



Pre-Leaving Certificate Examination, 2018

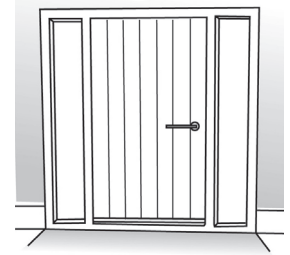
Construction Studies
Theory - Higher Level

(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 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. The main entrance to a dwelling is designed to allow access for everyone. The door shown is a high performance insulated wooden door with vertical sheeting on both sides. The door frame is 150 mm × 70 mm in cross-section and is fixed in the external wall. The external wall consists of a 100 mm concrete block outer leaf, a 200 mm timber frame inner leaf and a 60 mm insulated service cavity. The ground floor is an insulated solid concrete floor with a 20 mm quarry tile finish.



- (a) To a scale of 1:10, draw a vertical section through the centre of the door. Show the typical construction details from 500 mm below the finished floor, through the floor, the threshold, the external wall, the door and door frame to a level 300 mm above the concrete lintels over the door frame. Include **four** typical dimensions.
- (b) On your drawing show clearly the design detailing that ensures ease of access for all persons.

2. (a) Discuss in detail the importance of **each** of the following in ensuring the safety of all workers on a construction site:

- safety statement
- teamwork.

- (b) Discuss in detail, using notes and freehand sketches, **two** specific safety procedures that should be observed when carrying out the following:

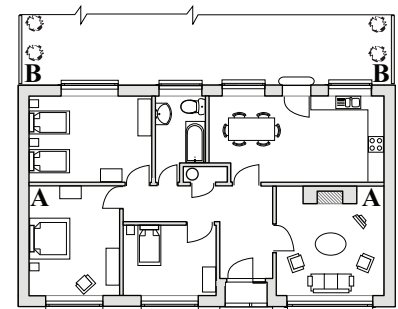
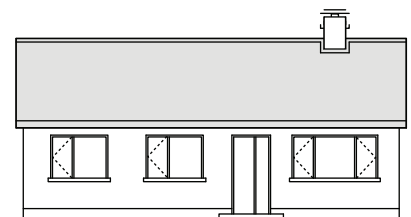
- laying pipes in a deep trench
- fitting a window lintel in the second storey of a dwelling house.



- (c) Recommend **three** best practice guidelines that should be observed when using electrical tools on a construction site.

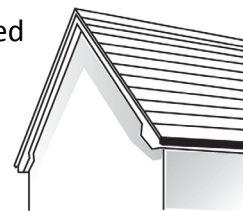
3. The drawing shows the plan and front elevation of a bungalow built in the 1970s. The house is of traditional construction with a slated cut roof and a 300 mm external cavity wall of concrete block construction. The internal walls are of 100 mm solid block construction and the internal wall **A-A** is a load bearing wall. The rear wall of the house **B-B** is south facing. The owners intend to build an extension to the kitchen at the rear of the house. Consideration at the design stage is to be given to:

- optimising daylight potential into **both** the extension and the existing kitchen
- redesigning the layout of the interior to maximise solar gain.



- (a) Using notes and freehand sketches, show a proposed design layout that incorporates **each** of the above requirements.
- (b) Discuss, using notes and freehand sketches, **three** advantages of natural light in a kitchen area.
- (c) The proposed extension will reach further into the garden area of the dwelling. Discuss **two** advantages of linking a space with the rear garden.

4. (a) Discuss, using notes and freehand sketches, **three** functional requirements of a roof suitable for a new dwelling house.
- (b) Using notes and freehand sketches, show **two** different types of pitched roof structure suitable for a dwelling house with an internal span of 7.0 metres and one internal supporting wall. Show the design detailing required to ensure the stability of the roof and include the typical dimensions of **three** roof members for **each** roof type selected.
- (c) Recommend a preferred roof structure for a new dwelling house and give **two** reasons for your choice.

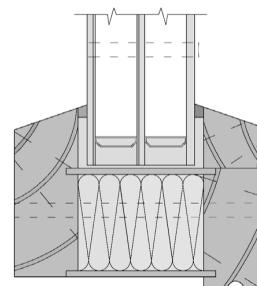


5. A section through a triple-glazed, high performance wooden window is shown. The frame is a thermally broken, insulated frame as shown. Two of the panes of glass have a low-emissivity (low-e) coating and the spaces between the panes are filled with argon gas.

- (a) Calculate the U-value of **each** of the following, given the following data:

- the thermally broken frame
- the triple-glazed argon-filled glazing unit.

Glass	thickness	4 mm
Space between panes of glass	each space	20 mm
Wood in thermally broken frame	each piece	35 mm
Rigid insulation	thickness	50 mm



Thermal data of thermally broken frame:

Resistance of external surface of frame	(R)	0.950	m ²	°C/W
Conductivity of wood	(k)	0.150	W/m	°C
Conductivity of rigid insulation	(k)	0.021	W/m	°C
Resistance of internal surface of frame	(R)	1.400	m ²	°C/W

Thermal data of triple-glazed unit:

Resistance of external surface of glass	(R)	0.075	m ²	°C/W
Conductivity of glass	(k)	1.050	W/m	°C
Conductivity of argon gas	(k)	0.160	W/m	°C
Resistance of internal surface of glass	(R)	0.110	m ²	°C/W
Total resistance of the low-e panes of glass	(R)	3.400	m ²	°C/W

