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2023 GED CONFERENCE

Essential Skills and Strategies Science

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GED TESTING SERVICE®

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Today's Focus

- The Life of an Item
- Assessment Targets & Content Topics
- Close Reading
- Specific Indicators with Item Examples
- General Strategies
- Resources
- Session Q&A

The Life of an Item

Develop Items & Passages	Field Test & Analyze	Build/Publish Tests
Write	Construct	Construct
Review/Edit	Review	Translate
Committee Review	Embed/Test	Review
Review/Edit	Analyze Data	Publish
Expert Review	Add to Bank	Research

Assessment Targets & Content Topics

GED® ***Assessment Guide for Educators***

https://ged.com/wp-content/uploads/assessment_guide_for_educators_all_subjects.pdf

- **Science Guide**: pages 135–179
- Science **Assessment Targets**: pages 138–142
- Science **Content Topics**: pages 145–146

Assessment Targets (Indicators)

SP.1 Comprehending Scientific Presentations	
R2, R8, P8, M2, M6	SP.1.a Understand and explain textual scientific presentations • Identify summaries and central ideas of passages. • Recognize restatements of research or experimental findings. • Recognize comparisons between scientific processes, theories and trends.
R4, L4, P8,M2, M4, M6	SP.1.b Determine the meaning of symbols, terms and phrases as they are used in scientific presentations • Distinguish between multiple meanings of an academic vocabulary term used in context. • Determine the meaning of symbols as they are used in scientific presentations
S-ID, 8.SP, P8, M2, M4, M6	SP.1.c Understand and explain a non-textual scientific presentations • Interpret scientific results and information in graphs, tables and various scientific diagrams.
SP.2 Investigation Design (Experimental and Observational)	
R8, P3, P4, M4	SP.2.a Identify possible sources of error and alter the design of an investigation to ameliorate that error • Identify the source of error using discrepant results. • Redesign an experiment to reduce sources of error.

Indicator

Each bullet describes a specific focus for an item.

Content Topics

Life Science
L.a Human Body and Health
L.a.1 Body systems (e.g. muscular, endocrine, nervous systems) and how they work together to perform a function (e.g. muscular and skeletal work to move the body)
L.a.2 Homeostasis, feedback methods that maintain homeostasis (e.g. sweating to maintain internal temperature), and effects of changes in the external environment on living things (e.g. hypothermia, injury)
L.a.3 Sources of nutrients (e.g. foods, symbiotic organisms) and concepts in nutrition (e.g. calories, vitamins, minerals)
L.a.4 Transmission of disease and pathogens (e.g. airborne, bloodborne), effects of disease or pathogens on populations (e.g. demographics change, extinction), and disease prevention methods (e.g. vaccination, sanitation)
L.b Relationship Between Life Functions and Energy Intake
L.b.1 Energy for life functions (e.g. photosynthesis, respiration, fermentation)
L.c Energy Flows in Ecologic Networks (Ecosystems)
L.c.1 Flow of energy in ecosystems (e.g. energy pyramids), conservation of energy in an ecosystem (e.g. energy lost as heat, energy passed on to other organisms) and sources of energy (e.g. sunlight, producers, lower level consumer)

The content topics can be used as a study guide.

Close Reading

- Reading skills are a doorway to other skills.
- GED® tests many science, math, social studies, and language arts skills; students who read the related text closely will be able to demonstrate these other skills.
- Science skills that require close reading
  - analyzing relationships
  - reconciling multiple findings
  - drawing conclusions
  - evaluating claims based on evidence

Close Reading Strategies

- Read and re-read to *determine the details* of what the text says *explicitly* and to make *logical inferences* from it
- Notice *significant language*
- Draw conclusions and make generalizations from synthesizing the information in the text and/or illustrations
- Cite specific textual *evidence* that supports *conclusions* drawn from the text

Tips for Close Reading

- Read and re-read the text
- Make notes and highlight clues
- Read through all answer options
- Eliminate options by comparing to notes and highlighted information
- Double check answer

