Geology 12
Unit 0 – Introduction
Day 2 – Sea Level Rise

Name: _____

Date: _____

Block: _____

The Facts:

- Global average sea level has risen 8–9 inches (21–24 centimeters) since 1880.

- In 2021, global sea level set a new record high—97 mm (3.8 inches) above 1993 levels.

- The rate of global sea level rise is accelerating: it has more than doubled from 0.06 inches (1.4 millimeters) per year throughout most of the twentieth century to 0.14 inches (3.6 millimeters) per year from 2006–2015

- In many locations along the U.S. coastline, the rate of local sea level rise is greater than the global average due to land processes like erosion, oil and groundwater pumping, and subsidence.

  High-tide flooding is now 300% to more than 900% more frequent than it was 50 years ago

- If we are able to significantly reduce greenhouse gas emissions, U.S. sea level in 2100 i s projected to be around 0.6 meters (2 feet) higher on average than it was in 2000.

- On a pathway with high greenhouse gas emissions and rapid ice sheet collapse, models project that average sea level rise for the contiguous United States could be 2.2 meters (7.2 feet) by 2100 and 3.9 meters (13 feet) by 2150.

Why if matters: In the United States, almost 30 percent of the population lives in relatively high population-density coastal areas, where sea level plays a role in flooding, shoreline erosion, and hazards from storms. Globally, 8 of the world's 10 largest cities are near a coast, according to the U.N. Atlas of the Oceans.

A tenth of the human race is at risk from rising sea levels, the head of the United Nations has warned.

The Cause: Global warming is causing global mean sea level to rise in two ways. First, glaciers and ice sheets worldwide are melting and adding water to the ocean. Second, the volume of the ocean is expanding as the water warms. A third, much smaller contributor to sea level rise is a decline in the amount of liquid water on land—aquifers, lakes and reservoirs, rivers, soil moisture. This shift of liquid water from land to ocean is largely due to groundwater pumping.

- The decadal average loss from glaciers in the World Glacier Monitoring Service's reference network quintupled over the past few decades, from the equivalent of 6.7 inches (171 millimeters) of liquid water in the 1980s, to 18 inches (460 millimeters) in the 1990s, to 20 inches (-500 millimeters) in the 2000s, to 33 inches (850 millimeters) for 2010-2018.

- Ice loss from the Greenland Ice Sheet increased seven-fold from 34 billion tons per year between 1992-2001 to 247 billion tons per year between 2012 and 2016.

- Antarctic ice loss nearly quadrupled from 51 billion tons per year between 1992 and 2001 to 199 billion tons per year from 2012-2016.

Measuring Sea Level: Sea level is measured by two main methods: tide gauges and satellite altimeters. Tide gauge stations from around the world have measured the daily high and low tides for more than a century, using a variety of manual and automatic sensors. Using data from scores of stations around the world, scientists can calculate a global average and adjust it for seasonal differences. Since the early 1990s, sea level has been measured from space using radar altimeters, which determine the height of the sea surface by measuring the return speed and intensity of a radar pulse directed at the ocean.

The Data: Future sea level rise
As global temperatures continue to warm, additional sea level rise is inevitable. How much and by when depends mostly on the future rate of greenhouse gas emissions. But another source of uncertainty is whether big ice sheets in Antarctica and Greenland will melt in a steady, predictable way as the Earth gets warmer, or whether they will reach a tipping point and rapidly collapse.