



Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination 2026

Construction Studies
Theory - Higher Level

(300 marks)

Thursday, 11 June
Afternoon, 2:00 - 5:00

- (a) Answer **any five** questions.
- (b) All questions carry equal marks.
- (c) Answers must be written in ink.
- (d) Drawings and sketches are to be made in pencil.
- (e) Write the number of the question distinctly before each answer.
- (f) Neat freehand sketches to illustrate written descriptions should be made.
- (g) The name, sizes, dimensions and other necessary particulars of each material indicated must be noted on the drawings.

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1. The sketch shows a dwelling house with a traditional slated cut roof. The roof has a pitch of 30° and is highly insulated at ceiling joist level. The internal span of the house is 5.8 metres. The walls of the house are of 450 mm rendered concrete block construction with a full-fill insulated cavity.

- (a) To a scale of 1:10, draw a vertical section through one half of the roof structure, from just below eaves up to the ridge. Show one external wall and one rafter length. Include the typical construction details from 600 mm below the ceiling joists up to the ridge, **and** include **three** courses of slate at eaves.

Include **four** typical dimensions.

- (b) On your drawing, show the typical design detailing that will ensure airtightness at the junction of the ceiling and the external wall.



2. Lifetime use of a dwelling should be a key consideration at the design stage.

- (a) Using notes and freehand sketches, discuss **two** best-practice guidelines that should be followed when designing for lifetime use at **each** of the following areas of a dwelling:

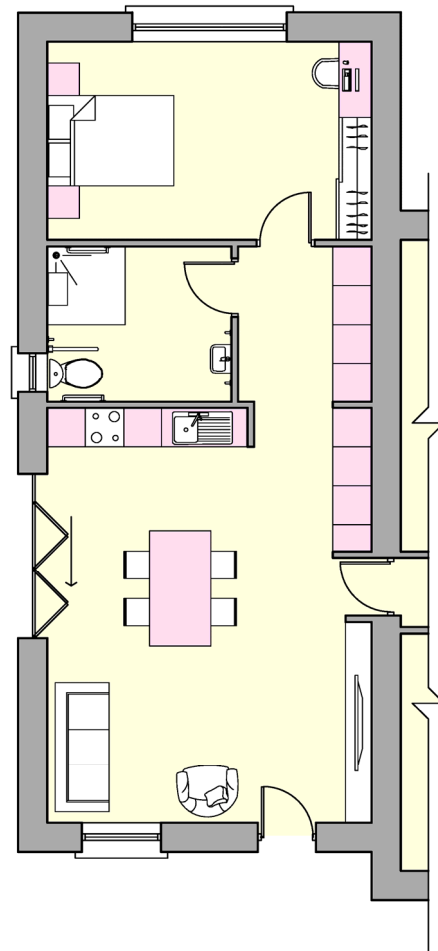
- entrance access
- bathroom.

- (b) The drawing shows the ground floor plan of a draft design for an adjoining garage conversion. The homeowner wishes to convert the garage, so that a family member with reduced mobility can live independently.

With reference to the design shown, using notes and freehand sketches, discuss **three** specific design considerations for the open-plan kitchen/dining and living area, that ensures ease of use by a person with reduced mobility.

Indicate on your sketches, typical dimensions as appropriate.

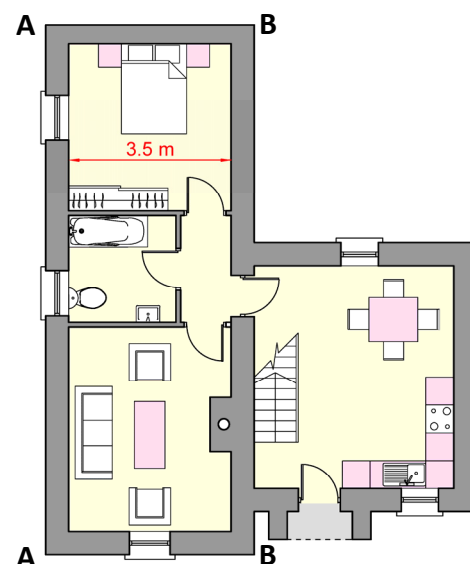
- (c) Discuss in detail **two** reasons why it is important to consider lifetime use at the design stage of a dwelling.