Focus on Indicators

- SP.2.c Identify the strengths and weaknesses of one or more scientific investigations (i.e., experimental or observational designs)
- SP.2.e Identify and interpret independent and dependent variables in scientific investigations
- SP.4.a Evaluate whether a conclusion or theory is supported or challenged by particular data or evidence
- SP.5.a Reconcile multiple findings, conclusions or theories
- SP.6.a Express scientific information or findings visually

Indicator SP.2.c

SP.2.c Identify the strengths and weaknesses of one or more scientific investigations (i.e. experimental or observational designs)

- Identify the strengths or weaknesses of a single experimental design.
- Compare experimental designs to identify strengths or weaknesses

Skills Requirements:

- Evaluating scientific investigations
- Analyzing experimental designs
- Making comparisons

Item Example 1

A biology student wants to determine the carrying capacity of trout in a region. He selects a lake that is open to the public that does not have trout but is capable of supporting trout. He plans to follow the steps shown to determine the carrying capacity of trout in the lake.

1. Stock the public lake with a predetermined number of trout.
2. Count the trout population three times a year for two years.
3. When the trout population begins to decrease, count individual trout for an additional three years.

Which statement describes a weakness of this investigation?

A. The student will use a predetermined number of trout.

B. The student plans to conduct the study using a public lake.

C. The student will evaluate the lake for three years after the trout population decreases.

D. The student plans to count the trout population three times a year for two years.

Indicator SP.2.e

SP.2.e Identify and interpret independent and dependent variables in scientific investigations

- Identify the independent and dependent variables in a scientific experiment.
- Interpret the relationship between the independent and dependent variables in a scientific experiment.

Skills Requirements:

- Analyzing experimental designs
- Comparing and contrasting

Item Example 2

An enzyme called pectinase is used by the fruit juice industry to increase the yield obtained during the juice extraction process. A researcher is investigating the effectiveness of pectinase by using this procedure.

1. Label two beakers A and B.
2. Add 50 g of chopped apple to each beaker.
3. Add 4 milliliters (mL) of prepared pectinase solution to beaker A.
4. Add 4 mL of distilled water to beaker B.
5. Stir the contents of both beakers.
6. Allow the beakers to remain undisturbed for 30 minutes.
7. Filter out the solids and measure the juice in each beaker.

Click on the variables you want to select and drag them into the boxes.

Independent Variable	Dependent Variable	Controlled Variables

Variables

amount of chopped apple used	presence of pectinase
amount of juice extracted	number of minutes

Indicator SP.4.a

SP.4.a Evaluate whether a conclusion or theory is supported or challenged by particular data or evidence

- Determine if specific evidence supports or challenges the proposed claim or solution.
- Determine which model (hypothesized set of relationships or experiment) is weakened by new evidence.
- Identify which data supports the theory or hypothesis.

Skills Requirements:

- Analyzing scientific information to Identify
  - the conclusion or claim
  - evidence (data) that is presented
- Evaluating whether the evidence (data) supports/refutes the conclusion(s) or claim(s)

Item Example 3

Plants live in symbiosis with soil microbes. These microbes colonize plants' roots. Researchers hypothesized that because different microbes perform different functions to aid plant growth, a greater microbial diversity will lead to a greater uptake of plant nutrients, such as nitrogen and phosphorus. Researchers performed an investigation of two species of microbes (AM fungi and rhizobia) in a grassland community containing two types of plants: grasses and legumes.

Which observation provides evidence that *best* supports this hypothesis?

A. Grasses have higher survival rates than legumes when rhizobia are present in the soil.

B. Legumes contain greater phosphorus concentrations than grasses when AM fungi are present in the soil.

C. Plants take up more phosphorus when AM fungi are present in the soil and more nitrogen when both species of microbes are present.

D. Plant communities are more diverse when both species of symbiotic microbes are present in the soil than when only rhizobia are present.

Indicator SP.5.a

SP.5.a Reconcile multiple findings, conclusions or theories

- Identify the reason(s) a particular finding or theory is superior to another.
- Identify the reason(s) two particular findings or theories are both correct.

Skills Requirements:

- Analyzing scientific information to identify findings, conclusions or theories
- Comparing and contrasting the findings, conclusions or theories
- Evaluating the scientific information to determine whether one finding, conclusion, or theory is superior to another

Item Example 4

Two teams of researchers studied the interactions between fungi and trees. Team A found that when olive trees form a symbiotic relationship with the fungus *G. mosseae*, the trees grow larger roots and shoots because *G. mosseae* provides the trees with increased nutrients, including nitrogen, phosphorus, and potassium. This table shows the results of team A's study.

