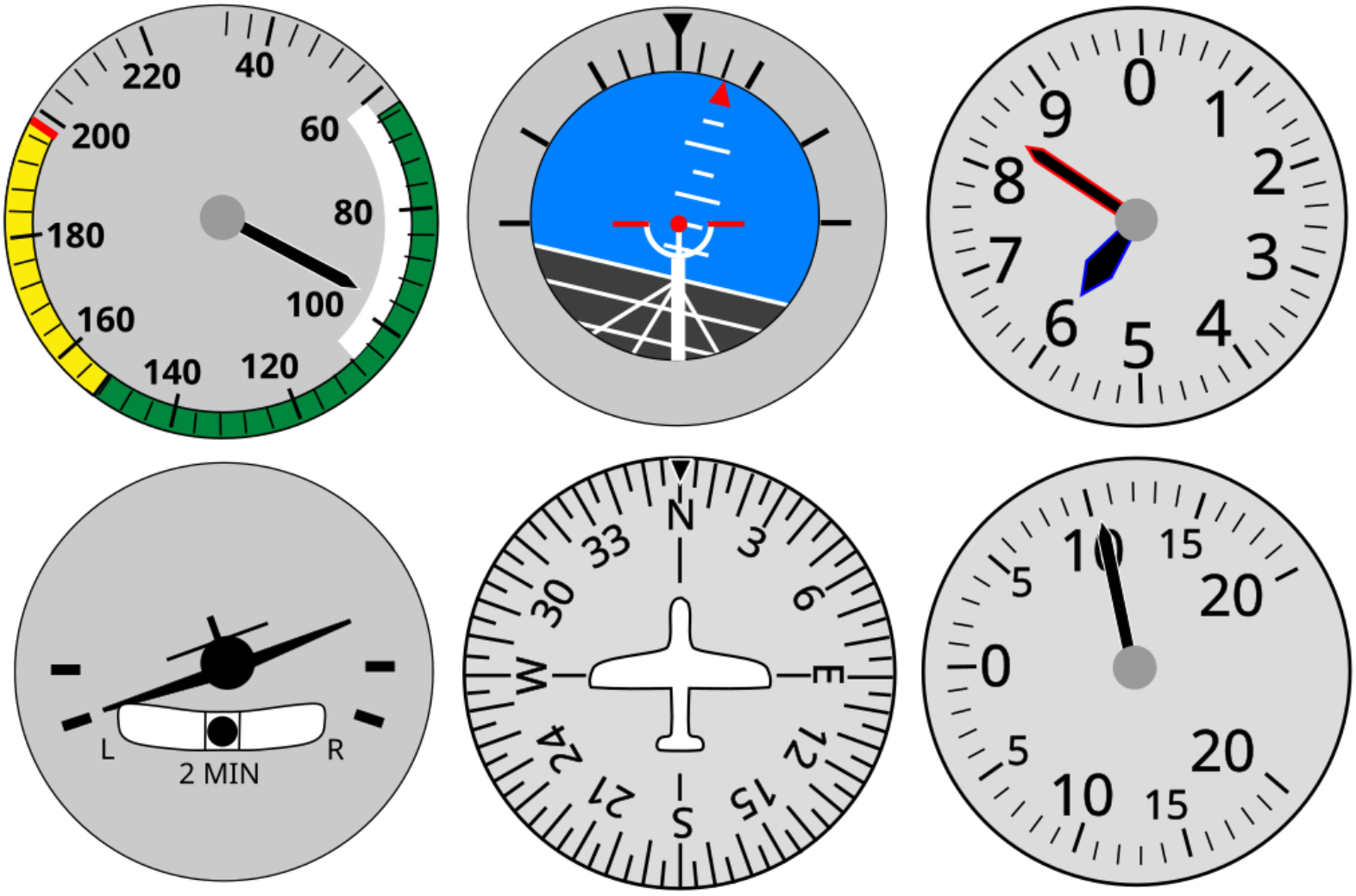
Instruments

Chapter 3

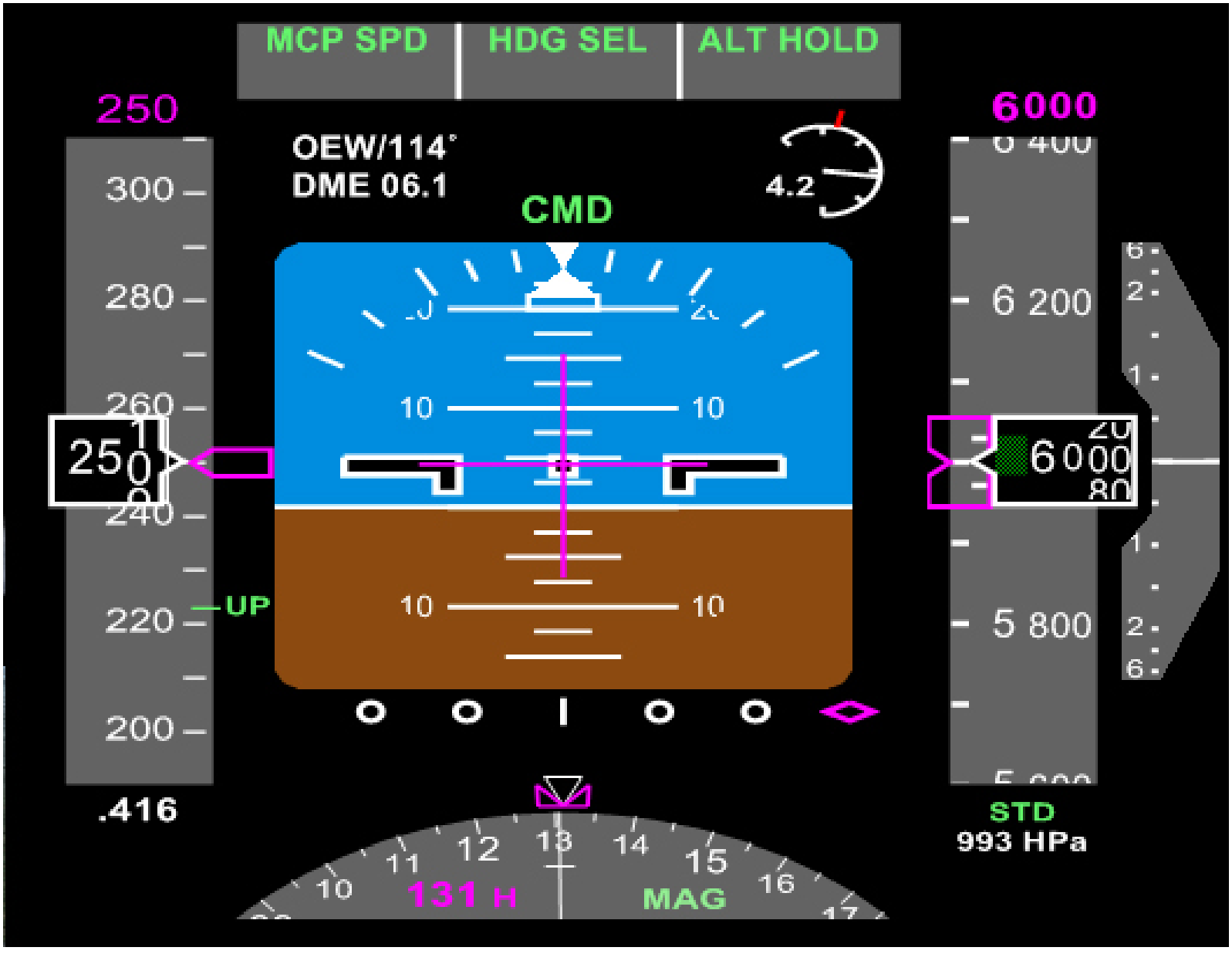
Questions

1. Where would absolute altitude be greater than true altitude?
2. How could you easily convert indicated altitude into pressure altitude?
3. Since V_x is best angle of climb and V_y is best rate of climb, which is a lower air speed?
4. Why isn't V_A marked on the airspeed indicator?
5. What happens to V_x, V_y and best-glide (V_g) as density altitude increases?
6. Order these v-speeds from slowest to fasts: V_{NO}, V_{FE}, V_{s0}, V_A, V_X, V_Y, V_{NE}, and V_{s1}.
7. The magnetic or wet compass *lags AND leads* from the actual magnetic heading. Why?
8. Why does a properly operating directional gyro drift from the correct magnetic heading at a rate of 15° per hour?

