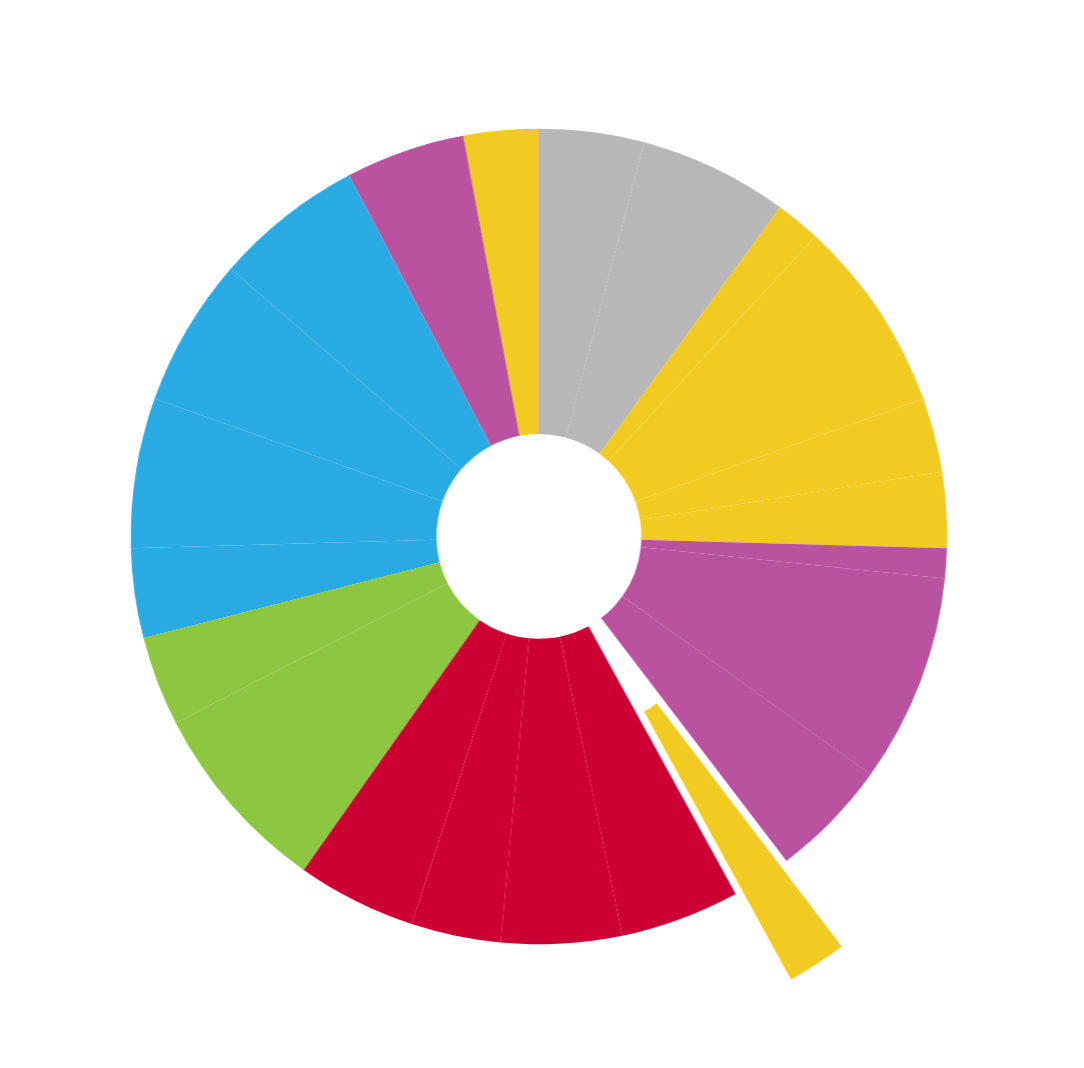
**Continent Formation Learning Segment Table:**



**CF**

**(approximately 4-5 traditional class days)**

The model:

1. Earth’s crust is broken into big chunks called plates.
2. Plates can be moving away from each other (diverging), toward each other (converging), or sliding along each other (transforming).
3. New oceanic crust forms at diverging plate boundaries. As oceanic plates diverge, magma from the mantle flows up, cools, forms new oceanic crust, and fills in the gap
4. On average, oceanic crust is more dense than continental crust so when they converge the more dense plate (oceanic) subducts, or slides beneath, the less dense plate
5. Over Earth’s surface, the amount of new crust forming must be in balance with the amount of old crust being subducted back into the mantle.
6. New continental crust forms along converging boundaries where one plate subducts under another one. The action of subduction produces low-density magma which can rise to the surface and form new continental crust: volcanic islands, mountain ranges, and granite formations.
7. Once low-density rock (continental crust) forms on Earth’s surface, it can’t sink again. It is stuck on the surface because of its density.
8. The total amount of continental crust on Earth slowly increases over time.

