Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate 2026

Marking Scheme

Construction Studies

Higher Level

Note to teachers and students on the use of published marking schemes

Marking schemes published by the State Examinations Commission are not intended to be standalone documents. They are an essential resource for examiners who receive training in the correct interpretation and application of the scheme. This training involves, among other things, marking samples of student work and discussing the marks awarded, so as to clarify the correct application of the scheme. The work of examiners is subsequently monitored by Advising Examiners to ensure consistent and accurate application of the marking scheme. This process is overseen by the Chief Examiner, usually assisted by a Chief Advising Examiner. The Chief Examiner is the final authority regarding whether or not the marking scheme has been correctly applied to any piece of candidate work.

Marking schemes are working documents. While a draft marking scheme is prepared in advance of the examination, the scheme is not finalised until examiners have applied it to candidates' work and the feedback from all examiners has been collated and considered in light of the full range of responses of candidates, the overall level of difficulty of the examination and the need to maintain consistency in standards from year to year. This published document contains the finalised scheme, as it was applied to all candidates' work.

In the case of marking schemes that include model solutions or answers, it should be noted that these are not intended to be exhaustive. Variations and alternatives may also be acceptable. Examiners must consider all answers on their merits, and will have consulted with their Advising Examiners when in doubt.

Future Marking Schemes

Assumptions about future marking schemes on the basis of past schemes should be avoided. While the underlying assessment principles remain the same, the details of the marking of a particular type of question may change in the context of the contribution of that question to the overall examination in a given year. The Chief Examiner in any given year has the responsibility to determine how best to ensure the fair and accurate assessment of candidates' work and to ensure consistency in the standard of the assessment from year to year. Accordingly, aspects of the structure, detail and application of the marking scheme for a particular examination are subject to change from one year to the next without notice.

Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination 2026

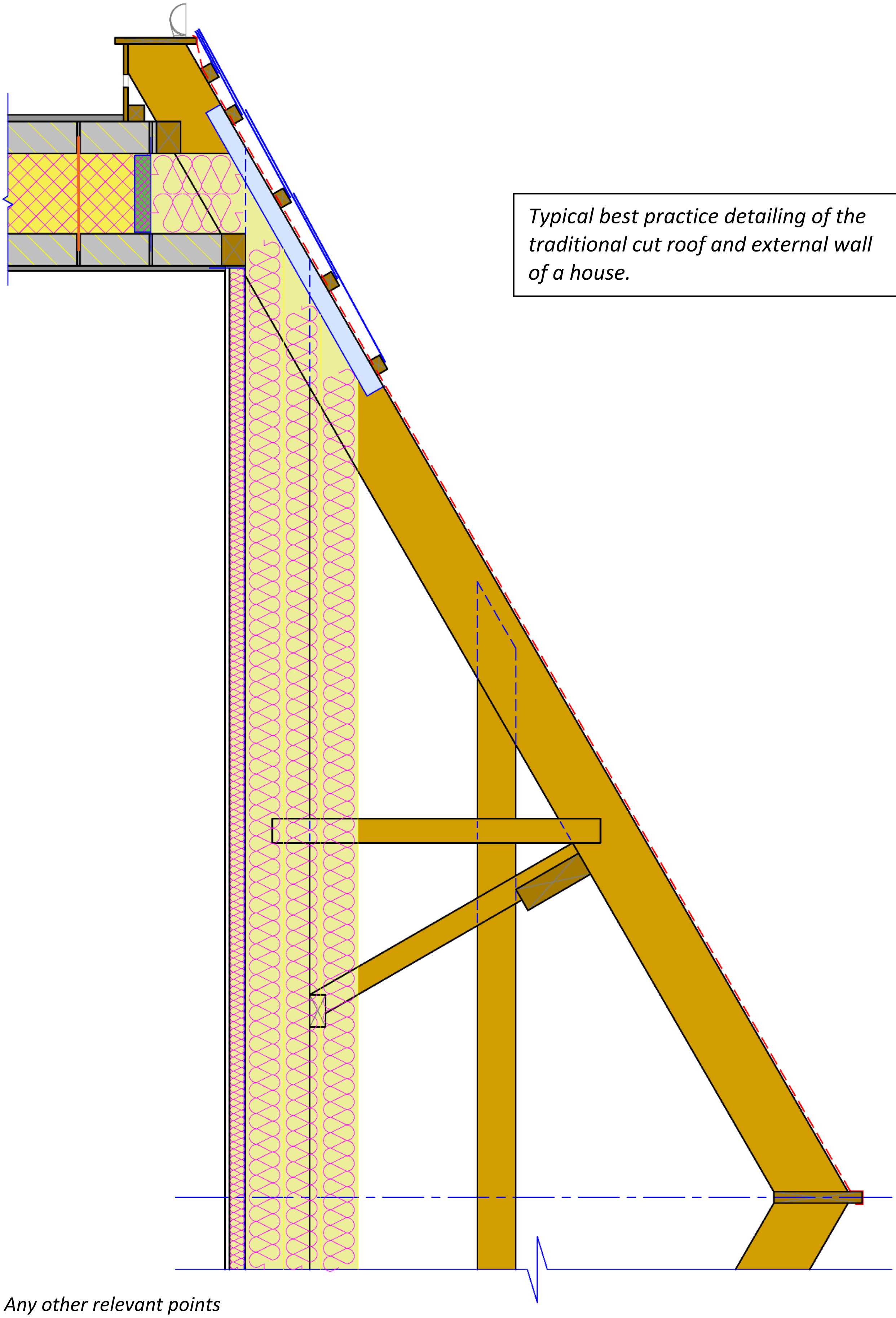
Construction Studies

Theory – Higher Level

Note: *Notes and graphics are for illustration and are not exclusive or exhaustive, other relevant notes and graphics are acceptable as responses and will be credited accordingly.*

Question 1

(a) Vertical section through one-half of the traditional cut roof and external wall of a house.



Typical best practice detailing of the traditional cut roof and external wall of a house.

Any other relevant points

External Wall – typical detailing
- External & internal render
- Cavity wall - 100 mm external and internal leaf
- Wall ties
- 250 mm full-fill insulated cavity
- Cavity closer
- 100 mm × 75 mm wallplate/s.

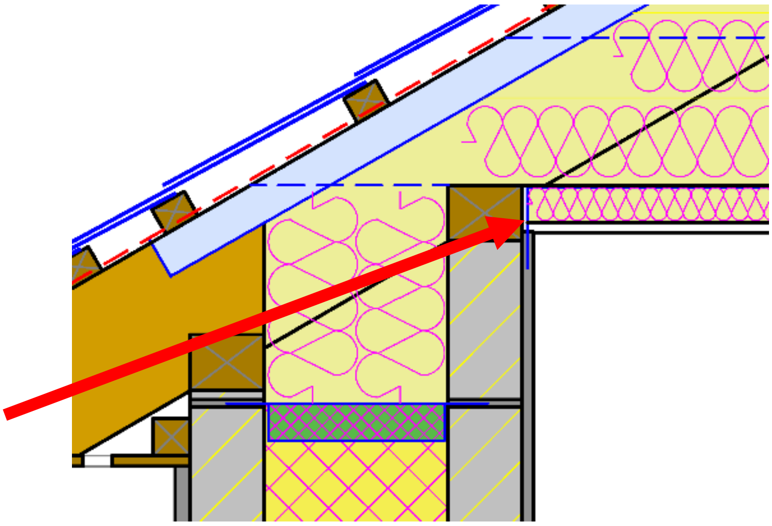
Roof Structure – typical detailing
- 200 mm × 50 mm rafters @ 400 mm centres
- Ceiling joist @ 400 mm centres
- 225 mm × 75 mm purlin
- Strut supporting the purlin
- Hanger
- Collar tie at each couple or @ 1200 mm centres
- Ridge-board
- Plasterboard and 350 mm insulation laid in 3 layers.

Eaves detail – typical detailing
- Tilting fillet
- Facia board, soffit, and gutter (any 2)
- 25 mm facia ventilator and 50 mm proprietary eaves ventilator
- Wind tightness barrier
- Breather membrane laid over roof rafters
- 50 mm × 30 mm slating batten
- 3 courses of slates.

Any other relevant points

(b) Typical design detailing that will ensure airtightness at the junction of the ceiling and the external wall.

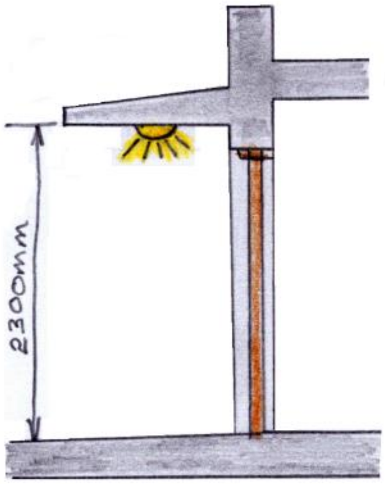
(b) Airtightness tape to seal the junction of the ceiling and the external wall



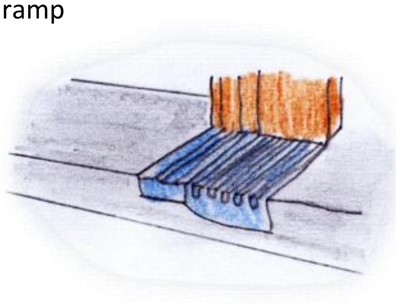
Question 2

(a) Best-practice guidelines that should be followed when designing for lifetime use at the:

Entrance Access:



- Provide a level threshold at all entrance doors with a maximum upstand of 15 mm
- Edges must be chamfered or rounded to prevent tripping and facilitate wheeled access
- A recessed linear drainage channel should be installed externally to prevent water ingress
- Internal floor finish should be flush with the threshold
- The entrance door should provide a minimum clear opening width of 1000 mm. This is measured from the face of the door leaf to the doorstop when the door is open at 90°
- The path leading to the entrance must be slip-resistant
- The ideal gradient is 1:20 or flatter. If the site constraints require a ramp (steeper than 1:20 but no more than 1:12), level landings must be provided at the top and bottom to allow users to rest or manoeuvre



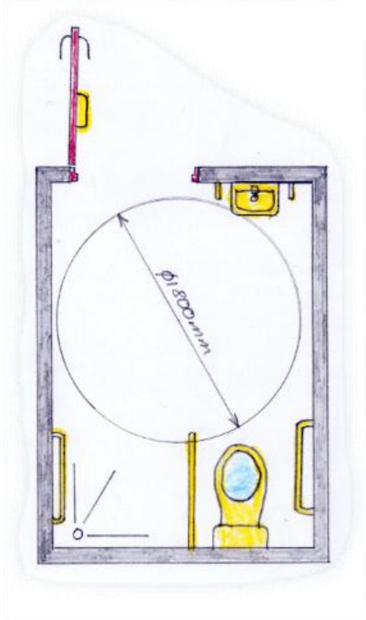
- There must be sufficient space outside the door for a wheelchair user to turn and operate the handle
- A level landing of at least 1500 mm x 1500 mm should be provided directly outside the door. This ensures the user can clear the swing of the door without rolling backwards off a slope
- Maintain a 300 mm clear unobstructed space on the leading-edge (handle side) of the door, both internally and externally. This allows wheelchair users to reach and operate the door handle without having to move out of the path of the door swing

