

Instrument Oral Questions

The test will be of a practical nature, asking questions based on a practical IFR flight. All answers should be of a conservative nature.

What are the required aircraft inspections for today's IFR flight?

Within the preceding 24 calendar months, each transponder, each static pressure system, each altimeter instrument, and each automatic pressure altitude reporting system has been tested and inspected. (FAR 91.411), ELT, VOR, Annual or 100 hour inspection.

What is the required recent pilot experience?

Six approaches within the past six months with holding and intercepting and tracking courses. (61.57c)

Does tracking a localizer count for tracking a course?

YES

What are the ways to accomplish a VOR check?

VOR test signal (VOT) +/- 4°, a designated VOR system checkpoint on an airport +/- 4°, an airborne checkpoint +/- 4°, use a prominent ground point along a selected radial +/- 6°, Dual VOR check +/- 4°. Each person making the VOR operational check shall enter the date, place, bearing error, and sign the aircraft log or other record.

Out of the several ways to check a VOR, which one is the best?

VOT ground check

When do you need to include an alternate airport in your IFR flight plan?

1,2,3 rule

When the weather at the destination airport within 1 hour before and 1 hour after the ETA is forecast to be less than 2000' ceiling and visibility is forecast to be less than 3 miles.

Can you file an IFR flight plan to a non-IFR airport?

YES – but you must file an alternate airport.

How much fuel is required for the IFR flight?

Enough to reach destination + alternate + 45 minute reserve

What are the speed categories based on when flying a non-precision approach?

Groundspeed

If you are flying a non-precision DME approach, how long should you be level prior to reaching the MAP?

1 mile from the missed approach point (MAP)

If you are flying a non-precision timed approach, how long should you be level prior to reaching the MAP?

1 minute prior to reaching the missed approach point (MAP)

How long before the flight should you file your IFR flight plan?

1 hour minimum

Can you depart an airport in uncontrolled/Class G airspace and enter the clouds without getting your IFR clearance?

YES – but not very safe. (FAR 91.175 (f) only restricts part 121, 125, 129 and 135 aircraft)

It is perfectly legal to fly IFR in glass G airspace, including departure and instrument approaches. It is commonly done in some areas (Alaska). You don't need an IFR flight plan in class G (and ATC would not issue one anyway).

You must meet ALL of the usual currency and equipment rules.

If you are "cleared as filed", does this guarantee route and altitude?

NO – only the route

If you are VFR at night and inadvertently get into the clouds and call for a pop up IFR clearance, should you move up or down to get on an IFR altitude?

Neither – you should stay at the VFR altitude until instructed by ATC to change to an IFR altitude. This will at least give you 500' separation should there be an IFR plane above or below.

What are some mandatory reports an IFR pilot needs to make?

Compulsory reporting points if not in radar contact, any non-forecast weather conditions, loss of instruments, entering a holding pattern, missed approach.

What direction is standard for holding?

Right

What is MEA and MOCA and the difference?

Minimum Enroute Altitude guarantees obstruction clearance and adequate radio/navigation reception. Minimum Obstruction Clearance Altitude guarantees only obstruction clearance.

If you were to lose communications, what is the correct transponder code and what do you do to try to fix it?

Squawk 7600 and check for transmit lights. Check radio volume adjustments, try co-pilot side if equipped, try hand mike and cabin speaker, try cell phone, turn-up volume on nearby VOR station – ATC may try to call you on the VOR frequency.

What route and altitude would you fly if you lost all communications?

Last assigned route, if on a radar vector – direct to point being vectored too, expect further clearance route or flight plan route. (AVEF) Fly at the highest of (1) last assigned altitude (2) MEA/MOCA (3) expect further clearance altitude (if given a “wait time”, do not start the climb until after you have waited the time – example ... “climb 3000’, expect 8000’ in 10 minutes”

FAR 91.185

What do the large and small numbers within a specific latitude/longitude grid on the Enroute Low Altitude Chart represent and how do they differ from the VFR Sectional Chart?

The number on the IFR chart is the Off-Route Obstruction Clearance Altitude (OROCA). The OROCA represents the highest possible obstruction elevation including both terrain and vertical obstruction data (towers, trees, etc.). The number on the VFR Sectional Chart is the Maximum Elevation Figure (MEF). OROCA is computed just as the MEF except that it provides an additional vertical buffer of 1000' in designated non-mountainous areas and a 2000' vertical buffer in designated mountainous areas within the United States.

