养了十天的晶体全军覆没，我重新学会了控制条件

寒假作业里有一项选做实验：养晶体。我选了明矾，觉得这实验简单得不能再简单——书上写了，配一杯饱和溶液，静置几天，晶体自己会长大。我第一炉做得极快：倒半杯热水，挖几大勺明矾进去，随便搅两下，杯底还剩一堆没溶的粉末，我也没管，直接端到窗台上等。我甚至提前想好了拍照发朋友圈的文案，就等一颗漂亮的八面体长出来。

十天过去，窗台上那杯东西给了我一个响亮的耳光。没有晶体，整杯水浑浊发灰，杯底那堆粉末不但没长大，反而化成了一滩糊状的东西，闻着还有点怪味。我查了资料才知道问题成串：水不够热，明矾根本没溶够，杯底那堆不是种子而是杂质；窗台白天被太阳晒、夜里降温，温度忽高忽低，溶液一会儿蒸发一会儿又溶回去；开窗通风时灰尘落进去，浑水就是这么来的。我以为的简单实验，其实每一步都有条件要求。

第二炉我认真多了：用刚烧开的水溶到不能再溶，过滤后再倒进洗净的杯子，放在桌子中央避开阳光。这一炉长出了晶体，但个个歪歪扭扭，像被捏过的冰块，还有几个悬在半空长成了畸形。我把杯子端到灯下转着看，发现杯壁上有细小的划痕，晶体附着在划痕上就长歪；而桌子正对着门口，每次有人进出带过的风都在让溶液轻微晃动。原来晶体长得好不好，取决于我看不见的稳定。

第三炉我把条件一项一项钉死：溶液过滤两遍，杯子里先吊入一颗挑出来的小晶体做晶种，杯子坐进泡沫箱里隔震保温，箱盖留一条缝缓慢蒸发，位置选在没人走动的储物柜顶。第十四天打开箱子，那颗晶种长成了一颗指甲盖大的透亮八面体，棱线笔直，对着光能看到里面干净的折射。我妈路过都愣了一下，问这是买的吗。

这二十多天给我的心得，比一颗晶体值钱。第一炉输在我不知道条件存在，第二炉输在我知道条件却没管住条件，第三炉才算真正会做：把温度、浓度、震动、洁净每一项都固定下来，只留时间这一个变量。科学探究课上老师反复讲控制变量，我以前觉得那是应付考试的词，现在才知道它是失败喂出来的规矩。失败本身不可怕，可怕的是不知道为什么失败，然后原样再错一次。后来复习别的科目我也用这套办法：错一道题，先把它缺的条件找出来，再决定重做还是只改那一点。储物柜顶那颗晶体我留着没交作业，就摆在书桌上，它提醒我，慢不是问题，盲目才是。

Ten Days of Crystals Wiped Out, and What I Learned About Controlling Conditions

One optional item in my winter break homework was to grow crystals. I chose alum, because the experiment seemed about as easy as anything could be: the book said mix a saturated solution, let it stand for a few days, and crystals would grow on their own. My first attempt was rushed: half a cup of hot tap water, a few big spoonfuls of alum, a lazy stir, and I ignored the powder still sitting at the bottom, then set the cup on the windowsill and waited. I had even drafted the caption for the photo I planned to post, just waiting for a fine octahedron to appear.

Ten days later the cup slapped me in the face. No crystals at all. The water was gray and cloudy, and the powder at the bottom had not grown — it had turned into a foul paste. Only then did I look things up and find the whole chain of errors: the water was not hot enough, so the alum never properly dissolved, and what sat at the bottom was impurity, not seed; the windowsill baked in sun by day and cooled at night, so the solution kept evaporating and redissolving; dust drifted in every time the window opened. The simple experiment I imagined had requirements hiding in every step.

My second attempt was serious: I dissolved alum in freshly boiled water until nothing more would melt, filtered it, and poured it into a washed cup placed at the center of the table away from sunlight. Crystals did grow this time, but every one of them twisted, like ice cubes that had been squeezed, and a few hung crooked in mid-solution. Turning the cup under the lamp, I found fine scratches on the inner wall — crystals clinging to a scratch grow crooked — and the table faced the door, so every person passing by set the solution gently rocking. Growing a good crystal, I learned, depends on a stability you cannot see.

For the third attempt I nailed every condition down one by one: the solution filtered twice, one selected tiny crystal lowered in as a seed, the cup nested in a foam box against vibration and temperature swings, the lid cracked open a sliver for slow evaporation, the whole box placed on top of a storage cabinet where nobody walks. On the fourteenth day I opened the box and the seed had become a translucent octahedron the size of a fingernail, edges dead straight, with clean refractions inside when held to the light. Even my mother paused and asked if I had bought it.

What those twenty-some days gave me is worth more than one crystal. The first attempt lost because I did not know conditions existed; the second lost because I knew the conditions but did not control them; only the third was real experimentation — fixing temperature, concentration, vibration, and cleanliness, leaving time as the single variable. Our science teacher kept saying control the variables, and I used to think it was exam boilerplate. Now I know it is a rule fed to you by failure. Failure itself is not frightening; what is frightening is failing without knowing why, then repeating the mistake exactly. I now use the same method in other subjects: when I get a problem wrong, first find the missing condition, then decide whether to redo everything or fix only that point. I kept the crystal on top of the cabinet instead of handing it in. It sits on my desk, reminding me that being slow is not the problem — being blind is.

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