Georgia Tech Center for Inclusive Design and Innovation

# Writing Effective Alternative Text for Educational Content:

## Best Practices for Reducing Cognitive Load

Presented by Valerie Morrison, Ph.D.
Research by K. James Monroe

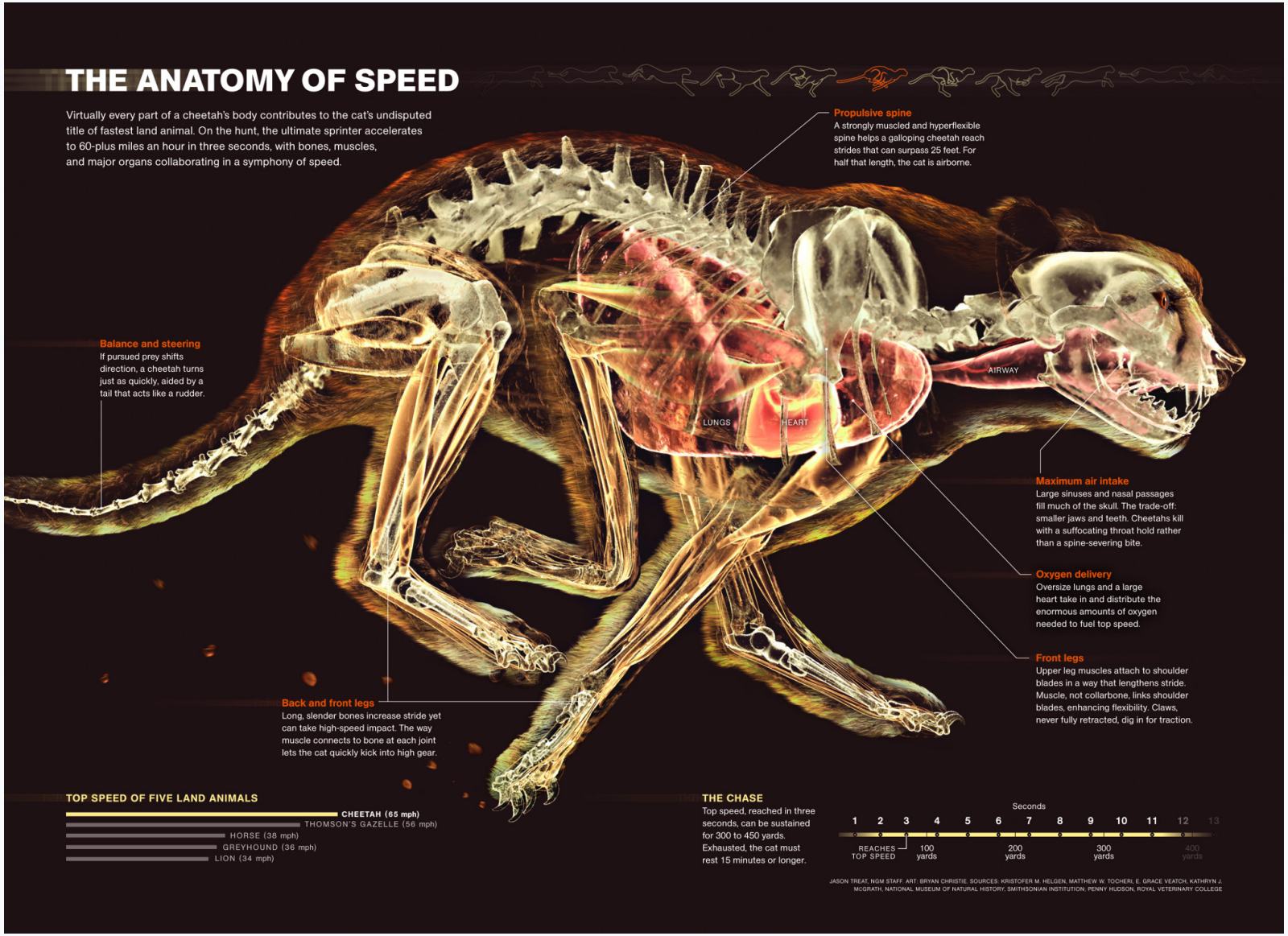
CREATING THE NEXT®

# Today's Presenter

**Valerie Morrison, Ph.D., E-Text Manager at CIDI**

Valerie manages the E-Text department, making accessible textbooks for students with print-related disabilities. Valerie earned her doctorate in English Literature. Now she provides educational materials to all students, finding new ways to transform course materials into accessible digital formats.

# Presentation Goals




1. My Work with Alternative Text
2. Concept of Cognitive Load
3. Examples of Educational and STEM Content


Alternative Text

# E-Text Products and Services

- Accessible PDF
- Microsoft Word DOC
- EPUB
- DAISY
- HTML
- Accessible Math
- Enhanced Tagged PDF
- PowerPoint

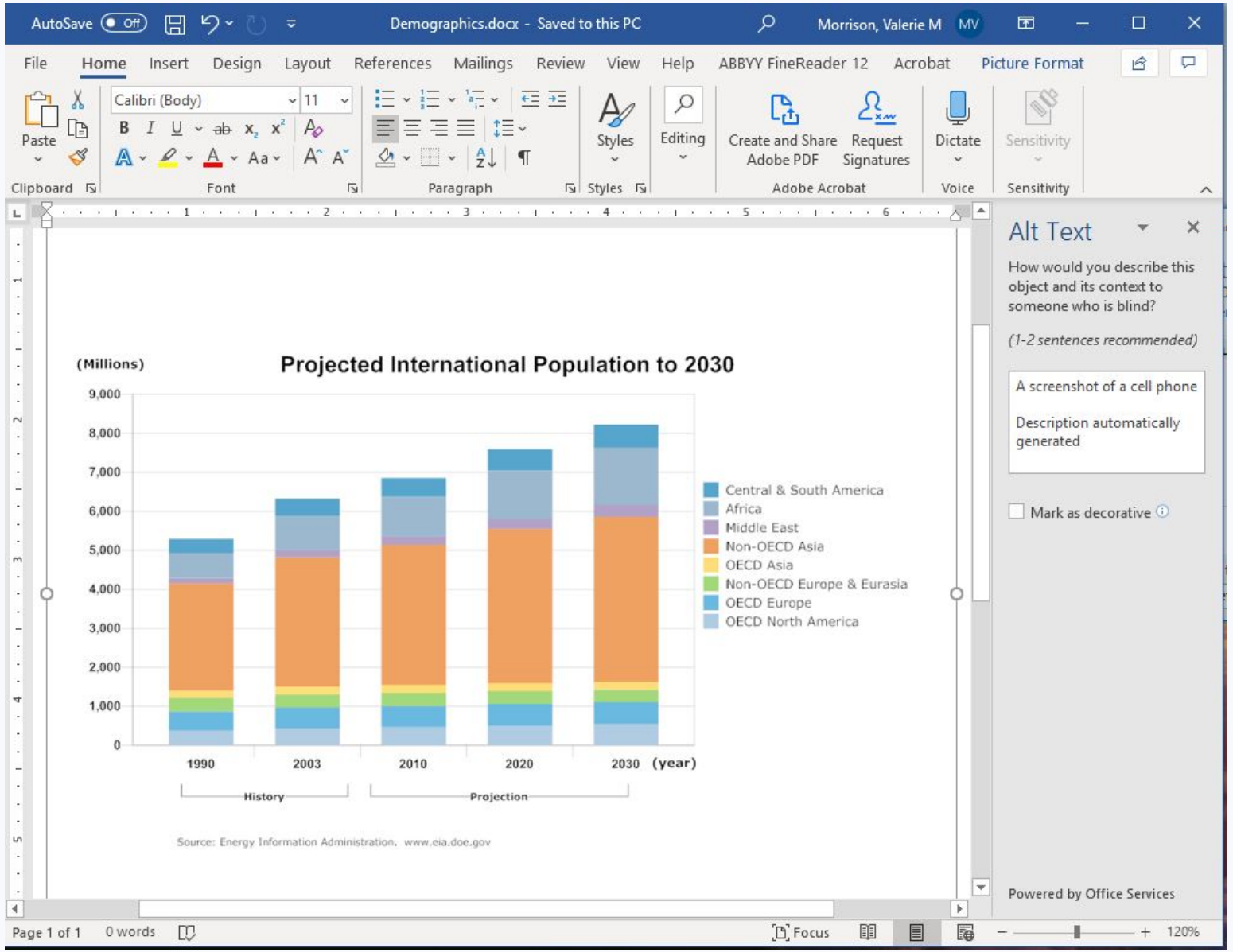
# Who Needs Alt Text?