Looking at the Enroute Low Altitude Chart, what is the quickest way to tell if an airport has an instrument approach?

Blue and Green have approaches – Brown ones do not. (Green airports are more prevalent – these airports are published in the FAA TPP and the DOD FLIP. Blue airports are only published in the DOD FLIP.)

What do the solid blue lines represent on the Enroute Low Altitude Chart?

These are low altitude RNAV (GPS) only routes. They will always begin with a “T” prefix and a “TK” prefix for helicopter only routes.

What do the numbers in the square box represent just below an airway line?

Total distance for the route

Why do some airway route intersections have a line across them and other do not? It looks like a sideways “T”.

This is to inform the pilot that the next leg segment has a change in the MEA.

Look at Lexington VOR (HYK). Why do some of the outbound radials have a degree mark & other radials do not?

The radials with the degree mark are numbers that could easily be read backwards when the chart is turned around; therefore, the degree symbol is inserted to keep the pilot from reading the radial incorrectly.

How long before a flight does a good preflight take place?

Whatever it takes to adequately assess the weather conditions and weather trends and to give adequate time for airplane servicing and repairs prior to the flight. Most planning and pre-flights should begin at least 24 hours in advance of the flight.

If a VOR changeover point does not have a defined crossing radial depicted on the chart, how do we know when we are there?

You can time it or ask ATC to point it out for you.

What is the fastest way to determine your ground speed?

Ask ATC

Look at the KDKX LOC 26, what is RIZEN?

It is the Outer Marker and the FAF

What three ways can we identify RIZEN?

(1) tones & lights from the marker beacon (2) GPS (3) Ask ATC

What color will the marker beacon light be?

Blue

Can you use (DKX/LOC 26) or (RHP/GPS 08) as an alternate?

YES, but it has non-standard alternate minimums – 1000-2

Where do you find the non-standard alternate minimums?

In front of the procedures book

Can you get a clearance on the ground at DKX?

YES, clearance delivery frequency is 121.7

It is 33 degrees F at the time we will be departing. Ceiling is 1000' overcast with tops reported at 3000'. What are some of the things you should check prior to taking off?

Turn & Bank Indicator working properly in case we were to lose vacuum, Pitot heat to keep airspeed working correctly, Electrical output so system will work properly, Cabin heat and defroster for comfort and visibility, outside air temp gauge agrees with reported temp so you will know when to expect ice.

Where will you obtain your weather forecast for a flight under instrument flight rules?

- FSS, DUATS, or other sources as approved by the administrator

What are NOTAMS?

- Notices to Airmen. NOTAMS contain time critical information that may affect your decision to make a proposed flight.

What are the three types of NOTAMs?

- NOTAM D (Distant) – Navigation facilities out of service
- NOTAM L (Local) – Taxiway closures, VASI out of service, etc.
- FDC NOTAMs (Regulatory) – Changes to instrument approach procedures, Temporary Flight Restrictions, Amendments to Aeronautical Charts

What is DUATS?

- Direct User Access Terminal System

What is a TAF?

- Terminal Area Forecast

What is the duration of a Terminal Area Forecast?

- Normally 30 Hours.

How Often are TAFs updated?

- Normally every six hours

At what frequency in time are Area Forecasts issued?

- Three times per day.

What are the three types of in-flight weather advisories?

- AIRMETs – Forecast
- SIGMETs – Forecast
- Convective SIGMETs – Forecast or Observation

What is an AIRMET (WA)?

- An AIRMET is an advisory of significant weather phenomena but describe conditions at intensities lower than those that require the issuance of a SIGMET.
- AIRMET Sierra is for IFR Conditions or Mountain Obscuration
- AIRMET Tango is for Turbulence
- AIRMET Zulu is for icing

What is a SIGMET (WS)?

- A SIGMET advises of non-convective weather that is potentially hazardous to all aircraft.
- SIGMETs are unscheduled products that are valid for four hours but can be extended.

What is a Convective SIGMET (WST)?

