should be asked to work through the questions in groups of two or three. In some lesson contexts which teachers may consider appropriate, students could be encouraged to devise their own questions and answers as post-lesson tasks, which could be tested on others in their group.

Remarks for teachers

- Students may know some of the science ideas or phenomenon via prior knowledge or informal science learning; but the activities were designed for which most students would not have a ready-made explanation or answer.
- The aim of the activities are to give a context for students thinking about ways to integrate, connect or distinguish objects as well as to make scientific explanation, rather than assessing whether students can recall explanations they have learnt
- Teachers should not expect students to have scientifically valid understandings of all the scientific concepts involved
- Teachers should not be concerned if they feel they cannot offer satisfactory explanations in response to some of the questions
- Teachers to look for whether the students could made attempt to give explanations linking to a range of relevant scientific concepts they have learnt
- It is very important that students do not get the impression that science is about closed questions, and all the major puzzles already have answers
- There is plenty of scope for individual teachers to modify the set – perhaps by adding some of their own examples
- the final outcome is less important than the process of debate and argument through which students explore the activity.

Scaffolding for students

- Teachers using these activities will need to decide how much help in the way of hints and suggestions to give students, and at what points to provide any support.
- Teachers may consider to provide students some reading materials about ways for spotting the flaws in explanations, to facilitate students' quality discussion during the activities:

Reading material – Spotting the flaws in explanation

There are lots of ways that an explanation may be inadequate – some are easier to spot than others.

An explanation may:

- Seem logical, but not actually answer the question asked
- Seem logical, but be based on false information or use principles that scientists do not accept
- be illogical, so that the steps in the explanation do not follow on from each other

Explanations may also look convincing yet there are flaws in them, for examples:

- Some explanations are just a renaming of the thing to be explained
- Some explanations are just saying the same things twice over in different words
- Some explanations use human feelings and motives to explain the activity of non-humans

Activity I – "Pair up"

Instructions

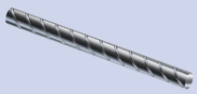
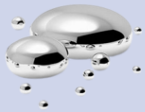
- Students are divided into a group of two
- Each group should collect a "Pair up" worksheet
- Allow some time for students to observe the characteristics of the objects
- Student A pairs up two objects from different rows and explain the reason
- Student B pairs up two remaining objects from different rows and provide reason
- Continue until all objects are paired up

Time required

- 10 minutes

Example 1

For the objects below, pair up the objects in Row A with the objects in Row B. Give your reason.

Row A				
	Water	Iron rod	Beaker	Thermometer
Row B				
	Stop watch	Mercury	Measuring cylinder	Ice

Provide your answer in the table below.

Row A	Row B	Reason

Example 2

For the objects below, pair up the objects in Row A with the objects in Row B. Give your reason.

Row A				
	Gold	Chocolate	Graphite	Pure water
Row B				
	Diamond	Dry ice	Milk	Silver

Provide your answer in the table below.

Row A	Row B	Reason

Activity II – "Odd One Out"

Instructions

- Students are divided into a group of three
- Each group should collect 3 "The odd one out" worksheets
- Allow some time for students to observe the characteristics of the objects
- Student A starts to choose the "odd one" and explain the reason
- Student B choose another "odd one" and explain the reason
- Student C explain the reason why the last object can also be the "odd one"
- Use another worksheet and change the order of choosing the "odd one"

Time required

- 10 minutes

Example 3

For the organisms below, select the one which is different from the others and give your reason.

Echidna	Whale	Crab
		

Provide your answer in the table below.

Odd one out	Reason

Example 4

For the elements below, select the one which is different from the others and give your reason.

Helium, Hydrogen, Carbon dioxide

Provide your answer in the table below.

Odd one out	Reason

Activity III – "Form groups"

Instructions

- Students are divided into a group of two
- Each group should collect 2 "Form groups" worksheets
- Allow some time for students to observe the characteristics of the objects
- Student A group the objects in two different groups and explain the reason
- Student B group the objects in two different groups in a different manner and explain the reason
- Use another worksheet and change the order of grouping the objects

Time required

- 10 minutes

Example 5

Group the below into two groups and give your reason.

Height	Blood Group	IQ	Skin Colour

Example 6

Group the below into two groups and give your reason.

Carbohydrates	Proteins	Vitamins	Dietary fibre

Activity IV – “Tell me why”

Instructions

- Students are divided into a group of two
- Each group should collect a “Tell me why” worksheet
- Allow some time for students to look through the question
- Students discuss among themselves in the group and propose a possible explanation
- Student groups present their explanation and other groups give feedback
- Allow time for students to revise their explanations after the presentations

Time required

- 40 minutes

Example 7

When you went on a picnic today, you saw the crowns of the trees do not touch each other, forming a canopy with channel-like gaps. Give a possible explanation of this observed scene.

Activity V – "Which is better"

Instructions

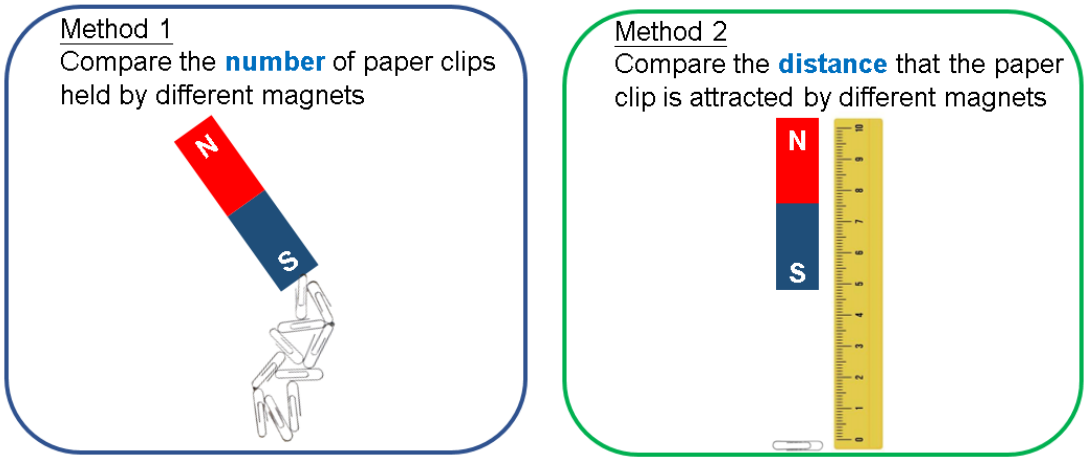
- Students are divided into a group of two
- Each group should collect a "Which is better" worksheet
- Allow some time for students to look through the question
- Students discuss among themselves in the group and choose the better method
- Student groups present their choices to other groups
- Allow time for students to propose a new method after the presentations

Time required

- 40 minutes

Example 8

A student proposes the following two methods to investigate the strength of different magnets.



For each method above, explain how you can compare the strength of different magnets. Which method you think is a better method? Could you modify the above methods or propose another better method?

Example 9

A student proposes the following two methods to find out the volume of the balloon.

Method 1
Pump air into the balloon using a marked syringe. Count the number of pumps.

Method 2
Immerse the inflated balloon into a bucket fully filled with water. Measure the volume of the overflowed water.

For each method above, explain how you can find out the volume of the balloon. Which method you think is a better method? Could you modify the above methods or propose another better method?