

Altimetry notes.

An altimeter is a device used to measure the **vertical distance** between the instrument and a datum pressure level.

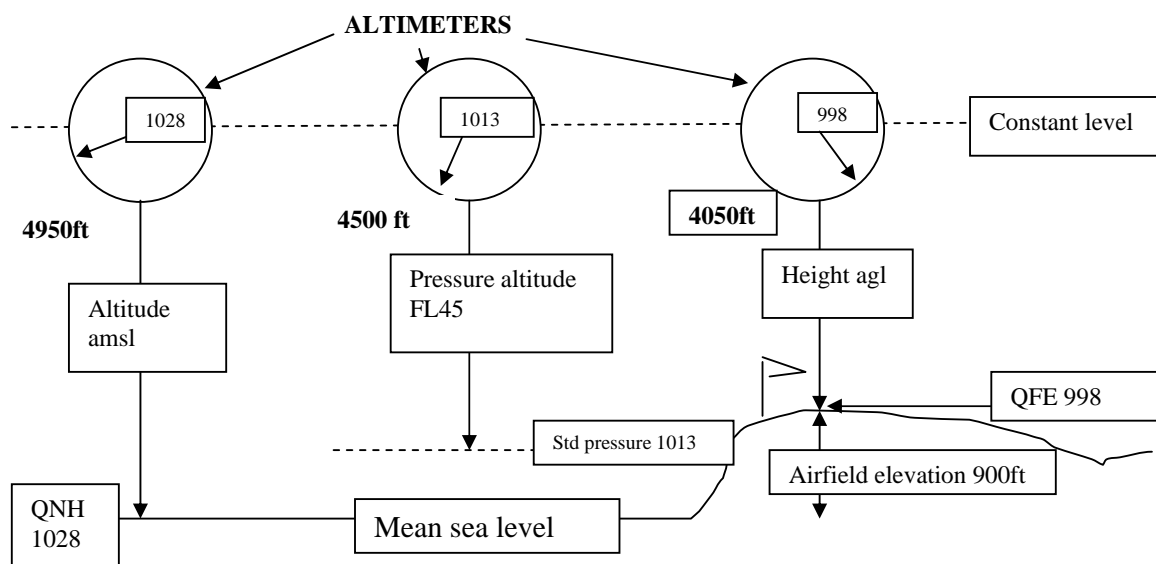
The datum pressure level can be set by turning the knob and altering the indication in the pressure window.

The instrument is calibrated, assuming the atmospheric pressure reduces with altitude at the same rate as the **standard atmosphere**---unfortunately this lapse rate is affected by air temperature, the altimeter is therefore seldom 100% accurate. Perhaps in the future GPS or radio altimeters will become more sophisticated and take over.

A reasonable estimate of the pressure lapse rate is 1hPa per 30 ft. 1 hecta pascal (hPa) is the same as 1 millibar (mb). This works quite well up to about 5000ft, and is usually the figure used in the bronze C paper.

The altimeter is a pressure instrument that operates in much the same way as a barometer. The instrument normally sticks a little, and like a barometer needs a gentle vibration to encourage movement. A gentle tap with the finger beside the instrument (never on the glass itself) is enough to get the needle to move.

In aviation, the words used are important, and often have very exact meanings. **“Height”** usually means the vertical distance above the ground or some feature. **“Altitude”** usually means the vertical distance amsl (above mean sea level). **“Pressure Altitude”** means the vertical distance above a standard pressure level of 1013 hPa. **“Flight level”** is a predetermined distance above the standard/pressure level of 1013 hPa (Shown on the 1:500000 chart as e.g. FL45, which means Flight Level 45 and means 4500ft above the 1013 pressure level.)



At any given level, the altimeter can be set to record altitude, height or pressure level (see diagram).

Radio “Q” codes are **QNH** (the barometric pressure at sea level) and **QFE** (the barometric pressure at the airfield). Q codes keep radio transmissions clear and concise. “Nympsfield base Glider Kilo six request QFE”.

Prior to take off, you can determine QFE by turning the knob on the altimeter and recording the figure in the pressure window.

Cross country flying is normally flown with QNH set, because it is easier to calculate your clearance above obstacles and high ground.

You can determine QNH by turning the knob until the instrument records the altitude of the airfield and recording the figure in the pressure window.

During longer flights, the pressure can (and often does) change. These changes can mean the indicated height is incorrect. If pressures reduce, the altimeter will over read (High to Low, look out below)

Altimeter errors can come about for a number of reasons,

- Instrument incorrectly set on the subscale.
- Faulty instrument.
- Pressure changes, over time.
- Temperature (The altimeter will over read at altitude on a cold day—by as much as 500ft at 10000ft)
- Lag, the instrument sticking
- Blockage of the static system (many gliders are vented directly into the cockpit which gets over the problem)
- Orographic effects, the mechanical effects of strong winds in the mountains, can cause pressure reductions in the lee of mountains. (Aviation theory centre, aircraft general, 2004, page128). These pressure reductions cause the altimeter to over read. A glider pilot may prefer not to be in the lee anyway!!

Idiots Guide to the Bronze paper questions.

- Always draw a little diagram---the instructor wont mind. The diagram should show an elevated part to represent the airfield etc, and a lower section representing the sea.
- Show QFE and QNH
- Work out where the 1013 pressure level should be, and draw it in.
- Show the heights of any item referred to (hills airfields etc)
- Calculate any differences in heights or levels using the lapse rate provided.
- Simple addition or subtraction should get your answer.

It really is that simple

Altimetry test

These questions are designed to test your understanding. They are significantly more difficult than the Bronze C questions. If you can unravel these you will have no difficulty with the paper.

Throughout these questions, assume 1mb reduction in pressure per 30ft gain in height.

1. You leave your home airfield with the millibar setting of 980. Regional QNH is reported to be 1010mb, and is not expected to change all day. Two hours later you arrive at your destination airfield with 2000ft on your altimeter, the airfield tells you that QFE is 975, how much clearance do you have over a nearby 1000ft mast?
2. Your home airfield is 1350ft amsl. You are flying at 3800ft with QFE of 960mb set on your altimeter. How much higher can you go before you reach FL65?
3. Your home airfield is 1350ft amsl. You are flying at 3800ft with QFE of 960mb set on your altimeter. The airway has a minimum altitude of 5500ft, and the regional QNH drops by 11mb. Are you infringing the airway, and how far away from the base are you?
4. You intend to use oxygen at an altitude of 10000ft. Regional QNH is 980mb, and you are flying at FL95, should you switch your oxygen on?
5. While flying, the weather deteriorates and pressures reduce. You are caught in cloud and you know there is a 450ft mast beside the airfield. You took off from the airfield with a regional QNH of 992mb, the airfield is 660ft amsl, the pressure has reduced by 15mb, what is the estimated QFE, and using this setting what height do you need to clear the mast by 500ft?
6. You are thermalling 5 nm NE of the Severn Bridge and realise you are over an area marked R154/2.0. You set your altimeter to QFE, when you left Nympsfield. Your altimeter now shows you are at 1500ft, are you in this restricted area or not and does it matter?
7. Your GPS tells you, you have 6.5 nautical miles to glide to Nympsfield, on a bearing of 323°(T) Your altimeter is set to 1003, which is QNH and shows 1900ft. You suspect you are in R105/2.0, are you and does it matter?
8. You are leaving Talgarth on a cross country, QFE is 972mb, what is QNH?
9. With a QFE of 972mb, what height above Talgarth airfield is the airway?
10. On the same day what height is the airway above Nympsfield?

Self test for Altimetry workshop