Study Guide
Grade 7

Question** السؤال**	Learning Outcome*** نتاج التعلم***	Reference(s) in the Student Book المرجع في كتاب الطالب	
		Example/Exercise نشاط/تمرين	Page صفحة
1	يناقش استخدام العلماء الطيف الكهرومغناطيسي لدراسة الكون	نص كتاب الطالب + شكل 1	381
	Discuss the use of scientists the electromagnetic spectrum to study the universe	student text book +figure 1	
2	يبحث انواع التلسكوبات الأرضية	نص كتاب الطالب + شكل 2	383
	Explore for types of ground-based telescopes	student text book +figure 2	
3	يستقصي التلسكوبات الفضائية ومميزاتها	نص كتاب الطالب + شكل 7	385
	Investigate space telescopes and their advantages	student text book +figure 7	
4	يفسر كيف تستخدم الصواريخ والأقمار الصناعية	نص كتاب الطالب	393
	Interpret how rockets and satellites are used	student text book	
5	يناقش ارسال البعثات المأهولة وغير المأهولة الى الفضاء	نص كتاب الطالب	394
	Discuss sending manned and unmanned missions into space.	student text book	
6	يستقصي تكنولوجيا الفضاء المستخدمة لتحسين الحياة على الارض	نص كتاب الطالب	396
	Investigates space technology used to improve life on Earth	student text book	
7	يناقش نظرية الصفائح التكتونية	نص كتاب الطالب	420
	Discuss the theory of plate tectonics	student text book	
8	يتعرف نظرية الانجراف القاري والأدلة على حركة الصفائح	نص كتاب الطالب	421
	Recognize continental drift theory and evidence for plate movement	student text book	
9	يتعرف أنواع حدود الألواح	نص كتاب الطالب + شكل 5	423
	Recognize the types of plate boundaries	student text book +figure 5	
10	يستقصي تأثير القوى الناتجه عن حركة الصفائح	نص كتاب الطالب + شكل 7	424
	Investigate the effect of forces caused by plate motion	student text book +figure 7	
11	يميز بين التجوية الفيزيائية والكيميائية	نص كتاب الطالب + شكل 18	442,443
	Distinguish between physical weathering and chemical weathering	student text book +figure 18	
12	يناقش دور عملية التجوية في تكوين التربة	نص كتاب الطالب + شكل 21	444
	Discuss the role of the weathering process in soil formation	student text book +figure 21	
13	يقارن بين طبقات الغلاف الجوي المختلفة	نص كتاب الطالب + شكل 2	461
	Compare between the different layers of the atmosphere	student text book +figure 2	
14	يفسر سبب حركة الهواء	نص كتاب الطالب + شكل 3	462
	Interpret the movements of air	student text book +figure 3	
15	يستقصي تكون السحاب، وأنواعه الثلاثة الرئيسة	نص كتاب الطالب + شكل 5	464
	Investigates cloud formation, and its three main types	student text book +figure 5	
16	يصف الطقس وعناصره المختلفة	نص كتاب الطالب	470,471
	Describe the weather and its various elements	student text book	
17	يميز بين انواع الجبهات الهوائية المختلفة	نص كتاب الطالب + شكل9	474
	Distinguish between the different types of air fronts	student text book +figure 9	
18	يناقش كيف تتشكل العواصف الرعدية	نص كتاب الطالب	480
	Discuss how thunderstorms are formed	student text book	
19	يستقصي تأثيرات الأعاصير البحرية	نص كتاب الطالب + شكل13	484
	Investigate the impacts of hurricanes	student text book +figure13	
20	يناقش العوامل المؤثرة في المناخ (دوائر العرض)	نص كتاب الطالب	501
	Discuss the factors affecting climate(latitude)	student text book	
21	يناقش العوامل المؤثرة في المناخ(ظلال المطر)	نص كتاب الطالب + شكل3	502
	Discuss the factors affecting climate(rainshadow)	student text book +figure3	
22	يناقش دورات المناخ طويلة المدى	نص كتاب الطالب + شكل8	510,511
	Discusses long-term climate cycles	student text book +figure8	
23	يفسر اسباب حدوث دورات المناخ قصير المدى مثل الفصول	نص كتاب الطالب + شكل10	513
	Explains why short-term climate cycles such as seasons occur	student text book +figure 10	
24	يبحث اشكال المناخ الناتجه عن تفاعل الغلاف الجوي والمحيط مثل (النينو والنينا الجنوبي)	نص كتاب الطالب	514
	Explore climate shapes resulting from the interaction of the atmosphere and the ocean (such as El Nino / Southern Frequency)	student text book	
25	يبحث تغيير المناخ الاقليمي والعالمي	نص كتاب الطالب	521
	Explore regional and global climate change	student text book	
-	Best 20 answers out of 25 will count. Example: 14 correct answers yield a grade of 70/100, while 20 and 23 correct answers yield a (full) grade of 100/100 each.		
-	تحتسب افضل 20 اجابة من 25. مثال: 14 اجابة صحيحة تعطي علامة 70/100 بينما 20 أو 21 اجابة صحيحة تعطي العلامة الكاملة أي 100/100.		
**	Questions might appear in a different order in the actual exam		
**	قد تظهر الأسئلة بترتيب مختلف في الامتحان الفعلي.		
***	As it appears in the S.E textbook version 2021-2022 /LMS/SoW		
***	كما وردت في كتاب الطالب طبعة 2021-2022 و LMS/ الخطة الفصلية		

Subject المادة	SCIENCE العلوم
Grade الصف	7
Stream المسار	General العام
Number of Questions عدد الأسئلة	25
Type of Questions طبيعة الأسئلة	MCQs اختيار من متعدد
Marks per Question الدرجات لكل سؤال	5
Maximum Overall Grade* العلامة القصوى الممكنة*	100
Exam Duration مدة الامتحان	120 minutes
Mode of Implementation طريقة التطبيق	SwiftAssess

Question** السؤال**	Learning Outcome*** ناتج التعلم***	References(s) in the Student Book المرجع في كتاب الطالب	
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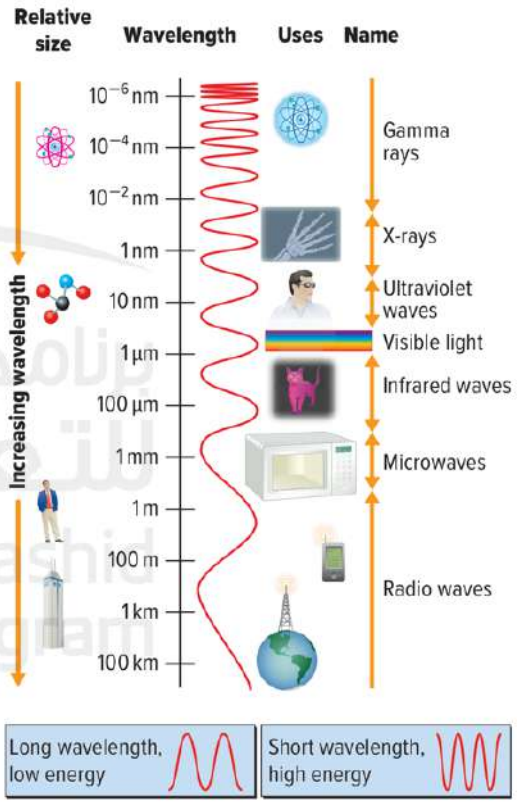
1	يناقش استخدام العلماء الطيف الكهرومغناطيسي لدراسة الكون	نص كتاب الطالب + شكل 1	381
	Discuss the use of scientists the electromagnetic spectrum to study the universe	student text book +figure 1	

The Electromagnetic Spectrum

The entire range of radiant energy carried by electromagnetic waves is the **electromagnetic spectrum.** As shown in **Figure 1,** waves of the electromagnetic spectrum are continuous. They range from gamma rays with short wavelengths at one end to radio waves with long wavelengths at the other end. Radio waves can be thousands of kilometers in length. Gamma rays can be smaller in length than the size of an atom. When you talk on a cellular phone, you use microwaves. When you change the TV channel with a remote-control device, you use infrared waves.

Figure 1 Humans observe only a small part of the electromagnetic spectrum—the visible part in the middle. Visible light includes all the colors you see. You cannot see the other parts of the electromagnetic spectrum



In which wavelength would you expect the hottest stars to emit most of their energy?

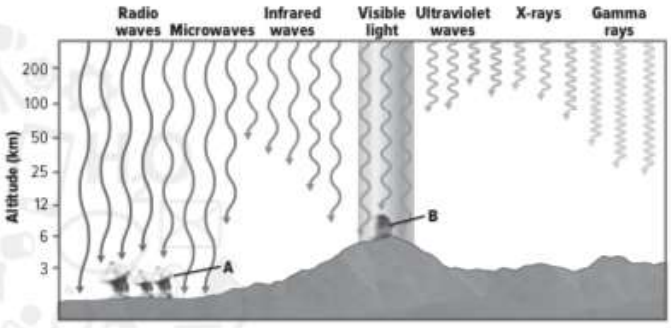
A. gamma rays
B. microwaves
C. radio waves
D. visible light

4. Which emits visible light?

A. moon **C.** satellite
B. planet **D.** star

Use the term *electromagnetic spectrum* in a sentence.

