

Part 1 / MCQ:

1	Students will explore how to describe the position and motion of an object.	Q 1 a	U2M1L1: Position and Motion: Student Book Page 13 and 14
		Q 1 b	

Moving in Two Dimensions

**** Sometimes you need to use more than one reference direction to describe an object's position.**

**** When you describe position using two directions, you are using two dimensions.**

**** To describe a position on a map, you might choose north and east or south and west as the reference directions.**

**** Sometimes north, south, east, and west are not the most useful reference directions.**

**** Imagine that you are looking at a skyscraper. You might describe a certain window as "up" and "to the left."**

• Suppose you want to locate your classmate's home on a map.

• To find a position in two dimensions.

• first choose a reference point. You could choose your home as a reference point.

• Next, give specific reference directions. For example, south and east.

• Then, determine the distance along each reference direction.

• For example, your classmate's home might be one block south and one blocks east of your home.



0565618257	Grade 8 General	Ms/ Reham Khaled
U 1 , 2	<u>Revision</u>	Term 1

3) To determine if an object has changed position, you need to know its position relative to another object. _____

- ☒ True
- ☐ False

COLLECT EVIDENCE

How can you describe the position of the train from the beginning of the lesson? Record your evidence (A) in the chart at the beginning of the lesson.

- A complete description of your position includes a **distance**, a **direction**, and a **reference point**.

2	Students will explore how to describe the position and motion of an object. They will analyze data including graphs to help construct and present arguments about the changes over time in the motions of objects	Q 2 a Q 2 b	U2M1L1: Position and Motion; Student Book Page 11,12
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Where are you right now?

- **A reference point:** is the starting point you choose to describe the location, or position, of an object.
- **A position:** is an object's distance in a certain direction from a reference point.
- A complete description of your position includes a **distance**, a **direction**, and a **reference point**.

The Reference Direction

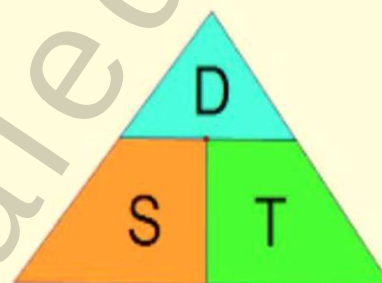
- Sometimes direction is described using the words **positive** or **negative**.
- **The reference direction** is the positive **(+)** direction.
- The **opposite** direction is the negative **(-)** direction.
- Suppose east is the reference direction in the diagram below.

Average Speed Equation

$$\text{average speed (in m/s)} = \frac{\text{total distance (in m)}}{\text{total time (in s)}}$$

$$\bar{v} = \frac{d}{t}$$

Distance = Speed x Time



$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

$$\text{Time} = \frac{\text{Distance}}{\text{Speed}}$$

** A cyclist travels 60 kilometers in 2 hours. How would you calculate their average speed, and what does it tell you about their motion?

$$d = 60 \text{ Km} \quad t = 2 \text{ h} \quad v = ?$$

$$\bar{v} = \frac{d}{t} = \frac{60}{2} = 30 \text{ Km/h}$$

- This means the cyclist was moving at a constant average speed of 30 kilometers per hour during the entire trip.

1. A truck driver makes a trip that covers 2,380 km in 28 hours. What is the driver's average speed in km/h?

$$d = 2380 \text{ Km} \quad t = 28 \text{ h} \quad v = ?$$

$$\bar{v} = \frac{d}{t} = \frac{2380}{28} = 85 \text{ Km/h}$$

** **Newton's second law of motion** describes the relationship between an object's acceleration and the net force that acts on the object.

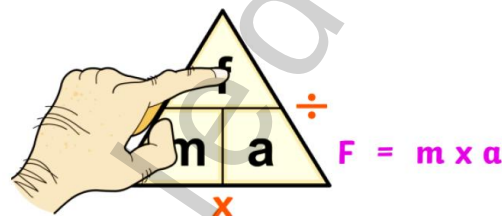
** The **acceleration** of an object is **equal** to the net **force** acting on the object **divided** by the object's **mass**.

** The direction of acceleration is the same as the direction of the net force.

Acceleration Equation

$$\text{acceleration (in m/s}^2\text{)} = \frac{\text{force (in N)}}{\text{mass (in kg)}}$$

$$a = \frac{F}{m}$$



MATH Connection

In the PhET interactive simulation, a force of 100 N is applied to the wrapped present, giving it an acceleration of 2 m/s².

$$a = F/m$$

$$m = F/a = 100 / 2 = 50 \text{ Kg}$$

What is the acceleration when a force of 2.0 N is applied to a ball that has a mass of 0.60 kg?

$$a = F/m$$

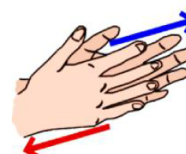
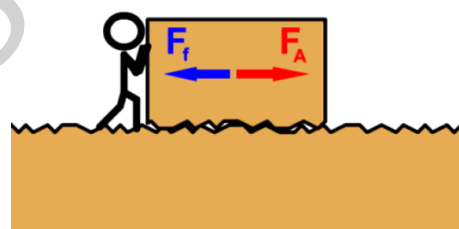
$$a = 2/0.60 = 3.3 \text{ m/s}^2$$

5	Students will explore how force affects motion. They will plan and carry out investigations to enhance their understanding of the changes in motion caused by a net force.	Q 5 a Q 5 b	U2M1L2: Force and Acceleration; Student Book Page 45,46 and 47
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How does friction affect motion?

**** Friction:** is a force that resists the sliding motion of two surfaces that are touching.

**** The force of friction acts in the opposite direction of the motion.**



• Example: When you push the book, the book moves.

- This is because the force you apply to the book is greater than the friction between the book and the table.



- If you **stop** pushing, **friction** **stops** the book.

**** What would happen if there were no friction between the book and the table?**

- According to Newton's second law, the book would continue to move at the same speed in the same direction unless a force changed its motion.

LAB

Sticky Situation



6. Compare the forces required to pull the block across the two surfaces.

- The force to slide the block across the table was less than the force required to slide the block across the sandpaper.

7. How did changing the surface affect the motion of the block?

- Changing the surface made it harder to change the motion of the block.

8. Which surface created a larger opposing force? Explain.

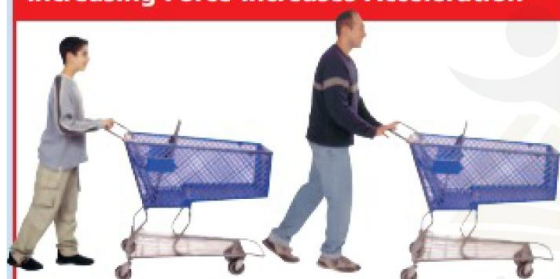
- The sandpaper created a larger opposing force because the surface was rough and not smooth like the table.



THREE-DIMENSIONAL THINKING

In what ways does Newton's second law of motion describe **stability and change** of any **system** that has forces acting on it?

Answers will vary. Sample answer: Stability can be obtained by balanced forces. This stability can only be changed by an imbalance in the forces acting on an object.

Increasing Force Increases Acceleration

small force



acceleration



larger force



acceleration

The force exerted on the cart by the man is greater than the force exerted on the same cart by the boy, so the acceleration is greater.

Newton's Second Law

The acceleration of an object increases with increased force, decreases with increased mass, and is in the same direction as the force.

FIRST CASE

NEWTON'S SECOND LAW OF MOTION**Increasing Mass Decreases Acceleration**

small mass



acceleration



larger mass



acceleration

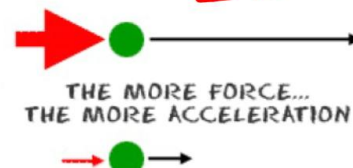
The mass of the full cart is greater than the mass of the empty cart, and the boy is pushing with the same force, so the acceleration is less.

Newton's Second Law

The acceleration of an object increases with increased force, decreases with increased mass, and is in the same direction as the force.

SECOND CASE

$$\mathbf{F=ma}$$

**NEWTON'S SECOND LAW OF MOTION****COLLECT EVIDENCE**

How do multiple forces help explain what happens when you push or pull a water tube? Record your evidence (C) in the chart at the beginning of the lesson.

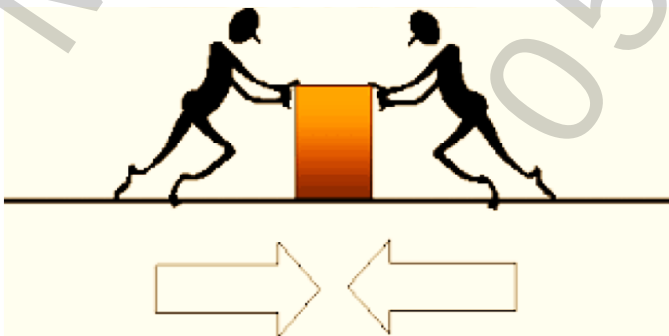
****** When you push or pull a water tube, multiple forces act on it. Your hand applies a force in one direction, while friction and resistance from the water push back in the opposite direction. The motion of the tube depends on the net force — the combination of all these forces. If the push is stronger than the opposing forces, the tube moves. If forces are balanced, it stays still.

How do multiple forces change motion?

- Force has both size and direction.
- Arrows can be used to show the size and direction of a force.
- Usually more than one force is acting on an object at a time. The forces can be added together to find **the net force**.
- **The net force:** is the sum of all the forces acting on an object.
- The net force can be modeled with **a free-body diagram**.
- **A free-body diagram:** is a simple model that can help you understand the forces acting on an object.

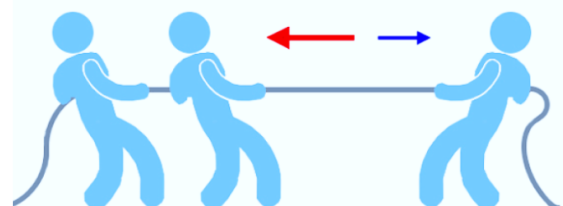
How can forces act on an object that is not changing its motion?

- **Newton's first law of motion** states that if the net force on an object is zero, the motion of the object does not change.
- **balanced** forces cause **no change** in the motion of an object. This is true when an object is at rest or in motion.
- **Unbalanced** forces cause **change** in the motion of an object. This is true when an object is at rest or in motion.



Unbalanced Force Example

A Game of Tug-of-war



Balanced force



Net force = 0

Object stays rest or
move constant
speed

Unbalanced force

Net force $\neq 0$ Speed
increases/decreases

Accelerate

7 Students will explore how to describe the position and motion of an object. They will analyze data including graphs to help construct and present arguments about the changes over time in the motions of objects.

