Restrict your responses **only** to the space available. Answer directly and fully - don't beat around the bush. Point values for each question are given in parentheses. Of course, any notes you added to Wanda's notebook printouts are allowed in answering the exam. All page references refer to Wanda's notebook.

1 (12). Of the locations described on page 158, what biome would you expect to occur at **location 7230160**? Provide a justification for your answer based on the climate diagram on page 159.

(5) This climate diagram is from a region occupied by an eastern deciduous forest ecosystem.

(7) Based on the observation that there is a year-round excess of precipitation, we know that this is a forest ecosystem region. Based on the warm summer temperatures, we know that this is likely to be a region occupied by deciduous forests and not coniferous forests.

2 (12). Of the locations described on page 158, what biome would you expect to occur at **location 7245000**? Provide a justification for your answer based on the climate diagram on page 159.

(5) This climate diagram is from a region occupied by a tall-grass prairie ecosystem (Wichita, Kansas).

(7) Based on the observation that the precipitation and temperature curves are nearly identical to each other, we are seeing an ecosystem where precipitation inputs just about equal the evapotranspiration.

This defines a semi-arid ecosystem, most likely a grassland We know that this would be a tall-grass prairie (as opposed to a short grass prairie), because the precipitation input always exceed evapotranspiration potential.. We know that this is a grassland and not a forest, because of the absence of sufficient wintertime precipitation.

3 (12). There are vegetation patterns as one drives up the Wasatch Mountains. For example, as one drives up Big Cottonwood Canyon, a tree species first appears on the north-facing slope and later at higher elevations they appear on the south-facing slope. We see these patterns in the data on page 156. Please provide a brief explanation of why these patterns are expected. Be sure to comment on both elevation and slope observations.

(5) The lower distribution limits of trees in the Wasatch Mountains are determined by site water balance (seasonal/annual soil water availability).

(7) North and south facing slopes have different energy balances, with south facing slopes being warmer and drier than north facing slopes at similar altitudes. Thus, at lower elevations, we would expect trees to first appear on a north facing slopes because these sites have a more favorable water balance, are cooler, and impose less evaporative stress than the south facing slope at the same altitude.

4 (10). Based on the tree distribution data for the western Wasatch Mountain slopes (page 156), how would you go about predicting the lower tree limits for trees on the eastern Wasatch Mountain slopes?

(5) I would make the assumption that the lower limit for tree distribution was determined by the same site water balance (seasonal/annual soil water availability) on both west and east sides of the Wasatch Mountains.

(5) Using the precipitation-elevation regression data, I would calculate what the elevation on the east side would be to produce an equivalent site water balance.

Name _____

5 (12). The relationships between precipitation and elevation for the east and west sides of the central Wasatch Mountains are provided on page 157. Briefly provide a succinct but complete **quantitative** description of the relationships between precipitation and elevation on the east (e.g., Park City) and west (e.g., Alta) sides of the Wasatch Mountains. Be sure to comment on the slopes of the precipitation-elevation relationships and why these patterns expected.

(3) Precipitation is positively related to elevation on both west and east sides of the Wasatch Mountains.

(3) The slope of this relationship is steeper for the west side (y = 0.519*x-262) than the east side (y = 0.253*x-42).

(6) Since the majority of rainfall comes in the winter and storms come from out of the west, we expect a west-to-east rainshadow. The west side of the Wasatch should therefore be much wetter than the east side. If you graph the data, you will see that much more rain falls on the western slopes than on eastern slopes at similar altitudes.

6 (10). Provide a clear, complete and justified explanation for why total daily transpiration amounts in the experimental treatment *Lactuca* are greater than on the control plants (natural orientation) (page 162).

(6) The total daily transpiration is greater on the experimental plants, because these leaves receive much greater solar radiation loads, particularly during midday periods.

(6) Given that both sets of leaves have identical conductances, we would expect that water loss and solar radiation incident on the leaf surface would be positively related to each other.

7 (10). Provide a succinct interpretation of the data results plotted on page 163.

(5) At every plant size, the control plants have higher seed yields than do the experimental treatment plants and the slope of this seed yield versus size relationship is steeper for the control plants.

(5) The control plants always have a greater reproductive output because these plants are able to photosynthesize and accumulate carbon for reproduction over a longer period into the drought (i.e., more days). The experimental plants transpire water at a higher daily rate, running out of water earlier in the season. When this happens the experimental plants die and reproduction is terminated.

8 (10) How do the early and late season leaf arrangements for *Lactuca* on page 160 relate to seasonal microclimate patterns?

(5) Early in the growing season air temperatures are cooler and plants have horizontal leaves in the warmer part of the microclimate profile at the soil surface.

(5) Later in the growing season, when air temperatures are hotter, new elevated leaves are produced that are above the hotter surface portion of the microclimate profile. The effect is to prevent leaf from attaining high leaf temperatures.

9 (12) Please match the observed plant life-form distributions on page 164 with specific biomes as described on page 158.

	Biome
Location 1	***Deserts of southern Utah***
Location 2	***Rocky Mountain coniferous forest***
Location 3	***Savannas of Texas***

10 (10) Locations 1 and 2 on page 164 have significantly different abundances of phanerophytes and therophytes. Would they be expected to have similar differences in the abundances of annuals and trees?

Yes or no. ***Yes***.

Provide a brief explanation to support your claim.

These are identical, redundant terms. Trees are phanerophytes and annuals are therophytes.

11 (5) What is the common name for *Abies concolor*?