Unit title	Sustainability in Construction
Guided learning hours	60
Number of lessons	30
Duration of lessons	2 hours

Links to other units

- Unit 1: Construction Technology
- Unit 2: Construction Design
- Unit 3: Construction Science
- Unit 21: Building Services Science
- Unit 25: Building Service Control Systems
- Unit 26: Heating, Ventilation and Air-conditioning
- Unit 27: Plumbing and Fluid Behaviour in Building Services Engineering
- Unit 33: Offsite and Onsite Construction Methods
- Unit 34: Planning the Built Environment

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	GW	• **Introduce the unit:** outline the nature of the topics, and the internally assessed assignments that learners will be expected to complete for this unit. • **Whole class activity:** learners work individually, in pairs or in small groups, to demonstrate any prior knowledge in the subject area and overall understanding of sustainability.	Paper and pens Interactive board
Learning aim A: Understand the impact of construction on the environment				
2	**A1:** Features of the natural environment that need to be protected	GW	• **Tutor presentation:** introduction to the topic by questioning learners to assess their understanding of what they consider the natural environment. • **Small group activity:** in small groups learners research a given topic from air, water or ozone quality. Groups produce either a short report or presentation. • **Whole class activity:** groups discuss their research and produce a shared preparation for assessment resource. • **Tutor presentation:** draw together the importance of air, water and ozone quality with respect to sustainability. • **Plenary:** discuss any misconceptions held by learners and clarify any areas where further clarification is needed.	Internet access Tutor-created worksheet Projector or interactive board to demonstrate examples

Lesson	Topic	Lesson type	Suggested activities	Classroom resources

3	**A1:** Features of the natural environment that need to be protected	V/GW	• **Tutor presentation:** introduction to the topic by questioning learners about what their understanding of what 'land' is in a sustainability and construction context.
			• **Visit:** arrange an educational trip to consolidate knowledge and understanding of the features of land. Try to cover as many of the following aspects as possible:
			  ○ landscape
			  ○ soil quality
			  ○ drainage
			  ○ forests
			  ○ biodiversity
			  ○ ecology.
			• **Tutor presentation:** use appropriate online videos to introduce any features from the content that have not been observed during the visit.
			• **Small group activity:** in small groups learners make a list of details of land; they write preparation for assessment notes linked to their experience and what they have seen during visits and/or on video.
			• **Plenary:** discuss any misconceptions held by learners and clarify any areas where further clarification is needed.
				Tutor-created worksheets
				Pens and paper
				Appropriate visit location
				Online videos
				Internet access

4	**A1:** Features of the natural environment	GW	• **Lead-in:** review understanding of why the natural world needs to be protected. • **Tutor-led discussion:** introduce learners to issues that are linked to light and light pollution.	Tutor-created worksheets Pens and paper

Lesson	Topic	Lesson type	Suggested activities	Classroom resources
	that need to be protected		• **Small group activity:** ask learners to investigate the effects of light on the environment, including light pollution and the impacts on wildlife. • **Tutor presentation:** introduce learners to the concept of finite resources and discuss any prior understanding and knowledge. • **Small group activity:** ask learners to research fossil fuels, ores and minerals or raw materials, then produce a short presentation. • **Plenary:** discuss the impact of extraction and the use of finite resources on the environment.	
5	**A2:** Impact of construction activities on the environment	GW	• **Lead-in:** review understanding of features of the natural environment that need to be protected. • **Tutor-led discussion:** introduce learners to ways in which construction activities can have a negative effect on the environment and introduce the concepts of airborne pollution. • **Paired activity:** ask learners to work in pairs to investigate the following sources of airborne pollution: o carbon dioxide emissions o carbon monoxide o particulates o chlorofluorocarbons (CFCs) o nitrogen oxides (NOx). Having completed research, invite pairs to present a short report to the whole class. • **Plenary:** review findings of the investigations and discuss how different types of airborne pollution have different effects on the environment.	Tutor-created worksheets Pens and paper Internet access

