

# Getting Thermodynamic and Transport Properties of Water in R

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IAPWS stands for International Association for the Properties of Water and Steam. One of its objectives is to provide formulations for thermodynamic and transport properties of water. The **iapws** package implements some of these formulations, in particular the so-called IAPWS-95 and IAPWS-IF97 formulations. The former is recommended for general and scientific use, the latter is designed for industrial use.

## 1 Installation

The simplest way to install **iapws** is to get it from CRAN. Type the following command in the R console:

```
> install.packages("iapws")
```

## 2 Usage

Let us load the **iapws** package:

```
> library(iapws)
```

And compute some water properties along the isochore  $\rho = 800 \text{ kg/m}^3$ :

```
> iapws95(c("p", "h"), rho = 800, t = seq(573, 623, by = 10))
```

	p	h
[1,]	72.58323	1323.453
[2,]	86.29644	1370.422
[3,]	100.03968	1417.171
[4,]	113.80655	1463.705
[5,]	127.59111	1510.032
[6,]	141.38777	1556.158

In this example, the pressure (**p**) and the specific enthalpy (**h**) are computed simultaneously for several temperatures (**t**) between 573 K and 623 K. The units follows the convention used by the IAPWS, so pressures are in MPa and specific enthalpies are in kJ/kg. The different output properties and their units are listed in the function documentation (type `help(iapws95)` to see them all).

If more interested in isobaric properties, one can use the function `iapws95_pt()` instead:

```
> iapws95_pt(c("rho", "cp"), p = 0.1013125, # atmospheric pressure
+           t = seq(293, 373, by = 20))
```

```
      rho      cp
[1,] 998.2380 4.184156
[2,] 992.2736 4.179401
[3,] 983.2729 4.184888
[4,] 971.8838 4.196641
[5,] 958.4569 4.215501
```

All the functions in **iapws** are vectorized. They take vectors as arguments and return vectors or arrays.

### 3 License

GPL-3.0-or-later