Use the figure below to answer questions 10 and 11.



10 Identify the types of telescopes labeled *A* and *B* in the figure. Briefly explain what radiant energy each gathers and how each telescope works.

Earth-Based Telescopes

Telescopes are designed to collect a certain type of electromagnetic wave. Some telescopes detect visible light, and others detect radio waves and microwaves.

Optical Telescopes

There are two kinds of optical telescopes–refracting telescopes and reflecting telescopes, illustrated in **Figure 2**.

Refracting Telescopes *A telescope that uses a convex lens to concentrate light from a distant object is a* **refracting telescope.** As shown at the top of **Figure 2,** the objective lens in a refracting telescope is the lens closest to the object being viewed. The light goes through the objective lens and refracts, forming a small, bright image. The eyepiece is a second lens that magnifies the image.

Reflecting Telescopes Most large telescopes use curved mirrors instead of curved lenses. *A telescope that uses a curved mirror to concentrate light from a distant object is a* **reflecting telescope.** As shown at the bottom of **Figure 2,** light is reflected from a primary mirror to a secondary mirror. The secondary mirror is tilted to allow the viewer to see the image. Generally, larger primary mirrors produce clearer images than smaller mirrors. However, there is a limit to mirror size. **Figure 3** is a good example of mirror size and use

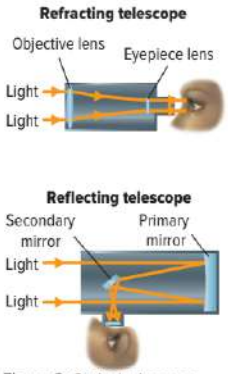


Figure 2 Optical telescopes collect visible light in two different ways.

Key Concept Check

2. Which electromagnetic waves do refracting telescopes collect?

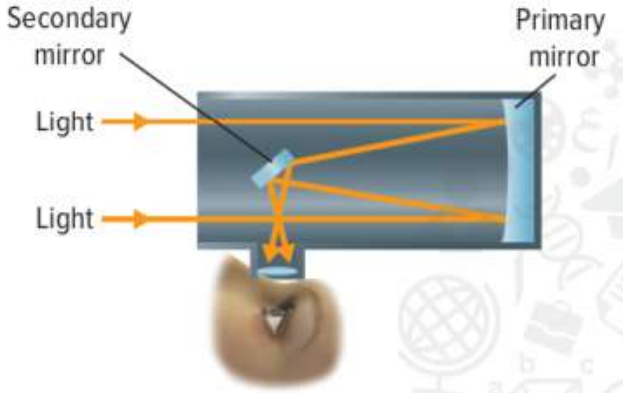
Radio Telescopes

Unlike a telescope that collects visible light waves, a **radio telescope** *collects radio waves and some microwaves using an antenna that looks like a TV satellite dish.* Because these waves have long wavelengths and carry little energy, radio antennae must be large to collect them. Radio telescopes are often built together and used as if they were one telescope. **Figure 4** shows the telescopes as part of the Very Large Array in New Mexico.

9 Which is true of the telescope above?

- **A** The eyepiece and the objective lens are concave lenses.
- **B** Light is bent as it goes through the objective lens.
- **C** Light is reflected from the eyepiece lens to the objective lens.
- **D** The eyepiece lens can be made of many smaller lenses.

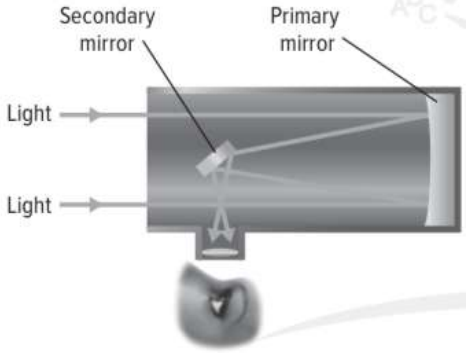
Which type of telescope is shown in the figure below?



- **A.** infrared telescope
- **B.** radio telescope
- **C.** reflecting telescope
- **D.** refracting telescope

Which is NOT a good place to build a radio telescope?

- **A** a location near a radio station
- **B** a location that is remote
- **C** a location with a large cleared area
- **D** a location with dry air



Which could increase the light-gathering power of the telescope in the figure?

- **A** adaptive optics
- **B** a larger eyepiece
- **C** multiple small mirrors
- **D** thicker lenses

Optical Space Telescopes

Optical telescopes collect visible light on Earth's surface, but optical telescopes work better in space. The reason, again, is Earth's atmosphere. As you read earlier, gases in the atmosphere can absorb some wavelengths. In space, there are no atmospheric gases. The sky is darker, and there is no weather.

The first optical space telescope was launched in 1990. The *Hubble Space Telescope*, shown in **Figure 7,** is a reflecting telescope that orbits Earth. Its primary mirror is 2.4 m in diameter. At first the *Hubble* images were blurred because of a flaw in the mirror. In 1993, astronauts repaired the telescope. Since then, *Hubble* has routinely sent to Earth spectacular images of far-distant objects. The photo at the beginning of this lesson 10.1 was taken with the *Hubble* telescope.

Figure 7 The *Hubble Space* Telescope is controlled by astronomers on Earth.

Which best describes *Hubble*?

A. infrared telescope

B. radio telescope

C. refracting telescope

D. space telescope

Contrast the *Hubble Space Telescope* and the *James Webb Space Telescope.*

How Satellites Are Used

The earliest satellites were developed by the military for navigation and to gather information. Today, Earth-orbiting satellites are also used to transmit television and telephone signals and to monitor weather and climate. An array of satellites called the Global Positioning System (GPS) is used for navigation in cars, boats, airplanes, and even for hiking.

Figure 11. Early Exploration of the Solar System Space exploration began with the first rocket launch in 1926.

1926 First rocket: Robert Goddard's liquid-fueled rocket rose 12 m into the air.

1962 First planetary probe: *Mariner 2* traveled to Venus and collected data for 3 months. The craft now orbits the Sun.

1958 First U.S. satellite: In the same year NASA was founded, *Explorer 1* was launched. It orbited Earth 58,000 times before burning up in Earth's atmosphere in 1970.

1962 First probe to outer solar system: *After flying past Jupiter,* Pioneer 10 is still traveling onward, someday to exit the solar system.

What are rockets used for?

A. carrying people

B. launching satellites

C. observing planets

D. transmitting signals

Which is NOT a satellite?

A. a flyby

B. a moon

C. an orbiter

D. space telescope

Which was the first satellite to orbit Earth?

A *Apollo 1*

B *Explorer 1*

C *Mariner 1*

D *Sputnik 1*

Which has the power to overcome the force of Earth's gravity to be launched into space?

A a probe

B a rocket

C a satellite

D a telescope

Space Probes

Some spacecraft have human crews, but most do not. *A* **space probe** *is an uncrewed spacecraft sent from Earth to explore objects in space.* Space probes are robots that work automatically or by remote control. They take pictures and gather data. Probes are cheaper to build than crewed spacecraft, and they can make trips that would be too long or too dangerous for humans. Space probes are not designed to return to Earth. The data they gather are relayed to Earth via radio waves. **Figure 12** shows three major types of space probes.

The engineering team of the Mohammed bin Rashid Space Center in the United Arab Emirates has construct the *Hope Probe,* which will reach Mars by 2021, to celebrate the 50-year anniversary of the UAE Union.

Key Concept Check

1. Why do scientists send uncrewed missions to space?

Figure 12 Scientists use space probes to explore the planets and some moons in the solar system.

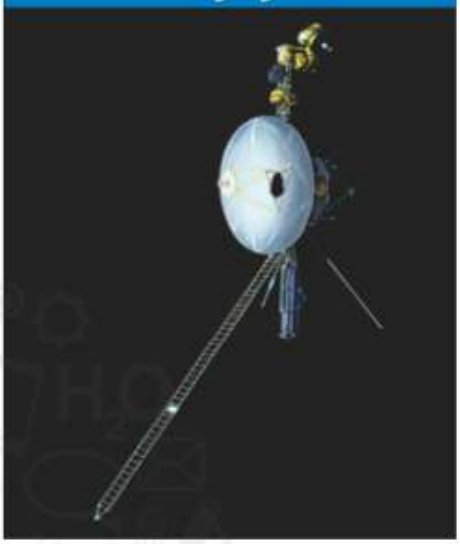
Orbiter

Once orbiters reach their destinations, they use rockets to slow down enough to be captured in a planet's orbit. How long they orbit depends on their fuel supply. The orbiter probe here, *Pioneer,* orbited Venus.

