

Table of Contents

The Exploration of Space.....	2
Graphic Ice Cream.....	6
It's Electric!	12
Systems of Measurement	16

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The Exploration of Space

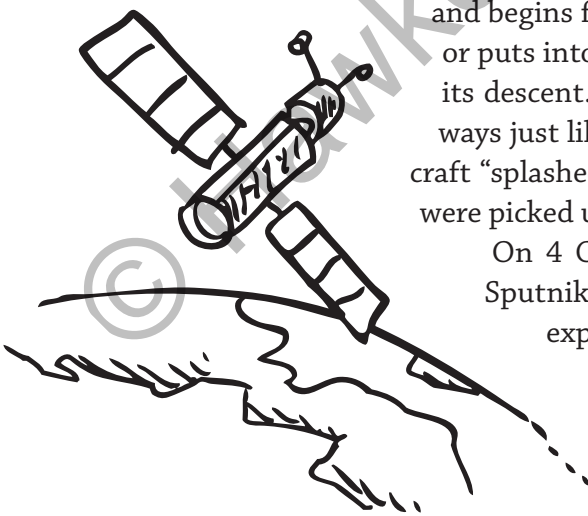
The exploration of space gives scientists the opportunity to learn about the Sun, stars and planets. Some space exploration involves scientists called *astronauts* travelling into space. Astronauts use spacecraft, such as space shuttles, to travel beyond the Earth's atmosphere into outer space, which begins about 96 kilometres above sea level. While in outer space, astronauts explore their surroundings with various tools, such as safety tethering systems to keep their spacesuits attached to the spacecraft (and smaller tethers to attach their tools to their spacesuits). Astronauts might also wear a SAFER or Simplified Aid for EVA Rescue (EVA stands for extravehicular activity, another term for spacewalk). A SAFER is like a backpack that uses small jet thrusters to allow an astronaut to move in space. Other space exploration does not require astronauts but instead uses spacecraft with robots or other mechanical devices, such as satellites, to gather information.

In order for spacecraft, manned or unmanned, to travel into outer space, they must first overcome the pull of Earth's gravity. The heavier an object, the more power is required to break the Earth's gravitational pull. As you can imagine, it takes a tremendous amount of power to launch a space shuttle. These large spacecraft require booster rockets full of fuel to launch them. The boosters burn the fuel that gives off gas bursts that push the spacecraft into the air. The spacecraft eventually reaches a height where the Earth's gravitational pull no longer affects it. Once it passes this point, the shuttle only needs to fire rockets to increase its speed or to change directions.

When a spacecraft is ready to return to Earth, it must first slow down.

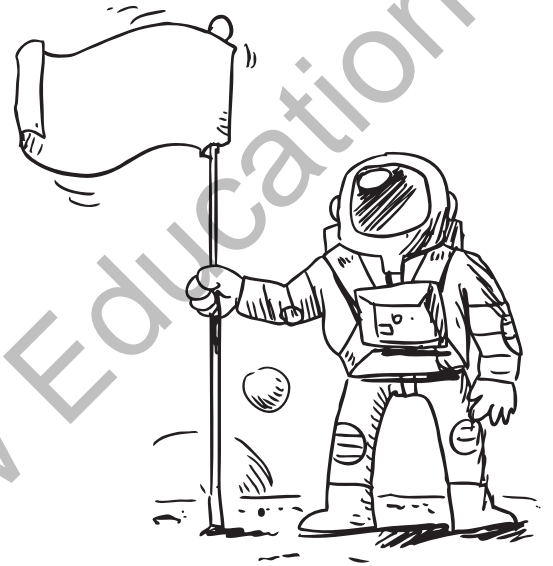
Once it re-enters the atmosphere, it slows down considerably and begins falling toward Earth. The spacecraft deploys, or puts into action, parachutes that further slow down its descent. Spacecraft like space shuttles land on runways just like aeroplanes. Some of the earlier US spacecraft "splashed down" in the ocean where the astronauts were picked up by boats.

On 4 October 1957, the Soviet Union launched Sputnik, a satellite that orbited Earth, and space exploration officially began. Years later, on 12 April 1961, Yuri A. Gagarin, a Soviet cosmonaut, became the first person to travel to space. In December 1968, the US took the first trip to the moon in the space-



craft Apollo 8, orbiting the moon 10 times before returning to Earth. Less than a year later, the American astronaut Neil Armstrong became the first person to walk on the moon on 20 July 1969. As Armstrong placed the American flag on the moon, he said, “That’s one small step for a man, one giant leap for mankind.”