- Individuals who are blind, or experience color blindness or low vision
- Individuals with learning disabilities such as dyslexia, dyscalculia, dysgraphia, or ADHD
- Individuals with head injuries, trauma, or cognitive disabilities
- Auditory learners
- Aging population
- Everyone

# Automated Alt Text

Microsoft Office now autogenerates alternative text by default.

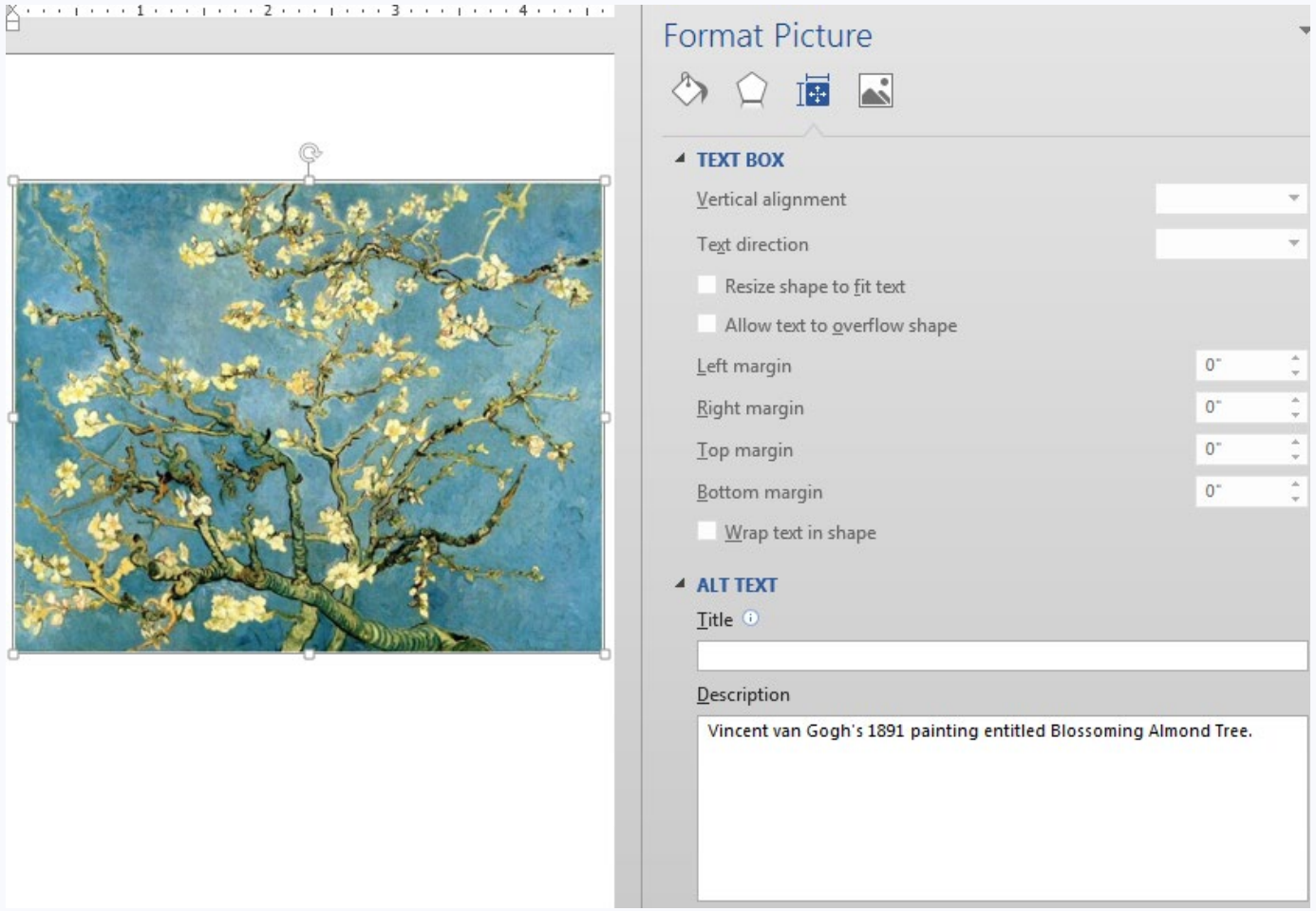
- Click on **File**
- Click on **Options**
- Select **Ease of Access** on the left
- Scroll down and uncheck “Automatically generate alt text for me.”



# Alternative Text Descriptions

Images should be described using proper capitalization, grammar, and punctuation.

- Right click on the image and select Edit Alt Text.
- Type in the Description field.
- In older versions of Office, right click on the image and choose Format Picture. Select the Layout Properties icon. Click on the Alt Text link.



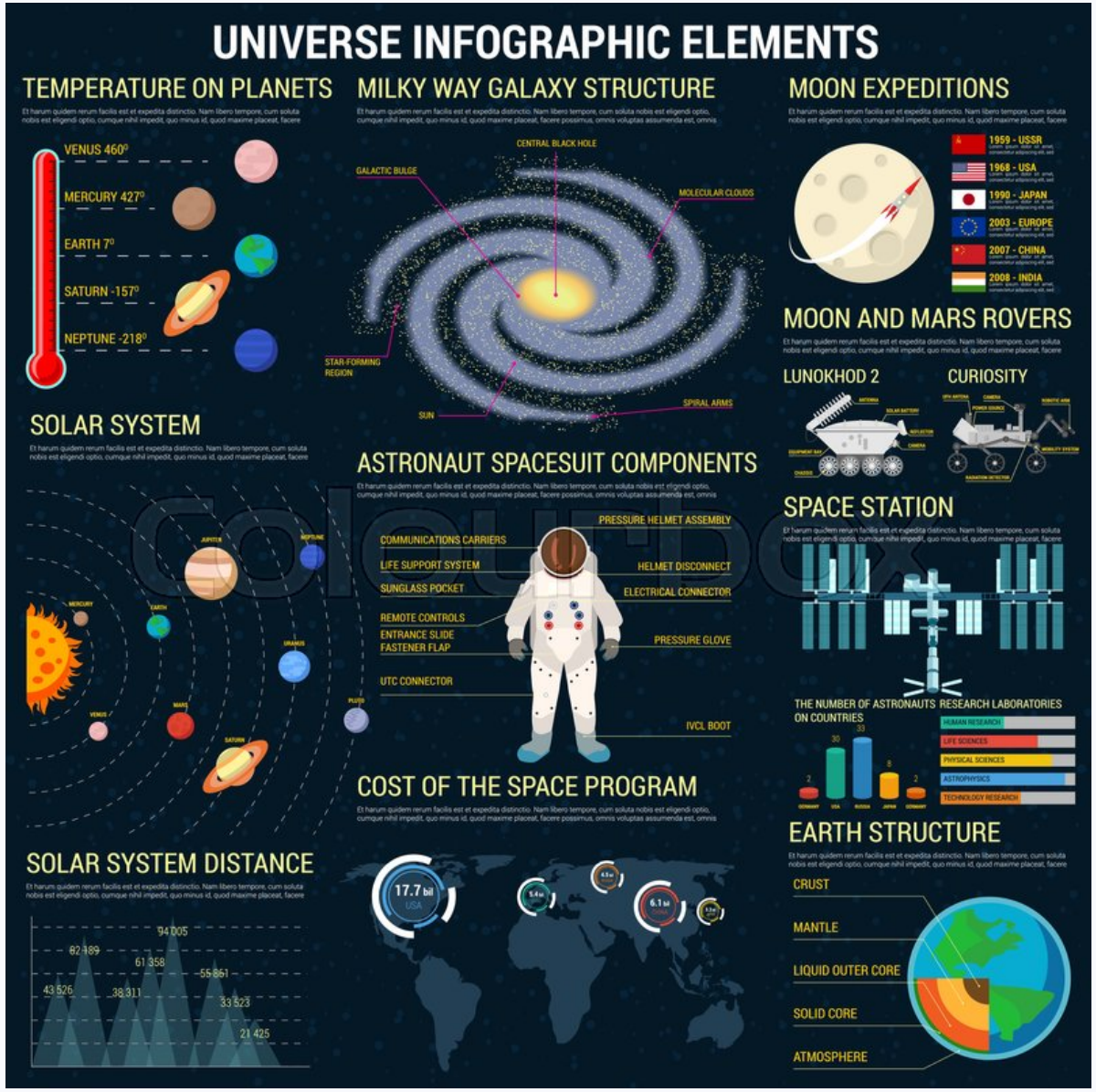
# How to Approach Image Description

- First summarize what you see in one general informative sentence.
- Keep your description neutral and informative.
- Use proper grammar, spelling and punctuation.
- Avoid acronyms and symbols.

