The lectures that will be covered in the quiz include:

- Stability, convection, latent heat release  Chapter 6
- Precipitation processes and types  Chapter 7
- Laws of motion and wind  Chapter 8
- Hawaii local winds  Chapter 9
- Global circulation  Chapter 10
- El Niño – impact on Hawaiian weather  Chapter 10/Lecture notes

1. An air parcel that is saturated (100% relative humidity) is lifted from sea level to the top of a mountain pass at 2 km elevation. If its temperature was 15°C at sea level, its new temperature at the pass will be ___________? (Show your work)

2. If the air parcel in part a) descended the far side of the pass back to a sea level elevation, its final temperature will be _____________? Use your answer to 7) as the starting point, and assume the descending parcel is dry because the excess cloud water has rained out. (Show your work).

3. Given the dry and moist adiabatic lapse rates in the figure on the right, draw and label lines that represent a conditionally unstable lapse rate, an absolutely stable lapse rate, and an absolutely unstable lapse rate.

4. Under what conditions in the atmosphere is the wind in geostrophic balance with the PGF = Co?

5. Write an equation for the geostrophic wind \( V_g \).

6. From a carefully drawn hand analysis the magnitude of the gradient in geopotential height \( (Z) \) at 500 mb over Seattle, Washington is estimated to be 10 m per 100 km, with lower heights to the south. Calculate the wind speed
in knots consistent with this gradient, and give the direction that the wind is blowing from. (Assume \( f \sim 10^{-4} \text{ s}^{-1} \), \( g \sim 10 \text{ m s}^{-2} \), 2 kt \( \sim 1 \text{ m s}^{-1} \)).

7. Give some examples of atmospheric phenomena the produce winds for which the Coriolis force is not important.

8. What causes the sea breeze and why is the sea breeze circulation strongest on the Island of Hawaii?

9. What is the relationship between the orientation and spacing of isobars on a weather map and the direction and strength of the winds?

10. For the following question, place an \( X \) in the box under the appropriate forces that are in balance in each case.

<table>
<thead>
<tr>
<th></th>
<th>Pressure</th>
<th>Coriolis</th>
<th>Gravity</th>
<th>Centrifugal</th>
<th>Friction</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Geostrophic Balance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Hydrostatic Balance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. Cyclostrophic Balance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. Gradient Balance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. Straight-line Surface Winds</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

11. El Niño conditions include anomalously warm sea surface temperatures over the eastern equatorial Pacific and anomalous westerly winds near the international dateline. Textbooks often misplace the enhanced rainfall near the coast of Central America, whereas it is really nearer the dateline. Why is that?

12. Using the diagram below draw and label the major features of the general circulation of the Earth’s atmosphere. Include arrows for winds, locate highs (H) and lows (L), Hadley cell, trade winds, westerlies, easterlies, ITCZ, and polar front.