- A permanent canopy or a recessed area should be designed to keep the landing dry and protect the user from the elements
- The canopy or recessed entrance should be at least 900 mm deep with a 300 mm overhang on either side of the door
- A canopy prevents the area from becoming slippery and protects the level threshold from direct driving rain
- Ironmongery should be easy to operate for those with limited manual dexterity (e.g., arthritis)
- Lever-type handles are preferred over door knobs
- Handles should be installed at a height between 800 mm and 1050 mm above floor level
- The door closer force should be kept to a minimum to ensure the door is not too heavy to push/pull

- Provide a vision panel in the door to create a clear view for people at all eye levels (seated or standing)

- Internal and external lighting should be provided, ideally activated by a motion sensor or a clearly located internal switch for safety at night
  Any other relevant points

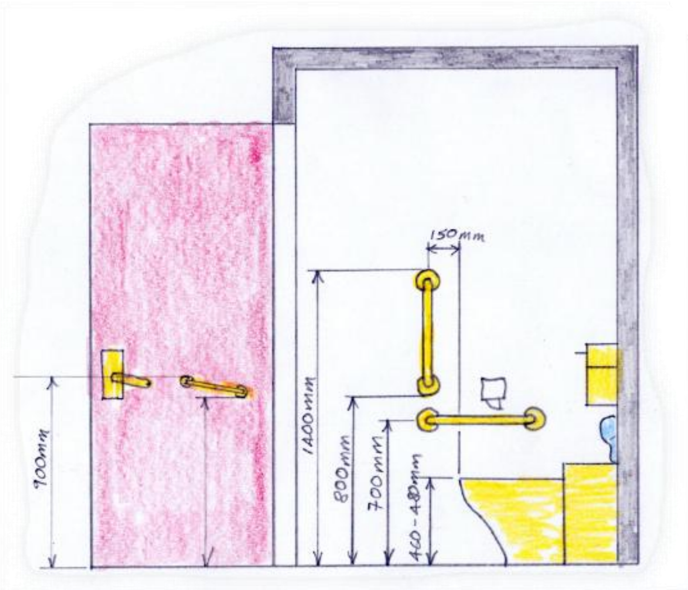
Bathroom:



- A fully accessible bathroom should be located on the entry-level floor of the dwelling. This ensures that the house remains functional for the resident should their mobility become permanently or temporarily impaired, eliminating the need for stairs

- The bathroom layout must provide a clear, unobstructed turning circle of at least Ø1500 mm (ideally Ø1800 mm). This ensures that a person using a wheelchair or walking frame can navigate the space, turn around, and close the door independently

- Walls behind the toilet, shower, and bath should be reinforced during construction with 18mm plywood or additional noggins behind the plasterboard. This allows grab rails to be securely fitted at any time without the need for major structural work or opening up the walls



- A level-access shower (wet room style) should be installed instead of a traditional raised shower tray or bath. The floor should be graded toward a gully to ensure effective drainage while removing any tripping hazards or physical barriers to entry

- Bathroom doors should open outwards or be sliding to ensure safety. In the event of a fall inside the bathroom, an inward-opening door could be blocked by the person on the floor, preventing emergency access. A minimum clear opening width of 800 mm is required

- The toilet (WC) should be positioned at a height of 450 mm – 480 mm to facilitate easier transfer from a wheelchair. The washbasin should be wall-hung (without a pedestal) to allow a wheelchair user to pull their chair underneath the sink to reach the taps

- All taps should be lever-operated rather than screw-type to accommodate users with limited manual dexterity

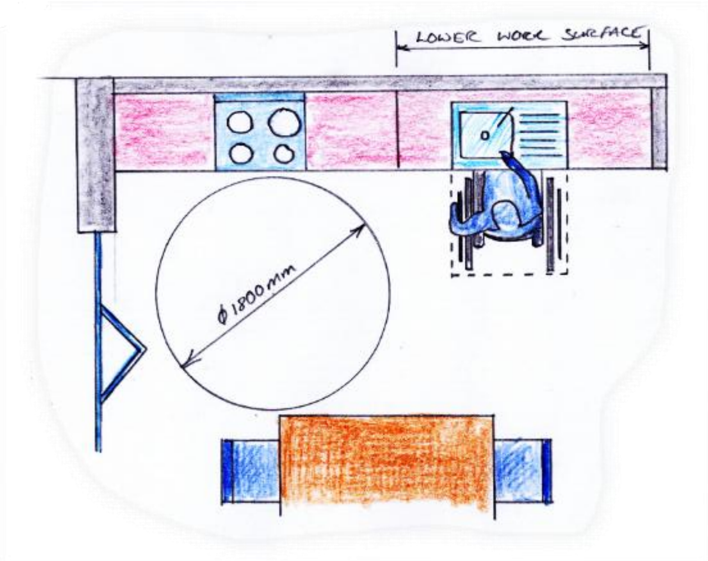
- Light switches should be large rocker-type plates or pull cords, and should be positioned at a height of 900 mm – 1200 mm above floor level

- The floor finish must have a high slip-resistance rating (R-rating), especially in wet areas. This provides safety for users with unsteady gaits or those using crutches and walking frames, reducing the risk of accidents on wet surface.

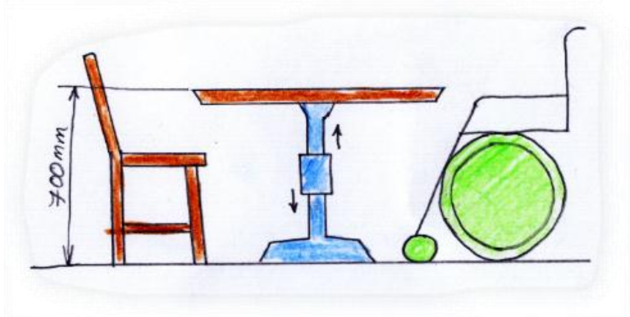
Any other relevant points

(b) Discuss three specific design considerations for the open-plan kitchen/dining and living area that ensure ease of use by a person with reduced mobility:

1. **Circulation and Manoeuvring Space**
   - Provide unobstructed turning circles of at least Ø1500 mm (ideally Ø1800 mm) in the kitchen and dining zones to allow a 360° turn
   - Maintain a clear width of 1200 mm for all internal traffic routes between furniture and fixed cabinetry to facilitate easy wheelchair movement
2. **Kitchen Worktop and Workspace Design**
   - Install worktops at a reduced height of 760 mm – 820 mm (standard is 900 mm) to accommodate a seated user
   - Provide a clear knee space (min. 700 mm high x 600 mm deep) under the sink and hob area to allow a wheelchair user to pull in close to the workspace



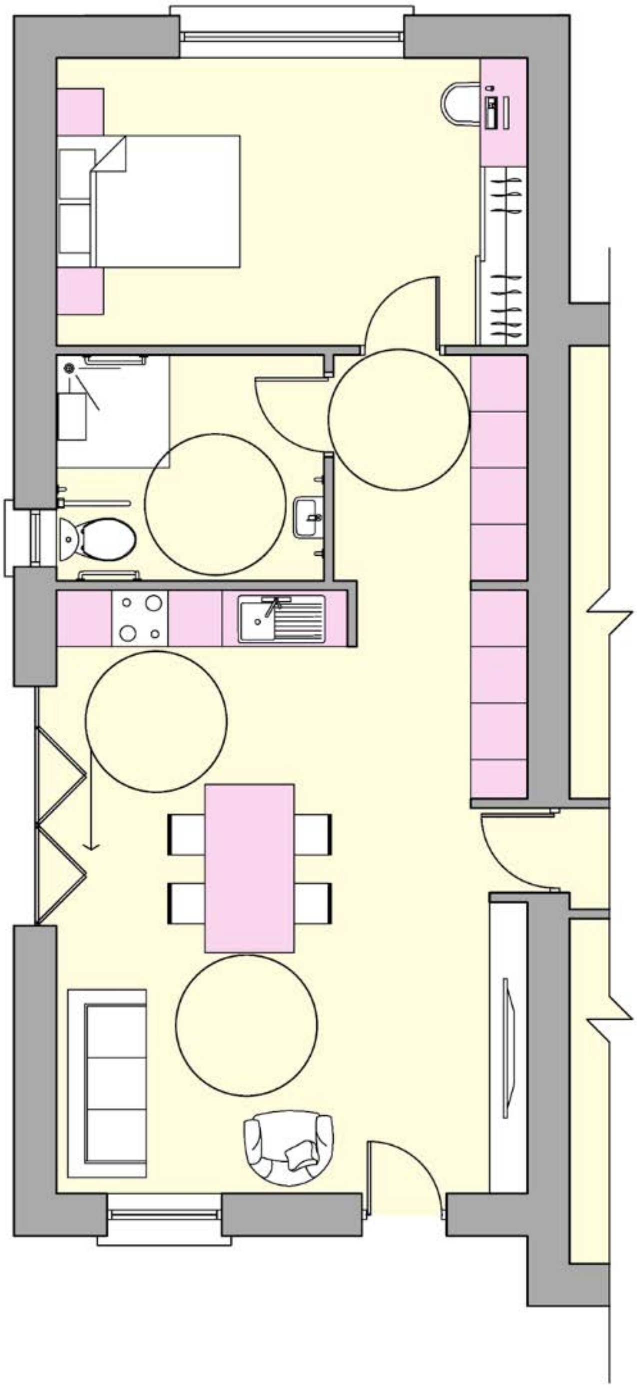
3. **Accessible Storage and Reach Ranges**
   - Ensure all frequently used storage, switches, and sockets are within the reach zone of 400 mm to 1200 mm above floor level
   - Incorporate pull-out larder units or pull-down baskets for high-level cabinets to ensure independent access to supplies
4. **Dining Area Accessibility**
   - Position the dining table to ensure at least 1200 mm clearance from walls or other furniture to allow for a wheelchair to be pulled out and manoeuvred
   - Ensure the table design provides a clear underside height of 700 mm for comfortable leg room while seated in a wheelchair



5. **Floor Finishes and Transitions**
   - Use firm, slip-resistant floor finishes (e.g., R10-rated tiles or commercial-grade laminate) throughout the open-plan space
   - Ensure all floor surfaces are level; where different materials meet, use flush transition strips with a maximum upstand of 5 mm
6. **External Access (Folding Doors)**
   - Ensure the folding doors feature a level threshold with a maximum upstand of 15 mm to allow seamless access to the outdoors
   - Position door hardware (handles and locks) between 800 mm and 1000 mm from the floor to ensure they are reachable from a seated position

