GED® Knowledge & Skill Gaps

Science

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Welcome

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Emphasis and Structure of Today's Presentation

- What is a skills gap?
- How the gaps were identified
- Possible reasons for gaps
- Indicators & content topics
- Specific examples
- Strategies to close the gaps
- Resources
- Session Q&A

What is a skills gap?

A gap represents the difference between the actual performance and the expected performance.

The expected performance is based on the indicators and content topics, and it represents:

- a straightforward skill that students seem to answer incorrectly.
- a common skill that is difficult but that students could answer correctly with more instruction.

Guidance and clarification on these skills could help students improve their overall performance.

Process used to identify the gaps

Develop Items & Passages

Write
Review/Edit
Committee Review
Review/Edit
Expert Review

Field Test & Analyze

Construct
Review
Embed/Test
Analyze data
Add to bank

Build/Publish Tests

Construct
Translate
Review
Publish
Research

Possible reasons for gaps

Students may need to improve their **critical thinking, data analysis,** and/or **reading skills**.

Students may need additional instruction on skills identified as gaps and on specific knowledge in content topics during GED test preparation.

Students tend to underperform on certain items simply because the concepts are difficult.

Indicators & 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** (Indicators): pages 140–142
- Science **Content Topics**: pages 145–146

Indicators

Bulleted lists identify specifics that items can be focused on.

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.
R2, R5, W5, P1, P8. M, M4, M8	SP.2.b Identify and refine hypotheses for scientific investigations • Identify the hypothesis in a scientific investigation. • Refine the hypothesis in a scientific investigation.
R8, R9, P2, P5, M3, M4	SP.2.c Identify the strength and weaknesses of one or more scientific investigation (i.e. experimental or observational) designs • Identify the strengths or weaknesses of a single experimental design. • Compare experimental designs to identify strengths or weaknesses.

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Content Topics

The content topics can be used as a study guide.

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)

Skill and knowledge gaps

- **Gaps in Group 1:**

  Analyzing scientific and technical arguments, evidence and text-based information

  - ❑ Reconcile multiple findings, conclusions, or theories (SP.5.a)
  - ❑ Express scientific information or findings verbally (SP.6.c)

- **Gaps in Group 2:**

  Applying scientific processes and procedural concepts

  - ❑ Design a scientific investigation (SP.2.d)
  - ❑ Reason from data or evidence to a conclusion (SP.3.b)
  - ❑ Make a prediction based upon data or evidence (SP.3.c)
  - ❑ Understand and apply scientific models, theories, and processes (SP.7.a)

Skill and Knowledge Gaps (continued)

- **Gaps in Group 3:**

  Reasoning quantitatively and interpreting data in scientific contexts

  - ❑ Describe a data set statistically (SP.8.a)
  - ❑ Determine the probability of events (SP.8.c)

Gap #1 in Group 1

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

Expectation

- Explaining why a particular scientific finding or theory is superior to another
- Explaining why/how a set of scientific findings may both be correct

Gap

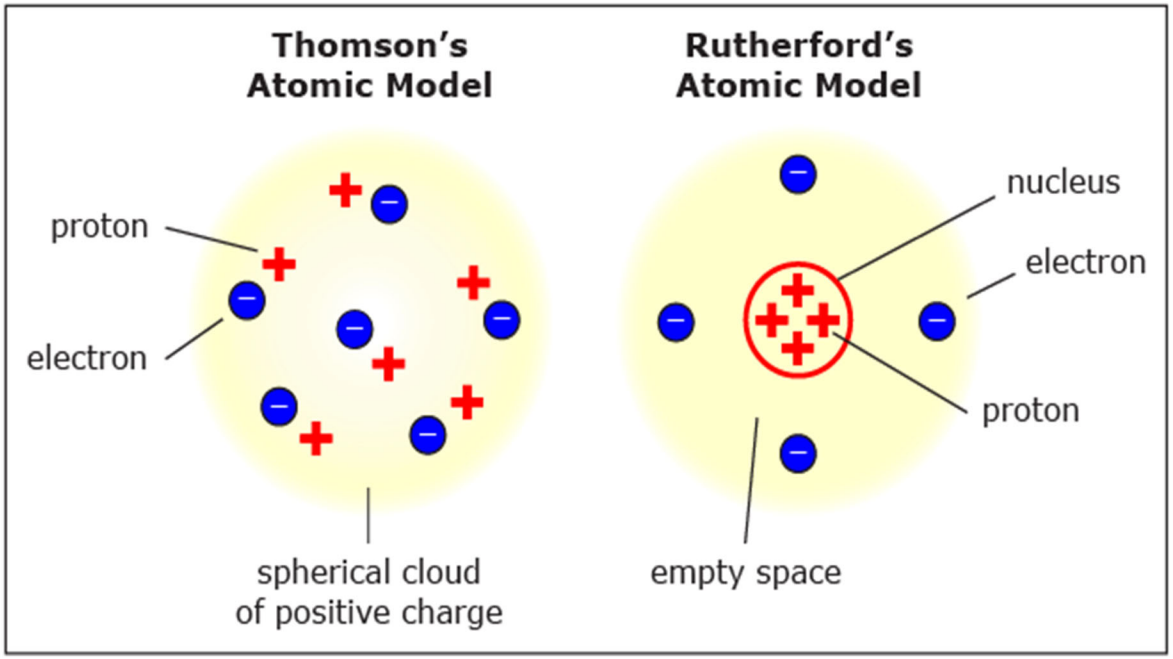
- Evaluating, comparing, and contrasting independent sets of information

Special considerations

- No more than two sets of scientific findings, theories, or explanations will be provided in the item.
- The scientific findings, theories, or explanations can be presented as written text, models, and/or data in tables and graphs.