Q 7 a

Q 7 b

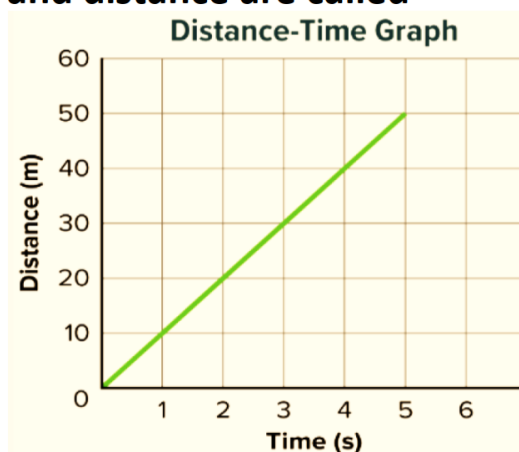
U2M1L1: Position and Motion;
Student Book Page 29

**** You are analyzing a distance-time graph. What features would indicate that an object is moving at a constant speed?**

**** Graphs that show comparisons between time and distance are called distance-time graphs.**

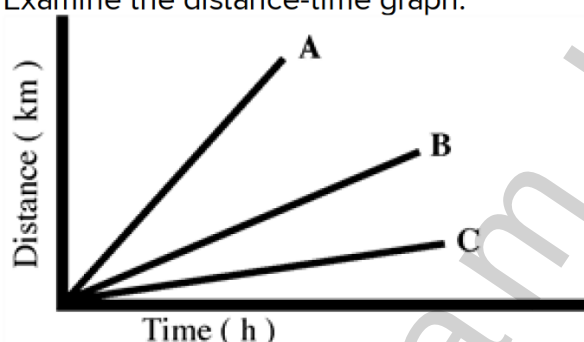
**** The change in distance is the same each second on the graph below, which represents an object moving at constant speed.**

**** Constant speed is shown as a straight line on distance-time graphs.**



When an object is moving at a constant speed, the line will be straight. The steeper the line, the greater the slope, which means the greater the speed of the object.

9) Examine the distance-time graph.



a. Which line represents travel at the fastest speed? Justify your answer.

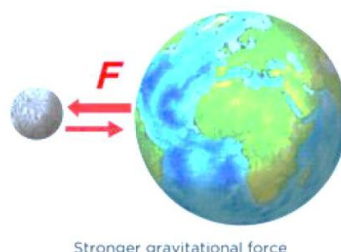
- Line A represents travel at the fastest speed. It represents an object that travels the greatest distance per unit of time.

8	Students will explore the attractive nature of gravitational force, the factors that affect it, and how it affects the motion of objects. They will model systems of objects to compose arguments from evidence about these forces.	Q 8 a Q 8 b	U2M1L4: Gravitational Force; Student Book Page 87 and 88
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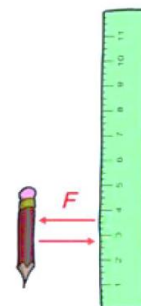
How can the force of gravity be measured?

**** Earth has more mass than any object near you.**

**** As a result, the gravitational force that Earth exerts on you is greater than the force exerted by any other object.**



Stronger gravitational force



Weaker gravitational force

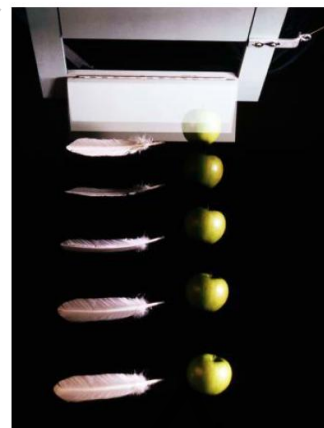
Gravitational Acceleration:

**** Newton's second law of motion** states that the force on an object can be found by multiplying mass by acceleration.

**** You can find the gravitational acceleration by dividing the force of gravity on objects by the mass of the objects.**

**** When the only force acting on a falling object is gravity, all objects fall with the same acceleration.**

**** Near Earth's surface, the acceleration is 9.8 m/s^2 . It is called gravitational acceleration (g).**



Weight

Weight Equation

$$\text{weight (N)} = \text{mass (kg)} \times \text{gravitational acceleration (m/s}^2\text{)}$$

$$W = mg$$

**** Because weight is a force, it is measured in newtons.**

**** Weight:** is the gravitational force exerted on an object.

**** Near Earth's surface, an object's weight is the gravitational force exerted on the object by Earth.**

LAB Weighing Washers

Analyze and Conclude, continued

7. **MATH Connection** Divide each force of gravity by its mass to see if there is a common ratio between mass and weight. Show your work in the space below.

$$a = \frac{F}{m}$$

$$g = \frac{W}{m}$$

LAB Weighing Washers

8. **MATH Connection** Did you see a pattern in the ratios between mass and weight? Explain what you think this pattern means.

- ** The ratio should be close to 10.
- ** force equals mass x acceleration.
- ** They found the acceleration due to gravity.
- ** This is a constant number at 9.8 m/s^2 .

9	Students will explore the sequencing of events preserved in the geological record. They will use models to observe time phenomena and analyze and interpret rock strata and the fossil record to provide relative dates. They will construct scientific explanations based on evidence gathered and an understanding of the principles of relative-age dating.	Q 9 a	U1M1L1: Analyzing the Rock and Fossil Records; Student Book Page 17 and 18
		Q 9 b	

- ** When studying rock layers in a canyon, how can you tell which layers are the oldest? Explain using geological principles.

What is relative-age dating?

Geologists:- the scientists who study Earth and rocks.

** Geologists use **rock layers** and **the fossils** within to build a record of Earth's geologic history.

** **How do rock layers form?**

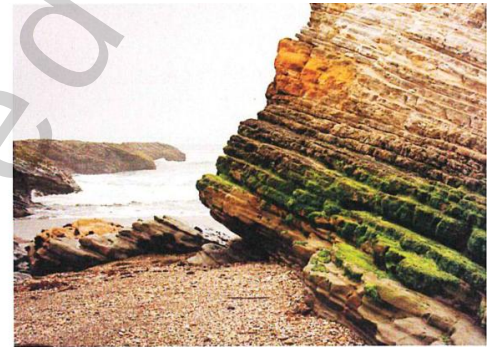
Weathering:- breaks rocks exposed at Earth's surface into smaller pieces called **sediment**.



- Over time, gravity, water, and wind carry sediment downhill and deposit it in low areas.
- Eventually, layers of sediment form.
- The increasing weight of the sediment slowly causes the layers to compress, forming layers of rock called **strata**.

Relative Age:

**** Relative age:-** is the age of rocks and geologic features compared with other rocks and features nearby.



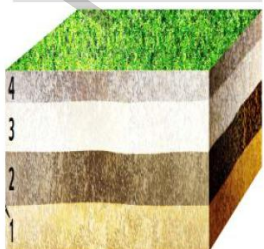
**** Geologists have developed a set of principles to organize rock layers according to their relative ages.**

**** Using the principles of relative-age dating, geologists can determine if rocks or features are **younger** or **older** than the rocks or **features around them**.**

The Principles of Relative-Age Dating

1/ Superposition

- It is the principle that in undisturbed rock layers, the oldest rocks are on the bottom.



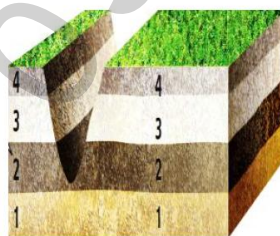
2/ original horizontality

- The most rock-forming materials are deposited in horizontal layers.



3/ Lateral continuity

- It is the principle that sediments are deposited in large, continuous sheets in all lateral directions.



4/ inclusions

- If one rock contains pieces of another rock, the rock containing the pieces is younger than the pieces.

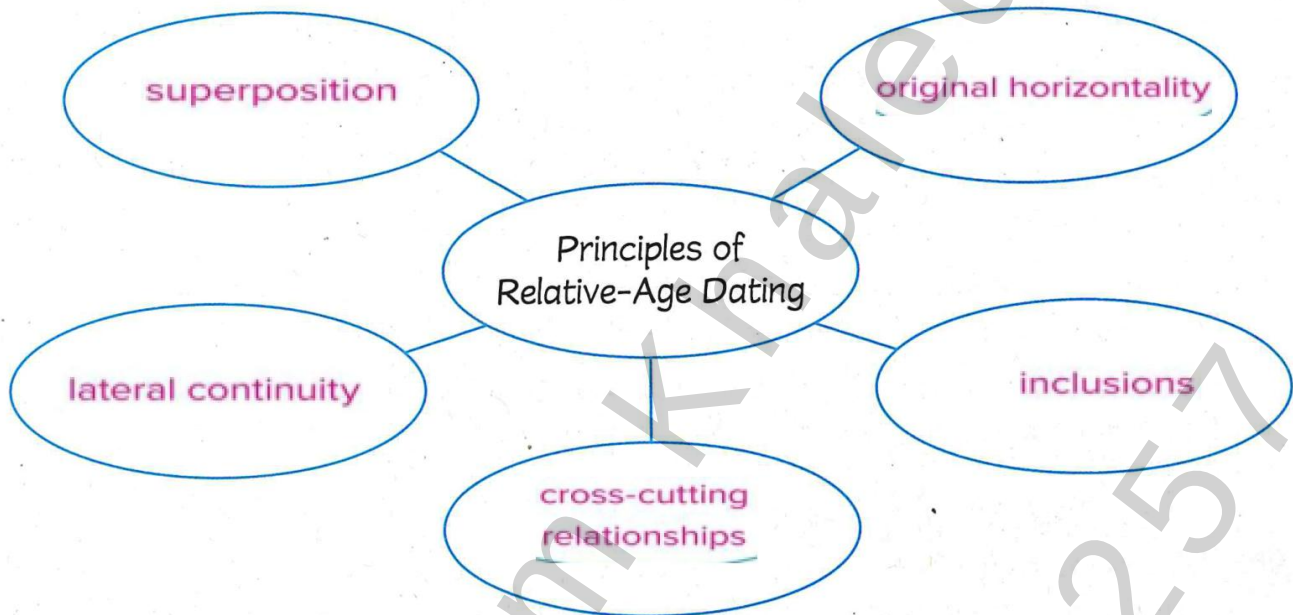


5/ cross-cutting relationships

- If one geologic feature cuts across another feature, the feature that it cuts across is older.



7. What are the principles of relative-age dating?



8. Which principle did you apply in Step 2 of the investigation?

superposition

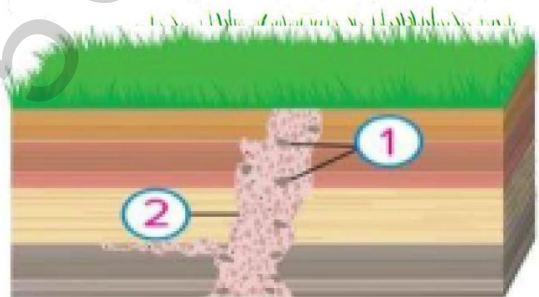
Using this principle, assign the rock layers in the diagram to the right their relative ages from oldest (1) to youngest (4).



9. Which principle did you apply in Step 4 of the investigation?

inclusions

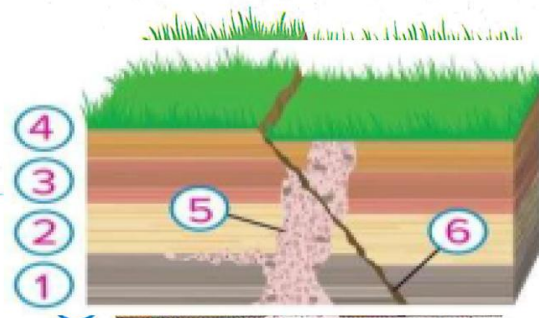
Using this principle, label the older feature 1, and the younger feature 2 on the diagram to the right.



10. Which principle did you use in Step 6 of the investigation?

cross-cutting relationships

Using this principle, label the rock layers and features from oldest (1) to youngest (6).



** If a ball is placed at the 10 cm mark and your reference point is at the 40 cm mark, how would you describe the ball's position relative to the reference point?

- The ball is 30 cm behind the reference point or 30 cm to the left of it, relative to the 40 cm mark.

INVESTIGATION

Start from Here

1. Put a sticky note at the 50-cm mark of a meterstick. This is your reference point.
2. Place a small object at the 40-cm mark. It is 10 cm in the negative direction from the reference point.
3. Continue moving the object and recording its distance, its reference direction, and its position to complete the table below.

