The Weather Book Study Guide Answer Key

Lesson 1

Introduction

1. See glossary.
2. Accept reasonable answers. Examples: daily activities, how we dress, our moods, work to be done, travel, play.
3. Wind is invisible because we cannot see it. We can feel it and see the effects of it around us.
4. Accept reasonable answers. See John 3:8.
5. Seasons have come and gone since at least Genesis 1:14.
6. Accept reasonable answers. Examples: Perhaps beautiful with year-round growing seasons.

God Created

1. See glossary.
2. The moon causes tides in the ocean.
3. The oceans would become very polluted.
4. The sun is 400 times the size of the moon and 400 times further from the earth.
5. If the earth were to spin slower, the light side of the earth would be too hot and the dark side would be too

cold. If it were to spin faster there would be fierce winds on the face of the earth.

6. A smaller tilt would result in the higher latitudes being too cold which would bring about an ice age. A greater tilt would result in unstable climates.
7. Oxygen 21%; Nitrogen 78%; Argon 0.9%; Water vapor and carbon dioxide 0.15%
8. The sun emits dangerous ultraviolet rays that can cause skin cancer and damage skin, hastening the effects of aging.
9. 20 million.
10. Most burn up before they hit the ground.

Lesson 2

What Causes Weather

1. See glossary.
2. Wind direction, wind speed, visibility, amount of water vapor (humidity), air pressure, cloud condition, air quality.
3. Rain, freezing rain, snow, hail, drizzle.
4. Some is absorbed, some is reflected. Of the absorbed sunshine, some becomes heat energy, while a portion is turned into chemical energy stored in plants.
5. Invisible rays transmitting heat energy, given off by the land as it cools down at night.
6. If days are long and nights short during summer, more heat is gained by sunshine than lost by infrared radiation. It works the opposite in the winter.
7. Clouds and precipitation.

World Climate Zones

1. See glossary.
2. Answers will vary. Accept reasonable replies.
3. Tropical rain forests are found near the equator where it is both very warm and wet.
4. Thirty.
5. The closer to the ocean, the wetter the climate.
6. Mountains are cooler and wetter, while the land downwind from mountains is drier.

Lesson 3

Weather Facts

1. See glossary.
2. 280 mph.
3. Snow reflects 90 percent of light energy back into the atmosphere.
4. Missouri and Hawaii.
5. The center of a tornado.
6. The Antarctic ice sheet normally only receives an inch of precipitation per year.

How to Read a Weather Map

1. See glossary.
2. The two types of weather observations are surface observations and upper air observations.
3. The measurements are taken hourly for the surface and twice a day for the upper.
4. Computers draw weather maps and solve equations that

tell the estimated position of the jet stream, the fronts and pressure centers in the future.

5. Meteorologists do not know enough about the atmosphere nor do they have enough observations. They need bigger and faster computers. Even then, the weather is so complex and chaotic that there will always be substantial limits as to its predictability.
6. High pressure areas are generally areas of good weather.
7. Accept reasonable answers.

Jet Stream

1. The jet stream is a ribbon of high-speed wind in the upper atmosphere.
2. A jet stream is caused by the differences in temperature between the tropical and polar latitudes.
3. The speed of the jet stream is 90 mph during winter and 35 mph during the summer.
4. The jet stream can cause storms (low pressure areas) and cold and warm fronts and steers storms.
5. Storms move generally from west to east.
6. The wind speed varies with areas.
7. Stormy weather can usually be found associated with certain portions of the maximum wind.
8. Fourteen days.

El Niño

1. See glossary.
2. Poor fishing, heavy rains, flooding, thunderstorms and mud slides.
3. Research scientists are trying to find out what causes an

El Niño, how far the influences may extend and what effect the two El Niños have on global weather.

4. The warm water is poor in nutrients so there is less plankton and therefore fewer fish.

Unit One Quiz

1. The pull of the moon on the oceans is the main cause of the tides.
2. A smaller tilt would cause the higher latitudes to be too cold. This would bring about an ice age. A greater tilt would make the climates more unstable.
3. The seven components of weather are: wind direction, wind speed, visibility, water vapor, air pressure, cloud condition and air quality.
4. The five forms of precipitation are: rain, freezing rain, snow, hail and drizzle.
5. The closer the distance to the ocean, the wetter the climate.
6. A large portion of the Antarctic ice sheet normally receives an inch of precipitation per year.
7. High pressure areas are generally areas of good weather.
8. The jet stream is a ribbon of high speed wind in the upper atmosphere.
9. El Niño brings poor fishing, heavy rains, flooding, thunderstorms and mud slides.

Lesson 4

Water in the Atmosphere

1. See glossary.

2. It evaporates from the ocean.
3. Rainwater.
4. See semi-arid and arid climates.
5. Plankton is the bottom of the ocean food chain. Sea life depends on it for survival.