Sixpack


220
40
200
60
180
80
160
100
140
120
L
R
2 MIN
N
33
3
30
6
W
E
24
12
21
15
S
0
5
10
15
20
5
10
15
20

Sixpack


MCP SPD
HDG SEL
ALT HOLD
250
OEW/114°
DME 06.1
CMD
4.2
6000
300
280
260
240
220
200
6 200
5 800
UP
10
10
10
10
.416
STD
993 HPa
10
11
12
13
14
15
16
131 H
MAG

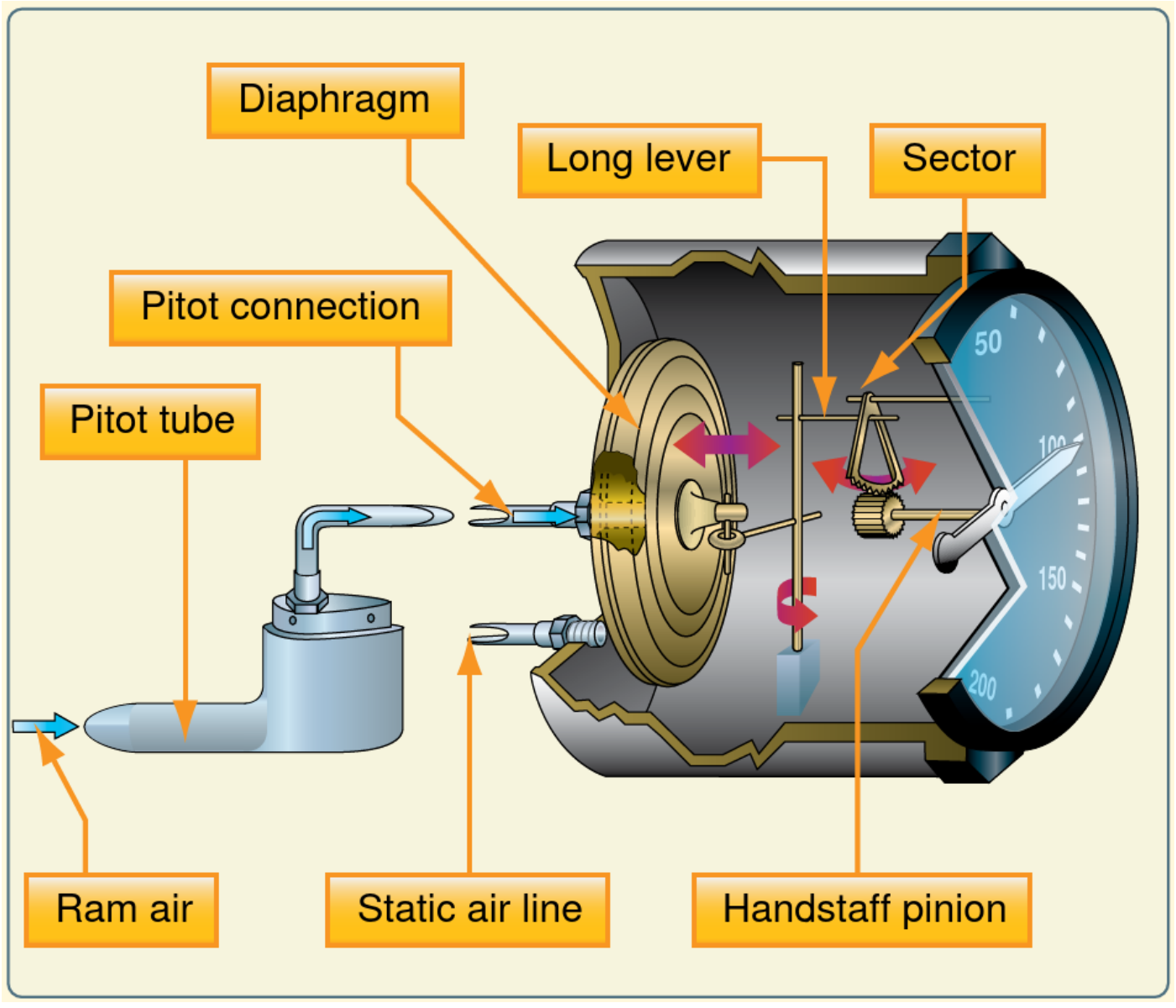
Sixpack

Photo by WKHarmon and Kyle Harmon.

Speeds

- True Airspeed: The actual speed through the air
- Indicated Airspeed: The indications from the airspeed indicator.
- Calibrated Airspeed: Indicated airspeed corrected for instillation errors.
- Ground Speed: Speed over the ground.
- Mach number: True airspeed as a faction of the speed of sound.