- Includes tornadoes, lines of thunderstorms, thunderstorms over a wide area, embedded thunderstorms, hail greater than or equal to 3/4 inch in diameter, and/or wind gusts of 50 knots or greater.
- NOTE: A WST consists of either an observation and a forecast or simply a forecast.

What would you expect when the temperature and dew point are within three degrees?

- Fog.

What are the five types of fog?

- Radiation,
- Advection,
- Upslope,
- Precipitation
- Induced, and
- Steam.

What are the four basic cloud groups?

- Low/Surface to 6,500. Stratus, Stratocumulus, and nimbostratus.
- Medium/6,500 to 20,000 – Altostratus and altocumulus.
- High/20,000 and up – Cirrus, Cirrostratus, and Cirrocumulus
- Clouds with vertical development.

What are the three conditions necessary for a thunderstorm to develop?

- Unstable air,
- A lifting action, and
- A high moisture content.

What are the three stages of a thunderstorm?

- Cumulus,
- Mature, and
- Dissipating.

What are some of the hazards associated with a thunderstorm?

- Turbulence due to updrafts and downdrafts.
- Hail.
- Icing.

What action might we take if we get caught in a thunderstorm?

- Slow to maneuvering speed.
- Maintain a constant ATTITUDE – don't fight the altitude excursions.
- Turn the interior lights to their highest intensity at night.

So we can fly into a thunderstorm?

- Legally – Yes. But why would we intentionally do this?

What is the difference between an isobar and an isotherm?

- Isobars connect lines of equal pressure and isotherms connect lines of equal temperature.
+Isotachs are lines of equal wind velocity.

What are the minimum altitudes you may use for IFR Operations?

- Except when necessary for takeoff and landing, the minimum altitudes are:
- 2,000 feet above the nearest obstacle within four nautical miles of the course to be flown when in mountainous areas,
- 1,000 feet above the nearest obstacle within four nautical miles of the course to be flown when in non-mountainous areas.

What is EFAS?

- Enroute Flight Advisory Service on 122.0 for low enroute operations.

Is EFAS available 24 hours per day?

- No. Normally it is available from 6:00am through 10:00pm.

What are you expected to do on an instrument flight when two-way communications has been lost?

- If you are in VFR conditions, you should land as soon as practical.
- If you are in IMC then your ROUTE should be as follows:
- By the route assigned in the last ATC clearance.
- If being radar vectored, by the direct route from the point of radio failure to the fix, route, or airway specified in the vector clearance.
- In the absence of an assigned route or a route that ATC has advised may be expected in a further clearance by the route filed in the flight plan.
- If in IMC, your ALTITUDE should be at the highest of the following altitudes for the route segment being flown:
- The Altitude assigned in the last ATC clearance received.
- The minimum altitude as prescribed in 91.121(c) for IFR operations
- The altitude ATC has advised may be expected in a further clearance.

What action might you take if you experienced a communication failure?

- How about listening to VORs and NDBs that have voice capability?
- What about a hand-held radio?

What is the appropriate transponder code for loss of communications?

- 7600

What is the difference between currency and proficiency?

- Being current fulfills the FAA requirement, being proficient keeps you alive.

What actions would you take if the alternator failure light illuminated while you were in IMC conditions?

- Try resetting the equipment.
- Turn off all unnecessary electrical equipment.
- Report the condition to the controller.
- Get the Airplane ON THE GROUND.

What would you do if you noticed that an electrical circuit breaker had tripped during your flight?

- Ask yourself if you really need that piece of equipment.
- If you do not absolutely positively need that piece of equipment, why tempt fate by resetting the breaker. It tripped for a reason. The next failure could result in a fire.

What would you do if you experienced a total electrical failure in IMC?

- Well hopefully you have a plan B. You should always leave yourself an out.
- If the area ahead of you is a pure VFR condition (zero clouds and unlimited visibility) then you may consider dead reckoning.
- If the area along your proposed route of flight is low ceilings and poor visibility, plan B should be put in place.
- If I were on a flight from St. Louis to Chicago Midway and experienced a total electrical failure in a low ceiling/visibility condition with the same condition forecast all along my route, I would go elsewhere.
- If I knew there was a VFR condition in Des Moines I would dead reckon in that direction. I would use a hand held GPS if one were available.
- If I had an engine failure while in IMC I would start a spiraling descent at a low bank angle and at my best glide rate. I always thought I would have less of a chance of hitting a tower by descending in a spiral.