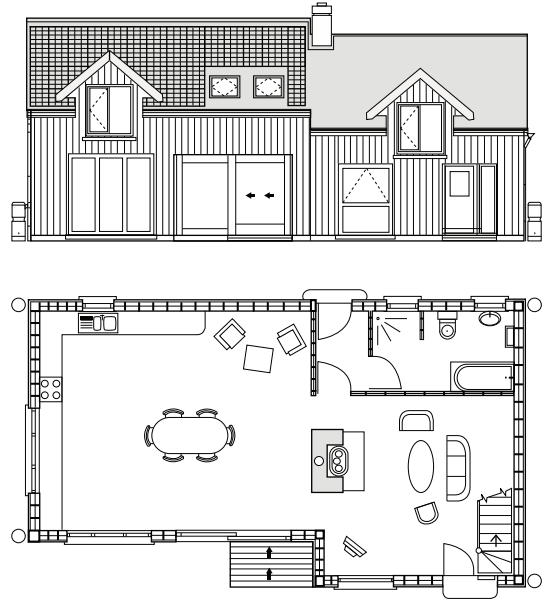
- (b) Using the U-value of the triple-glazed argon-filled glazing unit obtained at 5(a) above and the following data, calculate the heat lost annually through the glazed unit:

Area of glazing	90 m ²
Average internal temperature	17 °C
Average external temperature	6 °C
U-value of glazing unit	as calculated above
Heating period	8 hours per day, every day, for 38 weeks per annum
Cost of oil	94 cent per litre
Calorific value of oil	37350 kJ per litre
1000 Watts	1 kJ per second.

- (c) Using notes and freehand sketches, show best practice design detailing to prevent the ingress of water at the window head.

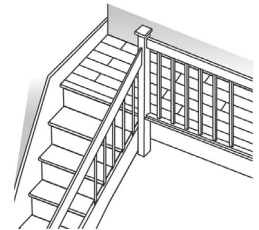
6. The drawing shows a dwelling house, which has three bedrooms and a bathroom upstairs. The house is of timber frame construction with an external rainscreen of native larch. The house is designed to be eco-friendly.

- (a) Using notes and freehand sketches, discuss in detail **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 an eco-friendly house:
- scale and layout
 - flexibility of the design
 - choice of materials.
- (c) Discuss in detail **two** advantages of designing nearly zero energy buildings (NZEB) in the 21st century.



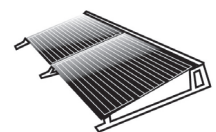
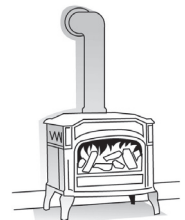
7. The top portion of a closed-string wooden stairs leads to a first floor landing, as shown. The landing has a tongue and groove hardwood floor, on 200 mm × 50 mm joists with a plasterboard ceiling beneath. The newel post is 100 mm × 100 mm and the rise of a step should not exceed 175 mm.

- (a) To a scale of 1:5, draw a vertical section through the centre of the stairs to include the landing. Show the typical construction details through the top three steps of the stairs and the landing. Include the typical handrail height to both the stairs **and** the landing. Include **three** typical dimensions.
- (b) On your drawing, show **two** design features that ensure that the stairs is safe for all users.



8. A wood-burning stove is to provide central heating for a new two-storey dwelling house. The stove combined with a solar collector will provide hot water for the dwelling.

- (a) Using notes and a single-line diagram, show a typical design layout for both the heating system **and** the hot water system. Show **two** independently controlled heating zones, one on each floor, and include **three** radiators on each floor. Indicate the location of the control valves and give typical sizes of the pipework.
- (b) The location of a solar collector is an important consideration to ensure its maximum efficiency. Using notes and freehand sketches, show a preferred location for a solar collector on a newly constructed dwelling.
- (c) Using notes and sketches, discuss **two** considerations that should be taken into account at the design stage of the house when selecting the location for the stove which would be used to provide central heating and hot water for the house.

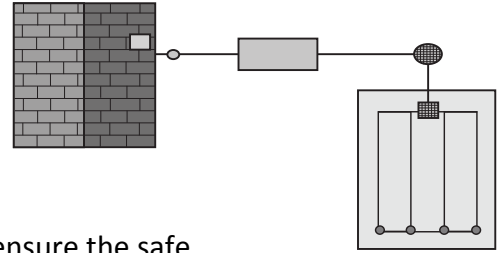


9. The drawing shows a layout for an on-site wastewater treatment system for a new single dwelling house.

(a) Describe in detail, using notes and freehand sketches, the operating principles of a conventional septic tank system.

(b) Show, using notes and freehand sketches, the typical design detailing for the percolation area to ensure the safe treatment of waste from the septic tank. Include dimensions as appropriate.

(c) Discuss in detail **three** reasons why a proposed site for a dwelling house may be unsuitable for a conventional septic tank wastewater treatment system.



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

- wall design
- windows and glazing
- space heating demand.

(b) Using notes and freehand sketches, discuss the importance of orientation in the siting of a Passive House. Show the sun path in your sketch.

(c) Avoiding overheating in summer is an important consideration in Passive House design. Using notes and freehand sketches, show **two** design details that would reduce the possibility of overheating.



OR

10. Ireland's historic houses are an important part of our social, cultural and architectural heritage. They are an essential thread of our national story and a great source of local community pride. Historic houses provide a passageway to the past, and help preserve our unique cultural and built heritage tradition.

An Action Plan for the Sustainable Future of the Irish Historic House in Private Ownership – Foreword by Heather Humphreys, T.D.
Published by: Department of Culture, Heritage and the Gaeltacht, 2015.

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

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