Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination 2024

Construction Studies

Theory - Higher Level

(300 marks)

Friday, 14 June
Afternoon, 2:00 - 5:00

(a) *Answer **any five** 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.*

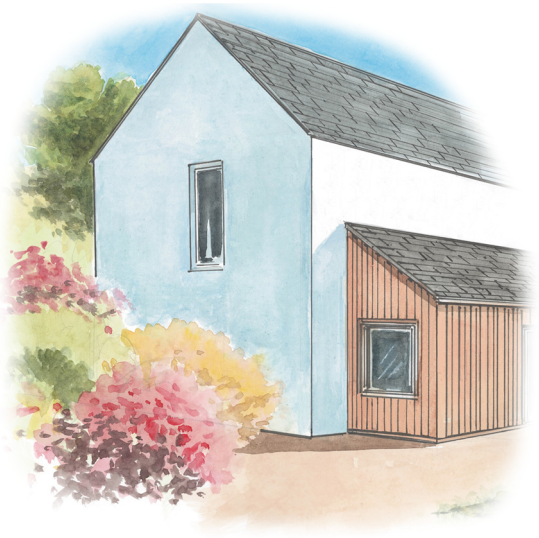
(g) *The name, sizes, dimensions and other necessary particulars of each material indicated must be noted on the drawings.*

Do not hand this up.

This document will not be returned to the State Examinations Commission.

The 2024 examination papers were adjusted to compensate for disruptions to learning due to COVID-19. This examination paper does not necessarily reflect the same structure and format as the examination papers of past or subsequent years.

1. An entrance porch with a lean-to roof projects 1.8 metres from the external wall of a house. The walls of the porch and of the house are of 450 mm concrete block construction with a full-fill insulated cavity. The external wall of the porch is finished with a rainscreen of 20 mm vertical larch cladding. The highly insulated lean-to roof has a pitch of 30° with a slate finish. The rafters are 200 mm × 50 mm with insulated plasterboard fixed to the underside of the sloping rafters.



(a) To a scale of 1:10, draw a vertical section through the entrance porch showing the external wall of the porch, the sloping roof, and the front wall of the house.
Include the typical construction details of the porch from a point 300 mm below the wall plate, through the sloping rafters, to a level 350 mm above the abutment of the porch roof with the front wall of the house.
Show **three** courses of slate at eaves.

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

2. The design of a house should be flexible to meet the changing needs of the occupants over their lifetime.

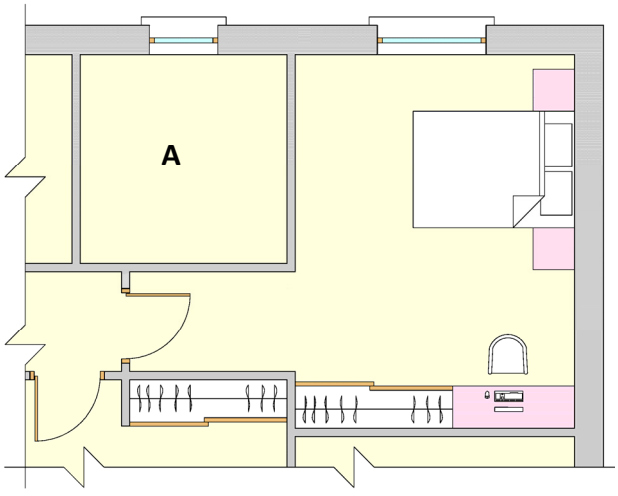
(a) Discuss in detail, using notes and freehand sketches, **two** best practice guidelines for **each** of the following areas when designing a house for lifetime use:

- kitchen
- bedroom.

(b) A draft design for a bedroom and an *en suite* bathroom is shown. The *en suite* bathroom at **A**, is to be accessed from the bedroom.
Using notes and a freehand sketch, show a preferred layout for the *en suite* to ensure ease of use by a person with limited mobility.
On your design sketch, show the location of the following:

- access to the *en suite* from the bedroom
- shower area
- water closet (W.C.)
- wash basin
- grab rails.

Include **two** typical dimensions.

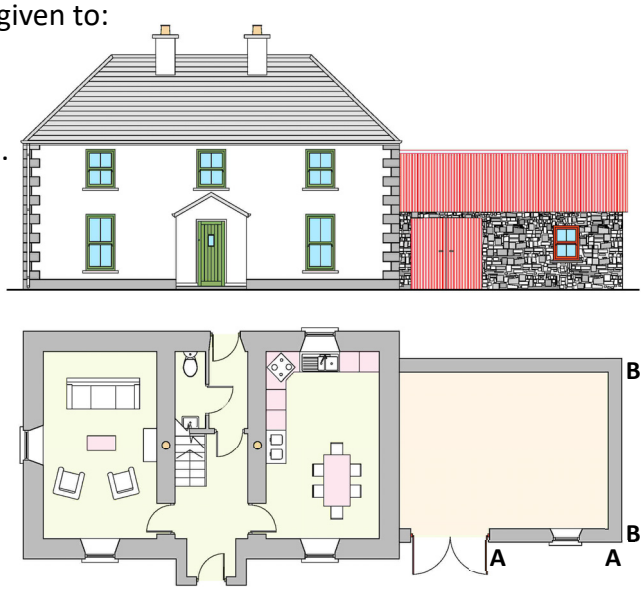


(c) Justify your preferred location for **each** of the bathroom items listed at **2(b)** above.

3. The drawing shows the front elevation and ground floor plan of a house with an adjoining disused forge. The forge was built using natural local stone with a red corrugated steel pitched roof. The wall **A-A** is south facing and the wall **B-B** has views to the mountains. The owners intend to convert the forge into an open-plan kitchen/dining and living space.

Consideration at the design stage is to be given to:

- linking the existing kitchen to the forge
- optimising natural daylight
- maximising the views to the mountains.