# Cognitive Load

# Consider Cognitive Load

- Try to avoid causing Auditory Fatigue when describing complex images.
- Learning is enhanced when you reduce the number of items stored in the working memory.
- Alt text is most effective when it's as concise as possible and organized efficiently with items grouped for easier mental processing.



# Use Clear and Concise Syntax

- Edit for clarity
- Simplify word choice
- Use parallel structure
- Spell out acronyms or symbols

# Organize Information

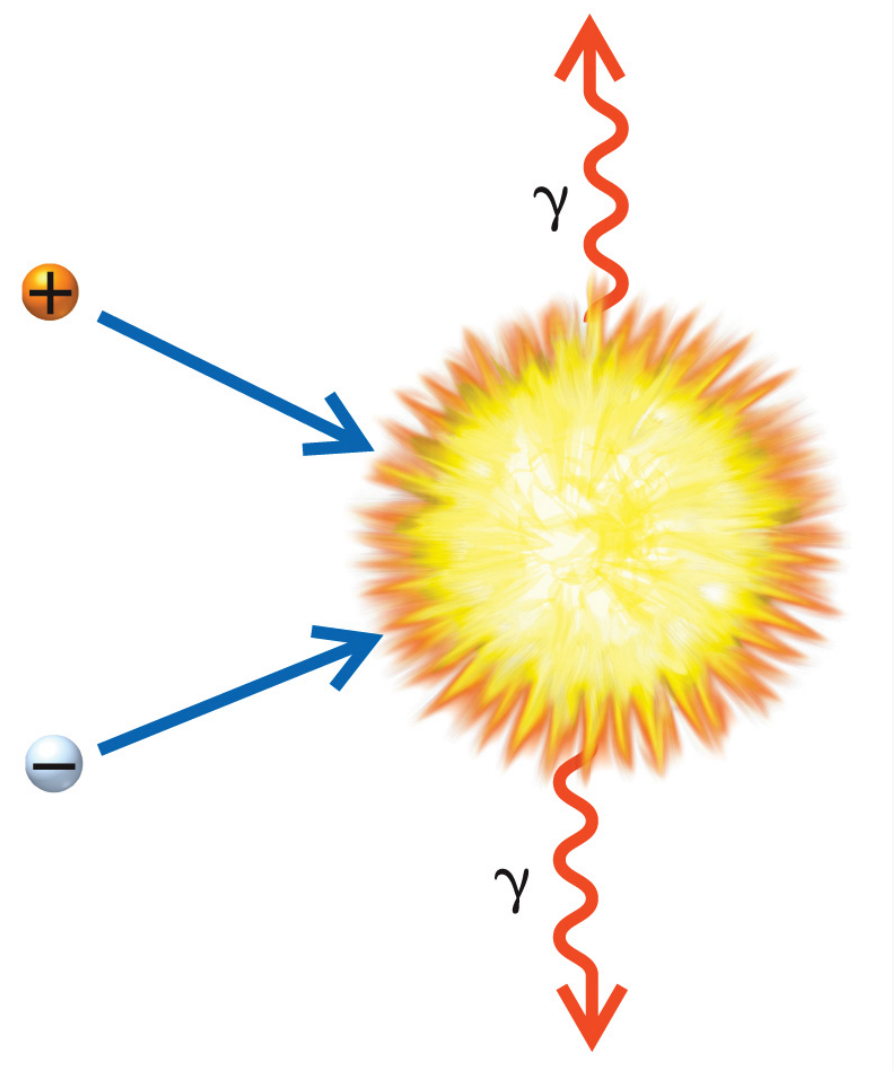
- Work from general to specific to provide a framework
- Group like items and describe relationships
- Describe images by their similarities first, differences second
- Organize information in predictable ways

# Reduce Redundancies

- Avoid repeating what is in a caption or the surrounding text
- Edit your description if it becomes wordy
- Integrate symbols or labels into your description, meaning describe the function of symbols, not the appearance of them

# Focus on Meaning

- Avoid the common mistake of spending your time describing the **appearance** of symbols rather than their **meaning**.
- Example: In this image, you would want to avoid describing “a ball labeled with a plus sign” and instead you should call it “a positron.” Avoid describing “a squiggly arrow labeled with a weird y” and instead call it “a gamma ray.”

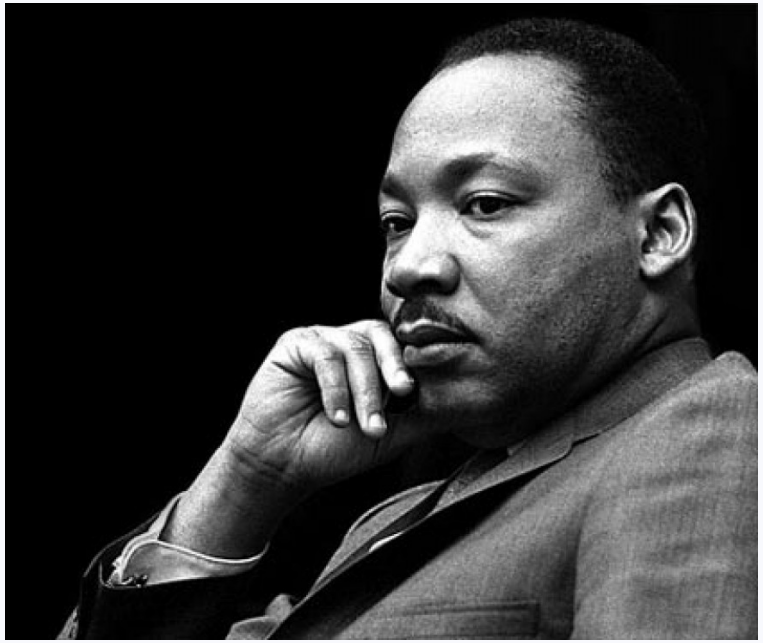


# The Result?

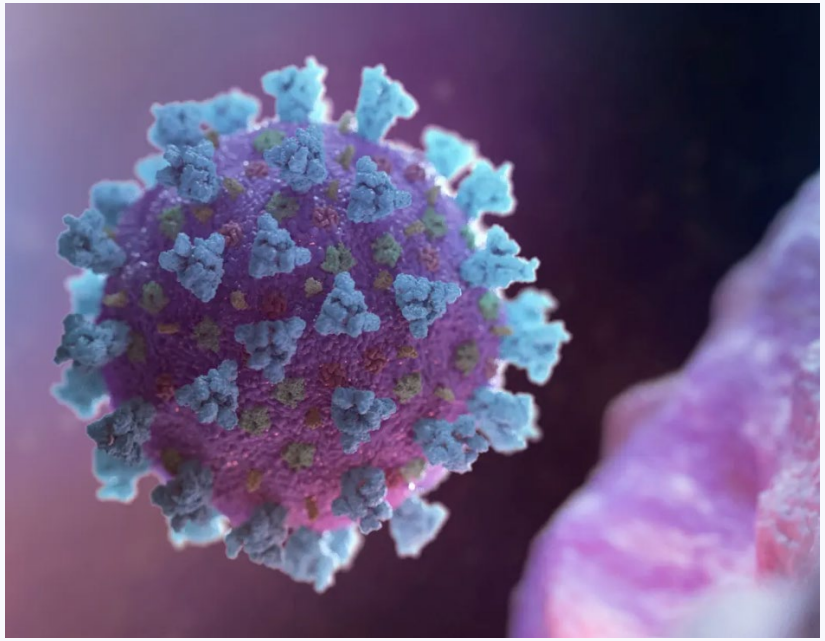
- Reduce simultaneous mental tasks in working memory
- Increase ability to focus on new concepts
- Eliminate misunderstandings or confusion
- Decrease time and energy needed for understanding
- Allow for integration of new concepts into a mental model

