Unit title	Construction Science
Guided learning hours	60
Number of lessons	40
Duration of lessons	1.5 hours
Links to other units	
Unit 1 Construction Technology Unit 2: Construction Design Unit 12: Building Surveying in Construction	

Key to lesson types			
AW	Assignment writing	**RS**	Revision session
GS	Guest speaker	**V**	Visit
IS	Independent study	**GW**	Group work

Lesson	Topic	Lesson type	Suggested activities	Classroom resources
1	**Unit introduction**	V	• **Lead-in:** introduction to the unit, including a brief overview of the content. • **Visit:** visit to either a new built project or a project under construction. Discuss the project, the materials used, the reasons for selection and how the building is intended to function, with reference to human comfort requirements. • **Plenary:** discuss thoughts and experiences from the visit; use questioning to gauge levels of understanding.	• Local construction site or recently completed project

Topic A: Explore construction materials and the properties				
2	**A1:** Material properties	GW	• **Lead-in:** tutor-led discussion to consider material properties. • **Class discussion:** discuss how the properties of materials influence the selection of materials for construction applications. • **Paired activity:** research material properties, including mass and density; tensile, compressive, bending and shear strength; hardness; toughness; malleability; workability; stiffness; fatigue and creep, considering how these properties affect the use of materials in construction applications. • **Plenary:** knowledge quiz to determine understanding of material properties, considering construction applications and the properties that materials must possess in order to be fit for purpose.	• Reference books • Textbooks • Internet access • ICT facilities • Examples of materials
3	**A1:** Material properties	GW	• **Lead-in:** tutor-led review of material properties and how this influences material selection. • **Tutor presentation:** introduce learners to further properties of materials, including a discussion of why materials may need to have fire resistance qualities. • **Small group activity:** investigate and produce a presentation for a given material property (one from electrical conductivity and conductance; thermal conductivity and conductance; or resistance to moisture penetration). • **Whole class activity:** groups present their presentations for their given material properties to the wider class. • **Plenary:** draw together the theory covered in the session and relate this to the wider topic of material properties.	• Reference books • Textbooks • Internet access • ICT facilities
4	**A1:** Material properties	GW	• **Lead-in:** tutor-led review of material properties and how this influences material selection.	• Reference books • Textbooks • Internet access

			• **Tutor presentation:** introduce learners to the concept of embedded energy and how this can impact on the selection of materials for construction projects. • **Small group activity:** investigate and produce a presentation for a given material property (one from resistance to vapour penetration, resistance to degradation or recycling potential) that explains how the property impacts on material selection. • **Whole class activity:** groups present their presentations for their given material properties to the wider class. • **Plenary:** summarise different properties of materials, using a knowledge quiz to gauge understanding.	• ICT facilities
5	**A2:** Properties of construction materials	GW	• **Lead-in:** review different types of bricks that are used in construction, including engineering, common and facing bricks. • **Paired activity:** continue to produce presentations related to bricks that include performance in use. • **Tutor-led discussion:** groups present aspects of their research and presentations to the wider class, with tutor-led discussion to clarify where appropriate. • **Plenary:** review different applications of types of bricks and the properties that make them suitable for given applications. Address any misconceptions.	• Reference books • Textbooks • Internet access • ICT facilities
6	**A2:** Properties of construction materials	GW	• **Lead-in:** review different mixes that are used for concrete and why they are used. • **Individual activity:** continue to produce flow charts and reports related to concrete and concrete blocks that include reference to performance in use. • **Tutor-led discussion:** group members discuss the fitness for purpose of both materials based on their reports. Tutor-led discussion to clarify where appropriate.	• Reference books • Textbooks • Internet access • ICT facilities

