

Type your name here: **MY NAME**

1. Answer directly and completely - don't beat around the bush.
2. Read the verb(s) twice in the sentence before you begin writing. This tells you what we are looking for in your answer. Answers need not be long – but preferably to the point.
3. Point values for each question are given in parentheses.
4. Of course, any notes you have prepared are allowed in answering the exam. All page references refer to pages 656-659 Wanda Weatherley's notebook.

Below is a copy of Table 8 from the USGS publication described on page 656. Questions 1-3 are related to page 656.

Month	Average monthly temperature (C)			Average monthly precipitation (mm)		
	<i>Pinus flexilis</i>	<i>Pinus ponderosa</i>	<i>Pinus edulis</i>	<i>Pinus flexilis</i>	<i>Pinus ponderosa</i>	<i>Pinus edulis</i>
1	-7.9	-4.0	-2.1	39.0	57.0	24.0
2	-5.7	-1.3	0.7	33.0	43.0	20.0
3	-2.7	1.4	3.9	40.0	45.0	24.0
4	2.1	5.6	8.2	40.0	39.0	19.0
5	7.3	10.2	13.1	47.0	41.0	20.0
6	11.9	14.5	18.3	44.0	35.0	17.0
7	15.7	17.9	21.4	39.0	29.0	49.0
8	14.7	17.3	20.0	39.0	32.0	54.0
9	10.1	13.1	15.9	38.0	32.0	35.0
10	4.9	7.6	10.2	31.0	37.0	30.0
11	-2.2	1.0	3.7	34.0	50.0	21.0
12	-7.1	-3.1	-1.3	38.0	58.0	24.0

**Question 1 (10)** Which of the three pine species occurs in a monsoonal climate? Provide a brief justification for your answer.

***Pinus edulis* clearly grows in a distinct monsoonal climate, with its characteristic low-to-moderate precipitation in the winter/spring and high precipitation in the summer.**

**Partial credit for identifying that there is summer rain in zones where both *Pinus ponderosa* and *Pinus flexilis* live.**

**Question 2 (10)** While there are clear differences in the total amounts of precipitation for the landscapes in which these three pine species occur, there are clearly differences in the total amounts of precipitation received and some species could be exposed to a drought during the growing season. Which of the species (if any) occurs in a habitat with at least one month in which potential evapotranspiration exceeds precipitation? If so, what months are water-deficit months?

***Pinus ponderosa* (July and August) and *Pinus edulis* (May and June).**

**Question 3a (5)** Which of these species is likely to occur on landscapes with the most extensive precipitation as snow?

*Pinus flexilis.*

**Question 3b (5)** For that pine species, if the growing season is defined as any month in which the average temperature is above 0°C, how many months long is the growing season for that pine species?

**Seven months.**

Questions 4-7 relate to page 657.

**Question 4 (10)** Based on a climate diagram analysis, what are the primary differences in climate between Long Beach, Washington, and Long Beach, California?

**The two major differences are the total annual precipitation and the extent of the summer drought.**

**Question 5 (10)** Based on your understanding of climate diagrams for the three Colorado City cities, in which of these was the photograph of the surrounding vegetation taken? Please provide a brief explanation to justify your answer.



**Technically, this photograph could have been taken in any of the three locations. However, it is from Colorado City, Arizona.**

**Question 6 (10)** Based on your understanding of climate diagrams and the relationships between climate and vegetation, what vegetation (biome) do you expect to find in Florida, Missouri?

**Deciduous forest.**

**Question 7 (10)** Why is the natural vegetation around Naples, Utah, not the same vegetation as you find surrounding Naples, Italy? Provide a brief explanation.

**The differences in vegetation between the two Naples cities occurs because the climates are quite different. Naples, Italy, is in a Mediterranean climate. Naples, Utah, is a cold desert steppe location.**

Questions 8-12 relate to page 659.

**Question 8 (10)** Based on the information on page 659, which conifer species is the most drought tolerant and which is the least drought tolerant?

***Juniperus osteosperma* is the most drought tolerant.**

***Pinus longaeva* is the least drought tolerant.**

**Question 9 (10)** Mount Ellen is named after Ellen Powell Thompson, the sister of the great explorer John Wesley Powell. When I climbed Mount Ellen recently, I ascended from the south side, had lunch on the peak, and then descended on the north side. During the hike I noticed that the upper-lower distribution limits of the conifers were different on the two different slopes. Why should this be the case?

**The difference in the lower elevation distributions on north versus south slopes is related to site water balance (precipitation minus evaporation). The south-facing slopes are drier because of greater solar exposure. The upper distribution is determined by cold-temperature tolerances and may be the same on both slopes.**

**Question 10 (10)** Continuing on with the topic in Question 9, should the lower distribution limits of subalpine fir be lower or higher on the south-facing slopes? Provide a brief explanation to support your answer.

**Higher. The difference in the lower elevation distributions on north versus south slopes is related to site water balance (precipitation minus evaporation). The south-facing slopes are drier because of greater solar exposure.**

**Question 11 (10)** Are the Henry Mountains in a region that receives monsoonal precipitation? Yes or no. Please provide a brief justification for your answer.

**Yes. *Pinus edulis* trees occur only in regions with monsoonal rains. *Pinus edulis* is present in the Henry Mountains.**

**Question 12 (10)** Is there a tree line on the peaks of the Henry Mountains? Yes or no. Please provide a brief justification for your answer based on information on page 659.

**Yes. The text clearly indicates an alpine zone, which is the vegetation type occurring above treelines.**