2g.1 • Transformers • 000 •

From low to high frequencies, the choice of core is IRON, then FERRITE or DUST IRON COMPOSITEF and finally AIR (see below).

Construction
- Two coils on a common former
- Input = primary winding
- Output = secondary winding
- Not only used in power supplies, can include tuned circuits or for broadband coupling
- Former can be an insulator, ferrite, iron or other magnetic material
  - Choice of core depends on use and frequency
    - Air core = VHF/UHF
    - Ferrite (or dust iron composite) = RF
    - Iron = Mains and AF
- Core can absorb energy and heat up
  - high power transformers need to be large and heavy

2g.1 • Transformers • 010 •

Self inductance with a single coil, but mutual inductance with two coils.

Mutual inductance
- Two coils share common former
- Magnetic field formed by primary winding will induce current in secondary
- Where single coil has self-inductance, two coils that share magnetic fields have mutual inductance

Step up/Step down
- Ratio of the turns on the two coils determines how it will changes
  - Voltage
  - Current and
  - Impedance
- Need to be able to calculate the changes...

2g.1 • Transformers and the Turns Ratio • 020 •

Voltage transforms with the turns ratio

- Winding with more turns will have more voltage

If turns are the same (turns ratio = 1:1)

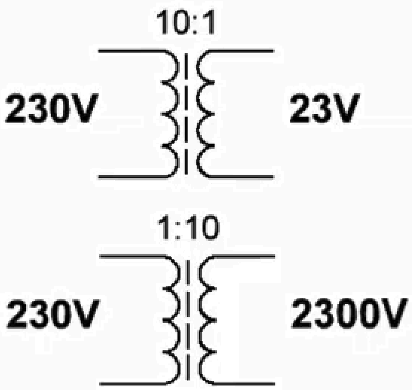
- There will be no change
- Known as an isolating transformer

Fewer turns on secondary = lower voltage out

More turns on secondary = higher voltage out

Ratio of turns determines how much lower/higher

- Ratio is larger number of turns ÷ lower number of turns
- 2:1 will have half voltage out, 1:2 will have double
- 10:1 will have 1/10th out, 1:10 will have 10 times



2g.1 • Transformers and the Turns Ratio • 030 •

Two step approach on left, all in one go on the right.

A mains transformer has a 684 turns on the primary and 38 turns on the secondary.

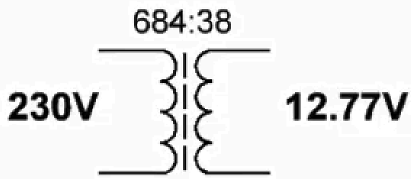
What voltage be available on the secondary winding?

1 - Turns ratio = 684 ÷ 38 = 18:1

2 - Voltage on secondary is 1/18th that in the primary = 230 ÷ 18 = 12.77V

***Sanity check:* does the winding with fewer turns have less voltage? Yes! ✓**

You can use the formula on EX309, but the ratio method is much easier!



$$v_s = v_p \left(\frac{N_s}{Np}\right)$$

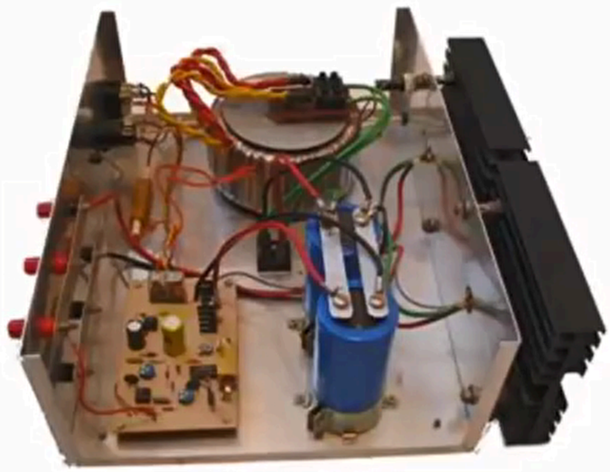
V_s = 230 x (38÷684) = 12.77V

2j.4 • linear power supply • 000 • KTOX4MGD

Linear Power Supply Recap

Intermediate Recap:

- **Transformer** – changes mains AC voltage to different AC voltage, usually lower
- **Rectifier** – one or more diodes change the AC to ‘lumpy’ DC; pulses of positive voltage
- **Reservoir Capacitor** – holds the charge between pulses to give DC with a ‘ripple’
- **Voltage Regulator** – keeps 100% smooth

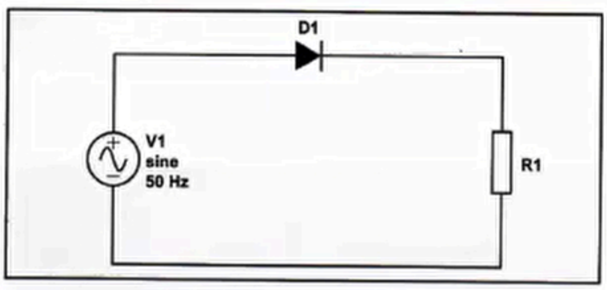


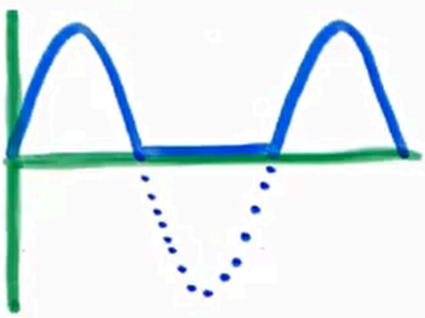
Nothing changes at Full level, just more detail on:

- Transformers
- Rectifier diodes
- Zener Diodes and ICs in Voltage Regulators

2j.4 • linear power supply • 010 • ZOL062H9

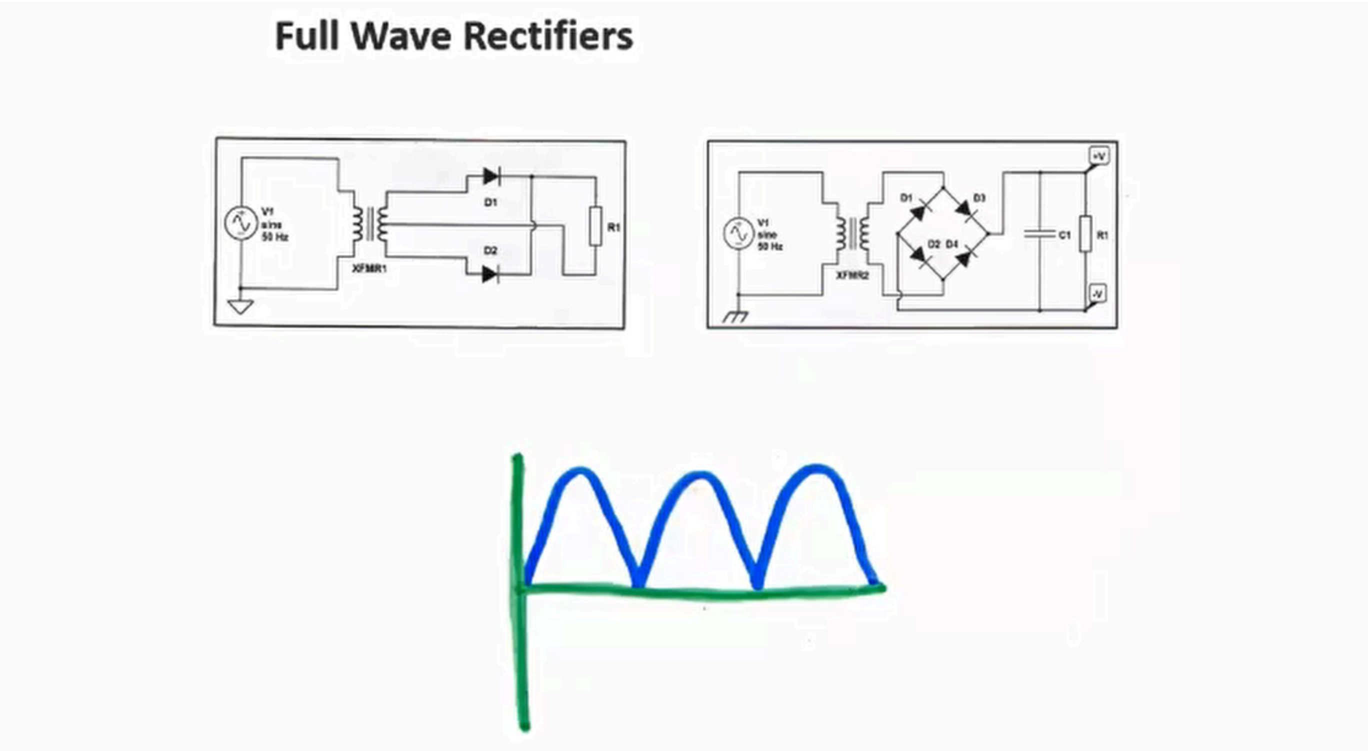
Half Wave Rectifier





2j.4 • linear power supply • 020 • YPCGDC5U

In the two diode model, a centre tapped transformer is used.



2j.4 • linear power supply • 050 • U6MKCF4N

The capacitor just before the voltage regulator should be an electrolytic capacitor.

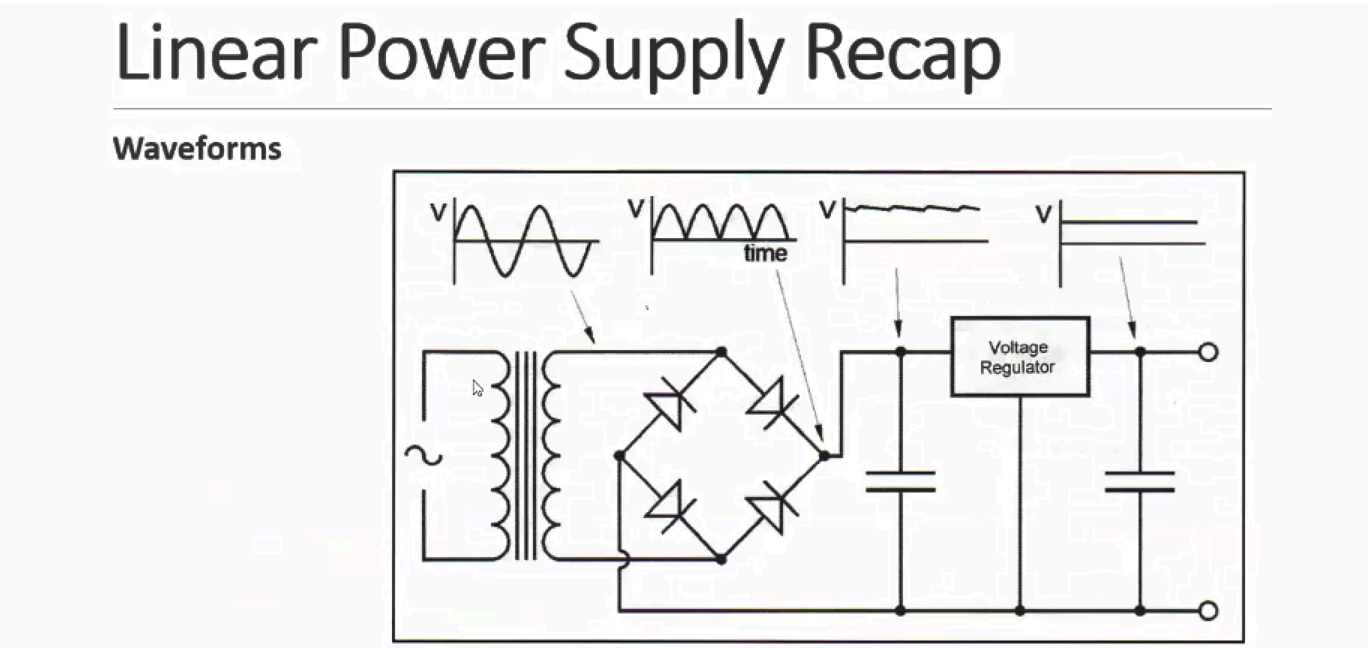


Fig 5.9: A simple linear power supply schematic