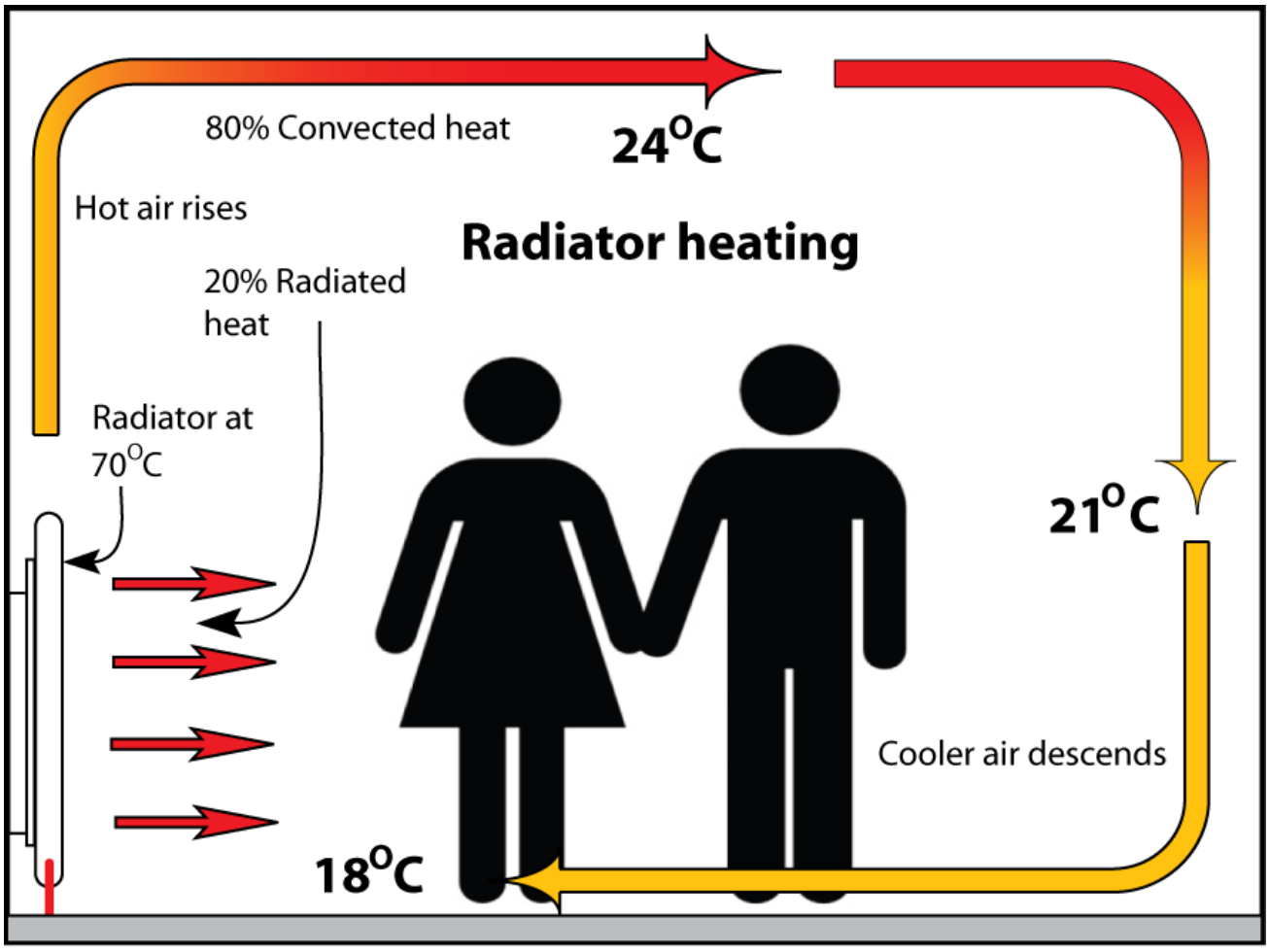
Learning Outcome 1

Know the uses of central heating systems in dwellings



Author: BPEC Ltd. Editor: BPEC Ltd. Design: BPEC Ltd

There are two Assessment Criteria in this Learning Outcome:

AC1.1. State the purpose of central heating systems used in dwellings.

AC1.2. Identify the different types of space heating systems used in dwellings

Good central heating starts with good design, the recommendations for which are set out in a series of documents, both legislative and advisory. In this first Learning Outcome, we will investigate the purpose of central heating. In other words, what makes us thermally comfortable and why and what can we do to achieve this.