7. Service Controls and Sockets

- Mount electrical sockets at a minimum height of 400 mm above the floor (higher than standard) to reduce the need for bending
- Locate light switches and thermostats at a maximum height of 1200 mm, ensuring they are not placed behind wide worktops or furniture



Any other relevant points

(c) Reasons for Considering Lifetime Use at the Design Stage:

1. Future-Proofing and Adaptability

- Designing for lifetime use ensures that the dwelling can accommodate the changing needs of the occupants as they age
- It allows a person to remain in their own home and community for longer (ageing in place), rather than being forced to move to specialised care facilities due to mobility issues

2. **Cost-Effectiveness (Initial vs. Retrofit)**
   - It is significantly cheaper to incorporate accessible features (e.g., level thresholds, reinforced walls, or wide doors) during the initial construction phase
   - Retrofitting a standard house later to meet disability needs often involves expensive structural alterations, such as moving internal load-bearing walls or installing lifts

3. **Inclusivity and Social Integration**
   - A lifetime home is inclusive for all visitors, not just the residents. It ensures that friends or family members with disabilities or young children in strollers can visit without facing physical barriers like steps or narrow doorways
   - This promotes social interaction and prevents the isolation of individuals with reduced mobility

4. **Safety and Accident Prevention**
   - Designing with universal principles reduces the risk of domestic accidents. Level thresholds and slip-resistant flooring minimise trip and fall hazards for both the elderly and young children
   - Adequate space for manoeuvring reduces the likelihood of collisions with furniture or door frames

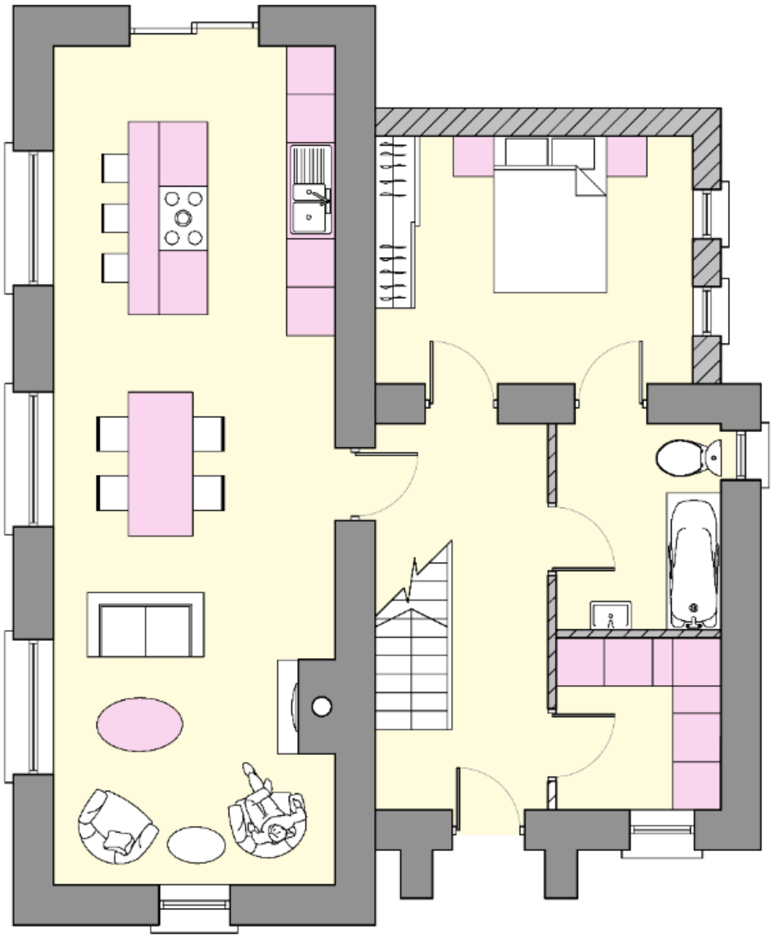
5. **Sustainability and Resource Management**
   - An adaptable house is more sustainable over the long term. If a building can be easily modified to suit different life stages (e.g., converting a garage to a bedroom), the life cycle of the building is extended
   - This reduces the need for new construction or major demolition, lowering the overall carbon footprint of the dwelling

6. **Market Value and Resale Appeal**
   - Homes designed for lifetime use appeal to a much broader segment of the market. As the average age of the population increases, there is a growing demand for homes that are already accessibility-ready
   - Houses with these features are often more attractive to buyers planning for their long-term future, increasing the property's resale potential.

Any other relevant points

Question 3

(a) Revised internal layout for the ground floor that incorporates each of the above design requirements.



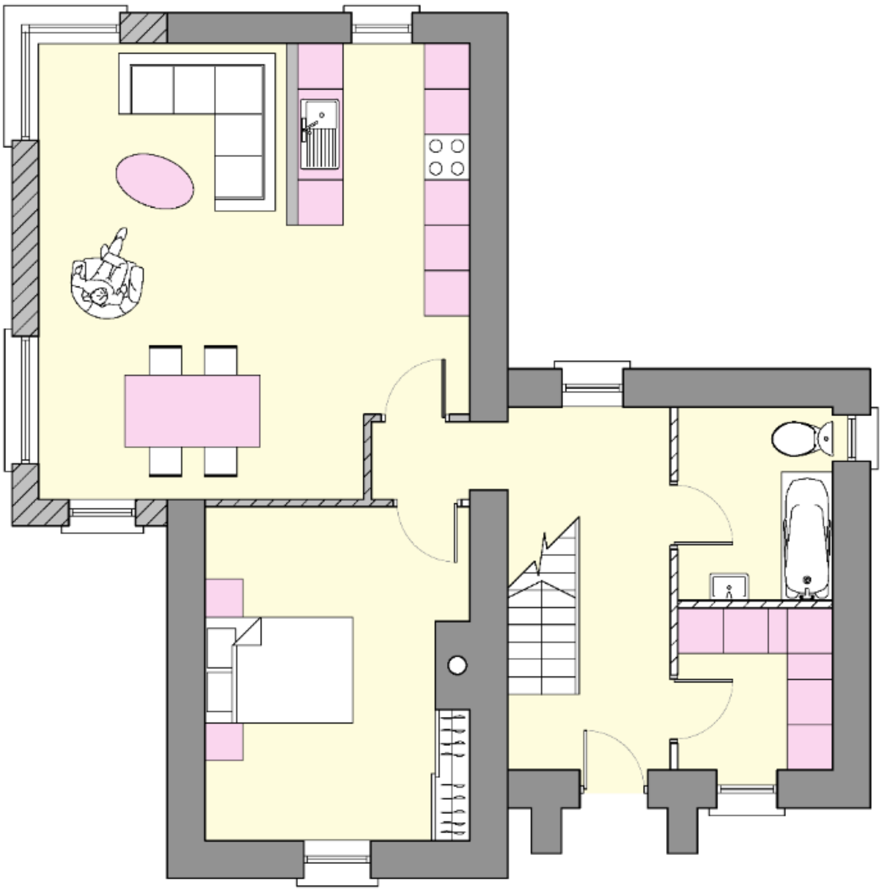
Option 1: (North-West/Rear Extension)

This design proposes a substantial internal reconfiguration, moving the primary living zones to the original main block of the house and extending to the side/rear.

1. **Open Plan Layout**:
   - The kitchen, dining, and living areas are integrated into a single large, longitudinal space
   - The use of a large kitchen island defines the workspace without breaking the visual flow
   - The living area is situated to the south (Wall A-A), maximising the view and light
2. **Optimising Daylight**:
   - The south-facing wall (A-A) features three large window openings
   - By removing internal partitions in this block, light from the south can penetrate deep into the dining and kitchen zones.
3. **Bedroom & Bathroom Retention**:
   - The bedroom is relocated to the new extension/remodelled wing on the right
   - The bathroom is kept adjacent to the bedroom for a private wing feel, utilising the existing plumbing stack locations where possible

Any other relevant points

Option 2: (South Extension)



1. **Open Plan Layout**:
   - The utility and bathroom occupy the original north-eastern wing, while the living area is pushed into a new extension in the south-west wing.
   - Three distinct zones within the one open plan area
   - Users in the kitchen can easily converse with those in the living area

2. **Optimising Daylight**:
   - The living area is wrapped with glazing on three sides (South, West, and East).
   - The South-facing (A-A) glazing is prioritised to capture maximum solar gain during the day
   - There is a window on the east wall of the extension for morning sunlight at the breakfast table.
   - Corner glazing allowing evening light into the living space
   - The kitchen island is facing the glazing and views so the user can avail of natural light and scenery

3. **Bedroom & Bathroom Retention**:
   - The bedroom is moved to the north side of the house and maintains a good size
   - The bathroom is moved to the north side of the house- the occupants can avail of natural sunlight in the rooms they spend the most amount of time in

Any other relevant points

(b) Three reasons for your proposed layout

Option 1: (North-West/Rear Extension)

- This option succeeds by transforming the restrictive, compartmentalised 1920s layout into a dynamic, light-filled environment. It balances the technical requirements of Part L (Fuel and Energy) with the practical need for privacy and acoustic comfort in the sleeping quarters.

Reason 1: Environmental Performance & Solar Gain

- This option takes full advantage of the south-facing aspect (Wall A-A).
- Unobstructed Light Penetration: By removing internal partitions in the longitudinal block to the south, the design allows natural light from the south-facing windows to penetrate deep into the kitchen, dining and living space. This creates a dual-aspect effect, significantly reducing the depth of room lighting issues common in traditional farmhouse layouts
- Passive Solar Heating: The concentration of three large window openings on the south wall acts as a solar collector. The thermal mass of the floor and internal walls can absorb this heat during the day and radiate it in the evening, aligning with Part L of the Building Regulations regarding energy efficiency
- Opening double doors on the east wall from the kitchen area so the occupants have access to an outside seated area while enjoying the evening sun

Reason 2: Structural Rationalisation

- Option 1 prioritises a Life-Cycle approach by creating a flexible, modern living space through clever structural intervention.
- Longitudinal Zoning: The use of a single, large open space creates a broken-plan feel rather than just one big room. The kitchen island acts as a subtle structural and visual threshold between the high-activity cooking zone and the social dining/living zones without the need for light-blocking walls.
- By consolidating all social functions into the main block, the design eliminates redundant hallway space. Every square meter of the original house is utilised, making the overall footprint more efficient and easier to heat.

Reason 3: Occupant Privacy and Service Efficiency

- A distinct private wing for the bedroom, bathroom and utility room
- Acoustic Separation: By relocating the bedroom to the new extension on the right, it is physically separated by the original thick wall from the noise of the open-plan living area (e.g., TV, dishwasher, social gatherings)
- Service Grouping: The bathroom and utility are in close proximity to the original kitchen location/existing plumbing stacks. This minimises the length of pipe runs and lowers construction costs
- The bedroom can access the bathroom without going into the hallway – increasing privacy if visitors were present.

