# Ch 8

## Ch8.1

**Natural light source** is for e.g. the sun, it is the most important one

White light contains all the colours, you can see that by letting the light pass through a **prism.** A sequence like this is called a **spectrum**. You can only see objects when there is light reflecting on it (illuminated). The light that falls on the object is then **reflected diffusely** (in all directions).

Light sources that are manufactured by humans are called **artificial light sources**. You can use a **spectroscope** to study the light they emit. A **sodium lamp**  emits light with a pure yellow/orange colour.

A TV screen or a computer screen is made up of light-emitting strips, dots, or squares that are called **subpixels**. They always have three colours: red, green, blue.
Ch 8.2

The light that is radiated by a light source spreads out in all directions. You can indicate that by drawing in **rays**. If an object blocks the light from the light source, it creates a **shadow**. To determine what area is shadowed, use the method with maths to determine the area you can see with two objects.

**Direct light** is light that goes directly from the light source to the working area (table, desk or worktop). When you use two light sources to work, you can have two shadows. When two overlap, you’ll have a darker shadow called the **umbra**. The lighter parts around it are called the **penumbra**.

When you shine a light source on a wall, it gives **indirect light**. The wall is in this case the **indirect light source** (fig. 15 page 270). The lamp (fig. 16) on page 271 is also an indirect light source. The light that falls on translucent paper, that scatters the light in all directions. The light that you obtain this way is called **diffuse light**.

A= direct B= indirect C= diffuse

## Ch 8.3 mirror images

In a **mirror** the light reflects. It is called a **mirror reflection**. It does not reflect in all directions because its surface is very smooth and flat. In a **diffuse reflection**, it reflects in all directions.

The perpendicular line of the mirror is the **normal.** The angle between the incoming ray and the normal is called  **the angle of incidence** $\left(∠i\right)$ . the angle between the reflected ray and the normal is called **the angle of reflection** $\left(∠r\right)$.

The rule of the angle reflects is always this: $The angle of incidence = the angle of reflection$

Or in symbols: $∠i=∠r$

This rule is known as the **law of reflection**.

## Ch. 8.4 Infrared and ultraviolet

All the objects around you – including humans and animals – are sources of **infrared (IR) radiation**. The higher the temperature, the more radiation the object emits. **Heat lamps**  give off a little bit of red light that you can see. Infrared literally means ‘below the red’

When you lie in the sun your skin receives **ultraviolet (UV) radiation** as well as light. Sun cream contains a UV filter that blocks out some of the UV radiation. The package states the **protection factor**. The factor means how much longer you can stay in the sun. For instance 10 x (your maximum without cream).

There are also lamps that produce primarily UV, such as the **UV lamps** in a solarium or blacklights in discos. UV literally means ‘beyond the violet’



violet

red

# Chapter 7: sound

## Ch 7.1 making and hearing sounds

An object that makes a sound is referred to as a **sound source**.

You can only hear sound when there is a **medium** to carry it: a substance that the vibrations can pass through from the sound source to the **detector/receiver**. Most sounds pass through air, but they can also pass through liquids and solids.

The **speed of sound** is 343 m/s. That’s more than 1200 km/u!

There is a formula to calculate the distance between the source and receiver: $distance=speed\*time$ or in symbols: $s=v\*t$

S= distance, v= speed, t= time



## Ch 7.2 pitch and frequency

The pitch that a string produces depends on three factors:

* The **thickness**, the thicker the string, the lower the pitch
* The **length**,the longer the string, the lower the pitch
* The **tension**, the lower the tension, the lower the pitch

A stringed instrument is **tuned** by adjusting the strings tensions correctly.

The number of vibrations in a second is called the **frequency** ($f$). Frequencies are measured in hertz (Hz). If the frequency is 128 Hz, this means that the prongs of the tuning fork move back and forth 128 times every second. The higher the frequency, the higher the pitch.

The **microphone** ‘translates’ the pressure differences of the sound into an electrical signal. The **oscilloscope** then sows that signal on the screen. This lets you investigate how rapidly the air pressure is changing. A set of axis is shown on the oscilloscope screen. Time is presented along the horizontal axis.

You can use the knobs on the oscilloscope to set the time scale. This is referred to as selecting the **time base**. In figure 12, the time base is set to 1 ms per division. That means that every square is one millisecond ‘wide’.

Four vibrations on the oscilloscope screen take up nine squares altogether. That means that the four vibrations take total of 9 x 1= 9 ms, so a single vibration needs 9:4 = 2.25 ms. The time required for a single complete vibration is called the **period** ($T$) of the vibration. You say that period of the vibration of the tuning fork in figure 12 is 2.25 ms. If you know the period of a vibration, you can calculate its frequency: $frequency= \frac{1}{period}$or in symbols: $f= \frac{1}{T}$ . if you use *T* in seconds, you get the *f* in Hz. most people can hear tones between 20 Hz-20,000 Hz. This is known as the **frequency range**.

## Ch 7.3 Noise levels

The **amplitude** is the difference from the top to zero on an oscilloscope.

The unit of **sound intensity** is the **decibel (dB)**. The device you can use to measure the sound intensity is called a sound intensity meter or a **decibel meter**.

The threshold level you can hear is called **limit of hearing**. The sound intensity at which your ears start to hurt is called the **pain threshold**.

Because your ears are not equally sensitive at all frequencies, most decibel meters have an **A meter**. This adds a profile or contour to the meter’s response, giving a lower weighting to very high/low frequencies. If you use the filter you need to use this unit: dB(A).

If an number of sound sources becomes twice as great the sound level increases by 3 dB.

## Ch 7.4 combating noise nuisance

The longer you listen to loud sounds, the more damaged your ears can get. **Noise barriers** make sure that the volume decreases (e.g. by a road). A thick dike of earth beside a motorway can mute traffic noise. The sound is **absorbed**  by this dike. If there isn’t enough room to place a dike, often screens are placed. The screens **reflects** the sound in such a way that it doesn’t reach the houses/forest etc.

Noise pollution can often be combated by **sound insulation**. You can fight noise pollution at three places:

1. By the sound source (e.g. set the radio on a lower volume)
2. Between the sound source and the receiver (e.g. put screens next to the road; put insolation material on the walls)
3. By the receiver (e.g. wear earplugs/earmuffs)