What is the basic difference between a precision approach and a non-precision approach?

- A precision approach will provide vertical guidance.

What is considered the Initial Approach Segment on an approach?

- The initial approach segment begins at the initial approach fix and ends where it joins the intermediate approach segment.

What is considered to be the Intermediate Approach Segment?

- The intermediate segment (normally aligned within 30 degrees of the runway) begins at the intermediate point and ends at the beginning of the final approach course.

What is the Final Approach Segment?

- The final approach segment for a precision approach begins where the glide slope is intercepted at the minimum glide slope intercept altitude shown on the approach chart;
- The final approach segment for a non-precision approach begins at either a designated Final Approach Fix (FAF) or at the point where you are established on the final approach course.
- When the FAF is not designated, such as where there is a VOR or NDB on the field of intended landing as published, the Final Approach Point (FAP) is where the procedure turn intersects the final approach course inbound.

What is considered the Missed Approach Segment?

- The missed approach segment begins at the MAP and ends at a designated point.

How long are VOR Checks valid?

- 30 Days.

What are the ways a VOR may be certified for use on an instrument flight?

- VOT, designated airborne or ground check, radio to radio, and shop.

What information must be recorded?

- Name, date, place and Bearing Error.

Does the information have to be in an aircraft logbook?

- No. You just have to have a written record.

After you successfully pass your instrument checkride, how long is your instrument currency valid?

- Six Calendar Months.

How can you maintain instrument currency?

- By having completed six approaches, navigation, tracking, and at least one hold in the previous six months.

What if you don't fly for a year?

- After any six-month period where you do not maintain currency, you have six months of grace that will allow you to do the six approaches, navigation tracking, and the required hold with a safety pilot.
- After the grace period you may regain your instrument privileges by doing an instrument proficiency check with an FAA inspector, a designated instrument examiner, or with a certified instrument flight instructor.

When are you required to file an alternate airport?

- When the weather forecast at your destination airport during the period of one hour before through one hour after your estimated time of arrival the ceiling is forecast to be less than 2,000 foot ceiling and the visibility is forecast to be less than three miles.

That being the case, what constitutes a ceiling?

- The lowest broken or overcast cloud layer.

What is the reason we file an alternate airport?

- The primary reason is that ATC knows your intention in the event of a communication failure during the flight.
- You do not have to fly to the alternate airport filed in your flight plan in the event of a missed approach at your destination airport.
- You may ask the controlling agency for vectors for the same approach again if you have two-way communication, or ask for vectors for a different approach to an airport in the vicinity of your original destination airport.

What are the weather forecast requirements for the alternate airport if an alternate is required?

- The forecast at your ETA must be:
- 600 feet ceiling with two miles visibility for an airport with a precision approach.
- 800 feet ceiling with two miles visibility for an airport with a non-precision approach.

What is an MEA and what does it assure you?

- The minimum enroute altitude assures you obstacle clearance, communication coverage, and unless marked as an MEA gap, adequate navigation reception.

What is a MOCA?

- Minimum Obstruction Clearance Altitude.

What is MAA?

- Maximum Authorized Altitude.

What is a standard rate turn?

- Three degrees per second.

What is a half-standard rate turn?

- One and one-half degrees per second.

What additional equipment is required for IFR flight over and above the VFR equipment requirements?

- A two-way radio communication system;
- Navigation equipment appropriate to the ground facilities being used;
- Gyroscopic rate-of-turn indicator;
- Slip/skid indicator
- Sensitive altimeter adjustable for barometric pressure;
- A clock capable of displaying hours, minutes, and seconds;
- Gyroscopic direction indicator.
- Note the absence of the vertical speed indicator.

What are the three fundamental skills of instrument flight?

- Instrument cross check;
- Instrument Interpretation;
- Aircraft Control

Which ATC instructions are you required to read back to the controller?

- Acknowledge speed/altitude instructions;
- VFR-on-Top altitude changes
- Time and Altitude when reaching a holding fix.
- Departure from any holding fix or designated pint
- Missed approach
- When unable to climb or descend at a minimum of 500 feet per minute;
- True Airspeed Changes of 5% or 10 knots, whichever is greater;
- Loss of any communication or navigation capability
- Unforecast weather or any other information pertaining to the safety of flight.

