Lesson 5 Test Bank – Atmospheric and oceanic circulations

Multiple Choice Questions

1. Which type of heat transfer primarily involves phase changes?
   1. Conduction
   2. Radiation
   3. Sensible heat
   4. Latent heat

Correct Answer: D

1. What is air pressure?
   * 1. The speed of air movement
     2. The weight of the air above a location
     3. The temperature of the air
     4. The amount of water vapor in the air

Correct Answer: B

1. Which instrument measures atmospheric pressure without using liquid?
   * 1. Mercury barometer
     2. Anemometer
     3. Aneroid barometer
     4. Hygrometer

Correct Answer: C

1. What term describes the sideways movement of air along Earth’s surface?
2. Convection flow
3. Wind
4. Barometric pressure
5. Conduction

Correct Answer: B

1. How are winds typically named?
2. By the direction they come from
3. By the direction they are heading
4. By their altitude
5. By the type of cloud they produce

Correct Answer: A

1. What happens to air pressure as altitude increases?
   * 1. It remains constant
     2. It increases
     3. It decreases
     4. It fluctuates randomly

Correct Answer: C

1. What is the standard sea-level pressure in millibars?
   * 1. 1000 mb
     2. 1013.2 mb
     3. 950 mb
     4. 29.92 mb

Correct Answer: B

1. What is the typical height of a mercury column in a barometer at sea level?
2. 760 mm (76 cm)
3. 1013 inches
4. 29.00 millibars
5. 32.01 inches

Correct Answer: A

1. Which unit is commonly used for air pressure in U.S. weather forecasts?
   * 1. Pascals
     2. Kilopascals
     3. Inches of mercury
     4. Newtons per square meter

Correct Answer: C

1. Under which condition was the highest surface air pressure ever recorded?
2. When the air was very cold
3. When the air was very hot
4. At a high elevation
5. During high humidity

Correct Answer: A

1. Which weather phenomenon is typically linked to the lowest barometric pressures on Earth?
2. Hurricanes or typhoons
3. Frontal boundaries
4. Cold, dry climates
5. Sea level conditions

Correct Answer: A

1. Which of the following causes air pressure to increase?
   * 1. Rising temperature and lower density
     2. Sinking cold air and higher density
     3. Expansion of the air column
     4. Decrease in air molecules

Correct Answer: B

1. What does a pressure gradient represent?
   * 1. A temperature difference
     2. A change in elevation
     3. A change in pressure over distance
     4. A shift in wind direction

Correct Answer: C

1. What is a line connecting points of equal atmospheric pressure on a weather map called?
2. Isotherm
3. Isoplat
4. Isobar
5. Isohyet

Correct Answer: C

1. Closer isobars on a weather map indicate:
   * 1. Weak winds
     2. Stronger pressure gradients and faster winds
     3. Calm weather
     4. Higher humidity

Correct Answer: B

1. Wind flows from:
   * 1. Low to high pressure
     2. West to east only
     3. High to low pressure
     4. South to north

Correct Answer: C

1. Which of the following does not influence wind speed or direction?
2. Electromagnetic force
3. Pressure gradient force
4. Coriolis force
5. Friction force

Correct Answer: A

1. What is the Coriolis effect?
   * 1. Gravitational pull on air masses
     2. Bending of light in the atmosphere
     3. Deflection of moving air due to Earth's rotation
     4. Result of atmospheric friction

Correct Answer: C

1. What is the primary cause of wind?
2. Earth’s rotation
3. Uneven heating of Earth’s surface
4. Changes in ocean currents
5. Atmospheric pollution

Correct Answer: B

1. In which direction does the Coriolis force deflect moving air in the Northern Hemisphere?
2. Left
3. Right
4. East
5. South

Correct Answer: B

1. How are moving objects and winds affected by Earth's rotation in the Northern Hemisphere?
2. Always deflected west in the Southern Hemisphere
3. Influenced only by pressure gradient and friction
4. Deflected to the right due to friction
5. Apparently deflected to the right from a straight path

Correct Answer: D

1. What would lead to a stronger Coriolis effect on a moving object?
2. An increase in wind speed
3. Location near the equator
4. Greater surface friction
5. Movement over short distances