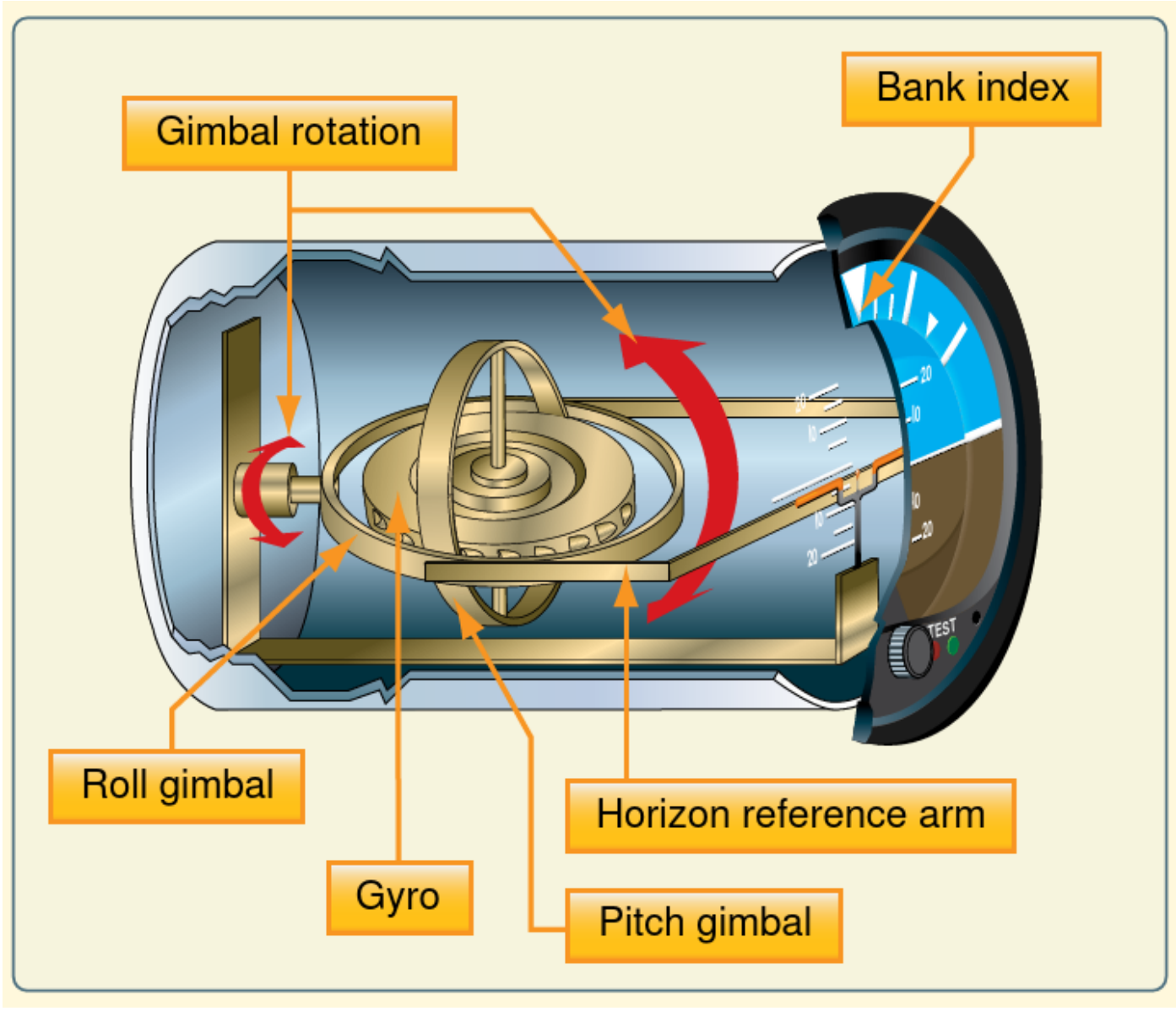
Airspeed Indicator



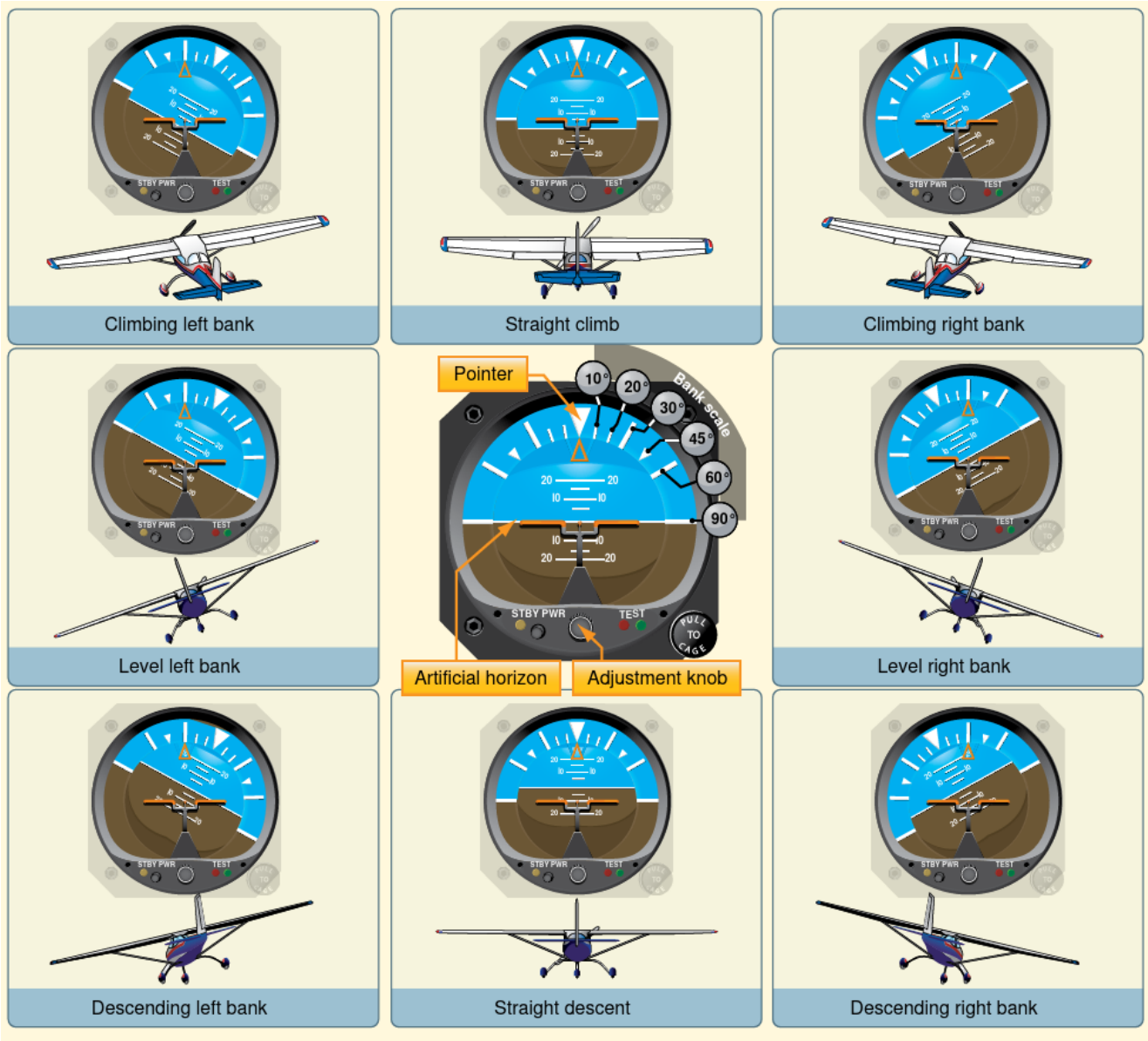
Airspeed Indicator

- V_{s0}
- V_{s1}
- V_{FE}
- V_A
- V_X
- V_Y
- V_{NO}
- V_{NE}

Attitude Indicator



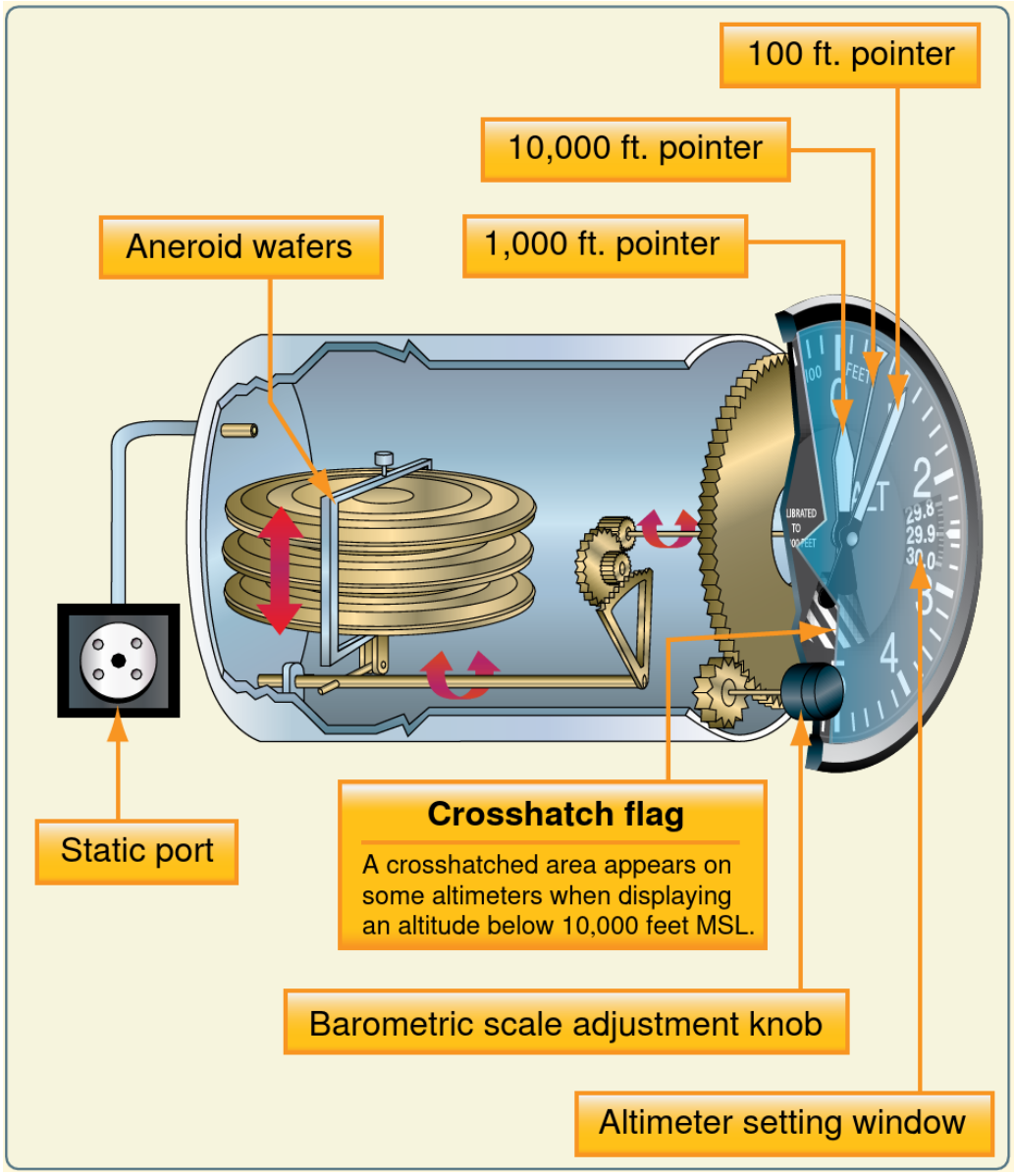
Attitude Indicator



Altitude

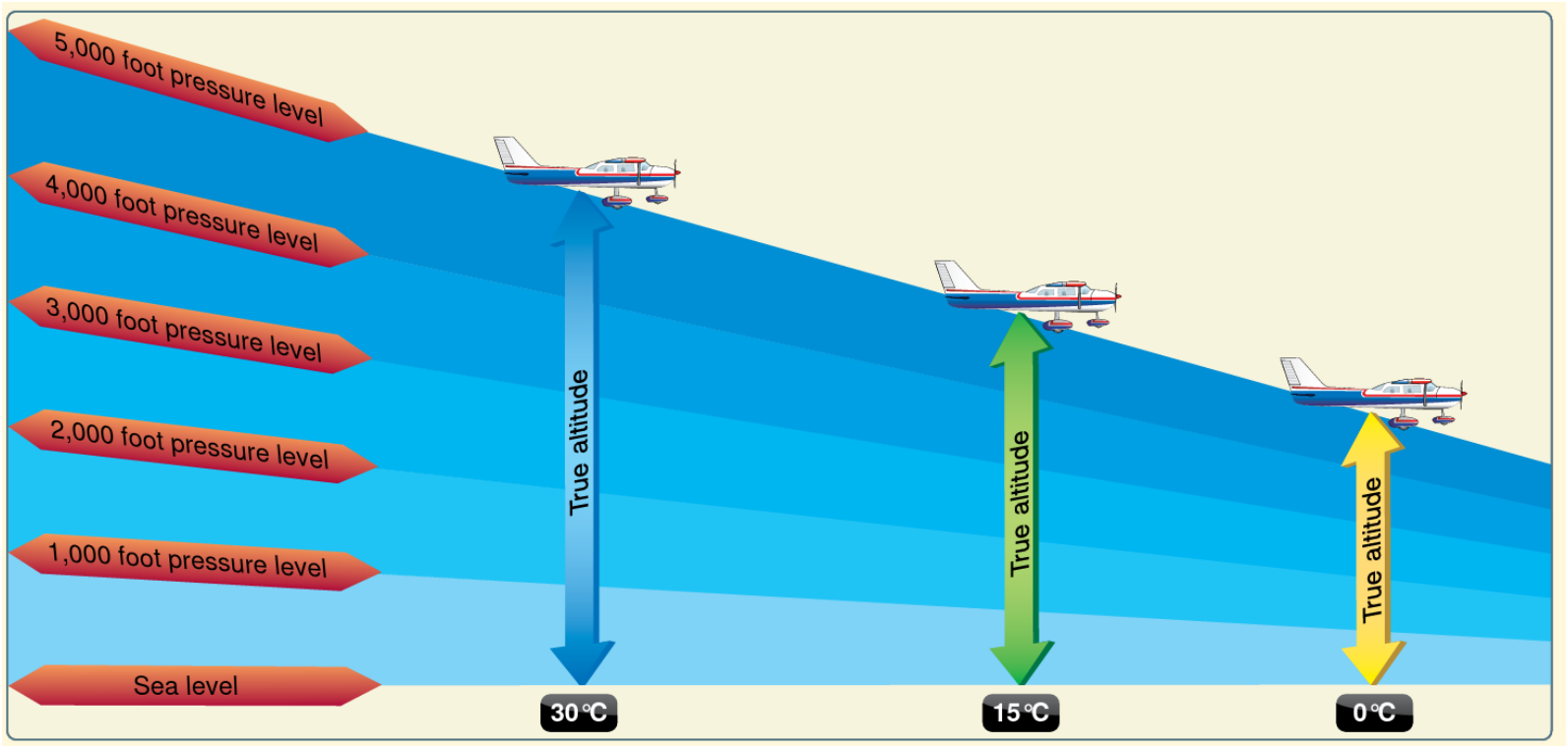
- True Altitude (MSL): Altitude from the mythical mean-seal-level.
- Absolute Altitude (AGL): Actual distance from the ground.
- Pressure Altitude (PA): Altitude above the standard datum (92.29" or 1013mb).
- Indicated Altitude: The indications from the altimeter.
- Density Altitude (DA): pressure altitude corrected for non-standard atmospheric conditions (e.g., temperature).
- Flight Level: Pressure altitude in 100s of feet used above $18,000$' in the US.