Which reports become mandatory in the event radar coverage is lost?

- Leaving final approach fix or outer marker inbound on the final approach;
- Revised estimated time of arrival if it varies by more than three minutes from the flight planned estimate.
- Position reporting and compulsory reporting points.

What minimum rate of climb is required for a normal departure in order to assure obstruction clearance if no ODP is published?

- 200 feet per nautical mile.

What minimum rate of climb is required for an enroute climb in order to assure obstruction clearance?

- 150 feet per nautical mile at sea level through 5,000 feet MSL.
- 120 feet per nautical mile from 5,000 feet through 10,000 feet MSL.
- 100 feet per natural mile above 10,000 feet MSL.

What instruments would be affected if the static port became blocked?

- The altimeter would remain at the altitude indicated when the blockage occurred and the VSI would remain at zero.
- The airspeed indicator could be affected depending upon the status of the Pitot tube and the Pitot drain.
- The airspeed indicator will provide erroneous readings if the Pitot (ram) air is open but the static port is blocked.
- In this case, the airspeed indicator would read lower than actual if the aircraft was at a higher altitude than where the static port became blocked, and would indicate a higher than actual indicated airspeed at altitudes below where the static port became blocked.
- **PUDSOD** Pitot blocked – Under-reads in Descent (over-reads in a climb)
Static blocked – Over-reads in Descent (under-reads in a climb)

What airspeed indication would you expect if the ram air inlet of the Pitot tube became blocked while the pitot drain remained open?

- The airspeed would read zero.

What indication would you expect if the pitot ram air inlet and the pitot tube drain were blocked?

- The airspeed indicator would act as an altimeter in this case. If you climbed, the indicated airspeed would increase. The indicated airspeed would decrease if you descended.

What are the fuel requirements for a flight conducted under instrument flight rules?

- You must have an adequate fuel supply to fly from the originating airport to the destination, and then fly at normal cruise for forty-five minutes.
- If an alternate airport was required for the flight, then you must have sufficient fuel to fly from the originating airport to the original destination airport as filed in your flight plan, then fly to the alternate airport, and then have sufficient fuel to fly at normal cruise for an additional forty-five minutes.

What action must be taken on an instrument approach if full needle deflection occurs on the horizontal guidance navigation equipment?

- A missed approach procedure must be initiated.

What action must be taken on an instrument approach if full needle deflection occurs on the vertical guidance navigation equipment?

- A missed approach procedure must be initiated.

When may turns be initiated when on a missed approach procedure unless special instruction from ATC are issued?

- Only after reaching the missed approach point.

You are on an instrument flight while in VFR conditions. You see an aircraft that may pass close enough to your aircraft as to present a hazard. ATC has not informed you of this aircraft. What action should you take?

- It is every pilot's responsibility to "see and avoid." You should notify ATC and make the appropriate maneuvers so as to eliminate the hazardous condition.

What is CFIT?

- Controlled Flight Into Terrain.

When do you think CFIT may occur?

- When you descend below published minimums on an approach
- When a change in terrain height occurs and the aircraft does not climb to the appropriate safe altitude;
- When the pilot is distracted due to a system failure or while trying to determine the cause of any abnormality;
- Pure inattention to detail
- Extreme weather conditions;

You are told to hold at a published fix. What change must occur within three minutes of reaching the fix, but prior to reaching the fix?

- A speed reduction if one is required.

The inbound course at the fix is 180. Your heading to the fix is 270. What entry will you make in a standard holding pattern.

- Direct.

What entry would you make if it were a non-standard hold?

- Parallel

What report must be given to ATC when you reach the holding fix?

- Aircraft Identification, Time, and Altitude.

What does EFC mean?

- Expect Further Clearance.

You determine you will reach the holding fix in four minutes. ATC has not issued you an EFC. What should you do?

- The controller should issue you a clearance beyond the fix at least five minutes before you reach the present clearance limit (the holding fix) if no additional delay is expected.
- You should query the controller if you have not received additional information when you are within five minutes of the clearance limit.

You are flying an aircraft equipped with DME. The controller issues you an authorization for ten-mile legs. Where is the ten-mile point located in the holding pattern?

