Pre-Leaving Certificate Examination, 2014

Construction Studies

Theory - Higher Level

(300 marks)

Time: 3 Hours

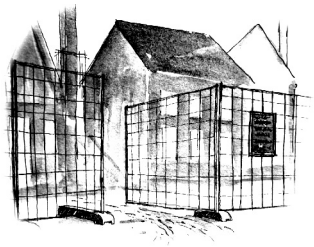
(a) *Answer* ***Question 1*** *and* ***four*** *other questions.*
(b) *All questions carry equal marks.*
(c) *Answers must be written in ink.*
(d) *Drawings and sketches to be made in pencil.*
(e) *Write the number of the question distinctly before each answer.*
(f) *Neat freehand sketches to illustrate 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. A double glazed hardwood window is fitted in the cavity wall of a new building, as shown in the accompanying sketch. The external wall is a 350 mm concrete block wall with an insulated cavity. The wall is plastered and constructed to latest building regulations.

(a) To a scale of 1:5, draw a vertical section through the wall and window. The section should show the typical construction details from 300 mm below the concrete cill to 300 mm above the head of the double glazed window.

(b) Indicate on your drawing **two** specific design details that ensure moisture does not penetrate to the inner leaf of the new building.

2. The safety of workers and correct safety procedures are concerns for all professions engaged in working on an active building site.



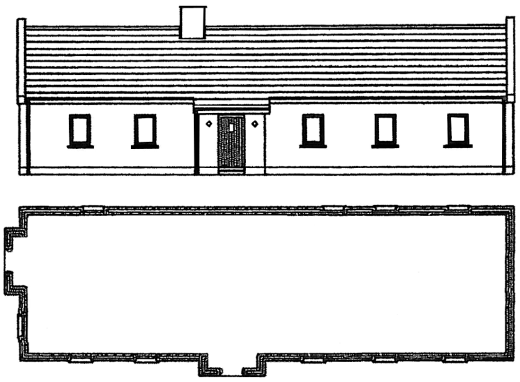
(a) Identify **two** possible risks to personal safety associated with **each** of the following:

- carrying out a deep excavation on a building site
- working around a stairwell on an upper floor before the stairs are fitted
- erecting scaffold around a building to allow maintenance work to be carried out.

(b) Using notes and freehand sketches as appropriate, outline **two** specific safety procedures that should be observed to eliminate **each** risk identified at **2(a)** above.

(c) Discuss **three** guidelines, which are commonly referred to in the Health and Safety Statement of a construction company, as required by the Health and Safety Authority.

3. The drawing shows the elevation and plan outline of the external wall of a new dwelling designed for an elderly couple, of which, one is wheel chair bound.



(a) Discuss **three** areas of the new house design that require specific consideration for this couple.

(b) Select **one** of the areas identified at **3(a)** above and show, using notes and freehand sketches, **three** specific design considerations that would make it suitable for a wheelchair user. Indicate on your design sketches typical dimensions as appropriate.

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

(b) The owner of a dwelling has decided to convert the attic space to accommodate an extra bedroom. The roof structure was constructed using traditional cut rafter method.
Using notes and freehand sketches, show the construction details necessary to accommodate the new living space.
Indicate clearly the ventilation and insulation detailing for the roof structure and include **three** typical dimensions on your drawing.

5. **(a)** Calculate the U-value of the external wall of a house built over thirty years ago, given the following data:

External render	thickness	19 mm
Concrete block outer leaf	thickness	100 mm
Un-insulated cavity	width	100 mm
Concrete block inner leaf	thickness	100 mm
Internal plaster	thickness	16 mm

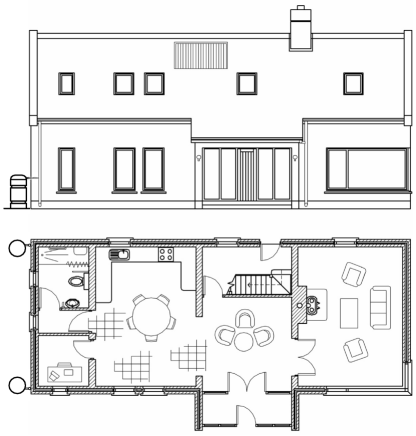
Thermal data of external wall:

Resistance of external surface	(R)	0.55	m^2 °C/W
Conductivity of external rendering	(k)	0.460	W/m °C
Conductivity of concrete blocks	(k)	1.440	W/m °C
Resistance of cavity	(R)	0.18	m^2 °C/W
Conductivity of internal plaster	(k)	0.460	W/m °C
Resistance of internal surface	(R)	0.123	m^2 °C/W

(b) The owner wishes to upgrade the thermal properties of the wall and has chosen to use the external insulation method of fixing expanded polystyrene to the external surface. Given the thermal conductivity (k) of the expanded polystyrene as 0.037 W/m °C, calculate the thickness of insulation required to achieve a U-value of 0.27 W/m^2 °C.