Group 1 – SP.5.a
Reconcile multiple findings, conclusions, or theories

This diagram shows the Thomson and Rutherford atomic models for different atoms.



Which statement *best* compares the atomic models?

A. They contradict each other because each model shows the position of protons differently.

B. They support each other because both models show the distribution of electrons correctly.

C. They contradict each other because each model shows a different structure for the protons and the electrons.

D. They support each other because both models show that protons and electrons occupy the same amount of space.

Gap #2 in Group 1

Express scientific information or findings verbally (SP.6.c)

Expectation

- Translating quantitative or technical information expressed numerically or visually into a version that is expressed verbally (words or sentences)

Gap

- Identifying relationships among the details in visual representations

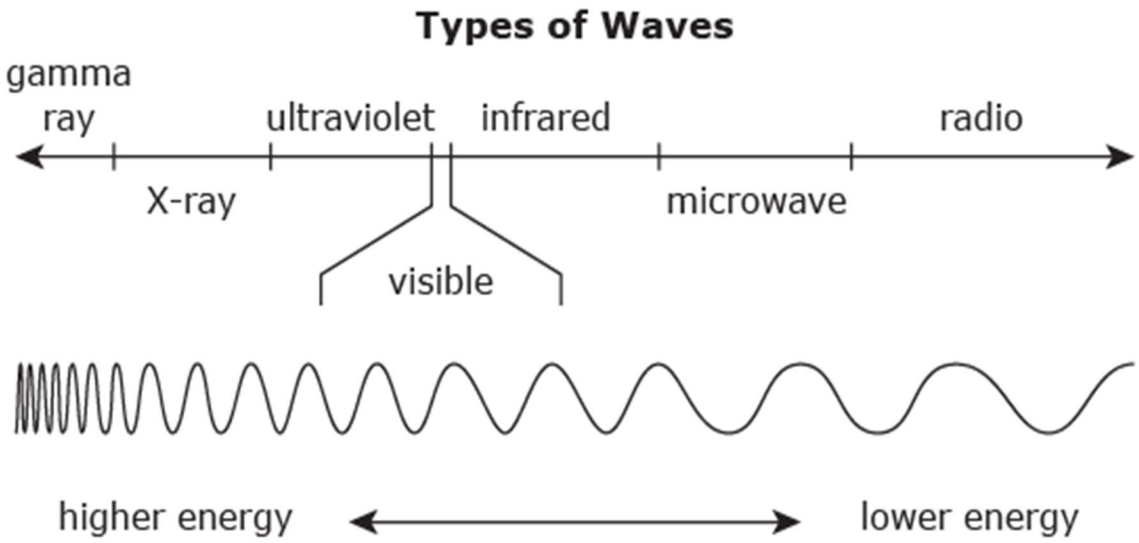
Special considerations

- Information will be presented in the form of tables, graphs, diagrams, or equations.
- Items may ask for a trend shown in data or for a description of an event or process shown in a diagram.

Group 1 – SP.6.c

Express scientific information or findings verbally

A student uses this diagram to study the electromagnetic spectrum.



Which statement describes the diagram?

A. Waves with longer wavelengths transfer more energy than waves with shorter wavelengths.

B. Seven types of visible waves send different amounts of energy throughout Earth.

C. Radio waves transfer much more energy than any other type of wave found on Earth.

D. Waves are categorized by the energy they transmit from high energy gamma waves to lower energy radio waves.

Gap #1 in Group 2

Design a scientific investigation (SP.2.d)

Expectation

- Identifying the logical order of steps or a missing step of a scientific investigation
- Identifying proper tools, appropriate units, or techniques for a scientific experiment

Gaps

- Evaluating a scientific procedure based on the purpose and/or hypothesis of an investigation
- Knowledge of scientific tools and what they are used for

Special considerations

- A scientific investigation will be described in paragraph form or in numbered format
- Properties may include mass, volume, length, temperature, time, speed, force, cells/organisms of different sizes.
- Scientific tools may include a balance, graduated cylinder, beaker, ruler, thermometer, stopwatch, seismograph, and different types of microscopes.

Group 2 – SP.2.d
Design a scientific investigation

A student researcher is investigating the law of conservation of mass. The steps of the investigation are shown.

1. Measure 5 milliliters (mL) of Solution X and of Solution Y.
2. Pour Solution X into a 250mL flask and pour Solution Y into a 10mL test tube.
3. Tie a thread around the test tube and hang the test tube in the flask making sure the solutions do not mix.
4. Insert a cork into the mouth of the flask.
5. Determine the mass of the flask.
6. Tilt the flask so the two solutions mix in the flask.
7. Wait 2 minutes until a precipitate (solid) forms in the solution.
8. Measure the mass of the flask again.
9. Compare the mass measured in step 4 to the mass measured in step 8.

What tools are used in steps 1 and 5?

