

FLUIDS: PRESSURE UNDER OCEAN

Unit 18 , Dr John P. Cise,

Professor of Physics, Austin Com. College, Austin Texas, USA, jpcise@austincc.edu & NYTimes, June 9,2018 by Jo Ana Klain

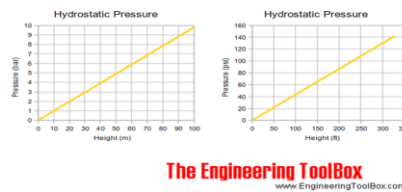
This Device Helps Fish Make It Out of the Twilight Zone Alive



Divers collect fish with a **portable decompression Chamber** developed to help scientists study species from the ocean's mesophotic zone(130-490 ft. deep)

With height of fl

Height of Water Column (m)	(ft)	(kPa)	(bar)	(psi)
1	3.3	9.8	0.1	1.4
2	6.6	19.6	0.2	2.8
3	9.8	29.4	0.3	4.3
4	13.1	39.2	0.4	5.7
5	16.4	49.0	0.5	7.1
6	19.7	58.8	0.6	8.5
7	23.0	68.6	0.7	10.0
8	26.2	78.4	0.8	11.4
9	29.5	88.2	0.9	12.8
10	32.8	98.0	1.0	14.2
12	39.4	117.6	1.2	17.7
14	46.0	137.2	1.4	21.2
16	52.6	156.8	1.6	23.3
18	59.2	176.4	1.8	26.4
20	65.8	196.0	2.0	29.0
25	82.0	245.0	2.5	36.1
30	98.4	294.0	3.0	43.3
35	114.8	343.0	3.5	50.5
40	131.2	392.0	4.0	57.7
50	164.0	490.0	5.0	71.9
60	196.8	588.0	6.0	86.1
70	229.6	686.0	7.0	100.3
80	262.4	784.0	8.0	114.5
90	295.2	882.0	9.0	128.7
100	328.0	980.0	10.0	142.9



The Engineering Toolbox
www.EngineeringToolBox.com

INTRODUCTION: Pressure (P) under any fluid increases with depth(h) . Goal here is to confirm table at left that under 200 ft. of sea water the pressure is about 85 psi.

QUESTIONS: (a) Find pressure under ocean at 200 ft. in lb./ft.²? (b) Find P in psi?,(c) Does (b) compare well with table at left?

HINTS: D = weight density
D = m g/V=ρ g h , D_{SEA WATER} = 64 lb./ft.³
P = D h, 144 inch² = 1 ft.²

In the ocean, sandwiched between sun-filled shallows and ever-darker depths, is a strange place where the noon sun shines only as bright as twilight. **Some 200 to 500 feet below the surface is the mesophotic zone**, where ancient reefs once drowned, leaving behind empty bodies now inhabited by new corals and colorful mystery fish.

Much of this zone remains unexplored: It is often skipped by scientists on their way to the ocean bottom. Just as we begin to discover this slice of the sea, climate change, overfishing and other human activities may be threatening its very existence. Those who study the zone have long needed a safer way to bring its fishy residents to the surface without killing them.

That's why scientists at the California Academy of Sciences and the Monterey Bay Aquarium invented a device to safely transport fish, which was described in [a paper published Monday in the journal Frontiers in Marine Science](#).

It's basically a **portable decompression chamber, protecting fish from the same damage that humans experience when we dive deep into the ocean and return too quickly to the surface.**

If you've ever traveled with snacks from the bottom of a mountain to the top, you may have noticed that an unopened bag of chips will expand as you ascend. Deep divers carry tiny bubbles of air in their bodies, and fish have swim bladders; both expand as bodies ascend and pressure decreases. And if care isn't taken to decompress slowly along the way, bubbles expanding in the body can become fatal. Some scientists poke holes into fish swim bladders with needles to solve the problem. But [Bart Shepherd](#), who directs the Steinhart Aquarium at the California Academy of Sciences, with colleagues there and at the Monterey Bay Aquarium, thought there was a less intrusive way. They developed transparent collection jars two feet long that fit into chambers, small and simple enough for divers to carry and manipulate. **As the divers ascend with their catch, they insert the jar into the chamber and blow a bubble into it. This maintains the pressure until it reaches the surface. There, a valve releases air from the bubble over two or three days so the fishes have time to adapt to surface pressure.**

After decompression, the fishes temporarily occupied makeshift kiddie-pool aquariums in hotel rooms before they were packed and shipped by air to California. Most survived the journey. "That chamber becomes the world's deepest aquarium," said Mr. Shepherd. "Now in our exhibit we have eight undescribed species of fish on the public floor that people can see that they'd have no opportunity to see anywhere else in the world."

ANSWERS: (a) P = 12,800 lb./ft.² , (b) p = ~ 88.3 psi, (c) P in table (above) from Engineers Toolbox.com at 197 ft. lists the pressure to be 85 psi. Thus, your computed value of 88.3 psi at 200 ft. is very reasonable considering your computed P was for a deeper pressure at 200 ft = h.