Clouds

1. See glossary.
2. Clouds form when the atmosphere can no longer hold all of the invisible water vapor so it condenses into water droplets or ice crystals.
3. Warm air.
4. They are all formed by moist air cooling enough to form clouds.
5. Cumulus, cirrus and stratus.
6. Usually on a bright, sunny day.
7. Cirrus.
8. Stratus.
9. Height.
10. Cumulonimbus and nimbostratus.

Warm Fronts and Cold Fronts

1. Warm air pushes the cold air back and warmer air rises above it.
2. Most clouds and precipitation are formed as air rises into the atmosphere.
3. Gravity.
4. We can tell when a warm front is approaching by the type of clouds observed – high clouds first, then thicker

and lower clouds.

5. When the warm front is close, the clouds are low and precipitation falls.
6. North or west.
7. Cold.
8. Thunderstorms.

Fog

1. Evaporation, advection, radiation, upslope.
2. Point of saturation, dew point.
3. Accept reasonable answers.
4. Fog is a cloud that forms on the ground.
5. Evaporation and advection.
6. Radiation, upslope, and advection.

Lesson 5

Thunderstorms

1. See glossary.
2. Tropics.
3. Cumulus.
4. Because updrafts that cause thunderstorms occur more often when the ground is warm than cool.
5. Three conditions: (1) A large difference in temperature between the ground and upper troposphere, (2) plenty of moisture in the lower atmosphere, and (3) a trigger—a process to start the thunderstorm.
6. Because the stratosphere is warmer than the air immediately below it.

7. Thunderstorms provide summer water, cool the earth, and clean the air. They also balance the earth's electricity and provide fertilizer.
8. Rainbows are sometimes seen with thunderstorms (Genesis 9:11–17).

Lightning

1. See glossary.
2. Both lightning and static electricity involve electrons that travel from a negative to a positive area liberating energy.
3. Thunder is the sound of air expanding as the temperature increases due to the lightning bolt splitting the air.
4. A sharp crack.
5. The speed of sound, 750 mph (1200 kph).
6. Lightning travels at the speed of light which is a million times faster.
7. Negative.
8. Positive.
9. Small clouds can generate electricity. Electricity can form without ice crystals. There are cases of positive charges, and scientists can't explain it.
10. Reasonable answers are meeting the energy needs of cities or an alternative to fossil fuel.

Lesson 6

Dangerous Thunderstorms

1. See glossary.

2. Ten percent.
3. He has given us the knowledge and ability to predict dangerous weather patterns so we can protect ourselves.
4. The combination of warm earth and moist air creates thunderstorms. Severe thunderstorms require this condition along with a strong updraft and a strong downdraft.
5. The two features are (1) moist air from the Gulf of Mexico and (2) the warm earth of the plains.
6. These regions are the southern and central midwest.
7. This is true because warm moisture from the Gulf of Mexico moves east across Florida and Florida stays warm most of the year.
8. California, Oregon and Washington.
9. (1) Slow moving thunderstorms drop an unusual amount of rain on a small area that cannot be absorbed by the ground. (2) Two or more gully-washing thunderstorms hit the same spot, one after another. (3) Heavy rain falls on rapidly melting snow.
10. Accept reasonable answers. Possibly by paying more attention to weather forecasts or by not taking chances unnecessarily while driving in flash flood conditions, such as not driving across a road when water is flowing over it.

Hail and Wind Damage

1. See glossary.
2. Cumulonimbus.
3. As a small water drop is blown upward inside a cloud, it collides with other supercooled drops, growing larger.
4. The speed of the downdraft determines the speed of the

hail.

5. The cloudy ice is caused mainly by rapid freezing, trapping many air bubbles.
6. False. Hail comes in strange shapes, sometimes with ragged edges.
7. Answers should include crop losses, property damage, injury and possible death.
8. Accept reasonable answers.
9. Losses include damage to mobile homes, roofs and airplane crashes.

Tornadoes

1. See glossary.
2. Tornadoes are relatively small, while hurricanes cover hundreds of miles.
3. For tornadoes, the updraft must be halted for a while by a layer of warm air just above the ground.
4. Storm chasers are professional people who try to get as close to a tornado as possible so they can film and take pictures of it.
5. Tornadoes form under the thunderstorm where there is little rain or lightning, in the southwest part of the storm cloud.
6. The most dangerous tornadoes are thick, black clouds that are 2,000 feet across. They spin at 250–300 mph. They move about 50 mph across the land. They can travel for 100 miles and have a damage path of over 1 mile wide.
7. Tornadoes can change shape as they move. They can also go back up into the cloud and to the ground again.

