



Pre-Leaving Certificate Examination, 2019

Construction Studies

Theory - Higher Level

(300 marks)

Time: 3 Hours

- (a)*** Answer **Question 1** and **four** other 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.

1. A front porch, which projects 1.5 metres from the external wall of a dwelling house, has a flat roof, as shown. The roof of the porch is insulated and is covered with layers of bituminous felt, on plywood decking, on 200 mm × 40 mm roof joists.

Insulated plasterboard is fixed to the underneath of the roof joists. The external wall of both the porch and the house is a 400 mm wall of concrete block construction with a full-fill insulated cavity. The window of the porch is triple-glazed, with a thermally broken wooden frame.

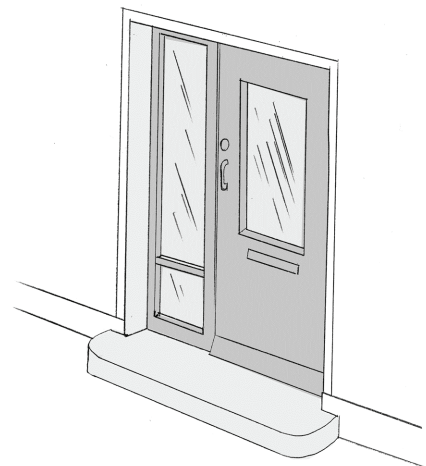


- (a) To a scale of 1:5, draw a vertical section through the porch, showing the external wall of the porch, the flat roof, the window of the porch, and the front wall of the house. Show the typical construction details from a level 300 mm below the fixed frame of the porch window, through the walls, the window head, lintels and flat roof to a level 400 mm above the abutment of the flat roof and the front wall of the house. Include **four** typical dimensions.
- (b) On your drawing, show clearly the design detailing to prevent the ingress of rainwater at the junction between the roof of the porch and the front wall of the house.

Note: Position your drawing carefully to ensure that the answer fits on the drawing sheet.

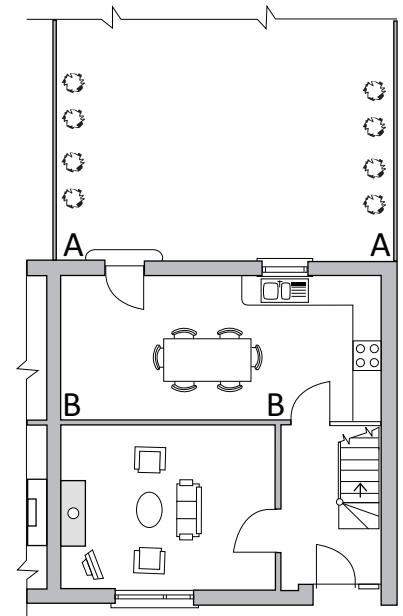
2. The drawing shows the main entrance to a dwelling house. The owners have decided to make a number of changes to the entrance of the dwelling to facilitate access for everyone, including those with reduced mobility.

- (a) Discuss in detail **three** features to be provided at the main entrance to the dwelling to ensure that everybody can enter the house without assistance.
- (b) For **each** feature discussed at 2(a) above, show, using notes and freehand sketches, appropriate design detailing to ensure that the main entrance to the dwelling house is safe and comfortable for all users.



- (c) Discuss in detail **two** reasons why provision for lifetime use should be considered at the design stage of a dwelling.

3. The drawing shows the ground floor plan of a two-storey semi-detached house and a portion of the rear garden. The external walls of the house are 350 mm concrete block walls with a full-fill insulated cavity. The rear wall **A-A** is south facing. The internal walls are of 100 mm solid block construction and the internal wall **B-B** is load-bearing. The owners intend to undertake a self-build single-storey extension, not greater than 16 m² in area, to the rear of the existing kitchen.

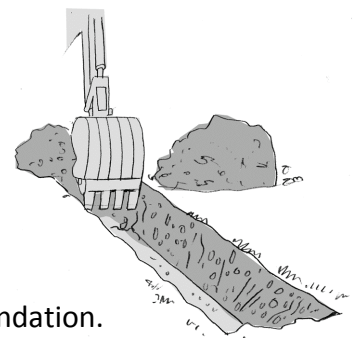


- (a) Using notes and freehand sketches, show a proposed design layout for the extension that will enhance the living space and also be sensitive to the garden.
- (b) Using notes and freehand sketches, discuss **three** advances in glazing technology that make modern glazing systems more energy efficient.
- (c) Self-building as a method of construction may be a suitable alternative to the engagement of construction professionals. Recommend **three** best practice guidelines that should be observed when undertaking a self-build project to ensure that it meets the requirements of the current Building Regulations.