Altitude

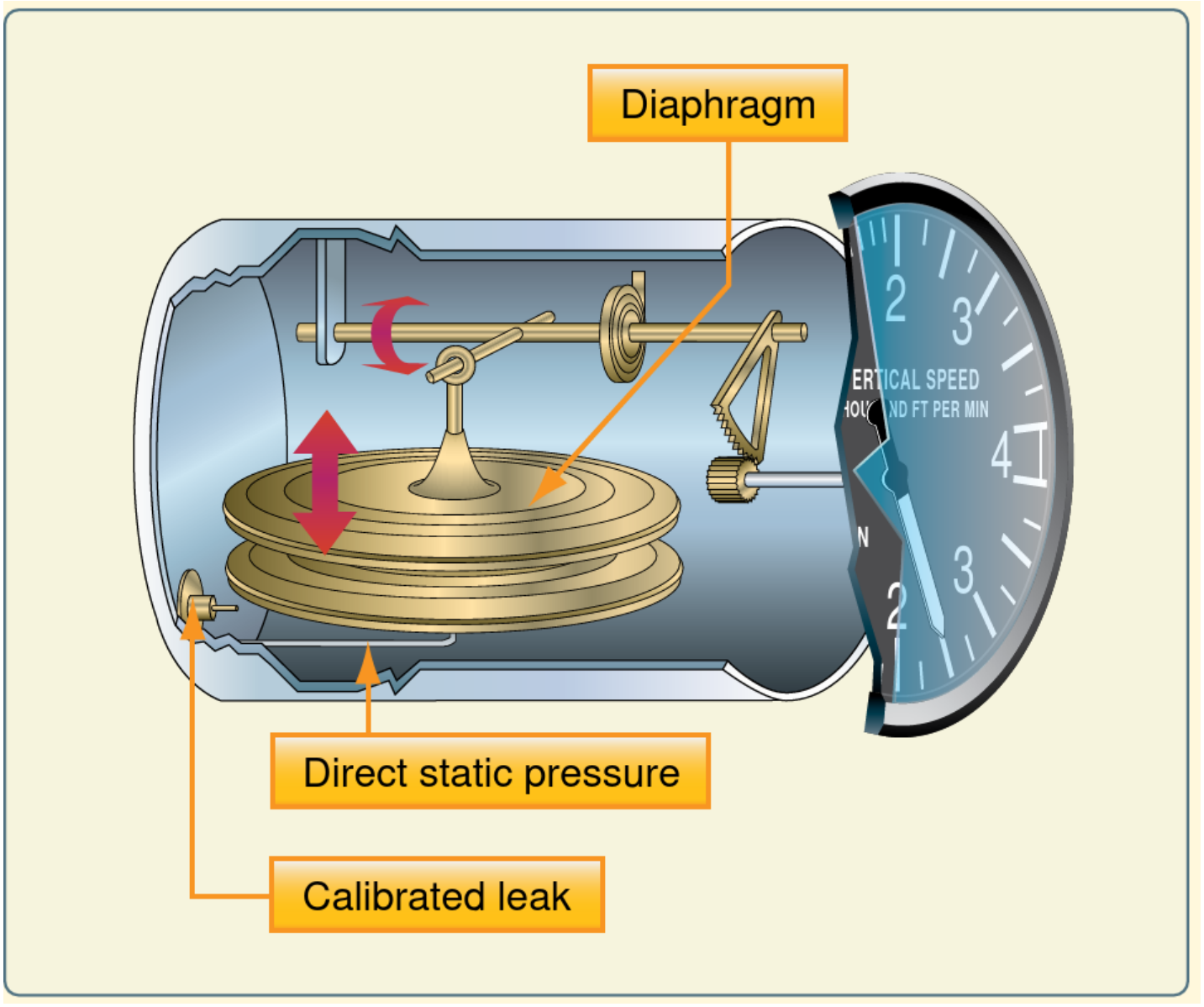

100 ft. pointer
10,000 ft. pointer
Aneroid wafers
1,000 ft. pointer
Static port
Crosshatch flag
A crosshatched area appears on some altimeters when displaying an altitude below 10,000 feet MSL.
Barometric scale adjustment knob
Altimeter setting window

Altitude

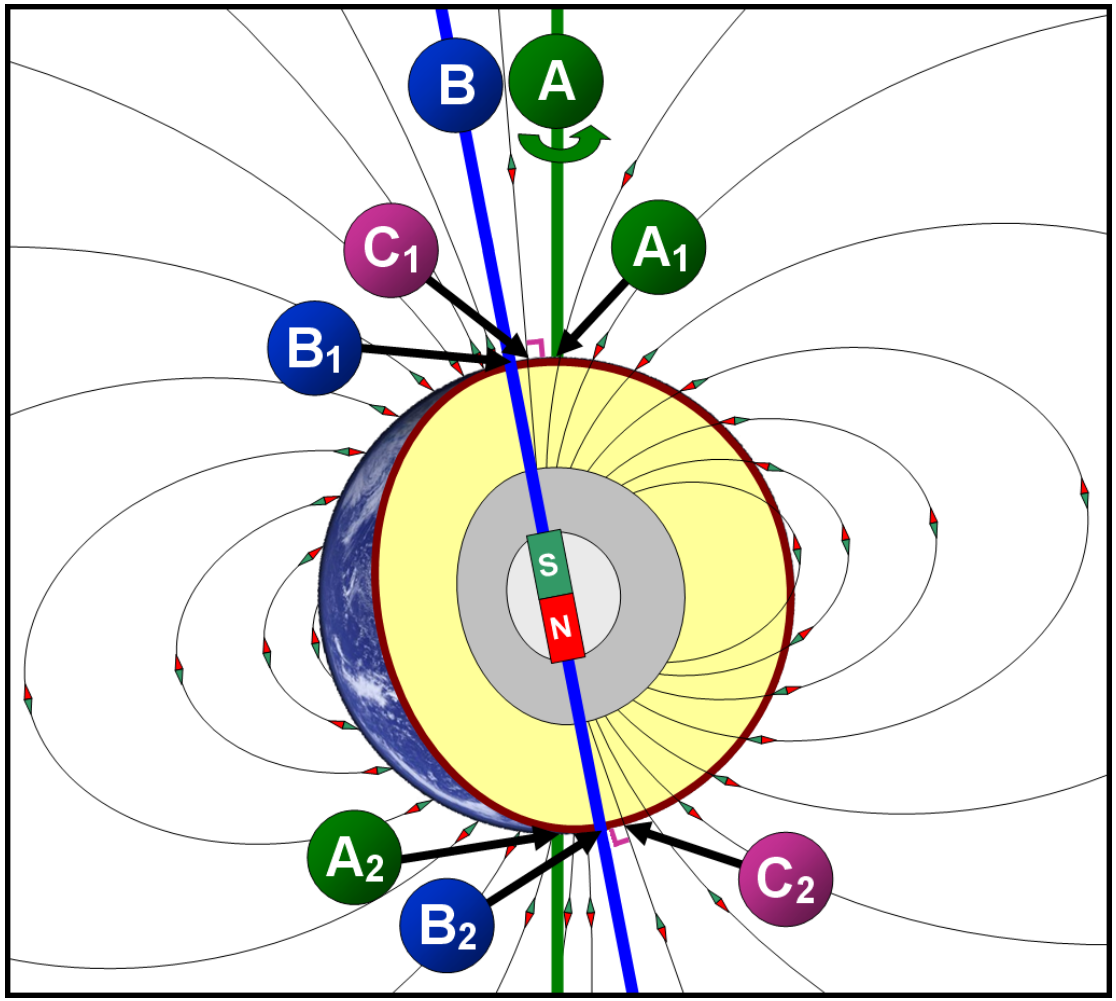
Altitude


5,000 foot pressure level
4,000 foot pressure level
3,000 foot pressure level
2,000 foot pressure level
1,000 foot pressure level
Sea level
True altitude
True altitude
True altitude
30 °C
15 °C
0 °C