8. A tornado watch indicates conditions are right for a tornado to form.
9. A tornado warning indicates a tornado has been spotted or seen on Doppler radar.
10. We are able to see tornadoes because of condensed water vapor, dust and debris.
11. The largest number of waterspouts occurs in the Florida Keys.

Unit 2 Quiz

1. The water drop cycles from the ocean to the land to the ocean again.
2. The three basic cloud types are cumulus, cirrus and stratus.
3. Most clouds and precipitation are formed in areas of rising air in the atmosphere.
4. Fog is a cloud that forms on the ground.
5. A thunderstorm develops from a cumulus cloud.
6. Thunder is created when a lightning bolt splits the air. The temperature causes the air to expand at a rapid rate causing the sound we hear.
7. The three conditions needed are warm earth, moist air and a trigger.
8. As the drop of water travels upward, it collides with other super-cooled drops, all the while growing bigger.
9. Both lightning and static electricity involve electrons that travel from a negative to a positive area, liberating energy.
10. Flash floods occur when:

1. Slow moving thunderstorms drop an unusual amount of rain on a small area that cannot be absorbed into the ground.
2. Two or more gully-washing thunderstorms hit the same spot, one after another.
3. Heavy rain falls on rapidly melting snow.

11. The difference between tornadoes and hurricanes is that tornadoes are small, while hurricanes cover hundreds of miles.
12. A tornado watch means conditions are right for a tornado to form.
13. A tornado warning means one has been spotted or detected from Doppler radar.

Lesson 7

1. See glossary.
2. A monsoon is six months of rain in the tropics.
3. Tropical depression (rainstorm with winds of 38 mph (60 kph) or less), tropical storm (heavy rain and winds between 39–74 mph (60–120 kph), hurricane (very heavy rain and winds of 75 mph (120 kph) or greater).
4. They both chase after dangerous storms, hoping to gather information.
5. They have learned that most hurricanes form after the ocean water warms up past 80°F, so hurricanes are more likely to form during months when water temperatures are above this.
6. The eyewall directly surrounds the center, or eye, of the storm.

7. The falling barometric pressure in the middle of the mass of the hurricane causes the winds to increase.
8. Typhoons; willy-willies.
9. The rising ocean water on land (storm surge) causes 90 percent of the deaths.
10. Extremely low air pressure inside the hurricane.
11. The country is very flat, and there was no way to warn the people of Bangladesh because they did not have modern communication systems.
12. Most were killed by touching downed electrical wires.
13. It is a governmental agency that issues watches and warnings to the people of advancing hurricanes. They use the latest technology to do so.
14. It has been able to give 24-hour warnings of approaching storms. The people are able to leave their homes to go to safer areas until after the storm has passed.
15. When a hurricane draws near, Doppler weather radar tracks the storm's details.

Lesson 8

1. See glossary.
2. Earth's seasons are due to the tilt of its axis.
3. Shorter days (with less sunshine) and longer nights cause cooler temperatures.
4. Longer days allow more sunshine to warm the ground and atmosphere.
5. No seasons or very small changes in the temperature.
6. Warm winds from the ocean blow onto the land keeping it too warm for snow.

7. Plants and animals would not be protected from harsh winter weather. We would have no storehouse of water in the mountains.
8. It adds to the water table and replenishes above-ground water sources.
9. Erosion and even mudslides.
10. Winds over 35 mph and poor visibility.
11. A storm that moves northeast along the east coast.
12. A temperature inversion, so rain falling into below-freezing temperatures of the lower atmosphere becomes supercooled. Supercooled droplets freeze when jostled, sometimes before they hit the ground (ice pellets or sleet) and at other times on objects (freezing rain–very hazardous!).
13. Accept reasonable answers. Examples: auto accidents, property damage, personal injury or death due to the freezing temperatures.

Lesson 9

1. See glossary.
2. It occurs during the last phases of a violent thunderstorm.
3. Trade winds pick up great amounts of water vapor as they blow across the Pacific Ocean. The water vapor condenses as the winds move up the mountainside, forming clouds that quickly develop into thunderstorms.
4. Washington.
5. A relatively warm and dry wind that is descending down a mountain front.

6. Cumulus.
7. Chinooks (a native American word meaning "snow eater").
8. They can fan grass fires out of control. They can blow vehicles off the road or damage homes. They can cause rapid condensation of water vapor, leading to lowered driver visibility as car windows turn white.
9. Arctic cold fronts cause high evaporation rates, triggering heavy snowstorms once they hit land.
10. Winds blowing from the west pick up moisture as they cross the Great Lakes and cause snowstorms in places up to 100 miles (160 km) downwind from the Lakes.
11. It is a glowing ball of electricity that occasionally forms during thunderstorms.