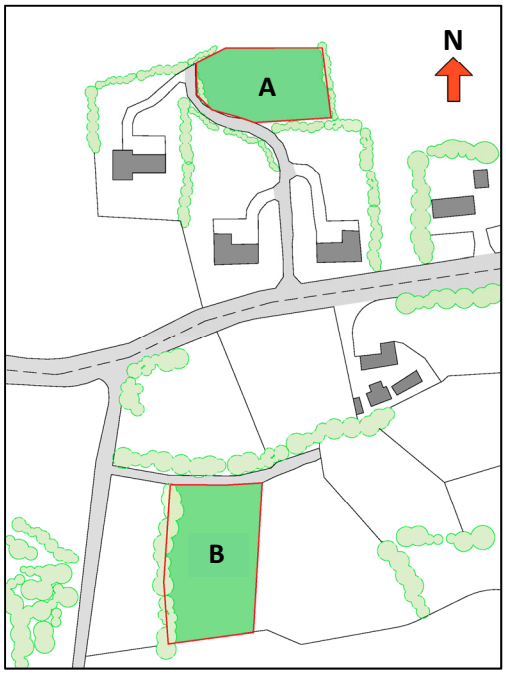


(a) Using notes and freehand sketches, show a revised internal layout for the proposed renovation of the forge shown, that incorporates **each** of the above requirements. Justify your design choices.

(b) Using notes and freehand sketches, show an external design for your forge renovation that will respect and enhance the overall visual appearance of the house.

(c) Discuss **two** advantages of respecting Irish vernacular architecture when renovating an old building.

4. **(a)** Discuss in detail **three** reasons why local planning authorities regulate the design and location of all proposed new dwellings.



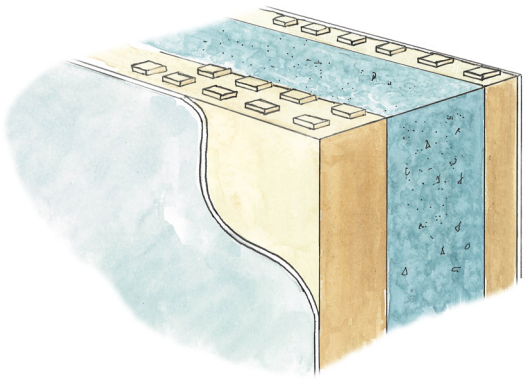
(b) Shown is an extract from a site location map. **A** and **B** are possible sites for a new dwelling house.
Select your preferred site and discuss **three** considerations you took into account when selecting your site.

(c) Draw a well-proportioned sketch of your selected site and immediate boundaries.
On your sketch, show a preferred:

- location and orientation of a house on the site
- outdoor living space
- layout of the road entrance and driveway to the house.

For **each** of the above, justify your design choices.

5. The sketch shows a proposed external wall design for a new house.
The external wall is constructed using Insulated Concrete Formwork (ICF).



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

Acrylic external render	thickness	12 mm
External insulation	thickness	150 mm
Concrete	thickness	150 mm
Internal insulation	thickness	50 mm
Internal plasterboard	thickness	12.5 mm
Internal skim coat	thickness	4 mm

Thermal data of the external wall:

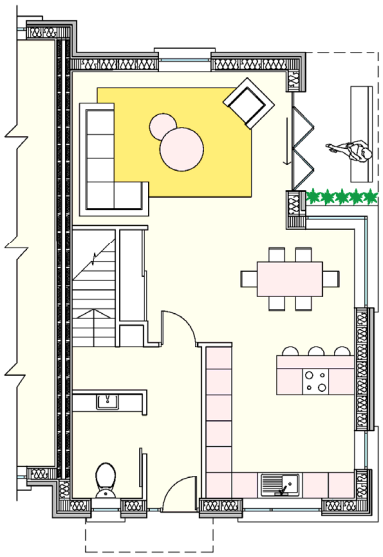
Resistance of external surface	(R)	0.048	m^2	$^oC/W$
Conductivity of acrylic external render	(k)	0.670	W/m	^oC
Conductivity of external insulation	(k)	0.030	W/m	^oC
Conductivity of concrete	(k)	1.280	W/m	^oC
Conductivity of internal insulation	(k)	0.030	W/m	^oC
Conductivity of plasterboard	(k)	0.250	W/m	^oC
Resistivity of skim coat	(r)	5.550	m	$^oC/W$
Resistance of internal surface	(R)	0.122	m^2	$^oC/W$

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

- area of external wall — 110 m^2
- average internal temperature — 20 ^oC
- average external temperature — 6 ^oC
- heating period — 6 hours daily for 32 weeks per annum
- cost of wood pellets — 52 cent per kg
- calorific value of wood pellets — 17350 kJ per kg
- 1000 watts — 1 kJ per second.

(c) Discuss **two** advantages and **two** disadvantages of designing a domestic heating system to incorporate a wood pellet boiler stove.

6. The elevation and ground floor plan of a house constructed in an urban area are shown. The external walls are of timber frame construction with a rendered concrete block and brick finish. Space heating is provided using a renewable heat source. The house was designed to be energy-efficient and to have a low environmental impact.

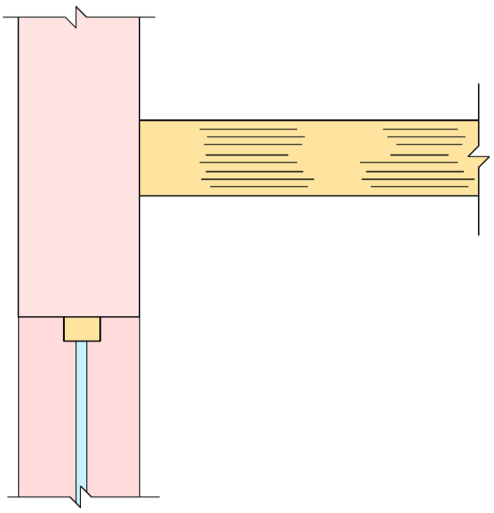


(a) Discuss using notes and freehand sketches, **three** features of the design that contribute to the house having a low environmental impact.

