New England Common Assessment Program

Released Items Support Materials 2008

Grade 11 Science

PS1.4 (9–11) Model and explain the structure of an atom or explain how an atom's electron configuration, particularly the outermost electron(s), determines how that atom can interact with other atoms.

Please use the periodic table on the reference sheet to answer the question.

1 Element X reacts with potassium (K) to produce the compound K_2X. The table below shows the number of valence electrons in four elements.

Valence Electrons in Four Elements

Element	Number of Valence Electrons
Hydrogen (H)	1
Nitrogen (N)	5
Oxygen (O)	6
Fluorine (F)	7

Which element listed in the table is **most likely** element X?

A. hydrogen
B. nitrogen
C. oxygen
D. fluorine

.

PS2.6 (9–11) Using information provided about chemical changes, draw conclusions about and explain the energy flow in a given chemical reaction (e.g., exothermic reactions, endothermic reactions).

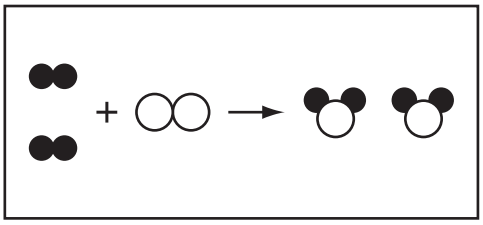
2 Which model demonstrates the Law of Conservation of Matter?

Key

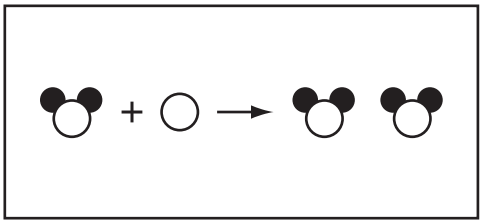
● represents hydrogen

○ represents oxygen

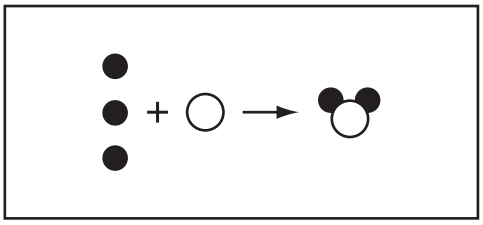
A.



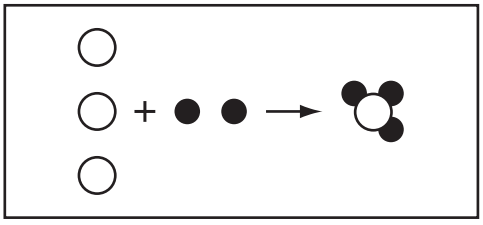
C.



B.

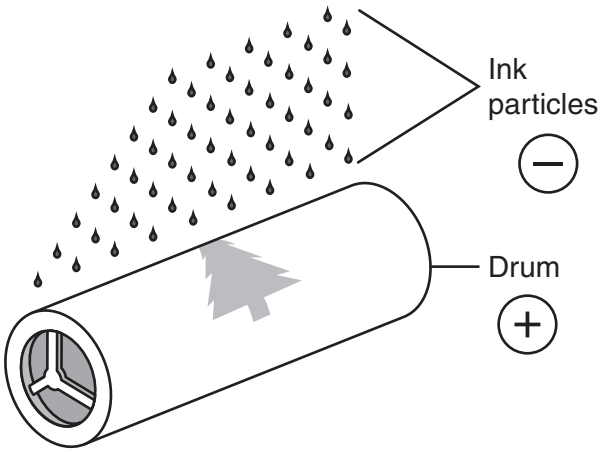


D.



PS2.7 (9–11) Explain relationships between and among electric charges, magnetic fields, electromagnetic forces, and atomic particles.

3 Photocopiers use static electricity to copy images. The drum is sensitive to light and becomes positively charged in certain areas based on the image being copied. Ink particles are negatively charged and attracted to the positively charged areas on the drum, as shown below.



Which change will **most likely** cause the greatest increase in the attractive force acting on the ink particles?

A. decreasing the distance between the ink particles and the drum
B. increasing the distance between the ink particles and the drum
C. changing the charge of the ink particles to positive
D. changing the charge of the drum to negative

PS3.8 (9–11) Given information (e.g., graphs, data diagrams), use the relationships between or among force, mass, velocity, momentum, and acceleration to predict and explain the motion of objects.

Please use the Formulas on the reference sheet to answer the question.

4 The table below lists the positions of a free-falling ball.

Ball in Free Fall

Time (s)	Position of Ball (m)
0	0
1.0	5
2.0	20
3.0	45
4.0	80
6.0	?

a. Construct a graph of the ball's position, z, in meters (m), as a function of time, t, in seconds (s). On the graph, mark the approximate position of the ball at 1.5 s.

b. Calculate the position of the ball at 6.0 s.

c. Briefly describe the motion of the ball during free fall.

You may include the terms listed below in your response to part (c).

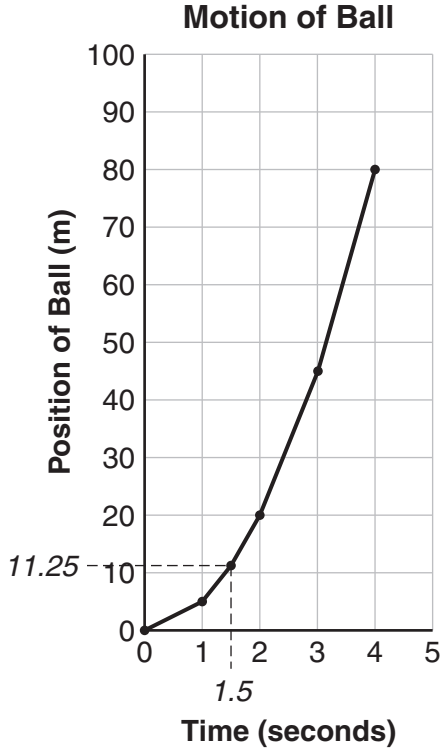
- distance
- time
- force due to gravity
- acceleration

Scoring Guide

Score	Description
4	Response demonstrates a thorough understanding of the motion of objects, using experimental data. Student completes all tasks required by constructing a position vs. time graph from the given data, interpolating and extrapolating data points, and describing object motion. The response has no errors or omissions.
3	Response demonstrates a general understanding of the motion of objects, using experimental data. The response has an error or omission.
2	Response demonstrates a limited understanding of the motion of objects, using experimental data. The response has errors and omissions.
1	Response demonstrates a minimal understanding of the motion of objects, using experimental data. The response has several errors and omissions.
0	Response is incorrect or contains some work that is irrelevant to the skill or concept being measured.
Blank	No response

Training Notes:

Part (a): (1 point for correct graph and for correct interpolation)



- If student uses the graph to estimate the position at 1.5 s, accept position value of 11.25 ± 2.
- Student can use the correct formula for gravitational acceleration to calculate the position at t = 1.5.

Training Notes (continued):

$$z = \frac{gt^2}{2} = 5t^2 = 5\ (1.5)^2 = 11.25$$

Part (b): (1 point for correct setup and for correct extrapolation)

- Using the equation, the position at t = 6.

$$z = \frac{gt^2}{2} = 5t^2 = 5(6)^2 = 180$$

- Students may realize that the position quadruples when time is doubled:
  - 5 m to 20 m from 1 s to 2 s
  - 20 m to 80 m from 2 s to 4 s

  Therefore, from 3 s to 6 s , the position goes from 45 m to 180 m.

Part (c): (2 points)

- The ball is accelerating due to the force of gravity.
- The ball is moving faster and faster due to gravity.