Vertical Speed



Magnetic North

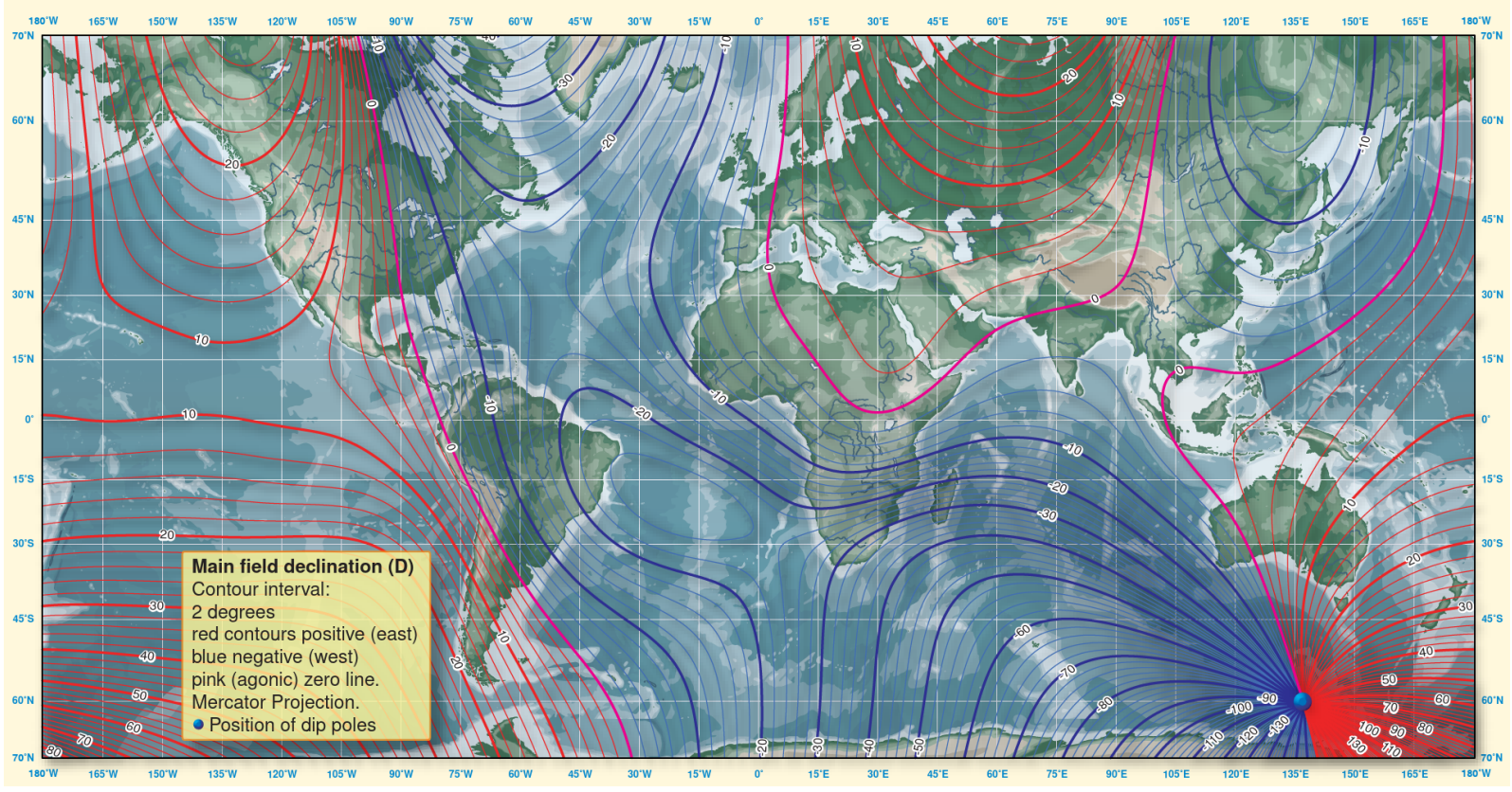


A is true pole, B is geomagnetic pole, and C is magnet pole.
Image by DMY.

Terms

- Variation: difference between true and magnetic heading
- Deviation: difference between magnetic heading and magnetic disturbances caused by the aircraft and installed electronics.

Variation

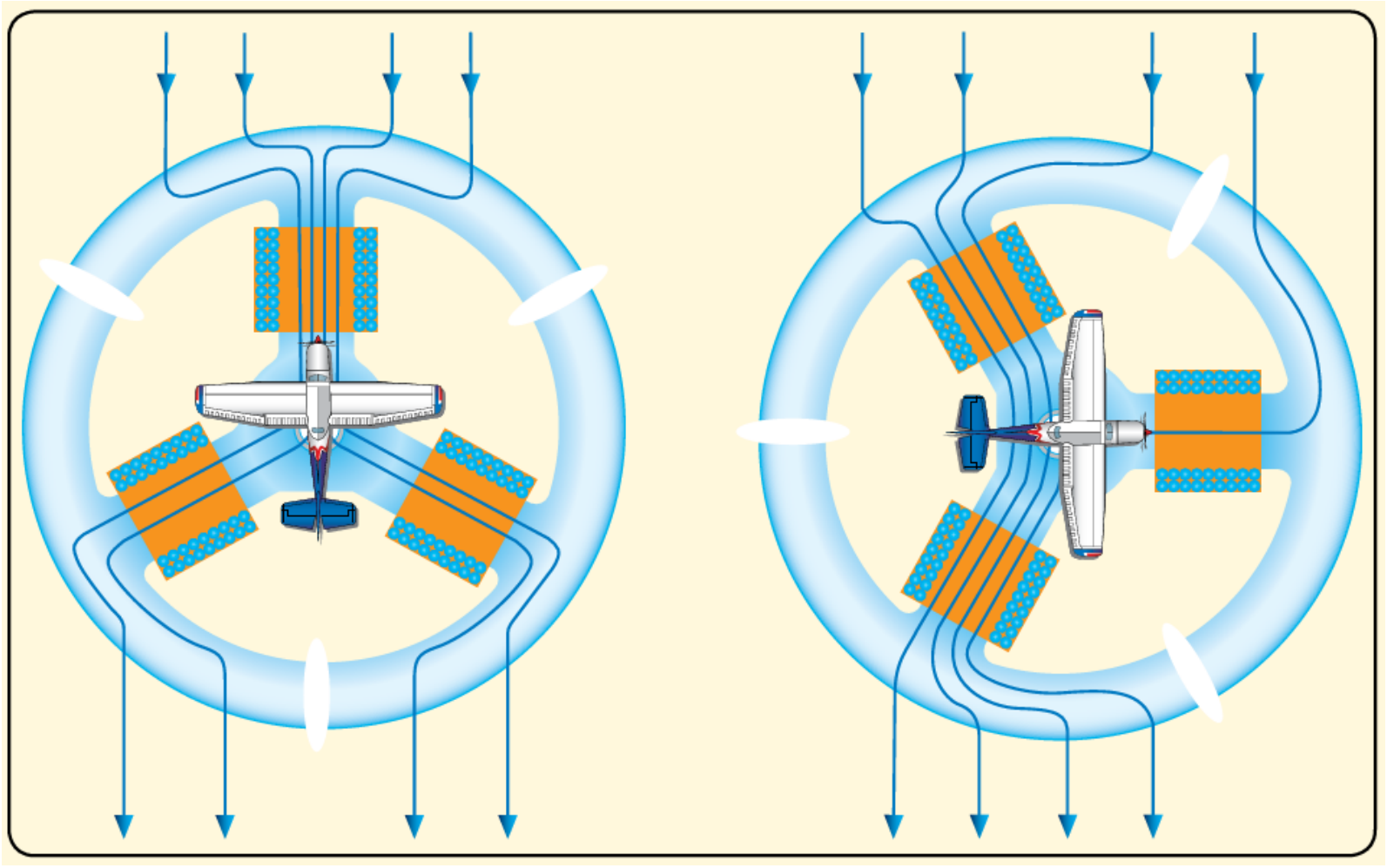

Main field declination (D)
Contour interval:
2 degrees
red contours positive (east)
blue negative (west)
pink (agonic) zero line.
Mercator Projection.
Position of dip poles