4. (a) Discuss in detail, using notes and freehand sketches, **two** functional requirements of a foundation suitable for a dwelling house.

- (b) A trial hole at the site for a new two-storey dwelling house indicates that the subsoil is of low bearing capacity. Consideration is being given at the design stage to using either:
- a raft foundation **or**
 - a piled foundation.

Using notes and freehand sketches, show the typical design detailing for **each** type of foundation. Recommend a preferred foundation for the house and give **two** reasons for your recommendation.

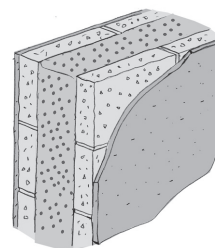


- (c) The strength of concrete depends on a number of factors. Discuss the importance of **each** of the following when manufacturing concrete:
- curing
 - placing
 - reinforcement
 - water / cement ratio.

5. The external wall of a house is of concrete block construction and has a full-fill insulated cavity, with polystyrene bead insulation, as shown.

- (a) Calculate the U-value of the external wall of the dwelling, given the following data:

External render	thickness	16 mm
Concrete block outer leaf	thickness	100 mm
Cavity	width	150 mm
Concrete block inner leaf	thickness	100 mm
Internal plaster	thickness	12 mm



Thermal data of the external wall:

Resistance of external surface	(R)	0.048	m ²	°C/W
Conductivity of external render	(k)	0.720	W/m	°C
Conductivity of concrete blocks	(k)	1.440	W/m	°C
Conductivity of insulation	(k)	0.031	W/m	°C
Resistance of internal surface	(R)	0.104	m ²	°C/W
Resistivity of internal plaster	(r)	4.545	m	°C/W

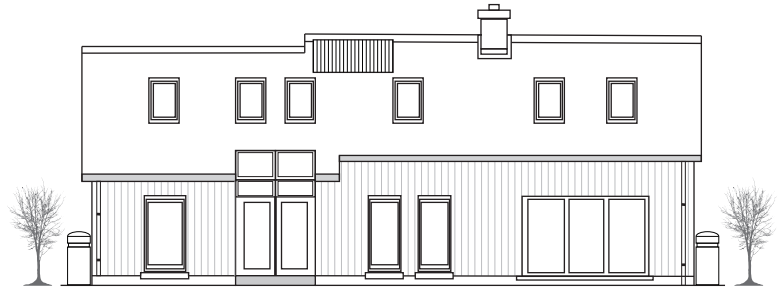
- (b) Using the U-value of the external wall obtained at 5(a) above and the following data, calculate the cost of heat lost annually through this wall:

• area of external wall	120 m ²
• average internal temperature	18 °C
• average external temperature	7 °C
• heating period	8 hours daily for 30 weeks per annum
• cost of oil	96 cent per litre
• calorific value of oil	37350 kJ per litre
• 1000 Watts	1 kJ per second.

- (c) It is proposed to upgrade the thermal properties of the wall, to meet Passive House standard, by fixing expanded polystyrene to the external surface. Given the thermal conductivity (k) of expanded polystyrene as 0.037 W/m °C, calculate the thickness of expanded polystyrene required to achieve a U-value of 0.15 W/m °C.

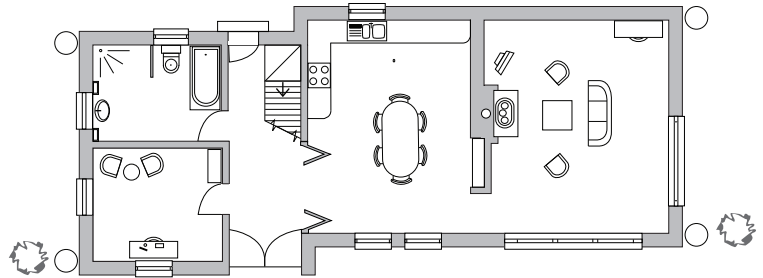
6. Planning permission has been obtained for an eco-friendly house. The external walls of the house are of timber frame construction and finished externally with rendered cement board and cedar cladding, as shown.

- (a) Discuss in detail, using notes and freehand sketches, **three** features of the given design that contribute to making the house eco-friendly.