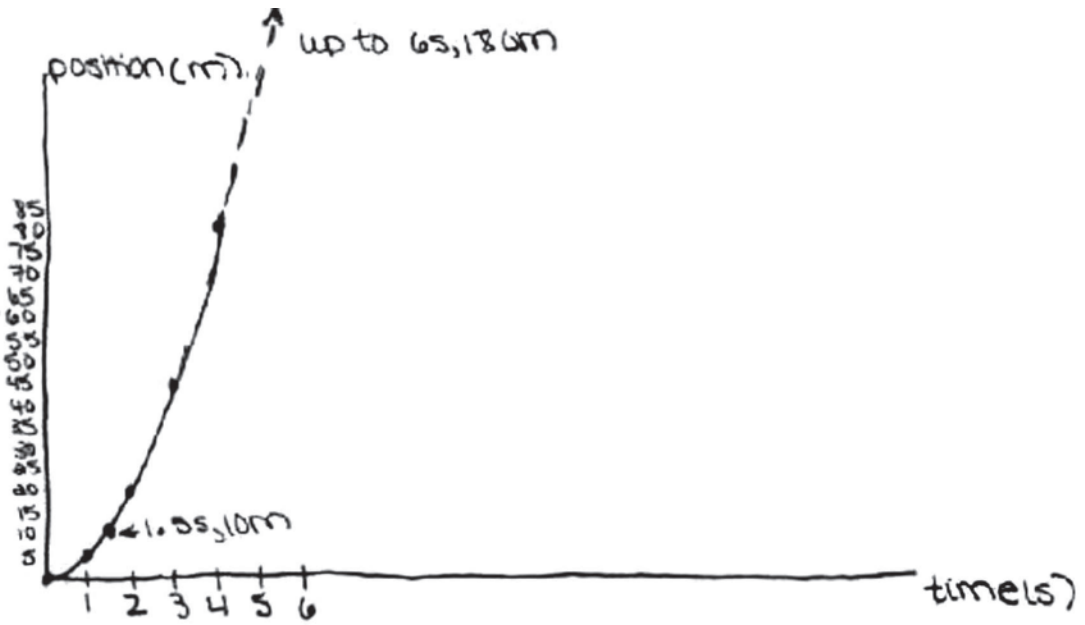
Notes:

- Graph must be correct to score 4 points.
- Lack of units in answer should not affect score.
- Data points on graph must be accurate to receive a score of 4.

- Part (c) must include explanation about acceleration due to gravity, distance increasing during free fall, and increasing velocity during free fall for full credit. Three elements is worth 2 points, two elements is 1 point, and one element is 0.5 point.

SCORE POINT 4

4



b) $Z = \frac{1}{2}gt^2$

$Z = \frac{1}{2}(10m/s^2)(6s)^2$

$Z = 180$

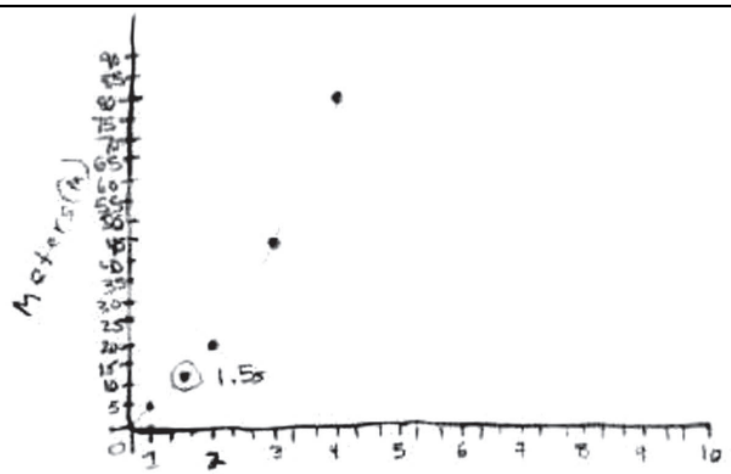
c) When a ball is in freefall, as time increases the velocity of the object increases at a constant rate of acceleration, g. (This forms the parabolic shape on the graph) Of course, as time progresses so does the distance until something (i.e. the ground stops it). The force due to gravity may increase also, because as the free-fall object nears the earth, the distance between the centers is decreasing, which would cause the force to increase (according to formula).

For part (a), the elements of the graph are correct and, for part (b), the position of the ball is correctly calculated. For part (c), the response demonstrates a clear understanding that velocity increases at a constant rate of acceleration. The idea that the force gravity may increase as the ball approaches the center of the Earth is theoretically true based on the formula $F_{gravity} = G\ \frac{m_1 m_2}{r^2}$, which concludes that the force of gravity between two objects in space is inversely proportional to the distance between the objects. However, in this case, the mass of the ball is negligible compared with the mass of Earth, and therefore the increase in force is also negligible. Overall, the response demonstrates a clear understanding of the concept and receives full credit.

SCORE POINT 3

4

a)



b) 15, 25, 35, ... 45, 55
The distance for each of the times is increasing due to acceleration.

5.0 seconds 80 + 45 = 125 m
6.0 seconds 90 + 55 = 145 m

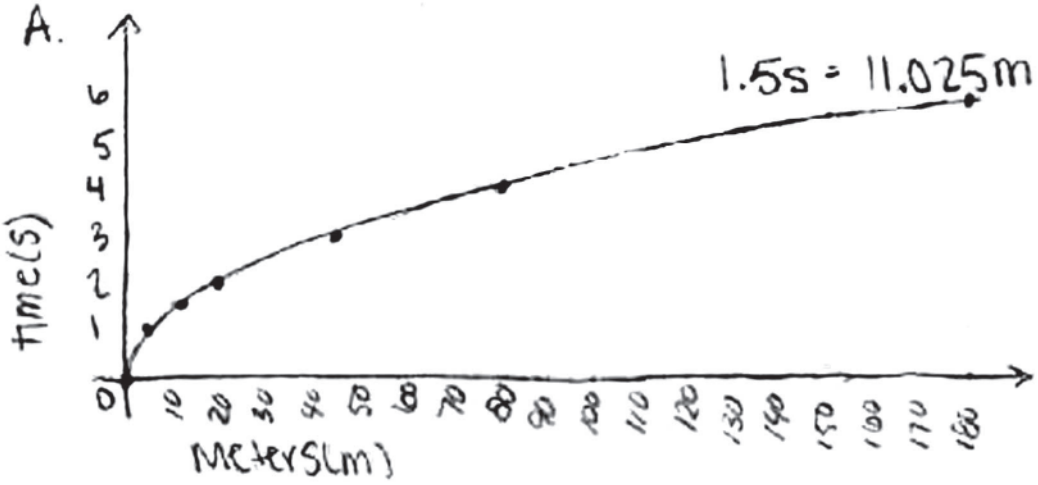
c) As the ball is freefalling, the force due to gravitational pull is pulling the ball towards the earth, acceleration occurs, as the ball picks up speed. Acceleration is directly connected to the increase in distance per second and the decrease in time it takes to get to its destination. Thats why the graph is expodentially growing

For part (a), the points are correctly plotted on the graph. For part (b), the response is incorrect. For part (c), the response acknowledges that acceleration due to gravity causes the distance covered per unit time to increase (velocity increases), which makes the graph parabolic. The response demonstrates a general understanding of the concept and receives a score of 3.

Score Point 2

4

A.