Position of Object		
Distance (cm)	Reference Direction	Position (cm)
10 cm	negative	40 cm
40 cm	positive	90 cm
15 cm	positive	65 cm
25 cm	positive	75 cm
20 cm	negative	30 cm

4. How would the data in the table change if the positions were the same, but the reference point was at the 40-cm mark? Complete the table below with the new information.

Position of Object		
Distance (cm)	Reference Direction	Position (cm)
0 cm	—	40 cm
50 cm	positive	90 cm
25 cm	positive	65 cm
35 cm	positive	75 cm
10 cm	negative	30 cm

11

Students will explore how to describe the position and motion of an object. They will analyze data including graphs to help construct and present arguments about the changes over time in the motions of objects

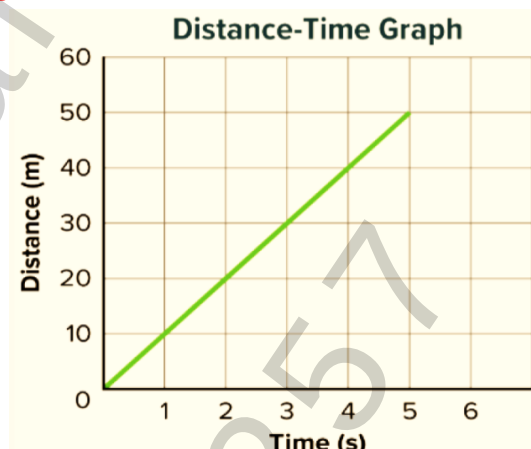
Q 11 a

Q 11 b

U2M1L1: Position and Motion;
Student Book Page 22

**** How can you determine whether an object is moving at a constant speed, and what evidence would support your conclusion?**

- Measuring the distance it travels at regular time intervals.
- If the object covers equal distances in equal amounts of time, then it's moving at constant speed.



**** Evidence to support this:**

- A position-time graph shows a straight line with a constant slope.
- Speed = distance ÷ time stays the same at each interval.

**** Give two examples from everyday life where an object moves at a constant speed.**

1. A car driving on a highway at 100 km/h without changing speed.
2. An escalator moving people upward at a steady pace.

12

Students will explore how geologists use correlation, evidence of Earth's major events, and the fossil record to build a timeline of Earth's history. They will create a scale model of the geologic time scale and construct scientific explanations to enhance their understanding of how the geologic time scale is interpreted from rock strata and used to organize Earth's history.

Q 12 a

Q 12 b

U1M1L2: Building a Timeline;
Student Book Page 34, 35 and 36

**** Geologists often compare rock layers from different locations. What is this process called, and how does it help in understanding Earth's history?**

- This process is called correlation.
- It helps geologists match rock layers from different locations by comparing features like fossils, composition, and thickness.
- This allows them to build a more complete picture of Earth's history, identify the same time period across regions, and understand how geological events occurred over large areas.

COLLECT EVIDENCE

How do geologists fill gaps in the rock record? Record your evidence (A) in the chart at the beginning of the lesson.

**** Geologists fill in gaps in the rock record by matching rock layers or fossils from separate locations.**

**** This is particularly helpful when unconformities occur, or when rocks are buried underground.**

Correlation:

**** Geologists fill gaps in the rock record through**

Correlation.



**** Correlation:-** the matching of rock layers or fossils exposed in one geographic region to similar layers or fossils exposed in other geographic regions.

**** If two or more rock formations contain fossils of **about the same age**, scientists can infer that the formations are also **about the same age**.**

**** Not all fossils are useful in determining the relative ages of rock layers.**

**** Index fossils:-** the most useful fossils represent species that existed on Earth for a short length of time, were abundant, and inhabited many locations.

**** The correlation of fossils and rock layers aids in the relative dating of rock sequences and helps geologists understand the history of larger geographic regions.**

**** It is largely through correlation that geologists have constructed Earth's time line.**

What happens when the rock and fossil records are not complete?

- ** Geologists use rock layers and the fossils within to build a record of Earth's geologic history.
- ** A complete rock record In one place, however, does **not** exist.
- ** Weathering, erosion, volcanism, and other processes are constantly changing Earth's surface.
- ** This makes it **difficult** to find a sequence of rock layers that haven't been disturbed.
- ** Sometimes, the record of a past event or time is completely eroded away.

Unconformities:

**** Unconformities:-** when new sediment is deposited on top of old, eroded rock layers, the eroded surface represents a gap in the rock record.



** Unconformities could represent **a few hundred years**, **a million years**, or even **billions** of years.

Types of Unconformities

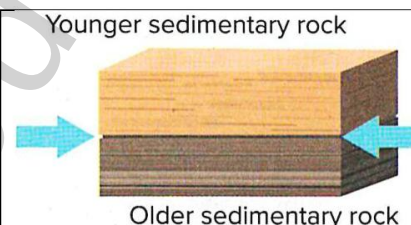
1/ An angular unconformity

2/ A disconformity

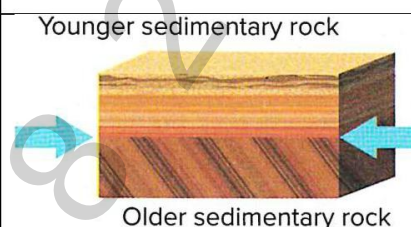
3/ A nonconformity

1/ An angular unconformity

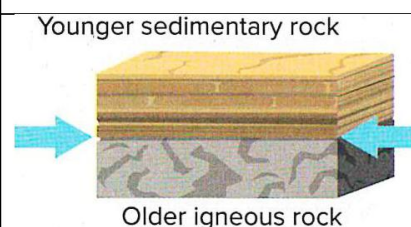
- When horizontal layers of sedimentary rock are deformed during mountain building or other geologic events, they are usually **uplifted** and **tilted**.
- During this process, the layers are exposed to **weathering** and **erosion**.
- If horizontal layers of sedimentary rock are later laid down on top of the tilted, eroded layers, the resulting unconformity is called **an angular unconformity**.

**2/ A disconformity**

- When a horizontal layer of sedimentary rock overlies another horizontal layer of sedimentary rock that has been eroded, the eroded surface is called **a disconformity**.
- Disconformities can be **easy** to identify when the eroded surface is **uneven**.
- When the eroded surface is **smooth**, disconformities are often **hard** to see.

**3/ A nonconformity**

- When a layer of sedimentary rock **overlies** a layer of **igneous** or **metamorphic** rock, such as **granite** or **marble**, the eroded surface is easier to identify.
- This kind of eroded surface is called **a nonconformity**.
- A nonconformity indicates a gap in the rock record during which igneous or metamorphic rock layers were uplifted, eroded at Earth's surface, and new layers of sedimentary rock formed on top.



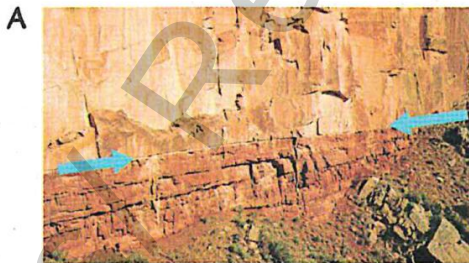
**** A sedimentary rock layer is found resting on top of eroded metamorphic rock. What type of unconformity does this represent, and what does it tell us about geological history?**

- This represents a **nonconformity**.
- It tells us that older metamorphic rock was exposed at the surface, eroded over time, and then later covered by younger sedimentary rock.
- This indicates a significant gap in the geological record, where some layers were removed or never deposited, showing a period of uplift and erosion before sedimentation resumed.

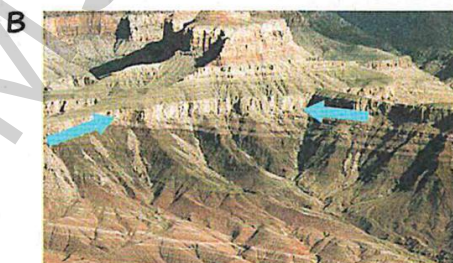
INVESTIGATION

Gaps in the Rock Record

1. Analyze the three photos below. Notice how the arrows point to a line between different rocks. How would you describe the rock below the arrows versus the rock above the arrows? Write your descriptions next to each image.



horizontal sedimentary layer
overlies horizontal sedimentary
layer



horizontal sedimentary layer
overlies tilted sedimentary layer



horizontal sedimentary layer
overlies nonsedimentary layer

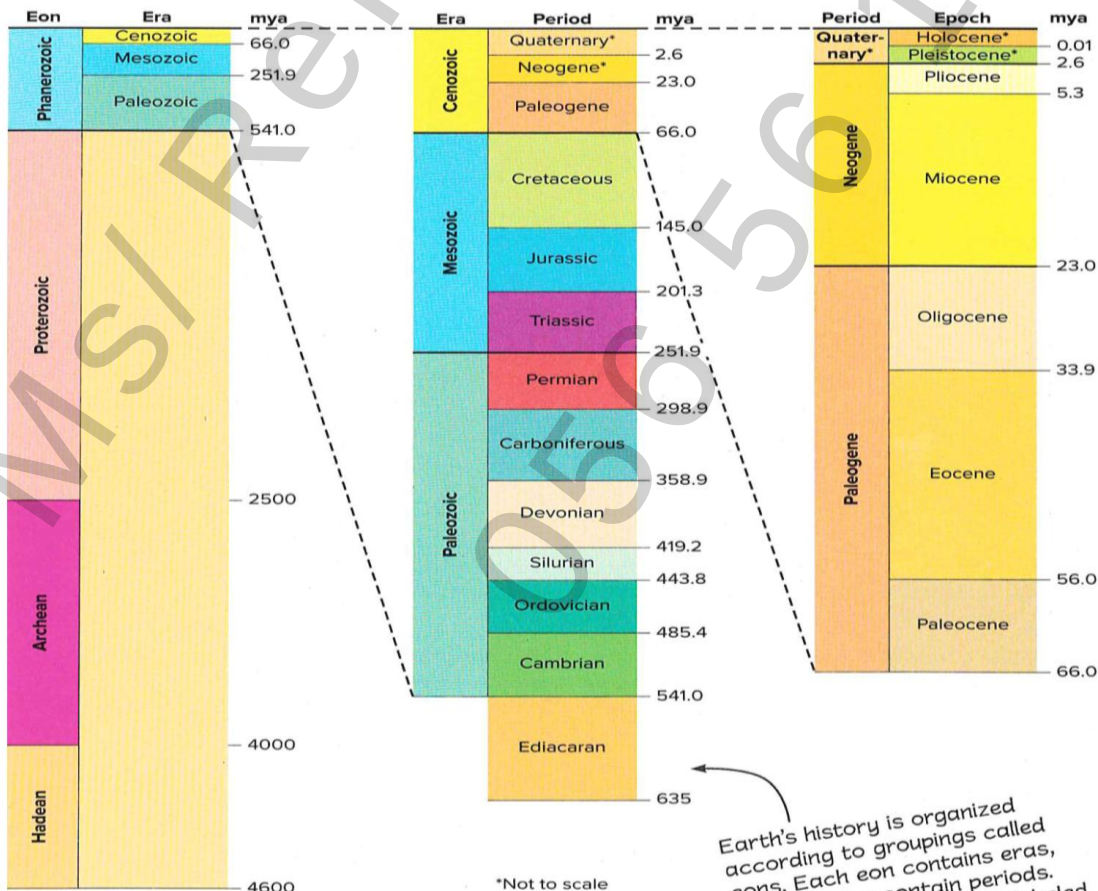
What is the geologic time scale?