Lander

Landers touch down on surfaces. Sometimes they release rovers. Landers use rockets and parachutes to slow their descent. The lander probe here, *Phoenix,* analyzed the Martian surface for evidence of water.

Flyby



Flybys do not orbit or land. When its mission is complete, a flyby continues through space, eventually leaving the solar system. *Voyager 1,* here, explored Jupiter and Saturn and will soon leave the solar system.

	Discuss sending manned and unmanned missions into space.	student text book	
6	يستقصي تكنولوجيا الفضاء المستخدمة لتحسين الحياة على الأرض	نص كتب الطلب	396
	Investigates space technology used to improve life on Earth	student text book	

Space Technology

The space program requires materials that can withstand the extreme temperatures and pressures of space. Many of these materials have been applied to everyday life on Earth.

New Materials

Space materials must protect people from extreme conditions. They also must be flexible and strong. Materials developed for spacesuits are now used to make racing suits for swimmers, lightweight firefighting gear, running shoes, and other sports clothing.

Safety and Health

NASA developed a strong, fibrous material to make parachute cords for spacecraft that land on planets and moons. This material, five times stronger than steel, is used to make radial tires for automobiles.

Medical Applications

Artificial limbs, infrared ear thermometers, and robotic surgery all have roots in the space program. So do the orthodontic braces shown in **Figure 14.** These braces contain ceramic material originally developed to strengthen the heat resistance of space shuttles.

7	يناقش نظرية الصفائح التكتونية	نص كتاب الطلب	420
	Discuss the theory of plate tectonics	student text book	
8	يتعرف نظرية الانجراف القاري والأدلة على حركة الصفائح	نص كتاب الطلب	421
	Recognize continental drift theory and evidence for plate movement	student text book	

Plate Motion

Even though we usually cannot feel it, Earth's surface is always moving. This motion can cause earthquakes and volcanic eruptions. It also can form mountains.

The theory of **plate tectonics** *states that Earth's crust is broken into rigid plates that move slowly over Earth's surface.* The rigid plates are called tectonic plates. Look at the North American Plate, shown in **Figure 1.** Tectonic plates slowly move over Earth's surface. The movement of one plate is described as either moving away from or toward another plate, or sliding past another plate. Plates move at speeds of only a few centimeters per year. At this rate, it takes moving plates millions of years to make new continents, new mountain ranges, or other landforms.

Continental Drift Long before geologists proposed the theory of plate tectonics they discovered evidence of continental movement. One piece of evidence is the shape of Earth's continents. Look at the outlines of South America and Africa, shown in **Figure 2.** If you could push these two continents together, they would fit together like two pieces of a puzzle. In 1912, Alfred Wegener developed *the hypothesis that continents move, called* **continental drift.**

Fossil Evidence Different plants and animals live on different continents. For example, lions live in Africa, but not in South America. Many fossils of animals and plants show the same thing–some ancient organisms lived in certain areas, but not in others. However, geologists have discovered the same types of fossils on continents that are now separated by vast oceans.

Fossils of the freshwater reptile *Mesosaurus,* shown in **Figure 3,** have been found in South America and Africa only. These two landmasses now are separated by the Atlantic Ocean. So how did a freshwater reptile cross a saltwater ocean? When the two continents were together, as shown in **Figure 2,** *Mesosaurus* likely traveled in freshwater rivers from one area to another.

Geological Evidence Rocks that are made of similar substances and mountains that formed at similar times are present on continents that are now far apart, as shown in **Figure 2.** Scientists can look for similarities in these rocks and mountains, as wells as the locations of ancient glaciers, deserts, and coal swamps, from one continent to the next.

Tectonic plates generally move toward or away from each other at what speed?

A. centimeters per second
B. centimeters per day
C. centimeters per year
D. centimeters per million years

Which is part of the theory of plate tectonics?

A Continents stay in the same place over millions of years.
B Earthquakes are equally likely at any location on Earth.
C Earth's crust is broken into rigid plates that move slowly.
D Earth's plates only can slide past each other because they are rigid.

Which is NOT considered evidence that supports the theory of plate tectonics?

A identical fossils on distant continents
B similar rock types on distant continents
C earthquakes occurring far from plate boundaries
D the shape of Earth's continents

9	Recognize the types of plate boundaries	يتعرف أنواع حدود الألواح	نص كتاب الطالب + شكل 5 student text book +figure 5	423
10	Investigate the effect of forces caused by plate motion	يستقصي تأثير القوى الناتجة عن حركة الصفائح	نص كتاب الطالب + شكل 7 student text book +figure 7	424

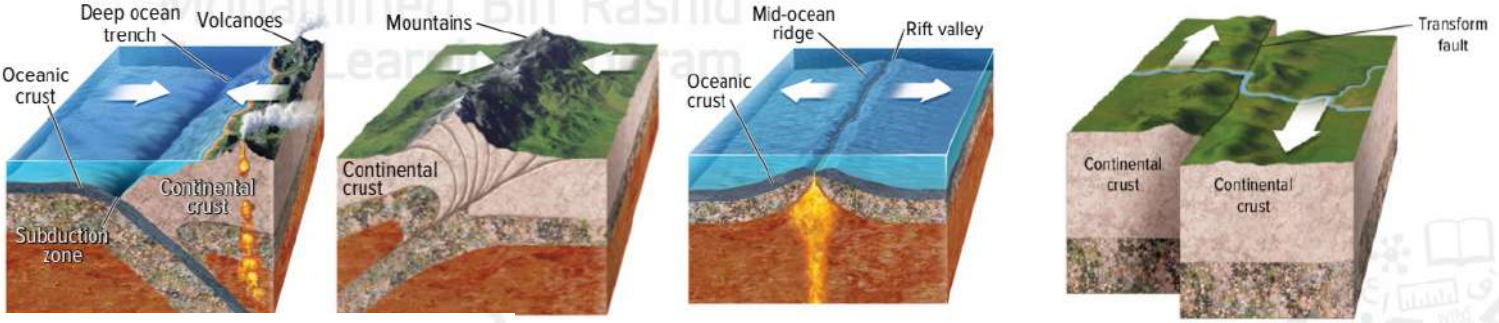
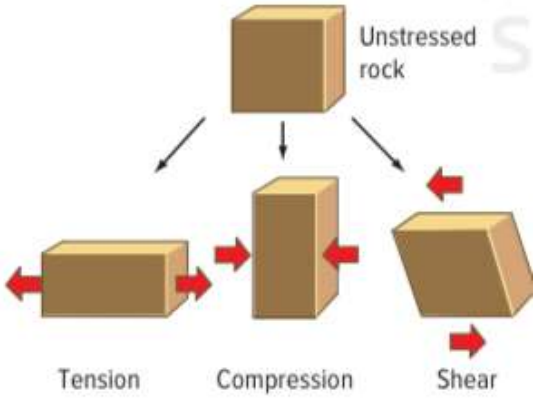


Figure 7 The three types of forces— tension, compression, and shear—cause rocks to change shapes in different ways.



compression → convergent → come together

tension → divergent → go away

Shear → transform → slide past

Which is NOT a type of plate boundary?

A. convergent **C.** subduction

B. divergent **D.** transform

nderstand Key Concepts

Rifts form at which type of plate boundary?

A. convergent **B.** divergent

C. hot spot **D.** transform

The force produced when two plates move away from each other is

A. compression. **B.** shear.

C. subduction. **D.** tension.

Tectonic plates slide horizontally past each other at

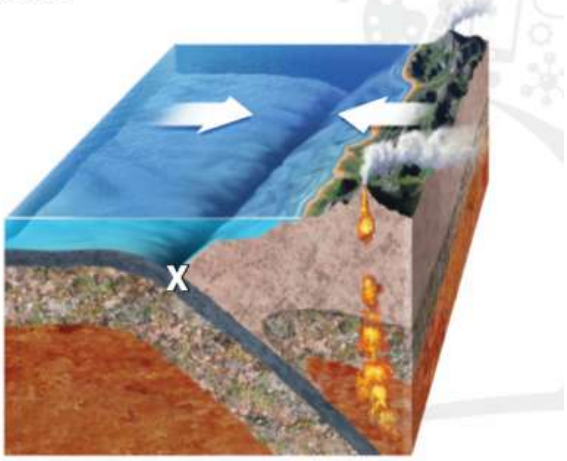
A. convergent boundaries.

B. divergent boundaries.

C. mid-ocean ridges.

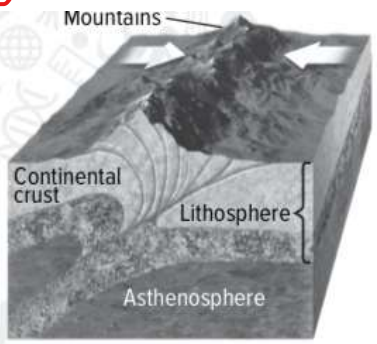
D. transform boundaries.

