

>>> Chemistry, Diane Jewell: Technetium-99m has a half-life of 6.0 hours. How long will it take to decay to $1/64$ of its original level – $1/64$, okay? How many times do we have to divide by 2 or multiply by $1/2$ to get to $1/64$, okay? With 1 half-life – after 1 half-life, we end up with $1/2$ of our material. With two half-lives, that's $1/2$ times $1/2$. We now have $1/4$ of the material – third half-life, $1/4$ – from over here – $1/4$ times a $1/2$ again gives us one $1/8$ of our material, okay? Starting with $1/8$ for our fourth half-life, $1/8$ times $1/2$ gives us $1/16$ – we're not there yet, we're getting there. On our fifth half-life, we're taking our fourth, which is $1/16$ – multiplying it by $1/2$, we get $1/32$, we're getting close now. That's after 5 half-lives. On the 6 half-lives, we're starting with where we ended up here, which was $1/32$, and taking half of that – $1/32$ times $1/2$ is $1/64$ – we did it! We found it! But that doesn't answer our question. Okay, so let's go back and see what the question is. How long will it take to decay? Okay, so it's going to have to go through 6 half-lives in order to get to $1/64$. So how much is 6 half-lives? So go back and find out what we have. We have 6 half-lives and now here's our conversion factor – it's 6 – oops, sorry – that's 6.0. Okay, there we go – 6 hours, and we're going to take 6 half-lives. So 6 hours in 1 half-life times our 6 half-lives. Half-lives cancel, leaving us with hours – 6 times 6 gives us 36 hours. So, after 36 hours, Technetium-99m will decay down to $1/64$ of its original level.