3. The drawing shows the front elevation and ground floor plan of a farmhouse built in the 1920's. The wall **A-A** is south-facing and the wall **B-B** is load-bearing. The owners wish to build a single-storey extension, no greater than 15 m² in area, to increase and revise the ground floor layout.

Consideration at the design stage is to be given to:

- creating an open-plan kitchen/dining and living space
 - optimising daylight
 - retaining a bedroom and family bathroom on the ground floor.
- (a) Using notes and freehand sketches, show a revised ground floor layout, that incorporates the proposed extension, and **each** of the above design requirements.
- (b) Discuss **three** reasons for your proposed design layout.
- (c) Discuss **two** benefits to the occupants of revising the internal layout of an existing house.



4. The sketch shows a railway keepers cottage built over 130 years ago. These traditional cottages can be seen at railway crossing points throughout our rural landscape. They form an important part of our built heritage.

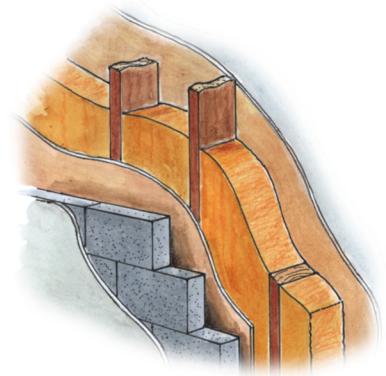
- (a) A survey of the cottage reveals:
- 500 mm solid external wall of stone construction, uninsulated, with an internal lime render
 - uninsulated traditional cut roof with natural slate
 - single-glazed, softwood sliding sash windows.



Select any **two** of the above areas and, using notes and freehand sketches, describe in detail the steps involved in upgrading the thermal performance of **each** area selected in a manner that respects the original character of the cottage.

- (b) Discuss the importance of any **two** of the following when restoring traditional heritage buildings:
- conservation of original materials
 - breathable structure
 - respect for our built heritage.

5. Shown in the sketch is the proposed external wall design detail for a new house of timber frame construction.



- (a) Calculate the U-value of the proposed wall, given the construction has the following sequence and data:

External render	thickness	16 mm
External concrete block	thickness	100 mm
Clear cavity	width	60 mm
Oriented Strand Board (OSB)	thickness	12 mm
Timber stud	thickness	250 mm
Insulation between studs	thickness	250 mm
Oriented Strand Board (OSB)	thickness	12 mm
Plasterboard	thickness	12.5 mm

Thermal data of the external wall:

Resistance of external surface	(R)	0.048	m ²	°C/W
Resistivity of external render	(r)	2.170	m	°C/W
Conductivity of concrete block	(k)	1.440	W/m	°C
Resistance of clear cavity	(R)	0.440	m ²	°C/W
Conductivity of OSB	(k)	0.130	W/m	°C
Conductivity of insulation	(k)	0.039	W/m	°C
Conductivity of OSB	(k)	0.130	W/m	°C
Conductivity of plasterboard	(k)	0.250	W/m	°C
Resistance of internal surface	(R)	0.130	m ²	°C/W

Note: The timber studs need not be considered in your calculations.

- (b) Using the U-value of the wall obtained at 5(a) above and the following data, calculate the cost of heat lost annually through this wall:

