6-8 years

pri-sci-net

inquire
investigate
evaluate
connect

Science Content:
Physical Science

Target Concepts/Skills:
Change of state, physical changes, freezing, melting

Target Age group:
6-8 years

Duration of activity:
1-2 lessons or 45 mins to 1 hour

Summary:
Children explore the change of state of matter by investigating how a snow/ice man can be saved from melting. Children are presented with a story/picture about a snowman which is melting. They are asked to come up with questions about how fast the ice melts, what makes it melt, and in what ways they can slow down the melting. Different types of investigations can be carried out depending on the questions the children want to answer. All the investigations target the rate of change of state.

Objective:
By the end of the activity children should be able to:

- Identify the factors that slow down the melting process for ice;
- Design an investigation to test which materials or what circumstances best keep the ice from melting;
- Take measurements of temperature with time

Resources:

- Ice cubes or ice pops with wrappers on;
- Small bowls to put the ice in;
- Different materials to wrap the ice cube in (fabrics, plastic, paper, foil, polystyrene, bubble wrap;
- Syringes for measuring the amount of melting water;
- Pens, chalk pieces, measuring tape;
- Thermometers;
- Cameras.

Change of Matter

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European Commission

CAPACITIES

Change of Matter

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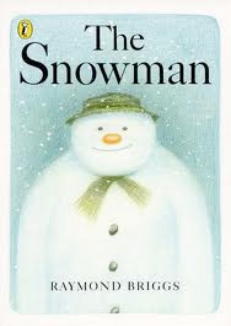
1. Engage (Forming hypotheses)

Decide which question to investigate (= the challenge)
What do children already know? What are their ideas? (make the question to investigate meaningful for the children)

Starter/ stimulus to elicit children's prior knowledge
The children are told a story about a snowman melting; 'The Snowman' by Raymond Briggs, or another story if this is not available.
The snowman (Naylor and Keogh) concept cartoon to pose questions (see appendix) can be used to introduce the investigation.
The children are invited to consider why the snowman melts. Why does it sometimes melt fast, sometimes stays for a long time?

Pose the questions – How can we investigate how we can stop the snowman from melting? What do we need to know?

- Children start thinking about how to investigate this, what is important to find out the answer to the question posed.



2. Inquiry (Designing and running experiments and observations)
Plan and conduct investigations in order to collect data

Investigation - How can we save the snow/ ice man from melting?

Teacher explains to the children that they are going to do group investigations in groups of 4 to test how they can keep the snow/ ice man from melting.

- Children need to discuss together:
  - which questions they would like to answer;
  - how they will try and answer these and in which order;
  - which materials they need/want to use;
  - how long they are going to take for each part of the investigation;
  - who will do what;
  - what they expect to see;
  - which findings are important to answer their question and how;
  - how they will record their findings;
  - how to present their ideas/findings to the whole class.

Explore and investigate how to keep the snowman whole

Possible options for questions to investigate + children make predictions for chosen questions
Which place might be best to stop the snowman from melting?
What could we use to put on the snowman to stop him melting?
Does it help if the snowman is in the dark or the light?

The investigation is planned according to thwat the children decide to investigate.

Planning including identifying variables, prediction
Teacher discusses planning and practical matters with class in plenary before children split up into groups – where materials are, what materials are needed, what groups have to think about, how much time they have, rules

- Children are put in groups and plan their investigations (making predictions, deciding how they will go about finding out, how they will record their findings, what they need, role-assignment, time-management, recording materials etc.)

Planning including identifying variables, prediction

- Children discuss in groups what they want to investigate, how they will do this, what variables they should consider, and what equipment they need.
- Children set up their investigation

Teacher facilitates the process. Fair testing can be discussed if deemed appropriate.

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Inquiry 1
Recording, measure and describe – changes in the snow-man over time
The children use identical blocks of ice and wrap them up in different materials. They can note how long it takes for the ice to melt completely or how much ice has melted at regular time intervals. The amount of melting water can be measured using the syringe.
Which recording measures are you going to use?

Teacher leads short session on:
How are you going to record what you find? What would be the best way(s) to record? I.e.