			• **Plenary:** review the reasons for different concrete mixes and how these variations impact on the properties of the concrete.	
7	**A2:** Properties of construction materials	GW	• **Lead-in:** tutor review of use and properties of concrete and concrete blocks. • **Tutor presentation:** use of video to explain production methods for plasterboard and mortars. Discuss the types of sand that are used in construction. **YouTube:** 'How gypsum board (Drywall) is made' • **Small group activity:** investigate and produce a factsheet for a given material group (mortar, sand or plasterboard) that includes the processes used in manufacturing, how this impacts on properties and fitness for purpose. The factsheet should include reference to manufacturing, properties, performance in use, sustainability issues and embedded energy. • **Plenary:** groups present their findings to the wider class, discuss and address misconceptions that may be held.	• Reference books • Textbooks • Internet access • ICT facilities
8	**A2:** Properties of construction materials	IS	• **Lead-in:** tutor introduction to the different types of glass and glass finish that are used in construction projects. • **Tutor presentation:** use of video to explain production methods and applications of smart glass. **YouTube:** 'Saint-Gobain Glass Production Process' **YouTube:** 'SageGlass® – The Process, The People, The Passion' • **Individual activity:** investigate and produce a report for a given type of glass or glass finish that includes the processes used in manufacturing, how this impacts on properties and fitness for purpose. The report should include reference to manufacturing, properties, performance in use, sustainability issues and embedded energy.	• Reference books • Textbooks • Internet access • ICT facilities

			• **Plenary:** groups present their findings to the wider class, discuss and address misconceptions that may be held.	
9	**A2:** Properties of construction materials	GW	• **Lead-in:** tutor-led discussion to gauge prior knowledge of insulation materials. • **Site visit:** observe and discuss types of insulation materials that are used in construction projects. • **Small group activity:** complete a survey of insulation materials used in a building. Examples of materials could be examined in class. Explain the reasons for the selection of the materials, including information about manufacturing methods. • **Plenary:** groups present their findings to the wider class, discuss and address misconceptions that may be held.	• Reference books • Textbooks • Internet access • ICT facilities
10	**A2:** Properties of construction materials	GW	• **Lead-in:** tutor review of use and properties of plastics that are used in construction. • **Tutor presentation:** group discussion about the generic properties of plastics and how these properties can be used in construction applications. Use video as a stimulus. **YouTube:** 'UPVC manufacturing process, deceuninck' • **Paired activity:** investigate and produce a short set of revision notes for a given application (doors and window frames, soffits, bargeboards, fascia, guttering, damp proof course, damp proof membrane) that includes the processes used in manufacturing, how this impacts on properties and fitness for purpose. The notes should include reference to manufacturing, properties, performance in use and sustainability issues. • **Plenary:** groups share and discuss their notes with the wider class, discuss and address misconceptions that may be held.	• Reference books • Textbooks • Internet access • ICT facilities

11	**A2:** Properties of construction materials	GW	• **Lead-in:** tutor review of sourcing, processing/ manufacture, use and properties of timber. • **Tutor presentation:** group discussion about the differences between timber, manufactured board and engineered timber. • **Small group activity:** investigate and produce a presentation for a given type of timber or manufactured board that includes the processes used in manufacturing, how this impact on properties and fitness for purpose. Produce presentations that include reference to manufacturing, properties, performance in use and sustainability issues. • **Tutor-led discussion:** groups present their presentations to the wider class, with tutor-led discussion to clarify where appropriate. Discuss engineered timber in detail and the applications of engineered timber. This should introduce the concept of manufacturing becoming integrated into the building process – a good example being the use of engineered, pre-fabricated timber for panels or modules, which are assembled on site. • **Plenary:** knowledge quiz concerning timbers, manufactured board and engineered timber.	• Reference books • Textbooks • Internet access • ICT facilities
12	**A2:** Properties of construction materials	GW	• **Lead-in:** tutor introduction to different types of roofing materials that can be used in construction projects. **YouTube:** 'Different Types of Roofing Material' • **Tutor presentation:** group discussion about the purposes of roofing materials and why different types may be used. • **Paired activity:** investigate a given type of roofing material (slate, concrete, pantile, roofing felt, thatch) that includes the processes used in manufacturing, how this impacts on properties and fitness for purpose. Produce an illustrated report that includes reference to manufacturing, properties, performance in use and sustainability issues.	• Reference books • Textbooks • Internet access • ICT facilities