What feature is marked by the x on the image below?



A. continental rift **B.** mid-ocean ridge

C. subduction zone **D.** transform fault



What is shown in the diagram above?

A two continental plates colliding

B two oceanic plates colliding

C a rift valley forming as two plates collide

D an oceanic plate getting subducted beneath a continental plate

11	Distinguish between physical weathering and chemical weathering	يميز بين التجوية الفيزيائية والكيميائية	نص كتاب الطلب + شكل 18 student text book +figure 18	442,443
12	Discuss the role of the weathering process in soil formation	يناقش دور عملية التجوية في تكون التربة	نص كتاب الطلب + شكل 21 student text book +figure 21	444

Physical Weathering

The process of breaking rock into small pieces without changing the **composition** *of the rock is* **physical weathering.** As you just

Chemical Weathering

The process of changing the composition of rocks and minerals by exposure to water and the atmosphere is called **chemical weathering.**

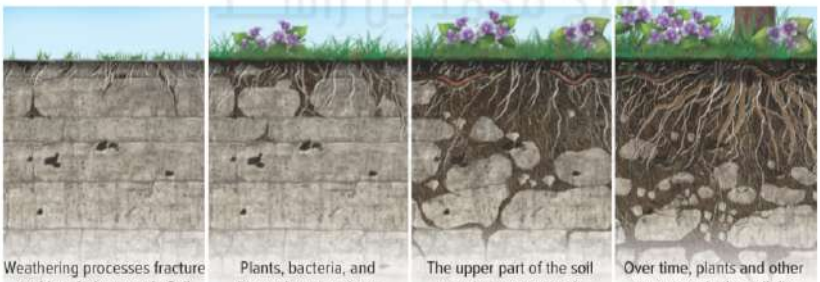
Figure 18 The roots of plants can break rock in the same way they broke this sidewalk.

Soil Formation

Soil *consists of weathered rock, mineral material, water, air, and organic matter from the remains of organisms.* Soil forms directly on top of the rock layers from which it is made. The process of soil formation is illustrated in **Figure 21.** Soil formation takes a long time. It is the result of hundreds to thousands of years of weathering. The rock type being weathered, the biological activity, and the climate all affect soil formation.

Biological activity plays an important role in making soil. Worms and other organisms create pathways in soil for water and air. Decaying plants and animals also produce carbon dioxide and other acids that enhance chemical weathering. Eventually, the decayed plants and animals become part of the soil and make it better for plant growth.

Where do you think soil forms the fastest? Warm, wet climates produce soil fastest. Large amounts of rain can speed weathering of rocks. And chemical reactions are faster in warmer temperatures. Weathering also can happen quickly in areas where freezing and thawing break apart rocks.



Weathering processes fracture and break down rock. Soil formation can take hundreds or thousands of years.

Plants, bacteria, and burrowing organisms help break down rock.

The upper part of the soil contains more organic material than the lower part. The lower part of the soil also can contain weathered rock.

Over time, plants and other organisms in the soil die and decompose. The upper part of the soil contains nutrient-rich organic material

In the diagram, the growing tree roots apply enough force to break the sidewalk into pieces. What is the term for this process?

A chemical weathering
B erosion
C liquefaction
D physical weathering

Which process is an example of physical weathering?

A. a nail rusting
B. acidic water dissolving calcite
C. rock weathering to make clay
D. plant roots breaking rock

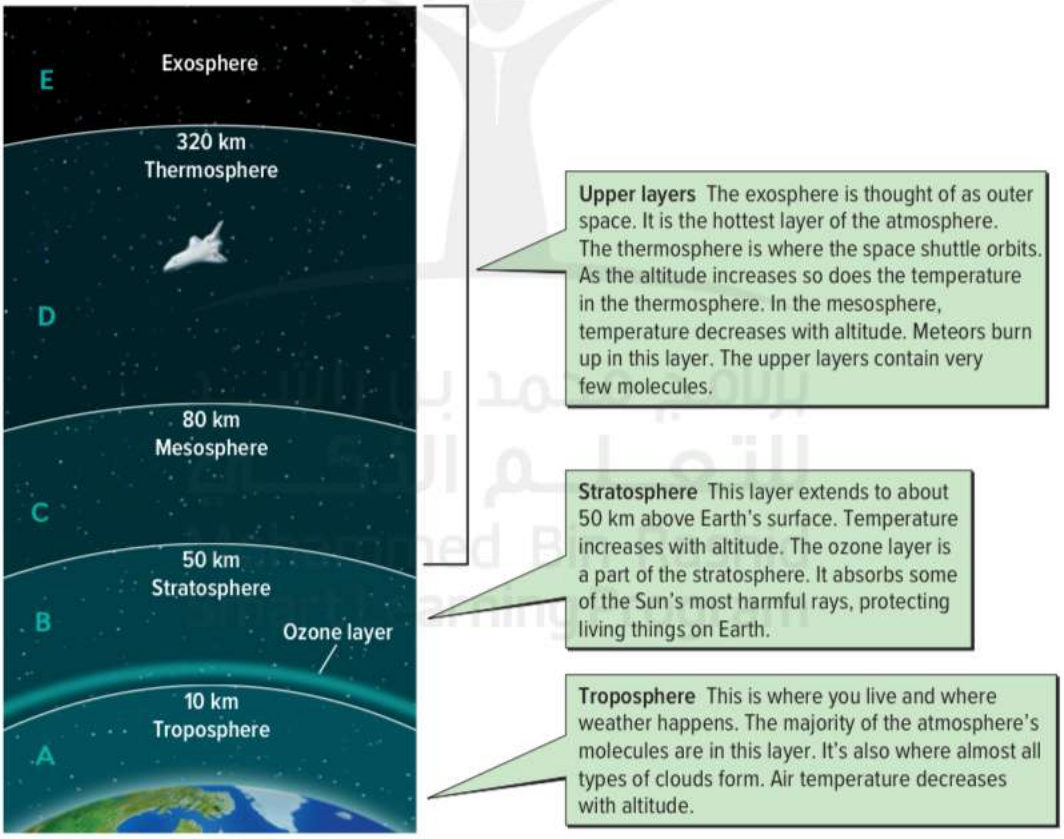
Which two processes form soil?

A climate and living organisms
B erosion and deposition
C glaciers and sediment
D weathering and biological activity

Sediment is made by

A. erosion. **B.** deposition.
C. weathering. **D.** transportation.

13	Compare between the different layers of the atmosphere	يقارن بين طبقات الغلاف الجوي المختلفة	نص كتاب الطلب + شكل 2 student text book +figure 2	461



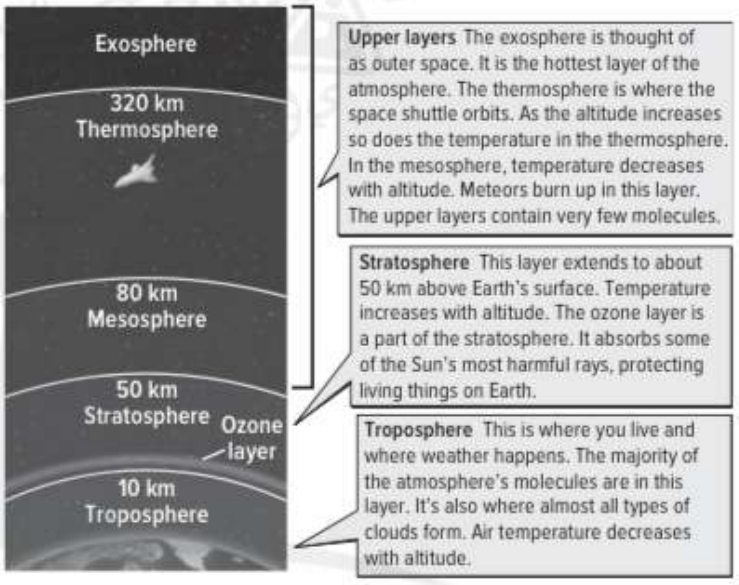
Weather happens in which layer of the atmosphere?

A. exosphere

B. mesosphere

C. stratosphere

D. troposphere



6 Which describes the relationship between air pressure and the layers of the atmosphere?

A Air pressure increases from layer A to layer E.

B Air pressure increases from layer E to layer A.

C Air pressure is greatest in layer D due to the ozone layer.

D Air pressure is greatest in layer C.

Moving Air

Air pressure in the troposphere is always changing because air in the troposphere is always moving. Changing air pressures create wind patterns and cause weather events.

The Importance of the Sun

The Sun warms the rocks, the soil, and the water at Earth's surface. In turn, the Earth warms the air in the troposphere. Because warm air is less dense than cool air, it rises high in the troposphere. As the air moves higher, it cools. Denser, cooled air sinks. It flows toward the low-pressure area left by the rising warm air. The cooled air then warms and rises again. *The circulation of rising, less dense, warm air and sinking, more dense, cool air is called* **convection.** As illustrated in **Figure 3,** convection is responsible for the movement of air in the troposphere.