**** Geologists developed a model of Earth's history from its origin 4.6 billion years ago to the present called the geologic time scale.**

**** Time units on the geologic time scale are thousands and millions of years long-much longer than the units you use to organize events in your life.**

The Geologic Time Scale:

**** Geologists developed the geologic time scale to help them correlate rock units across countries and continents and to have a standard model and vocabulary for describing geologic time.**



Earth's history is organized according to groupings called eons. Each eon contains eras, which in turn contain periods. Each unit on the scale is labeled with its range of time in millions of years ago (mya).

Relating Time Scales:

**** Earth formed approximately 4.6 billion years ago.**

**** But how long is 4,600,000,000 years?**

- It is difficult to comprehend time that extends so far into the past unless you can relate it to your own experience.

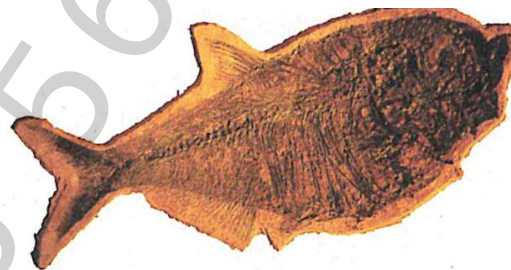
$$\frac{\text{Known age of past event (years before present)}}{\text{Known age of Earth (years before present)}} = \frac{X \text{ time scale unit location}}{\text{Maximum distance or extent of metaphor}}$$

Example: To find where "first fish" would be placed on your model if you used a meterstick (100 cm), set up your equation as follows:

$$\frac{500,000,000 \text{ years}}{4,600,000,000 \text{ years}} = \frac{X \text{ (location on meterstick)}}{100 \text{ cm}}$$

**** How can fossils found in sedimentary rocks help scientists learn about the environment in which the organisms once lived?**

7. The Earth events on your model are based mostly on fossil evidence. How are fossils useful in understanding Earth's history? How are they useful in the development of the geologic time scale?

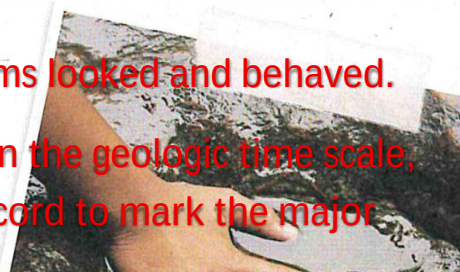


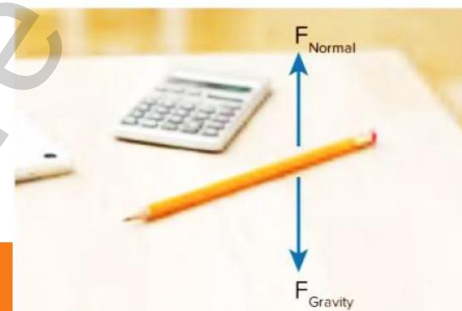
**** Fossils help scientists learn about ancient environments and organisms.**

**** Scientists use fossils to interpret how Earth's environments have changed over time.**

**** Fossils are evidence of how ancient organisms looked and behaved.**

**** Fossils were used to develop the time units in the geologic time scale, scientists use sudden changes in the fossil record to mark the major divisions of the scale.**



Normal Force:

Newton's third law of motion states that for every force there is an opposite equal force.

A pencil sitting on a table is acted on by gravity.

This force in the downward direction is equal to its weight.

Because of gravity, the pencil is pushing down on the table.

The table pushes up on the pencil with an equal but opposite force. The force of the table on the pencil is called the **normal force**.

** A 10 kg object is resting on a flat surface. How would you calculate its weight?

$$\underline{\text{Weight (W) = mass} \times \text{gravitational acceleration}}$$

$$\underline{W = mg}$$

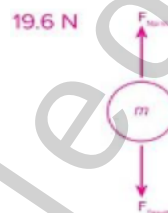
- Mass = 10 kg

- Gravitational acceleration (g) = 9.8 m/s²

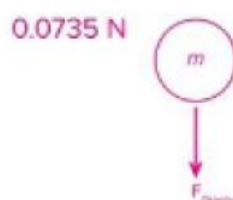
$$W = 10 \text{ kg} \times 9.8 \text{ m/s}^2 = 98 \text{ N}$$

MATH Connection For each of the systems below, calculate the weight of the object. Then, apply scientific understanding to draw a free-body diagram of the system.

A. A book with a mass of 2 kg is at rest on top of a desk.



B. A pencil with a mass of 0.0075 kg is falling toward the floor.



16 Students will explore how to describe the position and motion of an object. They will analyze data including graphs to help construct and present arguments about the changes over time in the motions of objects

Q 16 a

Q 16 b

U2M1L1: Position and Motion;
Student Book Page 22 and 23

10) A driver needs to make a delivery to an office that is 30 km away. The driver has traveled for 45 minutes west down a straight road at 50 km/h.

a. Has the driver traveled far enough to reach the office? Support your response.

Average Speed Equation

$$\text{average speed (in m/s)} = \frac{\text{total distance (in m)}}{\text{total time (in s)}}$$

$$\bar{v} = \frac{d}{t}$$

- The driver has traveled for 0.75 h and has traveled $(50 \text{ km/h})(0.75 \text{ h}) = 37.5 \text{ km}$.
- He has traveled far enough to reach the office.

3. How long would it take a bus traveling at 52 km/h to travel 130 km?

$$V = 52 \text{ km/h} \quad d = 130 \text{ km} \quad t = ?$$

$$T = \frac{d}{v} = \frac{130}{52} = 2.5 \text{ h}$$



17 Students will explore how the force exerted by one object on a second object is equal in strength and opposite in direction to the force that the second object exerts on the first.

Q 17 a

Q 17 b

U2M1L3: Force Pairs; Student Book
Page 64

What forces are present when you
push an object?

**** Forces** that occur in **pairs**.

**** For example,** if you drop a tennis ball, the falling ball pushes against the floor.

**** The ball bounces** because the floor pushes with an opposite force against the ball.



**** Opposing Forces:**

**** If you are wearing skates and push against a wall, you will move away from the wall.**

**** What force causes you to move?**

**** when you push against the wall, the wall pushes back in the opposite direction.**

**** The push of the wall causes you to accelerate away from the wall. ** When an object applies a force on another object, the second object applies a force of the same strength on the first object, but the force is in the opposite direction.**

**** Newton's third law of motion,** when one object exerts a force on a second object, the second object exerts a force of the same size but in the opposite direction on the first object.

**** This idea explains how helicopters and drones work.**

**** When a drone pushes the air down, the air pushes the drone up.**

**** Air particles may be small and not very massive, but pushing a large amount of air can lead to a large push back.**



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** If you push against a wall with a force of 60 N and the wall doesn't move, what can you infer about the force the wall exerts on you?

- The wall pushes back on you with an equal and opposite force of 60 N.

Three-Dimensional Thinking

A person is applying a force to the right on an object as shown. Use the model below to answer questions 2 and 3.



2. What forces are acting on the person?

A a slightly smaller force to the left because the object is accelerating
☒ B a force equal to the force applied going to the left
 C a force to the right to apply the force to the object
 D a force to the right because the object is accelerating

18	Students will explore the attractive nature of gravitational force, the factors that affect it, and how it affects the motion of objects. They will model systems of objects to compose arguments from evidence about these forces	Q 18 a Q 18 b	U2M1L4: Gravitational Force; Student Book Page 82
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What pulls things down?

Gravitational Force:

** Objects fall to the ground because Earth exerts an attractive force on them.

** You also exert an attractive force on objects.

**** Gravity:** is an attractive force that exists between all objects that have mass.

**** Mass:** is the amount of matter in an object.

** Mass is often measured in **kilograms (kg)**.

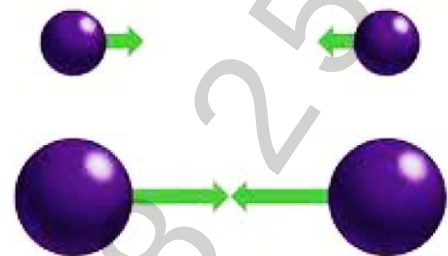
- An object does not have to be touching Earth for gravity to act on it.
- The force of gravity is exerted through space as a field.



- **A field:** is a region of space that has a physical quantity (such as a force) at every point.
- The gravitational field of Earth surrounds Earth at all points.
- The low mass objects are surrounded by smaller gravitational fields.

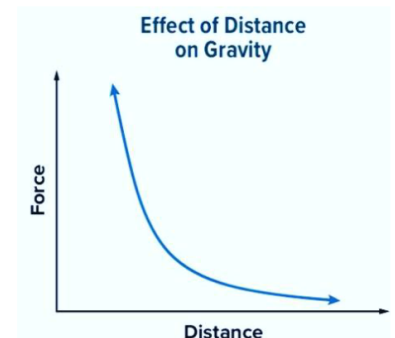
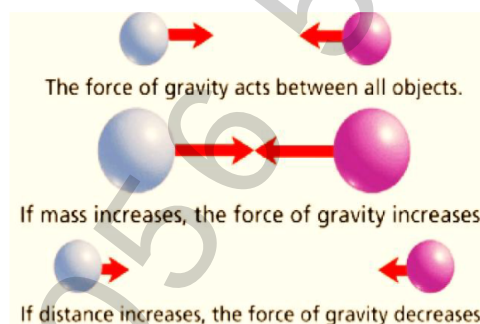
What factors affect the strength of a gravitational force?

Gravitational Force and Mass:



- ** When the mass of one or both objects increases, the gravitational force between them also increases.
- ** Each object exerts the same attraction on the other object.

Gravitational Force and Distance:

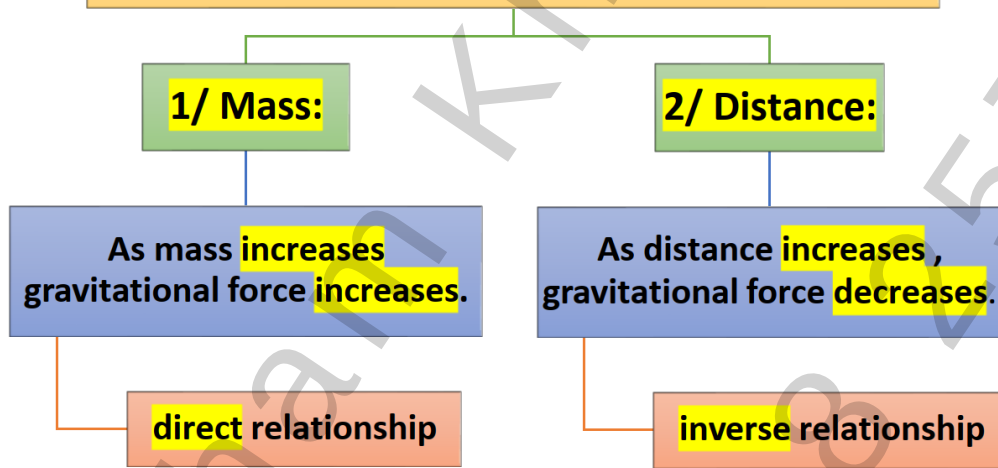


- ** The attraction between objects decreases as the distance between the objects increases.