			• **Tutor presentation:** explain, using video if appropriate, the purpose and properties of ridge tiles and lead flashing in roofing structures. • **Plenary:** groups present their findings to the wider class, discuss and address misconceptions that may be held.	
13	**A2:** Properties of construction materials	GW	• **Lead-in:** tutor review of prior understanding and knowledge of properties of steel and aluminium. • **Tutor presentation:** group discussion about the generic properties of metallic materials and how these properties can be used in construction applications. • **Small group activity:** investigate and produce a presentation for a given type of steel or aluminium that includes the processes used in manufacturing, how this impacts on properties and fitness for purpose. Produce presentations that include reference to manufacturing, properties, performance in use, embedded energy and sustainability issues. • **Plenary:** groups present their findings to the wider class, discuss and address misconceptions that may be held.	• Reference books • Textbooks • Internet access • ICT facilities
14	**A1–A2**	RS	• **Lead-in:** review the concepts that have been covered in topics A1 to A2. • **Individual activity:** investigate a range of construction properties and their applications. • **Plenary:** discuss results of investigations. Address any common misconceptions.	• Reference books • Textbooks • Internet access • ICT facilities
Topic B: Examine the behaviour of construction materials				
15	**B1:** Degradation of construction materials	IS/GW	• **Lead-in:** tutor-led review of materials and material properties and how these influence choices for construction projects. • **Tutor presentation:** introduce learners to the range of sources of degradation and causes which affect construction materials.	• Reference books • Textbooks • Internet access • ICT facilities

			• **Paired activity:** investigate timber infestation and timber decay. Produce a brief report that examines the causes and effects of each. • **Tutor presentation:** demonstrate to learners the effects of moisture movement, using video as appropriate. • **Plenary:** draw together the theory covered in the session and relate this to the wider topic of material failure.	
16	**B1:** Degradation of construction materials	IS/GW	• **Lead-in:** tutor-led review of types of degradation of materials, revisiting moisture movement. • **Tutor presentation:** introduce learners to the principles of degradation caused by exposure and chemical degradation. • **Individual activity:** research and make notes on a range of modes of degradation caused by exposure and chemical degradation. • **Paired activity:** use individual notes to produce a presentation that covers each of the required sources of degradation, including reference to the cause. • **Plenary:** peer review of presentations, use of targeted questions to gauge understanding of individual learners.	• Reference books • Textbooks • Internet access • ICT facilities
17	**B1:** Degradation of construction materials	IS/GW	• **Lead-in:** tutor-led review of degradation of materials and introduce the concept of remedial measures. • **Tutor presentation:** introduce learners to modes of failure associated with construction materials and how these can influence material selection. Use video to support descriptions. • **Individual activity:** investigate paints and coatings used in construction. Examine how treatments can be used to prevent and reduce degradation and their benefits and drawbacks. • **Paired activity:** investigate remedial measures to prevent and reduce degradation.	• Reference books • Textbooks • Internet access • ICT facilities • Examples of materials with a range of surface treatments applied to them

			• **Plenary:** draw together the remedial measures covered in the session and relate this to the wider topic of behaviour of material properties.	
18	**B2:** Effects of temperature changes on construction materials	GW	• **Lead-in:** tutor-led discussion to introduce the effects of temperature change on construction materials. • **Tutor presentation:** introduce learners to latent and sensible heat, explaining theory related to each. • **Paired activity:** produce definitions for latent and sensible heat; feed back to class and discuss the impact on materials. • **Tutor presentation:** use video or demonstrations to introduce changes of state of matter. **YouTube:** 'Particulate Nature of Matter and Changes of State' • **Paired activity:** investigate how temperature can change the properties of materials, including change of state, evaporation and expansion and contraction. Produce revision notes that concisely explain each. • **Plenary:** knowledge quiz to check understanding of sensible and latent heat and the effects of temperature change.	• Reference books • Textbooks • Internet access • ICT facilities
19	**B3:** Behaviour of structural members under load	GW	• **Lead-in (15 minutes):** review prior knowledge of structural members. • **Tutor-led practical demonstration:** demonstrate the differences between beams, columns and struts. Use appropriate video or demonstration to show how each reacts to different types of loading. **YouTube:** 'Buckling failure of a pin ended column of low slenderness: Materials Lab on-line' **YouTube:** 'Lateral torsional buckling of a plate girder in bending: Materials Lab on-line' • **Tutor-led practical demonstration:** demonstrate the different types of support that can be used for structural	• Reference books • Textbooks • Internet access • ICT facilities

