



Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination, 2020

Construction Studies

Theory - Higher Level

(300 marks)

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. The sketch shows a dwelling house with a traditional slated cut roof. The roof has a pitch of 30° and flush eaves as shown. The internal span of the house is 6.0 metres and the roof is highly insulated. The external wall of the house is a 215 mm single leaf wall of solid concrete block construction with 200 mm external insulation and acrylic render external finish. Insulated plasterboard is fixed to the underside of the ceiling joists. A 50 mm service cavity is also provided at the internal surface of the wall.

- (a) To a scale of 1:10, draw a vertical section through one half of the roof structure from just below eaves up to 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 of the roof structure.

- (b) On your drawing, show the typical design detailing to ensure ventilation of the roof structure.



2. (a) Discuss in detail, using notes and freehand sketches, **two** specific best practice guidelines to be observed for **each** of the following when using scaffolding on a construction site:

- erecting scaffolding
- accessing scaffolding
- use of working platforms.

- (b) The on-site Health and Safety Officer performs a key role in maintaining a safe working environment on a construction site.

Discuss in detail **three** responsibilities of a Health and Safety Officer on a construction site.



3. The drawing shows the floor plan and front elevation of a semi-detached bungalow. The internal wall **A-A** is load-bearing. The rear wall of the house is south facing.

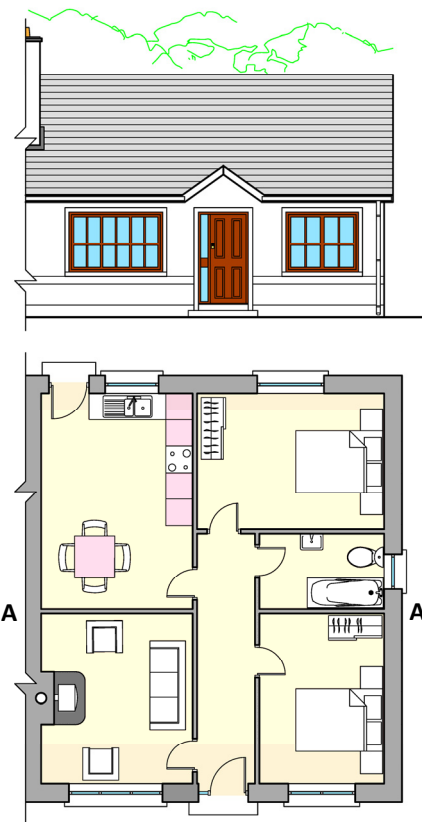
The owners intend to modify the internal layout to:

- make it fit for use by a person with limited mobility
- create a bright open-plan kitchen/living space.

- (a) Discuss in detail, **three** design considerations necessary when modifying the internal layout of the house shown to meet the needs of a person with limited mobility.
- (b) Using notes and freehand sketches, show a revised internal layout that incorporates each of the design considerations you outlined at **3(a)** above **and** include the open-plan kitchen/living space.

Justify your choices.

- (c) Discuss **two** advantages and **two** disadvantages of open-plan living in a domestic house.



4. The sketch shows a vacant site located between two existing dwellings in an urban area. The owners are at the design stage for a new house to be built on this site. It is proposed that the characteristics of existing dwellings should have an influence on the external house design.

- (a) Using notes and freehand sketches, discuss the importance of considering **each** of the following characteristics when designing a house for this site:

- materials and finishes
- shape and form
- streetscape.

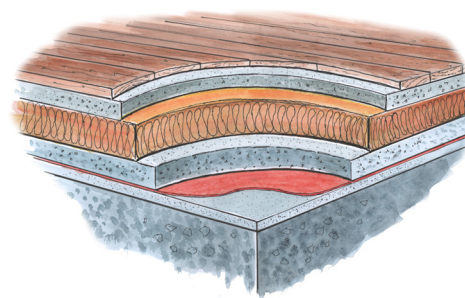
- (b) Using notes and freehand sketches, show a proposed external design for a house to be located on this site, which incorporates each of the characteristics discussed at **4(a)** above.

Justify your proposed design solution.



- (c) Discuss in detail **two** advantages of developing vacant sites in urban areas.

5. A house built to nZEB standards has a highly insulated solid concrete ground floor with a hardwood finish, as shown.



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

Hardwood flooring	thickness	20 mm
Sand/cement fine screed	thickness	65 mm
Floor insulation	thickness	200mm
Concrete floor slab	thickness	150 mm
Radon Barrier	thickness	0.25 mm
Sand blinding	thickness	40 mm
Hardcore	thickness	200 mm
Subsoil	thickness	300 mm

Thermal data of the ground floor:

Resistance of internal top surface of floor	(R)	0.104	m ²	°C/W
Conductivity of hardwood flooring	(k)	6.666	W/m	°C
Resistivity of fine screed	(r)	1.410	m	°C/W
Conductivity of floor insulation	(k)	0.022	W/m	°C
Conductivity of concrete floor slab	(k)	1.280	W/m	°C
Conductivity of radon barrier	(k)	0.250	W/m	°C
Conductivity of sand blinding	(k)	0.160	W/m	°C
Conductivity of hardcore	(k)	1.350	W/m	°C
Conductivity of subsoil	(k)	1.600	W/m	°C

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

• dimensions of floor slab	6.5 metres × 9.0 metres
• average internal temperature	20 °C
• average temperature of subsoil	6 °C
• heating period	9 hours daily for 39 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) Using notes and a freehand sketch, show best practice design detailing that will prevent the formation of a thermal bridge at the junction of the concrete floor and an external concrete block wall with a full-fill insulated cavity.