Deviation

FOR STEER	000	030	060	090	120	150
RDO. ON	001	032	062	095	123	155
RDO. OFF	002	031	064	094	125	157

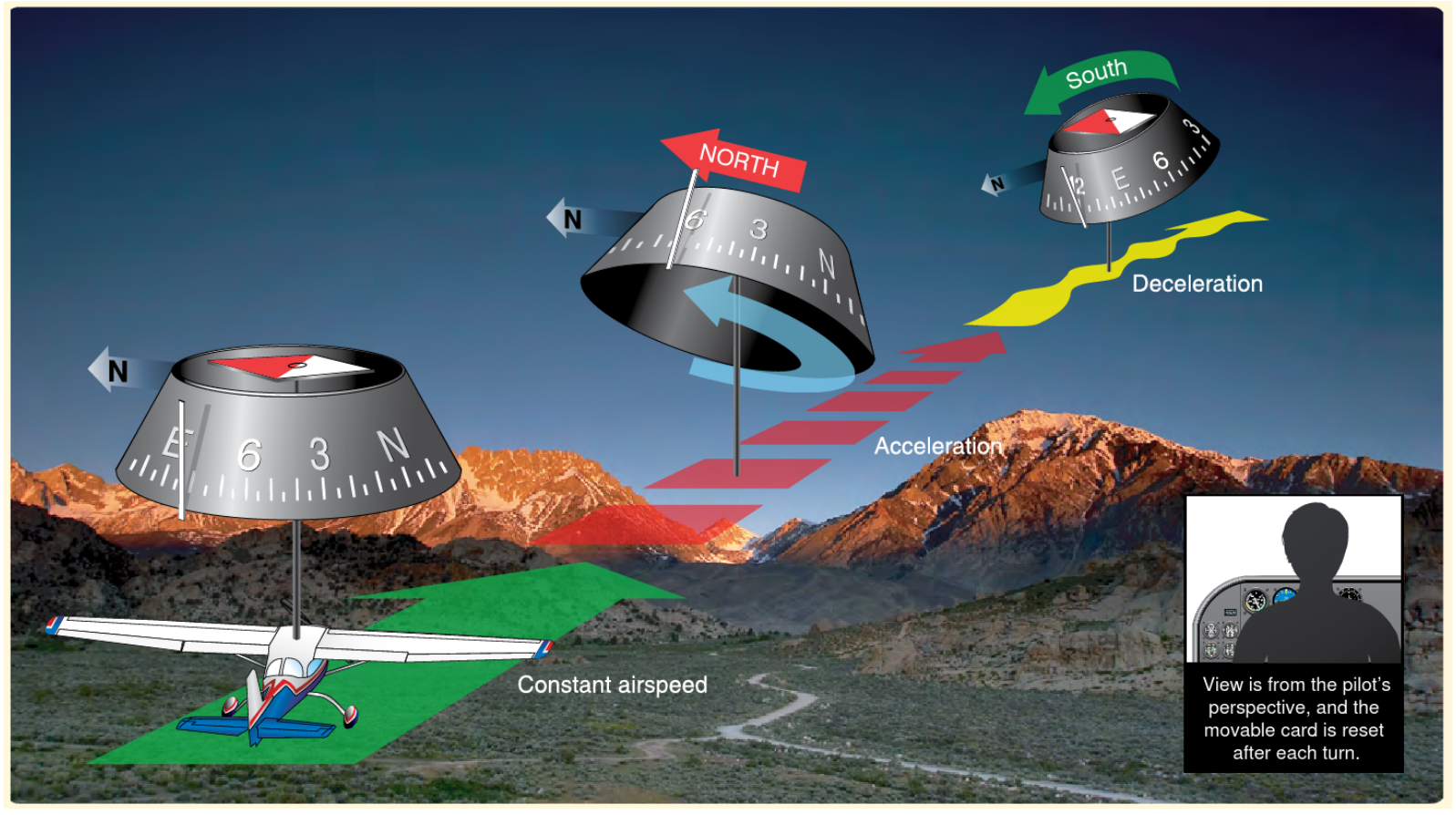
FOR STEER	180	210	240	270	300	330
RDO. ON	176	210	243	271	296	325
RDO. OFF	174	210	240	273	298	327