# Educational and STEM Content

# Simple Images



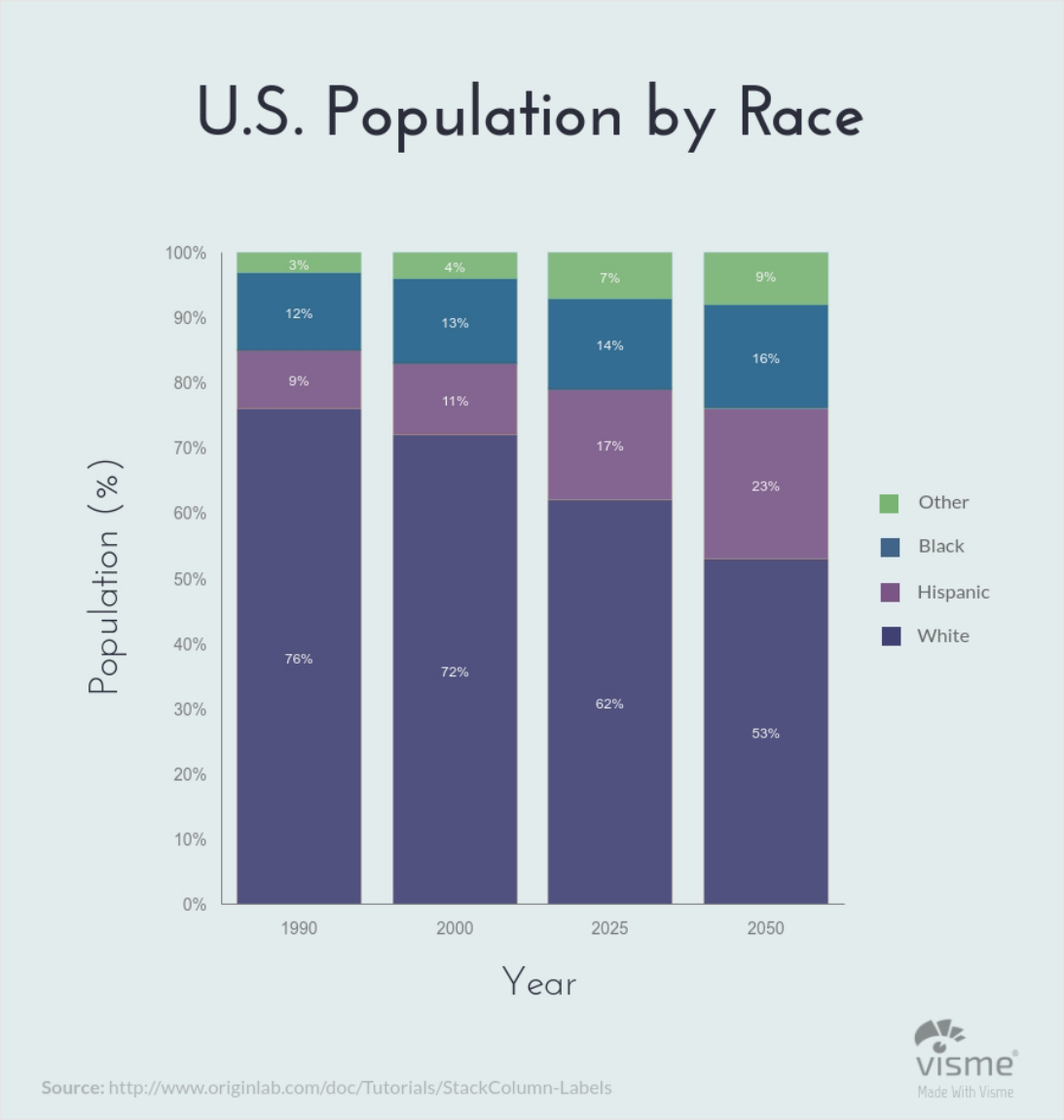
Photographs of people just need a name:
Martin Luther King, Jr.



Simple graphics can often be described in one sentence: A magnified image of the human coronavirus.

Additional details about its spherical structure and the projecting glycoproteins could be added depending on your audience and context.

# Bar Graphs




Work from general to specific. Begin by naming the type of graph and title. Then describe the horizontal and vertical axes if applicable. Finally, describe the data.

A bar graph titled U.S. Population by Race that compares the percentages of Black, Hispanic, White, and Other races in the United States for the years 1990, 2000, projected 2025, and projected 2050. In 1990, there were 76% White, 9% Hispanic, 12% Black, and 3% Other. In 2000, there were…

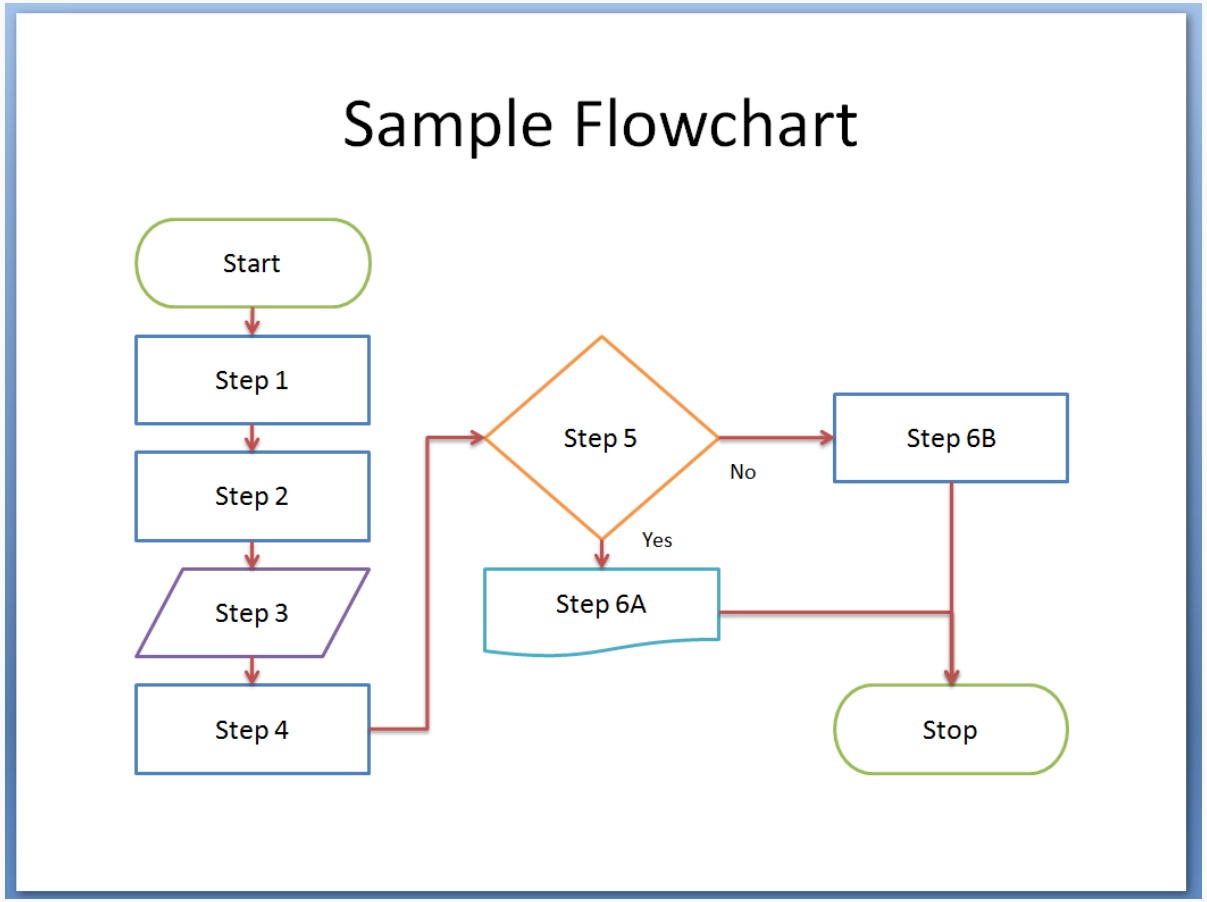
# Line Graphs

- Include title of graph and X-axis and Y-axis labels and ranges
- Summarize trends of lines, not every data point
- If every data point is needed, consider converting graph into table format
- If there is a noticeable change in slope then describe beginning and end point of that variation