Option 2: (South Extension)

Reason 1: Maximising Thermal Comfort and Solar Gain

- This design prioritises the south-facing aspect (Wall A-A) by placing the primary living and dining zones within a highly glazed extension
- Passive Solar Design: By wrapping the living area with glazing on three sides (South, West, and East), the room acts as a solar collector. The prioritised south-facing glazing ensures the space absorbs maximum solar radiation during the day, reducing the energy required for space heating (Part L compliance)
- Daylight Tracking: The layout follows the sun's path throughout the day. The East-facing window provides morning light for breakfast, while the corner window and west-facing windows capture the evening sun. This creates a bright, psychologically uplifting environment and reduces reliance on artificial lighting
- User Orientation: Positioning the kitchen island to face the glazing ensures that the user is working in natural light and has views of the garden/landscape, significantly improving the quality of the workspace

Reason 2: Functional Zoning and Social Connectivity

- The layout utilises an open-plan concept that still provides structure and logical flow between activities
- Social Hub: By placing the kitchen, dining, and living areas in a continuous south-west wing, the design fosters social interaction. The open sightlines allow someone preparing food at the island to converse easily with people in the living area, meeting the requirements of modern family life
- Distinct Zoning: Despite being one large room, the L-shape of the extension creates three distinct zones (Kitchen, Dining, Lounge). This provides a sense of enclosure for the living area while maintaining the airy feel of an open-plan space
- Rationalising Services: Moving the utility and bathroom to the north-eastern wing consolidates the services of the house in the darker, cooler part of the building. This leaves the premium southern light for the habitable rooms where occupants spend the most time

Reason 3: Enhanced Privacy and Accessibility

- The redesign successfully reconfigures the private quarters without compromising the 1920s character of the original structure
- Private Wing Separation: Relocating the bedroom to the front (South-East) and the bathroom to the North creates a clear division between the public social areas and the private sleeping areas.
- Universal Design: By retaining and optimising a large bedroom and full bathroom on the ground floor, the house adheres to Part M (Access and Use) principles. This ensures the farmhouse is future-proofed for occupants of all ages and abilities, allowing for long-term habitation without the need for future structural changes
- Optimising Room Use: The bathroom is moved to the north side as it requires less direct sunlight than the living spaces. This ensures that the south-facing rooms are reserved for active living

(c) Benefits to occupants when revising an internal layout:

1. **Improved Space Utilisation and Flow**
   - Revising a layout often removes unnecessary internal partitions (moving toward open-plan living), which eliminates dead space like dark hallways
   - This creates a more logical flow between zones (e.g., kitchen to dining), making the house feel larger and more functional for modern family life

2. **Increased Natural Light and Ventilation**
   - By repositioning internal walls or increasing the size of openings, daylight can penetrate deeper into the floor plan
   - This reduces the reliance on artificial lighting and improves cross-ventilation, leading to a healthier indoor environment with better air quality

3. **Enhanced Thermal Comfort and Energy Efficiency**
   - Reorganising a layout allows occupants to place living zones on the south-facing side of the house to maximise passive solar gain
   - Service rooms (utility/bathrooms) can be moved to the north side to act as a thermal buffer, reducing overall heating bills and increasing comfort

4. **Adaptability for Changing Needs (Lifetime Use)**
   - Layout revisions can include the provision of a ground-floor bedroom or an accessible bathroom.
   - This allows the occupants to age in place, ensuring the home remains suitable if mobility decreases, without the emotional or financial stress of moving house

5. **Zoning for Privacy and Acoustic Comfort**
   - A revised layout can better separate active zones (noisy kitchens/living areas) from quiet zones (bedrooms/home offices)
   - This is particularly beneficial for multi-generational living or for occupants who work from home, as it reduces noise transfer and improves privacy

6. **Increased Property Value and Aesthetics**
   - Modernising a dated layout to a contemporary design significantly increases the market appeal and resale value of the property
   - It allows occupants to customise their surroundings to reflect their personal style and aesthetic preferences, increasing their sense of well-being

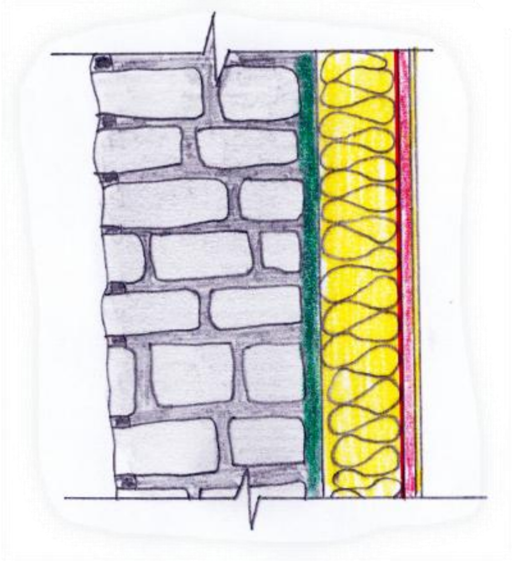
Any other relevant sketches or points

Question 4

(a) Steps involved in upgrading the thermal performance of each area selected

Thermal upgrading of solid stone external wall

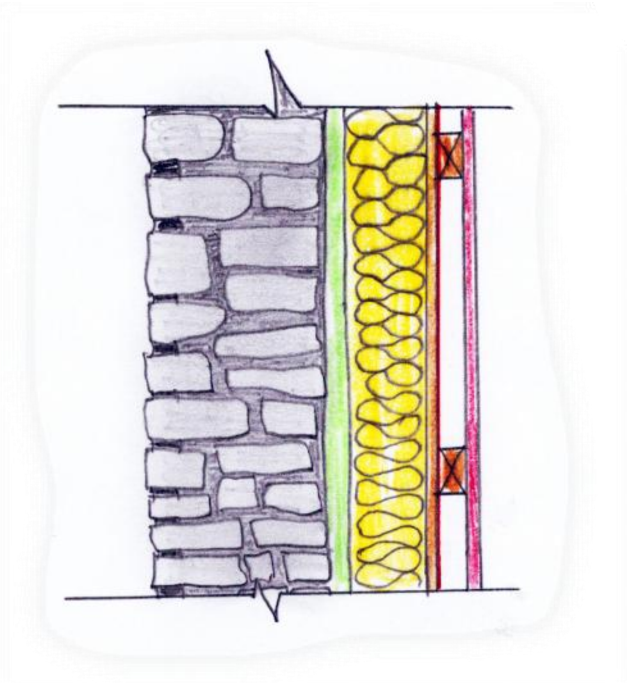
- A breathable structure is preferred which allows the gradual movement of moisture from the inside, through the building fabric of the walls
- Allows moisture exchange readily between the indoor and outdoor environment, moisture is not trapped within the wall structure
- Breathable wall prevents surface and interstitial condensation occurring - as water vapour is not trapped but is gradually released
- Ideally maintain the wall as a breathing structure – few barriers as in original
- Insulation materials have to be carefully selected - natural insulation materials allow breathability, such as lime, hemp, cork, wood fibreboard, sheep's wool, cotton, flax, earth-based mortars, renders, plasters and limewashes
- Natural insulation materials are made from renewable or recyclable natural products, they allow the building to breathe and have excellent hygroscopic properties



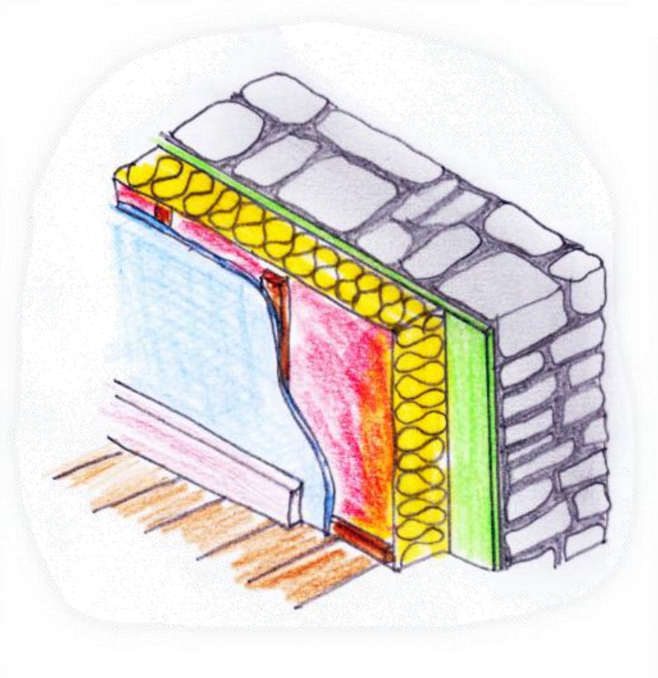
- Hygroscopic materials absorb the moisture from the air when the humidity is high and release it when the air is dry
- Hygroscopic properties of the insulation will allow water vapour to move through the structure
- Adding vapour barriers and materials that are highly resistant to the passage of water vapour are generally not appropriate for older stone buildings
- Rule of thumb – all layers should become progressively more permeable from the interior to the exterior
- Tanking may be required to prevent rising damp - depends on the design of the original wall.

Suitable insulation materials include:

- Hemp, hemp-lime composites, mineral wool, wood fibre, lime renders
- Rigid insulation, mechanically fixed to wall with ventilated cavity - vapour barrier, gypsum slab and gypsum skim
- Use of impermeable insulation materials generally requires ventilation - see sketch Re pointing of historic stone work:
- Re-pointing of historic stonework is a specialised task
- Raking out of the old deteriorated lime mortar must be undertaken with great care and powered angle grinders or concrete saws should not be used
- Best practice recommends the use of hand tools



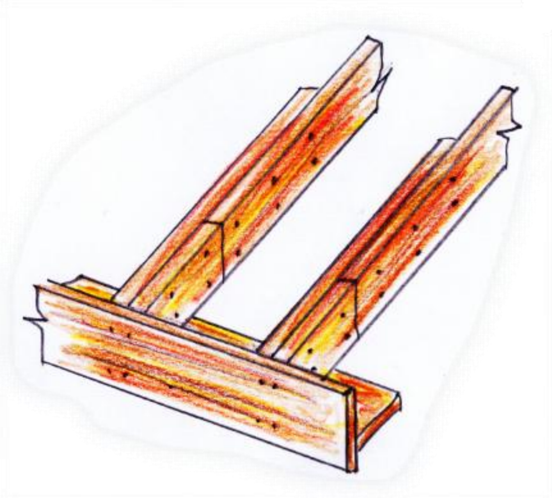
- Joints in general should be raked out to a depth twice the face width
- All joints should be thoroughly brushed out to remove any loose particles - working from the top down
- Prior to repointing, the stone wall should be dampened using a fine spray – do not saturate the stone
- Use a flat steel jointing bar to apply the lime mortar pointing
- Deep pointing will require filling in two stages as the lime mortar needs air to harden
- When the lime mortar hardens, a course bristled brush is used to beat it. This provides a coarse textured mortar with some of the aggregates visible
- Freshly pointed lime mortar requires protection from the weather for a considerable time period as lime hardens and sets slowly
- Hessian matting is frequently used to protect lime from sun, wind, rain and frost
- Insulation, straw or hay is also used under the hessian but allowing air circulation to facilitate carbonation occurring.



