

Computational Thinking in Science Curriculum

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Pre-Orientation Workshop on Curriculum Framing and Syllabus
Preparation for Science and Mathematics

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Outline

Introduction

Example: Conditional Statement - If Then Else

Example: Cooling of Water

Example: Loop Iteration

How to Identify Computational Thinking Moments in the Science Textbooks?

Computational thinking is a set of problem-solving methods that involve expressing problems and their solutions in ways that a computer could also execute.

4 S2 III Transparent, Translucent and Opaque objects

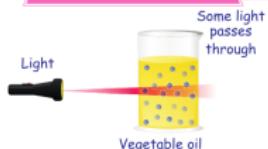
Some objects allow light to pass through them. This helps us to see through them as the window of a bus. Let us see how different objects behave with light.

1. Transparent Objects

Transparent objects allow the light to pass through them. So, we can see other objects clearly through transparent objects.
Examples: Air, glass and pure water.

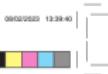
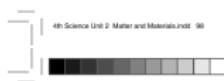


2. Translucent Objects



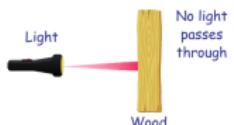
Translucent objects allow some light to pass through them. So, we cannot see objects clearly, but we see them as blurred images through them.
Examples: Paper soaked in oil, snow and vegetable oil.

98



3. Opaque objects

Opaque objects do not allow light to pass through them. So, we cannot see through these objects.
Examples : Wood, stone and metals.

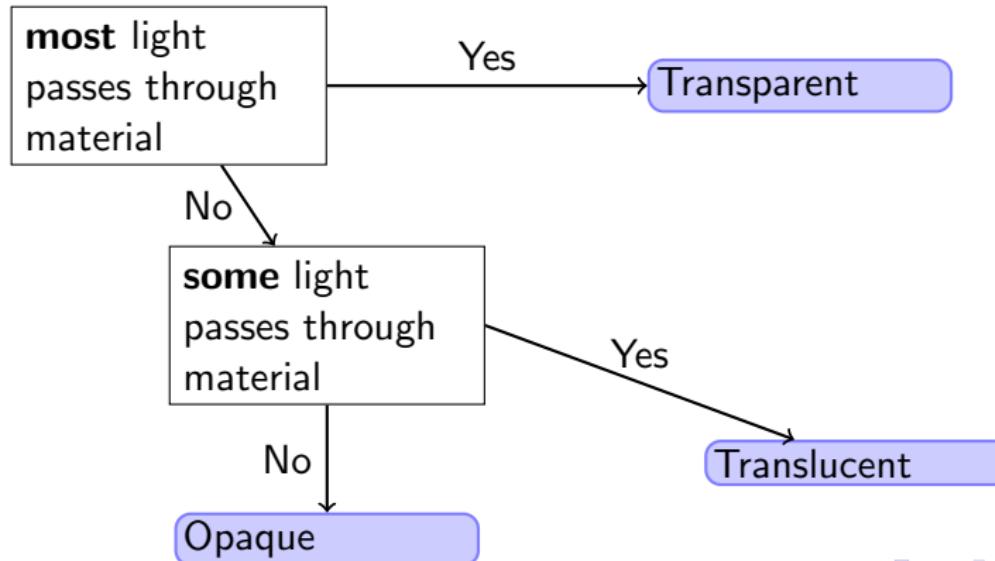


4 S2 III Transparent, Translucent and Opaque objects

Exercise

Classify the objects given below as transparent, translucent or opaque materials.

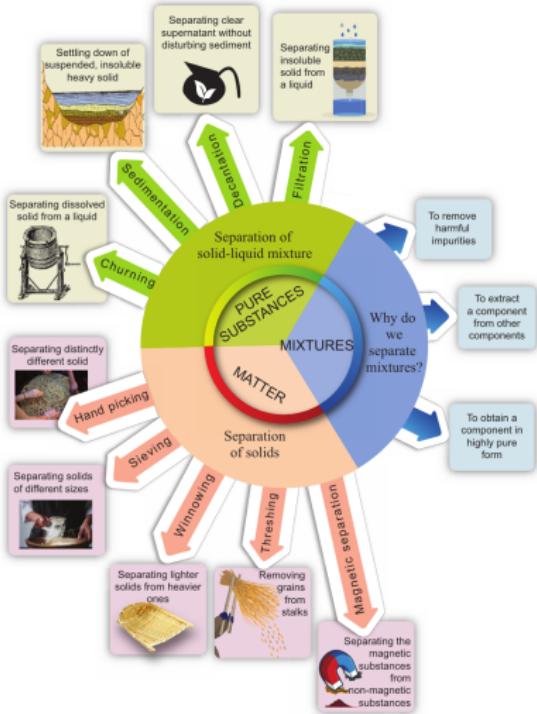
Air, Rock, Water, Aluminium foil, Mirror, Snow, Wooden board, Polythene bag, CD, Oil soaked paper, Glass tumbler and Coloured glass