Lesson	Topic	Lesson type	Suggested activities	Classroom resources
6	**A2:** Impact of construction activities on the environment	GW	• **Lead-in:** review understanding of features of the natural environment that need to be protected. • **Tutor presentation:** introduce learners to how site activities can affect water resources – e.g. spillages, discharges, wastage, run-off, storage and mixing activities. • **Paired activity:** ask learners to work in pairs to investigate the following sources of land and soil pollution: o oil-based fuels o cement products o gypsum products o chemical agents o temporary site facilities. The focus of research should be on the impact of these on soil quality, groundwater quality and the potential pollution of drinking water. • **Plenary:** invite pairs to share findings of investigations and address any misunderstandings learners may have.	Tutor-created worksheets Pens and paper Internet access
7	**A2:** Impact of construction activities on the environment	GW	• **Lead-in:** review understanding of air and water pollution. • **Tutor-led discussion:** introduce learners to how the land and landscape can be affected in a variety of ways by construction activities. • **Small-group activity:** ask learners to work in pairs to produce a short presentation about the impacts of a given subject from the list below on the landscape: o landfill activities o fly tipping and litter o deforestation	Tutor-created worksheets Pens and paper Internet access

Lesson	Topic	Lesson type	Suggested activities	Classroom resources
			o acid rain o loss of greenbelt and green spaces o drainage and flooding. The focus of presentation should be on how visual amenity, soil quality, habitats and ecosystems are affected. • **Plenary:** invite groups to present their presentations to the class with the tutor addressing any errors or misunderstanding.	
8	**A2:** Impact of construction activities on the environment	GW/GS	• **Lead-in:** recap light from learning aim A1, asking learners questions to assess their understanding. • **Tutor presentation:** examine with learners how light pollution impacts the natural and built environments. If possible a guest speaker who is an expert on light pollution could be invited to speak to the class or produce a short presentation. • **Small-group activity:** ask learners to work in small groups to produce a short presentation about the impacts of one of the following types of finite resources used during construction activities: o oil-based products o ore- and mineral-based products o timbers and boards o stone o clay-based products. The presentation should include both current impacts and the impacts on future generations. • **Plenary:** review impacts discussed in presentations and clarify any misunderstandings.	Tutor-created worksheets Pens and paper Internet access Presentation software Guest speaker

Lesson	Topic	Lesson type	Suggested activities	Classroom resources
9	**A3:** Impact of new development on the environment	V	• **Visit:** arrange a site visit to introduce learners to the impacts of development on the natural environment. The visit should give learners an opportunity to make notes about the impact of development on: o traffic density o land use. The visit could be a walk around any built-up area where developments are taking place. • To cover development on a larger scale you could also show online videos that explains impacts of urbanisation. Some examples are given in the Resource section at the end of this document.	Site visit Tutor-created worksheets Online video Projector Internet access
10	**A3:** Impact of new development on the environment	GW	• **Tutor-led discussion:** lead a discussion that covers the four main areas of impact on the environment (increased traffic density, increased surface water run-off, loss of land and green space, and increased greenhouse gases and emissions). • **Lead-in:** discuss with learners their views on the impact of new development on the environment, considering the site visit/videos watched. • **Tutor-led discussion:** introduce learners to effects of new developments on surface water run-off and increased greenhouse gases and emissions. Discuss the overall impacts of these. • **Small group activity:** working in small groups, learners are given one of the four impacts to research and make notes about.	Tutor-created worksheets Pens and paper Internet access

Lesson	Topic	Lesson type	Suggested activities	Classroom resources
			• **Plenary:** discuss findings of research into impacts of new development. Explain this will form the basis of a report based on a case study.	
11	**A3:** Impact of new development on the environment	GW	• **Lead-in:** discuss with learners their views on the impact of new development on the environment based on previous research. • **Tutor presentation:** introduce learners to a case study scenario of a large development for which they will need to assess the impacts on the environment. • **Small group activity:** working in small groups, learners use the information in the case study and independent research to produce a short report that assesses the impact of the development in terms of: o traffic density o surface water run-off o loss of land and green space o increased greenhouse gases and emissions. • **Tutor-led discussion:** discuss findings made by groups and consider common themes. Use questions to assess understanding. • **Plenary:** draw together understanding of impacts on the environment and address any misconceptions.	Tutor-created worksheets Pens and paper Internet access Case studies
Learning aim B: Explore the methods of sustainable building design				
12	**B1:** Energy-based techniques	GW	• **Lead-in:** review understanding of factors that can impact the environment and discuss with learners how the construction industry could produce more sustainable buildings.	Tutor-created worksheets Pens and paper Internet access