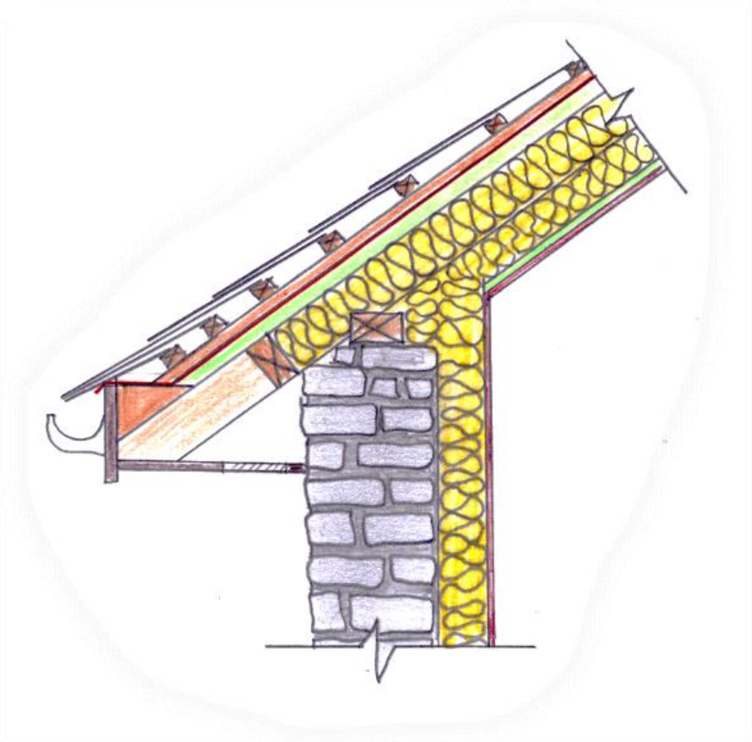
- Applying hempcrete as an insulating layer over the stone -internally + two coats of lime render plaster/putty. Applying three- coat lime plaster work to the internal surface of historic stone wall.
- Brush down the stone wall to get rid of any dust or loose particles
- All loose lime mortar beds should be raked out and re pointed prior to applying hempcrete or rendering
- Hempcrete – a mix of lime and hemp – may be sprayed directly onto internal stone surface, or it may be built up in layers with the use of temporary plumb/vertical battens or shuttering Sketch (2)
- The stone wall should be dampened down prior to applying hempcrete or lime render
- Hempcrete must be dried out completely (4-6weeks) before applying two coats of lime render/putty
- A scud coat of NHL and sand should be “dashed” onto the stone-if applying lime render only- and left for a few days to allow the grit time to bond sufficiently enough to support the following scratch coat of lime plaster. Sketch (3)
- Later (2-3 days) the scratch coat made up of a weak natural hydraulic lime render (NHL) plus animal hair is applied and left rough textured for better adhesion of following coats.
- Keep from drying out too quickly – lightly spray with water (Mist only) if required
- Lay the second or float coat of lime render plus animal hair over the scratch coat and texture
- Lay the third and finish coat of lime render using a mix of lime putty and sand.

Thermal upgrading of traditional cut roof

- Remove existing slate carefully
- Clean all slates on the underside only of lime parging. (No felt used at time of construction – 100 years ago)
- Do not power wash or clean the top surfaces of the natural slate as this will eliminate the "patina" that these old natural slates have acquired and helps to maintain the character of the dwelling
- When refitting slates place heaviest slates at eaves and working up the roof lay each slate according to its decreasing weight. The lightest slates will be located at ridge level



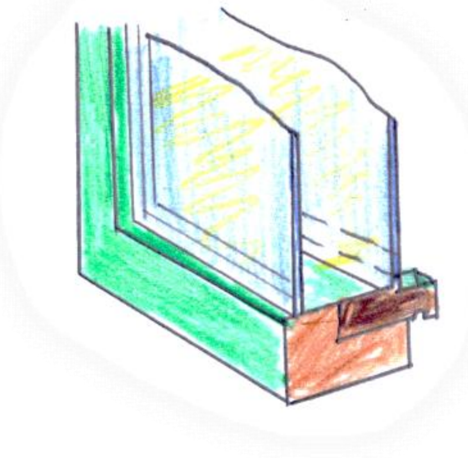
- Remove existing battens
- Examine roof joists for signs of decay and remove decayed end of rafters, wall plate, fascia and replace if necessary with the same species of wood and same profiles/ mouldings so as to maintain the historical integrity of the original roof.
- Trades persons such as carpenters should use the same carpentry jointing details during repairs where possible as this helps retain older traditional skills and techniques
- Treat all new replacement timbers with preservative – boron.
- Install vapour diffuse breathable membrane – to allow any vapour escape
- Counter battens for ventilation -should be used -provided the single roof plane for the terrace is maintained.
- Replace slate on the principal elevation - keeping same lap.
- Broken slates should be replaced – firstly with slates taken from the rear and secondly using reclaimed or salvaged natural slate on the lesser visible roof surface
- Rain water goods – gutters and downpipes – should be of the period -cast iron. The principle elevation should utilise salvaged or "new" cast iron rain water goods again to help maintain the character of the dwelling



- Insulate roof – all insulation materials to be hygroscopic – allow water vapour pass though
- Insulation such as sheep's wool laid between rafters: wood fibre board above and /or beneath rafters, lime plaster to fibreboard beneath rafters allow moisture through
- All roof structures must be thoroughly vented, otherwise condensation will cause the decay of the roof members
- Full fill insulation can be achieved if insulation is permeable and breathable membrane with counterbattens are installed.

Original sliding sash windows-softwood and single glazed

- Retaining the original sliding sash, softwood, single glazed windows maintain the character and increases the value of this dwelling
- The repair of such historic sash windows is therefore the recommended option rather than replacement
- Repair of these sash windows is expensive - however, grants are sometimes available from local authorities and the Heritage Council should the dwelling be included on the list of protected structures.
- The sliding sash windows should be carefully removed taking care not to break the original "float" glass or the timber sashes and frames.
- Retain the sash - counter balancing weights.
- A specialist conservation joiner should be tasked with the repair work
- Carefully remove glazing and note/record its original position in the sash window
- Caution required with this task as in removing the hardened linseed oil putty the original historic glass may get broken
- When framed up 100 years ago "animal glue" would have been used. This glue is thermoplastic and on re heating the joints it will be possible to dis-assemble (if necessary) all the components of both the sashes and the frame.
- Remove all rotten timbers and replace with the same species
- Identical profiles for all components must be replicated where required
- Traditional jointing details should also be utilised as this also helps to retain historic craft skills and develop an appreciation for such historic carpentry/joinery work
- When gluing up the repaired sashes and frames "animal glue" should again be used as this enables maximum retention of the original fabric and allows for repair and conservation work into the future.
- Pulleys should be removed and cleaned/freed up
- Sash cords will need to be replaced and the original sash counter- balance weights reused
- In the re assembly of the sashes and glazing- linseed oil putty should be used
- Original "float" glass is no longer manufactured in Ireland – however it is available and should be sourced elsewhere
- Non - toxic paints are a better or preferred option in the repainting of the windows
- A record of the date of conservation/repair work including the name of the individuals who carried out the work to the sash windows - should be made and placed – perhaps on the inside of the sash frames in the voids that house the counter – balance weights. Pencil is best for this purpose.
- Secondary glazing is also recommended for this dwelling as it significantly, restricts heat loss and provides excellent sound proofing – if triple glazed and having a U value of at least 0.8 Wm2 k



Any other relevant points

(b) Discuss the importance of any two of the following when restoring traditional heritage buildings:

Successful restoration of traditional heritage buildings depends on retaining original materials, preserving the building's natural breathability, and respecting its historic and cultural significance.

Conservation of Original Materials

Conserving original materials is important because:

- It preserves the building's historical authenticity and significance
- Traditional materials often have qualities that modern replacements cannot replicate
- Repairing existing materials is usually more sustainable than replacing them
- Original fabric contains valuable information about the building's age, development, and past uses
- Retaining historic materials helps maintain the building's cultural and architectural integrity

Maintaining a Breathable Structure

- It prevents moisture from becoming trapped within walls, floors, and roofs
- It reduces the risk of dampness, mould growth, and timber decay
- It protects masonry from damage caused by freeze-thaw cycles and salt crystallisation
- It helps create a healthier indoor environment
- It ensures the building performs as originally intended

Respect for Our Built Heritage

- Understanding and valuing the historical significance of a building before undertaking work
- Preserving distinctive architectural features and craftsmanship
- Ensuring alterations are sympathetic and do not diminish the building's character
- Following established conservation principles and heritage guidelines
- Recognising that heritage buildings are irreplaceable cultural resources

Any other relevant points

Question 5

(a) Calculate the U-value of the external wall.

Material Element	Conductivity k	Resistivity r	Thickness T(m)	Resistance R
External surface				0.048
External render		2.170	0.016	0.035
External concrete block	1.440		0.100	0.069
Clear cavity				0.440
OSB	0.130		0.012	0.092
Insulation	0.039		0.250	6.410
OSB	0.130		0.012	0.092
Plasterboard	0.250		0.0125	0.050
Internal surface				0.130
			Total R =	R^t = 7.367
Formulae: **R=T/k** **R=T × r** **U= 1/R^t** **U-value:** U = 1 / 7.367 = 0.136 W/m^2 °C				
			U-value =	**0.136 w/m^2 °C**

(b) Cost of heat lost annually through the wall.

- Heat lost through wall
  Heat loss formula: = U -Value × area × temp. diff
  0.136 × 144 × (20 - 7) = 254.592 Watts (Joules / sec)

- Heating period p/a: 60 × 60 × 6 × 7 × 33 = 4,989,600 seconds

- Kilo joules p/a: $\frac{4{,}989{,}600 \times 254.592}{1000}$ = 1,270,312.243 KJ/ second

- Kg p/a: *(Note: Calorific value of 1 Kg of wood pellets = 17350 kJ)*
  $\frac{1{,}270{,}312.243}{17{,}350}$ = 73.2168 kilograms

- Cost p/a: *(Note: 1 Kg of wood pellets cost €0.55)*
  73.2168 × 0.55 = €40.27

  Cost of heat loss annually through wall = €40.27

Alternative method:

Formula: $\frac{\text{U-value} \times \text{Area} \times \text{Temp Diff.} \times \text{Time (secs)} \times \text{Cost (Euros)}}{\text{Calorific value} \times 1000}$

$$= \frac{0.136 \times 144 \times 13 \times 4{,}989{,}600 \times 0.55}{17{,}350 \times 1000}$$

$$= \frac{697{,}334{,}992.4}{17{,}350{,}000}$$

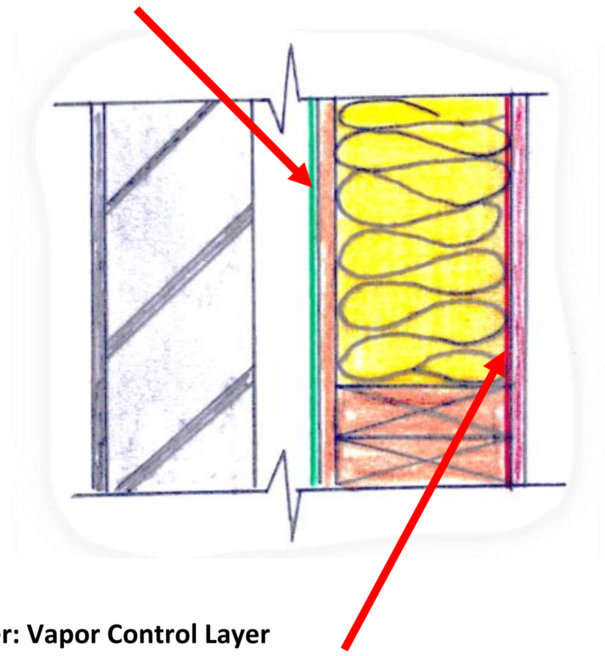
= **€40.27**

(c) Typical design detailing that will prevent the build-up of moisture within the timber frame structure.