Local Winds

Some winds blow over short distances. A local wind results from air flowing from an area of higher air pressure to an area of lower air pressure. Differences in pressure result when the atmosphere is warmer in one area than in another.

Global Winds

At Earth's surface, atmospheric convection makes giant bands of winds, as shown in **Figure 4.** The westerlies generally blow from west to east, but Earth's rotation causes them to turn away from the equator. The trade winds generally blow east to west, but Earth's rotation causes them to turn toward the equator.

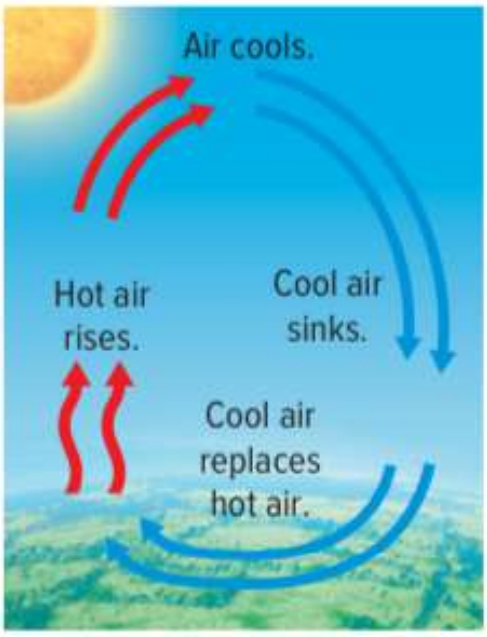


Figure 3 Cool air flows into a lower pressure area forcing the warmer air upward. After the air cools, it sinks toward Earth. As hot air rises, cool air replaces it.

Local winds blow from

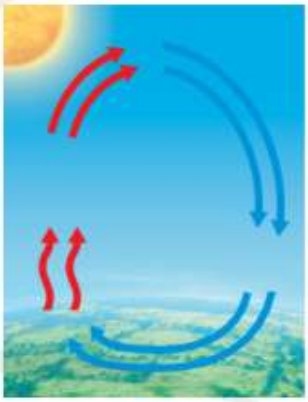
A. an area of high pressure to an area of low pressure.

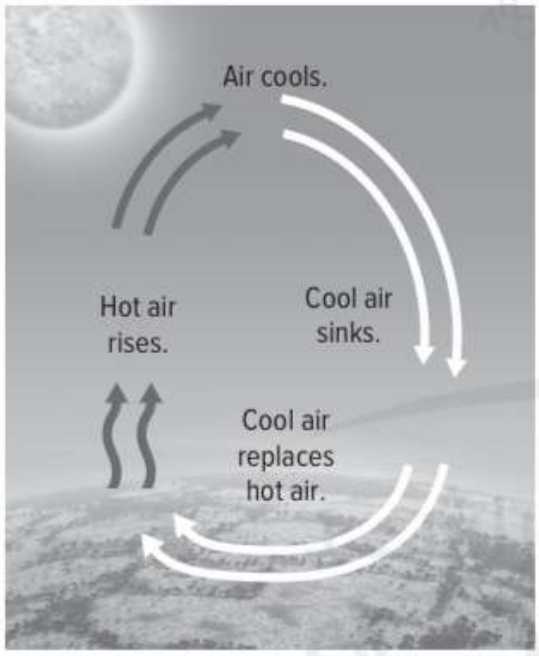
B. an area of high pressure to another area of high pressure.

C. an area of low pressure to an area of high pressure.

D. an area of low pressure to another area of low pressure.

Describe what causes air to flow in the pattern of convection shown here.





What process is shown in the diagram?

A condensation

B convection

C evaporation

D precipitation

Cloud Formation

How does the water vapor that makes clouds get into the sky? Most of it gets there by evaporation. Then, through the process of condensation, water vapor turns into clouds.

Evaporation *The process of a liquid, such as water, changing into a gas, such as water vapor, is called* **evaporation.** Thermal energy, usually from sunlight, heats water and causes it to evaporate. Water evaporates from the surfaces of bodies of water, such as the ocean, lakes, and rivers and from organisms, such as trees and humans.

Condensation *The process of water vapor gas changing into liquid water is* **condensation.** Water vapor condenses around tiny particles of dust, pollen, or other air pollution. These water droplets are so small that they are able to float in the air. Many billions of these little water droplets make up a cloud. As more water condenses and the droplets increase in size, they can become so large that they fall from the sky as rain or snow.


Cumulus


Stratus


Cirrus

Which cloud is associated with thunderstorms?

A. cirrus
B. cumulus
C. easterlies
D. westerlies

3. Which type of cloud is shown below?

A. cirrus
B. cumulonimbus
C. cumulus
D. stratus

What kind of clouds are thin and wispy and look as if they are very high in the sky?

A cirrus
B cumulonimbus
C cumulus
D stratus

Which process forms the droplets that make up clouds?

A. condensation
B. convection
C. deposition
D. evaporation

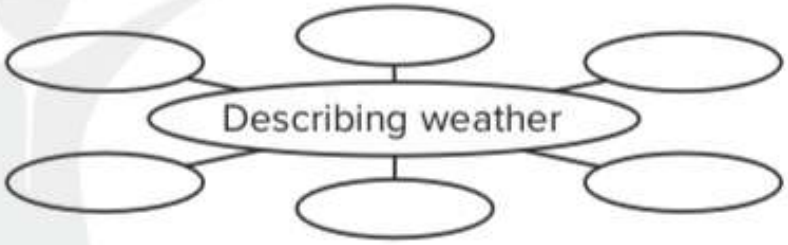
What kind of clouds are thin and wispy and look as if they are very high in the sky?

A cirrus
B cumulonimbus
C cumulus
D stratus

Weather

1. Temperature → thermometer (°C or °F)
   season, sunlight, altitude
   wind, shape
2. Air Pressure → Barometer
   Low AP → stormy
   High AP → sunn
3. Humidity → hygrometer
   amount of water vapor in air
   warm air holds more water vapor
4. Wind Speed → anemometer

   Wind direction → wind sock



What could happen if the temperature decreases when it is humid?

A. Evaporation would increase.

B. Precipitation could fall.

C. A high-pressure system could form.

D. A warm front could move in.

Which factor of the air does a barometer measure?

A. humidity

B. pressure

C. temperature

D. wind speed

What does an anemometer measure?

A. humidity

B. pressure

C. temperature

D. wind speed

Which term describes the typical weather conditions in an area?

A climate

B ecoregion

C pressure system

D watershed

Which instrument shows wind direction?

A an anemometer

B a barometer

C a wind sock

D a wind tool

Fronts

If a weather map, such as the one in **Figure 9,** shows a front will move through your area, you can expect a change in the weather. **Fronts** *are boundaries where two air masses meet.* Storms often form where fronts come together. If the two air masses are different, and if one front is moving fast, you sometimes can feel it pass. The temperature might change quickly and the wind speed might increase. When a front moves in, there is often a change in the types of clouds in the sky. Fronts can move quickly over an area, or they can stay in place for days. A front that is not moving is called **a stationary front.**

Cold Fronts The area where a cold air mass replaces a warm air mass is called a cold front. As a cold front moves through an area, the temperature decreases. At the edge of the front where the cold and warm air masses meet, cumulus clouds, and sometimes thunderstorms, can form.

Warm Fronts Where a warm air mass replaces a cold air mass, a warm front forms. As a warm front moves through an area, the temperature and the humidity increase. Sometimes there will be thunderstorms at a warm front. Or, you might see stratus clouds as a warm front approaches and then cirrus clouds after it passes.

