**MODULE 18: EOLIAN AND ARID LANDSCAPES**

**Note:** Please refer to the GETTING STARTEDmodule to learn how to maneuver through, and how to answer the lab questions, in the Google Earth (GE.gif) component.

**KEY TERMS**

You should know and understand the following terms:

|  |  |  |
| --- | --- | --- |
| Abrasion | Loess | Rain shadow |
| Barchan dune | Longitudinal dune | Reversing dune |
| Barchanoid Ridge dune | Mesa | Star dune |
| Butte | Parabolic dune | Sub-tropical high |
| Canyon | Pinnacle | Transverse dune |
| Desertification | Plateau | Yardang |
| Dome dune | Playa |  |

**LAB LEARNING OBJECTIVES**

After successfully completing this module, you should be able to do the following tasks:

* Identify erosional processes and features created by wind
* Identify depositional processes and features created by wind
* Describe the processes that create eolian landforms
* Distinguish different sand dune types
* Calculate slope
* Interpret the topographic profile of a landscape

**INTRODUCTION**

This module examines the eolian processes and arid environments. Topics include dune classification, eolian processes and features, and arid landforms. While these topics may appear to be disparate, you will learn how they are inherently related. The module starts with four opening topics, or vignettes, which are found in the accompanying Google Earth file. These vignettes introduce basic concepts of the eolian and arid landscapes. Some of the vignettes have animations, videos, or short articles that will provide another perspective or visual explanation for the topic at hand. After reading the vignette and associated links, answer the following questions. Please note that some links might take a while to download based on your Internet speed.

GE.gifExpandthe **INTRODUCTION** folder and then check **Topic 1: Introduction**.

GE.gif Read **Topic 1: Introduction**.

**Question 1**: What are some common characteristics of arid landscapes?

Read **Topic 2: Arid Land and Water**



**Question 2**: What are some sources of water for human use in arid environments?

GE.gif Read **Topic 3: Hot and Cold Deserts**.

**Question 3**: Why are polar deserts studied by scientists?

GE.gif Read **Topic 4: Human Interaction**.

**Question 4**: Name four techniques that humans have employed to stop desertification.

GE.gif Read **Topic 5: Eolian Landscapes**.

**Question 5**: Where is the thickest known Loess deposit and what is the depth?

Condense and uncheck **INTRODUCTIONGLOBAL PERSPECTIVE**



GE.gif Expand **GLOBAL PERSPECTIVE**. Double-click and select **Major World Deserts**.

This map shows the location of major deserts (in tan) throughout the world. It is important to note that while deserts are always considered arid environments, arid environments are not always deserts. Arid environments also include Mediterranean regions and semi-arid lands, among others. Areas where water is severely limited, eolian processes become the dominant mechanism for erosion, transportation and deposition of sediments.

GE.gif Expand and select **Major Cities**.

This map shows the location of major cities located in arid environments. At present, such cities are placing increasing pressure on water resources and contributing to desertification.

For Questions 6 to 9, type the information provided in the **Search** tab in Google Earth and press **Enter**. When you arrive at your destination, find the information to fill in the blanks below.

**Question 6:** Cairo, Egypt

Latitude/Longitude:

Population:

**Question 7:** Riyad, Saudi Arabia

Latitude/Longitude:

Population:

**Question 8:** 12° 2'49.53"S, 77° 0'37.67"W

City: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Population:

**Question 9:** 33°22'22.03"N, 112°34'48.60"W

City: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Population:

Condense and uncheck **GLOBAL PERSPECTIVE**



**LOCATION OF ARID REGIONS**

The following factors influence the location of deserts:

* Subtropical high pressure systems
* Rain shadow effect
* Ocean current temperatures
* Distance to large bodies of water

It is important to note that two or more of these factors may influence the location of deserts.

GE.gif Expand the **LOCATION OF ARID REGIONS** folder. Double‑click and select **Sahara Desert**.

Subtropical high pressure systems are generally located between 15 and 30 degrees north and south. At these locations, high pressure systems exist, with descending air warming as it falls. The result is a climate of hot temperatures and little precipitation. The Sahara desert is a good example of a desert formed because of a subtropical high pressure system.

GE.gif Double‑click and select **Oregon Great Sandy Desert**.

The rain shadow effect can be seen on the leeward side on mountain ranges. An air mass approaching a mountain range is forced upward by the mountains and precipitation results on the windward side of the range. On the leeward side, the air mass loses most of its moisture and warms as it descends the mountain range. The result is a semi-arid to arid landscape. The Oregon Great Sandy desert is a good example.

GE.gif Double‑click and select **Atacama Desert**.

Cold ocean currents do not significantly heat air mass above them. The result is an air mass containing little moisture, and when the air mass reaches land, precipitation is almost non-existent. The Atacama Desert is a good example.

GE.gif Double‑click and select **Gobi Desert**.

The distance to a large body of water such as an ocean or sea, is a factor, because water bodies can provide moisture to air masses, which in turn lead to precipitation. The further an area is from a large body of water, the less likely it is to receive moisture. The Gobi Desert straddling the China-Mongolia border is an example of an arid region far from a large body of water.

Description: GE.gif Double‑click and select **Namib Desert**.

**Question 10**: Which of the following factors are mainly responsible for the location of the Namib Desert?

1. Subtropical high pressure
2. Rain shadow effect
3. Cold ocean currents
4. Distance from large body of water

**Question 11**: Why did you pick the answer, or answers, you did in question 10?

Description: GE.gif Double‑click and select **Great Sandy Desert**.

