

# A Level Unit 3: Materials, technologies and techniques

## 2.3.8 Lighting in buildings and of assets

GCE AS and A level  
BUILT ENVIRONMENT

### Key terms

Term	Definition
Brightness	The subjective intensity of a light.
CIBSE	The Chartered Institution of Building Services Engineers produces a series of guides about optimum lighting requirements.
Colour rendering index (CRI)	A measure of the ability of a light source to show surface colours as they should be. A value of 100 means no colour distortion.
Illuminance	The amount of light received on the surface, measured in Lux.
Luminance	The amount of light reflected or emitted from a surface, measured in candela/m <sup>2</sup> .
Luminaire	An electrical device used to create artificial light and/or illumination, by using an electric lamp.
Luminous flux	The quantity of the energy of the light emitted per second in all directions, measured in lumens (lm).
Luminous intensity	The power emitted by a light source in a particular direction, measured in candela.

A light source with a luminous flux of **one lumen** that uniformly illuminates an area of **one square metre** has an illuminance of **one lux**.

### Daylight

Natural lighting, or daylighting, is a technique that efficiently brings natural light into a building using exterior glazing (windows, rooflights, etc.), thereby reducing artificial lighting requirements and saving

energy. Natural lighting has been proven to increase health and comfort levels for building occupants.

### Daylight factor

Daylight factors are used to assess the internal natural lighting levels on working planes or surfaces and to determine if light is sufficient for occupants to carry out normal activities. A daylight factor can be calculated by comparing the light level inside a structure with the light level outside the structure.

Daylighting design is more complex than simply bringing light into a space. Heat gains and losses, glare control, and variations in daylight availability must be considered, together with window size and spacing, glass selection, the reflectance of interior finishes, and the location of interior partitions.

### Artificial lighting

'Artificial lighting' generally refers to lighting that emanates from electric lamps. A lamp is a light source, typically comprising a light-emitting element within an outer container (bulb or tube) which emits radiation within the visible spectrum.

Artificial light can be used to create a range of effects according to the requirements of a space. It can be increased or decreased, directed, focused, and coloured.

(Colour appearance refers to the 'warmth' or 'coolness' of the light, measured in Kelvin (K). Warm white light is produced by lamps having a colour temperature below 3000K, cold white light is produced by lamps with a colour temperature over 4000K.)

Different types of electric lamps include the following:

**Filament lamps** – either an incandescent or halogen lamp

- An incandescent lamp contains a thin coil of wire that heats up as electricity passes through it and therefore emits light.

- A halogen lamp is an enhanced incandescent lamp that has a tungsten filament housed in a quartz capsule filled with an inert gas.

Filament lamps are being phased out in favour of LEDs which last longer and use far less electricity.

**Discharge lamps** – for example, fluorescent tubes which comprise a transparent container filled with a gas that is energised by an applied voltage. The nature of the gas dictates the colour of light emitted.

**Light-emitting diode (LED)** – energy-efficient lamps that provide high quality light output and use around 75% less energy and last 25 times longer than incandescent lamps.

### Categories of lighting

**Ambient lighting** – this is the general artificial lighting and overall illumination in a room. It can provide an even spread of light to give a comfortable level of brightness for most people to be able to see reasonably well.

**Task lighting** – this allows the completion of tasks such as reading, drawing etc. It is used where ambient light levels are insufficient for the task.

**Accent lighting** – lighting used to add interest and character and to draw the viewer's attention to the item that is lit, such as a painting or other design features.

**Emergency lighting** with battery backup – these are installed in case of a mains power failure to provide sufficient illumination to allow occupants to evacuate safely.

### Lighting control systems

These enable the provision of the optimum level of lighting at the place and time it is needed and help maximise the energy savings. Types of control include, photoelectric control, presence detection and absence detection in addition to local manual switching.