Correct Answer: A

1. Which statement correctly describes the Coriolis force?
   * + 1. It causes equal deflection from equator to poles
       2. It only affects motion along latitude lines
       3. It is strongest at the equator and zero at the poles
       4. Its strength varies with Earth's rotation speed and object velocity

Correct Answer: D

1. Which force opposes wind near the Earth's surface and slows it down?
2. Coriolis force
3. Friction
4. Gravity
5. Magnetic force

Correct Answer: B

1. On a weather map, widely spaced isobars indicate:
2. Light winds
3. Stormy weather
4. Strong winds
5. Rising air

Correct Answer: A

1. What does an anemometer measure?
2. Air temperature
3. Wind speed
4. Atmospheric pressure
5. Wind direction

Correct Answer: B

1. What is a cyclone in meteorology?
2. High-pressure system with diverging winds
3. Area of descending air and clear skies
4. Low-pressure system with converging surface winds
5. A wind with constant direction

Correct Answer: C

1. Which statement accurately describes the behavior of air in high-pressure systems?
2. Air rises and converges
3. Air sinks and spreads outward
4. Air rises and spreads outward
5. Air sinks and converges inward

Correct Answer: B

1. What is the general surface wind pattern around a low in the Northern Hemisphere?
2. Clockwise and inward
3. Clockwise and outward
4. Counterclockwise and inward
5. Counterclockwise and outward

Correct Answer: C

1. What characterizes a high-pressure system in the Northern Hemisphere?
2. Air converging and rising
3. Air diverging and rotating counterclockwise
4. Air diverging and rotating clockwise
5. Rising warm air

Correct Answer: C

1. What happens to air as it flows into a low-pressure center?
2. It converges and rises
3. It diverges and rises
4. It converges and sinks
5. It diverges and sinks

Correct Answer: A

1. Which of the following is associated with Chinook winds?
2. Cold and humid conditions
3. Sudden cooling and cloud formation
4. Rapid warming and drying on the leeward side
5. Seasonal reversal of wind direction

Correct Answer: C

1. Santa Ana winds increase wildfire risk because they are:
2. Cold and wet
3. Dry and slow-moving
4. Hot, dry, and fast
5. Moist and coastal

Correct Answer: C

1. What is the term for winds that spiral counterclockwise into a low-pressure area in the Northern Hemisphere?
2. Cyclonic
3. Anticyclonic
4. Geostrophic
5. Meridional

Correct Answer: A

1. What is a monsoon?
2. Constant trade wind
3. Seasonal reversal of wind direction
4. Cold descending wind
5. Local land breeze

Correct Answer: B

1. Which of the following pairings about air circulation is incorrect?
2. Anticyclone – high pressure center
3. Cyclone – low pressure center
4. Anticyclone – clockwise circulation in the Southern Hemisphere
5. Cyclone – counterclockwise in the Northern Hemisphere

Correct Answer: C

1. What direction do trade winds blow in the tropics?
2. From southeast in the Southern Hemisphere and northeast in the Northern Hemisphere
3. From the equator toward the poles
4. From west to east globally
5. Directly upward due to convection

Correct Answer: A

1. The Intertropical Convergence Zone (ITCZ) is characterized by:
2. Dry descending air
3. Cold polar winds
4. Rising air and heavy rainfall
5. Strong westerlies

Correct Answer: C

1. Which wind belt lies between 30° and 60° latitude?
2. Trade winds
3. Polar easterlies
4. Prevailing westerlies
5. Equatorial doldrums

Correct Answer: C

1. What drives the formation of the Hadley cell?
2. Cold air from the poles
3. Seasonal monsoons
4. Rising warm air near the equator
5. Strong polar jet streams

Correct Answer: C

1. What best describes the atmospheric conditions in the Intertropical Convergence Zone (ITCZ)?
2. Convergence and rising of warm surface air
3. Convergence and sinking of cold air
4. Divergence and rising of warm air
5. Divergence and sinking of cold air

Correct Answer: A

1. What happens in the upper atmosphere above a surface low-pressure system?
2. Convergence
3. Divergence
4. Sinking air
5. High pressure

Correct Answer: B

1. What causes the Polar Jet Stream to be strongest near the polar front?
2. Uniform pressure
3. Lack of Coriolis effect
4. Steep temperature gradient
5. Constant solar input

