

Can Lake Berryessa Freeze Solid? Frozen Rivers and Beautiful Flowers

by Peter Kilkus

The other day I found a video interview with Richard Feynman, one of the greatest physicists of the 20th century. I had used his famous series of physics textbooks in college. Unfortunately, he died in 1988 from a rare form of cancer. One of his last contributions was on the committee that was formed to analyze the cause of the Challenger shuttle disaster in 1986. I and several friends had watched the shuttle explode in real time. I still remember the shock of the sight of the explosion on TV when I worked at Digital Telephone Systems in Novato. It was a depressing rest of the day for us. I had watched almost every manned spacecraft lift off since the first one and would skip my classes, if necessary, to see one (even one happening during a scheduled physics test - I arrived late and passed anyway).

Feynman was the member of the committee that proved the Challenger disaster was caused by cold, brittle O-rings in the solid rocket boosters. The launch had been on hold at Cape Canaveral due to unusually cold weather. Unfortunately, NASA released the shuttle for take-off too soon.

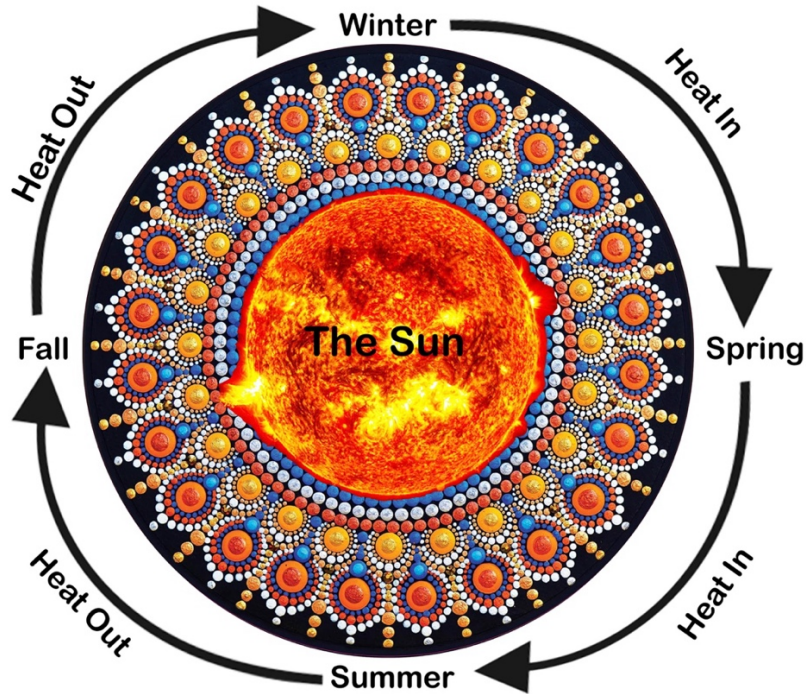
In the video, Feynman describes his view of the beauty of science and the science of beauty. The link to the video is given below if you wish to hear him in person. I also transcribed his statement for you to read without going online - but I think you would enjoy watching him make his 2 minute case in person.

His comments reminded me of similar experiences I've had over my years as a physicist. One of the first was driving with college friends from Winona, Minnesota along the Mississippi River to La Crosse, Wisconsin in the middle of winter.

On that trip of twenty miles the Mississippi was frozen solid. We all remarked at the beauty of the frozen river. As the only scientist in the car, I was amazed at the difference between the river flowing mightily (as in the song Mighty Mississippi Roll Along - <https://www.youtube.com/watch?v=7s0wpQbeOQA>) and the completely still sight. I simply remarked, "Can you imagine how much heat energy had to leave that river to make it completely stop flowing?"



My friends immediately started making fun of me for being a physicist who didn't get the beauty of the scene and was reducing it to scientific principles. They disparagingly called me a reductionist. Reductionism is usually defined as the explanation of complex life-science processes and phenomena in terms of the laws of physics and chemistry. The friendly chiding still stung a bit even though I knew that I saw more expanded beauty in that frozen river than they did. That's one reason Feynman's comments impacted me so strongly.



During my career as a practicing physicist, I've encountered several examples of this tension between the sciences and the humanities. Some folks are actually proud of their ignorance of science and broadcast that ignorance as a mark of sophistication. I had an acquaintance who was a Ph.D. professor at UC Berkeley, nice but a bit arrogant. He often accused me of being a crass reductionist and besides, he said obnoxiously, the Greeks had already proposed the atomic theory of matter centuries ago. It was technically true, but I pointed out that the Greek atomist philosopher was only one of many other philosophers who simply ended up being wrong centuries ago. I told him that his contribution to society, literally, was translating Greek writings into Latin and Latin documents into Greek. He was not amused.

That science/humanities is a false conflict. I know that they enhance each other in real life - as Feynman so eloquently points out. And that is why the new support of STEM education is so important to society's future.

What Are The Humanities?

The humanities are all of those academic disciplines that focus on the truly human elements of life – our unique ability to express our innermost thoughts, feelings and desires through words and actions. In the strictest sense, the humanities are literature and language, history, philosophy, and the arts (painting, poetry, theatre, sculpture, etc.)

What are the Sciences?

The sciences are typically divided into three groups: natural sciences, where you'll find biology, physics, and chemistry, as well as geology and a few others; formal sciences – including mathematics, statistics, and data-based subjects like computing and AI; and finally social sciences, including the often-disputed

archaeology, anthropology and geography. There is still a serious debate over whether math is in fact a science or not.

What is STEM?