B. $t = 6s$
$g = 10m/s$
$d = ?$

$d = \frac{1}{2}gt^2$

$d = \frac{1}{2}(10m/s)6s^2$

$d = 5m/s(36s)$

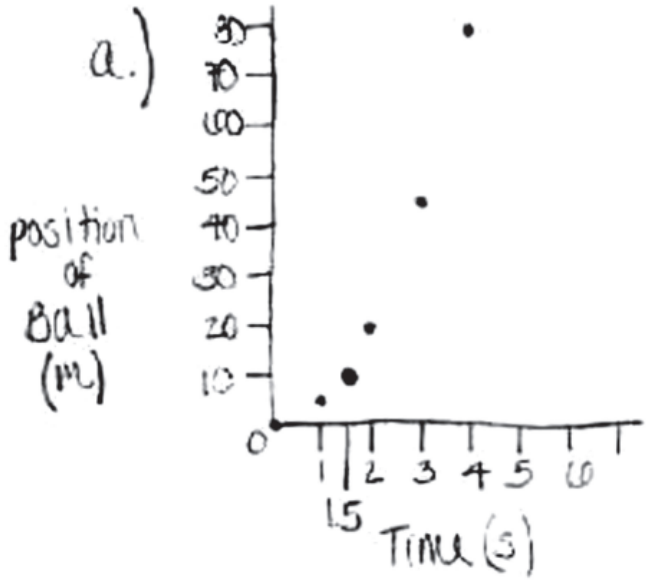
$d = 180m$

C. The distance covered increased between time periods as the time increased.

For part (a), the points are correctly plotted on the graph. However, the axes are flipped so that time is plotted on the *y*-axis, which is considered an error. For part (b), the position of the ball is correctly calculated. For part (c), the response receives minimal credit for stating that the distance covered during each time period increases. Overall, the response is limited and receives a score of 2.

SCORE POINT 1

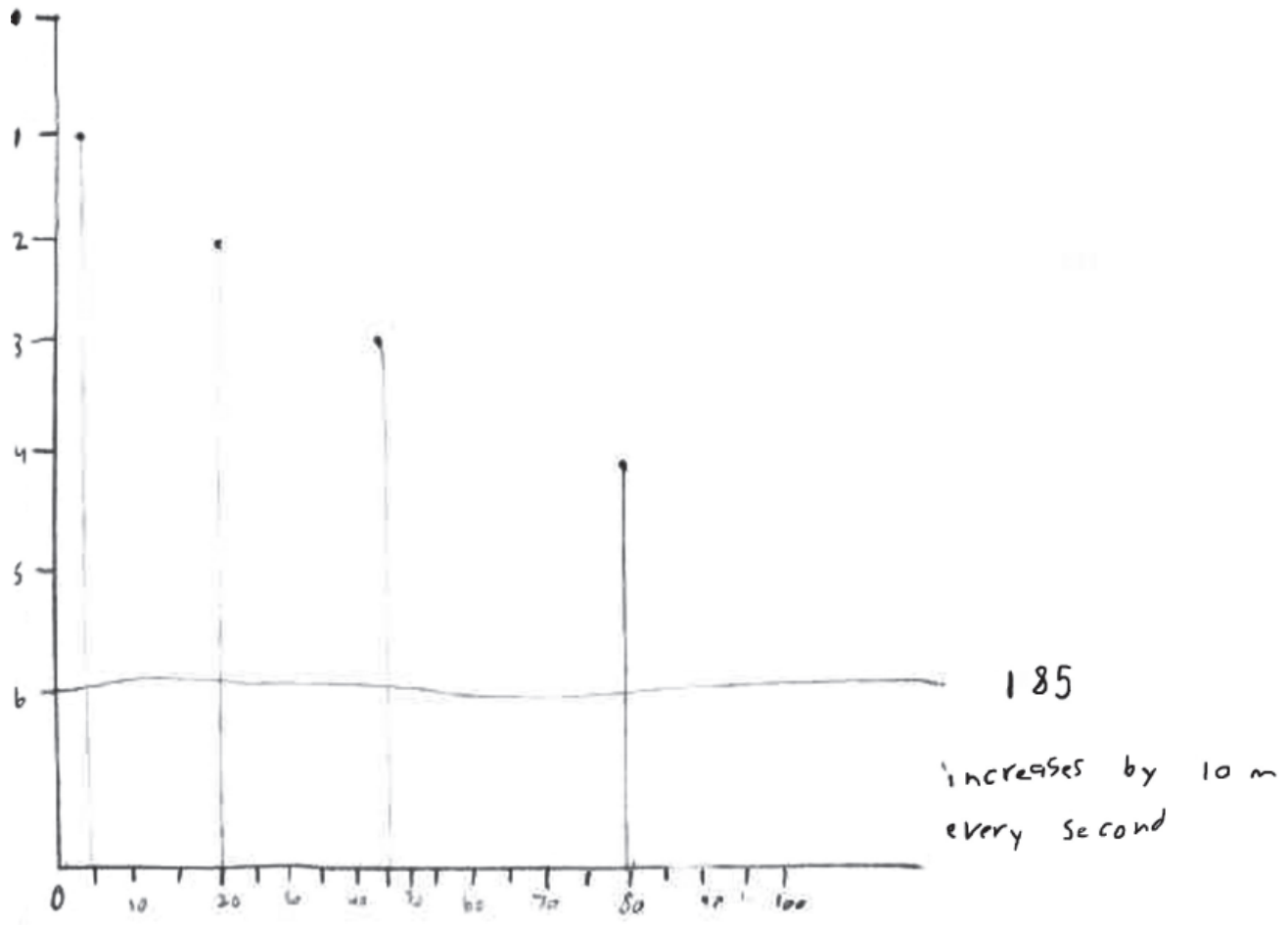
4



For part (a), the points are correctly plotted on the graph. For parts (b) and (c), the responses are omitted.

SCORE POINT 0

4



For part (a), the graph is incorrectly constructed and, for part (b), the position of the ball is incorrectly guessed (185).

ESS1.3 (9–11) Explain how internal and external sources of heat (energy) fuel geologic processes (e.g., rock cycle, plate tectonics, sea floor spreading).

5 New crust is being produced at a mid-ocean ridge. How does this affect Earth's crust?

A. The total amount of crust is always increasing.

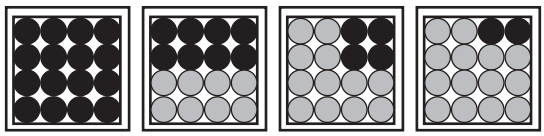
B. The new crust is denser than older crust.

C. The total amount of crust is always decreasing.

D. The older crust is recycled at subduction zones.

ESS1.4 (9–11) Relate how geologic time is determined using various dating methods (e.g., radioactive decay, rock sequences, fossil records).

6 The diagram below shows a radioactive isotope going through several half-lives as it decays.



I II III IV

In sample I, the original isotope has a mass of 40 g. How many grams of the **original isotope** remain in sample IV?

A. 37.5 g

B. 20 g

C. 10 g

D. 5 g

ESS3.5 (9–11) Explain how scientific theories about the structure of the universe have been advanced through the use of sophisticated technology (e.g., space probes; visual, radio, and X-ray telescopes).

7 At one time, the universe was thought to be limited to the Milky Way galaxy. How did Edwin Hubble change people's ideas about the universe?

A. He provided evidence that there are galaxies outside of the Milky Way galaxy.
B. He found other galaxies moving in orbit in the Milky Way galaxy.
C. He measured the intensity of radio waves coming from variable stars.
D. He discovered the composition of variable stars differs from that of nearby stars.

LS1.1 (9–11) Use data and observation to make connections between, to explain, or to justify how specific cell organelles produce/regulate what the cell needs or what a unicellular or multi-cellular organism needs for survival (e.g., protein synthesis, DNA replication, nerve cells).

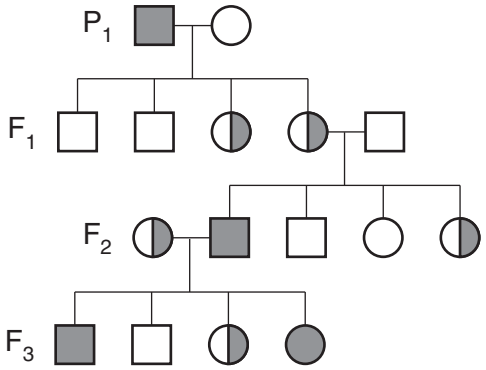
8 Tay-Sachs disease is a genetic disorder in which lipids are not properly digested. Which organelle is **not** properly working in this disorder?