A. Step 1: beaker
Step 5: thermometer

B. Step 1: graduated cylinder
Step 5: electronic balance

C. Step 1: seismograph
Step 5: electronic balance

D. Step 1: barometer
Step 5: beaker

Gap #2 in Group 2

Reason from data or evidence to a conclusion (SP.3.b)

Expectation

- Using scientific evidence to select an appropriate conclusion
- Determining which explanation best aligns with the provided evidence

Gaps

- Interpreting and analyzing data tables and graphs
- Making connections between the purpose and/or hypothesis of an investigation and the provided data

Special considerations

- The stimulus may provide scientific data or evidence in the form or written text or graphs.
- A series of events from an investigation or model may be provided as evidence.

Group 2 – SP.3.b

Reason from data or evidence to a conclusion

Researchers are investigating ways to transfer environmental vibrations into electrical energy. For example, the sound waves from a passing subway train cause the surrounding area to vibrate. The researchers are harvesting this energy to convert it to electrical energy. One company uses this technology to power sensor systems for passenger trains by attaching the sensor to the track. The researchers are focusing on how this type of technology can be used in other applications, including household appliances.

Which conclusion can be drawn based on the information provided?

A. Sound waves are a main source of electrical energy.

B. Mechanical energy can be harnessed as an alternative energy source.

C. Railway systems are the most practical application for mechanical energy.

D. Sensor systems can be used to provide electrical energy for most household appliances.

Gap #3 in Group 2

Make a prediction based upon data or evidence (SP.3.c)

Expectation

- Understanding how a variable can change as a result of changing another variable
- Understanding trends in data and extending that trend to additional experiments

Gaps

- Interpreting and analyzing data tables and graphs
- Identifying variables of an investigation

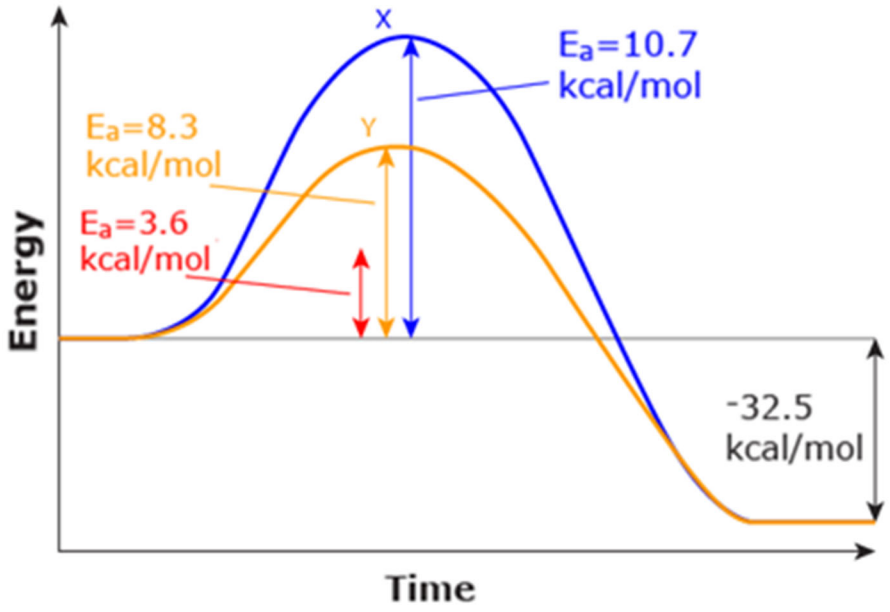
Special considerations

- A description of an investigation and/or a graphical component or data set will be provided.
- Items may require students to predict the results of an additional trial or measurement using the original experimental conditions.

Group 2 – SP.3.c

Make a prediction based upon data or evidence

The graph shows the effect of two catalysts, X and Y, on an exothermic reaction. The energy needed to start a reaction is known as the activation energy (E_a).



If a different catalyst with an activation energy of 3.6 kcal/mol is used in this reaction, what is the predicted amount of heat that will be released.

A. -32.5 kcal/mol
B. -28.9 kcal/mol
C. +3.6 kcal/mol
D. +22.6 kcal/mol

Gap #4 in Group 2

Understand and apply scientific models, theories, and processes (SP.7.a)

Expectation

- Using prior content knowledge to demonstrate understanding of scientific models, theories, and processes

