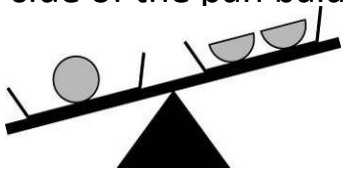
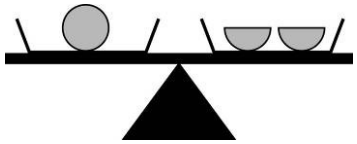
Physical Sciences Samples

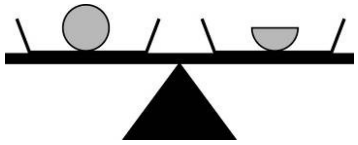
Grade: 3
State: NA

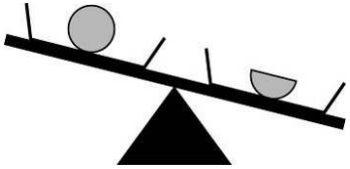
Standard: Knows that the weight of an object is equal to the sum of the weights of its parts.

Andy makes a pan balance using a wooden ruler and cardboard tray. Andy places a plastic ball on one side of the pan balance. He cuts an identical plastic ball into half and places them on other side of the pan balance. Which of these correctly show the pan balance and the balls?

A 

B 

C 

D 

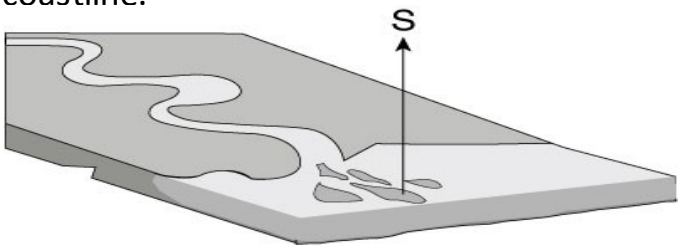
Solution: The correct response is B.

Grade: 7
State: Georgia

CTB McGraw-Hill

Standard: Explain the effects of physical processes (plate tectonics, erosion, deposition, volcanic eruption, gravity) on geological features including oceans (composition, currents, and tides).

Look at the diagram of a coastline.



Which of these causes landform S to form?

A. erosion by river water
B. erosion by ocean waves
C. deposition by river water
D. deposition by ocean waves

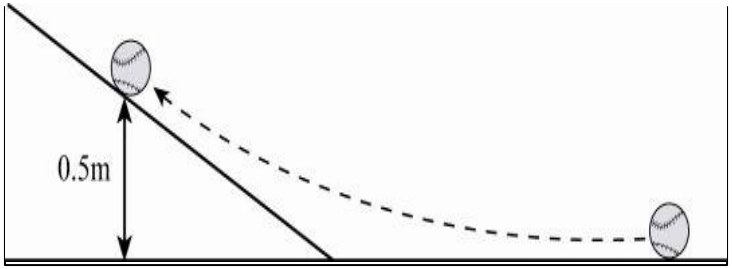
Distractor analysis
A. The deposition of soil particles by the river causes a delta to form and not erosion.
B. Wave action of ocean waves does not erode soil or sand to form delta.
C. Key. Delta is formed by deposition of soil and sediments brought by river.
D. Deposition occurring due to ocean waves does not result in the creation of a delta.

Grade: 8
State: EOG North Carolina

Standard: Investigate and analyze storage of energy:

a. Kinetic energy
b. Potential energies: gravitational, chemical, electrical, elastic, nuclear
c. Thermal energy.

A student rolls a ball with a mass of 140 grams over a frictionless inclined plane.



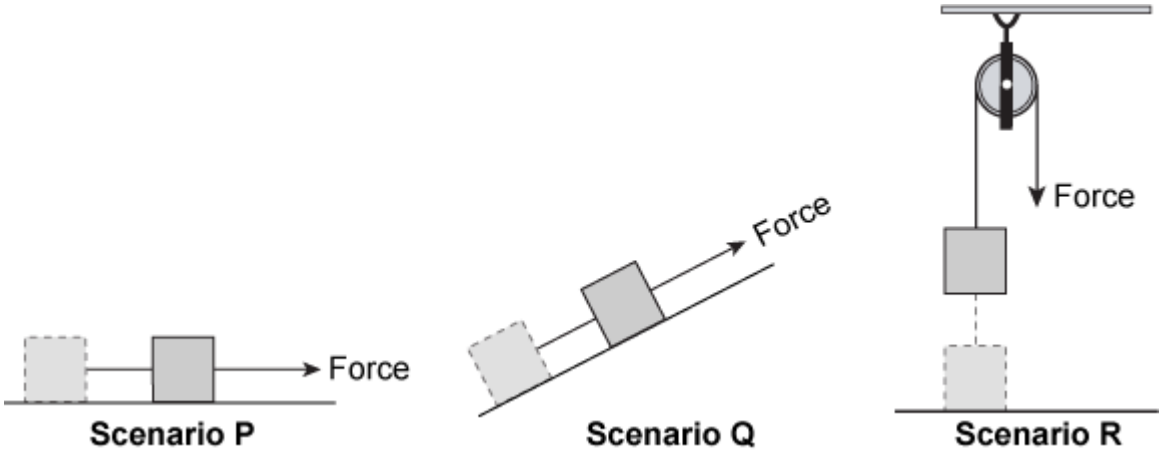
The ball reaches a height of 0.5 m and then rolls down again.
What is the kinetic energy and gravitational potential energy of the ball at 0.5 m?