A. cytoplasm
B. lysosome
C. nucleus
D. ribosome

LS1.2 (9–11) Explain or justify with evidence how the alteration of the DNA sequence may produce new gene combinations that make little difference, enhance capabilities, or can be harmful to an organism (e.g., selective breeding, genetic engineering, mutations).

9 The diagram below shows the pedigree of an individual with hemophilia, a sex-linked recessive condition. The diagram also shows how hemophilia is passed to offspring on an X chromosome.

Hemophilia Pedigree



Key

Male Female

displays trait

carries recessive gene for trait but does not display trait

normal

Which statement explains why few females in the family have the condition?

A. Males have two X chromosomes.

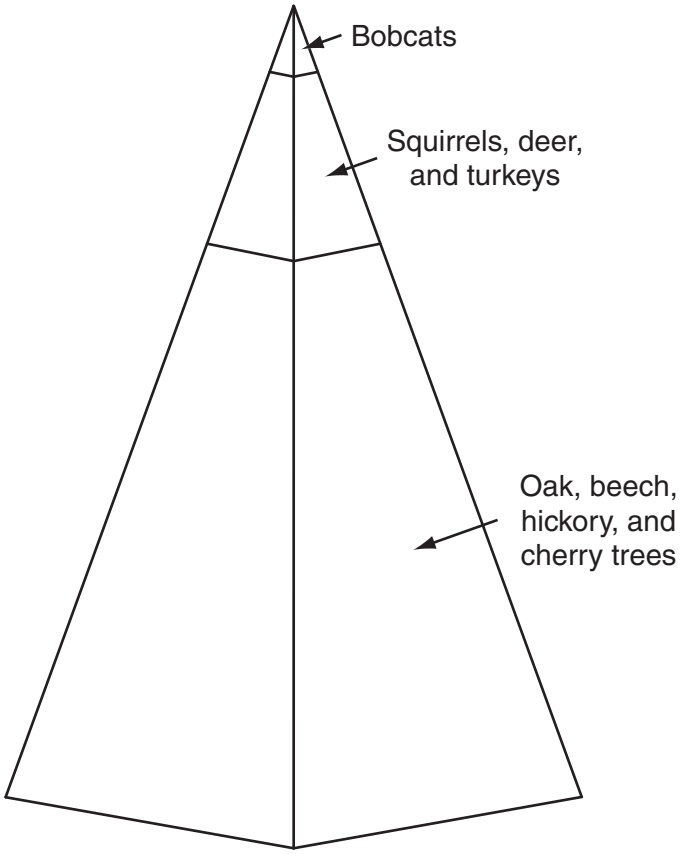
B. Females have two X chromosomes.

C. Females have a Y chromosome.

D. Males have a dominant Y chromosome.

LS2.4 (9–11)	Trace the cycling of matter (e.g., carbon cycle) and the flow of energy in a living system from its source through its transformation in cellular, biochemical processes (e.g., photosynthesis, cellular respiration).

10 The diagram below shows an energy pyramid for a forest ecosystem.



What do the sizes of the levels in the energy pyramid represent?

A. the amount of energy available in the organisms at each level

B. the amount of energy used daily by the organisms at each level

C. the amount of heat given off daily by the organisms at each level

D. the amount of energy recycled by the organisms at each level

Broad Area of Inquiry: Planning and Critiquing of Investigations

INQ2.5 (9–11) Develop an organized and logical approach to investigating the question, including controlling variables (DOK 2 – routine; DOK 3 – non-routine).

Josh identifies the following three variables to investigate:

- the mass of the vehicle being driven
- the speed at which the vehicle travels
- the stopping distance of the vehicle

11 a. In Josh's investigation, which variable is the dependent variable and which variables are the independent variables?

b. Explain how the independent variables are different from the dependent variable.

c. Why is it important to test each variable separately rather than at the same time? Explain your answer.

Scoring Guide

Score	Description
3	Response (a) correctly identifies one dependent and two independent variables, (b) defines the difference between the two, and (c) explains the reason to test each variable separately. The response must include solid definitions of all three. The response contains no errors or omissions.
2	Response demonstrates two of the following: (a) correctly names dependent and independent variables, (b) defines the difference between the two, or (c) explains the reason to test each variable separately. The response is general. If the response receives full credit for part (a) and partial credit for parts (b) and (c), a score of 2 is acceptable.
1	Response demonstrates one of the following: (a) correctly identifies two variables (two independent variables or one independent and one dependent variable), (b) defines the difference between the two, or (c) explains the reason to test each variable separately. The response can also show a minimal understanding.
0	Response is incorrect or contains some work that is irrelevant to the skill or concept being measured.
Blank	No response

Training Notes:

Part (a):
Response needs to correctly identify both independent variables and the dependent variable.
Independent variables: mass and speed (response needs to identify both independent variables)
Dependent variable: stopping distance

Part (b):
Response must recognize the function of independent and dependent variables.
An independent variable is a factor/property/characteristic (e.g., speed, mass) with a value determined and altered by the experimenter to determine the relationship to the dependent variable.
A dependent variable is what is affected/tested during the experiment (e.g., stopping distance). The dependent variable responds to the independent variable. It is called dependent because it "depends" on the value of the independent variable.
Note: Controlled variables are values that are kept constant—this is not an aspect of this question.

Training Notes (continued):

Part (c):
A correct explanation is worth one point.
The variables' effects must be isolated to determine the true cause of the results.
If there is more than one variable operating in an investigation, it will be impossible to determine which variable is actually responsible for the results or whether the results are a function of both variables.

Score Point 3

11 a. The stopping distance is the dependent variable.
The mass and speed are the independent variables

b. The independent variables aren't affected by another variable and stand alone. They are the variables that alter the dependent. Depending on the mass and speed of the vehicle will determine the stopping distance.

c. By testing each variable seperately you can determine how each affect the stopping distance individually rather than if they were combined. This way you can determine whether speed or mass is a larger factor in stopping distance.

For part (a), the response is correct. For part (b), the response demonstrates an understanding of the interaction between independent and dependent variables (independent variables stand alone and can be changed to alter dependent variables). For part (c), the response explains the importance of separately testing each variable to determine the degree to which each independent variable influences the results of the investigation.

SCORE POINT 2 (EXAMPLE A)

11 a.

The dependent variable is the stopping distance, while the independent variables are the mass and speed of each vehicle.

b.

The independent variables can be measured on their own, while the dependent variable can be measured only after the independent variable.

c.

One must test each variable separately so that one knows that that variable is the cause of the outcome.

For part (a), the response is correct. For part (b), the response does not provide complete evidence of an understanding of the interaction between independent and dependent variables. The response does not describe how independent variables can be manipulated to determine their effect on dependent variables. Any variables can be *measured* on their own. For part (c), the response explains that separately testing each variable is necessary to determine which variable is causing the results. Overall, the response demonstrates more than a minimal understanding of the interactions of independent and dependent variables and receives a score of 2.

SCORE POINT 2 (EXAMPLE B)

11 a.

The dependent variable would be the stopping distance of the vehicle while the independent variables would be the mass and speed of the vehicle.

b.

independent variable a what is being used to form your expiratment while the depent variable is what will result from each test.

c.

It's important to keep things controled so you have the most accurate results test at the same time doesnt allow for that to happen.

For part (a), the response is correct. For part (b), the response correctly identifies that independent variables are used to form an investigation and dependent variables are the result of an investigation. For part (c), the response does not demonstrate an understanding of the importance of separately testing variables. The response includes two correct parts and receives a score of 2.

Score Point 1

11 a.

dependent variable is stopping distance
independents are mass and speed.

b.

Independents can be any mass or speed but because he cant stop in time the biggest one is stopping distance.

c.

Testing each one at the sametime would be more accurate and give you better results rather than trying to do all of them at once which could interfere with accuracy.