Lesson	Topic	Lesson type	Suggested activities	Classroom resources
			• **Tutor presentation:** introduce learners to the learning aim by giving an overview of each of the four approaches in the learning aim. • **Tutor-led discussion:** introduce learners to methods that can be used to make buildings more energy efficient. • **Paired activity:** ask learners to research energy-efficient heating and ventilation systems that would be suitable for new buildings in the local area. • **Plenary:** discuss how efficient heating and ventilation can minimise impacts on the environment.	
13	**B1:** Energy-based techniques	GW	• **Lead-in:** review how efficient heating and ventilation systems improve the sustainability of buildings. • **Tutor-led discussion:** discuss with learners how high standards of insulation can complement efficient heating and ventilation systems. • **Tutor presentation:** introduce learners to approaches that can be used to achieve airtight buildings. • **Paired activity:** in pairs, learners research approaches to keeping a building airtight – e.g. windows and doors, and also methods of ventilation. • **Plenary:** discuss benefits of airtight buildings, questioning learners about ways in which it can be achieved.	Tutor-created worksheets Pens and paper Internet access
14	**B1:** Energy-based techniques	IS	• **Lead-in:** review prior knowledge of renewable and alternative sources of heat and power.	Tutor-created worksheets

Lesson	Topic	Lesson type	Suggested activities	Classroom resources
			• **Tutor presentation:** demonstrate types of renewable and alternative sources of heat and power. You could use an online video, e.g.: **YouTube:** 'Renewable Energy 101 | National Geographic' • **Visit:** if possible, learners could be taken to visit an example of a renewable installation. • **Individual activity:** learners carry out research then produce a presentation that can be shared with the remainder of the class. Learners should research one of the following: o small-scale wind turbines o roof-mounted photovoltaic cells o biomass boilers o ground and air source heat pumps. • **Plenary:** review research and discuss renewable installations that would be appropriate for use in local buildings.	Pens and paper Internet access Online video
15	**B2:** Materials-based techniques	GW	• **Lead-in:** review understanding of using energy-based techniques to reduce the impact of buildings on the environment. • **Tutor presentation:** introduce ways in which the selection and use of materials can impact on the sustainability of new buildings. Encourage learners to think not just about the use of materials, but also how they are produced and their life span. • **Paired activity:** learners research one of the six types of renewable materials listed in the unit content: o softwoods and associated timber products from sustainable forests o sustainable insulation	Tutor-created worksheets Pens and paper Internet access

Lesson	Topic	Lesson type	Suggested activities	Classroom resources
			o plant-based polymers o flax and associated products o hemp and associated products o recycled and reclaimed materials. Then they could produce a single-sided fact sheet about their material, which could be collated into a shared reference file. • **Plenary:** review how renewable materials can be used to improve the sustainability of buildings.	
16	**B2:** Materials-based techniques	PfA	• **Lead-in:** lead a preparation for assessment session on sustainable materials. • **Tutor presentation:** introduce learners to the concept of embodied energy and methods that can be used to minimise it during the production of materials. • **Paired activity:** ask learners to work in pairs to research a given material and consider the embodied energy during extraction, processing, manufacture, distribution and delivery of the material or components made from it. • **Tutor-led discussion:** consider more sustainable uses of materials. • **Individual activity:** ask learners to research the advantages of using durable and long-lasting materials and products. • **Plenary:** review reasons why embodied energy should be considered when choosing materials for a building project.	Tutor-created worksheets Pens and paper Internet access
17	**B3:** Waste-based techniques	GW	• **Lead-in:** introduce learners to learning aim B3 by showing them a video of modular construction, e.g.: **YouTube:** 'What is Prefabricated Construction? | ModSpace'	Tutor-created worksheets Pens and paper