# Flow Charts

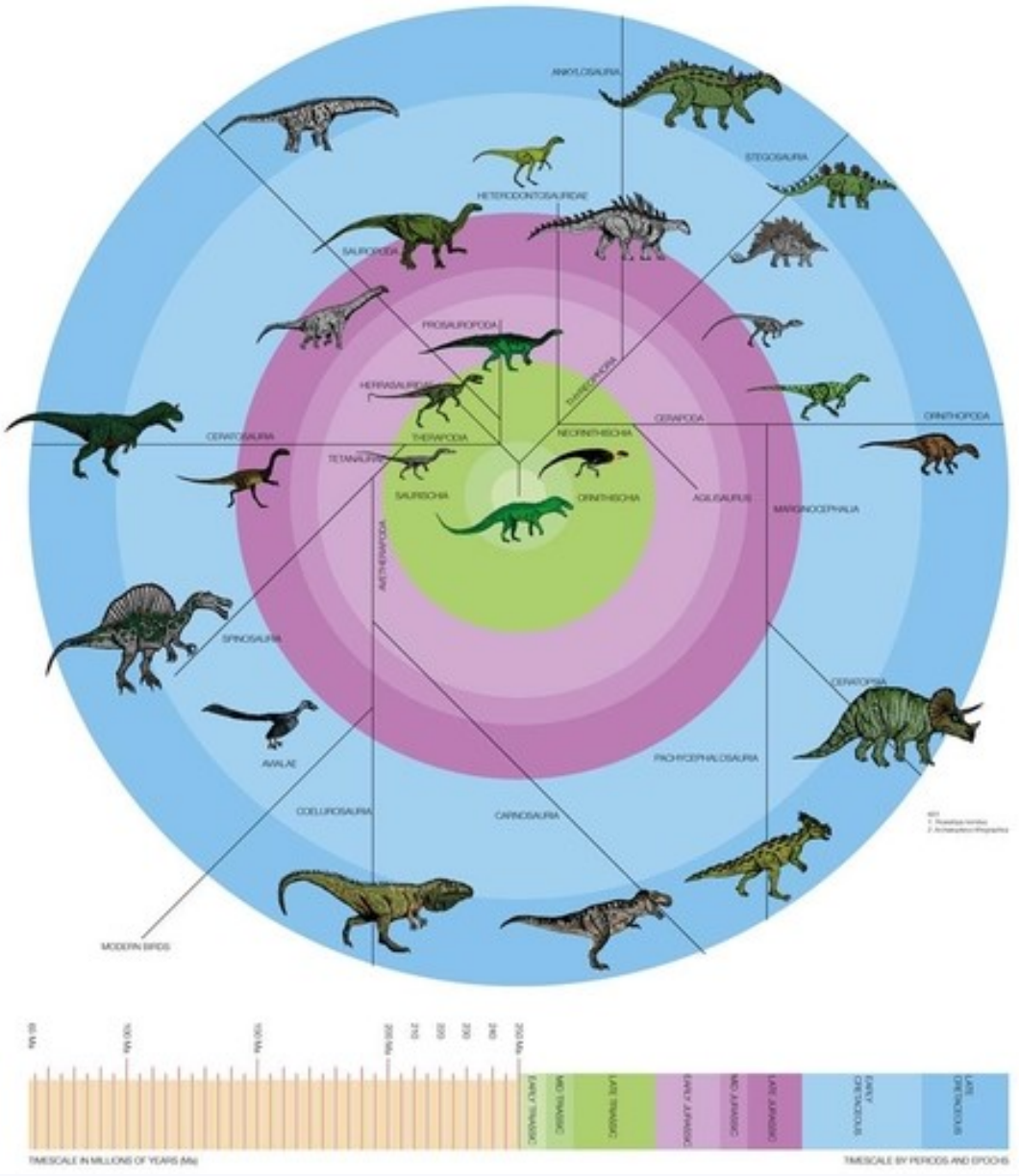
Often flow charts can be reproduced easily in list format, either as numbered options, or in text form like the example below:

This sample flowchart begins with Start, then Step 1, Step 2, Step 3, Step 4, and Step 5. If yes, proceed from Step 5 to Step 6A and Stop. If no, proceed to Step 6B and Stop.



# Complex Infographics

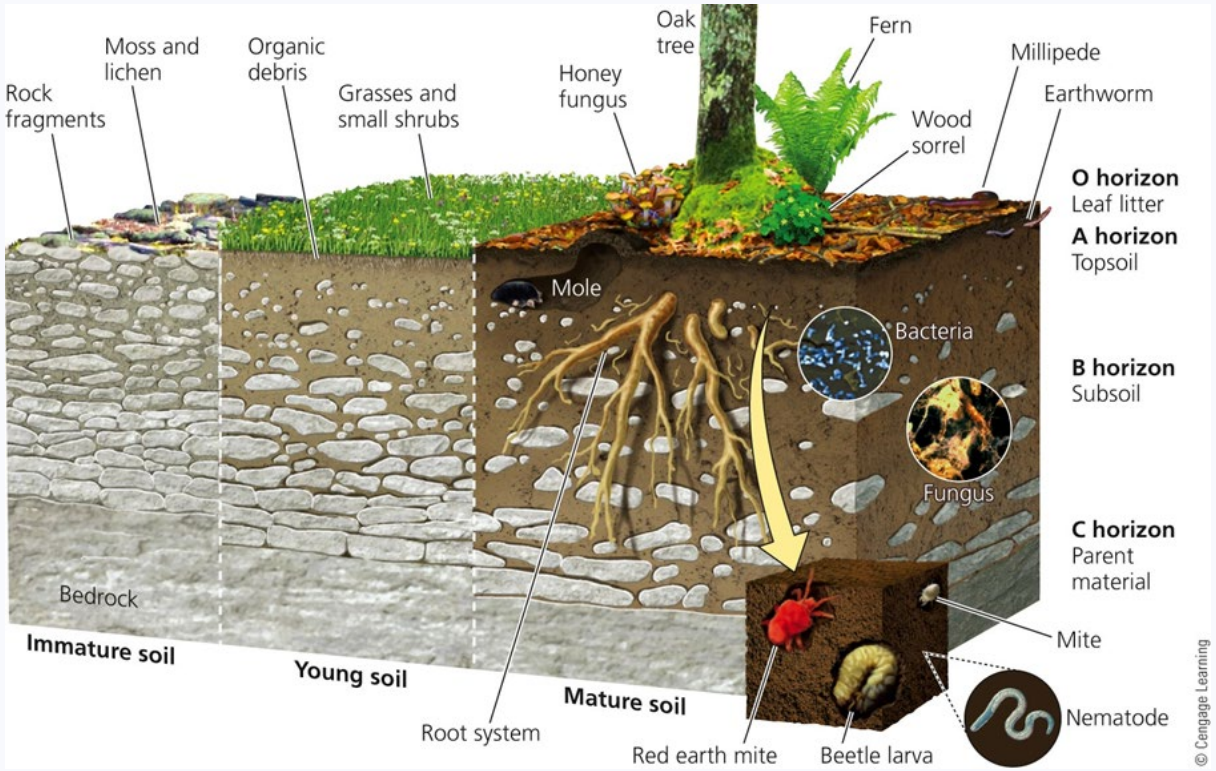
- Begin with an overview sentence describing the basic parts of the infographic: a timeline of different eras, illustrations of dinosaurs, and a phylogenetic tree.
- Work from general to specific, filling in the details as needed.



# Complex Diagrams

Brief: A diagram showing a cutout of soil formation in three stages: immature, young, and mature.