6. The elevation and ground floor plan of an Irish vernacular cottage, which has been retrofitted and extended, are shown. The existing cottage has been upgraded to meet **EnerPHit** Passive House standard. The new extension on the right has two bedrooms and a bathroom upstairs. The external walls of the extension are of timber frame construction with an external corrugated metal cladding finish. The house is designed to have low environmental impact.

- (a) Discuss **two** advantages and **two** disadvantages of retrofitting the vernacular cottage shown.
- (b) 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.
- (c) Discuss in detail, using notes and freehand sketches, **two** modifications to the house shown that would further reduce the environmental impact of the house. Justify your design choices.



7. Space heating is provided in a family living area by a wood-burning stove inset into a chimney breast, as shown. The chimney has been constructed to accommodate the stove and is located on a 200 mm internal solid concrete block wall. A 150 mm diameter cast iron flue connects the stove to the chimney flue. The living area has an insulated solid concrete ground floor with a 20 mm hardwood finish. The dimensions of the stove are: height 600 mm, width 550 mm, depth 400 mm.

- (a) To a scale of 1:5, draw a vertical section through the ground floor, hearth and chimney. Show the typical construction details from 350 mm below the finished floor to a level 300 mm above the top of the cast iron flue from the stove and include the connection to the flue liner in the chimney.

Include **three** typical dimensions on your drawing.

- (b) On your drawing, show the typical detailing to provide an independent air supply to the stove.



8. The main bathroom located on the first floor of a dwelling house is shown.

(a) Discuss in detail, using notes and freehand sketches, **two** considerations that should be taken into account when locating a bathroom on the first floor of a house.

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

- shower
- wash basin
- water closet (W.C.)
- kitchen sink on ground floor.

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



(c) Outline **two** considerations to minimise blockages occurring in a drainage system.

9. The owners have decided to convert an upstairs room into a family entertainment room. They are concerned that the sound from this room will be heard in the adjoining rooms upstairs and in the kitchen beneath.

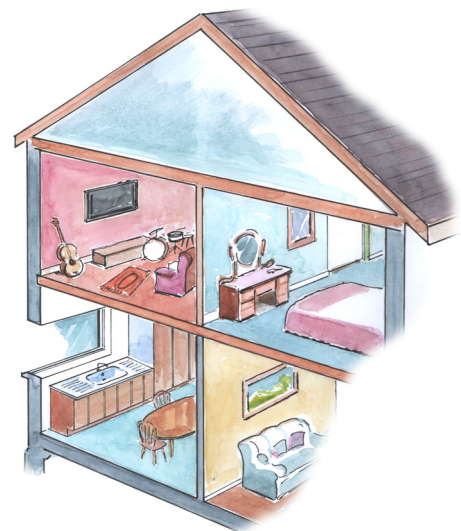
(a) Discuss in detail, using notes and freehand sketches, how **each** of the following contribute to reducing the transmission of sound in a dwelling house:

- completeness
- flexibility
- isolation.

(b) The partitions are of standard timber stud construction and the first floor is a softwood floor on timber joists, with a plasterboard ceiling beneath. The partitions and the floor are to be upgraded to reduce the transmission of sound from the entertainment room.

Using notes and freehand sketches show a revised design detailing that will reduce the transmission of sound through the stud partition **and** the existing first floor. Specify the materials to be used and give their typical dimensions.

(c) Discuss **two** benefits that the sound insulation upgrades will have on the health and wellbeing of the occupants.



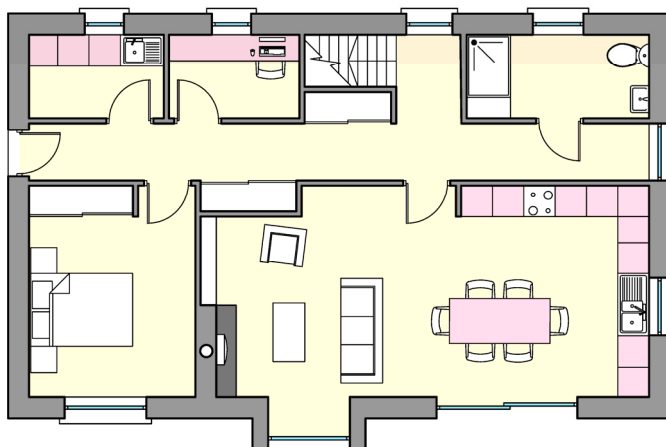
10. The drawing shows the draft design of the ground floor plan of a new dwelling house. The homeowners propose to install a Mechanical Ventilation with Heat Recovery (MVHR) system into their new home.

(a) Discuss in detail, using notes and freehand sketches, **three** considerations that should be taken into account when designing a MVHR system for a domestic house.

(b) Draw a line diagram of the given house plan. Show on your diagram the location of the MVHR unit and a typical layout for the system ducting. Indicate clearly the direction of the airflow in the ducts.

Describe how the MVHR system works.

Note: It is not necessary to show the furniture.



(c) Discuss **two** advantages of installing a MVHR system into a domestic house.

OR

10. "Worldwide, buildings are responsible for over 40% of the total primary energy use and related greenhouse emissions. Through standards and energy efficiency programs, several countries have succeeded in improving the energy performance of new and existing buildings. Designing and retrofitting electrical power systems to be energy efficient have been primary components in the effort to reduce energy consumption by the built environment."

Adapted from: **Optimal Design and Retrofit of Energy Efficient Buildings, Communities, and Urban Centers.**

by Moncef Krarti.

Published by: Butterworth-Heinemann. ISBN: 978-0-12-849869-9

(a) Discuss the above statement in detail.

(b) Propose **three** best practice guidelines that would ensure all buildings are retrofitted in the most sustainable way possible to minimise their primary energy use and improve their energy performance.

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