Since this historic landing on the moon, astronauts have continued to explore space by travelling there and by studying the data collected by satellites and other unmanned spacecraft. Through space exploration, astronauts and scientists have learned and continue to learn much about the universe beyond Earth.



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THE EXPLORATION OF SPACE

Consequences and Implications

A3 What are the implications of space exploration? Support your answer.

Cause and Effect

A2 What is the effect of the Earth's gravitational pull on spacecraft during launch? During re-entry? Support your answer with evidence from the text.

Sequencing

A1 In the space below, create a timeline of the history of space exploration as presented in the text.

Creative Synthesis

D3 Imagine you are an astronaut on the Apollo 8 spacecraft. Write a letter home describing the experience. Be sure to include plenty of details so the recipient of your letter feels like they were there with you.

Summarising

D2 In three sentences or fewer, describe the different ways scientists and astronauts explore space.

Paraphrasing

D1 In your own words, explain what Neil Armstrong meant when he said, "That's one small step for a man, one giant leap for mankind."

Graphic Ice-Cream

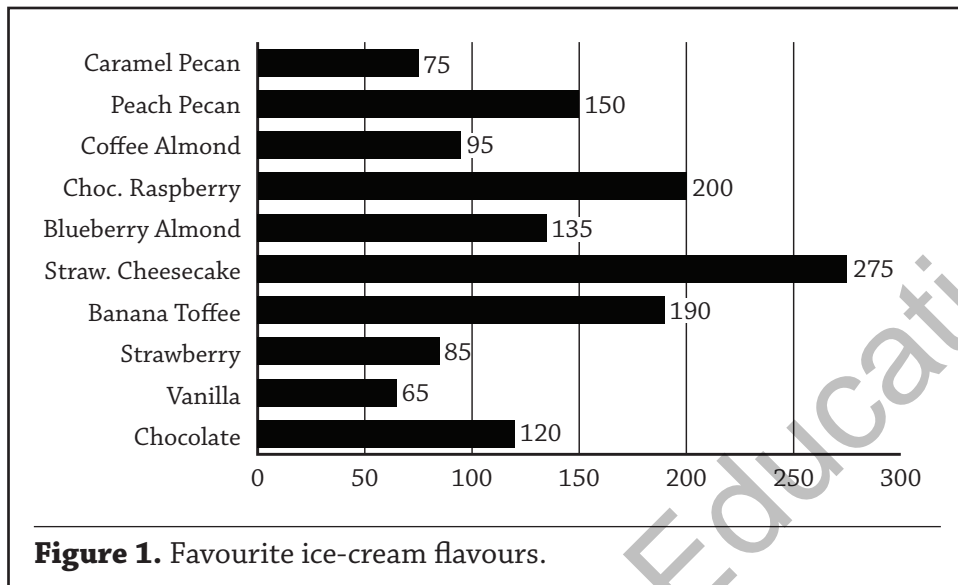
Tim and Lauren, the owners of Crema, an ice-cream shop, surveyed their customers about their favourite ice-cream flavours, gathered information about the number of customers on each day of the week and asked their employees to keep track of how they spend their work hours. They then used different kinds of graphs to represent these data.

Over the period of one month, the Crema owners asked their customers to choose their favourite flavours from a list including chocolate, vanilla, strawberry, banana toffee, strawberry cheesecake, blueberry almond, chocolate raspberry, coffee almond, peach pecan and caramel pecan. The results are presented in Table 1.

Table 1
Customers' Favourite Flavours

Ice-Cream Flavour	Number of Customers' Favourite Flavour
Chocolate	120
Vanilla	65
Strawberry	85
Banana Toffee	190
Strawberry Cheesecake	275
Blueberry Almond	135
Chocolate Raspberry	200
Coffee Almond	95
Peach Pecan	150
Caramel Pecan	75

Tim and Lauren then decided to graph the data they had gathered from their customers. They chose to graph the favourite flavours on a horizontal bar graph. A horizontal bar graph shows the relationships between groups. On a horizontal bar graph, one bar is not affected by another. Horizontal bar graphs are a good way to show large differences in results from surveys. They also are excellent tools for determining trends. By using a horizontal bar graph to represent the data about customers' favourite flavours, Lauren and Tim will be better able to plan their purchases of ingredients. They will know which ingredients will be used more quickly based on the flavour preferences. The horizontal bar graph of Crema customers' favourite flavours is presented in Figure 1.