6.3.6 Separation of Mixtures

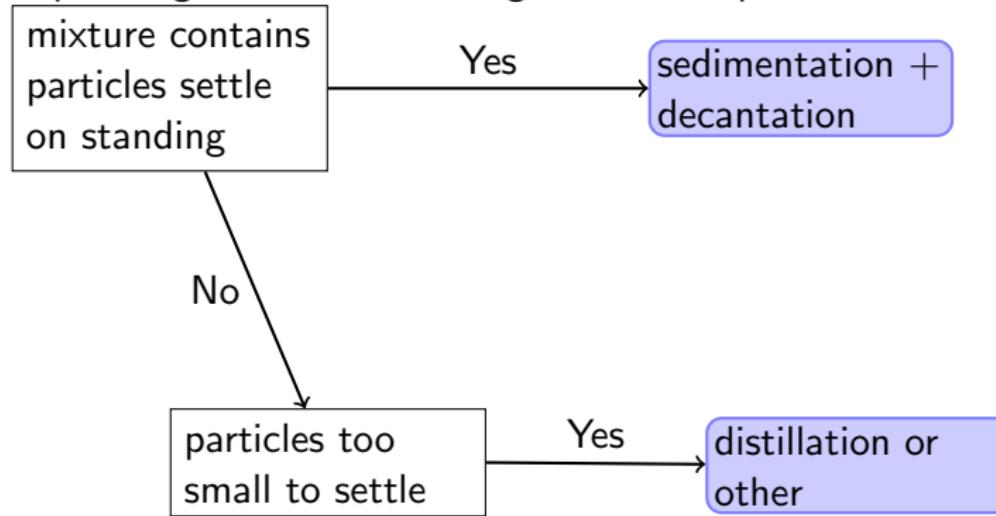


Separation Techniques

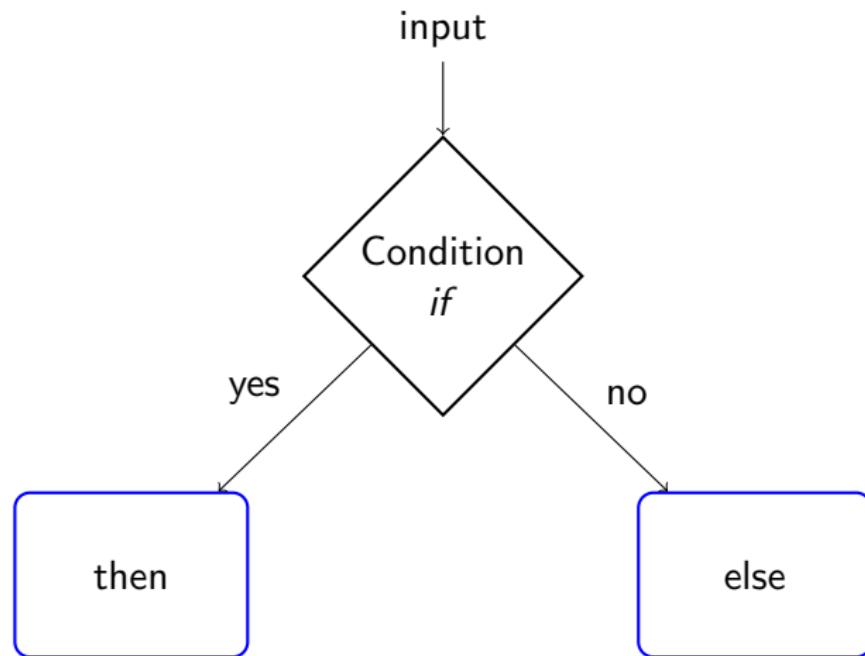


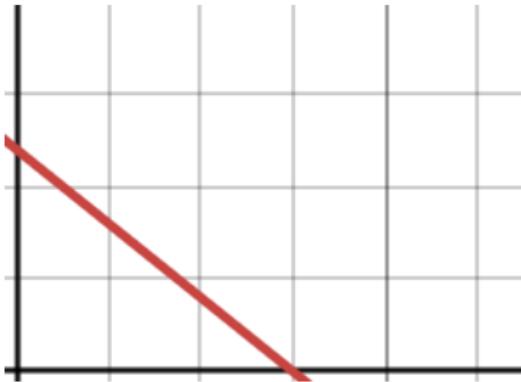
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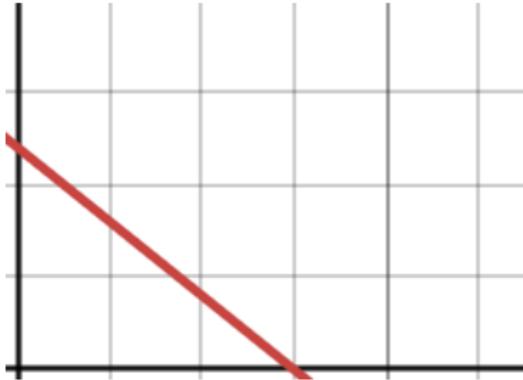
Separating mixture containing solid and liquid



If-Then-Else Flow Diagram

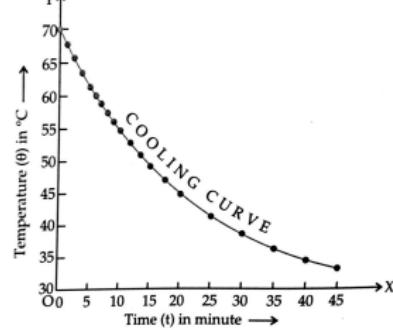






Data Table

Temperature of water (°C)	Time seconds (in second)	Room temperature (°C)	The difference of temperature (°C)
74.0	0.0	22.0	52.0
72.0	51.0	22.0	50.0
70.0	112.0	22.0	48.0
68.0	174.0	22.0	46.0
66.0	240.0	22.0	44.0
64.0	311.0	22.0	42.0
62.0	378.0	22.0	40.0
57.0	550.0	22.0	35.0
52.0	822.0	22.0	30.0
47.0	1150.0	22.0	25.0
42.0	1545.0	22.0	20.0
37.0	2110.0	22.0	15.0
32.0	3011.0	22.0	10.0
27.0	4656.0	22.0	5.0
22.0	6140.0	22.0	0.0



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Kerala SCERT Class 7, 8. Wonders of the Sky

how many days it takes for the Moon to reach the New Moon from Full Moon?

Class - VII

2023
May

1	2	3	4	5	6	
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

The date of Full Moon in the calendar

May 5

The date of New Moon in the calendar

May 5

Number of days taken to reach New Moon from Full Moon

May 5

Examine the next month's calendar also . Find out how many days are needed for the Moon to reach the next New Moon from the Full Moon?

2023
June

1	2	3				
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

The date of Full Moon

June 1

Date of New Moon in the calendar

June 1

The number of days between two consecutive New Moons by checking both the calendars.

June 1

Kerala SCERT Class 7, 8. Wonders of the Sky

how many days it takes for the Moon to reach the New Moon from Full Moon?



Class - VII



The date of Full Moon in the calendar	May 5
The date of New Moon in the calendar	
Number of days taken to reach New Moon from Full Moon	

Examine the next month's calendar also . Find out how many days are needed for the Moon to reach the next New Moon from the Full Moon?



The date of Full Moon	
Date of New Moon in the calendar	
The number of days between two consecutive New Moons by checking both the calendars.	

1. Identify full-moon date;
2. Identify next new-moon date;
3. Compute difference;
4. Repeat for next month.

Kerala SCERT Class 7, 8. Wonders of the Sky

how many days it takes for the Moon to reach the New Moon from Full Moon?

Class - VII

2023 MAY	The date of Full Moon in the calendar	May 5
	The date of New Moon in the calendar	<input type="text"/>
	Number of days taken to reach New Moon from Full Moon	<input type="text"/>

Examine the next month's calendar also . Find out how many days are needed for the Moon to reach the next New Moon from the Full Moon?

