

7.1 Acids, Bases and Salts – Oh My!

Kailey and Kyle are chomping on a burger and fries, washing it down with a soda, when Kyle wonders about the acidity of the soda.

Kyle: Yum, Yum! These baby butter burgers are beyond beliceous!

Kailey: Beliceous?

Kyle: Well, I couldn't think of a proper word to describe good tasting that started with a b, so I invented one.

Kailey: Right. How about tasty, scrumptious, flavorsome, mouthwatering, appetizing – stick to the King's English would you?

Kyle: Seeing as my creativity does not impress you – how about this question. Remember in chemistry our teacher said next week we were studying acids, bases and salts? I heard Sam say that sodas are acidic. And, my pop was talking about battery acid and not getting any on his skin or clothes and he wore goggles just to protect his eyes. How come I don't have to wear goggles drinking my soda?

Kailey: Ok, great question Kyle. First of all, there is an acid in sodas, and in batteries to help with the storage of electrical charges. But there are also acids in our bodies, and in the air – perhaps you have heard of acid rain, but we will get to that later on. So it's important that you understand the essence of acids, and also bases.

Kyle: Right – I have heard of bases but I'm really unclear of the connection to acids.

Kailey: So, let's start really simple with the definition of an acid – any compound that contains hydrogen atoms, when added to water, releases hydrogen ions. Let me break that down for you. If you take an acid like HCl and add it to water, the H atom loses an electron and becomes H⁺, the plus charge because it has lost the negative charge.

Kyle: All right – got it. How about bases?

Kailey: Hold on cowboy. We will hold off on bases until you understand more about acids. Now, you might have heard the names of other acids such as carbonic, sulfuric, or nitric acid.

Kyle: Right – my soda can has carbonic acid as one of the ingredients.

Kailey: Correcto mundo Kyle. And you can drink the soda without hurting yourself. But sulfuric and nitric acids are quite dangerous and would burn your skin, or really damage your eyes if you accidentally spilled some on you.

Kyle: Yup – when my pop, dad – not soda, got a new battery, he had to add the sulfuric acid into the battery cells, and he was super careful about pouring it in, and he made me stand way back so nothing could splash on me.

Kailey: Yes – I think sulfuric acid is much more dangerous than carbonic acid. But let's take a look at the difference. First, there is a scale that is used to indicate how strong or weak an acid is and it's called the pH scale. The pH scale ranges from 0 – 14, and anything in the middle, with a pH of 7, is called neutral, higher than 7 is called basic, lower than 7 is called acidic.

Kyle: OK – so that's easy to remember. A for acidic is first in the alphabet, so I can remember it comes first, from 0-7, and B for basic comes second and therefore is 7-14 on the pH scale.

Kailey: Hey, that's a good way to remember it. Now 7 is neutral right, neither acid nor base. But the strength of the acid comes from how many hydronium ions are in the solution. An acid with a pH of 3 has a lot more hydronium ions than an acid with a pH of 6. And an acid with a pH of 1 has a lot more hydronium ions than a pH of 3. Follow me.

Kyle: Sure, but going from a pH of 3 down to a pH of 1 isn't much of a change.

Kailey: You know, I also believed that but here's the deal. And listen closely to this. A pH of 5 is 10 times stronger of an acid than a pH of 6. And it is stronger because what Kyle?

Kyle: Stronger because of more hydronium ions, right?

Kailey: Ooooh! My budding scholar. You have broken away from your butter burger long enough to pay attention. That gives me goose bumps. But more on strength of an acid. An acid with a pH of 4 is also 10 times stronger than something with a pH of 5. And a pH of 3 is how many times stronger than a pH of 4?

Kyle: Well I guess the pattern seems to be a tenfold change with a drop of one number, right?

Kailey: Right. But how much stronger is a pH of 4 than a pH of 6?

Kyle: *(confidently)* Well, that's easy - 20 times stronger.

Kailey: *(giving Kyle a disappointed look)* Nope. Check this math out. If a pH of 4 is ten times stronger than a pH of 5, and a pH of 5 is ten times stronger than a pH of 6, then 10 times 10 equals 100, so a pH of 4 is 100 times stronger than a pH of 6.

Kyle: I see. So check this out. Then a pH of 3 is 1000 times stronger than a pH of 6, because $10 \times 10 \times 10$ equals 1000. Right?

Kailey: *(almost swooning)* Kyle, you are so quick to catch on – I'm quite proud of you.

Kyle: *(blushing)* Thanks Kailey – It's really no big deal.

Kailey: My food is getting cold. Let's pick up this conversation later and talk about the importance of acids in our lives.

Kyle: Sure, I don't quite get the acid rain thing. Maybe you can fill me in on that phenomenon. I am really worried about all the times I went out and played in the pouring rain. But now I know it is dependent upon the strength of the acid.

Kailey: Right. More on that later. Now I have finish my burger

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