(b) Discuss using notes and freehand sketches, **two** features that could be added to the house that would further increase the energy efficiency of the house.

(c) Discuss **two** advantages of designing energy efficient new homes.

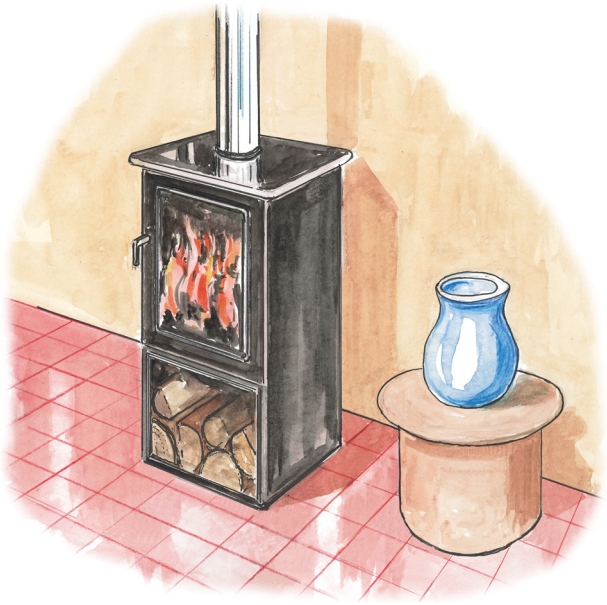
7. A window is fitted in the external wall of a two-storey dwelling house. The thermally broken window frame is 120 mm × 70 mm. The wall is of timber frame construction with an external rendered concrete block leaf. The internal timber frame leaf is 250 mm × 50 mm and has a 50 mm service cavity provided at the internal surface. The wall supports the first floor joists. The first floor is a 25 mm hardwood tongued and grooved floor, on a 20 mm OSB deck, on 225 mm × 50 mm wooden joists, with a plasterboard ceiling beneath.



(a) To a scale of 1:5, draw a vertical section through the external wall, window, and first floor. Show the typical construction details from a level 200 mm below the head of the window, to a level 200 mm above the finished first floor.

(b) On your drawing, indicate the typical design detailing to ensure airtightness at the junction of the first floor joist and timber frame inner leaf.

8. The sketch shows a wood burning stove used to provide hot water and central heating for a two-storey house.



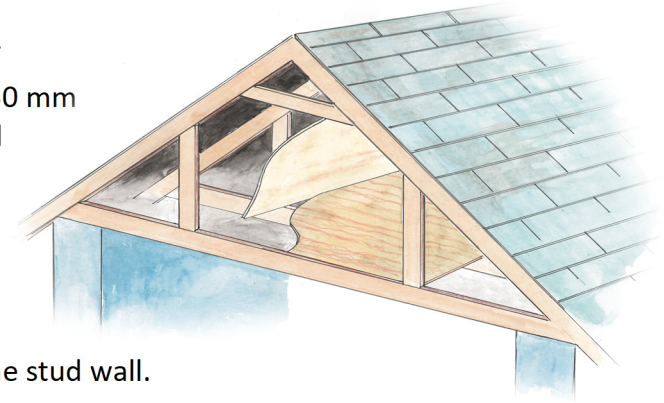
(a) Using notes and a single-line diagram, show a typical design layout for both the hot water system **and** the heating system. On the diagram, show **two** independently controlled heating zones, one on each floor. Include **two** radiators on each floor and give typical sizes of the pipework.

(b) On-site renewable energy generation can be used to heat water in the hot water cylinder of a house. Using notes and freehand sketches, discuss **one** method of incorporating such renewable technology into a hot water system.

(c) Underfloor heating is often installed in dwellings to provide space heating. Discuss **two** advantages and **two** disadvantages of incorporating an underfloor heating system into a dwelling house.

9. Homeowners wish to convert an existing attic space into a home office. They wish to carry out refurbishment works to reduce the level of sound transmission between the proposed office in the attic and the rooms beneath.

(a) Using notes and freehand sketches, discuss in detail, **two** functional requirements of an attic space suitable for use as a home office.



(b) The first floor of the attic consists of 18 mm OSB sheeting on 200 mm × 50 mm timber joists with plasterboard fixed beneath. The side walls are of standard stud construction. Using notes and freehand sketches, show a revised design detailing that will reduce the transmission of sound through both the floor **and** the stud wall.

(c) Discuss **two** approaches used to reduce the transmission of sound in the design of a dwelling house. Identify the sound insulation principle associated with **each** approach.

10. The sketch shows a bungalow which has been retrofitted. The owners have engaged skilled labour in the upgrade of their bungalow to meet the **EnerPHit** Passive House design standard.

(a) Using notes and freehand sketches, discuss the importance of any **two** of the following when carrying out a retrofit to achieve the **EnerPHit** Passive House design standard:

- airtightness
- windows
- building fabric.

(b) Using notes and freehand sketches, discuss in detail how **each** of the following could be improved, when upgrading an existing building to meet the **EnerPHit** standard:

- indoor air quality
- space heating.

(c) Discuss **two** advantages of using qualified skilled labour when retrofitting a house to meet **EnerPHit** Passive House standards.

OR

10. "Buildings have an impact on the environment at every stage of their lifecycle. Materials have to be quarried, mined or harvested, transported to factories and manufactured. The final products have to be transported to site, lifted into place and fixed in position. The buildings have to be operated, heated and cooled. Over a 60 year life cycle, components fail, roof finishes fail and need replacement, finishes spoil and need repainting and replacement. Eventually the building ceases to provide its function and needs to be deconstructed and all its components disposed by landfill, incineration, recycling or direct reuse."

Adapted from: ***Towards a circular economy in construction.***
Published by: Irish Green Building Council.

(a) Discuss the above statement in detail.

(b) Propose **three** best practice guidelines when selecting materials at the design and construction stages, to reduce the whole of life carbon impact of a dwelling house.