**** For example,** if your mass is 45 kg, the gravitational force between you and Earth is about 440 N.

**** On the Moon,** about 384,000 km away, the gravitational force between you and Earth would only be about 0.12 N.

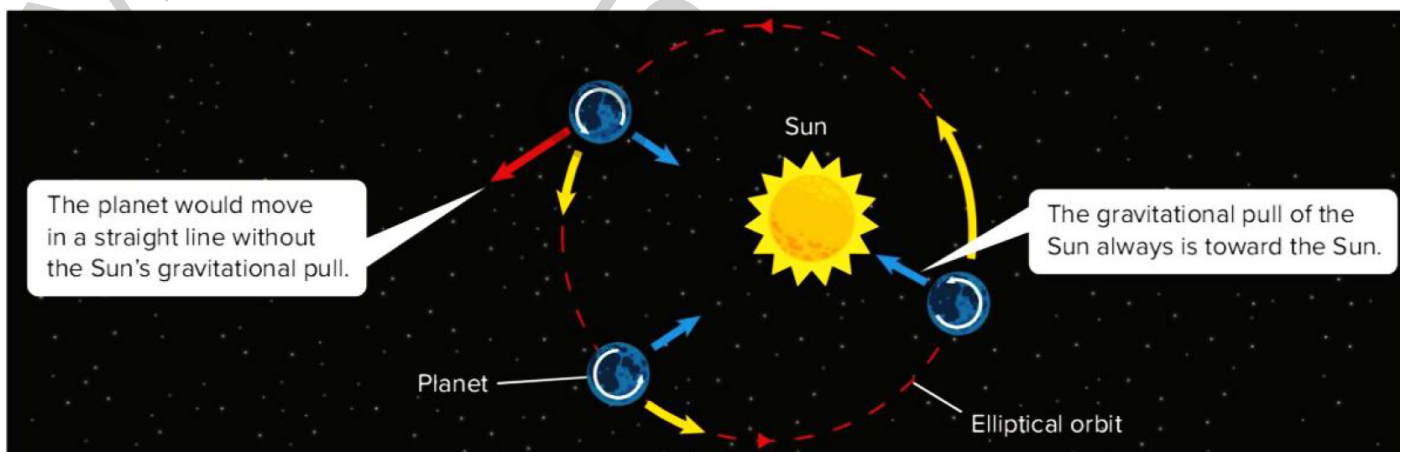
Factors affect gravitational force:



**** Everything in our solar system is held in orbit by the gravitational force created by the Sun.**

**** Earth travels around the Sun due to the gravitational force between the Sun and Earth.**

**** If this force disappeared, Earth would break away from its orbit and continue traveling in a straight line into space.**



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**** What is the nature of gravitational force, and how does it act between two objects in space?**

- **Gravitational force** is an attractive force that acts between any two objects that have mass.

**** In space, this force:**

- Pulls objects toward each other, no matter how far apart they are.
- Increases with more mass.
- Decreases as the distance between the objects increases.

**** For example**, gravity keeps planets in orbit around the Sun and holds moons around planets.

Summarize It!

- 1. Construct and Present Arguments** You have been asked to join a debate about the existence of gravity. Develop an argument to support the idea that gravitational forces are attractive and depend on the mass of the object. Use evidence to add validity to your argument.

**** Gravitational forces are real, attractive, and depend on mass.**

**** We observe gravity every day—objects fall toward Earth because Earth's mass pulls them.**

**** According to Newton's Law of Universal Gravitation, the force of gravity increases with mass and decreases with distance.**

**** For example**, the Moon orbits Earth due to Earth's gravitational pull, and Earth orbits the Sun because of the Sun's much greater mass.

**** These motions would not happen without an attractive gravitational force.**

**** Therefore, gravity must exist and depend on mass.**

19	Students will explore how force affects motion. They will plan and carry out investigations to enhance their understanding of the changes in motion caused by a net force.	Q 19 a Q 19 b	U2M1L2: Force and Acceleration; Student Book Page 52
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4. A train moves at a constant speed down a straight track. Which of the following scientific explanations is true?

- A No forces act on the train as it moves.
- B The train moves because no forces are acting against it.
- ☒ C The forces of the train's engine balance the force of friction opposing it.
- D An unbalanced force keeps the train moving.

** You place different weights on two sides of a balance scale. How would you determine if the scale is balanced, and what does that tell you about the forces involved?

- To determine if the scale is balanced, observe whether the two sides are level.
- If both sides remain at the same height, the scale is balanced, meaning the forces (weights) on both sides are equal.
- This tells us that the downward gravitational force on each side is the same.

** What happens when forces acting on an object are balanced or unbalanced?

- **Balanced forces:** The object does not change its motion. If it's at rest, it stays at rest. If it's moving, it continues moving at the same speed and in the same direction.

- **Unbalanced forces:** The object's motion changes. It may start moving, stop, speed up, slow down, or change direction — depending on the direction and size of the unbalanced force.

20	Students will explore how the force exerted by one object on a second object is equal in strength and opposite in direction to the force that the second object exerts on the first. They will use models of the systems of objects to construct explanations to illustrate these force pairs and their effects on motion	Q 20 a Q 20 b	U2M1L3: Force Pairs; Student Book Page 65 and 66
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** When a person sits on a bench, how do the forces between the person and the bench demonstrate Newton's third law of motion?

- When a person sits on a bench, their body applies a downward force on the bench due to gravity.
- According to Newton's Third Law, the bench applies an equal and opposite upward force on the person.
- These two forces are equal in size and opposite in direction, demonstrating that for every action, there is an equal and opposite reaction.

4. Which of the following systems does NOT represent a force pair?

- A** When you push on a bike's brakes, the friction between the tires and the road increases.
- B** When a diver jumps off a diving board, the board pushes the diver up.
- C** When an ice skater pushes off a wall, the wall pushes the skater off of the wall.
- D** When a boy pulls a wagon, the wagon pulls back on the boy.

1.  How old is Earth?



- a) 4.6 Trillion Years b) 4.6 Billion Years
c) 4.6 Million Years d) 4.6 Thousand Years

2.  True/False The same processes that occur today have been occurring since Earth formed?



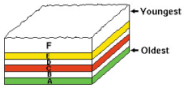
- a) True, it's called uniformitarianism b) False, processes are not the same.

3.  Which word fits this blank? _____ is the age of rocks and geologic features compared with other rocks and features nearby.



- a) Absolute Age b) Relative Age

4. Which Principle of Relative-Age Dating states that the oldest rock layers are on the bottom?



- a) Original Horizontality
b) Inclusions
c) Superposition
d) Lateral Continuity

5. Canyons are caused by which principle of relative-age dating? Hint: This also states that ground is placed in all directions.



- a) Inclusions
b) Cross-Cutting Relationships
c) Lateral Continuity
d) Superposition

6. A fossil is a what? Check all that apply:



- a) traces of an ancient animal
b) traces of an ancient Plant
c) a rock
d) traces of ancient living thing

7. True or False Simple fossils can be found in both older layers and younger layers.



- a) False
b) True

8. True or False? Complex fossils can be only found in younger layers.



- a) True
b) False

9. What happens when fossils disappear from the fossil record?

- a) That creature has stopped dying
b) magic
c) That creature has ascended beyond this plane of time and space
d) That creature has become extinct

11. The fossil record helps us do what? Check all that apply.

- a) Determine if there were any extinctions that occurred.
b) Determine the color of ancient organisms.
c) Determine what the environment was like a long time ago.
d) Determine how old rock layers are.

10.



What is the definition of mass extinction?

- a) A time when few species died within a long period of time. b) A time when many species died within a long period of time.
- c) A time when few species died within a short period of time. d) A time when many species died within a short period of time.

12.



True or False? The oldest fossilized bacteria in the world were 3.5 trillion years old.

- a) True b) False.

13. When Bacteria first started to grow, Early Earth looked like:

- a) Lots of water, ocean everywhere. b) Mostly land, no water.
- c) Largely what it looks like today. d) Lots of volcanic activity, lots of hot-springs.

14. This principal states that, if magma breaks into a rock, the pieces of rock in the magma are older than the magma itself.

- a) Original Horizontality b) Lateral Continuity
- c) Inclusions d) Cross-Cutting Relationships

Answer Keys

1. b) 4.6 Billion Years

2. a) True, it's called uniformitarianism

3. b) Relative Age

4. c) Superposition

5. c) Lateral Continuity

6. a) traces , traces , traces
of an b) of an d) of
ancient ancient ancient
animal Plant living
thing

7. b) True

8. a) True

9. d) That creature has become extinct

10. d) A time when many species died within a short period of time.

11. c) Determine , Determine , Determine
what the d) how old a) if there
environment rock were any
was like a layers extinctions
long time are. that
ago. occurred.

13. d) Lots of volcanic activity, lots of hot-springs.

14. c) Inclusions

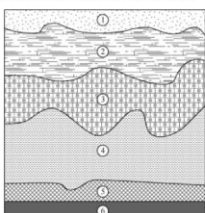
- Modern humans (Homo sapiens) and dinosaurs never existed together on Earth.
 - True
 - False
- How old do Paleontologists believe the Earth is?
 - 4.6 million years old
 - 2015 years old
 - 4.6 billion years old
 - 3.6 billion years old
- When did life on Earth begin?
 - 3.9 to 3.5 thousand years ago
 - 3.9 to 3.5 billion years ago
 - 4.6 to 4.0 billion years ago
 - 4.6 to 4.0 million years ago
- Which of the following places the geologic time eras in order from oldest to most recent?
 - Mesozoic, Cenozoic, Paleozoic, Precambrian
 - Cenozoic, Mesozoic, Paleozoic, Precambrian
 - Precambrian, Paleozoic, Mesozoic, Cenozoic
 - Paleozoic, Cenozoic, Precambrian, Mesozoic
- The _____ era covers almost 90% of earth's history.
 - Precambrian
 - Mesozoic
 - Cenozoic
 - Paleozoic



According to the law of superposition, which layer is the youngest?

- A
- C
- B

7. The diagram shows a cross section of rock layers.



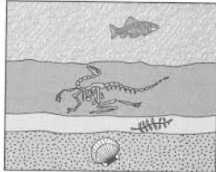
Which rock layer is most likely older than rock layer 4?

- 1
- 2
- 3
- 5

8. Most events on the geologic timeline happened: (think about where events were most crowded together on our timeline)

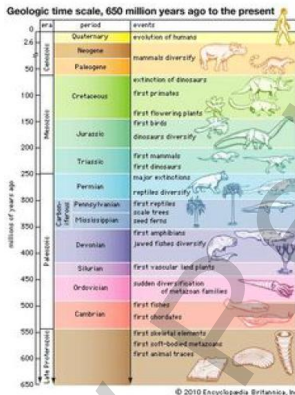
- a) a long time ago, near the beginning
- b) right in the center of the timeline
- c) evenly spread out
- d) more recently, near the modern time

9. Which of the following questions can be answered by studying these fossil layers?



- a) Are reptiles the ancestors to birds or fish?
- b) Which organisms lived before/after/or at the same time?
- c) What did the fish eat?
- d) Why did dinosaurs become extinct?

10. Scientists chose where units of geologic time began and ended based on major changes in life forms at certain times.



- a) True
- b) False

11. The Geologic Time Scale is a record of what?

- a) the known history of rocks and fossils
- b) sweet geology music
- c) old geologists
- d) a list of every living thing ever

12. If a fossil appears in a rock layer and then disappears in the next, what is the most likely reason.

- a) The entire population of the organism was frozen in suspended animation and will appear again in a more recent rock layer.
- b) The entire species was abducted by aliens.
- c) The species became extinct and will not appear again.
- d) The species became extinct but will be resurrected in Jurassic World.