Complex: A diagram showing a cutout of soil formation in three different stages. Immature soil includes a large layer of bedrock at the bottom, large rocks throughout the rest of the ground, and rock fragments near the surface. Moss and lichen can grow on this soil. Young soil has a smaller layer of bedrock at the bottom, fewer large stones above it, and organic debris near the surface. Grasses and small shrubs can grow on this soil. Mature soil has an even smaller bedrock layer called the C horizon parent material followed by the B horizon subsoil, followed by the A horizon topsoil, and lastly the O horizon leaf litter. Throughout the soil there are root systems, moles, bacteria, fungus, beetle larva, red earth mites, nematodes, and earthworms. On the surface there are honey fungus, oak trees, ferns, wood sorrels, and millipedes.



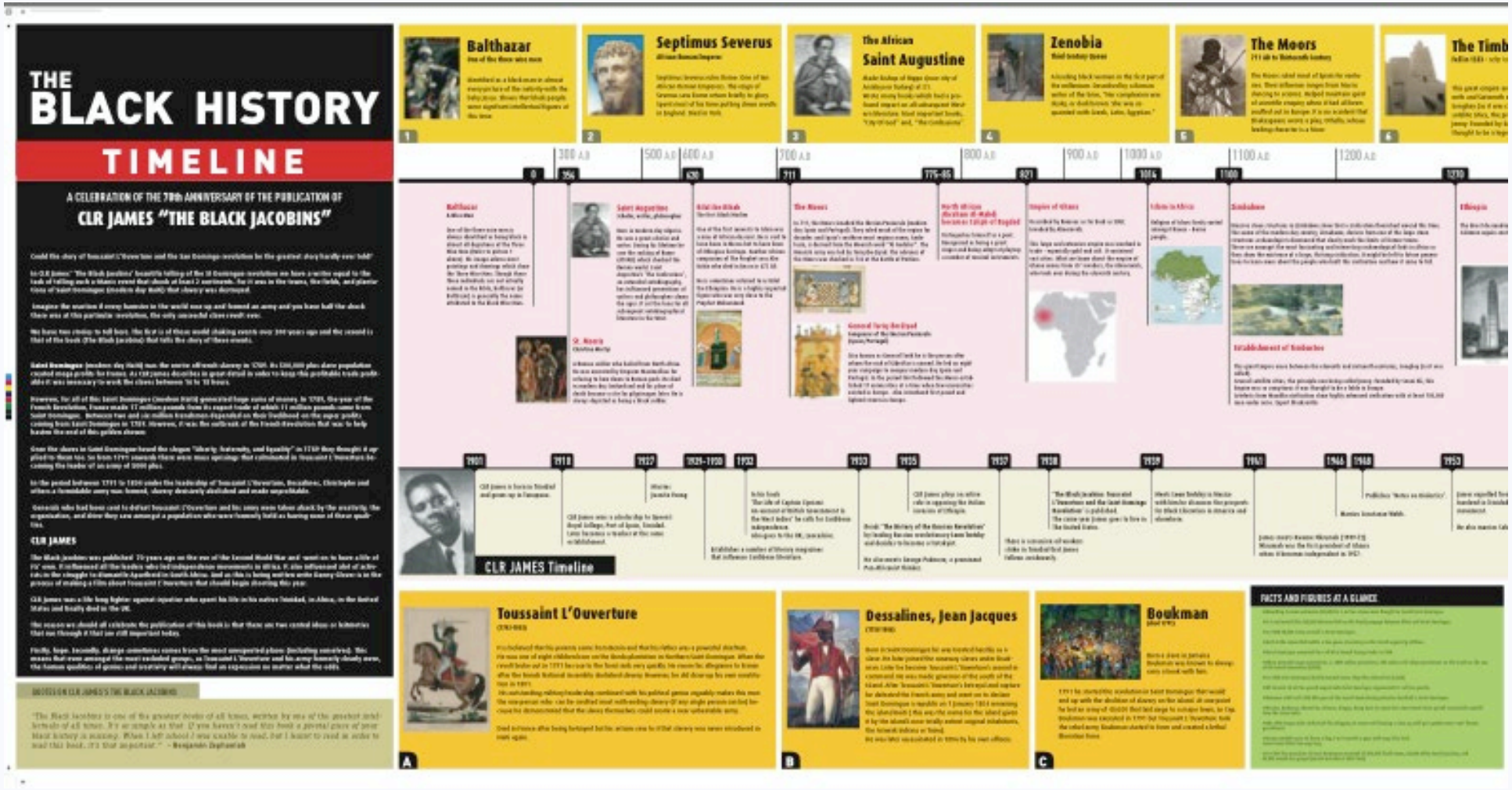
# Maps

Describe the areas, regions, and relevant details on the map plus any inset. Often the colors, shapes, or arrows on a map have no significance.

A map of oceanic exploration routes by Dias and de Gama circa 1500, during the reign of the Holy Roman Empire in Europe and the Ottoman Empire in northern Africa and the Middle East. Dias' route begins in Portugal and hugs the western coast of Africa, ending at the Cape of Good Hope. The route for de Gama also begins in Portugal, goes around the Cape of Good Hope, hugs the eastern coast of Africa, and crosses the Indian Ocean ending in India.

# Timelines

- Begin with describing the range of the timeline and type of events listed.
- List events by date or convert into a numbered list by era.



# Math and Chemistry Equations

$$t = \frac{(325 - 286) - 0}{\sqrt{\frac{(40)^2}{12} + \frac{(44)^2}{12}}} = 2.27$$

Brief: An equation.

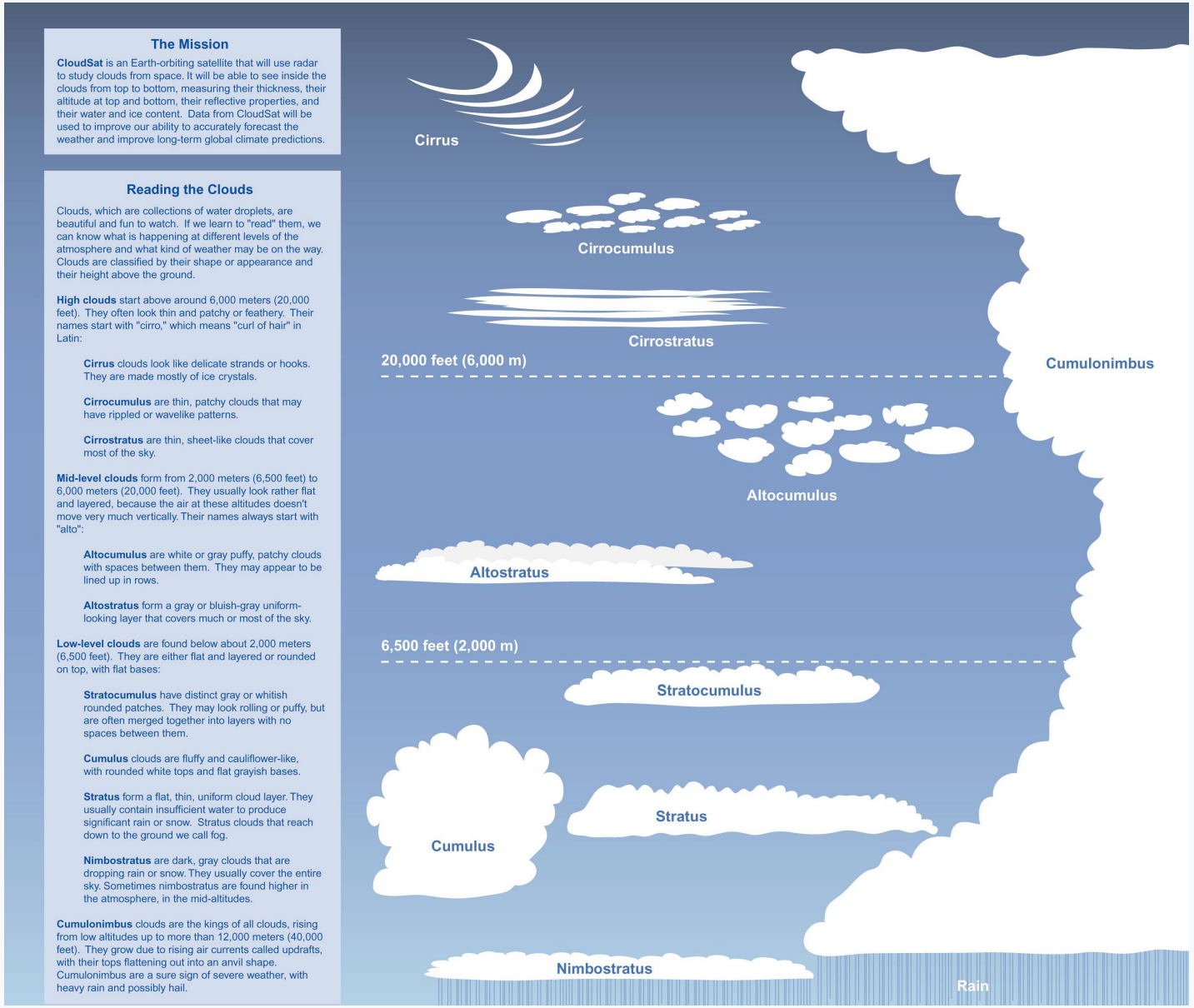
Complex: Begin equation. T equals start fraction left parenthesis 325 minus 286 right parenthesis minus 0 over start root start fraction left parenthesis 40 right parenthesis squared over 12 end fraction plus start fraction left parenthesis 44 right parenthesis squared over 12 end fraction end root end fraction equals 2.27. End equation.

