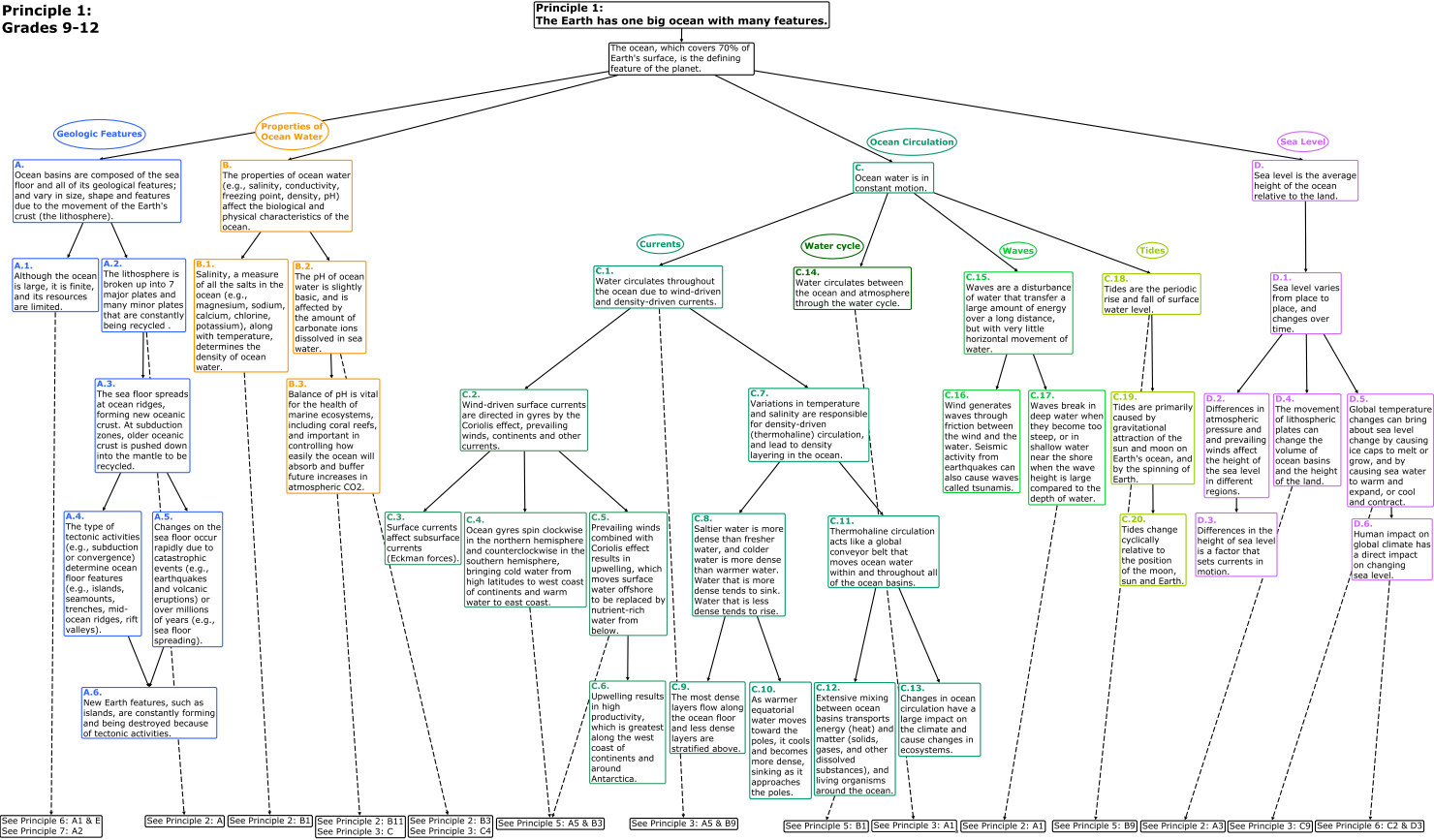
Principle 1:
Grades 9-12
Principle 1:
The Earth has one big ocean with many features.
The ocean, which covers 70% of Earth's surface, is the defining feature of the planet.
Geologic Features
Properties of Ocean Water
Ocean Circulation
Sea Level
A.
Ocean basins are composed of the sea floor and all of its geological features; and vary in size, shape and features due to the movement of the Earth's crust (the lithosphere).
B.
The properties of ocean water (e.g., salinity, conductivity, freezing point, density, pH) affect the biological and physical characteristics of the ocean.
C.
Ocean water is in constant motion.
D.