(c) Using notes and freehand sketches, discuss the importance of thermal mass in improving the thermal performance of a dwelling house.

6. The elevation and ground floor plan of a house are shown. The house has two bedrooms and a bathroom in the attic space. The external wall is a concrete block wall with an insulated cavity. The house is designed to have a low environmental impact.

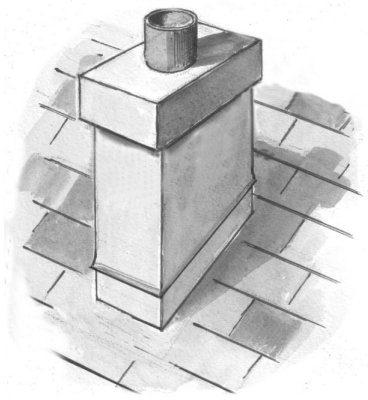


(a) Using notes and freehand sketches as appropriate, discuss in detail **three** planning guidelines that should be observed when designing a new house in a rural area to have low environmental impact.

(b) With reference to the design shown, discuss in detail, using notes and freehand sketches, the importance of **each** of the following when ensuring the house has a low environmental impact:

- scale and layout
- energy efficiency
- flexibility of the design.

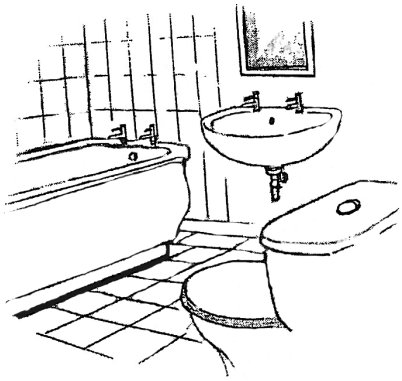
7. A concrete block chimney passes through a pitched roof as shown in the accompanying sketch. The chimney is finished with a sand / cement render and the roof is pitched at 45 degrees.



(a) To a scale of 1:5, draw a vertical section through the roof. Show clearly all the constructing details at the roof / chimney intersection to prevent water penetration, include one course of slates both sides of the chimney. Include **three** typical dimensions on your drawing.

(b) Using notes and freehand sketches, show the necessary design detailing to prevent the occurrence of down draught in a chimney.

8. A properly designed and constructed sewage system is essential for the safe removal of waste from a domestic house in a rural area.

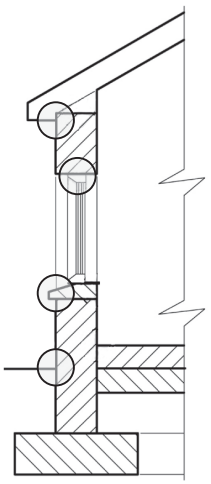


(a) Using notes and freehand sketches, discuss **three** typical design details of an underground drainage system that ensure the safe removal of waste from a dwelling house to its septic tank.

(b) The accompanying sketch shows a bathroom on the first floor of a dwelling house. Using notes and a single-line diagram, show a typical pipe layout of a single stack system to remove waste safely from the bathroom.

(c) Using notes and freehand sketches, outline **two** tests that may be carried out on an underground drainage system to ensure the pipe network is air and water tight.

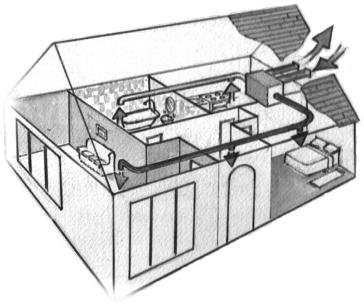
9. The drawing shows an outline section through a 350mm external wall of a house with an insulated cavity. The owner of the dwelling has decided to thermally upgrade the dwelling by the use of external insulation.



(a) Select any **three** locations from those circled on the sketch and show clearly, using notes and annotated freehand sketches, the typical design detailing required when fixing external insulation.

(b) Discuss in detail **two** advantages of applying external insulation when thermally upgrading a dwelling.

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



- foundations suitable for a Passive House
- orientation and shade
- windows and glazing.

(b) Describe, using notes and freehand sketches, how a Mechanical Heat Recovery with Ventilation (MHRV) system operates for a Passive House.

(c) Discuss in detail **two** advantages and **two** disadvantages of Passive House construction.

OR

10. "Good builders were very conscious of the outward appearance of their work and took great care to improve and enhance it, while the use of purely local materials always ensured that the finished structure fitted smoothly into its environment, and did not shock it or do violence, as do some misguided efforts of 'modern' fashion in building."

IRISH COUNTRY HOUSEHOLDS (1985)
Kevin Danaher

Discuss the above statement in detail and propose **three** guidelines that would promote the development of environmentally sustainable housing.

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