To protect a timber frame from moisture build-up, two essential layers are installed:

The Outer Layer: Breather Membrane

- Function: Lets indoor vapor escape while repelling external water.
- Installation Tip: Seal all joints with tape to stop accidental air leaks.

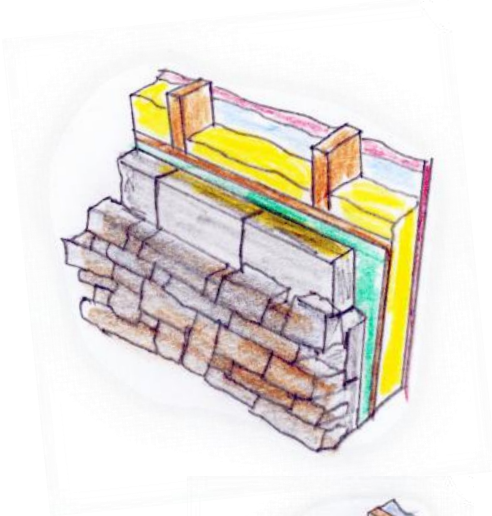


The Inner Layer: Vapor Control Layer

- Function: Blocks warm, humid indoor air from penetrating the structure.
- Purpose: Prevents interstitial condensation, which can cause dry rot in the timber frame.
- Installation Tip: Ensure the VCL is entirely continuous and sealed at every lap.

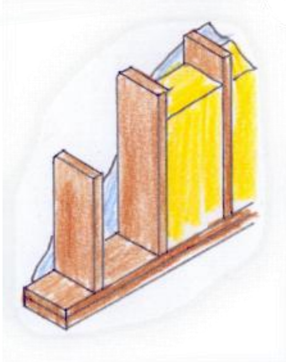
Question 6

(a) Three features of the design that contribute to the house having a low environmental impact.

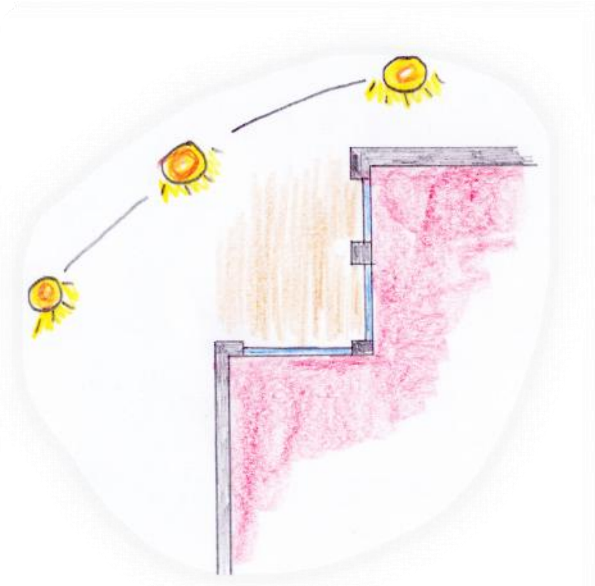


1. Selection of Sustainable Materials

- The use of locally sourced timber cladding reduces the embodied energy of the building by minimising carbon emissions associated with long-distance transport
- Timber frame construction is a renewable structural method. Timber acts as a carbon sink (sequestration) and generally has a lower carbon footprint compared to traditional masonry or steel frames
- Use of natural stone provides a durable, low-maintenance finish with a long-life cycle, reducing the need for chemical-based paints or future repairs



2. Optimisation of Passive Solar Gain



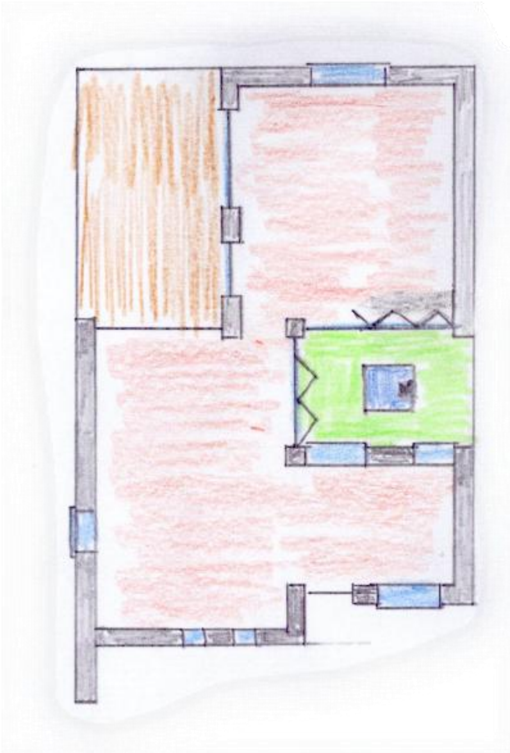
- The elevation and plan show extensive south-facing glazing (large windows in the living/kitchen areas). This maximises free heat from the sun to warm the internal thermal mass
- Benefit: This reduces the demand on the space heating system, lowering the overall energy consumption and carbon emissions of the dwelling

3. Renewable Space Heating Source

- Renewable heat source (such as an Air-to-Water Heat Pump or Geothermal system) indicates a move away from fossil fuels (oil/gas)
- When paired with a highly insulated timber frame envelope, these systems operate at high efficiency, significantly lowering the house's operational carbon footprint

4. Integration of Indoor-Outdoor Living (Biophilic Design)

- The design includes a central courtyard/garden and large folding doors that connect the interior living spaces with nature
- This promotes natural cross-ventilation, reducing the need for mechanical cooling or ventilation systems. It also maximises natural daylighting, reducing electricity loads



5. Compact and Efficient Building Form

- The house utilises a relatively compact footprint with an open-plan internal layout
- A compact form has a lower surface-to-volume ratio, which minimises the area of external wall through which heat can escape, making the building easier and more efficient to heat.

6. Permeable Surfaces and Greenery

- The plan shows integrated planters and green spaces (terrace/courtyard/balcony)
- These help manage surface water runoff (SUDS - Sustainable Urban Drainage Systems) and promote local biodiversity, mitigating the urban heat island effect and improving air quality

Any other relevant points/sketches

(b) Two features of the design that contribute to increasing the occupants' connection with nature.

1. Integrated Central Courtyard and Gardens

- The ground floor plan is designed around a central courtyard garden, ensuring that nature is physically situated at the heart of the home
- This allows for 360-degree views of greenery from the main circulation areas and living zones, blurring the boundary between inside and outside

2. Extensive Use of Large-Scale Glazing

- The elevation shows floor-to-ceiling glass panels and large folding/sliding doors
- These act as picture windows framing the surrounding landscape and allowing the occupant to observe seasonal changes, weather patterns, and local wildlife from within the living space

3. Strategic Use of Natural, Locally Sourced Materials

- The use of stone finishes and timber cladding mirrors the textures and colours found in the Irish landscape.
- Using natural materials (Biomimicry) creates a tactile connection to nature; timber, in particular, provides a warm aesthetic that contrasts with industrial materials like steel or concrete

4. Maximisation of Natural Daylighting

- The open-plan layout and large glazed areas ensure that the internal spaces are flooded with natural light
- This helps regulate the occupants' circadian rhythms (sleep-wake cycles), improving mental well-being and reinforcing the connection to the sun's movement throughout the day

5. Direct Physical Access (Outdoor Living)

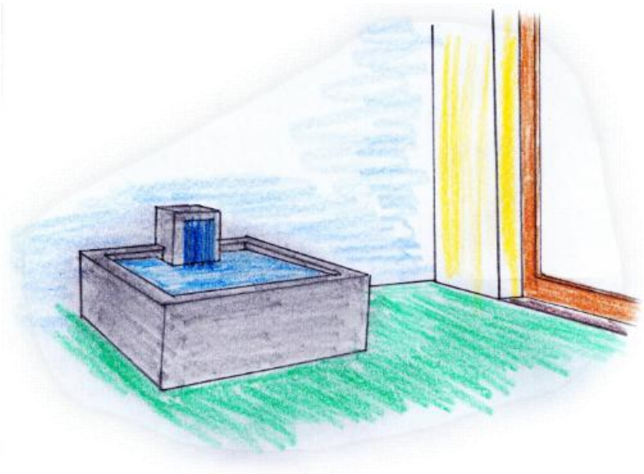
- The design features multiple access points to the external terraces and courtyard
- Level thresholds facilitate easy movement to the outdoors, encouraging the occupant to use the garden as an outdoor room for dining, relaxation, and fresh air

6. Promoting Natural Ventilation

- The placement of windows on opposite sides of the living areas (cross-ventilation) allows for the scent of the garden and the sound of wind or rain to enter the house
- This sensory engagement—hearing and smelling nature—is a key psychological factor in feeling connected to the environment

7. Integrated Courtyard Water Feature

- The inclusion of a central water feature provides a strong auditory connection to the environment. The sound of moving water creates a tranquil atmosphere that masks ambient noise and reduces occupant stress
- It facilitates evaporative cooling; as water evaporates, it naturally lowers the temperature of the air in the courtyard, which can then be drawn into the living areas through the folding doors to improve the internal microclimate
- The water surface acts as a reflective plane, bouncing natural light and shifting patterns into the deeper parts of the open-plan living and dining zones, further strengthening the visual link to the outdoors



Any other relevant points/sketches

(c) Advantages of Enhancing the Connection to Nature

1. Improved Mental Health and Well-being

- Increased exposure to natural light and views of greenery reduces cortisol levels (stress) and promotes relaxation
- The concept of Biophilia suggests that humans have an innate need to connect with nature; fulfilling this need in a home environment leads to improved mood and cognitive function