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Leaving Certificate – Higher Level

Construction Studies

Friday 14 June
Afternoon 2:00 – 5:00

Coimisiún na Scrúduithe Stáit
State Examinations Commission

Scrúdú na hArdteistiméireachta, 2024
Leaving Certificate Examination, 2024

Staidéar Foirgníochta
Triail Phraiticiúil

Construction Studies
Practical Test

(150 marc/marks)

Day 1 / Lá 1

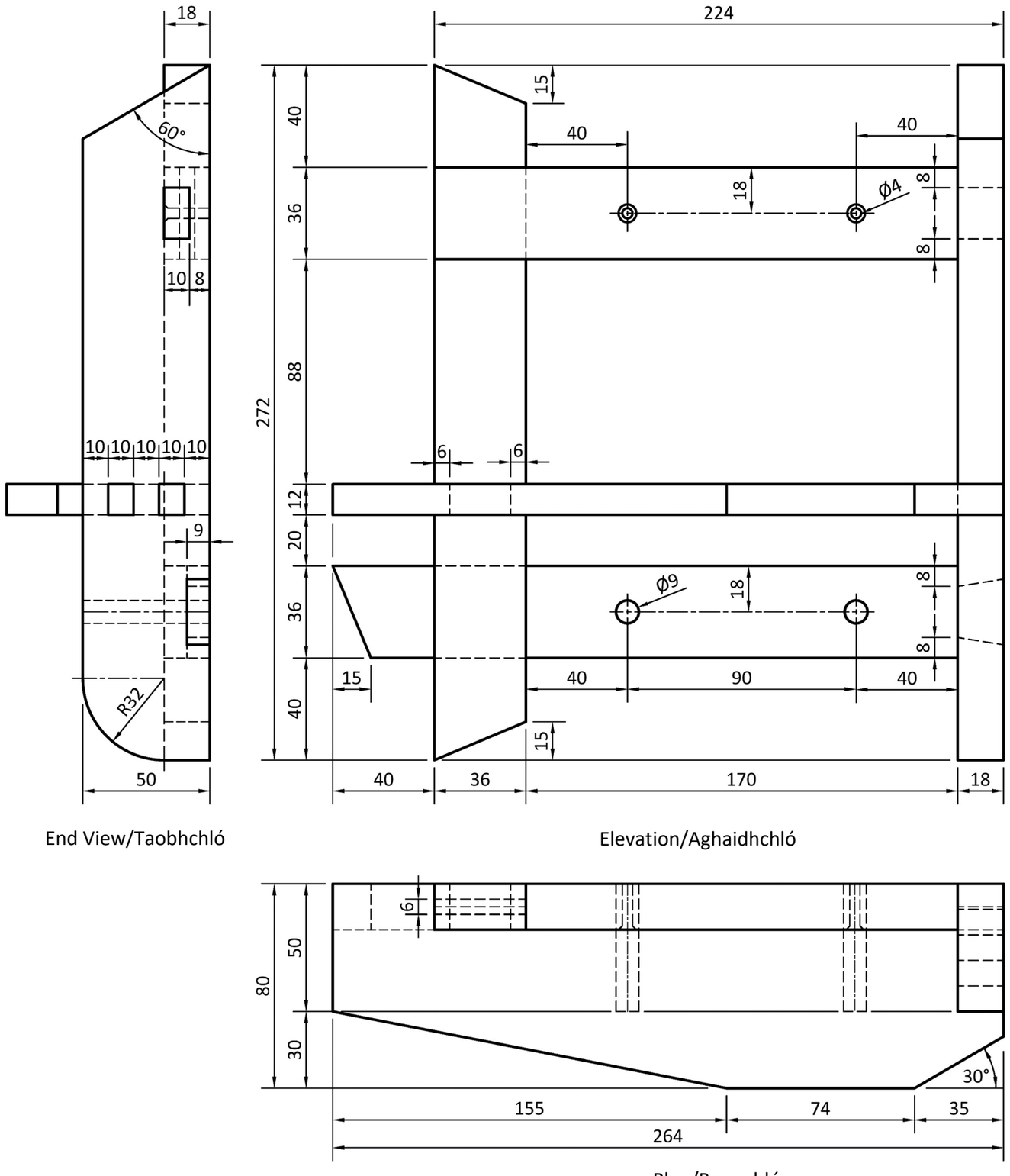
Duration: ***4:00 hours***
Fad: ***4:00 uair an chloig***

Write your Examination Number in this box:
Scríobh do Scrúduimhir sa bhosca seo:

Put this examination paper and the artefact into the candidate envelope supplied, and hand up the envelope to the **Superintendent** at the end of the examination.

Cuir an scrúdpháipéar seo agus an déantúsán isteach i gclúdach an iarrthóra atá curtha ar fáil, agus tabhair an clúdach don **Fheitheoir** ag deireadh an scrúdaithe.

Note: For clarity, some hidden detail has been omitted from this drawing.
Nóta: Tá roinnt sonraí fágtha ar lár as an líníocht seo ar mhaithe le soiléireacht.