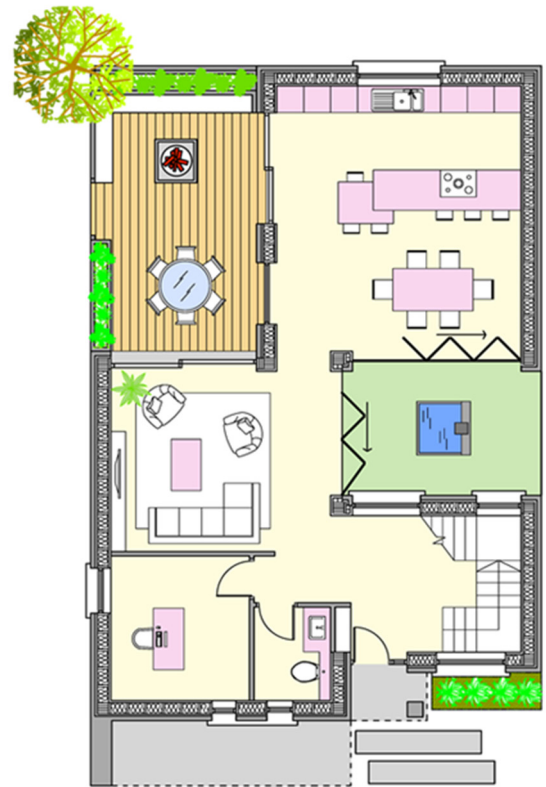
• area of external wall	144 m ²
• average internal temperature	20 °C
• average external temperature	7 °C
• heating period	6 hours daily for 33 weeks per annum
• cost of wood pellets	55 cent per kg
• calorific value of wood pellets	17350 kJ per kg
• 1000 watts	1 kJ per second.

- (c) Using notes and freehand sketches, show the typical design detailing that will prevent the build-up of moisture within the timber frame structure.

6. The elevation and ground floor plan of a house are shown. The external walls are of timber frame construction with a rendered concrete block, locally sourced timber cladding, and stone finish. Space heating is provided using a renewable heat source. The house is designed to increase the occupants' connection with nature and to have a low environmental impact.



- (a) With reference to the design shown, discuss using notes and freehand sketches, **three** features of the design that contribute to the house having a low environmental impact.
- (b) Discuss using notes and freehand sketches, **two** features of the design that contribute to increasing the occupants' connection with nature.
- (c) Discuss in detail **two** advantages of designing a house that will enhance the connection to nature for the occupants.



7. The main hallway of a two-storey dwelling has an open riser wooden stairs. The newel post is 120 mm × 120 mm. The rise of the step should not exceed 175 mm.

- (a) To a scale of 1:5, draw a vertical section through the centre of the stairs. The section should show the typical construction details through the bottom **three** steps of the stairs, showing the newel post, balusters, string, and handrail. Include the typical dimensions of **three** structural members of the stairs.
- (b) On your drawing, show **two** design details of an open riser stairs that will ensure the stairs is safe for all users.



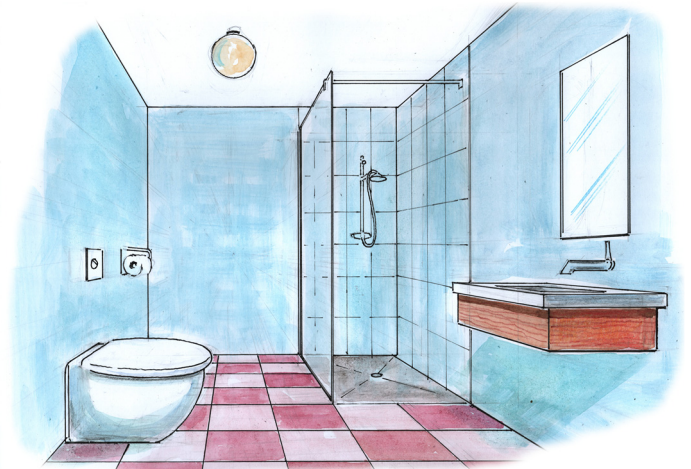
8. A bedroom with an en-suite bathroom is located on the first floor of a dwelling house.

(a) Discuss **two** considerations that should be taken into account when planning the drainage layout of a bathroom located on the first floor of a house.

(b) Using notes and freehand sketches, show the above-ground pipework necessary for the safe removal of waste from the following appliances:

- shower
- water closet (W.C.)
- wash basin.

Include on your sketch typical sizes of the soil and vent pipe (svp) **and** the waste pipe from each appliance.