Lesson	Topic	Lesson type	Suggested activities	Classroom resources
			• **Tutor-led discussion:** introduce learners to other approaches to offsite prefabrication of buildings and building elements. • **Small group activity:** ask small groups to investigate offsite prefabrication methods. Learners could use their research to produce a brief illustrated report that explains the benefits of prefabrication • **Tutor-led discussion:** discuss approaches used in local projects and why these are selected, then introduce benefits associated with modular materials. • **Plenary:** discuss the benefits of offsite prefabrication.	Internet access Online videos
18	**B3:** Waste-based techniques	GW	• **Lead-in:** review the benefits of prefabrication and modular materials. • **Tutor presentation:** introduce learners to modern methods of construction. This could be supported by a site visit or use of videos of modern methods of construction such as assembling a steel prefabricated building, e.g.: **YouTube:** 'Time lapsed construction of a 2 storey house' • **Small group activity:** working in small groups, learners investigate modern methods of construction used on local construction sites. • **Tutor-led discussion:** discuss the need for waste planning in construction. • **Individual activity:** working alone, learners investigate approaches to waste planning and how this impacts on the sustainability of a project. • **Plenary:** discuss the reasons why waste planning is beneficial for the environment.	Tutor-created worksheets Pens and paper Internet access Online videos

Lesson	Topic	Lesson type	Suggested activities	Classroom resources
19	**B4:** Methods of minimising the impact of development	GW	• **Lead-in:** review the impacts of developments that were considered in learning aim A. • **Tutor presentation:** introduce learners to approaches that can be used to minimise the impact of developments by traffic management. • **Small group activity:** investigate the use of traffic management techniques used in local developments. • **Tutor-led discussion:** discuss with learners a new development and introduce to them the issues that could be caused by traffic. • **Small-group activity:** encourage learners to develop a traffic management plan for the new development. • **Plenary:** discuss approaches taken by different groups to reduce the impact of traffic for the new development.	Tutor-created worksheets Pens and paper Internet access
20	**B4:** Methods of minimising the impact of development	GW	• **Lead-in:** review the impacts of increased developments on surface water run-off. • **Tutor presentation:** introduce learners to the concepts of sustainable urban drainage systems (SuDS) either through visits or the use of a video, e.g.: **YouTube:** 'Ever wondered where the rain goes? Sustainable drainage animation' • **Small-group activity:** divide the class into small groups to investigate: o delayed dispersal of surface water o temporary surface water storage o rainwater harvesting.	Tutor-created worksheets Pens and paper Internet access Online videos

Lesson	Topic	Lesson type	Suggested activities	Classroom resources
			Learners produce fact sheets for the topic they have investigated and share with the whole class. • **Tutor-led discussion:** discuss with learners the concepts of carbon offsetting. • **Small-group activity:** ask small groups to investigate carbon offsetting. This should include the ways in which it can be done and the benefits it brings to areas of development. • **Plenary:** discuss methods of minimising impacts of development.	
21	Learning aims A and B	PfA	• **Preparation for assessment of learning aims A and B:** divide the class into small groups and give each group a different set of research topics. Ask each group to produce responses to scenarios. On completion, resources can be photocopied and shared with the other groups as preparation materials for their assessment.	Practice tasks and scenarios Internet access
22	Learning aims A and B	AW	• **Assignment writing:** learners use this session to complete assessment activities for learning aims A and B. • **Tutor presentation:** discussion of approaches to answer questions and complete assessment activities, to emphasise/embed good practice in relation to providing evidence for merit and distinction criteria.	Assignment brief Paper and pens
Learning aim C: Examine alternative energy sources				
23	**C1:** Renewable methods of electricity generation	GW	• **Lead-in:** review the use of renewable and alternative sources of heat and power introduced in learning aim B1. • **Tutor presentation:** introduce to learners the five main types of renewable methods for electricity generation.	Tutor-created worksheet Projector or interactive board