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13. Paleozoic, Mesozoic & Cenozoic are all

- | | |
|-----------|------------|
| a) Epochs | b) Periods |
| c) Eons | d) Eras |

14. We are currently living in which era?

- | | |
|-------------|--------------|
| a) Mesozoic | b) Paleozoic |
| c) Cenozoic | d) Jurassic |

15. The disappearance of a species.

- | | |
|---------------|--------------|
| a) Mutation | b) Evolution |
| c) Extinction | d) Migration |

16. How large is the Pre Cambrian Time?

- | | |
|--------|--------|
| a) 22% | b) 50% |
| c) 88% | d) 95% |

17. Of the following organisms, which was around (or has been around) for the shortest amount of time?

- | | |
|------------|--------------|
| a) Humans | b) Dinosaurs |
| c) Reptile | d) Mammals |

Answer Keys

- | | | |
|--|---|---|
| 1. a) True | 2. c) 4.6 billion years old | 3. b) 3.9 to 3.5 billion years ago |
| 4. c) Precambrian, Paleozoic, Mesozoic, Cenozoic | 5. a) Precambrian | 6. a) A |
| 7. d) 5 | 8. d) more recently, near the modern time | 9. b) Which organisms lived before/after/or at the same time? |
| 10. a) True | 11. a) the known history of rocks and fossils | 12. c) The species became extinct and will not appear again. |
| 13. d) Eras | 14. c) Cenozoic | 15. c) Extinction |
| 16. c) 88% | 17. a) Humans | |

1. Who is considered one of the first scientists to propose that Earth is very old?

- A. Charles Darwin
- ☒ B. James Hutton
- C. Isaac Newton
- D. Albert Einstein

2. What principle did James Hutton's ideas lead to?

- A. Catastrophism
- B. Gradualism
- ☒ C. Uniformitarianism
- D. Punctuated Equilibrium

3. What does the principle of uniformitarianism state?

- A. Geologic processes have changed significantly over time.
- ☒ B. Geologic processes that occur today are similar to those in the past.
- C. Earth is only a few thousand years old.
- D. Geologic processes are unpredictable.

4. What method do scientists use to determine the order of geologic events?

- A. Radiometric dating
- B. Carbon dating
- ☒ C. Relative-age dating
- D. Fossil correlation

5. Which principle states that in undisturbed rock layers, the oldest rocks are on the bottom?

- A. Original Horizontality
- B. Cross-cutting Relationships
- ☒ C. Superposition
- D. Inclusions

6. According to the principle of original horizontality, how are most rock-forming materials deposited?

- A. Vertically
- B. In large chunks
- ☒ C. Horizontally
- D. In circular patterns



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7. What does the principle of lateral continuity state?

- A. Rocks are deposited in vertical columns.
- B. Rocks are deposited in large, continuous sheets in all lateral directions.**
- C. Older rocks are always found on top of younger rocks.
- D. Geological features form in isolation.

8. What does the principle of inclusions state?

- A. Younger rocks contain pieces of older rocks.**
- B. Older rocks contain pieces of younger rocks.
- C. Inclusions are always found in the oldest rocks.
- D. Inclusions are formed during volcanic eruptions.

9. According to the principle of cross-cutting relationships, which feature is older?

- A. The feature that cuts across another feature
- B. The feature that is cut across**
- C. Both features are the same age
- D. Neither feature is older

10. What does relative-age dating allow scientists to determine?

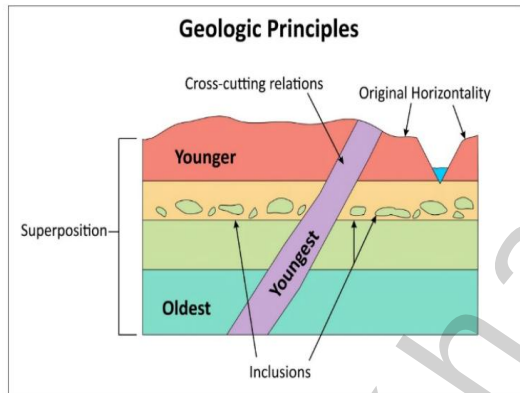
- A. The absolute age of rocks
- B. The exact date when rocks were formed
- C. The order in which geologic events occurred**
- D. The chemical composition of rocks

11. What process did Hutton believe could wear down mountains or carve deep canyons?

- A. Volcanic eruptions
- B. Erosion caused by streams**
- C. Earthquakes
- D. Glacial movements

12. Why is the principle of uniformitarianism important for understanding Earth's past?

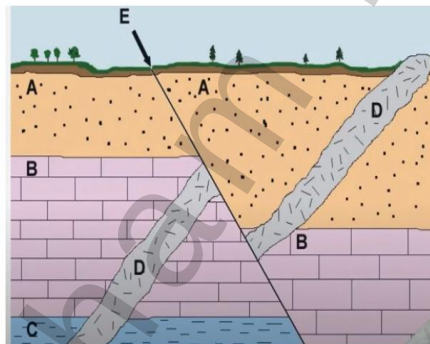
- A. It suggests that Earth is flat
- B. It implies that current geologic processes have always been the same**
- C. It denies the existence of fossils
- D. It promotes the idea of rapid, catastrophic events



16. What are microfossils?

- A) Fossils that can only be seen with a microscope
- B) Fossils of dinosaurs
- C) Fossils found exclusively in sedimentary rocks
- D) Fossils of ancient plants

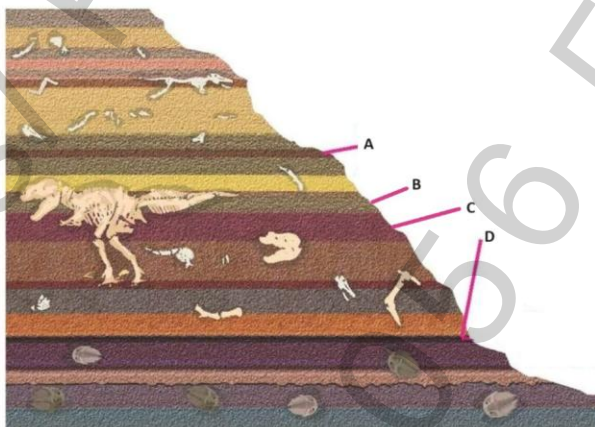
13. Order the following from the oldest to the youngest



C, B, A, D then E

14. mass extinctions

times when many species on Earth died or became extinct. **USE the following diagram and indicate which layer the disappearance of dinosaurs happened**



- A. A
- B. B
- C. C
- D. D

15. What do fossils primarily provide clues about?

- A) The chemical composition of rocks
- B) The relative ages of rocks
- C) The atmospheric composition of the past
- D) The magnetic properties of minerals

1. The starting point you choose to describe the position an object.
 - a) spot
 - b) position
 - c) reference point
 - d) south
2. To describe a position you need distance and this from the reference point.
 - a) time
 - b) mass
 - c) direction
 - d) location
3. Which is a reference direction?
 - a) to the North
 - b) backwards
 - c) faster
 - d) beside you
4. Which statement indicates that motion has occurred?
 - a) The reference point has changed.
 - b) The object is stationary.
 - c) The position the object has changed.
 - d) The object being described has changed.
5. " The house is one block east and one block south of school" is a set of directions in two ...
 - a) locations
 - b) positions
 - c) dimensions
 - d) references
6. Motion in the reference direction.
 - a) faster
 - b) backward
 - c) negative
 - d) positive
7. Direction of motion opposite the reference direction.
 - a) forward
 - b) slower
 - c) positive
 - d) negative
9. The difference between the initial position and the final position.
 - a) total distance
 - b) dimension
 - c) displacement
 - d) motion
8. The process of changing position.
 - a) reference point
 - b) yoga
 - c) direction
 - d) motion
10. When motion is a straight line in one direction, this equals displacement.
 - a) reference point
 - b) motion
 - c) dimension
 - d) distance

11. Displacement does not require movement.

a) False

b) True

12. starting point describing the location of an object

a) reference point

b) negative direction

c) positive direction

13. True or False:

When determining position, you can use cardinal directions or general directions.

a) false

b) true

14. Giving out descriptions of your location always helps you in identifying your _____.

a) Distance

b) Reference point

c) Direction

d) Position

15. An object's position always depends on what?

a) Location

b) Distance

c) Direction

d) Reference point

16. You call a friend up, and the two of you agree to meet up at the mall before going to grab a bite to eat. What is the reference point in this scenario?

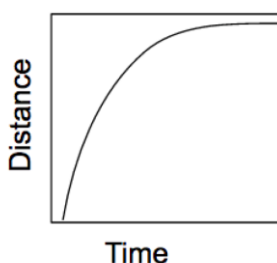
a) The restaurant

b) The mall

17. You agree to meet up with your family at the front of the baseball field before going to watch your little brother's game. What is the reference point in this scenario?

a) The baseball game

b) The front of the baseball field



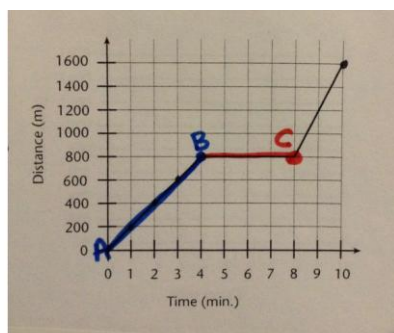
This graph shows

a) An object slowing down

b) An object speeding up

c) An object speeding up

d) An object stopped



The graph shows Ashley riding her bike to Maria's house.

What was occurring from point B to point C?

- a) she was increasing her speed b) she was decreasing in speed
c) she stopped for 4 minutes

19.

The graph shows Ashley riding her bike to Maria's house.

What is occurring from point A to point B?

- a) she is decreasing in speed b) she is traveling at a constant speed
c) she stopped to take a break

Answer Keys

- | | | |
|--|---|------------------------------|
| 1. c) reference point | 2. c) direction | 3. a) to the North |
| 4. c) The position the object has changed. | 5. c) dimensions | 6. d) positive |
| 7. d) negative | 8. d) motion | 9. c) displacement |
| 10. d) distance | 11. a) False | 12. a) reference point |
| 13. b) true | 14. d) Position | 15. d) Reference point |
| 16. b) The mall | 17. b) The front of the baseball field | 18. c) An object speeding up |
| 19. c) she stopped for 4 minutes | 20. b) she is traveling at a constant speed | |

1. What unit is used when measuring force?

- a) Newtons b) Stewies
c) Grams d) Kilograms

2. When an object is accelerating, the forces are:

- a) Balanced b) Unbalanced
c) Valenced d) Ridiculous

3. For Net Force, forces that are acting in the same direction are:
- a) Divided
 - b) Subtracted
 - c) Added
 - d) Multiplied
4. An object at rest will stay at rest unless acted upon by _____ force.
- a) a velocity
 - b) an unbalanced
 - c) a balanced
5. A measurement of the change in velocity in a period of time is:
- a) Velocity
 - b) Force
 - c) Speed
 - d) Acceleration
6. Which is NOT a way to decrease friction?
- a) Putting oil on a road
 - b) Pouring sand on ice
 - c) Using grease to remove a ring from a finger
 - d) Using wheels to move a heavy object
7. True or False: Friction is a Force.
- a) True
 - b) False
8. What is the equation for Acceleration?
- a) $S=D/T$
 - b) $M=F/A$
 - c) $F=M/A$
 - d) $A=F/M$
9. What is the equation for Force?
- a) $F=M \times A$
 - b) $S=D/T$
 - c) $A=F/M$
 - d) $M=F/A$
10. True or False: Forces cause all acceleration.
- a) False
 - b) True

