HOW HARD CAN IT BE?

FROZEN AND HYPOXIC

MINUS 21. 4500M. OUR OWN PRIVATE HIGH MOUNTAIN DISASTER.

Words **Simon Ingram** Photographs **Vicky How**

I almost froze to death once.

It's one of my favourite stories.

I was in Patagonia, alone, wrapped in a wet sleeping bag, wearing damp clothes, in a tent which – as the temperature plummeted – froze. Raindrops became ice-tacks, scraping like zips down the nylon while I huddled inside, too scared to give in to drowsiness through fear of quietly expiring during the night. I had the works: staccato shakes so pneumatic the tent quivered along like a washer on spin, a complexion grey as the clouds and – worst – a whingeing voice in my head constantly bitching about what an utter, *utter* plonker I was for getting myself into this mess. As dawn broke, I emerged shaking, aching and nauseous, and decided that being so cold that you were worried for your life really wasn't much fun. And here's the thing, the really *ridiculous* thing: the temperature never dropped below minus 3.

So, since this experience, my question has been this: what the hell would a proper, Himalayan temperature of minus 20 or more be like?

Mountain lore is filled with growly tales of such extremes, and the weird effect they have when combined with those other pesky niggles – thin air and hypoxia (reduced oxygen flow to the tissues) caused by altitude. A famous example is how Doug Scott survived a night on Everest's south summit at minus 30 deg C, and ended up having a three-way conversation with his feet. These extremes are, to most of us, untouchable. Something you'll read about, perplexedly imagine, but probably never experience – like anti-gravity, or a shark bite. And no matter how much some hard-ass tells you how nasty it is, you're never *really* going to know.

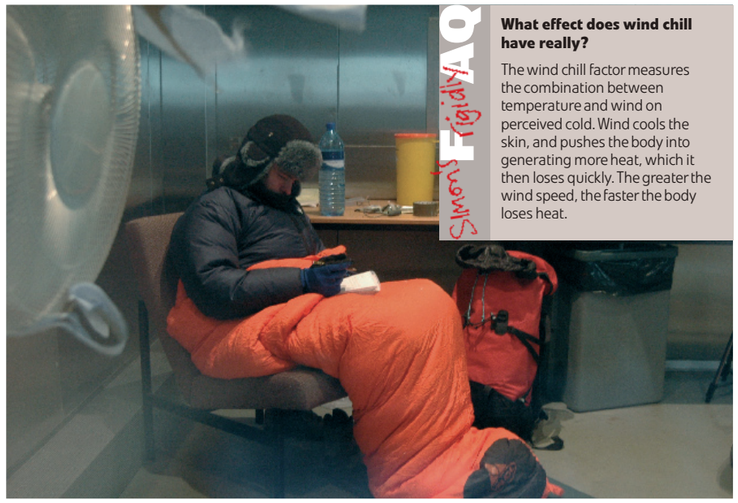
So I did what any other utter plonker would do.

I found a great big hypoxic freezer, turned the knob all the way to the left, and shut myself in it.

The door slams shut behind me. I hear a gasp of gas, and the chill hits like a draught in a shower room. It's a big room: brushed steel, the thrum of fans and a scattering of objects – exercise bikes, a chair, a table. Lewis and Vicky appear at the spacecraft window and throw me a wave. Minutes later, I watch Lewis wordlessly consult his computer screen, scribble something onto paper and press it to the window: '-19, 4500m. Cold yet?'

'Cold' doesn't cut it. This temperature is difficult to conceive; we in Britain rarely experience an air temperature even approaching it. It's colder than the average summer air temperature on top of Everest and as high as Mont Blanc, but I'm not on a mountain: I'm in the University of Glamorgan's School of Applied Sciences' environmental chamber – one of only three of its type in the UK, and capable of simulating almost any climate on earth.

I'm dressed for Scottish winter – base layer, fleece, down jacket, climbing pants and one pair of thick socks. Inside my rucksack is a sleeping bag, a bivvy and a notebook. The only question now is: how long I can stand it?



Simon's FAQ

What effect does wind chill have really?

The wind chill factor measures the combination between temperature and wind on perceived cold. Wind cools the skin, and pushes the body into generating more heat, which it then loses quickly. The greater the wind speed, the faster the body loses heat.

Simon's FAQ

Why did I need to pee so often?

It's normal at altitude to be urinating more than usual. If you're not, you may be dehydrated, or you may not be acclimatising well. It's caused by changes in the body's chemistry and fluid balance during acclimatisation: it's believed that in an effort to increase the concentration of oxygen-carrying red blood cells, the kidneys instruct the body to jettison fluid. Hence, altitude diuresis (water loss).