Lesson	Topic	Lesson type	Suggested activities	Classroom resources
			• **Paired activity:** ask learners to research the use of renewable energy locally, both for micro-generation at individual properties and also for national supply. • **Tutor-led discussion:** discuss the benefits and drawbacks of renewable methods of electricity generation. • **Plenary:** review learning and understanding of the five types of renewable energy.	Internet access
24	**C1:** Renewable methods of electricity generation	IS/GW	• **Lead-in:** use questioning to determine prior understanding and knowledge of wind and solar power generation. • **Tutor presentation:** introduce learners to small scale and large scale solar and wind power installations. • **Individual activity:** ask learners to investigate solar power generation and produce a short report that considers the benefits and drawbacks of a small-scale installation and compares it to a large-scale solar farm. • **Tutor presentation:** review the use of wind as a source of power. • **Small group activity:** in groups, learners investigate the use of wind power. Groups could look at various different types of wind power installation and then discuss these as a class. • **Plenary:** review understanding of the benefits and drawbacks of solar and wind power for generating electricity.	Tutor-created worksheet Calculators Drawing equipment Projector or interactive board to demonstrate examples
25	**C1:** Renewable methods of electricity generation	GW/IS	• **Lead-in:** review the benefits of solar and wind power. Ask learners questions about whether these apply to all types of renewable energy.	Tutor-created worksheet

Lesson	Topic	Lesson type	Suggested activities	Classroom resources
			• **Tutor presentation:** introduce learners to hydroelectric, and tidal and wave power generation. The use of an online video might be appropriate, e.g.: **YouTube:** 'Hydroelectric Power' • **Small group activity:** ask groups to investigate where hydroelectric and tidal power generation schemes have been successful either locally or internationally. • **Tutor-led discussion:** introduce learners to biomass power stations and discuss the benefits and drawbacks of these. • **Individual activity:** ask learners to investigate the differences between small scale and industrial scale biomass systems. • **Plenary:** set a homework activity to suggest types of renewable energy generation for a range of scenarios.	Projector or interactive board Internet access Online video
26	**C2:** Sources of heating and cooling	GW	• **Lead-in:** review the use of small-scale energy efficient systems for heating and ventilation covered previously. • **Tutor-led discussion:** introduce to learners the principles of ground and air source heat pumps. • **Paired activity:** ask learners to investigate the use of ground source heat pumps and air source heat pumps, and how these can be used for both heating and cooling. Learners should also investigate geothermal heating at this stage. • **Tutor presentation:** introduce learners to the concepts of district heating systems. If locally available, a visit would be useful. An online video could also be used, e.g.:	Tutor-created worksheet Projector or interactive board Internet access Online video

Lesson	Topic	Lesson type	Suggested activities	Classroom resources
			YouTube: 'COWI "Just imagine" district heating & cooling from Denmark' • **Small group activity:** ask groups to investigate a given district heating scheme. Each group could feed back to the class the benefits of their district heating scheme and compare different types that are used in different countries. • **Plenary:** discuss environmental benefits of heat pumps and district heating schemes.	
27	**C2:** Sources of heating and cooling	IS	• **Lead-in:** review the use of biomass and combined heat and power (CHP) for small-scale installations and how these can be seen as being sustainable. • **Tutor-led discussion:** discuss biomass boilers and combined CHP installations. Ask learners questions about the benefits and drawbacks of each. • **Individual activity:** ask learners to research the use of biomass and CHP installations that are use locally/internationally and report on the benefits and drawbacks of each. • **Plenary:** discuss the use of small scale and industrial scale heating and cooling systems with a focus on suitability for the location.	Tutor-created worksheet Projector or interactive board Internet access
28	Learning aim C	PfA	• **Preparation for assessment:** divide the class into small groups. Give each group a different specification topic. Ask each group to design question cards, posters and booklets for their topic in preparation for their assessment. On completion, resources can be photocopied and shared with the other groups as preparation materials.	Tutor-created questions Internet access Paper and pens

Lesson	Topic	Lesson type	Suggested activities	Classroom resources
29	Learning aim C	PfA	• **Mock assignment:** learners sit a mock assignment including a number of scenarios where they need to select and justify their choice of a renewable energy generation systems and heating or cooling system. • **Mock assignment results:** go through the mock assignment with the class.	Practice assignment and scenarios Internet access
30	Learning aim C	PfA	• **Assignment writing:** learners use this session to complete assessment activities for learning aim C. • **Tutor presentation:** discussion of approaches to answer questions and complete assessment activities, to emphasise/embed good practice in relation to providing evidence for merit and distinction criteria.	Assignment brief

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