**Question 12**: Which of the following factors are mainly responsible for the location of the Great Sandy Desert?

1. Subtropical high pressure
2. Rain shadow effect
3. Cold ocean currents
4. Distance from large body of water

**Question 13**: Why did you pick the answer, or answers, you did in question 12?

Description: GE.gif Double‑click and select **Taklimakan Desert**.

**Question 14**: Which of the following factors are mainly responsible for the location of the Taklimakan Desert?

1. Subtropical high pressure
2. Rain shadow effect
3. Cold ocean currents
4. Distance from large body of water

**Question 15**: Why did you pick the answer, or answers, you did in question 14?

Description: GE.gif Double‑click, and select, **Mojave Desert**.

**Question 16**: Which of the following factors are mainly responsible for the location of the Mojave Desert?

1. Subtropical high pressure
2. Rain shadow effect
3. Cold ocean currents
4. Distance from large body of water

**Question 17**: Why did you pick the answer, or answers, you did in question 16?

Condense and uncheck **LOCATION OF ARID REGIONS**



**EROSIONAL AND TRANSPORTATION PROCESSES AND LANDFORMS**

Description: GE.gif Expand **EROSIONAL AND TRANSPORTATION PROCESSES AND LANDFORMS**.

Description: GE.gif Expand **Erosional Features**.

GE.gif Double‑click and select **Fly Over**. Watch the fly over of the Spider Rock location to get an overview of the features and terrain in the area.

GE.gif Select **Spider Rock**. Use the transparency slide ruler to compare the aerial photograph to the topographic map. As you can see, there are several features common to this arid environment.

Identify the features labeled  through ****.

**Question 18:** Feature : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  |  |  |
| --- | --- | --- |
| A. Canyon | B. Mesa | C. Butte |
| D. Pinnacle | E. Plateau | F. Playa |

**Question 19**: Why did you pick the feature you did in Question 16?

**Question 20:** Feature : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  |  |  |
| --- | --- | --- |
| A. Canyon | B. Mesa | C. Butte |
| D. Pinnacle | E. Plateau | F. Playa |

**Question 21**: Why did you pick the feature you did in Question 20?

**Question 22:** Feature : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  |  |  |
| --- | --- | --- |
| A. Canyon | B. Mesa | C. Butte |
| D. Pinnacle | E. Plateau | F. Playa |

**Question 23**: Why did you pick the feature you did in Question 22?

**Question 24:** Feature : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  |  |  |
| --- | --- | --- |
| A. Canyon | B. Mesa | C. Butte |
| D. Pinnacle | E. Plateau | F. Playa |

**Question 25**: Why did you pick the feature you did in Question 24?

GE.gif Double‑click ****. This feature is found at the lowest elevation within the region, where high evaporation rates leave minerals (salt) from the water onto the ground surface.

**Question 26**: Feature : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  |  |  |
| --- | --- | --- |
| A. Canyon | B. Mesa | C. Butte |
| D. Pinnacle | E. Plateau | F. Playa |

**Question 27**: Why did you pick the feature you did in Question 26?

**Depositional Processes and Landforms**

GE.gif Double-click **Depositional Feature**. Double-click and select ****.

**Question 28**: Identify Feature : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Description: GE.gif Double-click and select **Measure Distance**

**Question 29**: Compute the distance (in km) across the Feature ****: \_\_\_\_\_

**Question 30:** What evidence exists of human activity on Feature ? \_\_\_\_\_

GE.gif Double-click and select **Slope 1**. Right‑click the title **Slope 1**, and then select **Show Elevation Profile.**

Using the elevation readings (that is, place your cursor over the elevation profile chart), compute the slope of the lines. Recall that slope is rise/run and the units need to be the same when dividing (that is, both in meters).

**Question 31**: What is the RISE (elevation gain) in feet? \_\_\_\_\_\_\_\_

**Question 32:** What is the RUN of the line (distance) in feet? \_\_\_\_\_\_\_\_\_

**Question 33:** What is the slope of the line (average slope)? \_\_\_\_\_\_\_\_

GE.gif Double-click and select **Slope 2**. Right‑click the title **Slope 2**, select **Show Elevation Profile**, and then compute the slope of the red line.

**Question 34**: What is the RISE (elevation gain) in feet? \_\_\_\_\_\_\_\_

**Question 35:** What is the RUN of the line (distance) in feet? \_\_\_\_\_\_\_\_\_

**Question 36:** What is the slope of the line (average slope)? \_\_\_\_\_\_\_\_

The x-axis is the distance along the elevation profile.

**Question 37:** The greatest slope is located between which distance markers on the x-axis?

**Question 38:** Describe the topographic profile of an arid landscape that would produce Feature 

**SAND DUNE CLASSIFICATION**

Description: GE.gif Click **SAND DUNE CLASSIFICATION**.

Use the animation to identify characteristics of dune types and to complete the table below. The first one has been done for you as an example

|  |  |  |  |
| --- | --- | --- | --- |
| **Dune type** | **Wind** | **Sand** | **Vegetation** |
| *Barchan* | From one constant direction | Limited | No |
| **Question 39:** Barchanoid Ridge |  |  |  |
| **Question 40:** Transverse |  |  |  |
| **Question 41:** Longitudinal |  |  |  |
| **Question 42:** Parabolic |  |  |  |
| **Question 43:** Star |  |  |  |
| **Question 44:** Dome |  |  |  |
| **Question 45:** Reversing |  |  |  |