Hour 1: I pace around for a couple of minutes, watching for effects. In being instantly transported to 4500m, I have almost halved the amount of oxygen going into my body and reaching my brain. Normal air contains 21% oxygen; the pressurised cabin of a jet has 18%; I'm breathing 12%. At the moment I can't detect any difference, other than relief that I didn't have a stroke the second I walked in. I walk over to the pedestal fan and turn it on full power. Lewis comes in after 15 minutes or so, takes my temperature and measures my oxygen saturation. In that short time, my core temperature has dropped 2 degrees and my arterial oxygen saturation has decreased by 12%. This is nothing but a figure to me, until I try to drag one of the exercise bikes across the floor. It's heavy, but as I lean against its saddle, breathing hard after moving it a few feet, it's obvious that something is happening. Plus I need the toilet – suddenly, and badly. Grabbing the whiteboard and marker pen that has been given to me so I can communicate, I scribble down my request and press it to the window. Soon after, a bottle arrives.

Hour 2: I'm starting to shake now. In front of the fan, the wind chill makes the temperature feel like -30 deg C. My toes are numb, stamping my feet doing little but giving me shooting pins and needles. Inside my gloves, my fingers are cold, so I try to keep them moving. Persistently shuffling around the chamber makes me feel better, though the floor chills my feet even further. My fleece Buff freezes up with every exhalation. This is exacerbated by my breathlessness – a combination of the cold and the low oxygen level. And by the time Vicky comes in to do the second set of hourly tests – physical, memory and coordination – I need the toilet again. The push-ups leave me dizzy and out of breath, my heart a speed-metal drumbeat. I struggle with remembering the words as if trying to do long division in my head. Eyes closed, I concentrate so hard on my coordination that I don't realise I'm falling backwards into the wall until I hit it. It's the altitude: by the end of the hour, it's not making me feel ill – but I *am* starting to feel it.

Hour 3: Soon after Vicky leaves, I unroll my sleeping bag and put my feet inside. Cold temperatures are stealthy enemies; you really don't realise something is going numb until you poke it and feel nothing. On inspection, I'm alarmed to discover that this is true for both of my thumbs, little fingers and the middle toe of my left foot. When I massage my numb fingers, they feel alien, like someone else's. I withdraw them from their fingerholes and make fists inside my gloves. The sleeping bag helps a little, but not much, and soon I'm massaging my feet, too, a worry thawing in my chill-slowed mind: frostbite. In a wind chill of -30, exposed skin can freeze in minutes. As frostbite risk goes, in here I'm at the low end; on a mountain, away from civilisation, it would be different. My lungs remind me with quick, sharp coughs that I'm not breathing often enough, so slumped in my chair I begin to resemble a marathon quitter. The shakes are now constant, like background static. Joints, knees and vertebrae are aching. I lie down and huddle into my sleeping bag. I'm drowsy. Is this the altitude, or the cold? Probably both...

Simon's FAQ

What caused the headache?

The latest theory behind high altitude headache is that an increase in free radicals (nasty reactive molecules) causes changes in the blood-brain barrier. This causes mild brain swelling – hence the headache.

Hour 4: There's a sharp *whoosh* of gas and Lewis comes in. His visit is brief as he peers at me and grins. "It's got you, hasn't it?" I look up. The halogen ceiling lights all have halos. My vision is slightly soft. I'm told later that my reactions are goofy and sluggish, though I don't notice it; I still feel drowsy as I prop myself up on my elbow and look around, still shaking. I may have been asleep; I'm not sure. I get up and immediately stumble dizzily to the wall, where I rest for a second, my heart hammering. "Bloody *hell*."

"Yep, you're hypoxic. Resisted longer than most, but you've definitely gone to the dark side now." A headache is beginning to knead my temples. It's the same sort of headache experienced by migraine sufferers – a throb that shoots back from above the ears to the back of the head. The dizziness is familiar – like emerging from a pub into daylight after two pints and no lunch. Only I'm not wavering out of my local – I'm hypoxic. My brain isn't getting enough oxygen. I don't like the feeling; moreover, I wouldn't trust myself with it. Vicky's test results for this hour show a collapse in physical ability, jumbled recollection and impaired balance. I can still place a finger on my nose with my eyes shut, but waver like a sapling in wind while doing it.

Hour 5: Minus 21 is a temperature that wants you dead. It makes no secret of it, either: things start to desert you the further into this zone you go – batteries, camera, food, water, fingers, toes. Your core temperature is the last to go – once your body starts to lose heat quicker than it can hang on to it, you're on the final glissade.

