

# AQA A-Level Physics

## 13.3 Analogue signal processing

### Flashcards

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What is a filter circuit? Give an example.



What is a filter circuit? Give an example.

A circuit that can select certain frequencies (or range thereof) from a mix of AC frequencies in the circuit.

In a stereo system, high frequencies go to one speaker (tweeter) and low to another (woofer).



# What is an LC parallel resonant circuit?



# What is an LC parallel resonant circuit?

A circuit with an inductor  $L$  (stores energy as a magnetic field) and a capacitor connected in parallel.



# What is inductance?



# What is inductance?

A measure of a coil's resistance to current changing, unit: Henry (H).

A coil has 1H inductance when current changing at 1A per second induces a voltage of 1V across it.



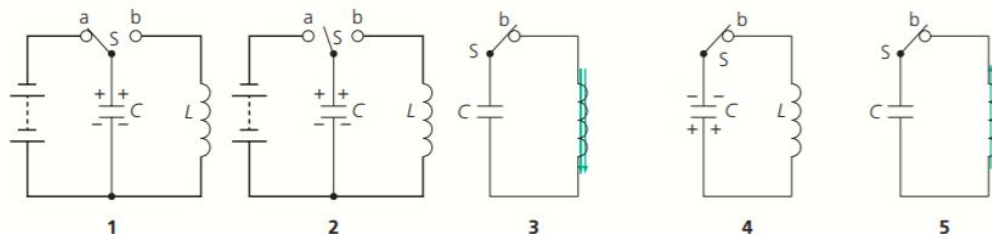
State the stages of operation of an LC circuit.





# State the stages of operation of an LC circuit.

1. Capacitor charges as switch is at 'a'.
2. S disconnected and capacitor stores electrostatic potential energy.
3. S at 'b', capacitor discharges its energy stored as magnetic field energy in inductor, after capacitor is discharged magnetic field starts to collapse so emf induced in opposite direction (Lenz's law).
4. Capacitor re-charges with opposite polarity and cycle repeats.



[Image: Collins](#)

Figure 16 Operation of an LC circuit



The LC circuit oscillates as the electrostatic to magnetic field energy changes happen. How can this be compared to a mass-spring system?



The LC circuit oscillates as the electrostatic to magnetic field energy changes happen. How can this be compared to a mass-spring system?

Energy only stored in the capacitor is like a spring at maximum displacement.

Energy only stored by the magnetic field is like when the mass is at the equilibrium position and moving with maximum velocity.



# How can the resonant frequency of an LC circuit be calculated?



How can the resonant frequency of an LC circuit be calculated?

$$f_0 = \frac{1}{2\pi\sqrt{LC}}$$

L = inductance (H)

C = capacitance (F)

$f_0$  = resonant frequency (Hz)



Define the Q factor (quality) of a resonant LC circuit.



Define the Q factor (quality) of a resonant LC circuit.

$$Q = f_0 / f_B$$

$f_0$  = resonant frequency (Hz)

$f_B$  = bandwidth frequency (the frequency range between the 50% maximum energy points on the energy response curve) (Hz)



# What is an operational amplifier?





# What is an operational amplifier?

An integrated circuit amplifier used as a system block in electronic systems to amplify voltages.



# What is an ideal op-amp?



# What is an ideal op-amp?

An ideal op-amp has an infinite open loop gain  $A_{OL}$  and infinite input resistance.



What are the two input terminals of an op-amp?



What are the two input terminals of an op-amp?

Non-inverting input and inverting input.



State one use of an op-amp.



State one use of an op-amp.

It can be used to compare two voltages.  
When they are equal, the output is 0.



# What is the transfer function of an op-amp?





# What is the transfer function of an op-amp?

## An open loop output function

$$V_{out} = A_{OL}(V_+ - V_-)$$

This shows that the op-amp amplifies the difference between its inverting and non-inverting terminals.