- On the outbound leg. This should be the FAR end of the outbound leg, but does not include the radius of the turn.

Are there speed restrictions for holding patterns?

- Yes.
- MHA through 6,000 feet = 200 knots
- 6,001 through 14,000 feet MSL = 230 knots
- 14,001 and above = 265 knots.

What is the primary purpose of a procedure turn?

- A reversal of course.

You are being radar vectored for an approach. You note that a procedure turn is shown on the instrument approach chart. Are you expected to make this procedure turn?

- No. You do not make a procedure turn if you are given radar vectors for an approach.

You are on a cross-country instrument flight and determine the aircraft is using more fuel than you had calculated in your flight planning. You feel you have adequate fuel to reach the destination if there are not unforeseen delays encountered. Should you report this to ATC?

- Yes. You should report that you are "minimum fuel". If you feel you need to be given priority handling then you should declare an emergency.
- Do not worry about the repercussions that could occur due to this condition. You will have ample time to determine what when wrong when you are on the ground.

While on an instrument flight ATC informs you of traffic at ten o'clock. Where is ten o'clock in relation to the nose of the aircraft?

- Sixty degrees to the left.

Should a wind correction angle be taken into consideration when looking for the traffic?

- Yes. The controller is giving you cues based upon your ground track, not the front of the aircraft.

What is a side-step maneuver?

- A side-step maneuver is when you fly an approach for a particular runway, but once you have the runway of intended landing in sight, you divert the flight path to the runway you are approved to land upon.
- This is normally done when there are parallel runways with a published instrument approach to just one of them. ATC can expedite the traffic flow by having alternating aircraft land on two runways while just having one approach available.

We are getting ready to depart on an instrument flight. Are there any special checks we want to perform for an IFR flight versus a VFR flight?

- Turn the pitot heat on **MOMENTARILY** during your preflight to ensure it is working. Do not leave this on any longer than necessary as the heating element can overheat, as there is no wind cooling it, as there would be in flight.
- Ensure the magnetic compass is floating freely and indicating known headings.
- Turn on the master switch prior to engine start and listen for any harsh or unusual noises from the gyro in the turn coordinator. Make sure the red flag on the turn coordinator disappears when the electrical power is turned on.
- Make sure the attitude indicator becomes stable in five minutes or less and that it is indicating correctly. While taxiing on level or somewhat level ground, the attitude indicator should not show more than a five-degree bank.
- Check the turn coordinator while taxiing. The airplane should show a bank in the direction of any turn and the coordination ball should roll away from the turn due to centrifugal force.
- The gyrocompass should remain at zero.
- Verify the VOR equipment has been checked within the past thirty days.
- But be aware that the equipment could have functioned normally during the VOR check that occurred two weeks ago and not be accurate on the day of the flight.

Our route will be through IMC and the temperature is forecast to be near freezing at the altitude we selected for our flight. Do we have deicing equipment on board this aircraft?

- No.

Do we have anti-ice equipment on this aircraft?

- Yes. On a Cessna 172 we normally have defrosters, pitot heat, and carburetor heat.

Knowing that we are going to be in an area of heavy precipitation, and possibly ice, would we perhaps take a closer look at the static discharge wicks to ensure they are in place?

- Static discharge wicks help prevent static electricity from arcing between the airplane and the atmosphere. If these static discharges are not controlled, radio interference can become so severe that communication and navigation signals may be unusable.

What are the two general types of icing?

- Structural and Induction.

When is induction icing in the carburetor venturi likely to occur?

- When the OAT is between -7 degrees C and 21 degrees C.

What are the three types of structural icing?

- Rime, clear, and mixed.

May we fly into an area where icing was forecast?

- No. Even if it were legal why would we do this?

What would be the appropriate action if we encountered UNFORECAST rime ice?

- Obviously this is where aeronautical decision making must come in. The only time you are going to get rime ice is when you are flying in visible moisture (clouds) and the temperature of the air and the aircraft structure is at a temperature at or below freezing.
- The temperature is normally higher at lower altitudes, but not always. You should tell the controller you are encountering ice and request an altitude change.
- The controller can ask other aircraft in your general area (if there are any) and ask them if they are in an ice-free area.
- You may be able to climb above the clouds, or you may be able to descend below the clouds, or you may seek a higher temperature. But you need to do something.
- You should also have already had the pitot heat on because in your training you learned this was anti-ice equipment, you should also turn on the carburetor heat as this will help prevent the venturi from becoming blocked, and you should turn the defrosters on.
- Be prepared to make a 180-degree turn if necessary. You didn't encounter ice before, but there is no assurance that the temperature hasn't changed in that area.