For part (a), the response is correct. For part (b), the response does not demonstrate an understanding of the interactions between independent and dependent variables. For part (c), the response does not demonstrate an understanding of the importance of separately testing variables. The response includes one correct part and receives a score of 1.

SCORE POINT 0

11 a.

The dependent variable is the mass of the vehicle being driven. The independent variables are the speed of the vehicle and the stopping distance of the vehicle.

b.

The dependent variable is unchanging, the independent variables can be changed.

c.

To get the most data possible.

For part (a), the response receives no credit for correctly identifying only one variable (speed). The responses for part (b) and part (c) also receive no credit. The dependent variable is not unchanging, and the statement "the independent variables can be changed" does not provide enough information to receive credit. The response does not demonstrate an understanding of independent and dependent variables.

Broad Area of Inquiry: Formulating Questions and Hypothesizing
INQ1.1 (9–11) Analyze information from observations, research, or experimental data for the purpose of formulating a question, hypothesis, or prediction: a) Appropriate for answering with scientific investigation; b) For answering using scientific knowledge.

12 Form a hypothesis about the relationship between the mass of a vehicle and its stopping distance. Explain your thinking.

Scoring Guide

Score	Description
2	Response identifies a hypothesis and provides a clear explanation that includes a cause-and-effect relationship related to mass and stopping distance.
1	Response identifies a hypothesis *or* a cause-and-effect relationship related to mass and stopping distance; *or* response attempts to identify both, but response may contain errors or omissions, or response is minimal.
0	Response is incorrect or contains some work that is irrelevant to the skill or concept being measured.
Blank	No response

Training Notes:

Hypothesis and cause-and-effect response must be related to mass and stopping distance.

A response can have an unexpected hypothesis as long as the rationale supports it.

Sample Hypothesis: The greater the mass of the object, the longer the stopping distance will be.
Because: If a vehicle has greater mass. . .it may take longer for it to stop. I know that 18-wheelers take longer to stop than a VW bug, and 18-wheelers have more mass than a VW bug.

Sample Hypothesis: The amount of mass will affect the stopping distance. The more mass the earlier it will stop. A stone wheel rolling down a hill will stop before a rubber tire (score 1 point: $\frac{1}{2}$ point for hypothesis).

Score Point 2 (Example A)

12

The heavier a vehicle is the faster it will stop.

when It weights More gravity is Pulling down on the Vehicle harder Causing More friction

The response states a hypothesis about the relationship between the mass and stopping distance of a vehicle and logically explains how the hypothesis was formed.

Score Point 2 (Example B)

12

I think that the more the MASS of the car is, the more distance it will take to stop. I believe this because it takes more force to accelerate a large car, so it would take longer for it to stop and the distance would be longer.

The response states a hypothesis about the relationship between the mass and stopping distance of a vehicle and provides logical reasoning to support the hypothesis (if it takes more force to accelerate, then it will take longer to stop).

Score Point 1 (Example A)

12

If the mass of a moving vehicle is small then the stopping distance will be larger.

The response states a hypothesis but does not explain how the hypothesis was formed. Even though the hypothesis seems illogical, the response still describes a cause-and-effect relationship that is testable.

Score Point 1 (Example B)

12

If you lower the mass of a vehicle then you will lower the stopping time.

The response states a hypothesis but does not provide logical reasoning to support the hypothesis.

Score Point 0

12

I think a stopping distance from a vehicle is important because the car infront of you could be going in a fast speed and then when it stops it takes long so its better if your distance is far apart of a vehicle.

The response does not state a hypothesis and therefore receives a score of 0.

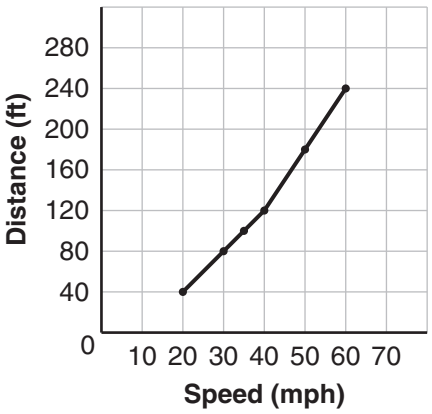
Broad Area of Inquiry: Conducting Investigations
INQ3.8 (9–11) Use accepted methods for organizing, representing, and manipulating data (compare data; display data).

Josh practices his stopping distances at different speeds in a small car. His older brother records the data in the table shown below.

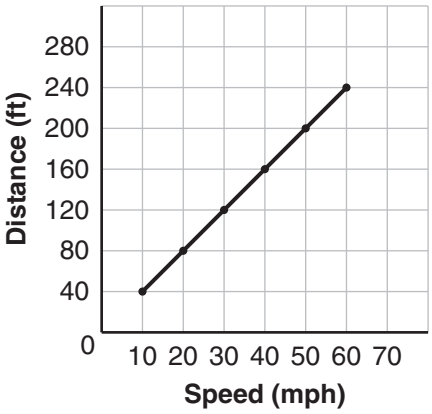
Table 1: Josh's Small Car Data

Trial	Vehicle Speed (mph)	Average Stopping Distance after Multiple Trials (ft)
A	20	40
B	30	75
C	35	95
D	40	120
E	50	175
F	60	240

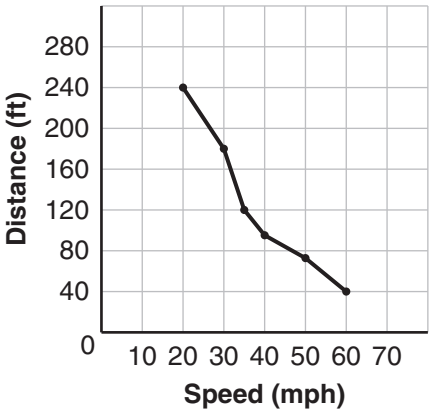
13 Which graph **best** represents Josh's stopping distance data in Table 1? Explain your answer.



Graph A



Graph B



Graph C

Scoring Guide

Score	Description
2	Response identifies correct graph and provides correct explanation.
1	Response identifies correct graph with limited or no explanation.
0	Response is incorrect or contains some work that is irrelevant to the skill or concept being measured.
Blank	No response

SCORE POINT 2 (EXAMPLE A)

13

Graph A. It has all of the points in the correct places on the xy plane. Graph B only has some points correct and Graph C is just wrong.

The response correctly identifies Graph A and explains that Graph A is the only graph that includes all of the correct points.

SCORE POINT 2 (EXAMPLE B)

13

Graph A best represents John's stopping distance because it corresponds correctly to the data table. As his speed increased, the stopping distance also increased, but it was not perfectly linear, so it could not be graph B. There is a steeper climb in the data when speeds get higher, and that is also shown on graph A.

The response correctly identifies Graph A and explains that Graph A is the only graph that increases without being perfectly linear.

Score Point 1

13

I think that Graph A represents Josh's stopping distance.

The response correctly identifies Graph A but omits an explanation.

Score Point 0

13

graph B because it goes straight up and on his tabel it close up fast.

The response identifies an incorrect graph.

Broad Area of Inquiry: Developing and Evaluating Explanations
INQ4.11 (9–11) Analyze data, including determining if data are relevant, artifact, irrelevant, or anomalous (specify relationships between facts; ordering, classifying data).

Josh and his friend Sam have the same kind of vehicle. Sam claims that he can stop his vehicle within 150 ft when traveling at a speed of 55 mph.

14 a. Use the data in Table 1 to determine Sam's actual stopping distance at 55 mph. Do the data support Sam's claim?

b. Use the relationship between speed and stopping distance to explain your answer.