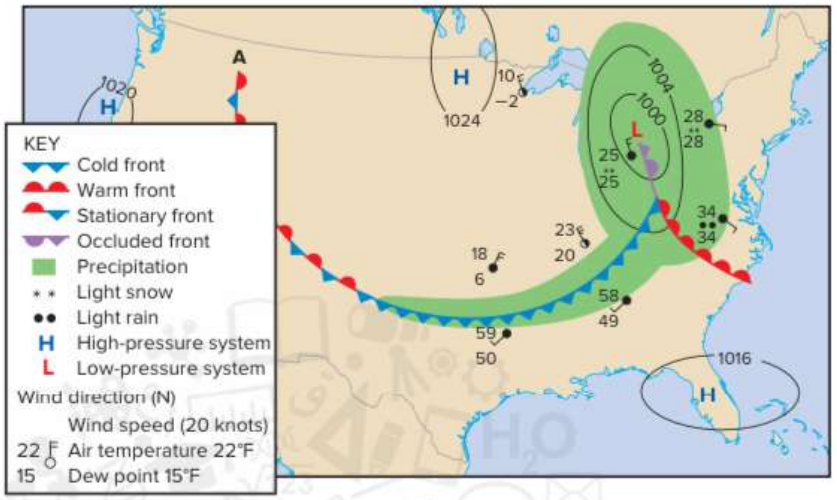
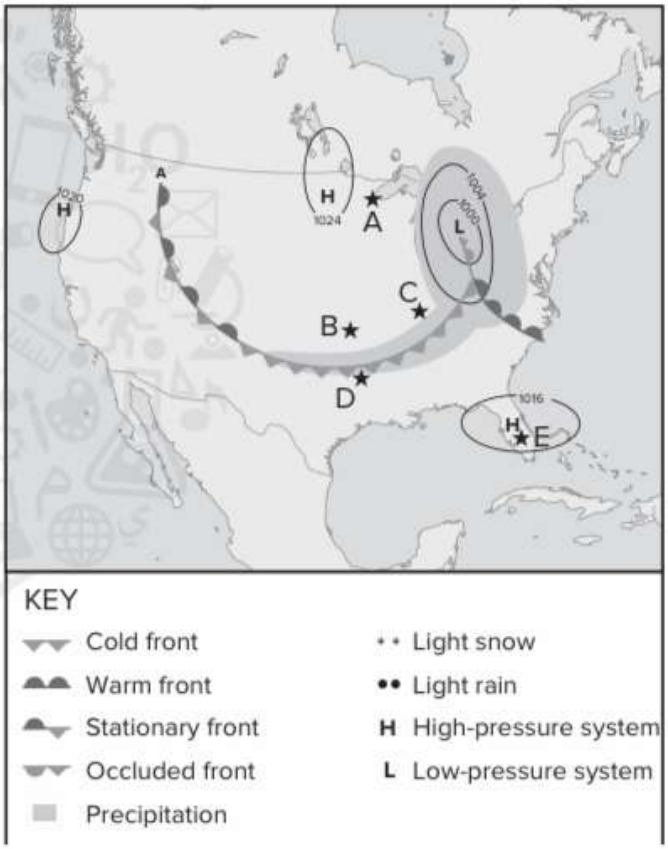


Figure 9 The line of red half-circles represents a warm front. The line of blue triangles represents a cold front. The shapes point toward the direction the front is moving. The line of red half-circles and blue triangles represents a stationary front.

Use the figure below to answer questions 10 & 11



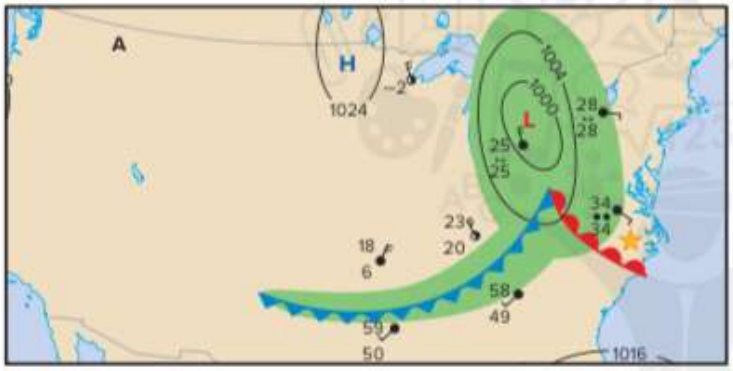
KEY

- Cold front
- Warm front
- Stationary front
- Occluded front
- Precipitation
- Light snow
- Light rain
- H High-pressure system
- L Low-pressure system

10 If this weather map shows today's weather, which city likely will have colder weather tomorrow? How do you know?

11 Which city or cities probably have clear skies today? Explain your answer.

14. Evaluate It was warm and sunny a few hours ago. Now the weather has turned windy and cold. There are cumulus clouds in the sky. Why is the weather changing?



15. Synthesize What kind of weather should the town marked with a star above expect?

Thunderstorms

If you've ever watched clouds, you know they constantly change. A cumulus cloud that becomes massive and tall is a towering, dark **cumulonimbus** (kyew myuh loh NIHM bus) **cloud**–*the type of cloud that can form thunderstorms. A* **thunderstorm** *is a weather event that includes rain, strong winds, thunder, and lightning.* The average thunderstorm is 25 km across and lasts only 30 min. However, some thunderstorms are huge and long-lasting, especially those that happen in the central part of the United States.

Thunderstorm Formation

When warm, moist air rises, it cools. Some of the cooled air sinks, starting the process of convection. Thunderstorms usually have many convection flows of air moving up and down. As the air cools, some of the water vapor in the air condenses and clouds form. As shown in **Figure 10,** a huge cloud can grow as more warm, moist air rises and more water vapor condenses. When the water droplets become large enough, rain starts to fall. The largest thunderstorms form where a warm, moist air mass meets a cool, dry air mass.

A thunderstorm happens in the area marked with an X. Where will the rainwater from this storm end up?

A in the Atlantic Ocean
B in the Gulf of Mexico
C in the Mississippi River
D in the Pacific Ocean

You hear there is a severe thunderstorm warning for your area. What other weather should you prepare for?

A clear skies
B freezing rain
C a tornado
D a drought

Hurricanes

A **hurricane** *is an intense tropical storm with winds exceeding 119 km/h.* A hurricane can produce strong winds, heavy downpours, lightning, and even tornadoes. As **Figure 13** shows, hurricanes are huge, averaging 480 km across. In other parts of the world, these large storms are called typhoons or tropical cyclones. When they occur in the north Atlantic Ocean, they are called hurricanes. An average of six hurricanes form each year in the north Atlantic Ocean.

At the center of these storms is a small area called the eye. In the eye, skies are clear and winds are light. Winds are strongest and the rain is most intense in the area around the eye.

A hurricane's winds can stir up huge waves. Also, *as a hurricane approaches land, its winds can push ocean water higher along the coast, creating* **storm surge.** As shown in **Figure 14,** storm surge can increase the sea level 6–10 m. This is high enough to cover buildings in low coastal areas.

Hurricane Formation

In the Atlantic Ocean, hurricane season is from June 1 to November 30. Hurricanes usually start as thunderstorms near the west coast of northern Africa. Warm ocean water provides energy for thunderstorms to become tropical storms. Humid air adds water to the growing clouds. If enough water and energy are added, tropical storms strengthen and become hurricanes. The storms move west across the Atlantic Ocean and then north along the eastern U.S. coast or into the Caribbean Sea or the Gulf of Mexico.

Atlantic hurricanes form

A. in Tornado Alley.

B. over south Florida.

C. near Bermuda's high-pressure system.

D. off the west coast of northern Africa.

Which is NOT a reason hurricanes form over the ocean in warm areas?

A Hurricanes need cool, dry air to form.

B Hurricanes need moist tropical air to form.

C Hurricanes use energy from warm water to form.

D Hurricanes need tropical winds to form.

What will happen to the hurricane shown below as it approaches the United States?

A. The storm will decrease in size.

B. The storm will increase in size.

C. The storm will move along the East Coast.

D. The storm will move into the Gulf of Mexico.

Latitude

Recall that, starting at the equator, latitude increases from 0° to 90° as you move toward the North Pole or the South Pole. The amount of solar energy per unit of Earth's surface area depends on latitude. **Figure 1** shows that locations close to the equator receive more solar energy per unit of surface area annually than locations located farther north or south. This is due mainly to the fact that Earth's curved surface causes the angle of the Sun's rays to spread out over a larger area. Locations near the equator also tend to have warmer climates than locations at higher latitudes. Polar regions are colder because annually they receive less solar energy per unit of surface area. In the middle latitudes, between 30° and 60°, summers are generally hot and winters are usually cold.