A. The kinetic energy is 0.686 J and the gravitational potential energy is 0 J.
B.* The gravitational potential energy is 0.686 J and the kinetic energy is 0 J.
C. The gravitational potential energy and kinetic energy are both equal to 0.686 J.
D. The gravitational potential energy and kinetic energy are both equal to 0 J.

Grade: 12
State: Connecticut

Standard: Changes in gravitational potential energy near Earth can be calculated by using the formula (change in potential energy) = mgh.

A student changes the position of an object in three possible ways.

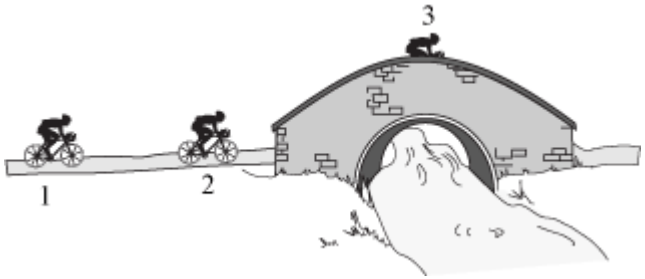


In which of these scenarios does the potential energy of the object change?

A. *Q and R
B. P and Q
C. P and R
D. P, Q and R

Grade: 12
State: Connecticut

Standard: Kinetic energy can be calculated by using the formula $E = (1/2)mv^2$.



The velocity of a cyclist at position 1, is 4.5 m/s. On reaching position 2, his velocity doubles.
a. What is the change in kinetic energy when he reaches position 2?
b. If he maintains the same speed as position 2, what will be his kinetic energy at position 3?
c. Will the mass of the bicycle have any effect on the kinetic energy of the cyclist?

Possible correct responses:

a. The kinetic energy of the cyclist at position 1 = $(½)mv^2$
= $(½)m(4.5\ m/s)^2$
= 10.125m Joules
The kinetic energy of the cyclist at position 2 = $(½)mv^2$
= $(½)m(9\ m/s)^2$
= 40.5m Joules
Change in kinetic energy = 40.5m - 10.125m
= 30.375
b. The kinetic energy depends only on mass and velocity. Therefore despite cycling on an incline, since the cyclist' velocity at position 3 is the same as position 2, his kinetic energy remains the same.
c. The kinetic energy of an object depends on its mass and velocity. The mass of the bicycle will have no effect on the kinetic energy of the cyclist.

Grade: 12
State: Connecticut

Standard: Kinetic energy can be calculated by using the formula $E = (1/2)mv^2$.

3-Point Rubric:

Score 3

The response uses the correct formula for kinetic energy, computes its value at position 1 and 2 and then works out the change in kinetic energy, when he reaches position 2.
The response also indicates that the kinetic energy of cyclist at position 3 will be same as position 2 and that the mass of the bicycle will have no effect on the kinetic energy of the cyclist.

Score 2

The response uses the correct formula for kinetic energy, correctly computes its value at position 1 and 2 and then works out the change in kinetic energy, when he reaches position 2, and the response also indicates that the kinetic energy of cyclist at position 3 will be same as position 2. However, the response fails to indicate that the mass of the bicycle will have no effect on the kinetic energy of the cyclist
OR
The response indicates that the kinetic energy of cyclist at position 3 will be same as position 2. Also, the response indicates that the mass of the bicycle will have no effect on the kinetic energy of the cyclist. However, the response fails to provide the change in the kinetic energy of the cyclist when he moves from position 1 to position 2.
OR
The response uses the correct formula for kinetic energy, correctly computes its value at position 1 and 2 and then works out the change in kinetic energy, when he reaches position 2. Also, the response indicates that the mass of the bicycle will have no effect on the kinetic energy of the cyclist. However, the response fails to indicate that the kinetic energy of cyclist at position 3 will be same as position 2.

Grade: 12
State: Connecticut

Standard: Kinetic energy can be calculated by using the formula $E = (1/2)mv^2$.

Score 1

The response uses the correct formula for kinetic energy, correctly computes its value at position 1 and 2 and then works out the change in kinetic energy, when he reaches position 2. It fails to explain the effect of mass of the bicycle on kinetic energy of the cyclist and fails to indicate that kinetic energy at position 3 is same as position 2.

OR

The response indicates that the kinetic energy of cyclist at position 3 will be same as position 2. It fails to work out the change in kinetic energy on moving from position 1 to position 2 and fails to explain the effect of mass of the bicycle on the kinetic energy of the cyclist.

OR

The response indicates that the mass of the bicycle will have no effect on the kinetic energy of the cyclist. It fails to work out the change in kinetic energy on moving from position 1 to position 2 and fails to indicate that kinetic energy at position 3 is same as position 2.

Score 0

The response provides little or no accurate or relevant information related to the questions.

