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Private Pilot Research - Weather Theory (Clouds)

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Clouds are extremely helpful indicators of weather and require adequate water vapor and air cooling to form, which cause moisture to transform into miniscule particles. Cloud type can be determined through the height, shape, and characteristics of the cloud and is dependent on the stability of the air mass when lifting occurs. The following are the basic types of clouds and their characteristics:

- Stratiform: formed when a stable and moist air mass is forced up the slope of a mountain and include Stratus, Stratocumulus, and Nimbostratus cloud formations
- Altocumulus: indication of a very strong turbulence and include Altostratus and Altocumulus cloud formations
- Cirrus: made of primarily ice crystals, which contribute to the structural icing on the plane, and include Cirrostratus and Cirrocumulus cloud formations
- Cumulonimbus: highest vertical development and has the greatest turbulence
- Altocumulus Standing Lenticularis: indicate heavy turbulence where winds move quickly through clouds

Because ice formations require below-freezing temperatures and clouds, in order to avoid icing within clouds, pilots either: fly around clouds, are aware of temperature and dew point spread, use pitot heat and carb heat, are aware of where above freezing temperatures are, or cycle the landing gear.

Furthermore, clouds form at the altitude where the temperature and dew point are the same value. In order to calculate where the base of clouds will form, pilots use the following cloud base formula: cloud base = 1000((temperature - dew point)/4.4)

Cloud coverage is based on what percentage of the sky is covered by clouds, and is interpreted by the following levels:

- Clear (CLR/SKC): 0/8 of the sky covered by clouds
- Few (FEW): 1/8 to 2/8 of the sky covered by clouds
- Scattered (SCT): 3/8 to 4/8 of the sky covered by clouds
- Broken (BKN): 5/8 to 7/8 of the sky covered by clouds
- Overcast (OVC): 8/8 of the sky covered by clouds

When the sky is considered broken or overcast, we consider the clouds to be the “ceiling”.

Finally, in order for thunderstorms to form, the air must have sufficient water vapor, an unstable lapse rate, and an initial lifting action must start the thunderstorm process. Because of the potential risks of lighting, hail, and strong turbulence, it is important to avoid thunderstorms as much as possible when flying an aircraft.