STEM - standing for Science, Technology, Engineering and Math - is an approach to learning and development that integrates the areas of science, technology, engineering, and mathematics. Through STEM, students develop key skills including problem solving, creativity, critical analysis, teamwork, independent thinking, initiative, communication, and digital literacy. These skills also apply to an understanding and enjoyment of, and academic accomplishments, in the humanities.

Science and the Beauty of a Flower - Richard Feynman's Opinion

<https://www.youtube.com/watch?v=ZbFM3rn4ldo>



"I have a friend who's an artist and has sometimes taken a view which I don't agree with very well. He'll hold up a flower and say, "look how beautiful it is," and I'll agree. Then he says, "I as an artist can see how beautiful this is, but you as a scientist take this all apart and it becomes a dull thing," and I think that he's kind of nutty.

First of all, the beauty that he sees is available to other people and to me too, I believe. Although I may not be quite as refined aesthetically as he is ... I can appreciate the beauty of a flower. At the same time, I see much more about the flower than he sees.

I could imagine the cells in there, the complicated actions inside, which also have a beauty. I mean it's not just beauty at this dimension, at one centimeter; there's also beauty at smaller dimensions, the inner structure, also the processes.

The fact that the colors in the flower evolved in order to attract insects to pollinate it is interesting; it means that insects can see the color. It adds a question: does this aesthetic sense also exist in the lower forms? Why is it aesthetic? All kinds of interesting questions which the science knowledge only adds to the excitement, the mystery, and the awe of a flower. It only adds. I don't understand how it subtracts."

Richard Feynman

Can Lake Berryessa Freeze Over?

If you've been to Donner Lake in the middle of winter and walked on its frozen surface, you remember how exhilarating it was to do. Wouldn't it be just as much fun to walk on a frozen Lake Berryessa? The same question can be posed as the one I did about the Mississippi River. How much heat energy must escape into the sky for the lake to freeze? That's an easier question to answer for a still lake than for a moving river.

Say you wanted the ice to be one foot thick for safety. Lake Berryessa a surface area of 20,700 acres. The top one foot of water is equivalent to 20,700 acre-feet. One acre-foot is 325,851 gallons. So, the top one foot of ice would be equivalent to 6.7 billion gallons of water. 1 gram of water requires 4.2 joules of heat energy to be released to lower it 1 degree Celsius. With a summer temperature of 80 degrees Fahrenheit and a freezing temperature of 32 degrees Fahrenheit, the energy drop required (48 degrees Fahrenheit) to lower that much water would be how many Joules? The formula for converting Fahrenheit to Celsius is $C = 5/9(F-32)$ and 1 gram = 0.000264172052 gallon. As our physics textbooks used to say, "the answer is left as an exercise for the student". The answer is basically: "a lot"!

Can Artificial Intelligence Help?

If you've been reading science fiction since childhood, as I have, you are familiar with the dozens of plots regarding artificial intelligence entities - robots and super computers - taking over the world and destroying humanity, the present hysteria in the news about the threat of artificial intelligence will seem quite naive and amusing. The best review I've seen of the present state of AI and its possible future, was from John Oliver in a funny, but highly educational, episode of his television show, Last Week Tonight with John Oliver - Artificial Intelligence. (https://youtu.be/3YNku5FKWjw?si=_0HIZS6-er165lc9) You should watch it if you want to know the real story of AI as it now exists. Natural Stupidity is more dangerous than Artificial Intelligence!

But AI has been around for decades. At the end of the last century (I love using that term rather than 1998, for example.) we called it "expert systems". Nothing is really new about AI, just faster computers, cheap large memories, huge data banks, and new software algorithms. But it makes "exciting" news. See a detailed timeline of the development of robotics and artificial intelligence at:

https://en.wikipedia.org/wiki/Timeline_of_artificial_intelligence

So I asked my cheap, i.e. free, version of ChatGPT for help. More than a year ago I had asked it to do a review of the Lake Berryessa News. It responded, "As an AI language model, I don't have access to real-time data or specific publications past my knowledge cutoff date of September 2021. Therefore, I cannot provide a review of the Lake Berryessa News as it might exist after that date."

This time I asked it to create a picture of a frozen Lake Berryessa. It responded, "As of my last knowledge update in January 2022, Lake Berryessa in California typically experiences mild winter temperatures, and it doesn't often freeze completely. However, the freezing of a lake can depend on various factors, including the specific weather conditions during a particular winter."

If you are looking for the current status of Lake Berryessa or whether it has frozen recently, I recommend checking local weather reports, live webcams in the area, or contacting local authorities for the most up-to-date information. You might also find recent photos or updates on social media platforms or local news websites. I don't have the capability to generate or create visual images. My design is centered around processing and generating text based on the input I receive. But I can describe how Lake Berryessa might look when frozen!

Picture Lake Berryessa, nestled in the scenic Napa County of California, blanketed in winter's embrace. The lake's surface is a vast, smooth sheet of ice reflecting the wintry sun, with the surrounding hills and mountains dusted in snow. Trees along the shore stand tall, adorned with frost, and the usually serene

water now frozen, creating a pristine, icy landscape. The tranquility of the scene is captivating, with the frozen lake offering a serene, otherworldly beauty."

The photo below accurately shows the beauty of our unusual snowstorm last February - which partially matches the AI's description.



But I was on my own. So, starting with a couple of real photos of the lake, I used my Actual Intelligence and the latest version of Photoshop to create a "frozen Lake Berryessa". Unless the climate gets really screwed up my version will "probably" never happen.