	Control	*G. mosseae*
Shoot Surface Area (cm^2)	66.98	206.60
Root Surface Area (cm^2)	80.58	282.36

Team B found that when white spruce trees form a symbiotic relationship with the fungus *P. scopiformis*, populations of the tree's insects decline due to toxins within the fungus that kill adult and larval insects. This table shows the results of team B's study.

	Control	*P. scopiformis*
Larval Survival	59%	50%
Total Survival	55%	40%

Which statement *best* evaluates the teams' results?

A. Team A's results are more reliable because this team studied two characteristics of the trees.

B. Team B's results are more reliable because this team studied the effects on both the trees and the insects.

C. Neither team's results are reliable because both teams only tested a single species of fungus, resulting in similar effects.

D. Both teams' results are reliable because both teams tested different fungus and tree species, so different effects are expected.

Item Example 5

There are two general types of dissolved organic matter (DOM) found in freshwater ecosystems that are classified by their origin. Type 1 DOM originates on land while Type 2 DOM originates in freshwater. Microbes degrade DOM as part of the carbon cycle, making the matter available for use by other organisms. Two groups of scientists (X and Y) studied DOM origin and degradation.

Group X collected and isolated oomycetes, which are closely related to algae, from lake banks and organized them into two treatments: carbon from terrestrial sources and carbon from water sources. This group found that the oomycetes could only degrade Type 2 DOM and concluded that it is more difficult for some freshwater organisms to degrade Type 1 DOM than Type 2 DOM.

Group Y collected stream water and isolated bacteria from that water. Then, the group placed isolated bacteria in three samples of water from the same stream and measured the time required for most DOM to be degraded. The group found no difference between the amount of Type 1 and Type 2 DOM remaining at the end of the experiment, suggesting that bacteria can degrade both types of DOM.

Which statement *best* evaluates the groups' findings?

A. Only Group X is most likely correct because this group used a control group as a base for comparison.

B. Only Group Y is most likely correct because this group used organisms and DOM from the same stream.

C. Both groups are equally likely to be correct because both groups studied completely different organisms.

D. Neither group is likely to be correct because both groups used completely different methods and are thus incomparable.

Indicator SP.6.a

SP.6.a Express scientific information or findings visually

- Translate information presented numerically or verbally into a visual representation.

Skills Requirements:

- Analyzing presented information
- Comparing visual representations to textual ones
- Evaluating information in visual representations

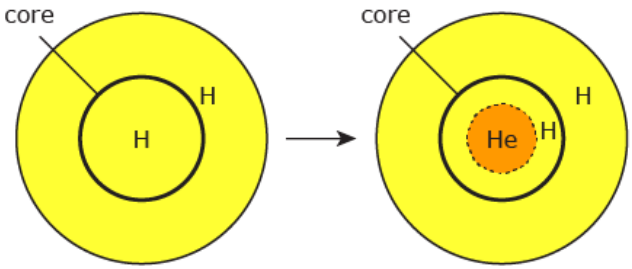
Item Example 6

When the Sun formed, three-fourths of its mass was hydrogen (H), while one-fourth was helium (He). Helium is more dense than hydrogen and therefore is always found closer to the core of the Sun.

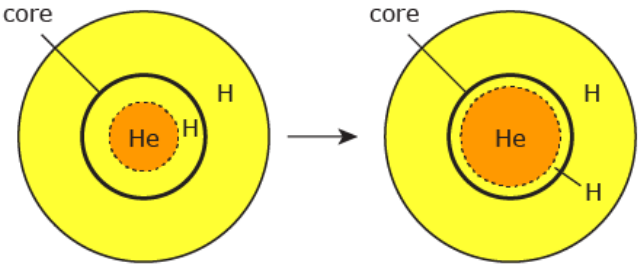
The core of the Sun is also hotter, and some of the hydrogen at the core is hot enough to fuse hydrogen into helium. Over time, the amount of hydrogen will decrease, and the amount of helium will increase.

