



Pre-Leaving Certificate Examination, 2013

Construction Studies

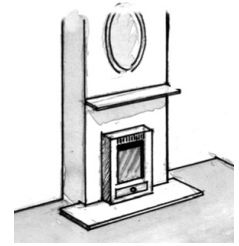
Theory - Higher Level

(300 marks)

Time: 3 Hours

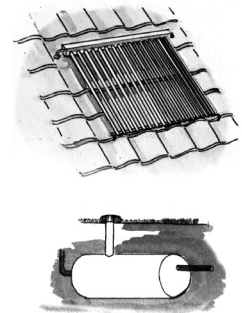
- (a) Answer **Question 1** and **four** other questions.*
- (b) All questions carry equal marks.*
- (c) Answers must be written in ink.*
- (d) Drawings and sketches to be made in pencil.*
- (e) Write the number of the question distinctly before each answer.*
- (f) Neat freehand sketches to illustrate 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 fireplace of a dwelling house is located on an internal party wall between two rooms, as shown in the accompanying sketch. The party wall is a 225 mm solid block and is supported on a traditional strip foundation. The house has an insulated solid concrete floor with 25 mm hardwood timber flooring.



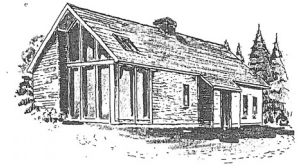
- (a) To a scale of 1:5, draw a vertical section through the party wall, fireplace and hearth. The section should show the typical constructional details from the base of the foundation to the top of the first flue liner.
- (b) Indicate on your drawing the design detailing that ensures efficient functioning of the fireplace.

2. Increased fuel costs and the introduction of household charges have lead to many homeowners utilising natural resources to reduce their household costs.



- (a) Show, using notes and freehand sketches, how a homeowner could incorporate **two** of the following to reduce their household costs:
- solar panels
 - rain water harvesting
 - insulation.
- (b) Discuss in detail **two** advantages of each of your preferred solutions in 2(a) above.
3. (a) The average daylight in a living room is to be increased from 90 lux to 150 lux by enlarging an existing window. Determine by degree of efficiency method, or any other suitable method, the approximate area of the new window. The living room is 4.8 m long by 4.0 m wide. Assume an unobstructed view and the illumination of a standard overcast sky to be 5000 lux.
- (b) Describe in detail, using notes and freehand sketches, the typical design detailing which will prevent the formation of thermal bridges at **each** of the following locations:
- head of the new window
 - cill of the new window.
- (c) Discuss in detail **two** environmental considerations that should be taken into account when choosing materials for the new window frame.

4. A new dwelling house is to be constructed on a site with moderately firm clay subsoil. The external walls are 350 mm concrete block with insulated cavity.



- (a) Show, using notes and freehand sketches, **two** different foundation types suitable for the dwelling house. Show clearly on your drawing the position of the reinforcing and indicate typical dimensions for each foundation type.
- (b) Recommend a preferred solution and give **three** reasons in support of your recommendation.
5. A house built in the 1970s has an un-insulated external cavity wall. The wall is finished with cement rendering and internally with a plaster finish.

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

Cement rendering	thickness	19 mm
Concrete block outer leaf	thickness	100 mm
Un-insulated cavity	thickness	100 mm
Concrete block inner leaf	thickness	100 mm
Plaster finish	thickness	16 mm

Thermal data of external wall:

Resistance of external surface	(R)	0.048	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)	0.170	m ²	°C/W
Conductivity of internal plaster	(k)	0.460	W/m	°C
Resistance of internal surface	(R)	0.122	m ²	°C/W

- (b) Using the U-value of the external wall obtained at **5(a)** above and the following data, calculate the heat loss annually through the un-insulated cavity wall:

Thermal data:

Area of external wall	160 m ²
Average internal temperature	20 °C
Average external temperature	5 °C
Heating period	10 hours per day for 40 weeks per annum
Cost of oil	85 cent per litre
Calorific value of oil	37350 kJ per litre
1000 watts	1 kJ per second

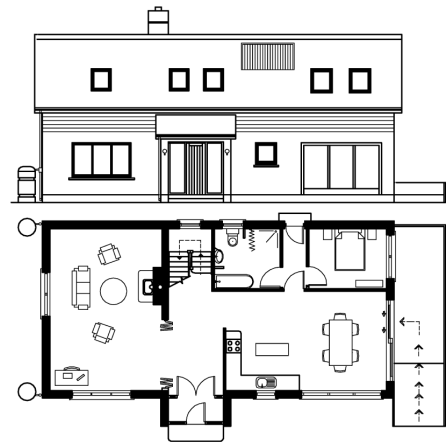
- (c) Discuss in detail, using notes and freehand sketches, the importance of thermal mass in improving the thermal performance of a dwelling house.