Correct Answer: C

1. The Intertropical Convergence Zone (ITCZ) is most closely associated with which of the following?
2. Horse latitudes
3. Midlatitude wind systems
4. Equatorial low-pressure trough
5. Subtropical high-pressure systems

Correct Answer: C

1. What is the name of the tropical circulation pattern involving rising air at the ITCZ and sinking air in the subtropics?
2. Polar cells
3. Ferrel cells
4. Hadley cells
5. Jet streams

Correct Answer: C

1. What are the winds called that blow from the northeast and southeast and converge at the Intertropical Convergence Zone (ITCZ)?
2. Westerlies
3. Polar easterlies
4. Trade winds
5. Jet streams

Correct Answer: C

1. What is the dominant surface wind direction in the midlatitudes?
2. Easterly
3. Westerly
4. Northerly
5. Southerly

Correct Answer: B

1. Wind blows \_\_\_\_\_\_\_\_\_\_In the Northern Hemisphere
   1. in a counterclockwise direction into the center of a low pressure system.
   2. in a counterclockwise direction into the center of a high pressure system
   3. in a clockwise direction into the center of a low pressure system
   4. in a clockwise direction into the center of a high pressure system.

Correct Answer: A

1. Air \_\_\_\_\_ at the surface and \_\_\_\_\_\_ above a low pressure system
   1. converges; diverges
   2. converges; converges
   3. diverges; converges
   4. diverges; diverges

Correct Answer: A

1. If my latitude was 20 N I will be under the influence of
   1. the polar easterlies
   2. the westerlies
   3. the northeast trade winds
   4. none of the above.

Correct Answer: C

1. A warm, dry wind that descends the lee side of mountains is called
   1. a monsoon
   2. a chinook
   3. a valley wind
   4. a land breeze

Correct Answer: B

1. A valley breeze
   1. occurs when wind is blowing in the down slope direction
   2. occurs when higher pressure is found near the top of the mountain
   3. occurs at night
   4. occurs when none of the above are true

Correct Answer: D

1. During the summer over monsoon Asia
   1. winds blow from land toward water creating a dry season
   2. winds blow from land toward water creating a wet season
   3. winds blow from water toward land creating a dry season
   4. winds blow from water toward land creating a wet season

Correct Answer: D

1. Which of the following patterns of pressure will you experience traveling from the equator to the north pole?
   1. low - high - low - high
   2. high -low - high - low
   3. low - low - high - high
   4. high - high -low – low

Correct Answer: A

1. Which of the following patterns of wind belts will you experience traveling from the equator to the north pole?
   1. Easterlies, Westerlies, Tradewinds
   2. Tradewinds, Easterlies, Westerlies
   3. Westerlies, Easterlies, Tradewinds
   4. Tradewinds, Westerlies, Easterlies

Correct Answer: D

1. Given equal energy input to both surfaces, I would expect to find
   1. higher pressure over land and lower pressure over water during the day
   2. air flowing from land toward water during the day
   3. lower pressure over water and higher pressure over land during the day
   4. none of the above

Correct Answer: D

1. According to the weather station model below, the wind direction is
   1. northeast
   2. southwest
   3. northwest
   4. southwest

Correct Answer: A

1. Which wind pattern explains the desert conditions near 30° latitude?
2. Polar easterlies
3. ITCZ uplift
4. Sinking air from subtropical highs
5. Mountain-valley winds

Correct Answer: C

1. Between 30° north and the equator, from which direction do winds blow as they move out of the subtropical high toward the ITCZ?
2. Northeast; subtropical high
3. Northwest; subtropical high
4. Southeast; subtropical high
5. Southwest; subtropical high

Correct Answer: A

1. What are the primary surface winds that blow from the subtropics toward the higher latitudes?
2. Westerlies
3. Trade winds
4. Polar easterlies
5. Jet streams

Correct Answer: A

1. What is the dominant climate characteristic of the regions between 20° to 35° north and south latitude?
2. Zones of major water surplus
3. Warm, wet areas with tropical rainforests
4. Arid and semi-arid desert regions
5. Regions dominated by cyclonic low pressure

Correct Answer: C

1. The Beaufort Scale is used to estimate:
2. Air pressure at sea level
3. Temperature changes with altitude
4. Wind speed based on land or sea conditions
5. Ocean current strength