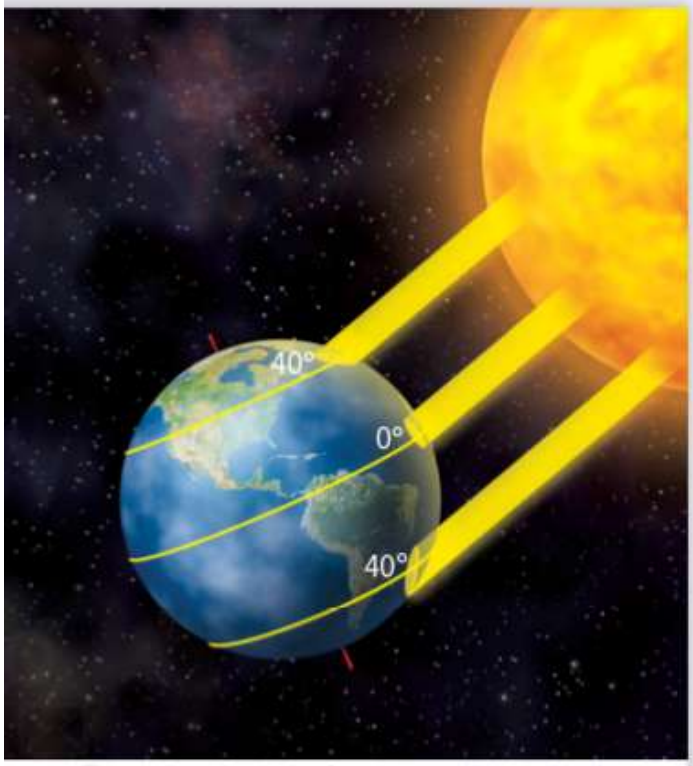
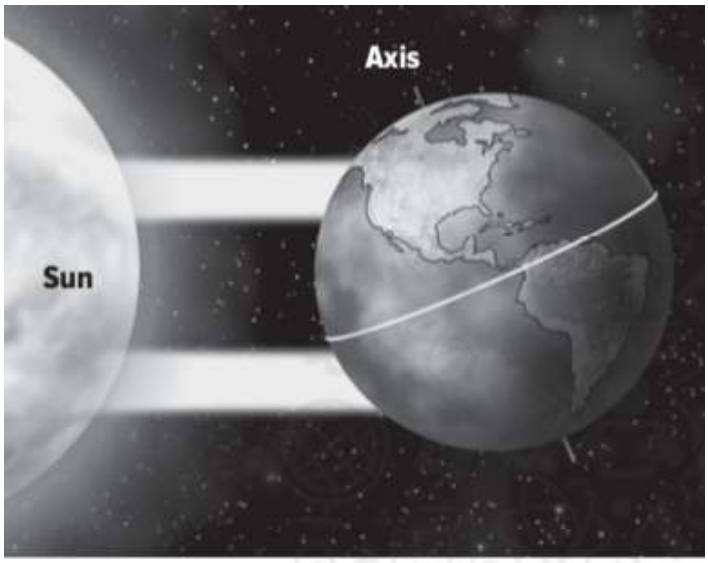
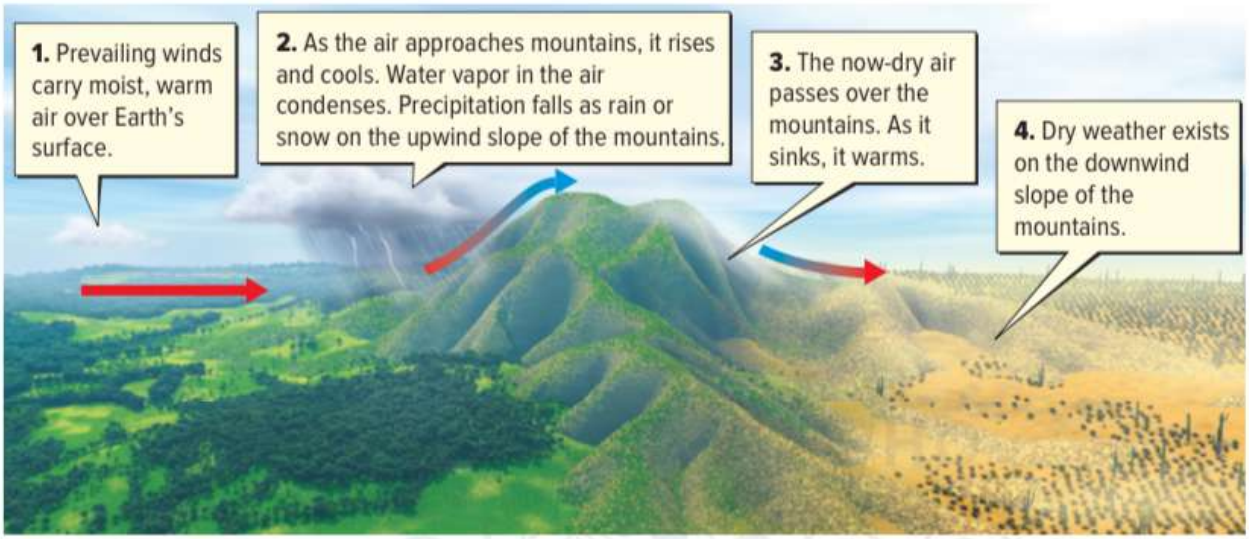


Figure 1 Latitudes near the poles receive less solar energy and have lower average temperatures



3 In the diagram above, what season is North America experiencing?

A fall
B spring
C summer
D winter



Rain Shadows

Mountains influence climate because they are barriers to prevailing winds. This leads to unique **precipitation** patterns called rain shadows. *An area of low rainfall on the downwind slope of a mountain is called a* **rain shadow,** as shown in **Figure 3.**

A rain shadow is created by which factor that affects climate?

A. a large body of water
B. buildings and concrete
C. latitude
D. mountains

What kind of climate would you expect to find at position 4?

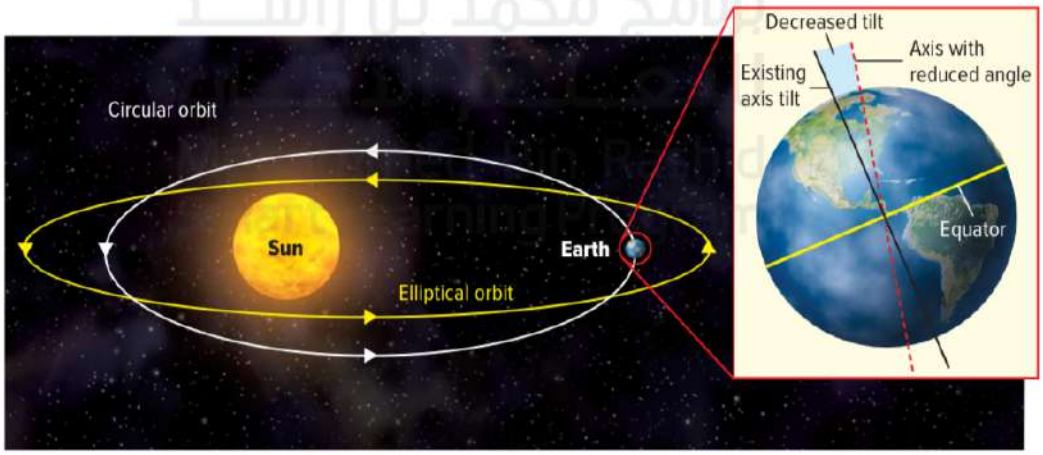
A mild
B continental
C tropical
D dry

Causes of Long-Term Climate Cycles

As the amount of solar energy reaching Earth changes, Earth's climate also changes. One factor that affects how much energy Earth receives is the shape of its orbit. The shape of Earth's orbit appears to vary between elliptical and circular over the course of about 100,000 years. As shown in **Figure 8,** when Earth's orbit is more circular, Earth averages a greater distance from the Sun. This results in below-average temperatures on Earth.

Another factor that scientists suspect influences climate change on Earth is changes in the tilt of Earth's axis. The tilt of Earth's axis changes in 41,000-year cycles. Changes in the angle of Earth's tilt affect the range of temperatures throughout the year. For example, a decrease in the angle of Earth's tilt, as shown in **Figure 8,** could result in a decrease in temperature differences between summer and winter. Long-term climate cycles are also influenced by the slow movement of Earth's continents, as well as changes in ocean circulation.

Long-term climate changes, such as ice ages and interglacials, can be caused by changes in the shape of Earth's orbit and the tilt of its axis.



Which are warm periods during or between ice ages?

A. ENSO
B. interglacials
C. monsoons
D. Pacific oscillations

Which characterizes interglacials?

A earthquakes
B monsoons
C precipitation
D warmth

Long-term climate cycles are caused by all of the following EXCEPT

A. changes in ocean circulation.
B. Earth's revolution of the Sun.
C. the slow movement of the continents.
D. variations in the shape of Earth's orbit.

What is the primary cause of seasonal changes on Earth?