2023 JUNE	The date of Full Moon	<input type="text"/>
	Date of New Moon in the calendar	<input type="text"/>
	The number of days between two consecutive New Moons by checking both the calendars.	<input type="text"/>

1. Identify full-moon date;
2. Identify next new-moon date;
3. Compute difference;
4. Repeat for next month.

Decomposition/
Defining subroutines/
functions

Kerala SCERT Class 7, 8. Wonders of the Sky

how many days it takes for the Moon to reach the New Moon from Full Moon?

Class - VII

2023

SUN	MON	TUE	WED	THU	FRI	SAT
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

The date of Full Moon in the calendar

May 5

The date of New Moon in the calendar

June 10

Number of days taken to reach New Moon from Full Moon

15

Examine the next month's calendar also . Find out how many days are needed for the Moon to reach the next New Moon from the Full Moon?

2023

SUN	MON	TUE	WED	THU	FRI	SAT
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

The date of Full Moon

Date of New Moon in the calendar

The number of days between two consecutive New Moons by checking both the calendars.

15

Detecting regularities
e.g. loop iteration
count or periodicity
in data.

Algorithm → Follows
a clear sequence: find
full-moon date → find
next new-moon date →
subtract → record →
repeat for next month.

Computational Thinking Moments in the Science Textbooks

- ▶ Understanding the problem

Computational Thinking Moments in the Science Textbooks

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- ▶ **Decomposition:** break down a complex problem into manageable sub-problems.

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- ▶ Abstraction and pattern recognition, focusing on relevant features. Tasks requiring comparison of data, drawing tables/graphs, identifying patterns, generalising from data, ignoring irrelevant detail

Computational Thinking Moments in the Science Textbooks

- ▶ Understanding the problem
- ▶ **Decomposition:** break down a complex problem into manageable sub-problems.
- ▶ Plan a method, design an experiment/solution, sequence actions: **Algorithm**
- ▶ Abstraction and pattern recognition, focusing on relevant features.
- ▶ Testing, debugging, evaluation test the solution, reflect on limitations, verify fairness of test

Computational Thinking Moments in the Science Textbooks

- ▶ Understanding the problem
- ▶ **Decomposition:** break down a complex problem into manageable sub-problems.
- ▶ Plan a method, design an experiment/solution, sequence actions: **Algorithm**
- ▶ Abstraction and pattern recognition, focusing on relevant features.
- ▶ Testing, debugging, evaluation
- ▶ Data visualisation Use of charts/tables/graphs to represent results

HOW TO SOLVE IT

xxi

UNDERSTANDING THE PROBLEM

First.

You have to *understand* the problem.

What is the unknown? What are the data? What is the condition?
Is it possible to satisfy the condition? Is the condition sufficient to determine the unknown? Or is it insufficient? Or redundant? Or contradictory?

Draw a figure. Introduce suitable notation.

Separate the various parts of the condition. Can you write them down?

How to Solve It

DEVISING A PLAN

Second.

Find the connection between the data and the unknown.

You may be obliged

to consider auxiliary problems if an immediate connection cannot be found.

You should obtain eventually a *plan* of the solution.

Have you seen it before? Or have you seen the same problem in a slightly different form?

Do you know a related problem? Do you know a theorem that could be useful?

Look at the unknown! And try to think of a familiar problem having the same or a similar unknown.

Here is a problem related to yours and solved before. Could you use it? Could you use its result? Could you use its method? Should you introduce some auxiliary element in order to make its use possible?

Could you restate the problem? Could you restate it still differently?

Go back to definitions.

How to Solve It

If you cannot solve the proposed problem try to solve first some related problem. Could you imagine a more accessible related problem? A more general problem? A more special problem? An analogous problem? Could you solve a part of the problem? Keep only a part of the condition, drop the other part; how far is the unknown then determined, how can it vary? Could you derive something useful from the data? Could you think of other data appropriate to determine the unknown? Could you change the unknown or the data, or both if necessary, so that the new unknown and the new data are nearer to each other?

Did you use all the data? Did you use the whole condition? Have you taken into account all essential notions involved in the problem?

How to Solve It

CARRYING OUT THE PLAN

Third.

Carry out your plan.

Carrying out your plan of the solution, *check each step*. Can you see clearly that the step is correct? Can you prove that it is correct?

How to Solve It

LOOKING BACK

Can you *check the result?* Can you check the argument?

Can you derive the result differently? Can you see it at a glance?

Can you use the result, or the method, for some other problem?

How to Solve It

Examine the solution obtained.