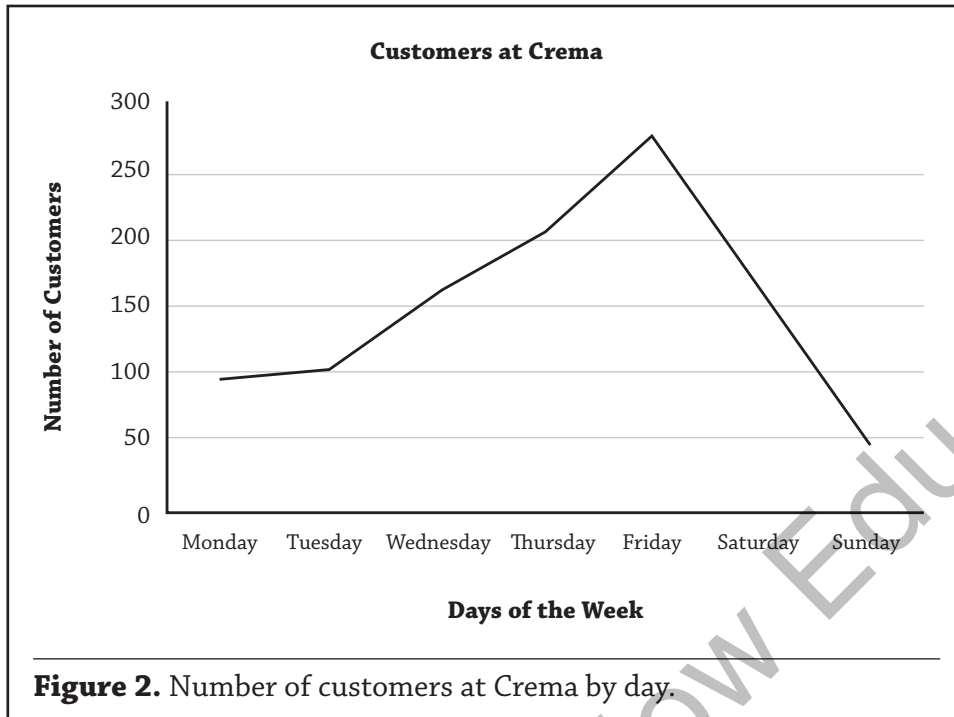
After realising how data can help them run their business more efficiently, Tim and Lauren decided to keep track of the number of customers coming to Crema on each day of the week. They were especially interested in Saturday and Sunday. They often wondered if they made or lost money by being open on the weekend. The results of their tracking are presented in Table 2.

Table 2

Number of Customers by Day

Day of the Week	Number of Customers
Monday	95
Tuesday	105
Wednesday	165
Thursday	210
Friday	275
Saturday	150
Sunday	45

Because the horizontal bar graph was helpful with comparing favourite flavours, the Crema owners decided to graph these data about customer attendance, too. But instead of a horizontal bar graph, they chose to use a line graph. Line graphs track continuing data where one point is affected by another. With line graphs, there are points on a graph with x- and y-axis coordinates. Points are then joined by a line. Line graphs often are used to



track rainfall, the average daily temperature or, in the case of Crema, the daily number of customers. The line graph they used is presented in Figure 2.

Tim and Lauren analysed the data to determine on what days they were most profitable. As they were thinking about money, they wondered how productive their employees were. They decided to ask their employees to keep track of how they spent their work hours. The results of this tracking are presented in Table 3.

Table 3
How Crema Employees Spend a Total Work Day (12 Hours)

Chore	Hours	Percentage of Work Day
Preparing Store to Open	1	8%
Taking Orders	3.5	30%
Preparing Orders	5	42%
Completing Transactions	1	8%
Reconciling Register	.5	4%
Closing	1	8%

The owners of Crema decided to use a circle, or pie graph, to display the data gathered from their employees. Pie graphs are particularly helpful when looking at how a part relates to a whole. In this case, Tim and Lauren wanted to see how the time spent on each chore related to the work day as a whole. The pie chart is presented in Figure 3.

GRAPHIC ICE-CREAM

Generalisations

B3 Write at least three generalisations about using graphs to represent data.

Classifications

B2 Look at your list of details. Classify your list into the categories of horizontal bar, line or pie graphs based on which type of graph would be most appropriate for each type of data. Use the definitions from the text to make your classification decisions.

Details

B1 List 15–20 different kinds of data that are often gathered or that could be gathered.
