PROPERTIES OF WATER.

Water expands about one-tenth its bulk by freezing solid.

Water is at its greatest density and occupies the least space at 39 degrees Fahrenheit.

Water is the best known absorbent of heat, consequently a good vehicle for conveying and transmitting heat.

A U. S. gallon of water contains 231 cubic inches and weighs 8 1/3 pounds.

A column of water 27.67 inches high has a pressure of 1 pound to the square inch at the bottom.

Doubling the diameter of a pipe increases its capacity four times.

To find the lateral pressure of water upon the side of a tank, multiply in inches, the area of the submerged side, by the pressure due to one-half the depth.

Example—Suppose a tank to be 12 feet long and 12 feet deep. Find the pressure on the side of the tank.

144 × 144=20,736 square inches area of side.

12 × .43=5.16, pressure at bottom of tank. Pressure at the top of tank is 0. Average pressure will then be 2.6. Therefore 20,736 × 2.6=53,914 pounds pressure on side of tank.

To find the number of gallons in a foot of pipe of any given diameter, multiply the square of diameter of the pipe in inches, by .0408

To find the diameter of pipe to discharge a given

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volume of water per minute in cubic feet, multiply the square of the quantity in cubic feet per minute by 96. This will give the diameter in inches.

To find the number of gallons in a cylindrical tank, multiply the diameter in inches by itself, this by the height in inches, and the result by .34. To find the number of gallons in a rectangular tank, multiply together the length, breadth and height in feet, and this result by 7.4. If the dimensions are in inches, multiply the product by .004329. To find the pressure in pounds per square inch, of a column of water, multiply the height of the column in feet by .434.

To find the head in feet, the pressure being known, multiply the pressure per square inch by 2.31.

Salt water boils at a higher temperature than fresh, owing to its greater density, and because the boiling-point of water is increased by any substance that enters into chemical combination with it. The density of water decreases as the temperature increases, since heat destroys cohesion and expands the particles, causing them to occupy greater space. The power of water to hold chemical substances, such as the salts of lime, in solution, decreases as the temperature increases.

The law of expansion by heat and contraction by cold is true as relating to water, with this exception, that as hot water cools down from the boiling-point it contracts until 45 degrees Fahrenheit is reached, but if cooled down from this point, it expands again.

With the barometer at 30 degrees Fahrenheit water boils in the open air, at sea-level at 212 degrees Fahrenheit, and in vacuum at 88 degrees Fahrenheit. The less the pressure of the atmosphere, the lower is the temperature at which water will boil. The pressure of the

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atmosphere at sea-level is 14.7 pounds per square inch, pressing equally and in all directions. A cubic foot of water evaporated under a pressure of one atmosphere, or 14.7 pounds per square inch, occupies a space of 1,700 cubic feet.

One cubic inch of water evaporated at atmospheric pressure makes 1 cubic foot of steam.

A heat unit known as a British Thermal Unit raises the temperature of 1 pound of water 1 degree Fahrenheit.

Water boils in a vacuum at 98 degrees Fahrenheit.

A cubic foot of water weighs 62½ pounds, it contains 1,728 cubic inches or 7½ gallons. Water expands in boiling about one-twentieth of its bulk.

In turning into steam water expands 1,700 its bulk, approximately 1 cubic inch of water will produce 1 cubic foot of steam.

At atmospheric pressure 966 heat units are required to evaporate one pound of water into steam.

To produce one horsepower requires the evaporation of 2.66 pounds of water.

Heated air and water rise because their particles are more expanded, and therefore lighter than the colder particles.

A vacuum is a portion of space from which the air has been entirely exhausted.

Evaporation is the slow passage of a liquid into the form of vapor.

Increase of temperature, increased exposure of surface, and the passage of air currents over the surface, cause increased evaporation.

Condensation is the passage of a vapor into the liquid state, and is the reverse of evaporation.

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Pressure exerted upon a liquid is transmitted undiminished in all directions, and acts with the same force on all surfaces, and at right angles to those surfaces.

The pressure at each level of a liquid is proportional to its depth.

With different liquids and the same depth, pressure is proportional to the density of the liquid.

The pressure is the same at all points on any given level of a liquid.

The pressure of the upper layers of a body of liquid on the lower layers causes the latter to exert an equal reactive upward force. This force is called buoyancy.

Friction does not depend in the least on the pressure of the liquid upon the surface over which it is flowing.

Friction is proportional to the area of the surface.

At a low velocity friction increases with the velocity of the liquid.

Friction increases with the roughness of the surface.

Friction increases with the density of the liquid.

Friction is greater comparatively, in small pipes, for a greater proportion of the water comes in contact with the sides of the pipe than in the case of the large pipe. For this reason mains on heating apparatus should be generous in size.

Air is extremely compressible, while water is almost incompressible.

Water is composed of two parts of hydrogen, and one part of oxygen.

Water will absorb gases, and to the greatest extent when the pressure of the gas upon the water is greatest, and when the temperature is the lowest, for the elastic force of gas is then less.

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To find the area of a required pipe, when the volume and velocity of the water are given, multiply the number of cubic feet of water by 144 and divide this amount by the velocity in feet per minute.

Water boils in an open vessel (atmospheric pressure at sea level) at 212 degrees Fahrenheit.

Water expands in heating from 39 to 212 degrees Fahrenheit, about 4 per cent.

When a substance solidifies or freezes, there is always a change of volume, which usually is contraction, but, in the case of water, an expansion takes place. The expansion of water at the freezing-point is by no means gradual, but takes place almost instantaneously, and the amount of force exerted at the time is enormous. It has been demonstrated by actual experiments, that in freezing, water exerts a pressure of about 30, 000 pounds per square inch.

The specific gravity of all waters is not the same. Sea water varies from 1.0269 to 1.0285, the mean being 1.0277, thus requiring 34.9741 cubic feet of sea water to make one ton, and about 35 cubic feet of fresh water.

Water has the greatest specific heat of all known liquids except hydrogen, and is therefore taken as the standard for all solids and fluids. The latent heat of water is 143 degrees Fahrenheit and that of ice 140 degrees Fahrenheit, as it absorbs that amount of heat in changing from a solid to a liquid state.

When water in a vessel is subjected to the action of fire it readily imbibes the heat and sooner or later, according to the intensity of the heat, attains a temperature of 212 degrees Fahrenheit. If, at this point of temperature, the water be not inclosed, but exposed to

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atmospheric pressure, ebullition will take place, and steam or vapor will ascend through the water, carrying with it the superabundant heat, or that which the water cannot, under such circumstances of pressure, absorb, to be retained, and to indicate a higher temperature.

Water in attaining the aëriform state, is thus uniformly confined to the same laws, under every degree of pressure, but, as the pressure is augmented, so is the indicated temperature proportionately elevated. Hence the various densities of steam, and corresponding degrees of elastic force.

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