AC1.1 State the purpose of central heating systems used in dwellings.

The purpose of central heating is to provide a set of conditions within a building that make us feel thermally comfortable. It's not just about heat and warmth. There are a number a different factors that must be taken into account and when these factors are in balance, then the conditions within the building make us feel not just warm, but thermally comfortable. These conditions will change with age, health, activity and the clothing we wear. They can be divided into two very distinctive groups – Physical and Personal:

Physical factors – Air condition

Humidity

Humidity is best described as the amount of moisture in the atmosphere within an environment. It is given as a percentage (%) of moisture. Ideal conditions for humans are between 40 – 60% humidity. Below 40% can make the eyes sore and the mouth and throat dry. The reason for this is the atmosphere is leeching water from the body making the body dry and hence the body's need for water in the form of thirst. Above 60% makes the atmosphere damp, clammy and uncomfortable. Even the slightest physical exertion will make the body sweat. This condition also make the body crave water in an effort to quench thirst.

Air changes

When humans breathe, they take in air (which is 20% oxygen) and expel Carbon Dioxide (CO_2). If there is not enough oxygen in the room, then the person will begin to feel sleepy and lethargic. This is because the atmosphere is CO_2 rich. Air changes are required to remove a CO_2 rich atmosphere and replace it with Oxygen rich air. Air changes need to be taken into account when designing central heating and the number of air changes per hour worked into the heat loss calculations.

Different rooms will have different air change requirements. For example a lounge will require 2 air changes per hour but a bathroom or kitchen 3 air changes per hour. A bedroom will only require 1 air change, since the purpose of the bedroom is for sleeping.

Air temperature

The temperature of the air required for comfort will depend largely on the sex, age, health, activity and the clothing of the persons in the building. Studies have shown that women like temperatures on average 2°C higher than men. The elderly and the infirm

Author: BPEC Ltd. Editor: BPEC Ltd. Design: BPEC Ltd

also prefer temperatures higher than the average person. On average, 22°C in the winter and 23°C in the summer are the optimum temperatures for human comfort.

Air velocity

The air velocity refers to the speed at which air travels through the building. If the air is travelling too quickly, the occupants will feel a draught. If the air travelling too slowly, then the air change requirements for the building will not be satisfied. The optimum velocity is 0.2 to 0.25 m/s. However a variable air velocity is much more beneficial to human comfort than a constant air velocity

Personal factors - Human

Activity within the building

The more work we do, the hotter we become and the less heat will be required in the building. In this instance the air temperature may need to be adjusted to suit the type of activity within the building. On average, 22°C in the winter and 23°C in the summer are the optimum temperatures for human comfort provided the occupants are sedentary. In other words, provided they are seated and inactive. When people begin to move, then the body temperature rises and the need for heat becomes less.

Clothing

This refers to the type of clothing worn by the occupants of the building. The more clothing is worn, then the less the air temperature will need to be. Adding and removing clothing or simply having a hot or cold drink can make a positive change in thermal comfort:

BEHAVIOUR	EFFECT	TEMP. OFFSET
Jumper/Jacket on or off	Changes Clothing by ± 0.35	± 2.2°C
Tight fit/Loose fit clothing	Changes Clothing by ± 0.26	± 1.7 °C
Collar and tie on or off	Changes Clothing by ± 0.13	± 0.8 °C
Seated or walking around	Varies Metabolism by ± 0.4	± 3.4 °C
Stress level	Varies Metabolism by ± 0.3	± 2.6 °C
Consume cold drink	Varies Metabolism by -0.12	+ 0.9 °C
Consume hot drink/food	Varies Metabolism by +0.12	- 0.9 °C
Operate desk fan	Varies Velocity by +2.0m/s	+ 2.8 °C
Operate ceiling fan	Varies Velocity by +1.0m/s	+ 2.2 °C
Open window	Varies Velocity by +0.5m/s	+ 1.1 °C

Table - The effect of adaptive behaviour's on optimum comfort temperatures. Taken from BRE

What is interesting about the above table, is that it shows that drinking a cold drink makes you hotter and drinking a hot drink makes you cooler!

Age and health

This is a major factor in good heating design. The age and the health of the building's occupants have a direct effect on the temperatures that the system is designed to meet. Older and infirm people quite often feel the cold in a way that the young and abled bodied persons do not. In nursing homes and hospitals, for instance, the temperature should be a constant 23 - 24°C. this will mean significant changes in the heating

Author: BPEC Ltd. Editor: BPEC Ltd. Design: BPEC Ltd