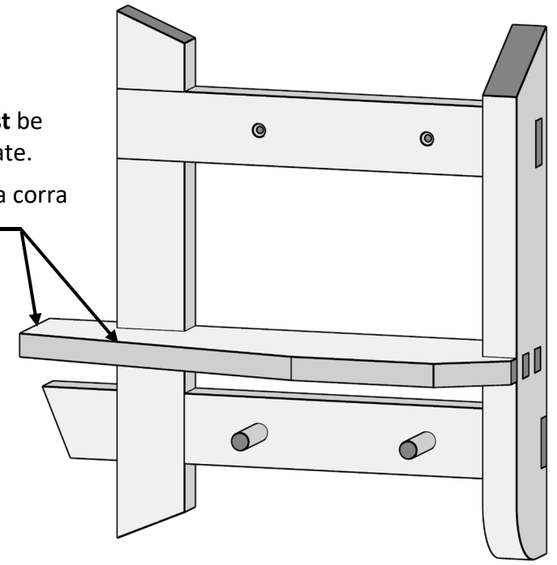


End View/Taobhchló

Elevation/Aghaidhchló

Plan/Bonnchló

Awards Display
Seastán Duaiseanna

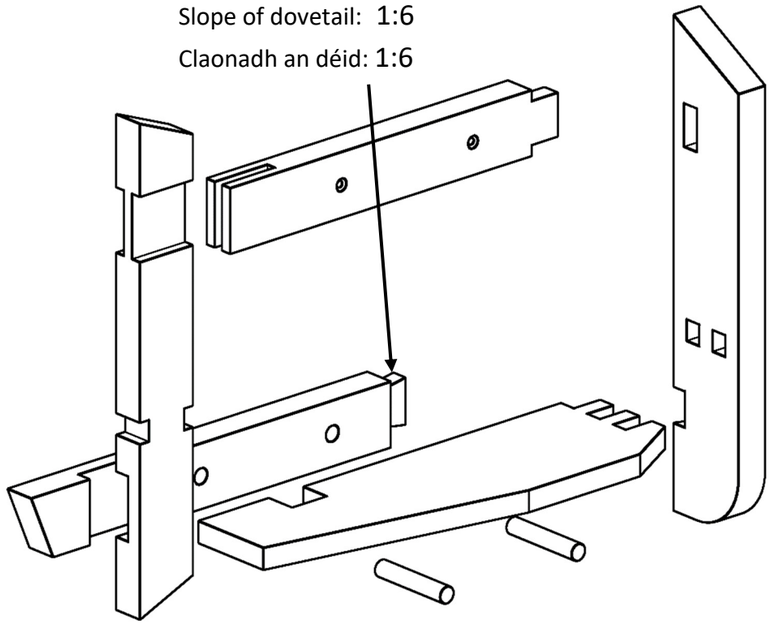


Shaping of the edges **must** be completed by the candidate.

Is faoin iarrthóir atá sé na corra a chríochnú.

Slope of dovetail: 1:6

Claonadh an déid: 1:6



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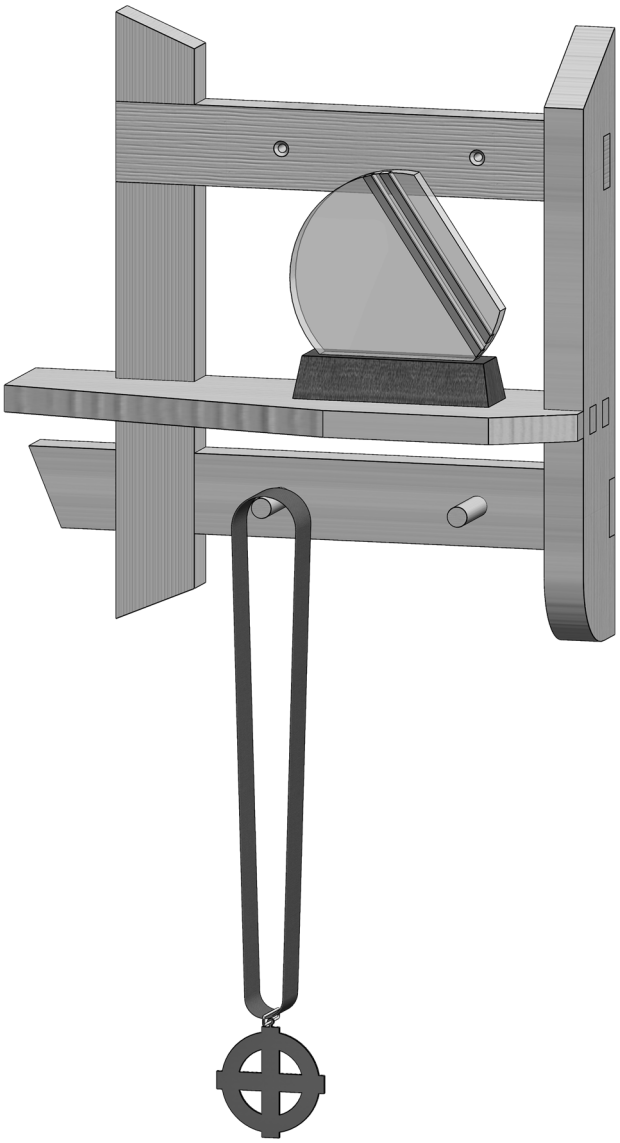

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State Examinations Commission

Scrúdú na hArdteistiméireachta, 2024
Leaving Certificate Examination, 2024

Staidéar Foirgníochta
Triail Phraiticiúil

Construction Studies
Practical Test

(150 marc/marks)