Which set of diagrams *best* represents the Sun as it changes over time?

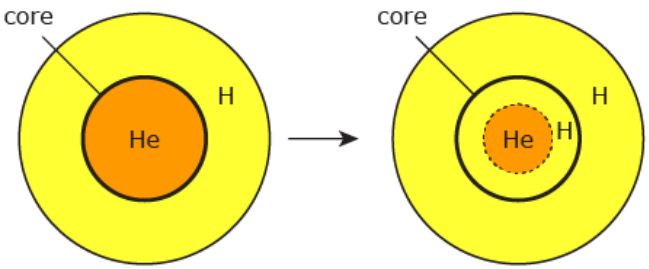
○ A A.



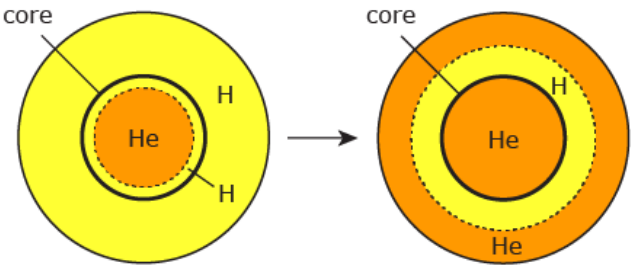
○ B B.



○ C C.



○ D D.



General strategies

- Share the GED® indicators and content topics with your students.
  - The content topics can be used as a teaching/study guide (vocabulary/processes).
- Provide students with opportunities to evaluate scientific investigations
  - Identify purpose, hypothesis, variables
  - Evaluate whether the procedure aligns well with the purpose and hypothesis
  - Identify tools and units that were used to measure specific properties
  - Analyze data—patterns, relationships between variables
  - Determine possible conclusions
  - Identify evidence supporting the conclusions
- Provide students opportunities to evaluate diagrams/illustrations and describe what is being shown.

General Strategies

- Remind students to carefully read the questions and to read through all four options before selecting their answer.
- Remind students to use the highlighter and the white board that are provided.
- Encourage students to read more. Strong reading skills will benefit students in all four subject area tests.
- Encourage students to analyze the content they read on a daily basis. Strong critical thinking skills will benefit students in all four subject area tests.

Teaching Strategies - Investigations

An investigation is conducted to test the effectiveness of different insulation materials. Identical boxes are filled with different materials and left in direct sunlight. The temperature inside the boxes is monitored throughout the day. The results are shown in degrees Celsius (°C) in the table.

Insulation Material	9 a.m.	10 a.m.	2 p.m.	5 p.m.	8 p.m.
none	21	25	30	26	24
fiberglass	21	22	25	25	23
wool	21	21	25	24	23

Which change will *most* improve the investigation by providing more specific results?