Correct Answer: C

1. What is the typical surface circulation around a cyclone in the Southern Hemisphere?
2. Clockwise and inward
3. Counterclockwise and inward
4. Clockwise and outward
5. Counterclockwise and outward

Correct Answer: A

1. What causes surface wind to cross isobars at an angle?
2. Jet stream influence
3. Friction
4. Latitude variation
5. Ocean currents

Correct Answer: B

1. What is the most prominent feature of upper-level westerly geostrophic wind flow?
2. Rossby waves
3. Jet streams
4. Cyclones
5. Ferrel cells

Correct Answer: B

1. What is a trough in meteorological terms?
2. A high-pressure ridge
3. An area of descending air
4. An elongated low-pressure system
5. An upper-level jet

Correct Answer: C

1. What is a key characteristic of Santa Ana winds?
2. They bring cool, moist air from the east to coastal California
3. They are not influenced by pressure gradients
4. They flow upslope and cool as they rise
5. They bring hot, dry air southwestward, increasing wildfire risk

Correct Answer: D

1. How do mountain-valley winds differ between day and night?
2. Day: downslope; Night: upslope
3. Day: upslope; Night: downslope
4. Same all day
5. Only occur during storms

Correct Answer: B

1. Which statement accurately describes sea breezes?
2. Caused by water heating faster than land
3. Result from higher pressure over land than sea
4. Involve onshore winds that develop in the afternoon
5. Occur because warm air is denser and sinks

Correct Answer: C

1. Which statement best describes mountain and valley breezes?
2. Warm air descends mountain slopes during the day and rises at night
3. Caused by valley floors heating faster than slopes during the day
4. Warm air rises upslope during the day, and at night, cool air sinks to the valley floor
5. They are caused by daytime high-pressure systems forming upslope

Correct Answer: C

1. What are seasonally reversing wind systems that bring shifts in rainfall patterns called?
2. Sea breezes
3. Santa Ana winds
4. Chinook winds
5. Monsoons

Correct Answer: D

1. What are the typical seasonal conditions in a monsoon climate?
2. Dry summers and dry winters
3. Dry summers and wet winters
4. Wet summers and dry winters
5. Wet summers and wet winters

Correct Answer: C

1. What oceanic event leads to warmer than normal sea-surface temperatures in the eastern Pacific?
2. La Niña
3. ITCZ shift
4. El Niño
5. Gulf Stream intensification

Correct Answer: C

1. During La Niña, what is expected in the southeastern U.S.?
2. Cooler and wetter conditions
3. Warmer and drier conditions
4. No change in climate
5. Constant rainfall

Correct Answer: B

1. How do ocean currents circulate around high-pressure systems in each hemisphere?
2. Counterclockwise in the Northern Hemisphere; clockwise in the Southern Hemisphere
3. Parallel in the Northern Hemisphere; perpendicular in the Southern Hemisphere
4. Clockwise in the Northern Hemisphere; counterclockwise in the Southern Hemisphere
5. Perpendicular in the Northern Hemisphere; parallel in the Southern Hemisphere

Correct Answer: C

1. What are desert winds like dust devils caused by?
2. High humidity
3. Surface heating and rising air
4. Cold fronts
5. Air pollution

Correct Answer: B

1. What happens to wind speed with increasing altitude in the troposphere?
2. It decreases
3. It stays the same
4. It increases
5. It fluctuates randomly

Correct Answer: C

1. What best describes the El Niño–Southern Oscillation (ENSO)?
2. An annual event around Christmas in the southern Pacific
3. A periodic shift in pressure between the western and eastern Pacific occurring every 2 to 12 years
4. A wind and pressure pattern affecting the northern Pacific only
5. A north-south pressure fluctuation in the North Atlantic

Correct Answer: B

1. What is the main function of ocean currents in climate regulation?
2. Reflect solar radiation
3. Create high-pressure zones
4. Redistribute heat between latitudes
5. Form clouds over land

Correct Answer: C

Written Response Questions:

1. Compare and contrast the movement of air around cyclones and anticyclones.

Correct Answer: Cyclones: Air moves inward toward the center of a cyclone (converges) at the surface, then rises up and diverges from the top. In the Northern Hemisphere air moves in a counterclockwise direction at the surface while in the Southern Hemisphere the air moves in a clockwise direction.

