A dipole antenna is a symmetrical antenna, consisting of two quarter wave elements, connected to each of the two conductors (inner and outer) of a coaxial cable. You will need a center insulator for connection of the two quarter wave elements and the coaxial cable.

The dipole antenna can be erected in different ways, in order to obtain different benefits for the radio propagation, or for the given physical and practical conditions. Radio signals can be propagated with two major polarizations: horizontal and vertical. For ground wave propagation the polarization should ideally be the same for all stations. For ionospheric propagation the horizontal polarization gives higher radiation angles (short-haul) than vertical polarization (long-haul).

The horizontal dipole antenna (1) is horizontally polarized, and has a bidirectional directivity perpendicular to the antenna. The antenna needs two points of suspension for ropes from the dipole end insulators. This antenna is ideal for ionospheric radio wave propagation.

The inverted V dipole antenna (2) needs only one point of suspension. It combines both horizontal and vertical polarization, is omnidirectional, and is ideal for both ionospheric and ground wave propagation.

The sloping dipole antenna (3) offers directivity in the direction of the sloping antenna. Note that the dipole element pointing up should be connected to the center conductor of the coaxial cable. This antenna is for vertical polarization via ground wave and long-haul ionospheric propagation, and requires just one point of suspension.

The vertical dipole (5) is offering vertical polarization and is omnidirectional, and perfect for ground wave propagation. It requires just one point of suspension. For longer wavelengths (lower frequencies) the height of suspension may be too long. In this case the broken vertical dipole (4) may be easier to erect. This variety will show a directivity in the direction of the lower, horizontal part [if adding more wires here, and spreading them horizontally, gives an omnidirectional antenna called a ground-plane antenna]. Note that the top dipole element is connected to the center coaxial cable conductor [unless we had a balun].

The total length of the dipole \(l\) in meters is an electrical half wavelength. It can be calculated according to the formula:

\[
l = \frac{(300 \cdot v)}{f \cdot 2}
\]

where \(f\) is the frequency in MHz, and 300 represents the speed of light propagation (electromagnetic propagation, like radio) in million meters pr. second. \(v\) is the velocity factor for the antenna material; 0.95 is a suitable factor for HF wire antennas. Hence the formula is reduced to:

\[
l = \frac{142.5}{f}
\]

The total length of a dipole antenna for 10 MHz would then be 142.5 / 10 = 14.25 meters. (Each element would be 7.125 m).

A resonant length for the inverted V dipole may be found to be 4 - 5 % longer than calculated from this formula, depending on ground (and other nearby object's) conductivity conditions.