Day 2 / Lá 2

Duration: ***4:00 hours***
Fad: ***4:00 uair an chloig***

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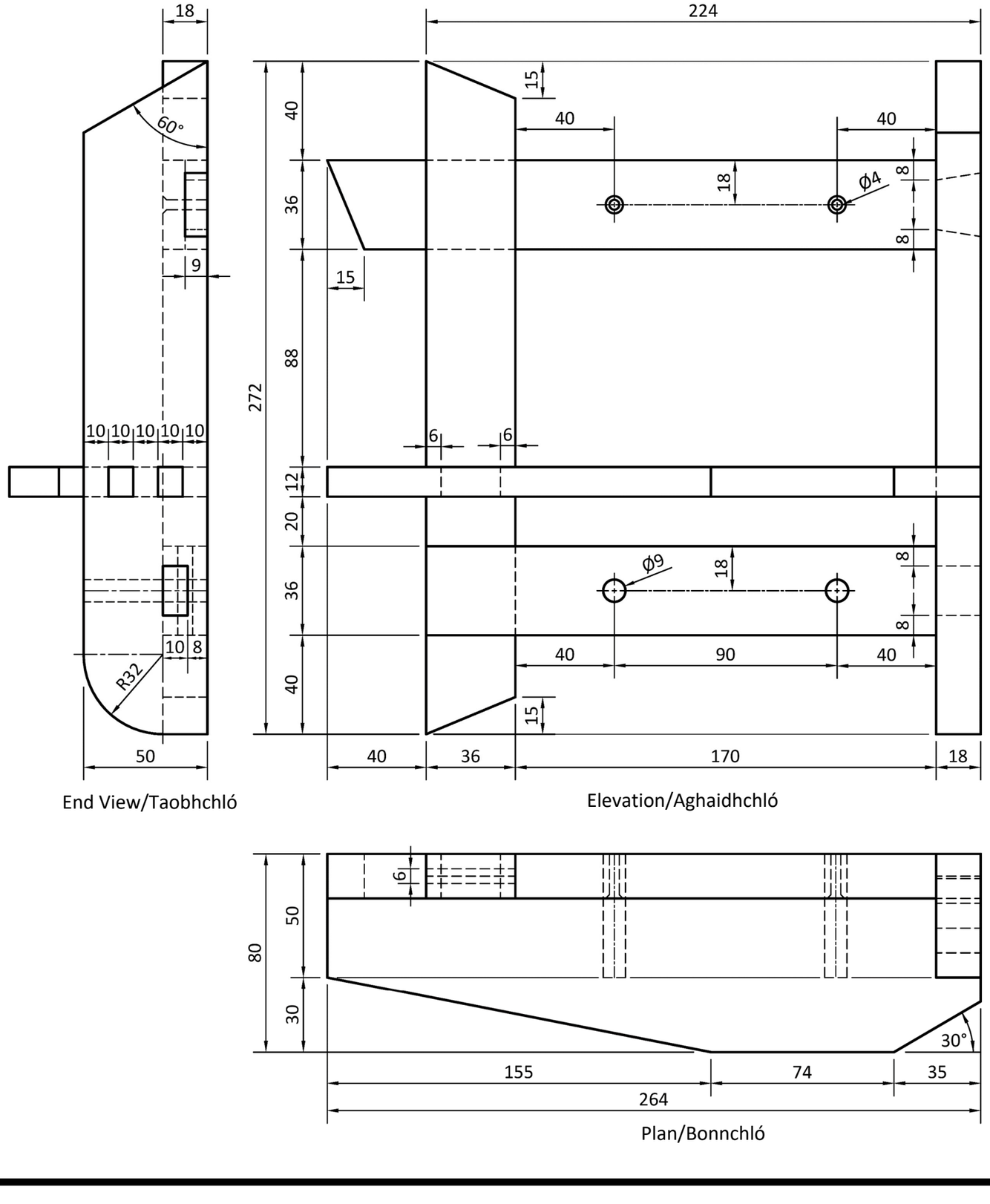

Awards Display
Seastán Duaiseanna

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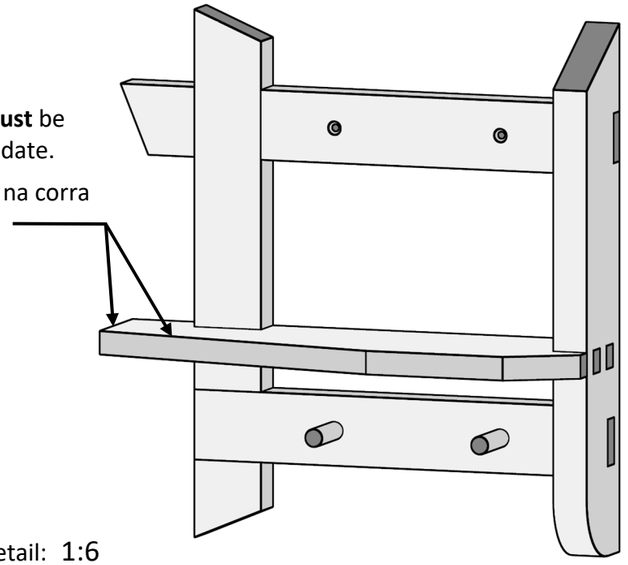
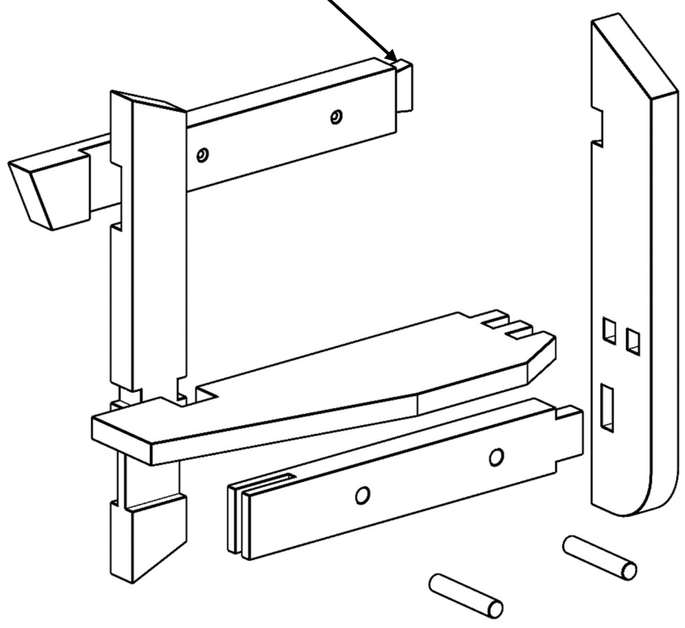