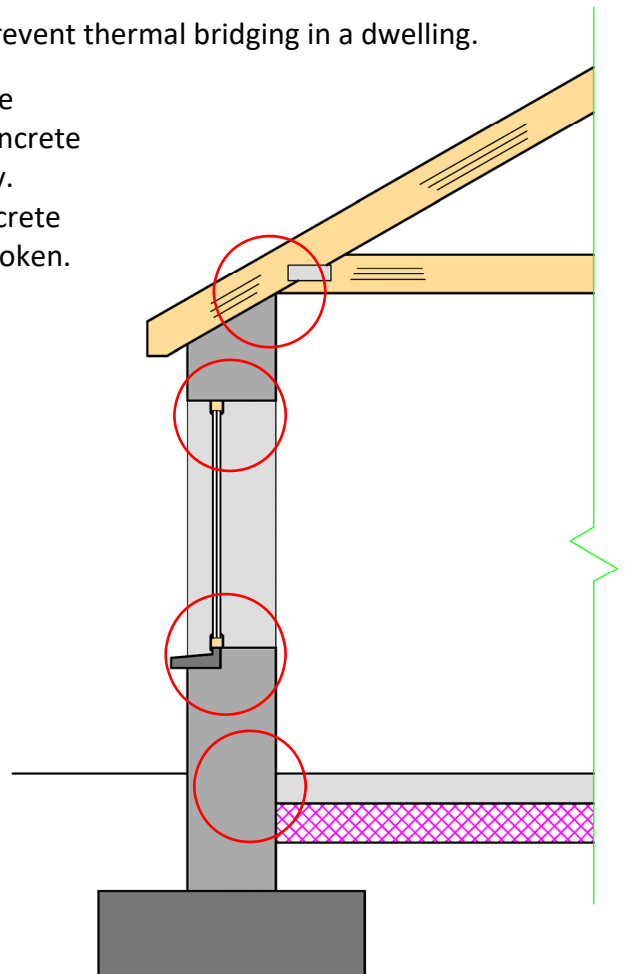
(c) Using notes and freehand sketches, outline **one** design detail in above-ground pipework that will prevent foul odours entering a dwelling.

9. A continuous thermal envelope is essential to prevent thermal bridging in a dwelling.

The drawing shows a vertical section through the external leaf of a bungalow having a 450 mm concrete block wall with a 250 mm full-fill insulated cavity. The house has a truss roof and an insulated concrete ground floor. The window frame is thermally broken.

(a) Using notes and freehand sketches, show best practice design detailing that will prevent the formation of a thermal bridge at **any three** locations circled on the drawing.

(b) Discuss in detail **two** benefits to the homeowner of eliminating thermal bridging.



10. EnerPHit is a certified standard that can be achieved when retrofitting an older house to improve its energy efficiency. The sketch shows a bungalow which has been retrofitted to the EnerPHit Passive House standard.

(a) Select any **three** areas of the building fabric of an older house that would need to be retrofitted to achieve the EnerPHit Passive House standard.
Give a reason for each area selected.

(b) Discuss in detail, using notes and freehand sketches, how you would retrofit **each** of the areas you specified at **10(a)** above, to achieve the EnerPHit Passive House standard.



(c) Describe using notes and freehand sketches, **one** test that could be carried out to determine the efficiency of the retrofit.

OR

10. “It would be reasonable to assume that ensuring good indoor air quality would be a key factor when designing and constructing buildings. The term sick building syndrome became well known in the 1980’s and still lingers today, though largely associated with poorly air-conditioned offices. However, the health impacts of buildings are still poorly understood and rarely taken into account as a key priority when buildings are designed or renovated. Architects, when specifying building materials are mainly concerned with cost, availability, robustness and aesthetics, not their impacts on health.”

Adapted from: ***Building Materials, Health and Indoor Air Quality: No Breathing Space***
by Tom Wooley

Published by: Routledge. ISBN: 978-1138934498

(a) Discuss the above statement in detail.

(b) Propose **three** best practice guidelines that would ensure a healthy indoor environment in our homes.

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