Scoring Guide

Score	Description
3	Response shows that the data do not support Sam's claim. Response uses the data points from the table or graph to correctly refute **or** calculate Sam's stopping distance (205–215 ft) at 55 mph. Response provides a clear explanation of the connection of the data.
2	Response shows that the data do not support Sam's claim. Response uses the data points from the table or graph to correctly refute **or** calculate Sam's stopping distance (205–215 ft) at 55 mph. Response provides a partial explanation of the connection of the data.
1	Response is minimal, but a piece of the process or information is correct.
0	Response is incorrect or contains some work that is irrelevant to the skill or concept being measured.
Blank	No response

Score Point 3 (Example A)

14 a.

Yes ☐

No ■

b. The faster a car is going, the more energy it has, and the harder it is to stop. So if a car going 50 mph took 175 ft to stop, a car going 55 mph should take more than 175 ft to stop, not less.

The response correctly identifies that the data do not support Sam's claim. The response uses the lower bound (50 mph) and explains that a vehicle with a high velocity has more energy than a vehicle with a low velocity and therefore requires more distance to stop.

Score Point 3 (Example B)

14 a.

Yes ☐

No ☑

175
240
415/2 = 207.5

b. The higher the speed, the higher the stopping distance of a vehicle. Even at 50mph, Josh could not stop his car in under 150 ft, so it wouldn't make any sense for him to be able to do so at a higher speed.

The response correctly identifies that the data do not support Sam's claim. The two bounds (50 mph and 60 mph) are averaged to estimate Sam's actual stopping distance, which is far greater than the distance Sam claimed. The response also deduces that Sam's claim is illogical, given that Josh was driving at a slower speed and was unable to stop in the distance that Sam claimed to have stopped in.

SCORE POINT 2 (EXAMPLE A)

14 a. $\frac{f(150)+f(160)}{2} = \frac{175+240}{2} = \frac{415}{2} = 207.5$ feet

Yes ☐

No ☑

b. objects with greater speed have greater momentum, making it harder to stop and requiring a greater stopping distance

The response correctly identifies that the data do not support Sam's claim. The response calculates the average of the two bounds (207.5 ft) and explains the relationship between speed and momentum. However, the response does not use data in the explanation, so the explanation is considered partial.

SCORE POINT 2 (EXAMPLE B)

14 a.

Yes ☐

No ☑

b. Because when josh is driving at a speed of 55mph his stopping distance is around 207ft and it would be impossible for Sam to stop at 150ft.

The response correctly identifies that the data do not support Sam's claim. The response estimates Sam's stopping distance based on the data in Josh's table (207 ft) but does not explain the relationship between speed and stopping distance. The response does not refer to data in the explanation; therefore, the explanation is considered partial.

Score Point 1

14 a.

Yes ☐

No ☑

b. a car with the same mass but going at a faster speed will have a greater stopping time

The response correctly identifies that the data do not support Sam's claim. The response gives a logical statement to explain why the data do not support Sam's claim but does not explain why the statement is true or provide data to support the statement.

Score Point 0

14 a.

Yes ☐

No ☑

b. By the inches of the car how fast you Drive.

The response is totally incorrect and receives a score of 0.

Broad Area of Inquiry: Conducting Investigations
INQ3.8 (9–11) Use accepted methods for organizing, representing, and manipulating data (compare data; display data).

Josh passes his driver's test and borrows his parent's SUV (large vehicle). He observes that the stopping distances he uses in his small car do not stop the SUV in time. For safety purposes, Josh researches stopping distances for SUVs and small cars to better understand the differences.

Table 2: Stopping Distances of Small Cars and SUVs

Speed (mph)	Stopping Distances (ft)	
	Small Car (1,230 kg)	SUV (2,223 kg)
20	40	70
30	75	105
35	95	125
40	120	155
50	175	210
60	240	280

15 Based on the stopping distance data for small cars and SUVs provided in Table 2, construct an appropriate graph with all the required elements to show a comparison of the two.

Scoring Guide

Score	Description
3	• Response correctly labels the axes and appropriately titles the graph. • An appropriate scale is used. • Data sets are correct and show a relationship between variables (*x*- and *y*-axes are correct). • A key is used if needed. • Units are labeled correctly.
2	• Data sets are correct and show a relationship between variables (*x*- and *y*-axes are correct). • Other elements of the graph may be missing or incorrect.
1	• Data sets are incorrect. • Other elements of the graph are correct. • If *x*- and *y*-axes are reversed, maximum score is 1 point.
0	Response is incorrect or contains some work that is irrelevant to the skill or concept being measured.
Blank	No response

Training Notes:

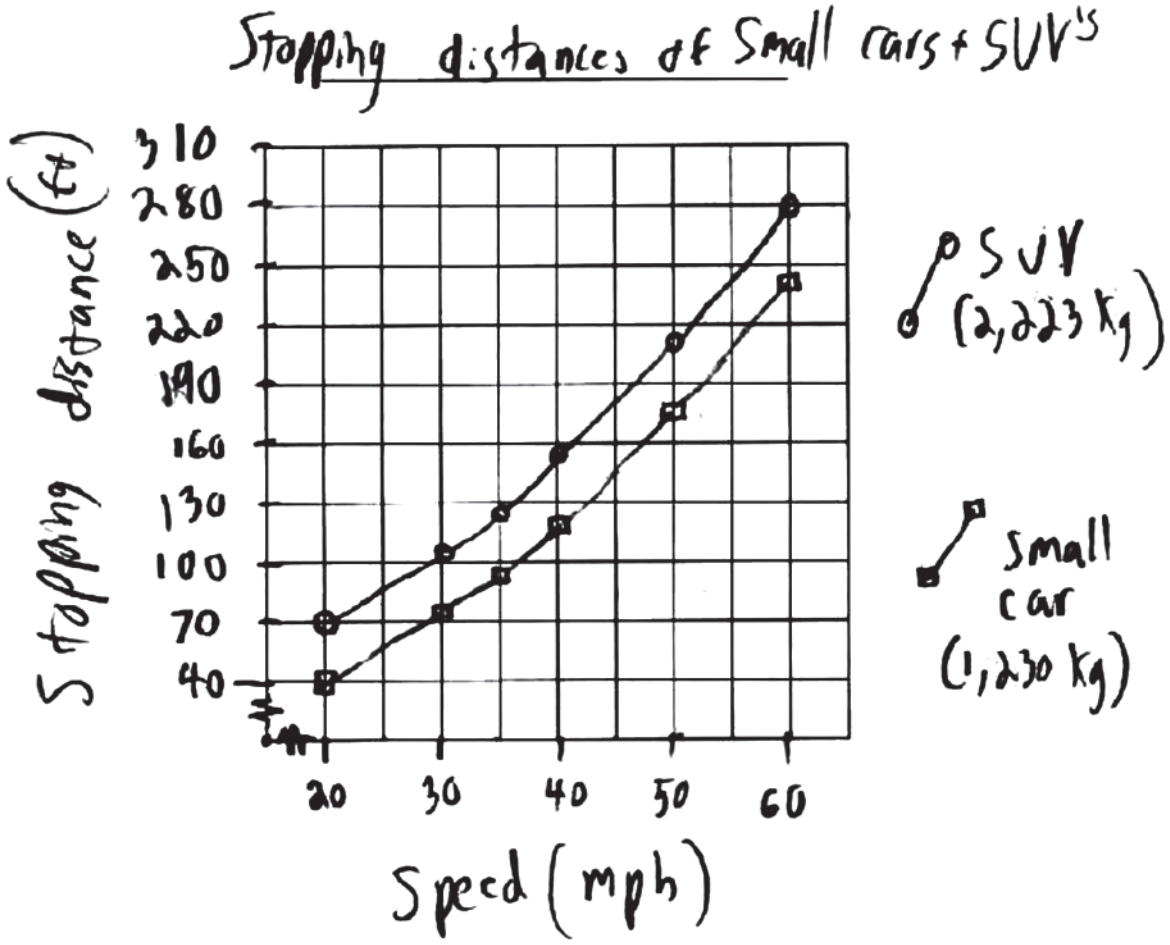
- Scale (major error is incorrect intervals; minor is 0 to break is missing)
- Units (major error)
- Labels (major error)
- Axes (major error)
- Title (*y* vs. *x* is minor error)
- Key (if applicable—minor error)

Notes:

- Points on the graph do not need to be connected.
- There would be two curves on this grid—one for each vehicle. A key would be necessary to identify each.
- Appropriate units must be used.
- Distance vs. speed is an appropriate title.

