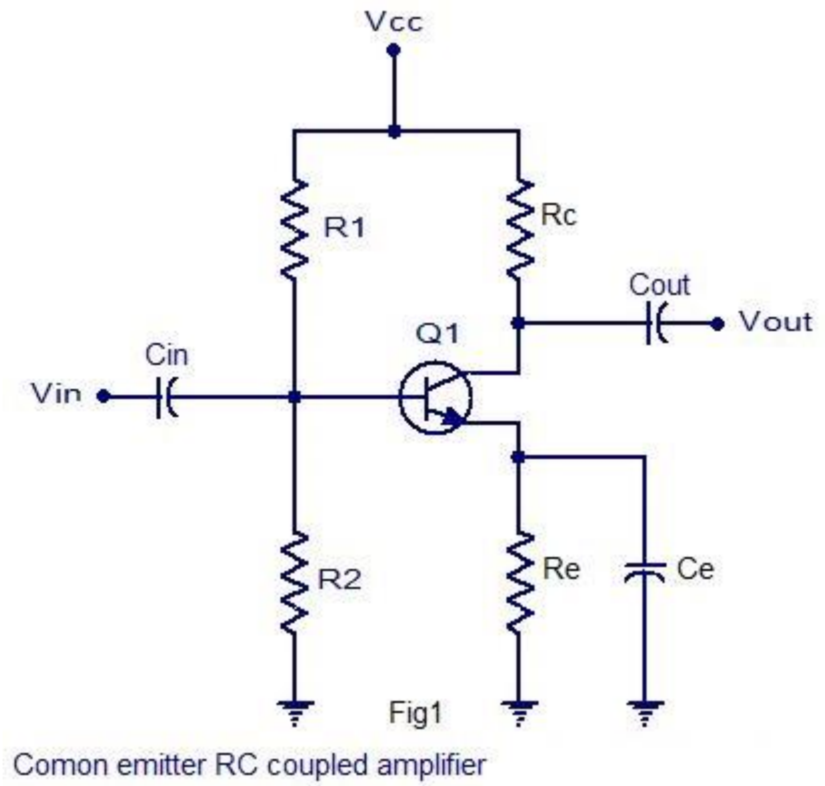
COMMON EMITTER RC COUPLED AMPLIFIER

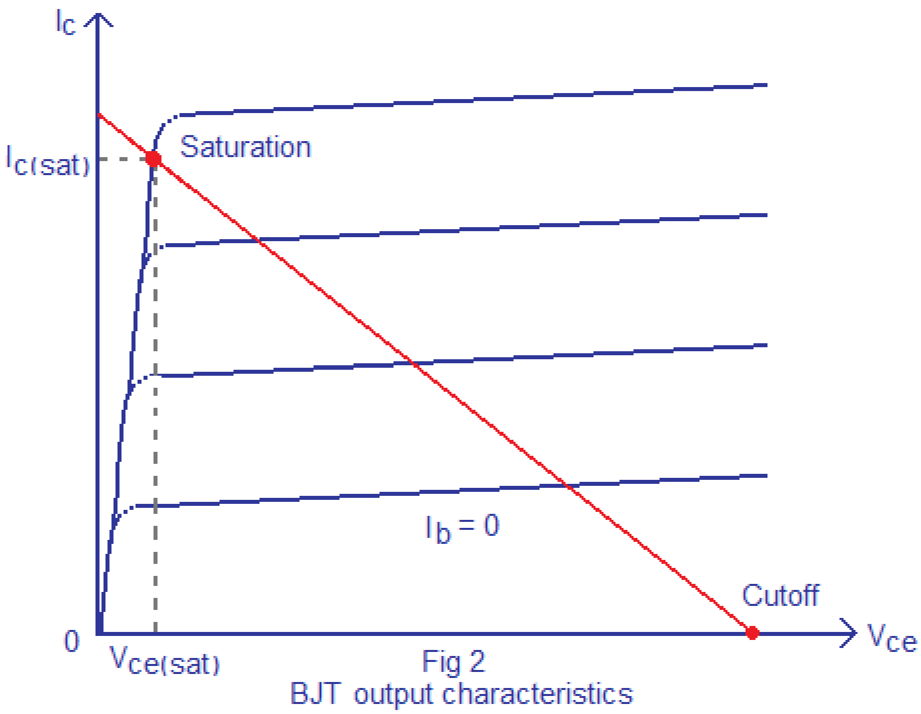
The common emitter RC coupled amplifier is one of the simplest and elementary transistor amplifier that can be made. Don't expect much boom from this little circuit, the main purpose of this circuit is pre-amplification i.e to make weak signals strong enough for further processing or amplification. If designed properly, this amplifier can provide excellent signal characteristics. The circuit diagram of a single stage common emitter RC coupled amplifier using transistor is shown in Fig1.



RC coupled amplifier

Capacitor Cin is the input DC decoupling capacitor which blocks any DC component if present in the input signal from reaching the Q1 base. If any external DC voltage reaches the base of Q1, it will alter the biasing conditions and affects the performance of the amplifier.

R1 and R2 are the biasing resistors. This network provides the transistor Q1′s base with the necessary bias voltage to drive it into the active region. The region of operation where the transistor is completely switched of is called cut-off region and the region of operation where the transistor is completely switched ON (like a closed switch) is called saturation region. The region in between cut-off and saturation is called active region. Refer Fig 2 for better understanding. For a transistor amplifier to function properly, it should operate in the active region. Let us consider this simple situation where there is no biasing for the transistor. As we all know, a silicon transistor requires 0.7 volts for switch ON and surely this 0.7 V will be taken from the input audio signal by the transistor. So all parts of there input wave form with amplitude ≤ 0.7V will be absent in the output waveform. In the other hand if the transistor is given with a heavy bias at the base ,it will enter into saturation (fully ON) and behaves like a closed switch so that any further change in the base current due to the input audio signal will not cause any change in the output. The voltage across collector and emitter will be 0.2V at this condition (Vce sat = 0.2V). That is why proper biasing is required for the proper operation of a transistor amplifier.



BJT output characteristics

Cout is the output DC decoupling capacitor. It prevents any DC voltage from entering into the succeeding stage from the present stage. If this capacitor is not used the output of the amplifier (Vout) will be clamped by the DC level present at the transistors collector.

Rc is the collector resistor and Re is the emitter resistor. Values of Rc and Re are so selected that 50% of Vcc gets dropped across the collector & emitter of the transistor.This is done to ensure that the operating point is positioned at the center of the load line. 40% of Vcc is dropped across Rc and 10%

of Vcc is dropped across Re. A higher voltage drop across Re will reduce the output voltage swing and so it is a common practice to keep the voltage drop across Re = 10%Vcc . Ce is the emitter by-pass capacitor. At zero signal condition (i.e, no input) only the quiescent current (set by the biasing resistors R1 and R2 flows through the Re). This current is a direct current of magnitude few milli amperes and Ce does nothing. When input signal is applied, the transistor amplifies it and as a result a corresponding alternating current flows through the Re. The job of Ce is to bypass this alternating component of the emitter current. If Ce is not there , the entire emitter current will flow through Re and that causes a large voltage drop across it. This voltage drop gets added to the Vbe of the transistor and the bias settings will be altered. It reality, it is just like giving a heavy negative feedback and so it drastically reduces the gain.

Source : http://todayscircuits.blogspot.com/2011/12/transistor-amplifier.html#.VUBxr9Kqqkp