			elements, considering the characteristics and typical uses of each. • **Plenary:** review understanding of types of structural member and the effect of different loading on different materials.	
20	**B3:** Behaviour of structural members under load	GW	• **Lead-in:** review types of loads and structural members. • **Tutor-led practical demonstration:** discuss failure modes for structural members, using video to demonstrate the effects of structural failure on structural members. **YouTube:** 'Beam Test...watch beam failure in slow-motion!' • **Paired activity:** investigate the effects on structural members that are made from a given material (concrete, reinforced concrete, timber or steel). The investigation should consider the effects of different types of load and potential failure of given structural components. • **Plenary:** draw together similarities and differences in failure modes for various materials. Discuss which material type is most suitable for specific types of loading.	• Reference books • Textbooks • Internet access • ICT facilities
21	**B1–B3**	RS	• **Lead-in:** review the concepts that have been covered in topics B1 to B3. • **Individual activity:** investigate a range of construction problems that relate to degradation of materials such as timber decay, temperature change and loading material to failure. • **Plenary:** discuss results of investigations. Address any common misconceptions.	• Reference books • Textbooks • Internet access • ICT facilities
Topic C: Examine thermal comfort in the built environment				
22	**C1:** Scientific principles and their application in the built environment	IS/ GW	• **Lead-in:** tutor-led introduction to the impact of heat on human comfort in the built environment. • **Tutor presentation:** introduce learners to the scientific principles of heat and how they impact on human comfort and comfortable living in the built environment.	• Reference books • Textbooks • Internet access • ICT facilities

			• **Group work:** discuss scientific principles relating to heat and how they are applied in the built environment. • **Tutor presentation:** demonstrate to learners the differences between wet and dry bulb temperatures. • **Paired activity:** investigate conduction, convection and radiation. Produce a short factsheet that explains and exemplifies each type of heat transfer mechanism. • **Plenary:** focused questions to determine understanding of heat transfer mechanisms.	
23	**C1:** Scientific principles and their application in the built environment	GW	• **Lead-in:** review the scientific principles related to heat in the built environment. • **Tutor-led practical demonstration:** demonstrate different types of temperature measuring instruments and explain briefly typical applications. • **Paired activity:** investigate how each type of measurement instrument is used to determine human comfort conditions. Produce a presentation that explains the purpose, operation and typical uses of each instrument. The notes should consider how the instruments are used in determining human comfort conditions. • **Plenary:** review understanding of measuring instruments and the differences between each and how this influences their uses.	• Reference books • Textbooks • Internet access • ICT facilities
24	**C1:** Scientific principles and their application in the built environment	IS/ GW	• **Lead-in:** tutor-led discussion of the factors that come together to influence whether thermal comfort parameters are acceptable. • **Tutor presentation:** introduce learners to the range of factors that need to be taken into consideration, including regulatory and personal factors.	• Reference books • Textbooks • Internet access • ICT facilities