Gap

- Lack of science content knowledge

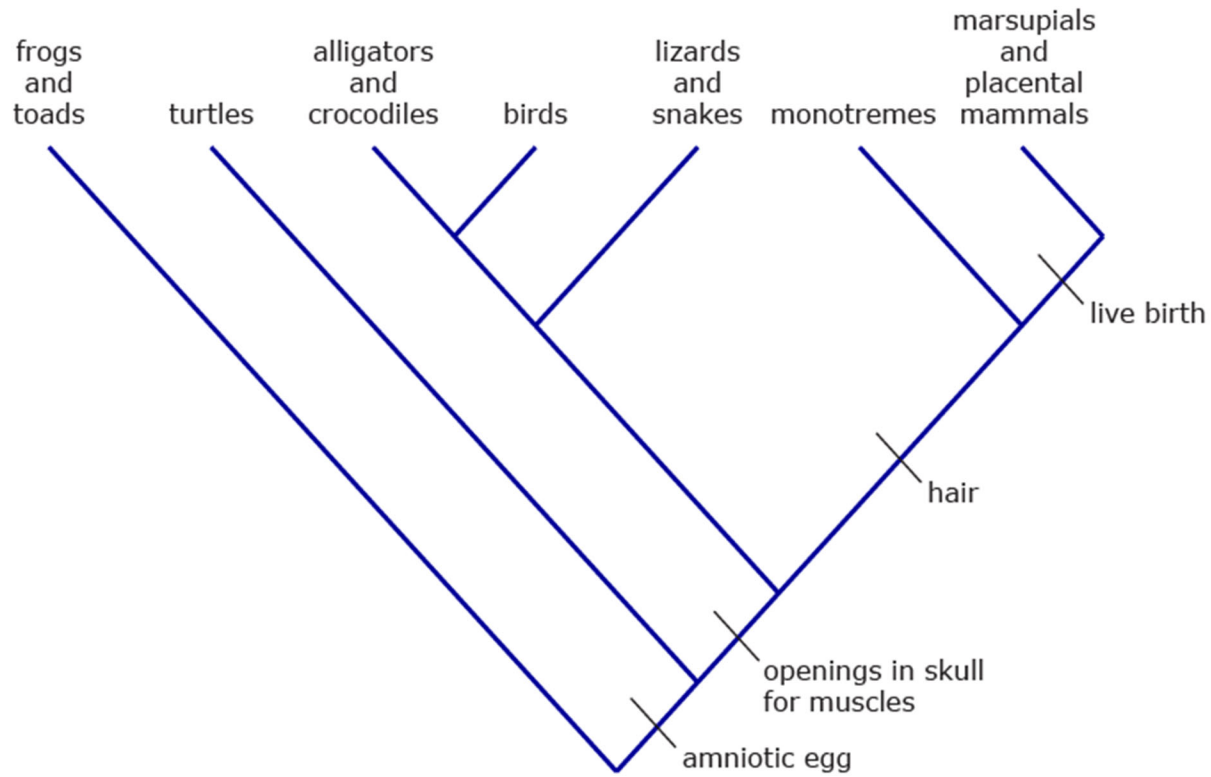
Special considerations

- Items may provide background information of common processes or present a theory or model.
- Basic processes may include cellular respiration, photosynthesis, cell division, energy conversions, heat transfer, endothermic and exothermic reactions, and fusion.
- Models and theories may include Bohr model of the atom, Newton's laws of motion, conservation of energy and matter, food web, cladogram, pedigree, Punnett square, the Big Bang theory, structure of Earth, and plate tectonics.

Group 2 – SP.7.a

Understand and apply scientific models, theories, and processes

The cladogram shows some of the relationships between different animals.



Which statement *best* describes a relationship shown in the cladogram?

A. Frogs and toads lay amniotic eggs, but turtles do not.

B. Monotremes give live birth to offspring, but snakes and lizards do not.

C. Lizards and monotremes are more closely related to each other than alligators are to birds.

D. Marsupials and monotremes share common ancestors with each other that they do not share with crocodiles.

Gap #1 in Group 3

Describe a data set statistically (SP.8.a)

Expectation

- Calculating the mean and identifying the median and mode of a given data set

Gap

- Definitional application of mean (average), median, and mode to a particular set of data

Special considerations

- These skills are not related to a specific context or science domain.
- The data set will have no more than 12 pieces of data.
- Students will be given a calculator when items ask them to describe a data set statistically.

Group 3 – SP.8.a

Describe a data set statistically

A scientist researched the effect of a prospective medication on the rate of cell division. She grew two groups of cells under normal conditions. She then treated one of the groups with a low dose of the medication and left the other group untreated.

The scientist collected data on the number of cells in each group over a four-day period, as shown in the table.

Day	Total Number of Cells in Untreated Group	Total Number of Cells in Treated Group
1	1,000	1,000
2	1,500	2,000
3	2,500	4,000
4	3,500	5,000

You may use the calculator.

The average number of treated cells counted over the four-day period is [dropdown options]. (2,125/3,000/12,000)

Group 3 – SP.8.a

Describe a data set statistically

Researchers collected wind speed data for a city over 10 days. The table shows the data rounded to the nearest whole number.

Day	Wind Speed (mph)
1	6
2	12
3	10
4	12
5	15
6	5
7	2
8	10
9	12
10	6

Identify the mean, median, and the mode of the data.

You may use the calculator.

Mean: ☐ mph

Median: ☐ mph

Mode: ☐ mph

This approach is only for instructional purposes only. Items will only ask for one of the three.

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Gap #2 in Group 3

Determine the probability of events (SP.8.c)

Expectation

- Determining the probability of events

Gaps

- Knowing how to calculate probabilities
- Applying ratios to Punnett squares

Special considerations

- Data will be provided in the form of text, a table, or a Punnett square.
- Students will be given a calculator when items ask them to determine the probability of events.

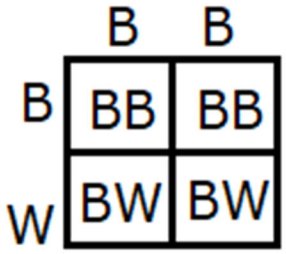
Group 3 – SP.8.c

Determine the probability of events

The Andalusian chicken exhibits incomplete dominance for the inheritance of feather color. The allele for black feathers can be represented by B, and the allele for white feathers can be represented by W.

