Marks 3

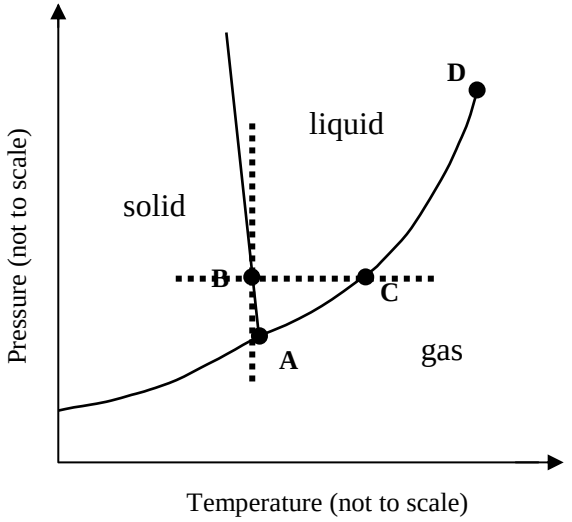
- The figure below illustrates the phase diagram for water. The points on the diagram correspond to:

  A: Triple point (0.0098 °C, 0.610 kPa)

  B: Normal melting point (0 °C, 1.01×10^2 kPa)

  C: Normal boiling point (100 °C, 1.01×10^2 kPa)

  D: Critical point (374.4 °C, 2.18×10^4 kPa)



Describe all of the phase changes that occur when water at 1.01×10^2 kPa is slowly warmed from –20 °C to 200 °C.

The horizontal dotted line on the phase diagram shows the changes. The pressure (1.01×10^2 kPa) corresponds to atmosphere or normal pressure.

The initial temperature of -20 °C is below the normal melting point so the water is initially a solid. As it warms up, it passes through the normal melting point (B, 0 °C) where melting to liquid occurs. After further warming, it passes through the normal boiling point (C, 100 °C). At this point it boils and a gas is formed.

Describe all of the phase changes that occur when water at 0 °C is slowly compressed from 0.500 kPa to 1000 kPa.

The vertical dotted line on the phase diagram shows the changes.

The temperature is below that of the triple point (A) as is the initial pressure (0.500 kPa). The water is initially a gas.

Increasing the pressure leads to water depositing straight from gas to solid. It does not pass through the liquid form or the triple point as the temperature and pressure are lower than at the triple point.

However, increasing the pressure further leads to melting of the solid to form a liquid, through the normal melting point (B).