A Earth's distance from the Sun
B Earth's ocean currents
C Earth's prevailing winds
D Earth's tilt on its axis

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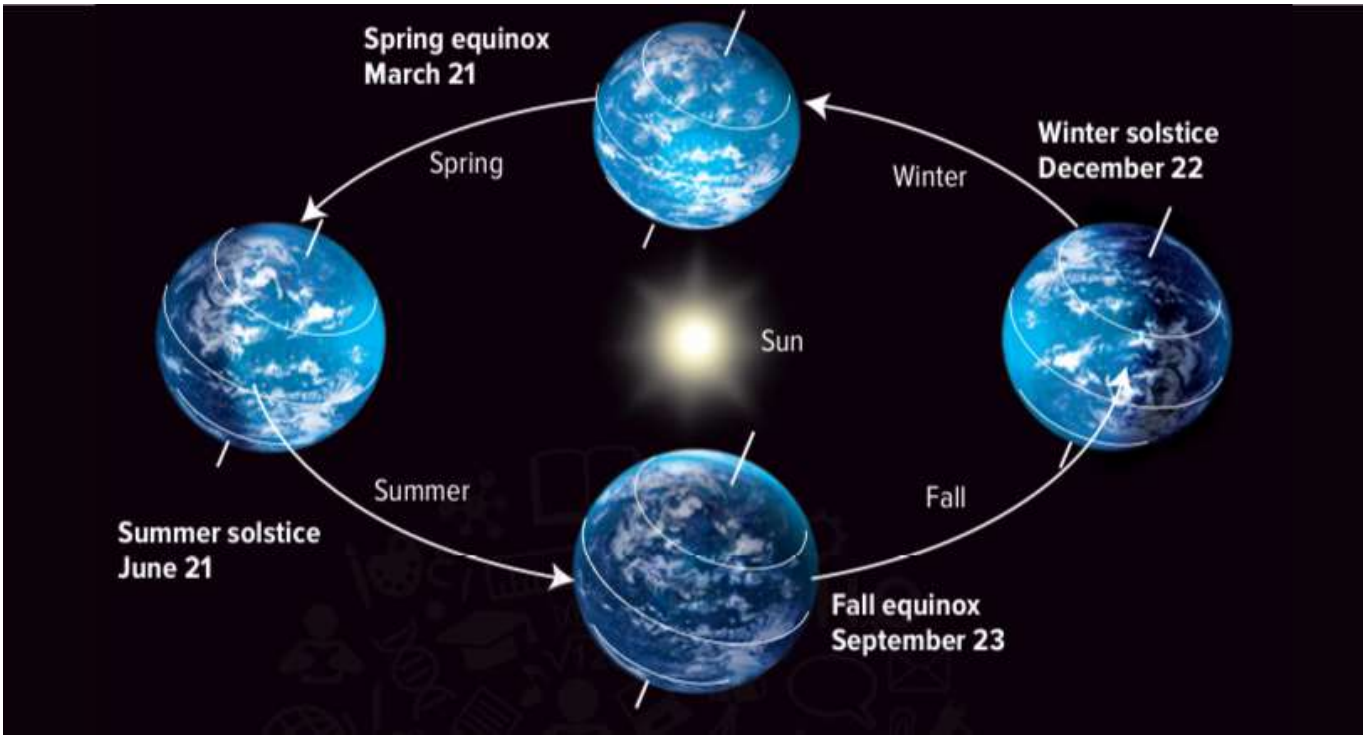
	Explains why short-term climate cycles such as seasons occur	student text book +figure10	



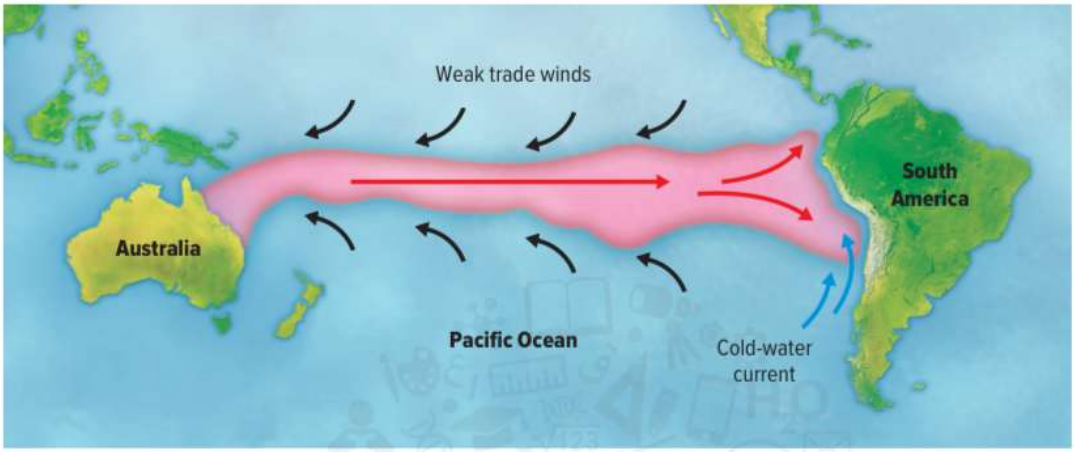
The picture below shows Earth as it revolves around the Sun.

Which season is it in the southern hemisphere in July?

A. fall **B.** spring

C. summer **D.** winter

The combined ocean and atmospheric cycle that results in weakened trade winds across the Pacific Ocean is called **El Niño/Southern Oscillation,** or ENSO. A complete ENSO cycle occurs every 3–8 years. The North Atlantic Oscillation (NAO) is another cycle that can change the climate for decades at a time. The NAO affects the strength of storms throughout North America and Europe by changing the position of the jet stream.



What happens during El Niño/Southern Oscillation?

A. An interglacial climate shift occurs.

B. The Pacific pressure pattern reverses.

C. The tilt of Earth's axis changes.

D. The trade winds stop blowing.

During which event do trade winds weaken and the usual pattern of pressure across the Pacific Ocean reverses?

A. drought

B. El Niño/Southern Oscillation event

C. North Atlantic Oscillation event

D. volcanic eruption

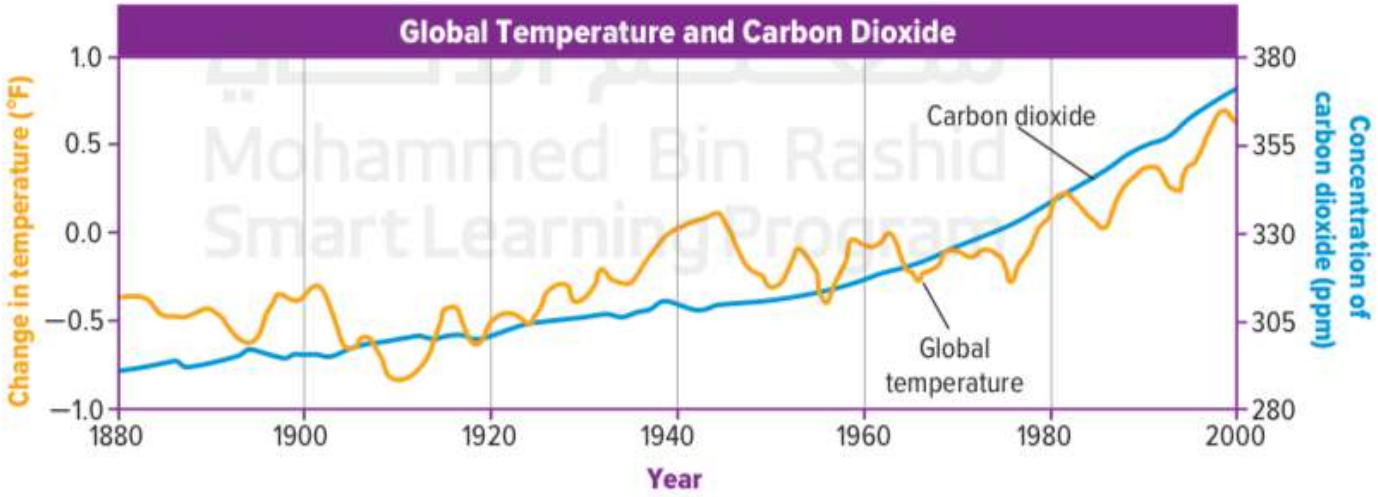
Human Impact on Climate Change

The rise in Earth's average surface temperature during the past 100 years is often referred to as **global warming.** Scientists have been studying this change and the possible causes of it. In 2007, the Intergovernmental Panel on Climate Change (IPCC), an international organization created to study global warming, concluded that most of this temperature increase is due to human activities. These activities include the release of increasing amounts of greenhouse gases into the atmosphere through burning fossil fuels and *large-scale cutting and burning of forests.* Although many scientists agree with the IPCC, some scientists propose that global warming is due to natural climate cycles.

Greenhouse Gases

Gases in the atmosphere that absorb Earth's outgoing infrared radiation are **greenhouse gases.** Greenhouse gases help keep temperatures on Earth warm enough for living things to survive. Recall that this phenomenon is referred to as the greenhouse effect. Without greenhouse gases, the average temperature on Earth would be much colder, about −18°C. Carbon dioxide (CO_2), methane, and water vapor are all greenhouse gases.

Study the graph in **Figure 14.** What has happened to the levels of CO_2 in the atmosphere over the last 120 years? Levels of CO_2 have been increasing. Higher levels of greenhouse gases create a greater greenhouse effect. Most scientists suggest that global warming is due to the greater greenhouse effect. What are some sources of the excess CO_2?



Which human activity can have a cooling effect on climate?

A. release of aerosols

B. global climate models

C. greenhouse gas emission

D. large area deforestation

Which cools the climate by preventing sunlight from reaching Earth's surface?

A. aerosols

B. greenhouse gases

C. lakes

D. water vapor molecules

Which action can reduce greenhouse gas emissions?

A. building houses on permafrost

B. burning fossil fuels

C. cutting down forests

D. driving a hybrid vehicle

Which cools the climate by preventing sunlight from reaching Earth's surface?

A. aerosols

B. greenhouse gases

C. lakes

D. water vapor molecules