What would you do if you encountered freezing rain?

- A 180-degree turn would be in order, or a change of altitude. This is a very dangerous condition. Whatever decision you make you must be quick about it.

Approach Chart Review

Enroute Chart Review

Magnetic Compass...

What is "ANDS"?

- ANDS is an acronym for Accelerate North Decelerate South. This is one type of magnetic compass error. This error primarily occurs if you are on an approximate heading of east or west, and most of this type of error occurs between 060 degrees and 120 degrees if the heading is easterly, or 240 degrees through 300 degrees if the heading is westerly.
- The magnetic compass will indicate a turn to the north if the aircraft is on one of these headings, and will indicate a turn to the south if the aircraft is decelerated while in this heading range. This error occurs due to magnetic dip. The error is eliminated when the airspeed stabilized.

What is "UNOS"?

- UNOS is an acronym for Undershoot North Overshoot South. A false error occurs on the magnetic compass when the aircraft is turned. This phenomenon of the magnetic compass is called northerly turning error. This error is zero on east or west headings, but is pronounced on turns to either north or south. When turning from east/west to north, the magnetic compass card actually lags the heading of the aircraft, so we undershoot, or turn what appears to be early, when rolling out to a northerly heading. The opposite is true when turning to a southerly heading and we must turn what appears to be past the south heading. How do we compensate for this error? We must factor in the latitude at which we are operating, plus one-half of our bank angle. We will use a latitude of 30 degrees for this session. With a bank angle of 16 degrees, we would take half of that (8 degrees) and calculate that into our bearing and roll out on a predetermined magnetic heading. The following is the initial part of the equation at 30 degrees latitude. This data reflects the amount of error when turning to various magnetic headings: If you are turning to:

Amount of Error on the Compass Card

360 Degrees 30 degrees of error

030 and 330 degrees 20 degrees of error

060 and 300 degrees 10 degrees of error

090 and 270 degrees 0 degrees of error

120 and 240 degrees 10 degrees of error

150 and 210 degrees 20 degrees of error

180 degrees 30 degrees of error

- Now we must calculate the lead by adding or subtracting $\frac{1}{2}$ of the bank angle and applying this to the compass card readings at different points on the turn. Let's say we are turning right to a heading of north from a heading of west. There is no error when we are on the initial heading of 270 degrees. We now roll into a 16-degree bank to the right. The compass card is now indicating a turn to the right, but the rate is faster than the turn. Using the information on the last page, the adjusted roll out point is 330 degrees as we are going to UNDERSHOOT NORTH. We deduct $\frac{1}{2}$ of the bank angle (8 degrees) and start our roll out when the compass card is 322 degrees. Here are some other examples, but remember that we OVERSHOOT SOUTH. We will assume a bank angle of 16 degrees for these examples.

Direction/New Heading Roll Out Heading Bank Angle Correction Roll Out

Left to 360 Degrees 030 degrees 8 degrees 038 degrees

Right to 180 Degrees 210 degrees 8 degrees 202 degrees

Left to 180 degrees 150 degrees 8 degrees 158 degrees

Right to 300 degrees 290 degrees 8 degrees 282 degrees

Left to 300 degrees 310 degrees 8 degrees 318 degrees

Right to 150 degrees 170 degrees 8 degrees 162 degrees.

- Remember that the magnetic compass is the primary navigation reference in an aircraft. It is important that you have a general working knowledge of this instrument. These calculations are only used to offset the compass error while you are in a turn. The compass will stabilize when you roll to wings level. A smaller amount of roll out lead is required with smaller bank angles. So if you are at 30 degrees latitude and you are turning left to a heading of 180 degrees with a 5-degree bank angle, you would overshoot the desired heading by 30 degrees and be within $2\frac{1}{2}$ degrees when you roll out. I have heard down south they teach "the south leads and the north lags." Seems like this may be one way to remember what correction to apply.