- (b) Using notes and freehand sketches, discuss the importance of **each** of the following when designing a house to have a low environmental impact:

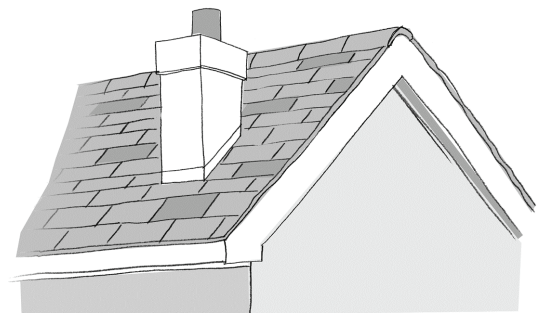
- compact form
- sourcing of materials
- low operating costs.



- (c) The on-site production of renewable energy has become a feature of many eco-friendly house designs. Discuss in detail **two** advantages of generating renewable energy on-site.

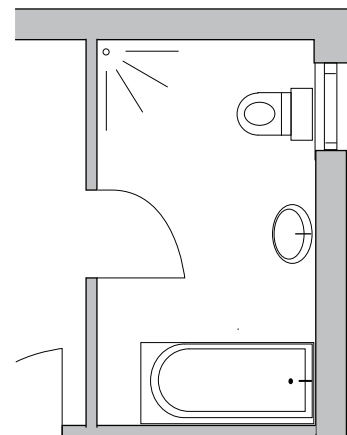
7. A solid concrete block chimney stack, with a sand/cement external render, projects through the pitched roof of a house as shown. The roof is a slated cut roof and is pitched at 45°.

- (a) To a scale of 1:5, draw a vertical section through the chimney stack and roof structure. Show the typical construction details of the chimney stack, flue, chimney capping and a portion of the adjoining roof structure. Include the design details necessary to prevent the penetration of water between the chimney stack and the adjoining roof surface.



- (b) Show clearly on your drawing **two** design features that will prevent a downdraught. Include typical dimensions.

8. The drawing shows the layout for a main bathroom located on the first floor of a dwelling house.



- (a) It is proposed to attach the waste pipe of each of the fittings shown in a single stack above-ground drainage system. Using notes and freehand sketches, show the pipework necessary in a single stack system for the safe removal of waste water from the shower, wash hand basin, bath and W.C. Include the typical size of the waste pipe for each fitting.
- (b) Using notes and freehand sketches, show **two** design details that ensure the pipework in an underground drainage system is watertight.
- (c) Discuss in detail, using notes and sketches, the operating principles of a wastewater treatment system suitable for a dwelling house in a rural setting.

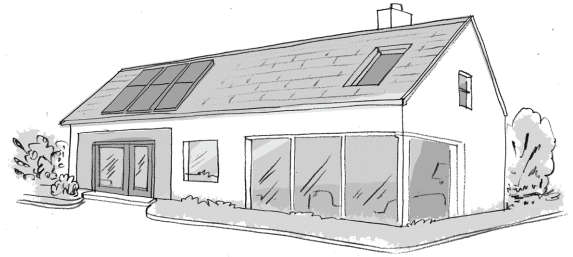
9. (a) Two electrical lights in a domestic dwelling, as shown, are controlled by a single switch. Using notes and freehand sketches, show the design of a typical electric circuit for the lights. Show the circuit from the consumer electrical distribution board to the light points and the switch. Indicate the following on your sketch:



- typical sizes of electrical cables
 - colour coding on electrical cables.
- (b) Using notes and freehand sketches, show **two** safety features that should be incorporated into the design of the above circuit to ensure that the circuit is safe for all users.
 - (c) The rising cost of energy requires home owners to be more economical in their use of electricity in the home. Discuss in detail **two** strategies that would ensure the economical use of electricity in the home.

10. (a) Using notes and freehand sketches, discuss the importance of any **two** of the following in Passive House design:

- airtight building envelope
- thermal mass
- indoor air quality.



(b) Show, using notes and freehand sketches, best practice design detailing to minimise heat loss and maximise heat storage in a Passive House foundation. Include the ground floor and give typical dimensions as appropriate. Indicate on your sketch the design detail that will prevent the formation of a thermal bridge at the junction between the wall and the floor.

(c) Using notes and freehand sketches, discuss how orientation **and** building form ensure the optimum thermal performance of a Passive House.

OR

10. Our market towns and villages sit alongside more modern, but equally distinctive settlements that knit modern architecture with the existing historic urban heritage. Investment in our towns and villages through regeneration, public realm improvements and the appropriate adaptation and re-use of our built heritage, are key factors in developing, promoting and investing in a sense of place.

From: **Project Ireland 2040: National Planning Framework**
Department of Housing, Planning and Local Government (2018)

Discuss the above statement in detail and propose **three** best practice guidelines that would promote the preservation and adaptation of historic buildings in Ireland.

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