SCORE POINT 3

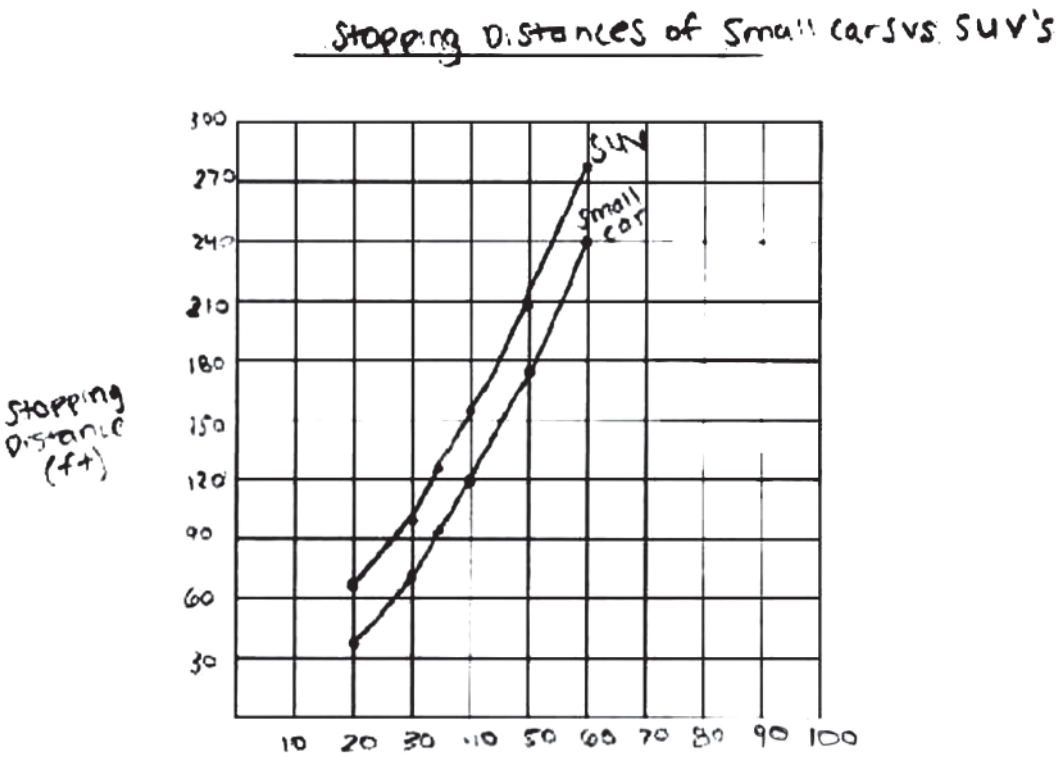
15



The data sets are correctly plotted on the graph and a corresponding key is provided. The axes are labeled with units and appropriately scaled. The truncation symbols from 0–20 and 0–40 are acceptable. The title is not in the preferred dependent vs. independent variable format but is still acceptable for a score of 3.

SCORE POINT 2

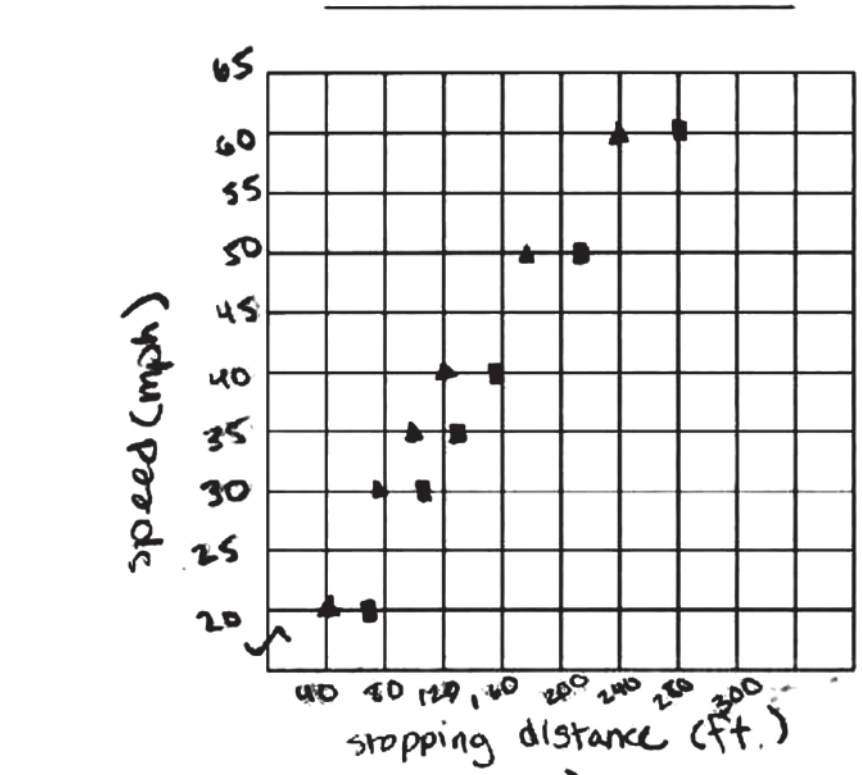
15



The data sets are correctly plotted on the graph and a label is provided for each line. The *y*-axis is appropriately labeled with units and both axes are appropriately scaled. The title is not in the preferred *y*-axis vs. *x*-axis format but is still acceptable. The response receives a score of 2 because the *x*-axis is not labeled.

SCORE POINT 1 (EXAMPLE A)

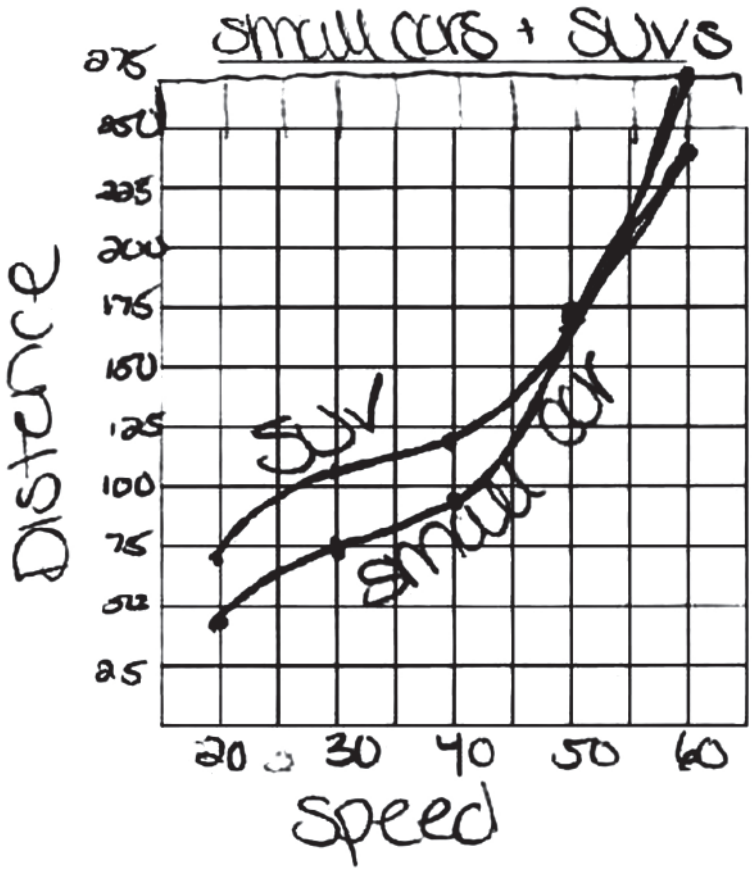
15



The response automatically receives a score of 1 because the independent variable is plotted on the *y*-axis and the dependent variable is plotted on the *x*-axis. In addition, the graph is not titled. However, the points on the graph are correctly plotted, a key is provided, and the axes are appropriately labeled with units and scaled. The response receives credit for an attempt to construct a graph with some correct elements.