2. Regulation of Circadian Rhythms

- Maximising natural daylighting helps synchronise the occupants' internal body clocks.
- Benefit: This leads to improved sleep patterns, higher energy levels during the day, and overall better long-term health for the inhabitants

3. Natural Temperature and Air Quality Control

- Designs that connect with nature often utilise cross-ventilation, bringing fresh, oxygenated air into the home and flushing out CO2 and pollutants
- Water features and vegetation in courtyards provide evaporative cooling, naturally lowering the indoor temperature during summer without the need for mechanical air conditioning

4. Passive Solar Gain and Energy Savings

- Designing large glazed areas to view nature often aligns with south-facing orientations to capture the sun
- Benefit: This provides free solar heating (passive solar gain), significantly reducing heating bills and the house's overall carbon footprint

5. Enhanced Sensory Experience

- A home that incorporates the sound of water, the scent of a garden, and the sight of changing seasons provides a more stimulating and enriched living environment
- This sensory variety prevents the sterile feeling of modern indoor environments and makes the home feel more vibrant and alive

6. Encouragement of Outdoor Living

- By creating a seamless transition between the interior and the garden (e.g., level thresholds and folding doors), occupants are more likely to spend time outdoors
- Benefit: This encourages physical activity, gardening, and social interaction in a healthy, open-air setting

7. Increased Visual Space and Perception

- Large windows and views through courtyards borrow space from the outside, making a compact house feel much larger and less confined
- This is particularly advantageous in smaller dwellings, such as the garage conversion previously discussed

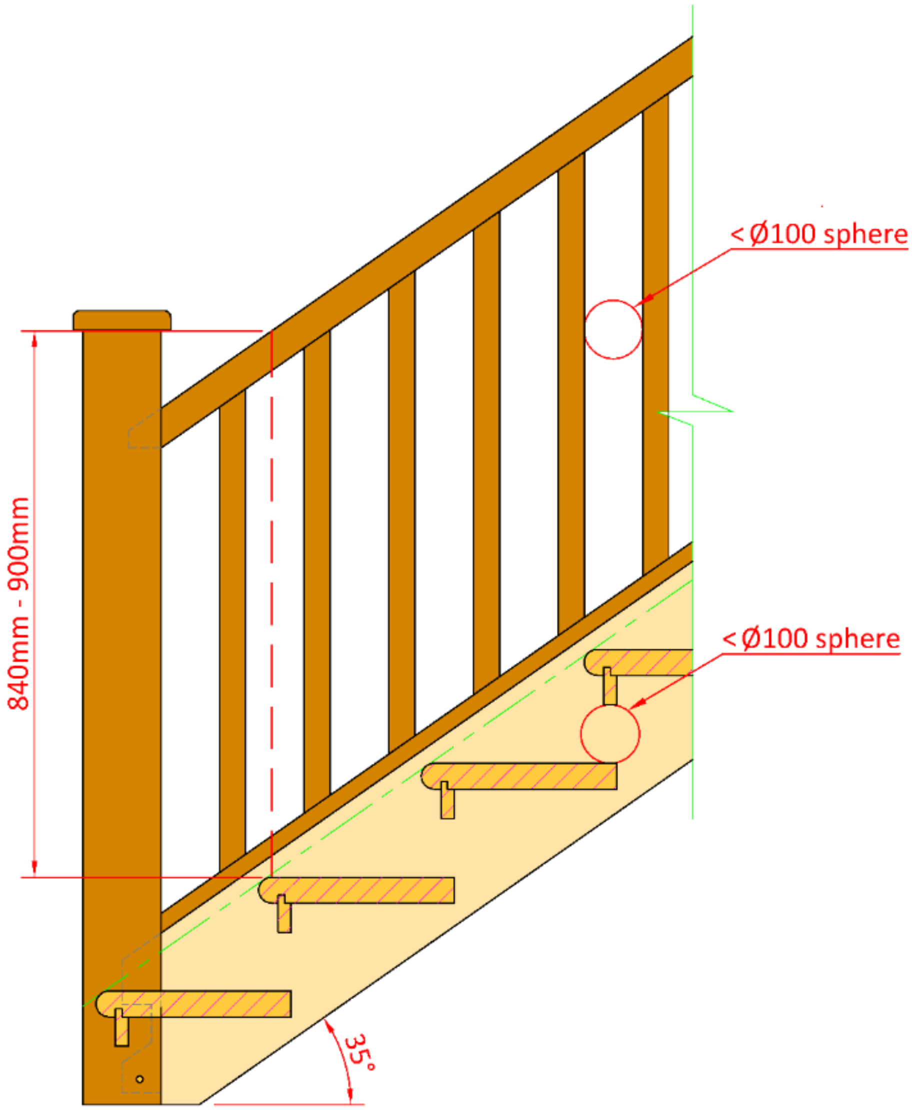
8. Appreciation of Biodiversity and Sustainability

- Occupants who are constantly connected to a living landscape develop a stronger environmental ethic
- Watching a local ecosystem (birds, insects, and plants) thrive in an integrated courtyard or garden fosters a sense of stewardship and appreciation for the natural world.

Any other relevant points

Question 7

(a) Vertical section through centre of an open riser stairs.



- Going: 220mm min (250 optimum)
- Rise: 220mm max (175 optimum)
- Minimum stairs width 800mm
- Minimum headroom 2m when measured from pitch line.
- No more than 16 risers in any one flight
- Stairs should be guarded at the sides and should not allow a 100mm sphere to pass through
- any of the openings.
- 2R+G to be between 550mm and 700mm
- Maximum pitch 42°
- Guarding should not be easily climbed by children
- A landing to be provided at the top of every flight
- Handrail should be provided on both sides of any stairs wider than 1000mm
- Handrails should be at a height of 840mm-900mm (when measured from the pitch line)

Question 8

(a) Drainage Considerations for a First-Floor Bathroom:

1. Alignment with Ground Floor Services

- Position the first-floor bathroom directly above or near ground-floor wet areas (like the kitchen or utility room)
- This allows for a shorter, more direct horizontal pipe run to the vertical Soil and Vent Pipe (SVP), minimising the risk of blockages and reducing material costs

2. Structural Integrity (Joist Routing)

- Pipework should ideally run parallel to the floor joists to avoid excessive notching or drilling
- If pipes must pass through joists, notches should only be made in the top 0.07 to 0.25 of the span length to prevent weakening the floor structure. Large holes for soil pipes (110mm) usually require the use of engineered joists (e.g., I-joists or Open-Web joists)

3. Pipe Gradients (Falls)

- Horizontal branch pipes must be laid at a specific gradient to ensure self-cleansing flow.
- Waste pipes (32mm–50mm) typically require a fall of 1:18 to 1:40, while soil pipes (110mm) require a fall of 1:40 to 1:80. If the fall is too steep, water leaves solids behind; if too shallow, flow is insufficient.

4. Acoustic Insulation (Noise Control)

- Drainage pipes located in floor voids or internal stud walls should be wrapped in acoustic mineral wool or high-density lagging
- Using low-noise plastic piping or boxing in the SVP with sound-rated plasterboard helps prevent the sound of rushing water from disturbing occupants in bedrooms or living areas below

5. Access and Maintenance

- Incorporate access points or cleaning eyes at significant changes in direction in the pipework
- Access panels should be designed into the boxing or flooring to allow for future maintenance or to clear blockages without the need to demolish finished surfaces

6. Ventilation of the System (SVP)

- The drainage system must be vented to the external air to prevent siphonage (where the water seal in traps is sucked out)
- The Soil and Vent Pipe (SVP) should terminate at least 900mm above any window or opening within 3 meters, or use an Air Admittance Valve (Durgo valve) within the attic space

7. **Water-tightness and Trap Provision**

- Every sanitary appliance (sink, shower, toilet) must be fitted with a deep-seal trap (usually 75mm water seal for first-floor applications)
- This prevents foul sewer gases from entering the living quarters. Connections should be tested under water pressure before the floorboards are fixed down

8. **Floor Depth and Traps (Shower Considerations)**

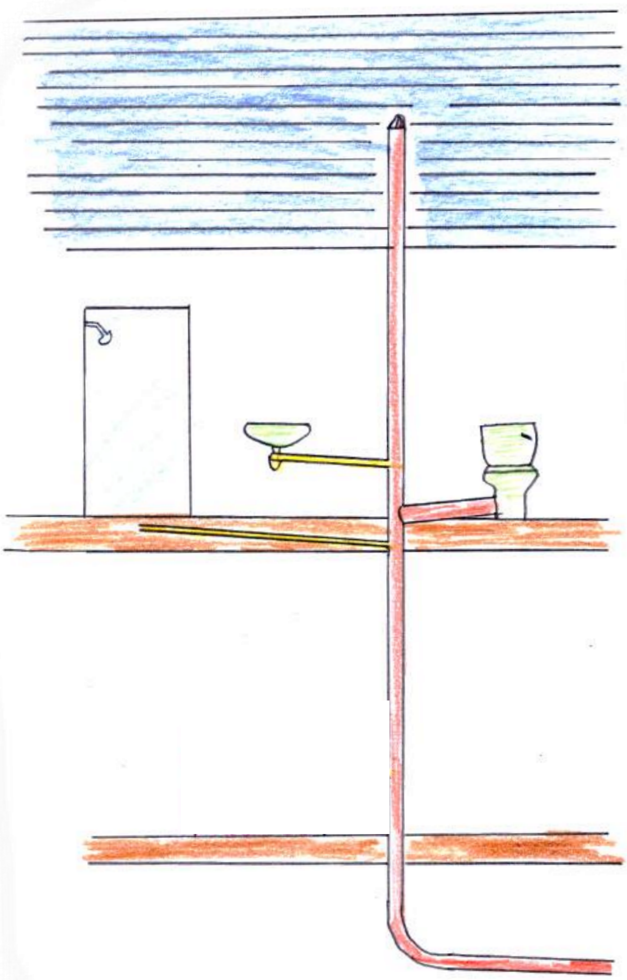
- Low-profile shower trays on first floors often require low-level traps or for the floor joists to be specifically designed to accommodate the waste outlet
- In wet-room applications, a waterproof tanking membrane must be applied to the entire floor and up the walls to prevent leaks to the ceiling below

Any other relevant points

(b) Above-Ground Drainage Layout (Single Stack System):

- **Soil and Vent Pipe (SVP)**

The main vertical stack should be 110mm diameter uPVC. It collects waste from all appliances and carries it to the underground drain. The top of the pipe must extend above the roofline (or terminate in the attic with an Air Admittance Valve) to vent sewer gases and prevent siphonage of traps