A. include temperature measurements taken at nighttime

B. seal the boxes completely with reflective tape

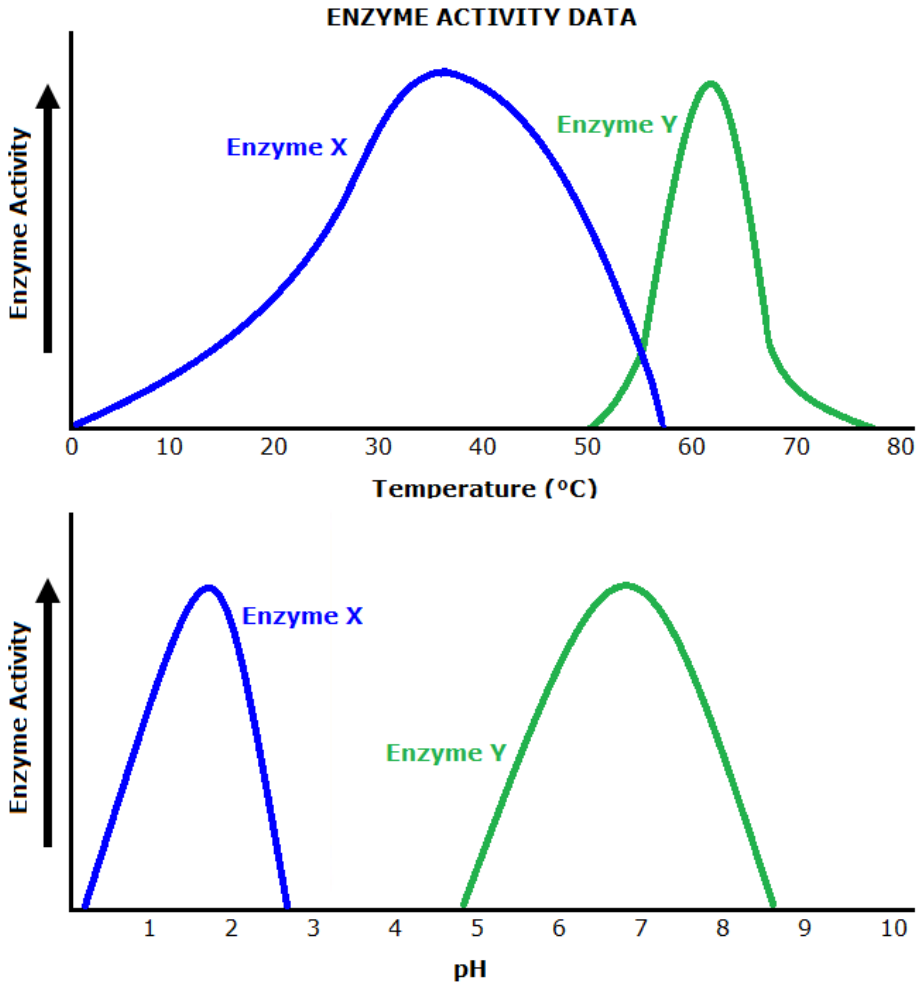
C. use a thermometer that measures temperature to tenths of a degree

D. inspect the materials in the boxes to look for damage

POSSIBLE ADDITIONAL QUESTIONS:

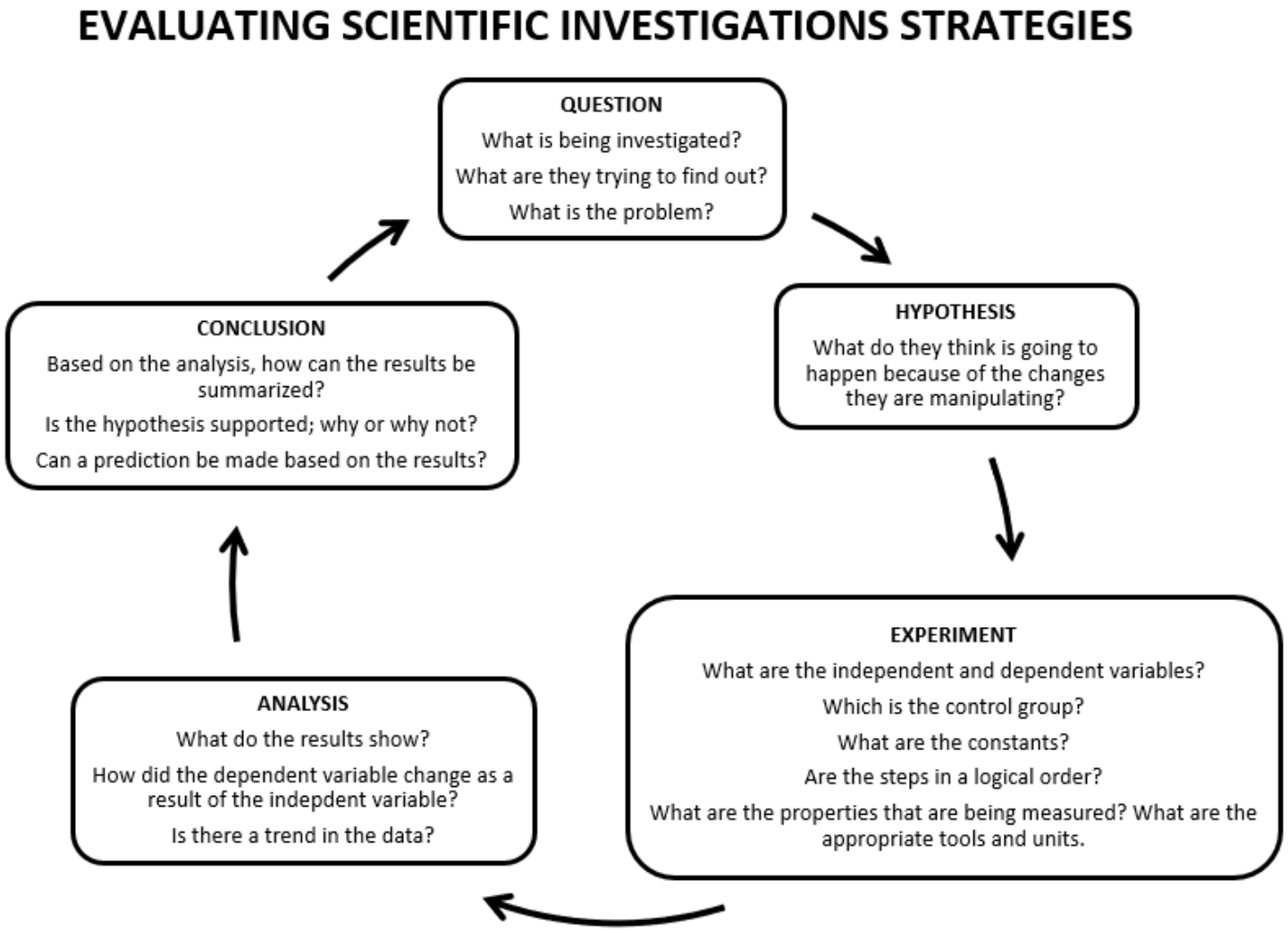
- What is the purpose of the investigation?
- What are the independent and dependent variables?
- Is there a control group?
- What is a probable hypothesis?
- What conclusion can be reached based on the data?
- What graph represents the data?
- What are the mean, median, and mode of the data?