SCORE POINT 1 (EXAMPLE B)

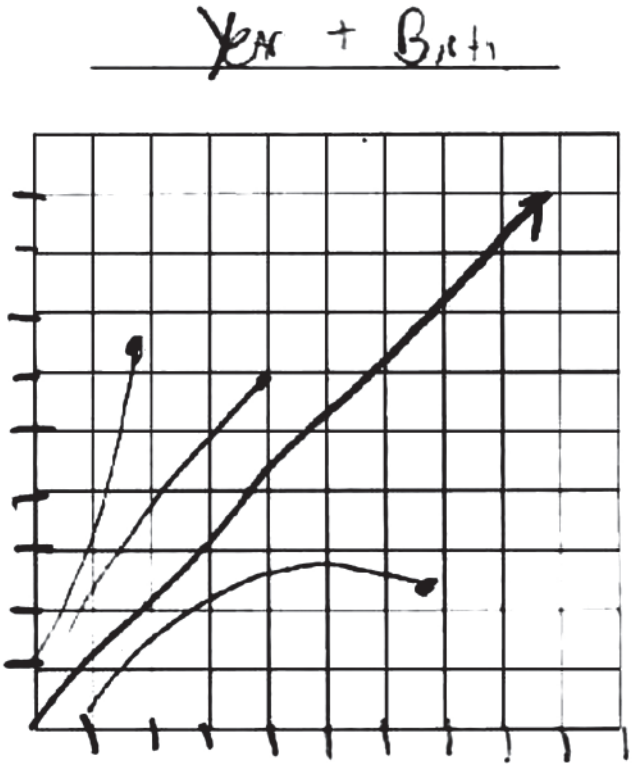
15



The data sets are not correctly plotted on the graph. The points corresponding to 35 mph are not plotted and several points after this point are omitted. The axes are labeled but without units. The scale on the *y*-axis is appropriate, even though it does not stay within the provided grid. The scale on the *x*-axis does not have a truncation symbol between 0–20, which is considered a minor error. The title is weak because it does not adequately describe what the graph represents. Some elements of the graph are correct, so the response receives a score of 1.

SCORE POINT 0

15



The response receives a score of 0 because no elements of the graph are correct.

Broad Area of Inquiry: Developing and Evaluating Explanations
INQ4.12 (9–11) Use evidence to support and justify interpretations and conclusions or explain how the evidence refutes the hypothesis.

16 Determine whether the data in Table 2 **support** or **refute** your hypothesis from question 12. Use evidence to explain how your hypothesis compares with these data.

Scoring Guide

Score	Description
2	Response correctly compares data from Table 2 and states that it supports or refutes the hypothesis from question 12 with correct evidence.
1	Response attempts to support or refute the hypothesis from question 12, but cited evidence may contain errors or omissions.
0	Response is incorrect or contains some work that is irrelevant to the skill or concept being measured.
Blank	No response

Notes:

- An "unsupported" **support** or **refute** does not constitute an attempt. (There is no attempt to use data.)

Score Point 2

16

The data supports my hypothesis. I said the lighter the vehicle the shorter the stopping distance. Josh's data shows that the small car had a shorter stop distance, Ex: At 20 mph, car stopped in 40 ft, SUV 70ft
" 40 mph, car" 120', SUV 155'

The response takes a position and uses data from the table to support the position.

Score Point 1 (Example A)

16

my hypothesis was correct the more mass you have the more distance you need to stop

The response states that the hypothesis is correct (should be supported by data, not correct) and reiterates the results of the experiment. The response receives a score of 1 because it does not provide supporting data.

Score Point 1 (Example B)

16 My hypothesis from question 2 support this graph. An SUV will take a longer distance to stop compared to a small car because the mass of an SUV is larger.

The response confuses the first statement—the graph should support the hypothesis, not the other way around—which is acceptable for a score of 1. The response does not provide supporting data, but it does take a position and reiterates the results of the experiment.

Score Point 0

16 it supported my hypothesis.

The response receives no credit for stating *it supports/does not support the hypothesis* without providing further explanation.

Broad Area of Inquiry: Planning and Critiquing of Investigations
INQ2.5 (9–11) Develop an organized and logical approach to investigating the question, including controlling variables (DOK 2 – routine; DOK 3 – non-routine).

After he gets his driver's license, Josh drives his parent's SUV on a local road. A traffic light turns red, and he applies the brakes so he will stop before the intersection. However, the car takes longer than he expects to stop, and he ends up in the middle of the intersection. Fortunately, Josh's car is the only vehicle on the road; the light turns green, and he starts driving again.

17 Josh wants to find out why the SUV took longer than expected to stop at the intersection. The mass of the SUV did not change. Other factors Josh could test include the wet road surface, the rate of brake application, the inflation of the tires, and the incline of the road.

a. Write a hypothesis that uses a factor other than mass to explain why the SUV took longer than expected to stop. Explain your reasoning.

b. Design an investigation car manufacturers might use to test the hypothesis you wrote in part (a). Explain your reasoning.

Scoring Guide

Score	Description
3	Response contains a hypothesis (1 point) with explanation (1 point) and a procedure (1 point) that **clearly** tests the new hypothesis to determine why Josh's SUV had a longer stopping distance than expected.
2	Response contains a hypothesis with explanation and a procedure that **partially** tests the new hypothesis as to why Josh's SUV had a longer stopping distance than expected. *or* Response contains 2 of the 3 components.
1	Response contains a hypothesis with explanation and a procedure that **minimally** identifies ways to determine why Josh's SUV had a longer stopping distance than expected. *or* Response contains 1 of the 3 components.
0	Response is incorrect or contains some work that is irrelevant to the skill or concept being measured.
Blank	No response

Notes:

- Topic of the hypothesis does not have to come from the four listed in the item.

SCORE POINT 3

17 a. I would believe that a wet road surface would increase the stopping distance of a vehicle because of a decrease in traction. With less traction, the brakes cannot effectively slow the vehicle.

b. This could be easily tested by driving a car at different speeds on a dry road and logging the stopping distance, then doing the same on a wet road. Comparing the data should show whether or not a wet road increases stopping distance.

For part (a), the response states a hypothesis supported with logical reasoning. For part (b), the response explains a way to test the hypothesis and demonstrates an understanding of controlled variables (dry road vs. wet road).

SCORE POINT 2

17 a.

The stopping distance increases when there are wet roads.

b.

He could conduct an experiment by driving the same vehicle at a constant speed on dry ground and see the stopping distance. Then he could do the same on a rainy day.

For part (a), the response states a hypothesis but does not provide logical reasoning to support the hypothesis. For part (b), the response explains a way to test the hypothesis and demonstrates an understanding of controlled variables (speed, dry/wet ground). The response receives a score of 2 for the omission in part (a).

SCORE POINT 1

17 a.

~~If a vehicle is travelling at an accelerated rate, then it will take longer for the vehicle to stop. OR:~~ If a vehicle is travelling downhill, then it will take longer for the vehicle to stop.

b.

There are too many variables to be able to test this hypothesis correctly/accurately.

For part (a), the response states a hypothesis but does not provide logical reasoning to support the hypothesis. For part (b), the response receives no credit for a refusal.

SCORE POINT 0

17 a.

I think the suv took long cause I whieghs more then the car.

b.

Ford explore loger stopping distance than A Honda civic.

For part (a), the response uses mass as the variable and therefore does not form an alternate hypothesis. The question instructs to "use a factor other than mass." The response receives no credit.