6. The elevation and ground floor plan of a newly built house, in a rural area, are shown. The house has two additional bedrooms and a bathroom in the attic space. The external wall is of timber frame construction with a concrete block outer leaf. The house is designed to have low environmental impact.

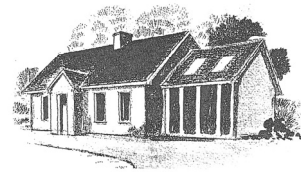
(a) With reference to the house design shown, discuss in detail, using notes and freehand sketches, **three** features in this design that contribute to reducing the environmental impact of this house.

(b) Discuss in detail the importance of **each** of the following when designing an environmentally sustainable dwelling house:

- selection of materials
- design for lifetime use
- location of house.



7. An extension has been built onto an existing dwelling house as shown in the sketch. The new extension has a solid concrete floor with a tiled finish. The existing dwelling house has an insulated suspended timber floor with a 25 mm tongued and grooved hardwood finish. The external walls of the existing are 350 mm cavity wall construction.



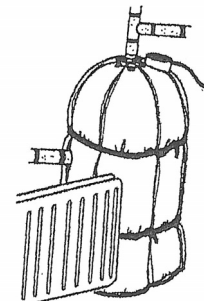
(a) To a scale of 1:5, draw a vertical section through the party wall. The section should show the typical construction details from the base of the existing foundation to 300 mm above the finished floor level. Both floors are finished at the same level. Include typical dimensions.

(b) Show clearly on the drawing a method of providing cross-ventilation between the two floors.

8. (a) Show, using notes and a single-line diagram, a typical design layout for an oil-fired central heating and hot water system for a single storey dwelling house. Show **two** radiators and give the typical sizes of the pipework.

(b) Show clearly on your drawing **three** valves necessary to ensure the safe running of the system and write a short note explaining their function.

(c) Discuss in detail **three** advantages of installing a zoned heating system in a domestic dwelling.

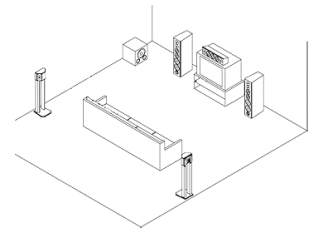


9. Careful design detailing is required to achieve effective sound insulation and acoustics in a contemporary dwelling house.

(a) Describe **two** sound insulation principles on which effective sound insulation is based.

(b) A living room, as shown in the sketch, is separated from an adjacent study/office by a traditional stud partition.

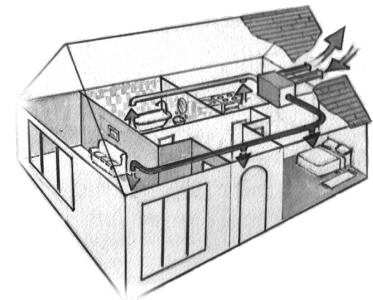
Using neat freehand sketches, show **two** design details that would improve the sound insulation properties of the stud partition. The walls and ceilings of the living room have a smooth hardwall plaster finish. The floor is solid concrete with a laminate wood finish.



(c) Show, using notes and freehand sketches, **two** methods of enhancing the acoustic properties of the living room.

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:

- optimum benefit from passive solar gain
- controlled air changes
- foundations suitable for a Passive House.



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

(c) It is important in Passive House design to eliminate possible air leakage routes. Show, using notes and freehand sketches, the typical design detailing that will prevent air leakage at **two** locations in the house.

OR

10. “Architecture has always involved the creative use of natural resources to serve human purposes. There is also a long and inventive tradition in the making of buildings that are sensitive to place and to climate. In the late twentieth century, these two concepts have taken on added meaning. Buildings play a surprisingly large role in that balance and the decisions taken by architects and engineers have calculable impact.”

GREEN DESIGN, SUSTAINABLE BUILDING FOR IRELAND.
Office of Public Works 1996, Page 3

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

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