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**Remote Learning Kit / Round 2**

**CONCRETE**

Let's talk about concrete!!! I'm going to start off with an overview and a little bit about the history of concrete. All of you should be familiar with some of the common uses of concrete. It really is "all around us" and a very important building material. I know a few of you had jobs last summer doing concrete work and Ethan Kough gave a really good presentation about the Hoover Dam, in the Energy Technology class, that covered some good information on concrete. Like I said, I'm going to start out basic and then get a little more involved and technical in the next few weeks. We will have a few quizzes but most of the work is going to be participation and discussion.

**For your first assignment**, read over this explanation of what concrete is, read over the brief timeline, and answer the few questions I have at the end. **ALSO**, take a few pictures of things around your house, yard, neighborhood, or town that are made of concrete and text (618-401-7438) or email (tmarshall@bccu2.org) them to me, if you are able. If you're not, that's ok. Your pictures can include examples of good, structurally strong, concrete or, you can send pictures of concrete that is cracked, busted, heaved, or crumbling and we'll talk about what the defect is, why it might have happened, how to prevent it from happening, and how to fix/repair it, if possible.

First of all, what is concrete? You need at least 3 ingredients to make concrete. To make "modern day" concrete, you need water, some type of aggregate, and Portland cement. We all know what water is but, what about an aggregate and Portland cement? An aggregate is any type of rock, sand, or gravel. Actually, concrete from different parts of the state, country, and world can LOOK different when you cut it or bust it up, because of the different types of aggregate used in it. Whatever kind of aggregate is close (local) and economically viable (cheap/affordable) will work. Now, the Portland cement, that's a very important part! That is the binding agent that makes everything stick together, once it has been mixed with water. "Portland" cement hasn't always been the binding agent used in concrete. In 1824, a guy named Joseph Aspdin invented it by taking chalk and clay, grinding them up into a fine powder, and baking it until all of the CO<sub>2</sub> (carbon dioxide) was baked out of it. Oddly enough, being the proud Americans that we are, we just ASSUME the "Portland" is referring to Portland, Oregon when, in fact, IT'S NOT!! Portland cement is named for Portland, England, which is known for the high quality building stones that are quarried there. The same material that makes up those stones is what was ground up into a powder and baked to produce Portland cement. So, those are the 3 basic ingredients, mixed in the correct ratio, needed to make concrete. I say "mixed in the correct ratio" because if you add too much or too little of one of those three things, in relation to the other two, you will not get concrete, you will get a hard, rocky, mess that is weak and

crumbly (more on that later). Other things can be added to those 3 main ingredients too BUT, we'll get into the "what's and why's" later too.

Here is an abbreviated timeline of concrete history.....

**6500BC** – UAE: The earliest recordings of concrete structures date back to 6500BC by the Nabataea traders in regions of Syria and Jordan. They created concrete floors, housing structures, and underground cisterns.

**3000 BC** – Egypt and China: Egyptians used mud mixed with straw to bind dried bricks. They also used gypsum mortars and mortars of lime in the pyramids. The Great Pyramids at Giza used about 500,000 tons of mortar. A form of cement was also used to build the Great Wall of China around this time.

**600 BC** – Rome: Although the Ancient Romans weren't the first to create concrete, they were first to utilize this material widespread. By 200 BC, the Romans successfully implemented the use of concrete in the majority of their construction. They used a mixture of volcanic ash, lime, and seawater to form the mix. They then packed the mix into wooden forms, and once hardened, stacked the blocks like brick. After more than 2,000 years, Roman concrete structures stand tall due to their ingredients colliding with Earth's natural chemistry.

**Technological Milestones:** during the Middle Ages, concrete technology crept backward. After the fall of the Roman Empire in 476 AD, the technique for making

pozzolan cement was lost until the discovery of manuscripts describing it was found in 1414. This rekindled interest in building with concrete.

It wasn't until 1793 that the technology took a big leap forward when John Smeaton discovered a more modern method for producing hydraulic lime for cement. He used limestone containing clay that was fired until it turned into "clinker", which was then ground into powder. He used this material in the historic rebuilding of the Eddystone Lighthouse in Cornwall, England.

In 1824 Joseph Aspdin invented Portland cement by burning finely ground chalk and clay until the carbon dioxide was removed. Aspdin named the cement after the high-quality building stones quarried in Portland, England.

In the 19th Century concrete was used mainly for industrial buildings. The first widespread use of Portland cement in home construction was in England and France between 1850 and 1880 by Francois Coignet, who added steel rods to prevent exterior walls from spreading.

**Question #1** What are the 3 basic ingredients needed to make concrete?

**Question #2** What is an aggregate?

**Question #3** During what time period did concrete “technology” suffer because people lost an interest in using it as a building material?

**Question #4** Theoretically speaking, can the terms concrete and cement be used interchangeably? Worded another way, are concrete and cement the same “thing”?