Construction and the Built Environment – Unit 2

2.1 Identifying and calculating information (1 of 2)

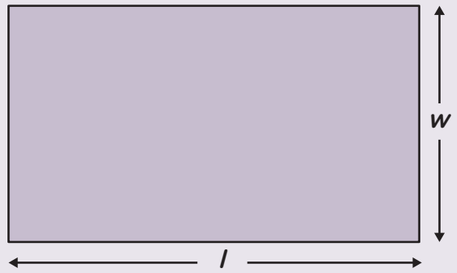
You will be required to make calculations, such as area and volume, as part of the Unit 2 controlled assessment.

AREA

Area in design and construction is used to work out:

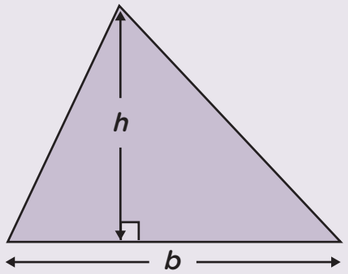
- floor plans, internal floors and wall surfaces
- room and external perimeters
- room volumes.

Rectangles



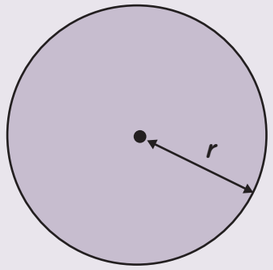
Area = length × width

Triangles



$$\text{Area} = \frac{(\text{base} \times \text{height})}{2}$$

Circles



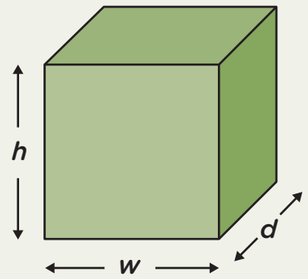
Area = πr^2 (remember π is 3·14)

VOLUME

Volume is important in several areas of building design, including:

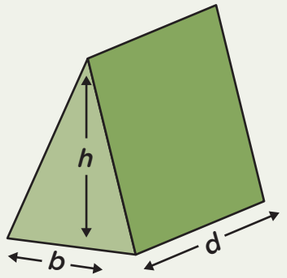
- working out quantities or materials for the estimation of cost
- ventilation rates
- requirements for space heating and lighting.

Rectangular spaces



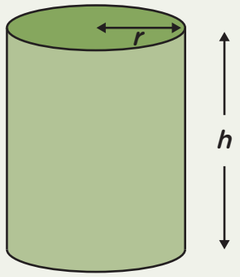
Volume = height × width × depth

Triangular spaces



$$\text{Volume} = \frac{(\text{base} \times \text{height})}{2} \times \text{depth}$$

Cylindrical spaces



Volume = $\pi r^2 \times h$ (remember π is 3·14)

Construction and the Built Environment – Unit 2

2.1 Identifying and calculating information (2 of 2)

LENGTH

The accurate measuring of distances is an important design consideration, such as measuring:

- room perimeters
- the length of internal evacuation routes
- boundary clearances in relation to building regulations
- distances of separation for privacy considerations.

The construction industry uses the SI system of measurement.

Length and distance are always measured in metres or millimetres, **never** centimetres.

A variety of measuring tools are used, including rulers, tape measures, measuring wheels and laser measures.

HIGH-LEVEL DESIGN REQUIREMENTS

High-level design requirements refer to the application of area, volume, length, angles and levels in practical construction design scenarios. The ability to carry out design calculations relies on an understanding of appropriate mathematical processes, together with a knowledge of the related building standards and regulations that need to be complied with.

For instance, UK regulations state that all habitable rooms should be provided with adequate natural light. The correct amount of natural light for a room is calculated by comparing the proportion of wall or ceiling surface area that is glazed with the total floor area. Regulations focus on the ratio of light to floor space which should be at least 1:8 or 12.5%. This means that a habitable room that measures 9 m × 4 m, with a floor area of 36 m², would require at least 4.5 m² (36 m²/8) of glazed openings or windows that allow light to enter the room.

Another common design requirement is the calculation of the amount of energy needed to heat a room. British Thermal Units (BTU) are the units used to measure the energy output required. To calculate the BTU output, a room's volume must be measured, as well as the size of the window area. For a room with an internal volume of 72 m³ and a window area of 4.5 m², 1100 BTUs of energy would be required. From this figure, heating options such as the size and number of radiators could be decided upon. Other high-level considerations may relate to:

- the provision of artificial lighting design
- ventilation, acoustic and thermal insulation
- compliance with regulations for the conservation of fuel and power.

LEVELS

Levelling is a branch of surveying concerned with determining the height of one level in relation to another. A surveyor will decide on a datum level, from which all vertical dimensions are measured. It shows the vertical height difference between floor levels of a building, as well as differences in levels between one part of the site and another.

The term '**levelling out**' refers to the processes involved in:

- **ground excavation** – flattening an area of ground or creating different flat levels for split level buildings
- **drainage levels** – ensuring that waste drains away from a building or structure; levelling out would be used to ensure that the pipe is laid at a slight gradient so that the water runs in the desired direction.

ANGLES

The **pitch** of a roof is the ratio or angle of the distance it rises vertically compared to the distance it extends horizontally. The pitch of a roof can be expressed as either:

- a ratio of vertical distance to horizontal distance (rise to run), for example 4:12; or
- as an angle in degrees, for example 14°.

Changing the pitch of a roof will affect the length of the external roof surface or **slope**.