Passage IX

A team of safety experts conducted experiments to determine the distance required to stop a vehicle traveling at different speeds. The experiments were all conducted along a stretch of flat, straight, paved roadway. A series of traffic signals was set up near the middle of the roadway. At the start of each experiment, the vehicle accelerated until it reached a pre-determined speed. The driver then continued traveling at that speed until one of the traffic signals was triggered. (The timing for the trigger was not known by the driver).

A driver always takes a small amount of time to react to seeing a traffic light before applying the brakes. The distance the car traveled during this interval is called the reaction distance. In the experiments, the team measured the reaction distance by recording the position of the vehicle when the traffic light was triggered and the position of the car when a sensor attached to the brakes indicated that the brakes had been applied. The team measured the additional distance the car traveled until it reached a full stop.

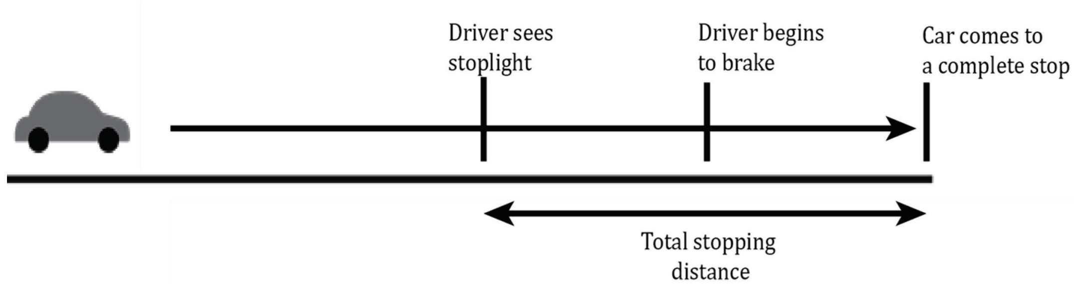

Figure 9

The team conducted seven runs on dry pavement and recorded their findings in Table 11.

Table 11: Stopping Distance on Dry Pavement

Initial Speed (miles per hour)	Reaction Distance (feet)	Braking Distance (feet)	Total Stopping Distance (feet)
20	20	20	40
30	30	45	75
40	40	80	120
50	50	125	175
60	60	180	240
70	70	245	315
80	80	320	400

Next, the team soaked the entire course with ordinary water using a fire hose. They conducted seven runs on wet pavement and recorded their findings in Table 12.

Table 12: Stopping Distance on Wet Pavement			
Initial Speed (miles per hour)	Reaction Distance (feet)	Braking Distance (feet)	Total Stopping Distance (feet)
20	20	40	60
30	30	90	120
40	40	160	200
50	50	250	300
60	60	360	420
70	70	490	560
80	80	640	720

Passage X

The ocean is salty because of the gradual concentration of dissolved chemicals eroded from Earth's crust and washed into the ocean. Solid and gaseous ejections from volcanoes, suspended particles swept to the ocean from the land by onshore winds, and materials dissolved from sediments deposited on the ocean floor also contribute salts.

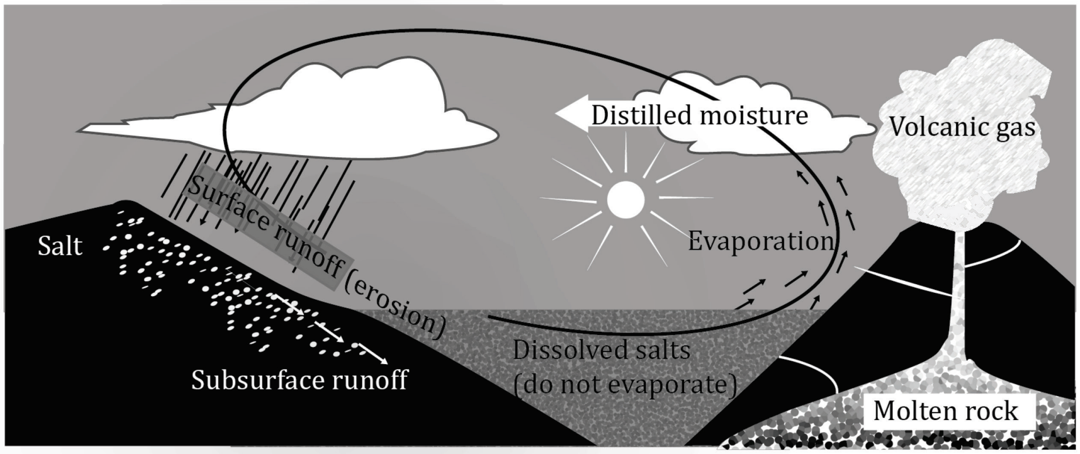

Figure 10

Salts become concentrated in the ocean because the Sun's heat distills or vaporizes almost pure water from the surface of the ocean, leaving the salts behind. In the hydrologic cycle (see Figure 10), water vapor rises from the ocean surface and is carried landward by the winds. When the vapor collides with a colder mass of air, it condenses (changes from a gas to a liquid) and falls to Earth as rain. The rain runs off into streams which in turn transport water to the ocean. Evaporation from both the land and the ocean again causes water to return to the atmosphere as vapor and the cycle starts anew. Because salts are continually added to the ocean basic and do not evaporate, the salinity of ocean water has increased over time.

