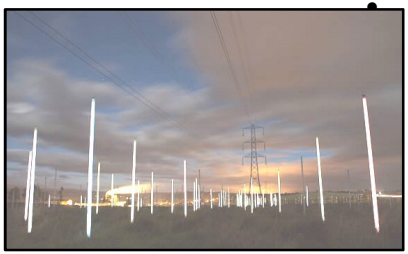
3.4 Energy Levels in Atoms (2)

Fluorescence

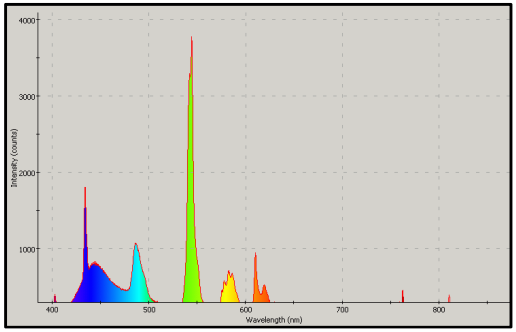
- Fluorescent chemicals absorb ultraviolet radiation and emit light
- This happens because the ultraviolet photons give their energy to atomic electrons which jump to higher energy levels in the atom but, when they fall back down, they do so in several smaller jumps. These smaller steps result in photons of smaller energy than ultraviolet photons – usually in the visible region.



Fluorescent tubes being lit by the electric field

Fluorescent Tubes

- The strip lights commonly used in schools and offices are really mercury vapour discharge lamps. They give a dim purple glow when a current flows through them because the radiation they emit is mainly ultraviolet but with some violet and small amounts of other colours.
- The glass tube is coated on the inside with a fluorescenty chemical which absorbs the ultraviolet produced by the mercury vapour and re-emits it as visible light of a variety of wavelengths – enough to make a convincing “white” light.



Light spectrum from a fluorescent strip light

Energy-Saving Lamps

Fluorescent tubes are much more energy efficient than filament lamps because they do not produce much heat. A 100 W filament lamp may be only 10% efficient but a fluorescent lamp can achieve efficiencies of more than 90%.

"Energy-saving lamps," which are becoming increasingly common as filament bulbs are phased out, are just folded-up fluorescent tubes inside another glass envelope. They reduce the electrical energy we consume and, that way, conserve fossil fuels.

Tube "Starters"

The p.d. needed to drive a current through the high resistance of a cold, low pressure gas is much higher than an ordinary household mains supply. Strip lights therefore contain a "starter" unit whose job it is to heat the electrodes at each end of the fluorescent tube. When the electrodes are hot, they release enough electrons by thermionic emission to provide a working current. The starter also uses electromagnetic induction to provide the high p.d. needed to start the discharge in the lamp. Once the tube has been started, the electron current is sufficient to keep the filament electrodes glowing. Sometimes, it can take several cycles before the tube discharge becomes self-sustaining, which is why a strip light can flash several times before it lights up.