Unit Three Quiz

1. The earth's seasons are due to the tilt of its axis.
2. Shorter days (with less sunshine) and longer nights cause cooler temperatures.
3. Longer days allow more sunshine to warm the ground and atmosphere.
4. The weather conditions during a blizzard are winds over 35 mph and poor visibility.
5. A monsoon is six months of rain in the tropics.
6. Scientists have learned that most hurricanes form after the ocean water warms up past 80°F, so hurricanes are more likely to form during months when water temperatures are above this temperature.
7. Doppler weather radar can track the details of a hurricane and thus provide warning to the population of

an area threatened.

8. A foehn wind is a relatively warm and dry wind descending a mountain front.
9. Arctic cold fronts cause high evaporation rates as they pass over the Great Lakes, triggering heavy snowstorms once they hit land.
10. A storm that moves northeast along the east coast.

Lesson 10

Climate in the Past

1. Warm-climate fossils have been found at high latitudes. Fossilized swamp cypress trees have been found in the Arctic Islands. Old river channels have been found in the Sahara Desert. Woolly mammoth bones have been found in Siberia.

Noah's Flood—Key to the Past

1. The beliefs one has about the past will affect how one interprets the evidence. We should be aware of our starting assumptions so that we understand how they are affecting our interpretations.
2. "The present is the key to the past"—i.e., the slow and gradual geological processes we sometimes observe today have been forming rocks, etc. this way for millions of years.
3. The Bible view is that creation took place approximately 6,000 years ago, and that God judged the entire Earth with a world-wide Flood during the time of Noah, approximately 4,500 years ago.
4. The vast amounts of water and sediment produced during the Flood would have had catastrophic effects

in re-shaping the geology of the earth. Many of the geological processes that occur slowly and gradually today would have taken place quickly during the Flood.

5. A straight-forward reading of the Bible shows that the earth is around 6,000 years old. It does not allow for the "millions of years" demanded by the uniformitarian view. See www.AnswersInGenesis.org/low_view for additional insights.
6. The Bible provides the history of the universe from the very beginning. Therefore, there is no time that is *before* history, or "pre-history."

The Ice Age

1. See glossary.
2. The ocean waters were warm from volcanic and tectonic activity (Note: much of the Flood waters came from under the ground), thus causing vast amounts of evaporation. As the water vapor blew over the cooler continents, it condensed as snow, continuing to fall in the northern latitudes year round. The piling snow eventually compacted into ice.
3. About 700 years.
4. The volcanic and tectonic activity that began during the Flood soon slowed. The rapid evaporation slowed down as the warm oceans cooled. The associated warming of the air, and the increased sunlight reaching the ground as the atmospheric dust and gas decreased, caused the ice sheets to begin to melt.

Lesson 11

1. See glossary.

2. The Ice Age was caused by the Genesis Flood. Since God promised to never again send a Flood of world-wide proportions, the conditions for starting another Ice Age will never again be present.
3. It helps to keep the atmosphere warm. As the amount of CO_2 in the atmosphere increases, the temperature of the earth's surface will increase.
4. Burning fossils fuels, cutting down trees.
5. Droughts may occur, hurricane activity may increase, ice sheets may begin to melt.
6. The amount of ozone found in the stratosphere is cyclical. Air circulation causes mixing of ozone. Certain chemical reactions can cause fluctuations, as can volcanic dust and gases.
7. Ozone is made from oxygen, yet oxygen supposedly could not have been present in Earth's original atmosphere, as oxygen destroys the compounds from which life allegedly evolved. But without oxygen, there would be no ozone layer, thus allowing harmful ultraviolet light to destroy the chemical compounds from which life allegedly evolved.

Lesson 12

God, Creation, and You

1. We have the responsibility of caring for the earth, as far as it is possible for us to do so, by cleaning up pollution or litter, etc. See also www.AnswersInGenesis.org/environmentalism.
2. Pantheism is the belief that everything is God. The Bible teaches that God and His Creation are *distinct* (Genesis 1, John 1:1-3), and that the essence of idolatry is giving

worship to created things instead of the Creator (Ex. 20:4-6, Rom. 1:23,25).

Unit Four Quiz

1. Briefly: The uniformitarian view is such that things originated on their own over millions of years, and that death, disease and suffering have always been a part of history. The biblical view states that God created a perfect world in 6 normal-length days around 6,000 years ago; that death, disease, corruption and suffering entered the world after Adam rebelled; that the Flood of Noah's day formed a majority of the rock layers and fossils we find today and initiated the Ice Age.
2. The ground would have been cooler and summers much colder. The oceans would have been warmer. Snow would have fallen in the northern latitudes year-round.
3. The Flood, which provided the right conditions to initiate the Ice Age was an one-time event.
4. The ozone layer protects the earth from harmful ultra-violet rays.
5. Christians are to take care of the earth and everything on it, including the atmosphere.