- Graphs
- Data tables
- Drawings
- Pictures
- Paragraphs/free writing
- Diary

Teacher selects what to discuss as appropriate for age group
Children decide on how to record and describe changes to the snowman – temperature, drawing, digital camera, marking distance on the floor (pen, chalk, tape), using tables (counts), drawings, graphs

Teacher goes round and assists/facilitates
Teacher makes sure all children/groups have recorded their findings

3. Evaluation (Evaluating evidence)

Conclusion: use data to construct knowledge and generate evidence. Demonstrate understanding of concepts and/or ability to use inquiry skills

Explanation of findings and evaluation
Plenary / whole class discussion of findings

- Group leaders present their findings to the whole class, which questions they asked and answers they got; their methods, their discoveries (surprises)? Next steps for investigation

How do they propose to best save the snowman from melting?
Teacher encourages groups to comment on each other's methods and findings, to compare, give feedback – come up with a synthesis of the best practice, and a top 3 of most interesting findings

Teacher also facilitates in terms of what questions could be asked, helping children note things they don't find out of their own accord

Inquiry 2
In what place will the ice melt slowest? Children can suggest different places in the classroom where they can put the ice and then test their prediction by placing identical ice-cubes in trays and test which place is best to preserve the ice the longest.

Inquiry 3:
Does ice melt differently in light and dark?
Children place an identical ice-cube in different places (one in darkness, one in light) ensuring that other environmental factors are more or less the same e.g. one in a closed box and the other in an open box (to limit differences in insulation) and to document any possible differences in the rate of melting.

Optional extension:
Extending thinking/creativity: Think about all the things that are made of ice. What would happen if we did not have ice? What is ice important or good for?

Teacher facilitates a philosophical enquiry with the whole class – eliciting arguments and counter-arguments; syntheses of both; new questions; conclusion for now (conservation of food, climate change, leisure activities; impact on health)

[This can be experimented with, i.e. the question can be asked before or after the investigation to measure the effect on the quality of the investigation and children's scientific enquiry based questions.]

Materials in attachment: teacher subject knowledge background and notes, worksheets, concept cartoon for starter

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Prior knowledge requirements of pupils: There are different types of materials and they can be classified according to their physical properties.

Common misconceptions

- Pupils often think that fabrics such as wool will warm things up and will therefore not help keep the ice from melting.
- Also, they often think that materials keep the cold in the ice rather than keeping the heat out.

Teacher notes/advice/things to think about

- How large should the groups be? Mixed ability or not? Should roles be assigned?
- Possible health & safety hazards
- How much guidance do children need with each stage of the investigation
- Other adults needed
- Have questions ready to help children along
- Structured vs. open-ended: this is something to be considered. The worksheets are provided if teachers prefer a more guided lesson. If the teacher prefers to let the children decide about how to record their data, they can decide not to use the worksheets. Similarly, if teachers wish to focus more on the active part of the investigation than on writing, the worksheets can be skipped, or worksheets can be adapted to the age of the children or children with special needs.

Subject knowledge background

Most of the common materials encountered by children can exist as solids, liquids or gases depending on conditions. Altering the state of a material (solid, liquid, gas) requires the transference of energy, and the movement of the particles within a material can explain the properties of solids, liquids and gases and changes such as melting, freezing, evaporation and condensing. These are physical changes and do not result in a new material being formed. Particle theory explains how in solid ice, the particles of water are packed close together and hardly move. Therefore a block of ice in a cold space retains its shape. As heat is added, the particles gain energy, and can move around more; they are less tightly packed. The ice starts to melt. Eventually it will become a liquid which means it can change it shape and flow. As further heat is added, particles at the surface of the water gain enough energy to leave the liquid and go up into the air: this is evaporation. This process can also happen in the opposite direction, i.e. as energy is lost, steam changes into liquid which in turn becomes ice. (See Cross et al., 2009)

Exploring physical changes will help children to understand what these terms (solid, liquid and gas) mean and help them relate to the terms usually used such as ice, water, steam/water vapour.

References

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Which materials keep the ice from melting? Worksheet

How long did you watch and record data? ... minutes

What did you do to keep the ice from melting	How thick was the material you used?	Amount of melting water after measuring time	Drawing or picture of the ice after measuring time	Other things you have tried or noticed?

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