$$N_2(g) + 3\,H_2(g) \longrightarrow 2\,NH_3(g)$$

Brief: A chemical equation.

Complex: Begin equation. Gaseous Upper N 2 plus 3 gaseous Upper H 2 yields 2 gaseous Upper N Upper H 3. End equation.

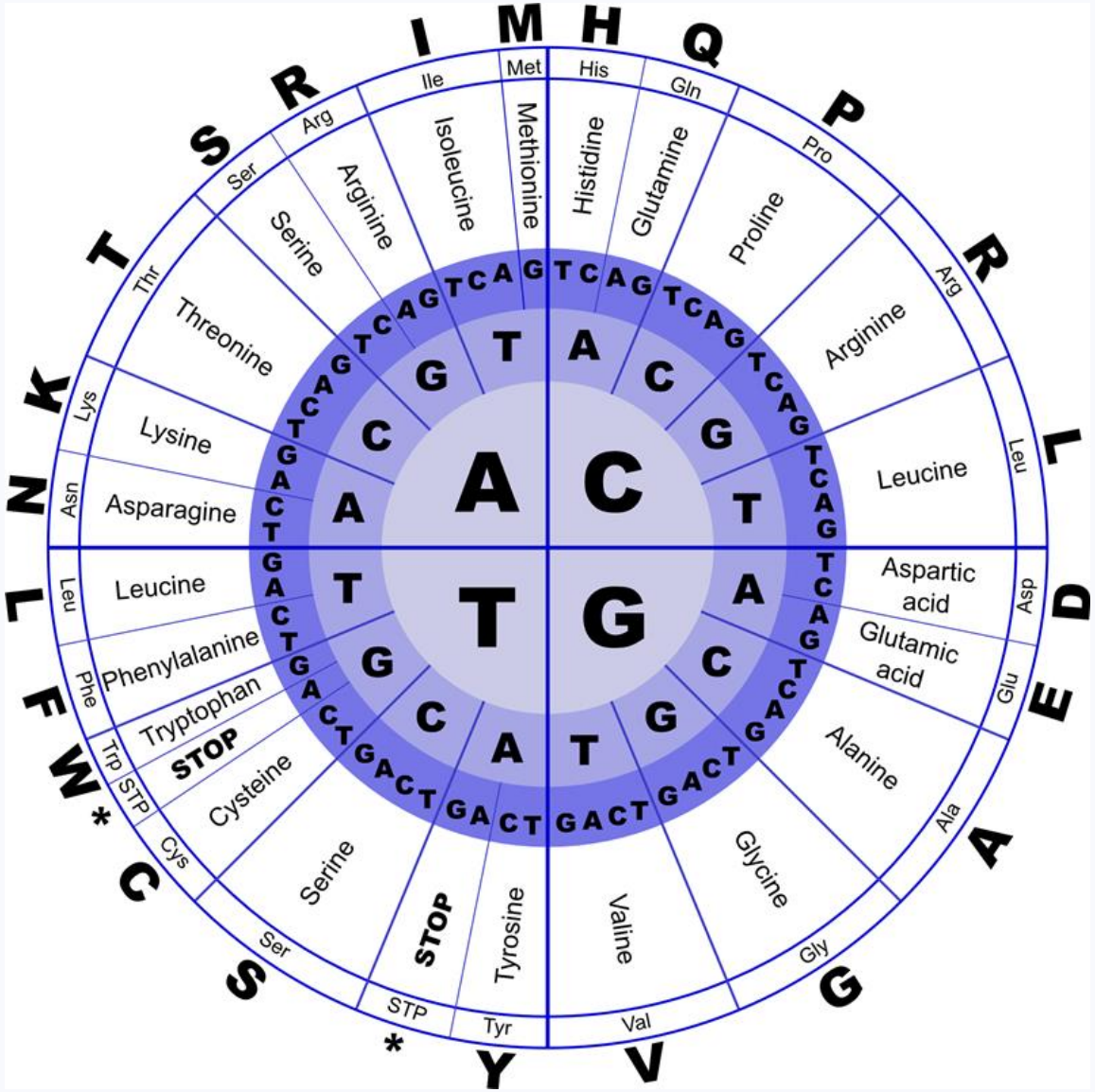
# Infographics and Tables




- Paragraph format removes the ease of comparison, which is available to sighted users by means of visual grouping.
- Instead, sort the information into a table.

# Complex STEM Infographic

- This infographic is difficult to parse even for sighted individuals.
- Conversion into table format with column headers would be more accessible.



# Converting Graphics to Table Form

| Amino Acid | Symbol | DNA Codons |
|---|---|---|
| Alanine | A | GCA; GCC; GCG; GCT |
| Cystenine | C | TGC; TGT |
| Aspartic Acid | D | GAC; GAT |
| Glutamic Acid | E | GAA; GAG |
| Phenylalanie | F | TTC; TTT |
| Glycine | G | GGA; GGC; GGG; GGT |
| Histidine | H | CAC; CAT |
| Isoleucine | I | ATA; ATC; ATT |
| Lysine | K | AAA; AAG |
| Leucine | L | CTA; CTC; CTG; CTT; TTA; TTG |
| Methionine (START) | M | ATG |
| Asparagine | N | AAC; AAT |
| Proline | P | CCA; CCC; CCG; CCT |
| Glutamine | O | CAA; CAG |
| Arginine | R | AGA; AGG; CGA; CGC; CGG; CGT |
| Serine | S | AGC; AGT; TCA; TCC; TCG; TCT |
| Threonine | T | ACA; ACC; ACG; ACT |
| Valine | V | GTA; GTC; GTG; GTT |
| Tryptophan | W | TGG |
| Tyrosine | Y | TAC; TAT |
| STOP | * | TAA; TAG; TGA |

- Providing this data in table form allows someone to tab through each column.
- A title and table caption placed before the table would allow someone to decide if they need to listen to this data.

# Structural Alt Text for Tables

Consider adding structural alt text to tables. This allows someone to hear what the table contains before listening to all the data.