Flux Valve

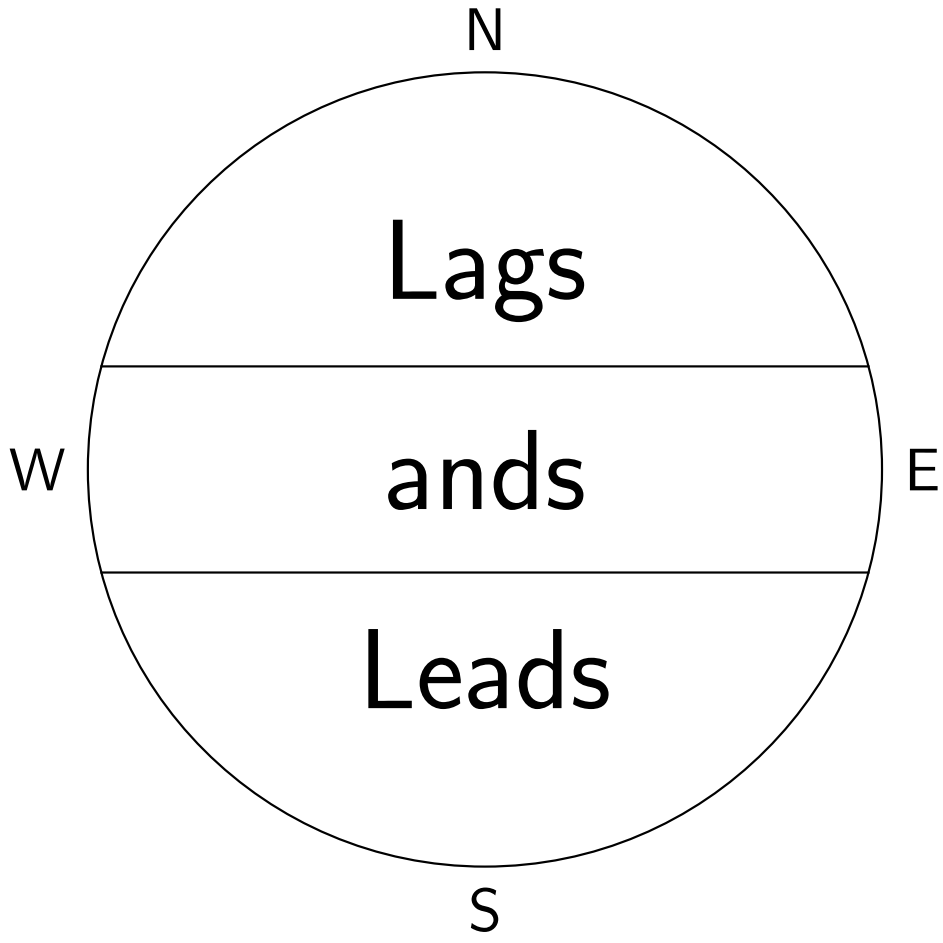


Compass

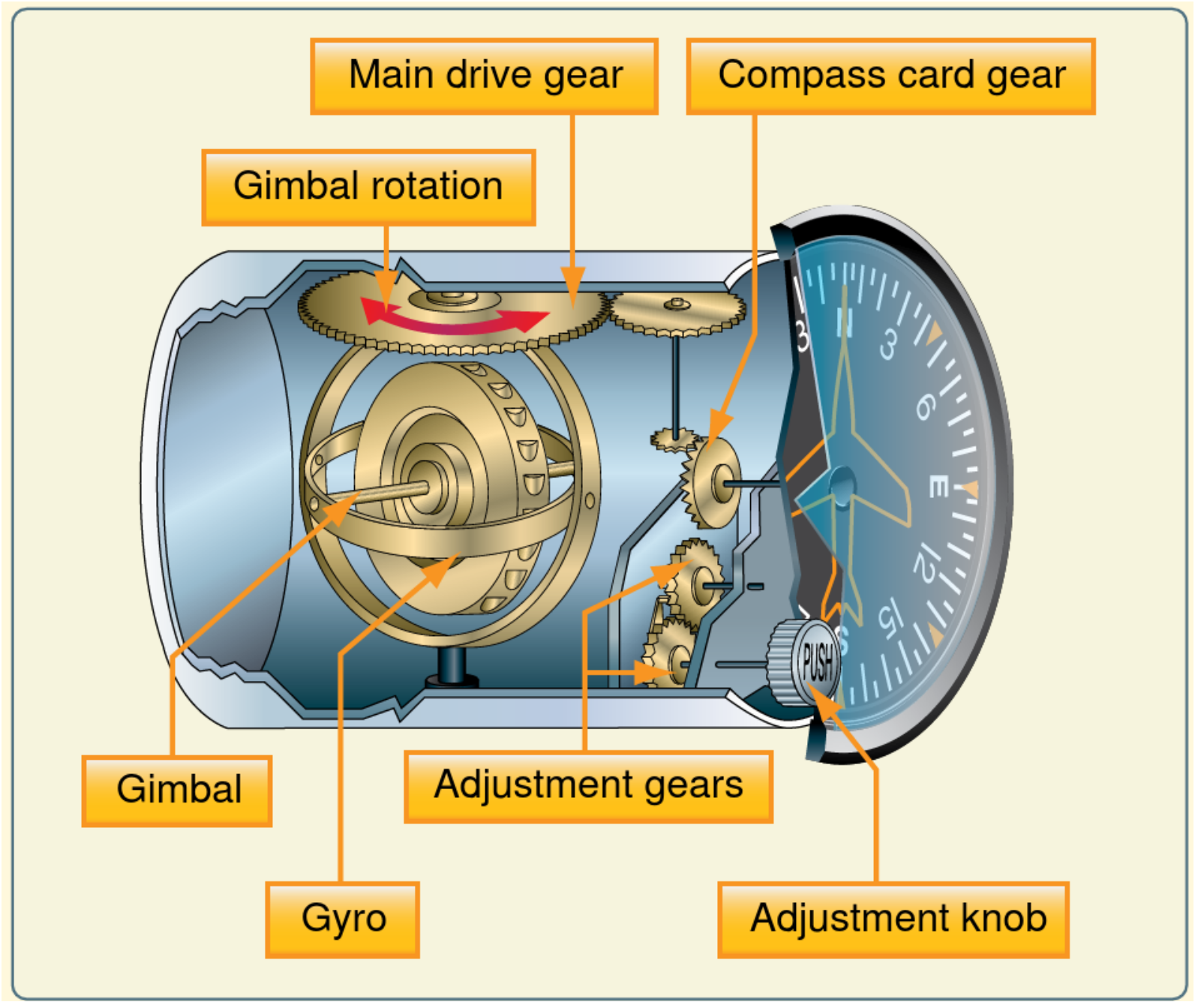
Compass


South
NORTH
N
Deceleration
Acceleration
Constant airspeed
View is from the pilot's perspective, and the movable card is reset after each turn.

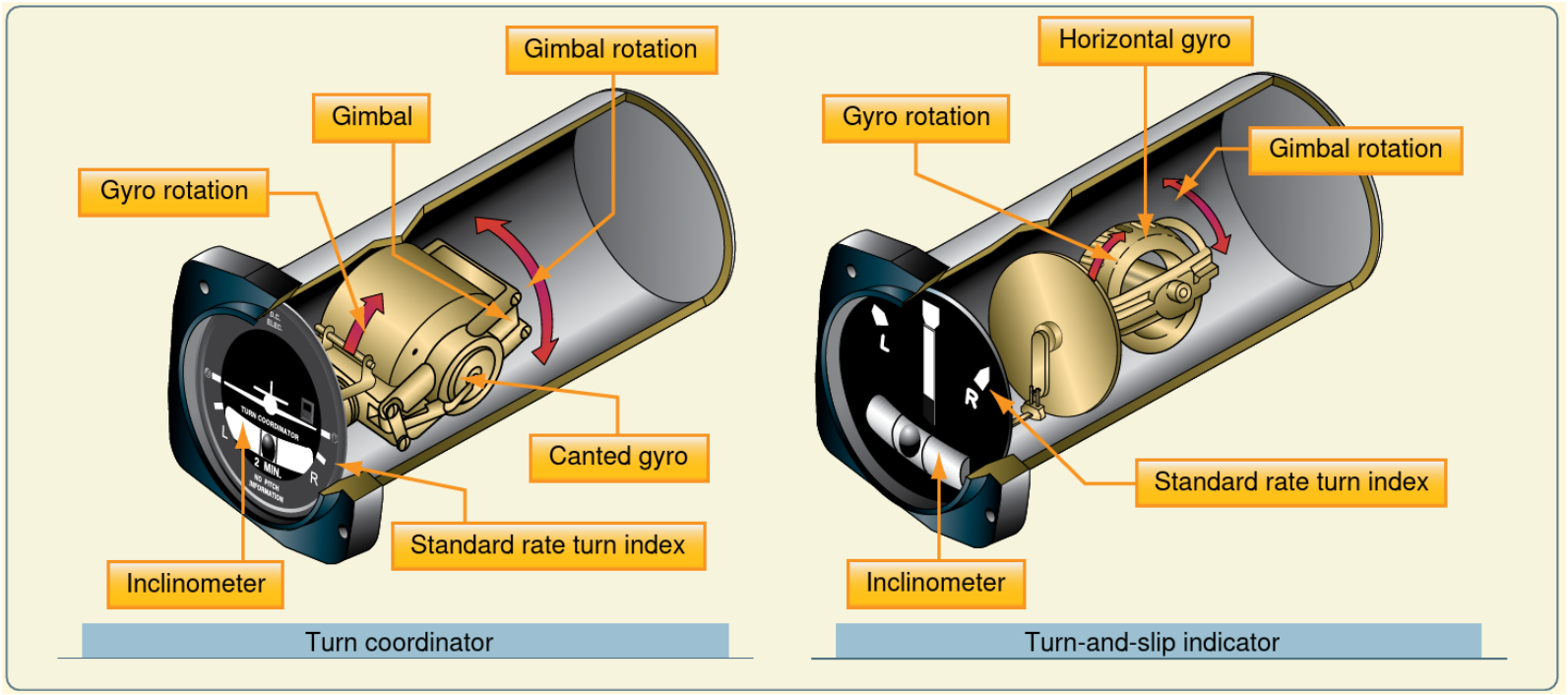
Lags AND Leads



Direction Gyro



Turn Coordinator



Turn Coordinator

Slipping turn

Skidding turn

1) The turn coordinator provides an indication of

A the movement of the airplane about the yaw and roll axes.

B the angle of bank to but not exceeding 30°

C the attitude of the airplane with reference to the longitudinal axis.

2) To receive accurate indications during flight from a heading indicator, the instrument must be

A set prior to flight on a known heading.

B adequately powered so that it seeks the proper direction.

C periodically realigned with the magnetic compass as the gyro precesses.

3) In the Northern Hemisphere, a magnetic compass will normally indicate a turn toward the north if

A a left turn is entered from a west heading.

B an aircraft is decelerated while on an east or west heading.

C an aircraft is accelerated while on an east or west heading.

4) Deviation in a magnetic compass is caused by

A the difference in the location between true north and magnetic north.

B magnetic ore deposits in the Earth distorting the lines of magnetic force.

C magnetic fields within the airplane distorting the lines of magnetic force.

5) In the Northern Hemisphere, a magnetic compass will normally indicate initially a turn toward the east if

A an aircraft is accelerated while on a north heading.

B a right turn is entered from a north heading.

C a left turn is entered from a north heading.

6) How do variations in temperature affect the altimeter?

A Pressure levels are raised on warm days and the indicated altitude is lower than true altitude.

B Higher temperatures expand the pressure levels and the indicated altitude is higher than true altitude.

C Lower temperatures lower the pressure levels and the indicated altitude is lower than true altitude.

7) If it is necessary to set the altimeter from 29.92 to 29.85, what change is made on the indicated altitude?

A 70-foot increase.

B 700-foot increase.

C 700-food decrease.

8) The pitot system provides impact pressure for only the

A airspeed indicator, altimeter, and vertical speed indicator.

B altimeter and vertical speed indicator.

C airspeed indicator.

9) Which V-speed represents maneuvering speed?

A V_A

B V_{LO}

C V_{NE}

10) Which of the color-coded markings on the airspeed indicator identifies the never-exceed speed?

A Upper limit of the white arc.

B Upper limit of the green arc.

C The red radial line.

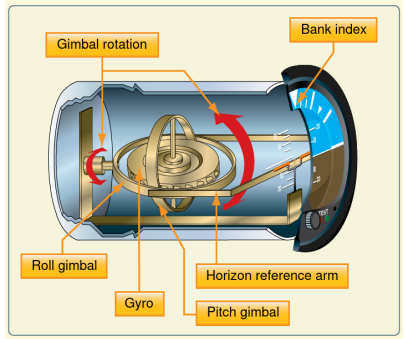
11) Which of the color-coded markings identifies the power-off stalling speed with wing flaps and landing gear in the landing position?

A Upper limit of the white arc.

B Lower limit of the green arc.

C Lower limit of the white arc.

12) How should
a pilot determine the direction of bank from an attitude indicator such as the one illustrated?



A By the direction
of deflection of the banking scale (A).

B By the direction
of deflection of the horizon bar (B).

C By the relationship of the miniature airplane (C) to the deflected horizon bar (B).