Sea level is the average height of the ocean relative to the land.
Currents
Water cycle
Waves
Tides
A.1.
Although the ocean is large, it is finite, and its resources are limited.
A.2.
The lithosphere is broken up into 7 major plates and many minor plates that are constantly being recycled .
B.1.
Salinity, a measure of all the salts in the ocean (e.g., magnesium, sodium, calcium, chlorine, potassium), along with temperature, determines the density of ocean water.
B.2.
The pH of ocean water is slightly basic, and is affected by the amount of carbonate ions dissolved in sea water.
C.1.
Water circulates throughout the ocean due to wind-driven and density-driven currents.
C.14.
Water circulates between the ocean and atmosphere through the water cycle.
C.15.
Waves are a disturbance of water that transfer a large amount of energy over a long distance, but with very little horizontal movement of water.
C.18.
Tides are the periodic rise and fall of surface water level.
D.1.
Sea level varies from place to place, and changes over time.
A.3.
The sea floor spreads at ocean ridges, forming new oceanic crust. At subduction zones, older oceanic crust is pushed down into the mantle to be recycled.
B.3.
Balance of pH is vital for the health of marine ecosystems, including coral reefs, and important in controlling how easily the ocean will absorb and buffer future increases in atmospheric CO2.
C.2.
Wind-driven surface currents are directed in gyres by the Coriolis effect, prevailing winds, continents and other currents.
C.7.
Variations in temperature and salinity are responsible for density-driven (thermohaline) circulation, and lead to density layering in the ocean.
C.16.
Wind generates waves through friction between the wind and the water. Seismic activity from earthquakes can also cause waves called tsunamis.
C.17.
Waves break in deep water when they become too steep, or in shallow water near the shore when the wave height is large compared to the depth of water.
C.19.
Tides are primarily caused by gravitational attraction of the sun and moon on Earth's ocean, and by the spinning of Earth.
D.2.
Differences in atmospheric pressure and and prevailing winds affect the height of the sea level in different regions.
D.4.
The movement of lithospheric plates can change the volume of ocean basins and the height of the land.
D.5.
Global temperature changes can bring about sea level change by causing ice caps to melt or grow, and by causing sea water to warm and expand, or cool and contract.
A.4.
The type of tectonic activities (e.g., subduction or convergence) determine ocean floor features (e.g., islands, seamounts, trenches, mid-ocean ridges, rift valleys).
A.5.
Changes on the sea floor occur rapidly due to catastrophic events (e.g., earthquakes and volcanic eruptions) or over millions of years (e.g., sea floor spreading).
C.3.
Surface currents affect subsurface currents (Eckman forces).
C.4.
Ocean gyres spin clockwise in the northern hemisphere and counterclockwise in the southern hemisphere, bringing cold water from high latitudes to west coast of continents and warm water to east coast.
C.5.
Prevailing winds combined with Coriolis effect results in upwelling, which moves surface water offshore to be replaced by nutrient-rich water from below.
C.8.
Saltier water is more dense than fresher water, and colder water is more dense than warmer water. Water that is more dense tends to sink. Water that is less dense tends to rise.
C.11.
Thermohaline circulation acts like a global conveyor belt that moves ocean water within and throughout all of the ocean basins.
C.20.
Tides change cyclically relative to the position of the moon, sun and Earth.
D.3.
Differences in the height of sea level is a factor that sets currents in motion.
D.6.
Human impact on global climate has a direct impact on changing sea level.
A.6.
New Earth features, such as islands, are constantly forming and being destroyed because of tectonic activities.
C.6.
Upwelling results in high productivity, which is greatest along the west coast of continents and around Antarctica.
C.9.
The most dense layers flow along the ocean floor and less dense layers are stratified above.
C.10.
As warmer equatorial water moves toward the poles, it cools and becomes more dense, sinking as it approaches the poles.
C.12.
Extensive mixing between ocean basins transports energy (heat) and matter (solids, gases, and other dissolved substances), and living organisms around the ocean.
C.13.
Changes in ocean circulation have a large impact on the climate and cause changes in ecosystems.
See Principle 6: A1 & E
See Principle 7: A2
See Principle 2: A
See Principle 2: B1
See Principle 2: B11
See Principle 3: C
See Principle 2: B3
See Principle 3: C4
See Principle 5: A5 & B3
See Principle 3: A5 & B9
See Principle 5: B1
See Principle 3: A1
See Principle 2: A1
See Principle 5: B9
See Principle 2: A3
See Principle 3: C9
See Principle 6: C2 & D3