Slope of dovetail: 1:6

Claonadh an déid: 1:6



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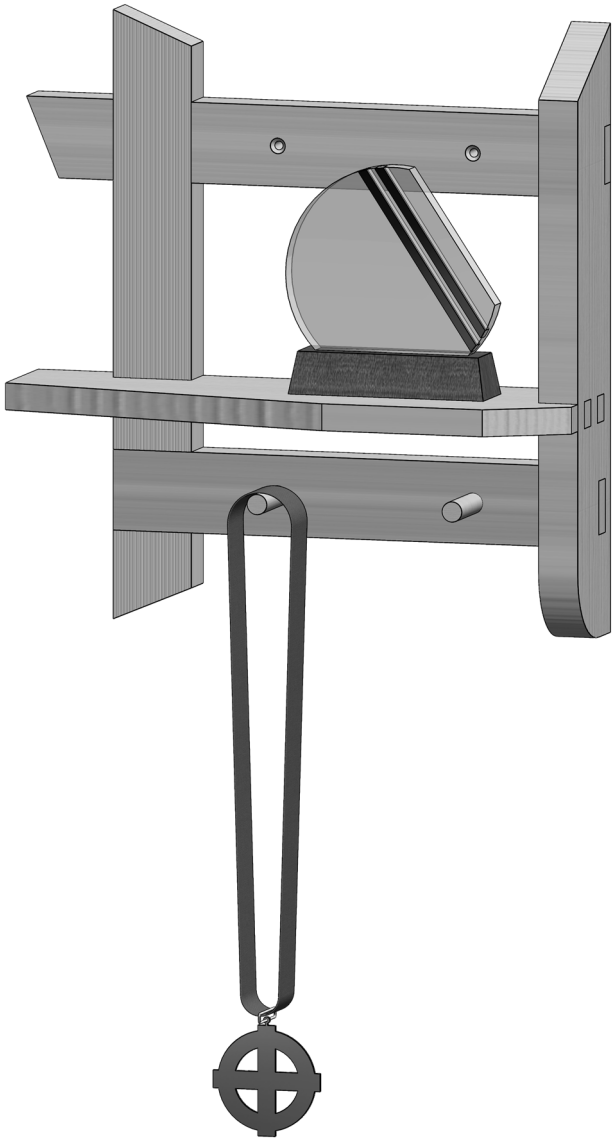

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Leaving Certificate Examination, 2024

Staidéar Foirgníochta
Triail Phraiticiúil

Construction Studies
Practical Test

(150 marc/marks)

Day 3 / Lá 3

Duration: ***4:00 hours***
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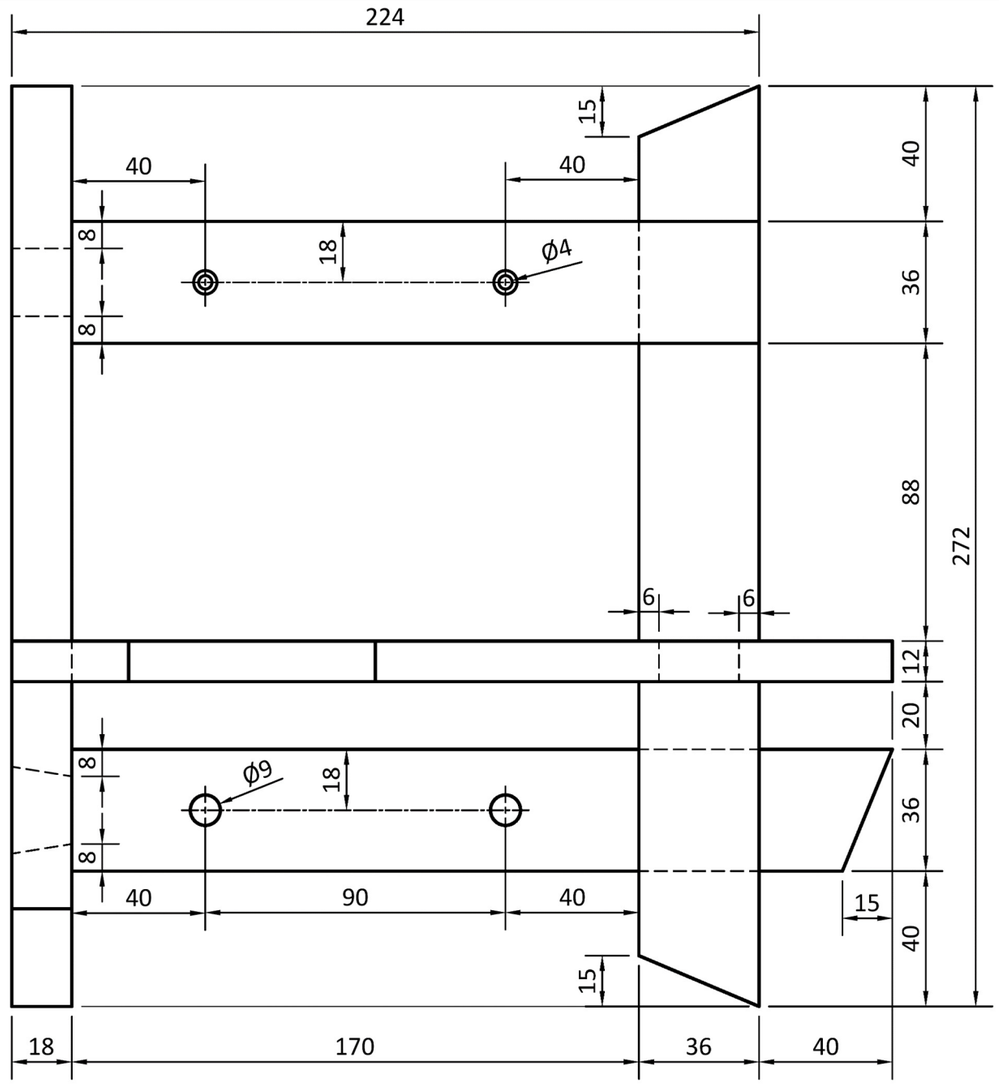
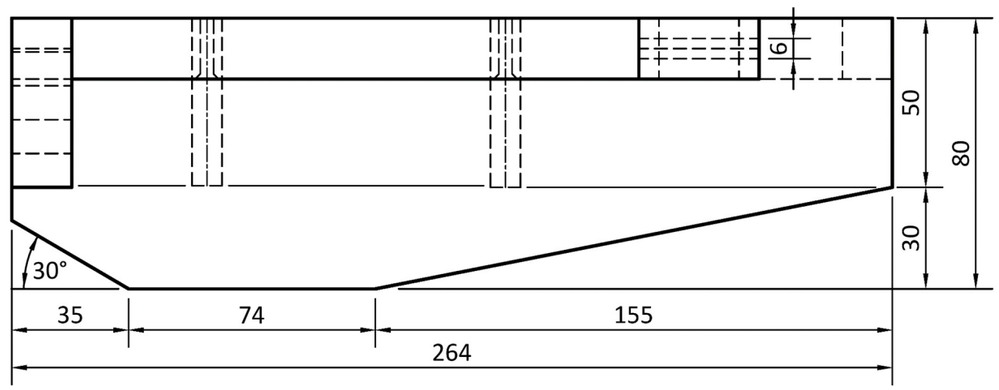
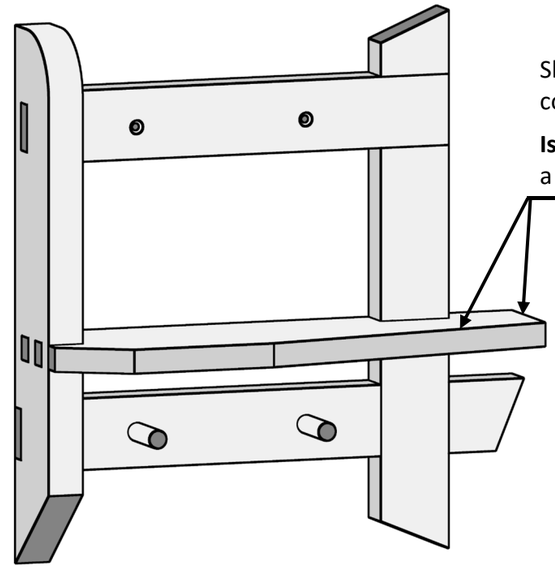