Grade: 11
State: Connecticut

Standard: The shape of simple molecules and their polarity can be predicted from Lewis dot structures.

Lithium oxide (Li_2O) is an ionic compound and carbon dioxide (CO_2) is a covalent compound. The table below represents the likely Lewis dot structures of Lithium oxide and Carbon dioxide.

Row	Lithium oxide (Li_2O)	Carbon dioxide (CO_2)
1	Li·· Ö ··Li	:Ö··C⁝⁝Ö:
2	Li·· Ö ··Li	:Ö: :C: :Ö:
3	$Li^+[:\ddot{O}:]^{2-}Li^+$	:Ö: :C: :Ö:
4	$Li^+[:\ddot{O}:]^-Li$	:Ö··C⁝⁝Ö:

Which row correctly represents the Lewis dot structure of Lithium oxide and Carbon dioxide?

A. *Row 3
B. Row 4
C. Row 2
D. Row 1

Grade: 10
State: Connecticut

SCANTRON

Standard: - Use mathematical operations to analyze and interpret data, and present relationships between variables in appropriate forms

An experiment was done to study the growth of Kentucky blue grass at varying pH of soils. The following table shows the results.

Condition	Soil pH and Height of Kentucky Blue Grass (mm)				
	pH 6.0	pH 6.5	pH 7.0	pH 7.5	pH 8.0
Average Grass Height	85	365	375	104	65

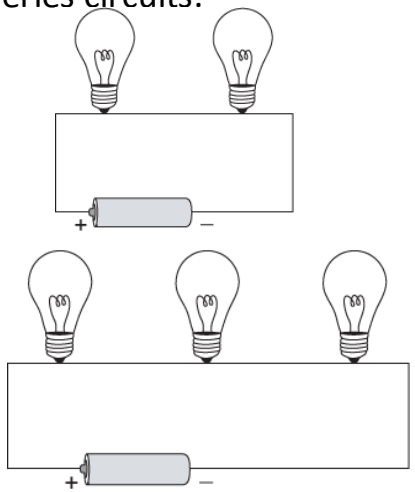
Which of the following graphs would be suited to interpret this data?

A. *Bar graph
B. Pie graph
C. Line graph
D. Scatter graph

Grade: 11
State: Connecticut

Standard: Formulate a testable hypothesis and demonstrate logical connections between the scientific concepts guiding the hypothesis and the design of the experiment.

A group of students wrote the following procedure for their investigation of simple series circuits.



1. Connect a battery and two bulbs as shown in the diagram below.

2. Add one bulb to the series circuit as shown in the diagram below.

3. Make an observation about the brightness of the bulbs and record it in a table.

4. Repeat steps 1-3 until there are a total of 5 bulbs in the circuit.

Which is **most likely** the hypothesis for this investigation?

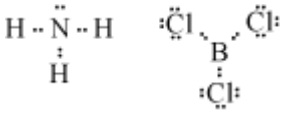
A. *If adding bulbs to a series circuit increases resistance, then the bulbs should be dimmer.
B. Adding bulbs to a series circuit will cause the bulbs to become dimmer.
C. Increasing the current causes the bulbs to become brighter.
D. If increasing the voltage provides more current, then the bulbs will become brighter.

Grade: 11
State: Connecticut

SCANTRON®

Standard: The shape of simple molecules and their polarity can be predicted from Lewis dot structures.

The Lewis dot structures of Ammonia (NH_3) and Boron trichloride (BCl_3) are shown below.



Which of these is **true**?

A. *NH_3 is polar and BCl_3 and is nonpolar.
B. NH_3 is nonpolar and BCl_3 and is polar.
C. Both NH_3 and BCl_3 are nonpolar.
D. Both NH_3 and BCl_3 are polar.

Grade: 11
State: Connecticut

Standard: The shape of simple molecules and their polarity can be predicted from Lewis dot structures.

Gold is a good conductor of electricity while sulfur is not a good conductor of electricity.
What type of bond is found in gold that makes it a good conductor? What type of bond is found in sulfur that makes it a poor conductor? Explain your answers.

Possible correct responses:

Gold is a metal and contains metallic bonds. Sulfur is a nonmetal and contains covalent bonds.
Metallic bonds are formed between metal atoms, where they "share" free electrons between them. These free electrons are not attached to one particular atom as they would be in ionic or covalent bonds. Thus, in metals, electrons are free to move around making them good conductors of electricity. Gold has a high number of free electrons that makes it a good conductor. Since sulfur contains covalent bonds, it has no free electrons, and is a poor conductor.

3-Point Rubric:

Score 3

The response correctly identifies the type of bonding in gold and sulfur, the properties of metallic bonds, and the properties of covalent bonds.

Score 2

The response correctly identifies the type of bonding present in gold and sulfur. The response fails to provide explanation for gold being a good conductor of electricity and sulfur being a bad conductor of electricity.

Score 1

The response incorrectly identifies the type of bonding present in gold and sulfur. Further the response provides inadequate explanation for gold being a good conductor of electricity and sulfur being a bad conductor of electricity.

Score 0

The response provides little or no accurate or relevant information related to the questions