			• **Individual activity:** investigate the requirements of the building regulations and produce a short report that highlights the key factors. • **Paired activity:** carry out research into the personal factors that influence thermal comfort, considering the requirements of different demographic groups. Produce a brief presentation that examines the differing requirements of different groups of people. • **Plenary:** consider the thermal comfort requirements of groups of people, justifying the answers given.	
25	**C2:** Heat losses and gains in buildings	IS/ GW	• **Lead-in:** tutor-led discussion of how heat can be lost and gained in buildings and how it is important to control these. • **Tutor presentation:** introduce learners to the range of ways in which heat can be lost from a building. • **Individual activity:** investigate heat losses from a range of different types of building. • **Paired activity:** investigate factors that contribute to heat gains and losses; pairs feed back to other group members and discuss their findings. • **Tutor presentation:** demonstrate how local climatic and exposure conditions impact on buildings. • **Plenary:** discuss reasons for heat losses and gains and how these can be controlled.	• Reference books • Textbooks • Internet access • ICT facilities
26	**C3:** Condensation	IS	• **Lead-in:** tutor-led discussion of the consequences and impact of condensation. • **Tutor presentation:** source and causes of condensation, the consequences of its occurrence and potential impact on the building fabric and methods of condensation control. • **Individual activity:** investigate sources of water vapour in buildings and the types, causes and effects of condensation in	• Reference books • Textbooks • Internet access • ICT facilities

			buildings and methods of controlling condensation in buildings. ● **Tutor-led practical demonstration:** demonstration of calculations relating to dew-point temperature profiles and structural temperature profiles. ● **Individual activity:** carry out calculations relating to dew-point temperature profiles and structural temperature profiles. ● **Plenary:** consider the reasons why it is important to calculate values when specifying materials for construction projects. ● **You Tube**: 'Minimising Condensation in Buildings'	
27	**C1/C2/C3**	RS	● **Lead-in:** tutor recap of thermal comfort needs. ● **Individual activity:** investigate a range of construction problems related to thermal comfort requirements. ● **Tutor-led discussion:** recap thermal comfort requirements. ● **Plenary:** review revision activities and resolve any issues that learners may have encountered.	
Topic D: Examine how acoustics and lighting affect human comfort in the built environment				
28	**D1:** Acoustic comfort	IS	● **Lead-in:** tutor-led introduction to the impact of sound on human comfort in the built environment. ● **Tutor presentation:** introduce learners to the scientific principles of sound and how they impact on human comfort and comfortable living in the built environment. **YouTube:** 'Noise Pollution' ● **Individual activity:** investigate scientific principles relating to sound, producing a report that defines the principles and how they are applied in the built environment. ● **Tutor-led discussion:** discuss with learners the differences between sound and noise, using appropriate examples. ● **Plenary:** focused questions to determine understanding of heat transfer mechanisms.	● Reference books ● Textbooks ● Internet access ● ICT facilities

29	**D1:** Acoustic comfort	IS/ GW	• **Lead-in:** tutor-led discussion of the factors that come together to influence whether acoustic comfort parameters are acceptable. • **Tutor presentation:** introduce learners to the range of factors that need to be taken into consideration, including regulatory and personal factors. • **Individual activity:** investigate the requirements of the building regulations and produce a short report that highlights the key factors. • **Paired activity:** carry out research into the personal factors that influence acoustic comfort, considering the requirements of different scenarios. Produce a brief presentation that examines the differing requirements of different building uses. • **Plenary:** consider the acoustic comfort requirements of groups of people, justifying the answers given.	• Reference books • Textbooks • Internet access • ICT facilities
30	**D1:** Acoustic comfort	IS	• **Lead-in:** tutor-led discussion of the reasons why sound levels are measured and how this can be done. • **Tutor presentation:** discuss the differences between sound insulation and sound absorption and the difference between airborne and impact sound. • **Individual activity:** investigate sound insulation, sound absorption and the issues related to flanking transmission. • **Plenary**: focused questions to reinforce understanding of measurement of sound levels and differences between sound insulation and absorption and airborne and impact sound.	• Reference books • Textbooks • Internet access • ICT facilities
31	**D1:** Acoustic comfort	IS	• **Lead-in:** tutor-led discussion of the reasons why sound insulation and sound reduction are required. • **Tutor presentation:** introduce reasons for sound insulation and sound reduction.	• Reference books • Textbooks • Internet access • ICT facilities