Teaching Strategies – Evaluating Graphs



- What is presented in each of the graphs?
- What are the independent and dependent variables for each investigation?
- What is the relationship between the variables in each graph?
- How does enzyme activity compare at different temperatures and at different pH levels?
- What statement can be used to reconcile the results of both investigations?

Teaching Strategies - Investigations

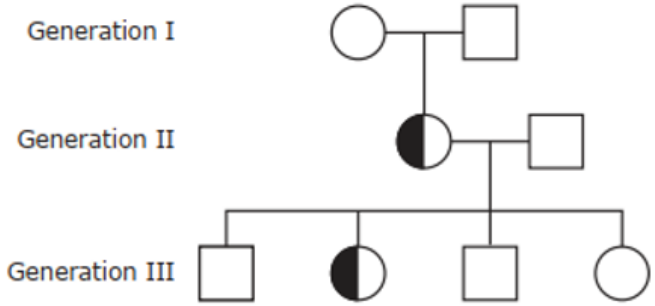


Resources – Scientific Tools and Processes as shown in Indicators and Content Topics (handout)

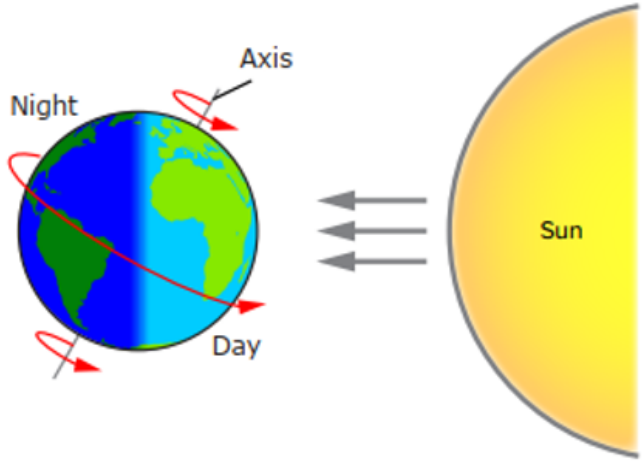
Balance (triple beam)
An instrument that measures the mass (grams; milligrams) of an object


Rabbitmindphoto/Shutterstock

Pedigree Chart
A diagram that shows an inherited trait in a family over several generations



Earth's Rotation
The amount of time (approximately 24 hours; 1 day) it takes Earth to complete one rotation on its axis

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Session Survey

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