If a chicken has black feathers, it's genotype is BB. If it has white feathers, it's genotype is WW. However, when a black-feathered chicken is bred with a white-feathered chicken, the genotype is BW, and the blending of the two colors results in offspring with a bluish-gray color.

This Punnett square shows the possible genotypes of offspring that result from a particular cross between two chickens.



What is the probability that an offspring will be bluish gray in color?

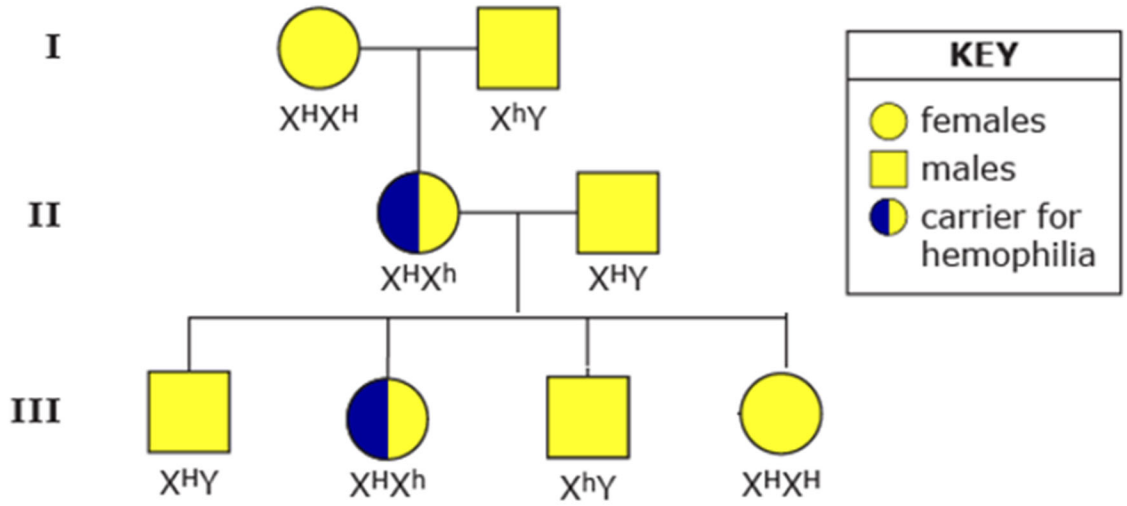
You may use the calculator.

A. 25%
B. 50%
C. 75%
D. 100%

Group 3 – SP.8.c

Determine the probability of events

Hemophilia (a genetic blood condition) is determined by a recessive allele (h) that is carried on the X chromosome. Males have one X chromosome and one Y chromosome, so they need only one copy of the hemophilia gene to have the condition. Females have two X chromosomes, so they need two copies of the gene in order to have the disease. If females have one copy of the gene, they are known as carriers. The pedigree shows one example of the inheritance of hemophilia.



Which statement describes the offspring in generation III?

A. 25% of the offspring have hemophilia, and 25% are carriers.
B. 50% of the offspring have hemophilia, and 50% are carriers.
C. 100% of the males have hemophilia.
D. 100% of the females have hemophilia.

General strategies to close the skill gaps

- Share the GED® indicators and content topics with your students.
  - The content topics can be used as a teaching/study guide (vocabulary/processes).

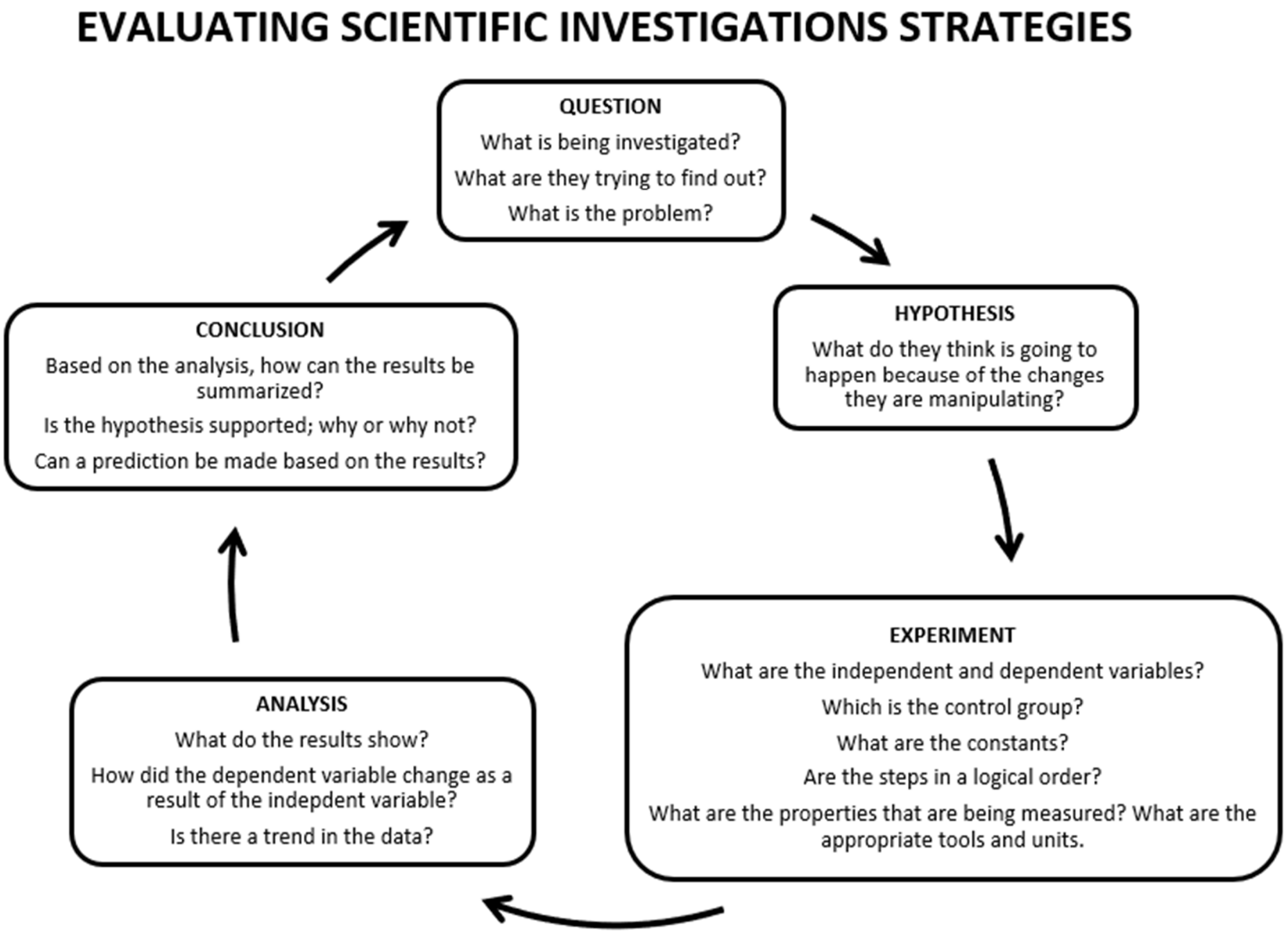
- Provide students opportunities to review scientific investigations.
  - Identify purpose, hypothesis, variables
  - Evaluate whether the procedure aligns well with the purpose and hypothesis
  - Identify tools and units that were used to measure specific properties
  - Analyze data – patterns, relationships between variables
  - Identify evidence that supports the conclusion