1. What is Newton's Third Law of Motion?

- a) for every action, there will be an equal and opposite reaction
 b) an object at rest stays at rest, and an object in motion will stay in motion until an outside force acts upon it
 c) the acceleration of an object will be equal to the net force of an object divided by its mass
 d) an object that is not moving will stay not moving until an unbalanced force acts on it

2. If a bird hit your windshield on your car, the force of the car on the bird equals

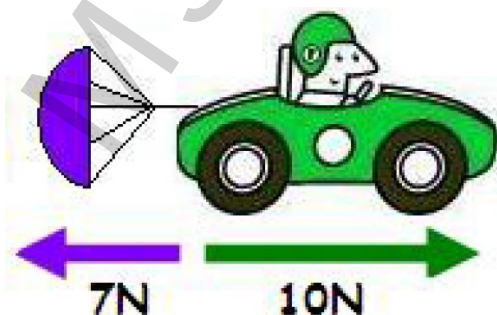
- a) a noncontact force acting on the windshield
 b) the force of the bird on your car.
 c) an elastic collision on the windshield
 d) the force of the car on the bird

3. Pick the best example of Newton's third law of motion in action.

- a) A rocket accelerating in space as a result of gases and the rocket pushing each other in opposite directions
 b) An asteroid continuing to spin because nothing has exerted a force to stop it
 c) An asteroid moving around the Sun while being pulled toward the Sun
 d) a rock skipping across a lake

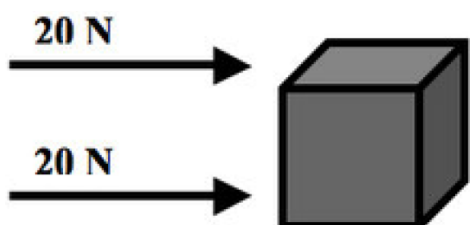
4. If you throw a ball into the air, Earth exerts a force on the ball. The ball in the air exerts no force on Earth.

- a) True; all forces act alone
 b) False; there will always be a force pair



What is the net force?

- a) 3 N
 b) 17 N, right
 c) 3 N, right
 d) 3 N, left



What is the net force?

- a) 0 N
 b) 40 N
 c) 400 N
 d) 20 N

7. What is the unit to MEASURE force?

- a) Pounds b) Kilogram
c) Newton d) Meter



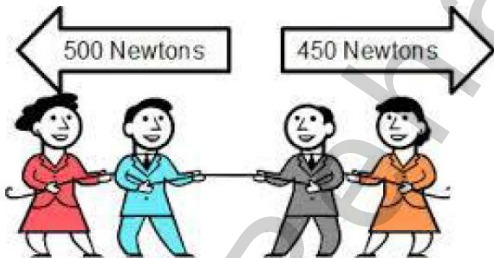
A _____ is a push or a pull on an object.

- a) friction
- b) force
- c) magnet
- d) gravity



If these teams are pulling with the same amount of force what will happen?

- a) Both will fall down.
- b) The boy in red will win.
- c) They will not move at all.
- d) The boy in blue will win.



Balanced or unbalanced?

- a) unbalanced



Forces that have a net force of zero Newtons

- a) Unbalanced force b) Balanced force

12. The sum of all forces acting on an object.

- a) Contact Force b) Net Force
- c) Unbalanced Force d) Balanced Force

13. What will cause an object to move?

- a) Unbalanced forces b) Applied forces
c) Balanced forces

14. All objects in the universe have a gravitational attraction to each other.
 - a) True
 - b) False
15. This type of force resist motion between two surfaces that are pressed together
 - a) friction
 - b) gravity
 - c) contact
16. If both forces are going in the same direction you should _____ those forces
 - a) Add
 - b) Subtract
 - c) Divide
 - d) Multiply
17. When forces are going in the opposite direction of each other you should do what do find the net force
 - a) Subtract
 - b) Add
 - c) Divide
 - d) Multiply
18. _____ a push or pull
 - a) Force
 - b) Motion
 - c) Postion



Why is it harder for the boy in Image B to get down the hill?

- 
20. What is the strongest force on Earth?
- a) Gravity
b) Love
c) Friction
d) Air Resistance
- a) Displacement
b) Friction
c) Motion
d) Work

Answer Keys

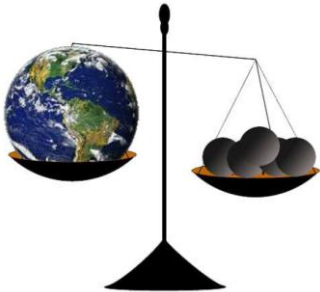
1. a) for every action, there will be an equal and opposite reaction
2. b) the force of the bird on your car.
3. a) A rocket accelerating in space as a result of gases and the rocket pushing each other in opposite directions

- | | | |
|--|-----------------------|----------------------------------|
| 4. b) False; there will always be a force pair | 5. c) 3 N, right | 6. b) 40 N |
| 7. c) Newton | 8. b) force | 9. c) They will not move at all. |
| 10. a) unbalanced | 11. b) Balanced force | 12. b) Net Force |
| 13. a) Unbalanced forces | 14. a) True | 15. a) friction |
| 16. a) Add | 17. a) Subtract | 18. a) Force |
| 19. b) Friction | 20. a) Gravity | |

-
- When placed at equal distances apart, the greatest gravitational attraction will be between two
 - bowling balls
 - skateboards
 - school buses
 - Which is needed to determine the amount of gravitational force between two objects?
 - weight and time
 - distance and mass
 - area and weight
 - The gravitational force exerted by an object depends on its
 - mass
 - weight
 - volume
 - Mass is a measurement of
 - none of the answers are correct
 - the amount a spring is compressed on a scale
 - how much weight is present in an object
 - how much matter is present in an object
 - as the mass of an object increases, the pull of gravity...
 - Decreases
 - Stays the same
 - Increases
 - Why do we have a stronger gravitational attraction with Earth than the Sun?
 - the sun has a larger mass
 - we are closer to center of Earth
 - the Earth has a larger mass
 - we are closer to center of sun

7. What does the strength of gravity between two objects depend upon?

- a) Gravity & inertia
- b) Mass & weight
- c) Mass & distance
- d) Inertia & mass



_____ is what makes up all things in the universe.

- a) Weight
- b) **Mass**

9. The gravitational force between two objects changes with the distance between the two objects

- a) False
- b) True

10. An object with more mass will exert greater gravitational force than an object with lesser mass.

- a) True
- b) False

11. This FORCE pulls things. It PULLS things into orbit around the sun.

- a) gravity
- b) Newton
- c) path
- d) weight



A baseball and bat are on the ground. What is true?

- a) The baseball will float because it's lighter.
- b) They attract each other with equal gravitational force.
- c) The bat will pull the baseball closer to itself.
- d) There is no gravitational force between them.

13. A student drops a bowling ball and an apple from a third-story window. Both objects hit the ground at the same time. From the experiment, the student should conclude that

- a) more air friction is acting on the apple than on the bowling ball
- b) the apple weighs more than the bowling ball
- c) gravity pulls on both objects, causing them to fall at the same time.

14. Jupiter has about 317 times more mass than Earth. What can you infer from this fact?
- a) Mass has no effect on the gravitational force between two objects b) That Jupiter's gravitational force is much weaker than on Earth's gravitational force.
- c) That Jupiter's gravitational force is much stronger than Earth's gravitational force. d) That Jupiter's and Earth's gravitational forces are equal.
15. How can you explain that we have a stronger gravitational attraction with Earth than the Sun?
- a) Closer to center of Earth b) Closer to center of sun
- c) The sun has a larger mass d) The sun has a smaller mass
16. Which of these best describes why your weight (on Earth) would change on another planet?
- a) Dehydration effects on different planets change weight. b) Different planets have different gravitational pulls
- c) Weight does not change, no matter where you are. d) In general, the smaller the planet, the greater weight
17. Which of the following does not affect the gravitational force between the earth and the sun?
- a) The net electrical charge of the earth b) The mass of the sun
- c) The distance between the earth and the sun d) The mass of the earth
18. An astronaut way out in space is considered to be "weightless". This is because—
- a) gravitational force decreases greatly over long distances. b) his mass is so small relative to the earth that gravity doesn't affect him.
- c) objects far away from the earth have less mass. d) gravitational force pushes objects away from each other at long distances.
19. Which statement is true?
- a) Gravity can both push and pull objects. b) Only celestial objects exert a gravitational force.
- c) Only Earth exerts a gravitational force. d) All objects with mass exert a gravitational force.

Answer Keys

1. c) school buses
2. b) distance and mass
3. a) mass
4. d) how much matter is present in an object
5. c) Increases
6. b) we are closer to center of Earth
7. c) Mass & distance
8. b) **Mass**
9. b) True
10. a) True
11. a) gravity
12. b) They attract each other with equal gravitational force.
13. c) gravity pulls on both objects, causing them to fall at the same time.
14. c) That Jupiter's gravitational force is much stronger than Earth's gravitational force.
15. a) Closer to center of Earth
16. b) Different planets have different gravitational pulls
17. a) The net electrical charge of the earth
18. a) gravitational force decreases greatly over long distances.
19. d) All objects with mass exert a gravitational force.

Part 2 / FRQ:

21	Students will explore how to describe the position and motion of an object. They will analyze data including graphs to help construct and present arguments about the changes over time in the motions of objects	Q 21	U2M1L1: Position and Motion
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** How can you calculate the total distance an object travels along a path?

$$d = s \cdot t$$

Average Speed Equation

$$\text{average speed (in m/s)} = \frac{\text{total distance (in m)}}{\text{total time (in s)}}$$

$$\bar{v} = \frac{d}{t}$$

Distance = Speed x Time

Speed = $\frac{\text{Distance}}{\text{Time}}$ Time = $\frac{\text{Distance}}{\text{Speed}}$

**** What does displacement tell us about an object's movement compared to distance?**

**** Distance:** is the length of the path.

**** Displacement:** is the distance between the initial (first) position and the final position of an object in a straight line.

<i>DISTANCE</i>	<i>DISPLACEMENT</i>
The total length of the path the object travelled.	The difference between initial and final positions (the shortest distance between them).
No need to mention direction: (magnitude only) = value = number .	Direction is important: Magnitude + direction .
Both are measured in meters (m)	

**** How can motion be described from different observers' points of view?**

- Motion depends on **the reference point**.
- One observer may see the object moving, another may see it as stationary, because position and movement are relative.

**** What happens to an object's displacement if it returns to its starting point?**

- The displacement becomes **zero**, because the final position is the same as the initial position.

**** How does changing the reference point affect how we describe an object's position?**

- The description of position changes when the reference point changes, because position is measured relative to that point.

**** Why is position considered relative in physics?**

- It is always measured with respect to a specific frame of reference point.

** How can average speed be calculated from distance and time? $V = \frac{d}{t}$

22	Students will explore how force affects motion. They will plan and carry out investigations to enhance their understanding of the changes in motion caused by a net force.	Q 22	U2M1L2: Force and Acceleration
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** What forces can cause a moving object to slow down and stop?

- Friction and air resistance act against the motion and cause the object to slow down and eventually stop.

**** Friction:** is a force that resists the sliding motion of two surfaces that are touching.

** How does friction affect the motion of objects on different surfaces?

- On **rough** surfaces, friction is **greater**, so **more** force is needed to move the object.
- On **smooth** or slippery surfaces, friction is **lower**, and **less** force is needed.

