

# How do astronauts write notes?

The ubiquitous ballpoint pen does not work in outer space, says S.Ananthanarayanan.

They say that NASA spent many hundreds of Dollars to develop a device that would. But the Russians simply used a pencil!

## Fountain pens

**The first pens were the ‘steel pens’ or nib holders, that had to be dipped into an ink-well. These served nicely through the ages, through Shakespeare and Dickens, and till the early 20<sup>th</sup> century when fountain pens became popular.**



In the fountain pen, the ink is stored above the nib, in the pen itself, and does not need to be dipped in the inkpot. The ink does not pour out through the nib because of atmospheric pressure. When the barrel of a pen that is reasonably full is overturned, the empty space above the ink is a bit of a vacuum. The pressure of the atmosphere pushes in at the opening, and is able to support the short column of ink, particularly when the passage for the ink to pour out is the narrow opening of the nib.

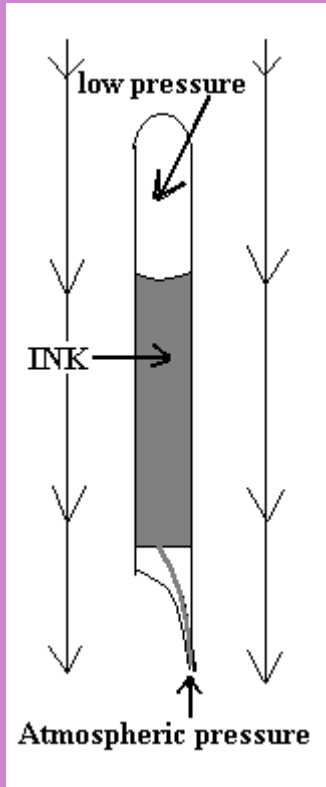
But when the nib touches paper, the ink does wet the paper and the nib captures minute bubbles of air, which pass into the ink barrel and let the ink descend just to keep the nib moist.

## World War II

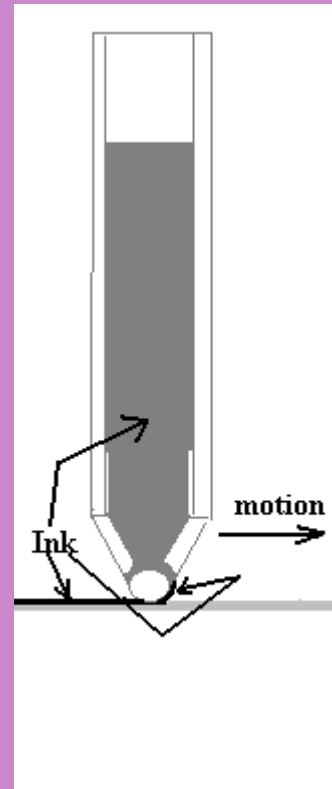
Fountain pens were a marvel in the early 20<sup>th</sup> century and soon became objects of clever craftsmanship and perfection. But during the war, it was found that fountain pens were useless for air force navigators when they were airborne. This was because, in the lowered atmospheric pressure at high altitudes, the ink would not stay in the barrel but leaked and ruined the charts! And going back to the old steel pen and ink would have been disastrous if the flyers hit an air pocket!

Well, it was to get over this very problem that the US air force research effort produced the ballpoint pen. The solution was to use a much 'thicker' and viscous ink, which stays in the barrel not due to the pressure, but because the space at the tip is just too narrow for it to flow through. And for writing, the tip has a ball, which rolls. So long as the pen is pointing down, the 'top' of the ball is wet with ink. When pressed on paper, the ball rolls, which brings the inky portion down to mark the paper, and this goes on while the ball turns round, so long as we keep writing.

### Fountain Pen



### Ballpoint



### Gravity at work

That's it, there's gravity at work here. That we need gravity to use a ballpoint pen becomes clear you noticed that ballpoint pens stop working if we hold the paper against a wall, so that the pen itself horizontal and not pointing down. We then need to point the pen down for a second, so that the ball is wet again, to be able write another few words.

### And in outer Space?

But in outer space, there is no gravity and the ballpoint pen is no good at all. NASA, they say, developed a complex thing that uses compressed gas to push the ink against the ball-tip. But what the astronauts need with a pen out there in their space suits is something of a mystery still!