Anticyclones: Air converges at the top, subsides toward the surface, then diverges outward. In the Northern Hemisphere air moves in a clockwise direction outward from the center at the surface. In the Southern Hemisphere the air moves in a counterclockwise direction at the surface.

1. Why does air pressure vary across Earth's surface?

Correct Answer: Variations in air pressure across the surface can occur in two ways, by thermal and mechanical means. Thermal means require the heating or cooling of air. When air is heated it becomes buoyant and rises off the surface and lowers surface pressure as it circulates away. If air is chilled it can sink, building pressure at the surface. Surface features like mountains can slow air allowing it to build up and increase pressure.

1. What controls wind velocity?

Correct Answer: Wind velocity is primarily a function of the pressure gradient force and surface friction. The greater the pressure greater the faster the wind. Rough surfaces impart friction to air and slow it down.

1. Draw a diagram of the global pattern of wind and pressure from the equator to the poles.

Correct Answer: See lecture slides for the diagram.

1. Define Monsoon. Explain how the monsoon circulation over Asia develops.

Correct Answer: Monsoon means wind that changes direction with season. During the summer, the Asian continent warms more than the ocean creating lower pressure over land and higher pressure over water. The resulting pressure gradient causes wind to blow from over the ocean toward land. This is the wet monsoon period. During winter, the pattern reverses with higher pressure over land and lower pressure over water. Air now travels from over the land toward the ocean. This is the dry monsoon period.

1. Explain how cold and warm ocean currents function.

Correct Answer: The major ocean currents are wind-driven currents. Cold currents form in response to air blowing out of a subtropical high that passes over a cool pool of water dragging it equatorward. Warm ocean currents form in response to air blowing out of a subtropical high that passes over a warm pool of water dragging it poleward.

1. Describe the effect of ocean currents on weather and climate.

Correct Answer: Ocean currents help redistribute heat across the Earth's surface. Warm ocean currents move heat gained in low latitudes toward high latitudes. Cold ocean currents moving equatorward help conduct heat out of the tropical atmosphere thus lowering low latitude temperatures. Ocean currents also affect precipitation. Cold ocean currents tend to make air stable thus inhibit precipitation formation. Warm ocean currents help to promote unstable conditions which enhance the likelihood for precipitation.

1. Explain how land - sea breezes form.

Correct Answer: Land/sea breezes form along coast of major bodies of water. A sea breeze occurs during the day as land warms more than nearby water. The differential temperature pattern creates a pressure gradient directed from over water (higher pressure) to land (lower pressure). Air travels from over the water toward land. A land breeze typically occurs at night when land cools more than nearby water. This creates a pressure gradient oriented from over the land (higher pressure) toward water (lower pressure).

1. Describe the effect of the global pattern of pressure on global precipitation patterns.

Correct Answer: Generally speaking, low pressure is associated with moist conditions while high pressure is associated with dry conditions. The ITCZ creates moist conditions in the low latitudes by promoting converging air masses. The subtropical high creates dry conditions in the subtropics like those found in the great deserts of the Earth (e.g. Sahara). In the midlatitudes the presence of the subpolar low and polar front jet stream creates humid conditions. Over the poles, the subsiding air of the polar high inhibits the creation of precipitation promoting dry conditions there.

1. How does jet stream affect surface pressure systems?

Correct Answer: The jet stream provides support for the formation and life-cycle of surface pressure systems. Regions of convergence and divergence are found in the jet stream. Some surface cyclones form beneath zones of diverging air aloft while surface anticyclone can form beneath zoned of converging air aloft.

1. How do Santa Ana winds increase wildfire risk in California?

Correct Answer: They are hot, dry winds that descend and warm, drying vegetation and increasing fire danger.

1. Name and describe the three global atmospheric circulation cells.

Correct Answer: Hadley (0°–30°), Ferrel (30°–60°), and Polar (60°–90°) cells move heat poleward and shape climate zones.

1. Compare El Niño and La Niña.

Correct Answer: El Niño: warm eastern Pacific, wet south U.S.; La Niña: cool eastern Pacific, dry south U.S., wet/cold north.

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