- Provide students opportunities to evaluate diagrams/illustrations and describe what is being shown.

General Strategies to close the skill gaps con't.

- 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



Teaching Strategies - Investigations

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 the procedure shown here.

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

What is the dependent variable?

Options:

*A. the amount of juice produced in each cup

B. the mass of the chopped apple

C. the presence of pectinase

D. the amount of time the cups are left undisturbed

POSSIBLE ADDITIONAL QUESTIONS:

- What is the purpose of the investigation?
- What are the independent and dependent variables?
- Is there a control group?
- What tools are needed?
- What is a probable hypothesis?

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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.	10a.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?

Options:

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?
- Create a graph based on the data.
- Identify the mean, median, and mode of the data.

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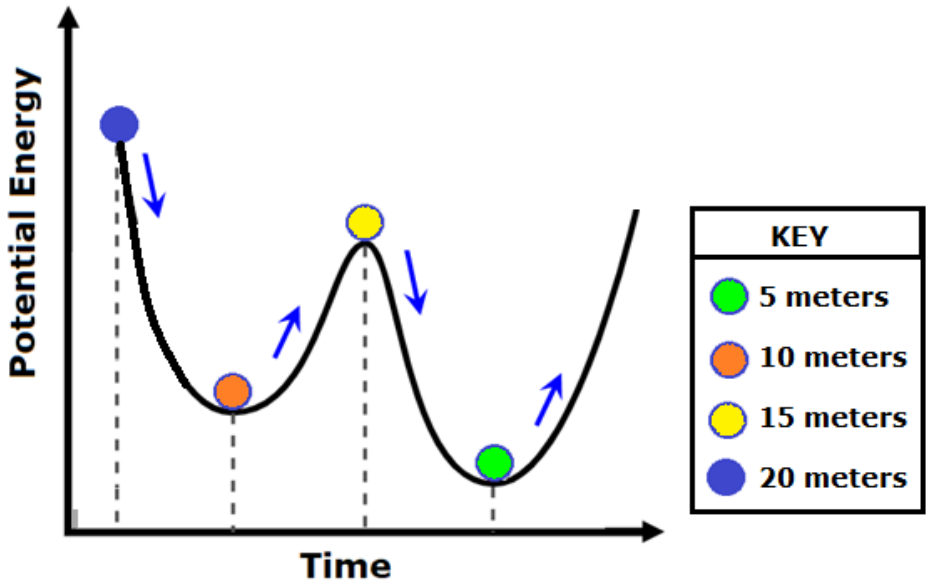
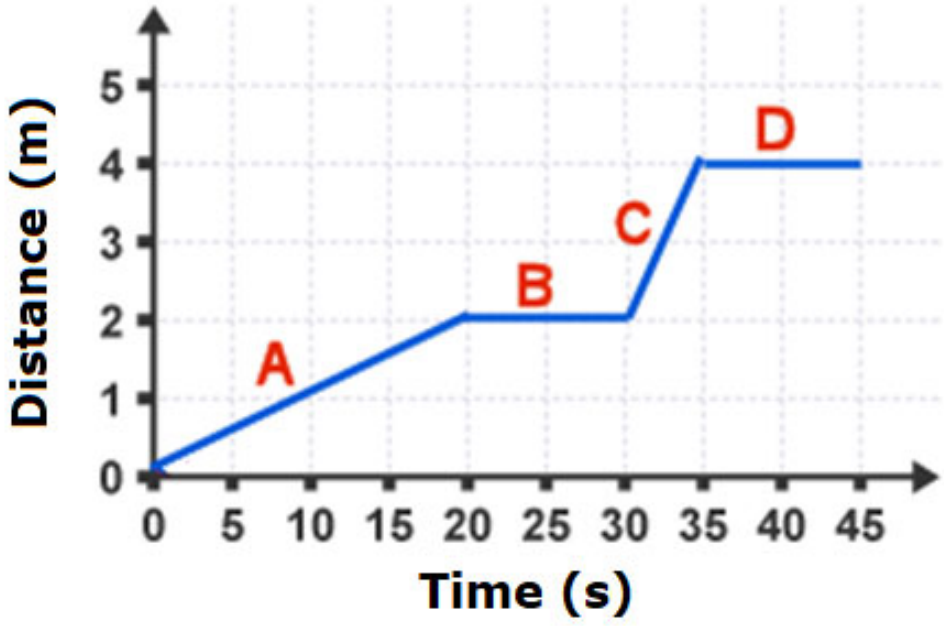
Teaching Strategies – Evaluating Graphs