**** How do you determine the net force acting on an object when multiple forces are involved?**

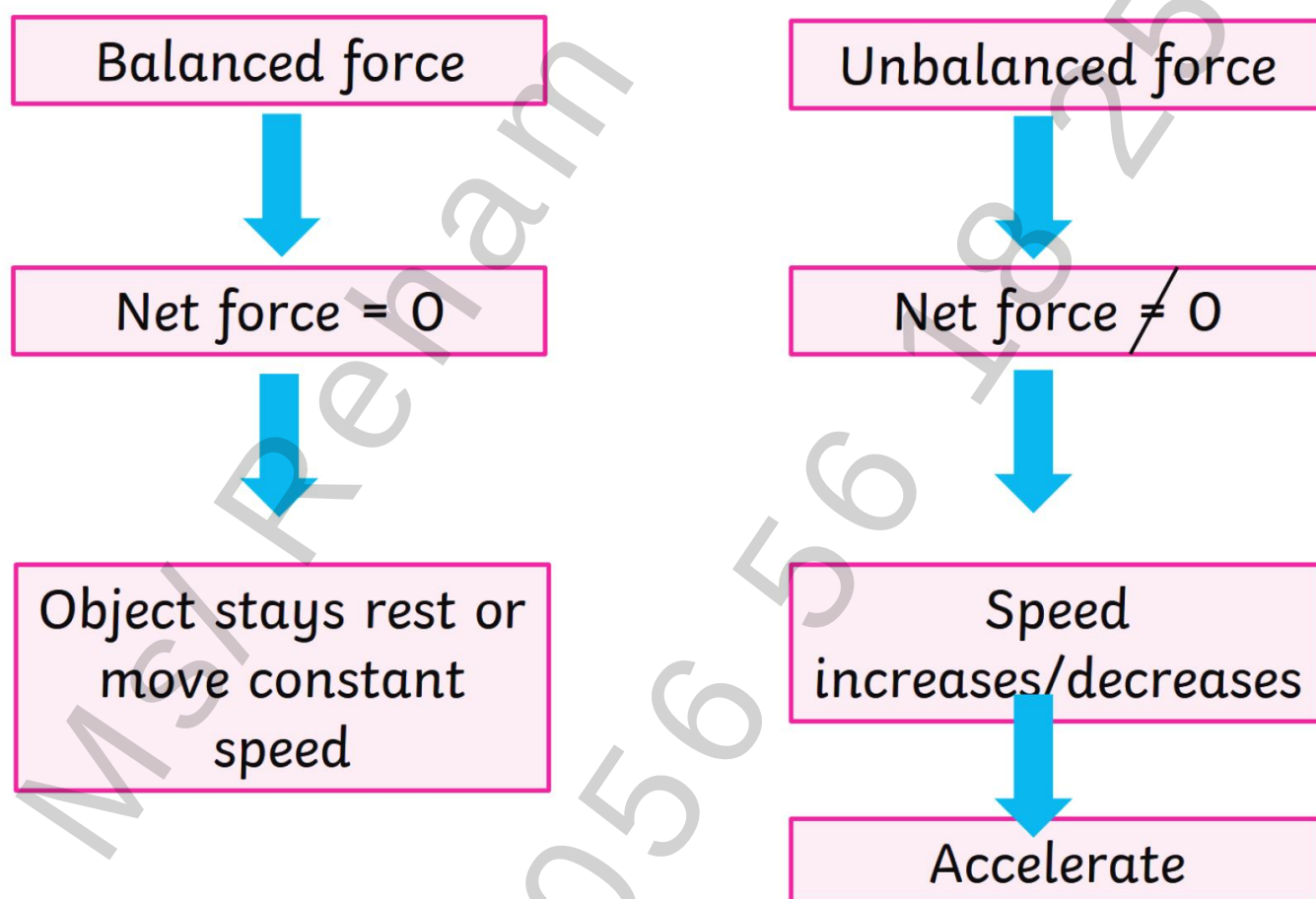
- Add all the forces acting on the object, considering their direction.
- If forces are in opposite directions, subtract them.
- The result is the net force.

How do multiple forces change motion?

- Force has both size and direction.
- Arrows can be used to show the size and direction of a force.
- Usually more than one force is acting on an object at a time. The forces can be added together to find **the net force**.
- **The net force:** is the sum of all the forces acting on an object.
- The net force can be modeled with a **free-body diagram**.
- **A free-body diagram:** is a simple model that can help you understand the forces acting on an object.

**** How does Newton's First Law explain the motion of an object when no force is applied?**

- **Newton's first law of motion** states that if the net force on an object is zero, the motion of the object does not change.
- **balanced** forces cause **no change** in the motion of an object. This is true when an object is at rest or in motion.
- **Unbalanced** forces cause **change** in the motion of an object. This is true when an object is at rest or in motion.



**** How can a free body diagram help us understand the forces acting on an object?**

- **A free-body diagram:** is a simple model that can help you understand the forces acting on an object.

- **A free-body diagram** shows all the forces acting on an object using arrows.
- It helps us understand the direction and size of each force and whether the forces are balanced or unbalanced.

**** Why does the amount of force needed to move an object change depending on the surface?**

- Because the friction changes with surface type.
- Rough surfaces create more friction and need more force, while smooth surfaces create less friction and need less force.

**** How can we compare the effects of friction on dry and lubricated surfaces?**

- On **dry** surfaces, friction is **higher**, making it **harder** to move objects.
- On **lubricated** surfaces, friction is **lower**, so objects move **more** easily with less force.

23	Students will explore the attractive nature of gravitational force, the factors that affect it, and how it affects the motion of objects. They will model systems of objects to compose arguments from evidence about these forces	Q 23	U2M1L4: Gravitational Force
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**** How does the mass of an object affect the gravitational force it experiences?**

- The gravitational force increases as the mass of the object increases.

**** How does the distance between two objects influence the gravitational pull between them?**

- The gravitational pull decreases as the distance between the objects increases.

** Why do larger celestial bodies exert stronger gravitational forces?

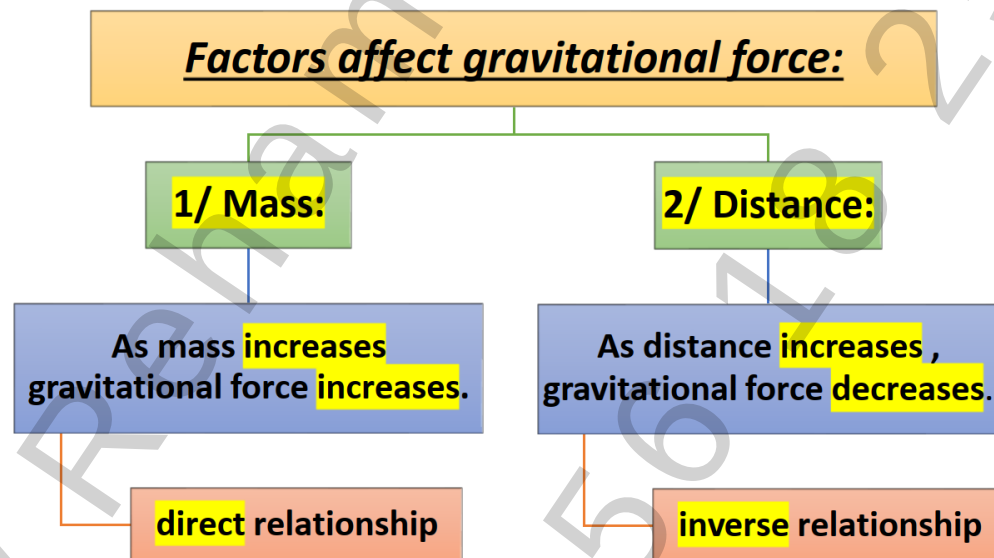
- Because they have more mass, which increases the strength of the gravitational force.

**** How can we compare gravitational forces acting on different planets at equal distances?**

- By comparing their **masses** — the planet with greater mass has stronger gravity.

**** What happens to the gravitational force when the distance between two objects increases or decreases?**

- **Increasing** distance **reduces** the gravitational force, while **decreasing** distance **increases** it.



**** How do you calculate the weight of an object using its mass and gravitational acceleration?**

Weight Equation

$$\text{weight (N)} = \text{mass (kg)} \times \text{gravitational acceleration (m/s}^2\text{)}$$

$$W = mg$$

**** Why is the gravitational force between small objects difficult to observe?**

- Because their masses are too small to produce noticeable gravitational attraction.

Gravity of Small Objects:

All objects have mass.

Therefore, all objects have a gravitational field.

The masses of the pencil and the book are **extremely small** compared to the mass of Earth.

That means their gravitational fields are also very small compared to Earth's gravitational field.

The pencil and the book pull on each other slightly but not enough to cause a change in motion.

24	Students will explore the sequencing of events preserved in the geological record. They will use models to observe time phenomena and analyze and interpret rock strata and the fossil record to provide relative dates. They will construct scientific explanations based on evidence gathered and an understanding of the principles of relative-age dating.	Q 24	U1M1L1: Analyzing the Rock and Fossil Records
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**** How can the position of fossils in rock layers help determine their relative age?**

- Fossils found in lower rock layers are generally older than those in upper layers, based on the principle of superposition.

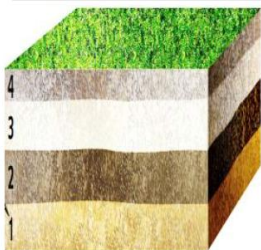
**** What geological principles help scientists understand the sequence of rock formation?**

- Principles like superposition, original horizontality, cross-cutting relationships, and inclusions help determine the sequence.

The Principles of Relative-Age Dating

**1/
Superposition**

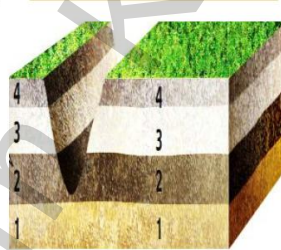
- It is the principle that in undisturbed rock layers, the oldest rocks are on the bottom.

**2/ original horizontality**

- The most rock-forming materials are deposited in horizontal layers.

**3/ Lateral continuity**

- It is the principle that sediments are deposited in large, continuous sheets in all lateral directions.

**4/ inclusions**

- If one rock contains pieces of another rock, the rock containing the pieces is younger than the pieces.

**5/ cross-cutting relationships**

- If one geologic feature cuts across another feature, the feature that it cuts across is older.

**** How does the presence of faults affect the interpretation of rock layer ages?**

- Faults can cut through layers, indicating that the fault is younger than the layers it cuts through (cross-cutting principle).

**** What does the principle of original horizontality tell us about sedimentary layers?**

- The most rock-forming materials are deposited in horizontal layers.

**** How can inclusions in rocks help determine which layer is older?**

- If one rock contains pieces of another rock, the rock containing the pieces is younger than the pieces.

**** What does the discovery of marine fossils in mountain rocks tell us about Earth's past environments?**

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- It suggests that the area was once underwater and has since been uplifted by geological processes.

**** What scientific idea explains that natural processes observed today also occurred in the past?**

- **The principle of uniformitarianism** — it states that the processes shaping Earth today also operated in the past.

**** How does fossil evidence support the idea that Earth's surface changes over time?**

- Fossils show how organisms and environments have changed, providing evidence of shifting landforms, climates, and sea levels.

👊 *Work hard — the future belongs to those with great determination* 💪

🌟 *Wishing you continued success and excellence in your studies* 📚 🧐

With best wishes,

Ms. Riham Khaled 🧐

☎️ *0565618257*

🙏 *Please remember me in your kind prayers* 💜