Summary of EEG Basics

The system by which EEG (electroencephalogram) electrodes are applied to the head is the international 10-20 system. It depends on 4 main positions-the nasion(bridge of nose), inion(back of head) and two preauricular points, anterior to each ear.

The basis of EEG recording is a differential amplifier that detects signals from two inputs and shows the difference between them. It is particularly useful in recording and displaying very small electrical signals. The differential amplifier filters out ambient electromagnetic noise, allowing brainwave differences to stand out.Hence, EEG is always relative.

EEGs are displayed using different montages.
Anterior-posterior bipolar montage: the difference between 2 adjacent electrodes is displayed as a channel. Moving posteriorly gives you a chain of recordings consisting of the left temporal chain, left parasagittal chain, midline, right temporal, and right parasagittal.
Average reference montage: The difference is taken between the electrode of interest and the average of electrodes in the rest of the head.They are versatile and commonly used as screening montages but are susceptible to reference contamination, which can lead to misleading findings.
Transverse bipolar montage: They are useful for focusing on the centre of the head, making them effective for analyzing sleep transients. They extend from left to right over the front of the head and can help identify abnormalities in the central region.
Common reference montage: They compare the signal at each electrode position to a single common reference, such as CZ. We move posterialy generating a chain like the anterior-posterior bipolar montage. This montage is effective for broadly distributed abnormalities but not ideal for focal discharges Laplacian montage: compare each electrode position to an average of its nearest neighbours. This solves the problem of reference contamination.

Polarity rules
By convention, if there is an upward deflection in the channel we say that input 1 is negative concerning input 2 or input 2 is positive concerning input 1 similarly if we showed a slightly different tracing this time with a downward deflection we could say that input 1 is positive concerning input 2 or input 2 is negative concerning input 1. They help identify patterns that pinpoint specific areas of interest and assist in identifying abnormalities or particular waveforms.

By knowing the relative charges of the inputs, we can determine the deflection of the channel and understand the direction of eye movements. The eye can be considered a dipole, with the cornea being relatively electro-positive and the retina being relatively electronegative. This dipole helps determine the charges recorded by EEG electrodes and provides insight into eye movements.

Eye blinking example: Positive charge from the cornea leads to downward deflection in electrodes closer to the eye, while negative charge from the retina leads to upward deflection in electrodes farther away.
Horizontal eye movement example: Positive charge from the cornea leads to upward deflection in electrodes closer to the eye, while negative charge from the retina leads to downward deflection in electrodes farther away. This pattern helps determine the direction of horizontal eye movements.
If there is space between the first two channels in the temporal chain, the eye movement is likely

in that direction. This can be a helpful visual cue in EEG analysis.

Frequency bands in EEG recordings:alpha(8-13 hz), theta(4-7 hz), delta(4 hz),beta(13 hz).

The low-frequency filter (high-pass filter) and high-frequency filter (low-pass filter) determine the range of frequencies recorded in EEG. Adjusting these filters can enhance or diminish specific frequency components.
The notch filter helps reduce interference from 60 Hz electronic devices, which can contaminate EEG recordings. Sensitivity and time base settings impact the representation of EEG waveforms on the screen.
Checking the sensitivity and time base settings before reading EEG recordings can help avoid false conclusions about amplitude and frequency.

The alpha rhythm is a key component of normal awake EEG and its reactivity, frequency, amplitude, and symmetry provide valuable information.If it becomes higher voltage with eye closure and lower voltage with eye-opening, this phenomenon is called reactivity.
Alpha rhythm is between 8.5 to 12 hz in most individuals and is fairly constant 0.5 to 1 secs after eye closure,the rhythm in the posterior aspect of the head is much faster than the normal 11 hz Alpha rhythm ;it is approximately twice as fast before returning to the normal 11 hz baseline this is called Alpha squeak.
Lambda waves are generated by inspecting complex visual patterns and are most prominent when the eyes are open.
The MU rhythm is arch shaped and is generated by the sensory motor cortex at rest and is most prominent when the patient's limbs are at rest and eyes are open.