Oceanographers report salinity (total salt content) and the concentrations of individual chemical constituents in seawater— for example, chloride, sodium, or magnesium—in parts per thousand (‰). That is, a salinity of 35 ‰ means 35 units of salt per 1,000 units of seawater. Similarly, a sodium concentration of 10 ‰ means 10 units of sodium per 1,000 units of seawater.

The salinity of surface seawater varies from one location to another in the world's oceans. The average salinity of surface seawater worldwide is 35 ‰, a value found at the equator. Maximum salinity values are found near the Tropics of Cancer and Capricorn (23.5° N and 23.5° S, respectively). As shown in Figure 11, at these locations, evaporation rates are higher and precipitation amounts are less than those found at the equator. High winds and high temperatures are responsible for the higher evaporation rates at these latitudes.

At still higher latitudes (45° N and 45° S), surface salinity values lower than average are found (34–34.5 ‰) because cooler temperatures result in much lower evaporation rates. Figure 11 does not show salinity values for polar waters (found at latitudes 60° N and 60° S and all locations poleward). At these locations, surface salinity values undergo significant seasonal variations. Values are higher in the autumn as sea ice forms (a process that removes water from seawater). In the spring, the melting of sea ice lowers salinity values as freshwater is once again added to the oceans (see Figure 11).

Longitudinal Variations in Evaporation and Precipitation

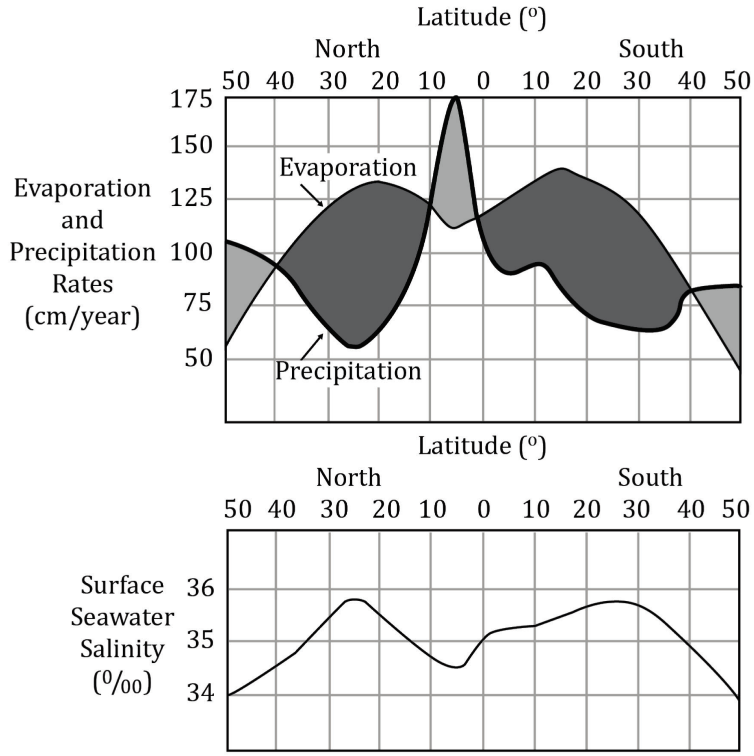

Figure 11

Table 13: Principal Constituents of Seawater	
Chemical Constituent	Concentration (parts per thousand)
Calcium (Ca)	0.419
Magnesium (Mg)	1.304
Sodium (Na)	10.710
Potassium (K)	0.390
Bicarbonate (HCO_3)	0.146
Sulfate (SO_4)	2.690
Chloride (Cl)	19.350
Bromide (Br)	0.070
Total dissolved solids (salinity)	35.079

Table 14: Comparison between Seawater and River Water		
Chemical Constituent	Percentage of Total Salt Content	
	Seawater	River Water
Silica (SiO_2)	—	14.51
Iron (Fe)	—	0.74
Calcium (Ca)	1.19	16.62
Magnesium (Mg)	3.72	4.54
Sodium (Na)	30.53	6.98
Potassium (K)	1.11	2.55
Bicarbonate (HCO_3)	0.42	31.90
Sulfate (SO_4)	7.67	12.41
Chloride (Cl)	55.16	8.64
Nitrate (NO_3)	—	1.11
Bromide (Br)	0.20	—
Total	100.00	100.00