Elevation/Aghaidhchló

End View/Taobhchló



Plan/Bonnchló



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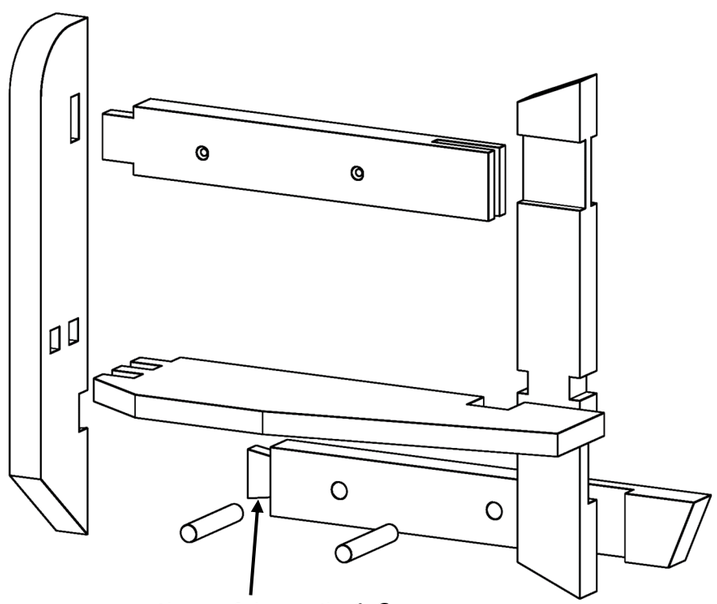

Slope of dovetail: 1:6

Claonadh an déid: 1:6

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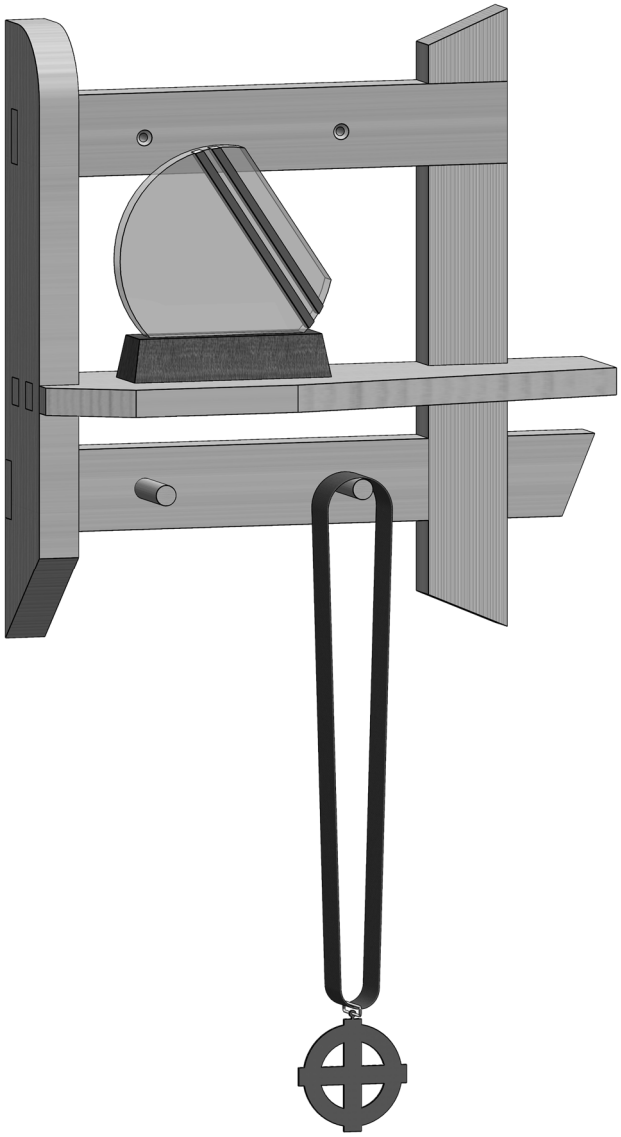

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