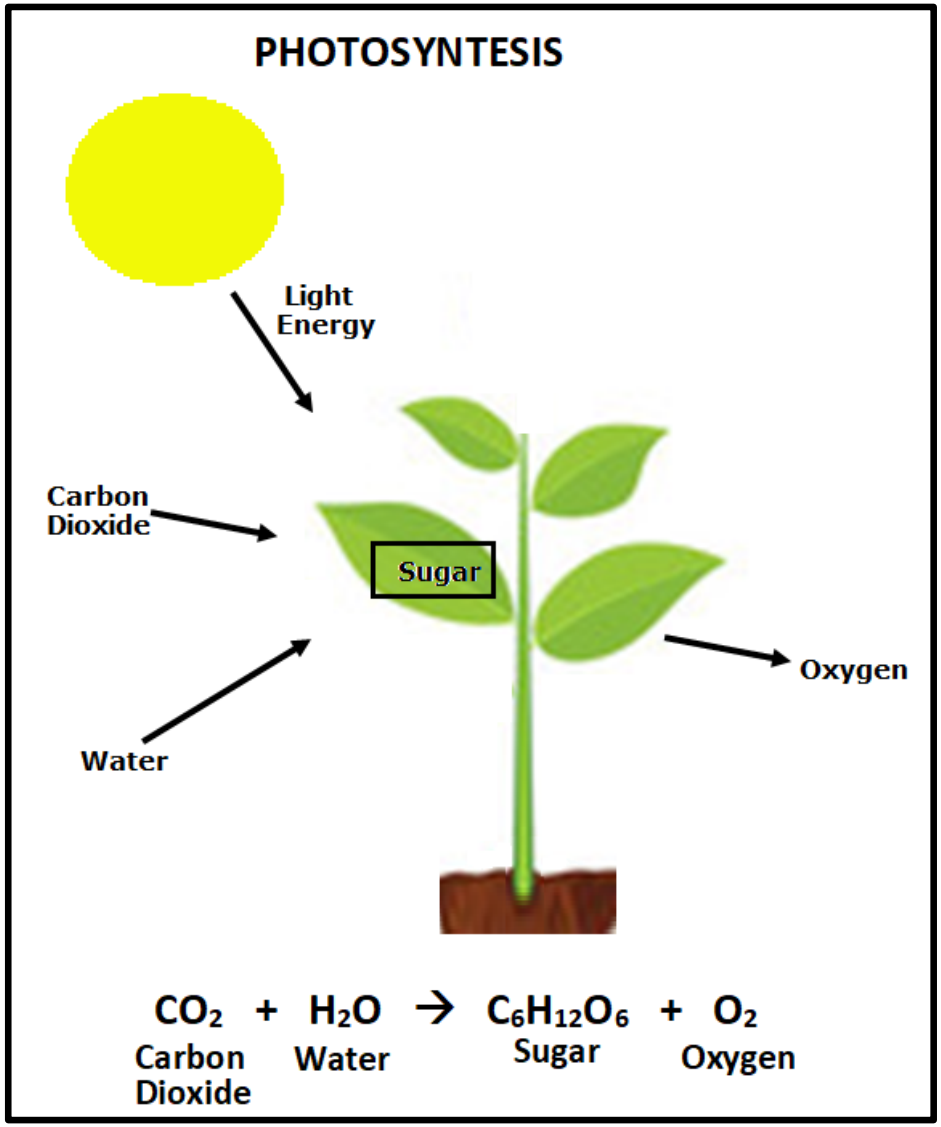


- What is presented in the graph?
- What conclusion can be reached based on the data?



- What are the independent and dependent variables?
- What is happening at each segment: A, B, C, D?

Teaching Strategies – Interpreting Diagrams



- Use content topics to identify processes and models the students should be familiar with.
- Find some diagrams and review with students. (It may be helpful for them to take notes, and then check for understanding.)
- Focus on labels and arrows.

POSSIBLE QUESTIONS:

- What are the reactants?
- What are the products?
- Where is photosynthesis occurring?
- Determine the number of atoms in each chemical formula in the equation.
- Is the equation balanced? Why or why not?