My core temperature is hovering above the upper limit of hypothermia, which means that – thanks to my clothing – I'm probably not going to die. I am, however, feeling wretched. I'm in one of my restless shuffles round the room when I decide to do something constructive: pitch my bivvy. But first there's something else I need to do. Again.

Peeing at this temperature isn't nice. Firstly, it takes ages. It's like trying to drain the last bit of ketchup from a bottle. Plus, my poor addled mind doesn't think to question why – after four hours of scarcely more than a sip from my long-crystalline water bottle – I continually feel like someone is pressing their boot heel into my bladder. The now half-full relief bottle makes a slushy sound when I shake it. The tent goes up slowly. I can't time myself as my watch has stopped working. The poles frustrate me as I try to bow them into position, the frigid tent material crackling stiffly like a crisp bag. I shuffle in a permanent stoop around it, pawing zips with numb fingers, breathing heavily and grimacing as my head explodes every time I bend down. It's now that I do something silly. To unzip the zip, I remove my left glove. My hand freezes immediately. Picking up the glove, I wrestle my hand back in – to find that the sweat lining the inside has also frozen, rendering it useless. Desperately cold, I jam my hand into my down jacket, under my arm. If this had happened on a mountain – in a place where the only warmth is a dim ember inside your body, and you're in a bad way – I would have panicked. For another ten minutes I stamp impatiently round the chamber, screwing my hand further and further into my ribs. My fingertips start to go white. It's been 5 hours, almost to the minute. Time to get out.

Lewis helps drag my tent from the chamber. "Fair play, mate. You pushed the chamber further than it's ever been. You coped well."

So *that* was what frozen hypoxia feels like.

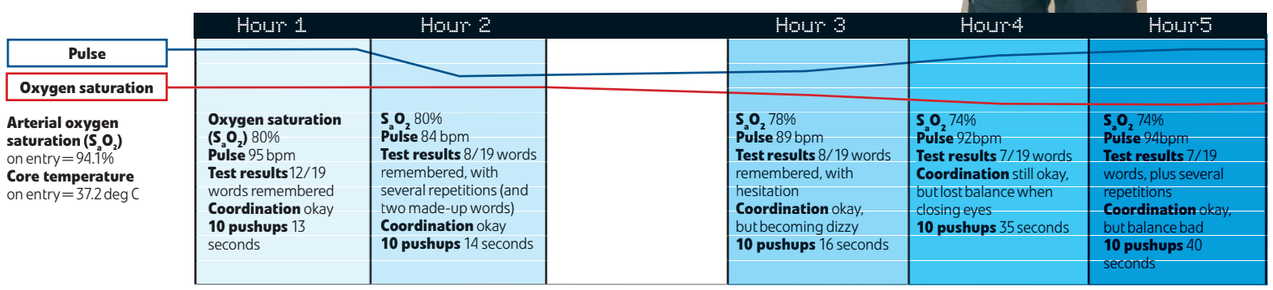
A shout comes from inside.

"Hey, you peed a Slush Puppie! *Hardcore*!"

Cool. I guess I have a new story to tell. T

CH-CH-CHANGES

Once an hour for each of the five I spent in the chamber, I was given three tests: a memory test on a list of 19 words, a timed physical test and a coordination test. I also measured my heart rate and arterial oxygen saturation. Here are the results:



Hour 1	Hour 2	Hour 3	Hour4	Hour5
Arterial oxygen saturation (S_aO_2) on entry = 94.1% **Core temperature** on entry = 37.2 deg C				**Arterial oxygen saturation (S_aO_2)** on exit = 74% **Core temperature** on exit = 35.7 deg C
Oxygen saturation (S_aO_2) 80% **Pulse** 95 bpm **Test results** 12/19 words remembered **Coordination** okay **10 pushups** 13 seconds	**S_aO_2** 80% **Pulse** 84 bpm **Test results** 8/19 words remembered, with several repetitions (and two made-up words) **Coordination** okay **10 pushups** 14 seconds	**S_aO_2** 78% **Pulse** 89 bpm **Test results** 8/19 words remembered, with hesitation **Coordination** okay, but becoming dizzy **10 pushups** 16 seconds	**S_aO_2** 74% **Pulse** 92bpm **Test results** 7/19 words **Coordination** still okay, but lost balance when closing eyes **10 pushups** 35 seconds	**S_aO_2** 74% **Pulse** 94bpm **Test results** 7/19 words, plus several repetitions **Coordination** okay, but balance bad **10 pushups** 40 seconds

● With thanks to Lewis Fall and the University of Glamorgan's Applied Sciences Department