50 YEARS of Exam Success

PRACTICAL INVESTIGATION

Demonstration of state changes – Heating and cooling curves of water

Prescribed practical for formal assessment

Materials

○ Bunsen burner
○ gauze
○ thermometer
○ tripod
○ beaker with ice
○ stopwatch

Methods

1. Set up a tripod stand with gauze over a Bunsen burner.
2. Fill a heat-resistant glass beaker about halfway with crushed ice.
3. Stir the contents well and take the temperature reading of the crushed ice with a thermometer.
4. Ignite the Bunsen burner.
5. Start a stopwatch at the same time and take a temperature reading every 30 seconds, while stirring continually.
6. Note the temperature at which the ice melts and again at which the water boils. Continue heating until the water has been boiling for 1 to 2 minutes.
7. Turn off the Bunsen flame.
8. Tabulate the data and draw an appropriate **heating curve of water**, with the time (seconds) on the horizontal axis and the temperature (°C) on the vertical axis.
9. Insert the beaker with fresh hot water in a tub with a saturated salt water solution at –10°C. Take temperature readings of the fresh water every 30 seconds, while stirring it continuously. Draw the corresponding **cooling curve of water.**

Results

Time (s)	Temperature (°C)
0	-10
30	0
60	0
90	0
120	25
150	50
180	75
210	100
240	100
270	100

ENRICHMENT

For the cooling process:
Saturated salt water is a good option to cool the water down, because adding salt to water significantly lowers its freezing point and provides a wider temperature range to observe during the cooling process.

Questions

1. Write down an investigation question for this investigation.

Give the:

2. (a) independent variable
   (b) dependent variable

3. Use the tabulated data above, or your own data, to draw a heating curve of water on the graph paper provided. Plot the temperature (ºC) and the corresponding time (s) values on their respective axes.

4. At which temperature:
   (a) has all the ice melted
   (b) does the water start to boil

5. What can be noticed about the shape of the graph at these temperatures?

6. What happens to the temperature between these two points, while constant heating continues?

7. Give an explanation for your observation about the temperature of the ice and again of the water during a state change.

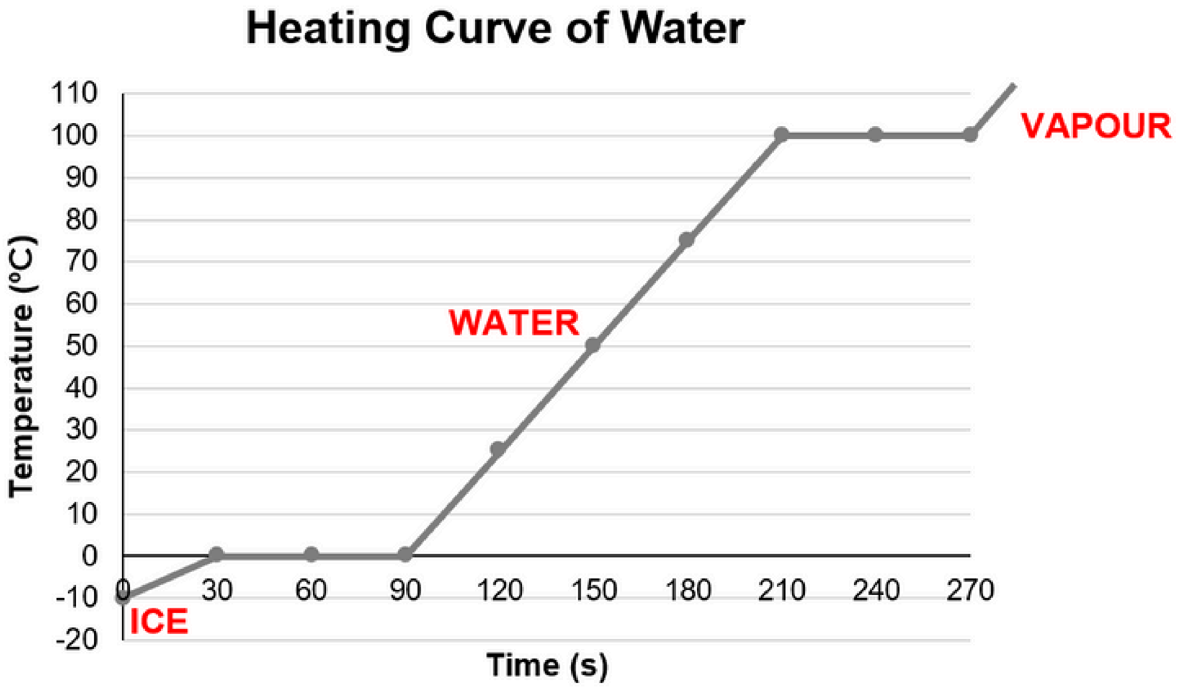
Answers

① What is the relationship between the change in time and the temperature / phase of the water?

② (a) time (s)

(b) temperature (°C)

③



④ (a) The temperature remains at 0°C until all the ice has melted.

(b) The water starts to boil at 100°C.

⑤ The temperature remains the same and the graph is parallel to the horizontal axis, during the time intervals when a state change occurs.

⑥ The constant heating causes a constant temperature increase per time interval of the water between these two points.

⑦ – During a state change, the heat energy added or removed is used to weaken/overcome or enhance the intermolecular forces.

– The potential energy of the particles/water molecules increases (when they move further apart) or decreases (when they come closer together).

– During this period the temperature, which is a measure of the average kinetic energy of the molecules, remains the same.

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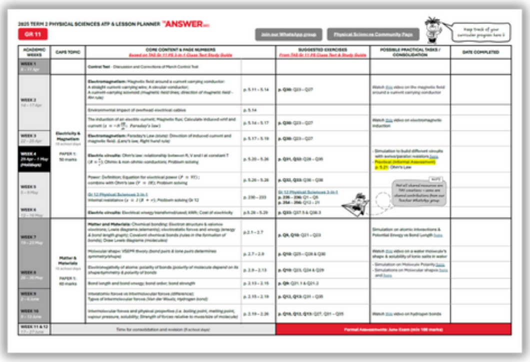

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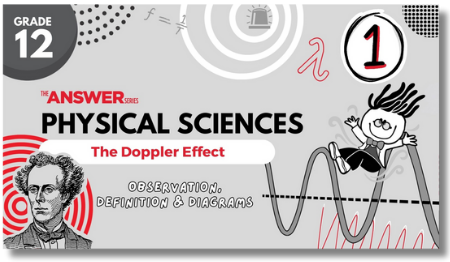

The Doppler Effect

*also available in Afrikaans

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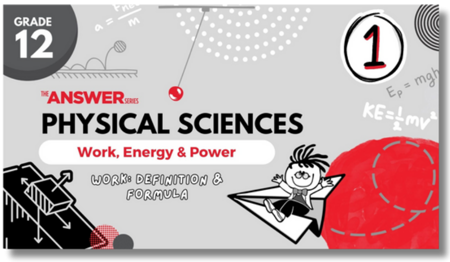
Afrikaans playlist



Work, Energy & Power

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