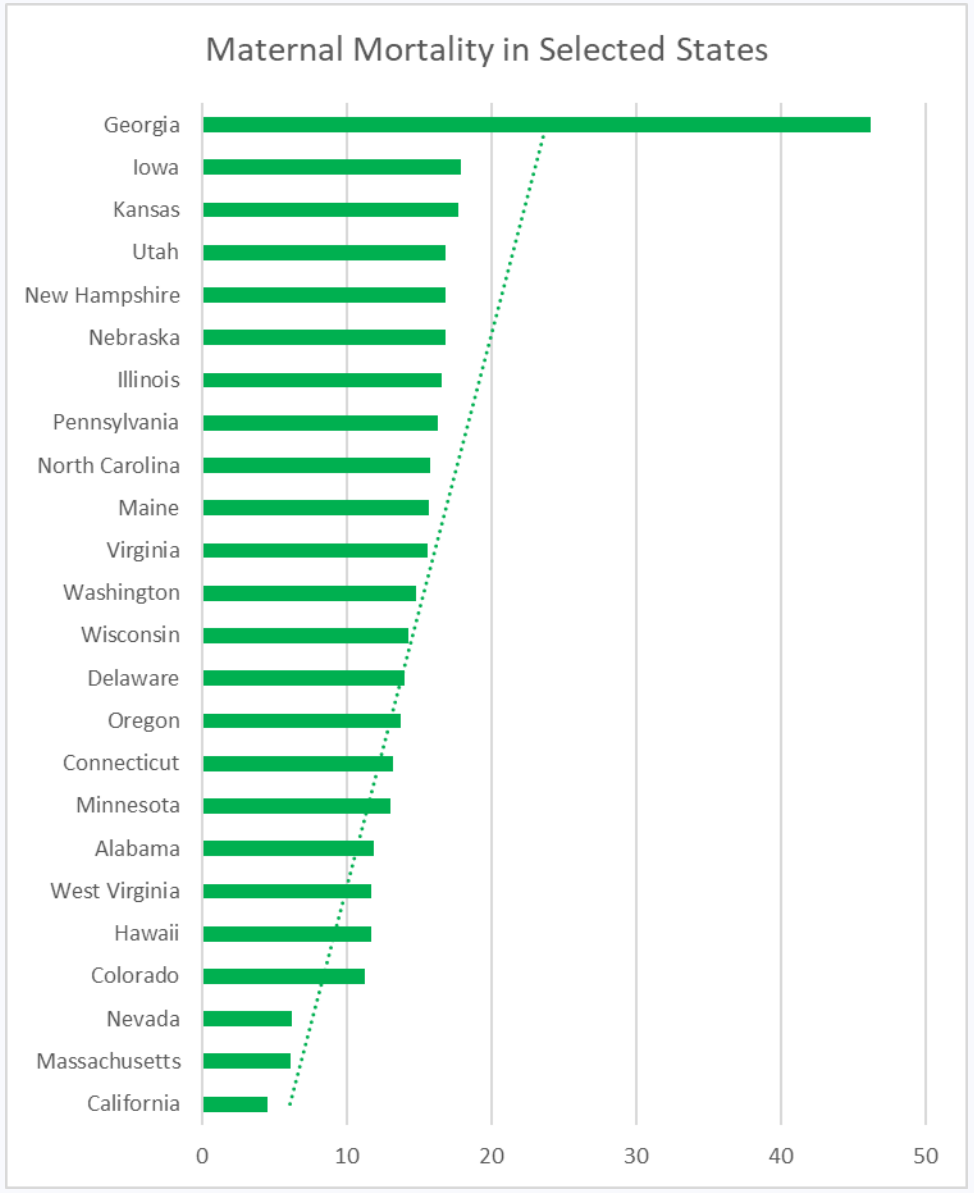
Table 10.1 is titled Physical Properties of the Giant Planets. It has 5 columns and 13 rows. The column headings are Physical Property, Jupiter, Saturn, Uranus, and Neptune.

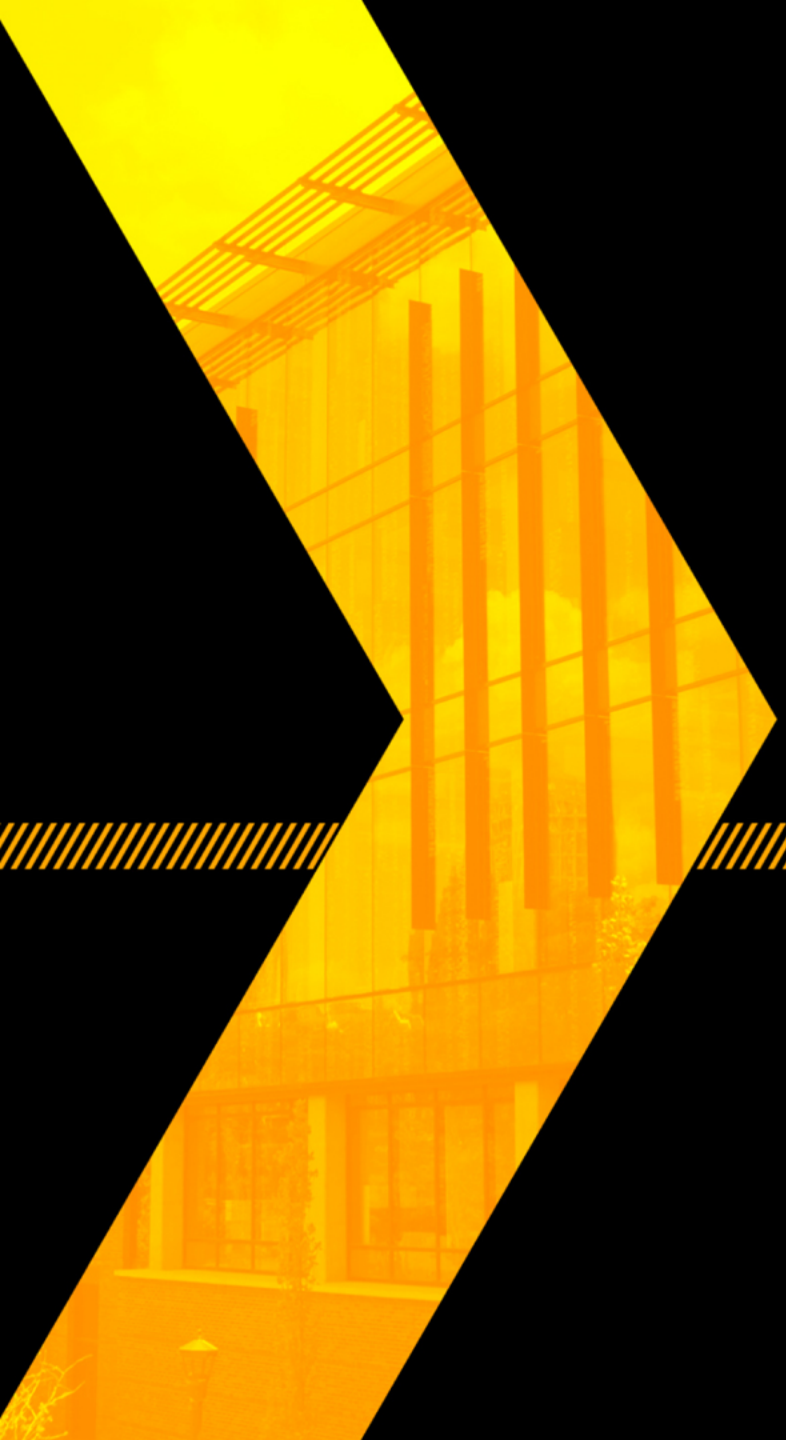
**TABLE 10.1** Physical Properties of the Giant Planets

| | Jupiter | Saturn | Uranus | Neptune |
|---|---|---|---|---|
| Orbital semimajor axis (AU) | 5.20 | 9.6 | 19.2 | 30 |
| Orbital period (Earth years) | 11.9 | 29.5 | 84.0 | 164.8 |
| Orbital velocity (km/s) | 13.1 | 9.7 | 6.8 | 5.4 |
| Mass ($M_{Earth} = 1$) | 317.8 | 95 | 14.5 | 17.1 |
| Equatorial radius (km) | 71,490 | 60,270 | 25,560 | 24,300 |
| Equatorial radius ($R_{Earth} = 1$) | 11.2 | 9.5 | 4.0 | 3.8 |
| Oblateness | 0.065 | 0.098 | 0.023 | 0.017 |
| Density (water = 1) | 1.33 | 0.69 | 1.27 | 1.64 |
| Rotation period (hours) | 9.9 | 10.7 | 17.2 | 16.0 |
| Tilt (degrees) | 3.13 | 26.7 | 97.8 | 28.3 |
| Surface gravity (relative to Earth's) | 2.53 | 1.07 | 0.89 | 1.14 |
| Escape speed (km/s) | 59.5 | 35.5 | 21.3 | 23.5 |

# Implied Visual Information

- Charts and graphs are visualizations for a reason: to make implications. Leaving out the visual impression leaves out important information.
- Graphs should not be described solely by the raw data they offer but rather by what they are communicating.
- What is the visual impact of this graph?
- What relationships are implied here?





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# Questions?

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