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| Seg | Model Move | Est Time  (min) | Overview | What did we figure out? | Model Ideas Generated |
| 1 | P🡪Q | 10 | We are coming out of figuring out natural selection and speciation so we begin by taking stock of where we are in our study of the Earth and its Spheres | We realize that all the spheres are interconnected. We recall that when last we discussed the formation of the Earth’s spheres we were talking about a world with just a small amount of dry land. We ask the broad question “how did the continents form?” | n/a |
| 2 | P🡪Q | 25 | We begin by reminding ourselves of some things about the Earth we may have learned before or heard about: that the Earth’s crust is made of plates. This is an important idea so we add it to our model as the first idea.  Next, we examine 2 maps that show crust age of ocean and continents. We notice that generally the ocean crust is younger than the continental crust. We spend a bit more time with the ocean crust map and generate 3 more specific questions to investigate. | We review the big idea that we hopefully learned before that the Earth’s crust is broken up into plates and add that as our first model idea. We find that the age of ocean crust is younger than continental crust.  This leads us to revise our driving question slightly to something like: ”What explains the patterns of crust age across the Earth and what does that have to do with continent formation?"  We look more closely at ocean crust and come up with three questions to investigate:   1. Why is new oceanic crust (almost) always along a plate boundary? 2. Why isn’t there new oceanic crust along ALL plate boundaries? 3. Why is the youngest oceanic crust in the middle of the oceans, with the oceanic crust getting older toward the continents? | Earth’s crust is broken into big chunks called plates. |
| 3 | Q🡪M | 20 | We begin by exploring how plates move on Earth and look at how that movement is measured. By examining more maps with movement data we are able to describe the various ways that plates interact with each other based on their movements. We look again at our crust age map and see that the newest crust on Earth is found at diverging boundaries and we explore what is happening there to create new crust. | We realize that plates are moving in many ways on Earth and that causes them to have different kinds of plate boundaries: converging, diverging and sideways (transforming). We add this as a model idea. Next, we figure out that new crust is formed at diverging plate boundaries in the oceans and comes from magma that seeps up through the cracks and hardens. This becomes our third model idea. | Plates can be moving away from each other (diverging), toward each other (converging), or sliding along each other (transforming).  New oceanic crust forms at diverging plate boundaries. As oceanic plates diverge, magma from the mantle flows up, cools, forms new oceanic crust, and fills in the gap |
| 4 | Q🡪M | 55 | We notice that there are other plate boundaries where new crust is forming that must be different from the diverging ones in the oceans. This, along with the crust age differences, pushes us to wonder about the differences between continental and ocean crust. We do a lab to look at some of the key rock types found in oceanic versus continental crust and consider what that might mean when the two types of plates interact at converging boundaries. | We find that the types of rock that make up oceanic plates are more dense than the ones that make up continental plates and infer that on average continental crust is less dense than oceanic crust. We explore what might happen when those two types of plates collide and figure out that one must slide under the other one. We add this as a new model idea. | On average, oceanic crust is more dense than continental crust so when they converge the more dense plate (oceanic) subducts, or slides beneath, the less dense plate |
| 5 | Q🡪M | 20 | We return to the crust age maps again and use what we have figured out so far to explain the age distribution on oceanic plates. We also explore what happens to the matter in the plate when it subducts. Specifically, we wonder why the Earth does not run out of magma and whether the Earth is getting bigger because of all the new crust. | By examining what is happening at a specific plate boundary off the coast of North America, we figure out that the subducting plate melts and gets recycled and replenishes the magma and keeps the Earth in balance. | Over Earth’s surface, the amount of new crust forming must be in balance with the amount of old crust being subducted back into the mantle. |
| 6 | Q🡪M | 25 | We realize that we still don’t know how continents are formed and why the land there is so much older than in the ocean. We consider what is happening deep in the crust when an oceanic plate subducts under a continental plate. We also consider what happens when two oceanic plates converge. Next we go back to our crust age map to look for patterns and finalize our ideas about how continents form. | We see that as oceanic crust subducts it causes some low density rock to rise and collect or erupt. The resulting crust often rises above sea level and becomes new land (either a volcanic mountain range or island). We also realize that this explains why the continental crust is so much thicker than the oceanic crust and that over time the movement of the plates causes the land to accumulate into larger and larger masses. This accounts for why the oldest rock is found in the interior of continents and the youngest at the edge near oceanic plates. We add the final model ideas. | New continental crust forms along converging boundaries where one plate subducts under another one. The action of subduction produces low-density magma which can rise to the surface and form new continental crust: volcanic islands, mountain ranges, and granite formations.  Once low-density rock (continental crust) forms on Earth’s surface, it can’t sink again. It is stuck on the surface because of its density.  The total amount of continental crust on Earth slowly increases over time. |
| 7 | M🡪P | 30 | We use our model to answer our driving question. | We fit all the pieces together to explain where continental crust comes from and how it accumulates over time to make the large land masses we see today. |  |