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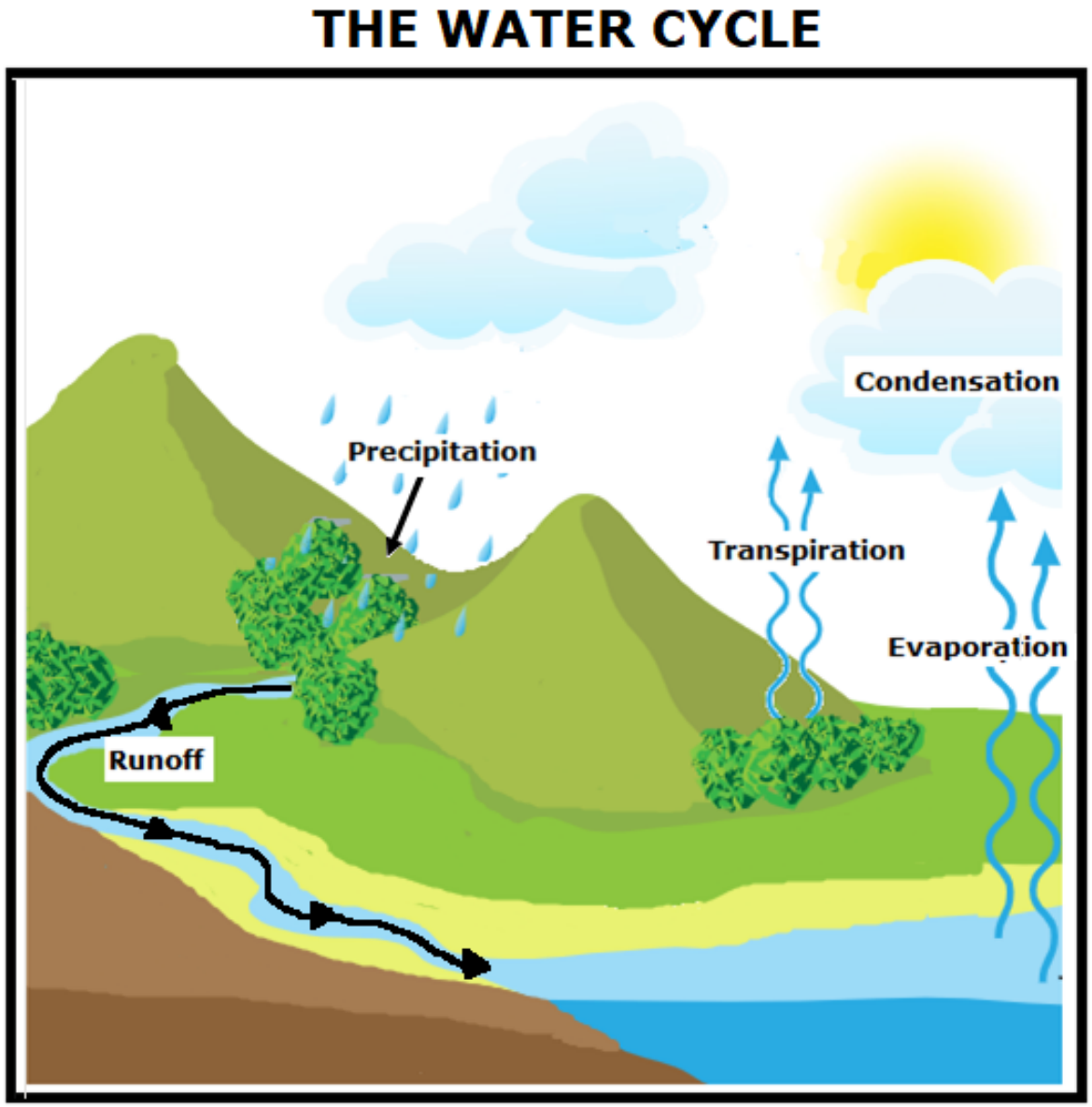
Teaching Strategies – Interpreting Diagrams



- Use content topics to identify processes and models the students should be familiar with.
- Find some diagrams and review with students. (It may be helpful for them to take notes, and then check for understanding.)
- Focus on labels and arrows.

POSSIBLE QUESTIONS:

- What do each of the arrows represent?
- In your own words, describe what occurs during the water cycle.

Correct Responses for Sample Items

Page #	Indicator	Correct Response
13	Group 1 - SP.5.a Reconcile multiple findings, conclusions, or theories	A
15	Group 1 – SP.6.c Express scientific information or findings verbally	D
17	Group 2 – SP.2.d Design a scientific investigation	B
19	Group 2 – SP.3.b Reason from data or evidence to a conclusion	B
21	Group 2 – SP.3.b Reason from data or evidence to a conclusion	A
23	Group 2 – SP.7.a Understand and apply scientific models, theories, and processes	D
25	Group 3 – SP.8.a Describe a data set statistically	3,000
26	Group 3 – SP.8.a Describe a data set statistically	Mean: 9 Median: 10 Mode: 12
28	Group 3 – SP.8.c Determine the probability of events	B
29	Group 3 – SP.8.c Determine the probability of events	A
33	Teaching Strategies - Investigations	A
34	Teaching Strategies - Investigations	C

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about ?
help
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Q & A
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HOW
answers
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