			• **Individual activity:** investigate approaches that can be taken to give sound insulation, producing research notes to describe how each works. • **Plenary:** consider the reasons why different approaches are used and the relative benefits of each.	
32	**D2:** Lighting	IS	• **Lead-in:** tutor-led introduction to the impact of appropriate lighting levels on human comfort in the built environment. • **Tutor presentation:** introduce learners to the scientific principles of appropriate lighting levels and how they impact on human comfort and comfortable living in the built environment. • **Individual activity:** produce a brief factsheet that defines these principles and how they are applied in the built environment. • **Plenary:** focused questions to determine understanding of the principles of lighting.	• Reference books • Textbooks • Internet access • ICT facilities
33	**D2:** Lighting	IS	• **Lead-in:** tutor-led review of learning completed regarding scientific principles related to lighting. • **Individual activity:** complete investigation into scientific principles relating to appropriate lighting levels, producing a report that defines the principles and how they are applied in the built environment. • **Tutor presentation:** introduce learners to the standard units of lighting and the desktop method to determine daylight factor. • **Individual activity:** complete activities relating to the desktop method for determining daylight factor in a range of construction scenarios. • **Plenary:** focused questions to determine understanding of the principles of lighting.	• Reference books • Textbooks • Internet access • ICT facilities

34	**D2:** Lighting	IS/GW	• **Lead-in:** tutor-led discussion of the factors that come together to influence whether illuminance levels are acceptable. • **Tutor presentation:** introduce learners to the range of factors that need to be taken into consideration, including regulatory and personal factors, to support mathematical techniques to determine lighting requirements. • **Individual activity:** investigate the requirements of buildings depending on the activities that are carried out and the use of the building. • **Paired activity:** carry out research into the principal components of daylight factors, investigating the variation of daylight factors in given rooms. Apply mathematical techniques to determine lighting requirements. • **Plenary:** consider the reasons why lighting requirements may differ for different uses of building.	• Reference books • Textbooks • Internet access • ICT facilities
35	**D2:** Lighting	IS/GW	• **Lead-in:** tutor introduction to different types of artificial light sources that can be used in construction projects. • **Tutor presentation:** group discussion about the purposes of artificial lighting and why different types may be used. • **Paired activity:** investigate and produce a presentation for a given type of lighting that includes how the light source functions, the typical uses and the reasons why the sources are used in given situations. • **Plenary:** groups present their findings to the wider class, discuss and address misconceptions that may be held.	• Reference books • Textbooks • Internet access • ICT facilities
36	**D1/D2**	RS	• **Lead-in:** tutor recap of thermal comfort needs. • **Tutor-led discussion:** recap acoustic comfort requirements and comfort needs related to lighting requirements. • **Individual activity:** investigate lighting requirements for a range of different activities.	

			• **Plenary:** review revision activities and resolve any issues that learners may have encountered.	
Preparation for Pearson Set Assessment				
37	Topic A	RS	• **Lead-in:** recap content of topics in preparation for practice exam questions. • **Individual activity:** work through practice exam questions based around Topic A. • **Plenary:** review questions. Discuss questions that learners considered to be challenging.	
38	Topic B	RS	• **Lead-in:** recap content of topics in preparation for practice exam questions. • **Individual activity:** work through practice exam questions based around Topic B. • **Plenary:** review questions. Discuss questions that learners considered to be challenging.	
39	Topic C	RS	• **Lead-in:** recap content of topics in preparation for practice exam questions. • **Individual activity:** work through practice exam questions based around Topic C. • **Plenary:** review questions. Discuss questions that learners considered to be challenging.	
40	Topic D	RS	• **Lead-in:** recap content of topics in preparation for practice exam questions. • **Individual activity:** work through practice exam questions based around Topic C. • **Plenary:** review questions. Discuss questions that learners considered to be challenging.	

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