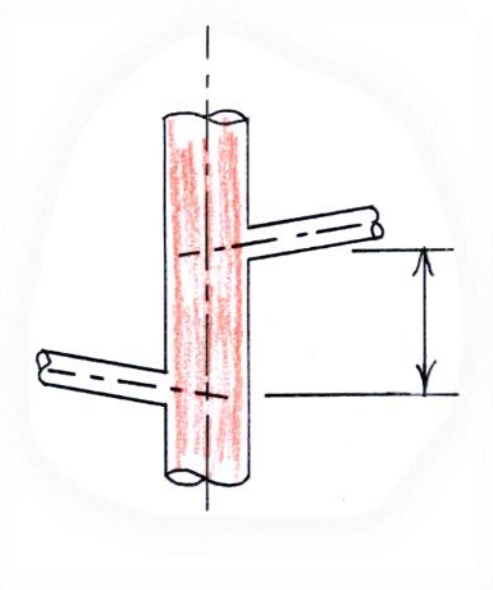


- **Water Closet (W.C.) Connection**

The W.C. is connected directly to the SVP using a 110mm diameter soil pipe. The branch should be as short as possible and installed with a gradient of 1:40 to 1:80. A 75mm deep-seal trap is integrated into the W.C. porcelain

- **Shower Connection**

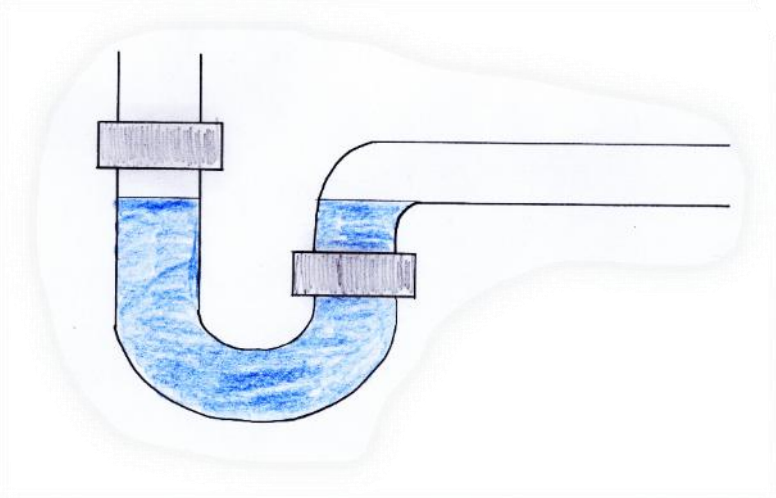
  The shower requires a 40mm or 50mm diameter waste pipe to handle the high flow rate of modern units. It must feature a low-profile 75mm deep-seal trap that is accessible for cleaning (usually via a removable grid). The waste pipe should be laid at a gradient of 1:18 to 1:40



- **Prevention of Siphonage (Branch Connections)**

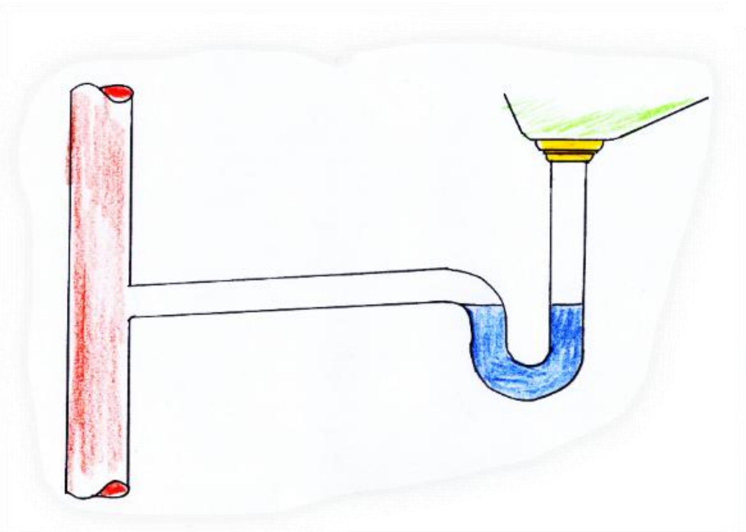
  To prevent cross-flow (waste from the W.C. being forced into the shower or basin pipes), the small waste branches must not enter the SVP within 200mm of the W.C. branch connection

(c) Design details to prevent foul odours



- **Provision of Deep-Seal Traps**

  Every sanitary appliance must be fitted with a trap that maintains a minimum water seal of 75mm. This column of water acts as a physical barrier, preventing sewer gases (foul odours) from travelling back up the pipes into the living spaces



- **System Ventilation (Soil and Vent Pipe)**

  The vertical stack (SVP) must be open to the atmosphere at the top. This allows air to enter or escape the system, equalising pressure. Without this, the vacuum created by a descending slug of waste (e.g., a toilet flush) would suck the water out of the traps (siphonage), allowing odours to enter

- **Correct Branch Gradients**

  Branch pipes must be laid at a self-cleansing gradient (e.g., 1:40). If the gradient is too steep, the water may flow too fast and create a siphonage effect. If too shallow, waste will stagnate and decompose in the pipe, creating local odours

- **Proper Pipe Diameters**

  Using the correct pipe sizes (e.g., 32mm for basins, 110mm for W.C.s) ensures that the pipes do not run full-bore. By maintaining a pocket of air above the flow of water, the system prevents the pressure fluctuations that lead to trap failure

- **Air Admittance Valves (Durgo Valves)**

  Where a pipe cannot terminate through the roof, a one-way Air Admittance Valve can be used. It opens to allow air into the system when there is negative pressure (preventing siphonage) but remains airtight to prevent foul air from escaping into the building or attic

- **Anti-Siphonage Traps (Resealing Traps)**

  In instances where long branch runs are unavoidable, specialised anti-siphonage or resealing traps can be used. These are designed to retain their water seal even when subjected to significant pressure changes in the pipework

- **Avoidance of Cross-Flow**

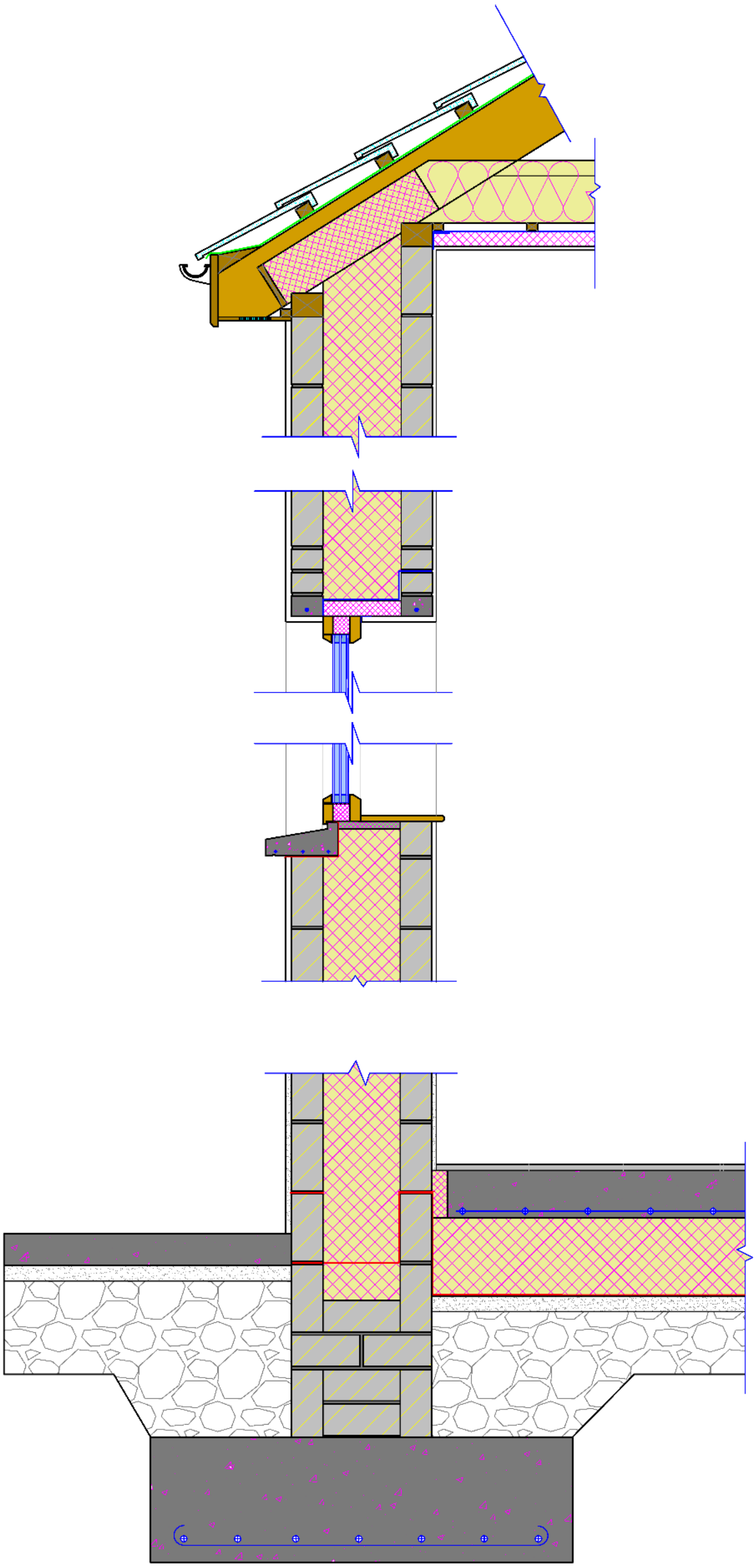
  Design the connections to the main stack so that small waste branches (basin/shower) do not enter the SVP directly opposite a large soil branch (W.C.). This prevents waste from one appliance being forced into the trap of another

- **Airtight Jointing and Testing**

  All joints in the above-ground pipework must be fully airtight, using solvent-weld or O-ring push-fit connections. The system should be subjected to an air or water test during construction to ensure no leaks exist in the pipework behind walls or under floors.

Question 9

(a) Best practice design detailing to prevent thermal bridging



Any other relevant points

Wall and roof junction
- Continuous insulation: Ensure wall and roof insulation meet to maintain the thermal envelope
- Thermal break at wall plate: Add an insulated barrier/ thermal blocks to reduce heat transfer through the junction
- Cavity and eaves insulation: Continue cavity insulation and detail the eaves to prevent cold bridging
- Minimise structural bridges: Avoid direct connections through materials such as steel fixings or roof supports

Window Head
- Continuous insulation: Ensure wall insulation connects with the window frame insulation
- Thermal break at frame: Use thermally broken window frames and insulated cavity closers at opening
- Lintel insulation: Use insulated lintels or thermal break details to prevent heat loss above the window
- Seal junctions: Provide airtight seals around the frame to reduce draughts and heat transfer

Window cill
- Continuous insulation: Ensure wall insulation and cavity closers continue around the window opening
- Thermal break at cill: Use insulated window cill details to prevent a direct heat path through the wall or insulation at back of concrete cill
- Frame connection: Use thermally broken window frames and insulated perimeter seals
- Airtight junction: Seal the frame-to-wall junction to reduce air leakage and heat loss

Wall and floor junction
- Continuous insulation: Ensure floor and wall insulation maintain a continuous thermal barrier
- Thermal break at slab edge: Use insulated slab edge details to reduce heat loss through the floor structure
- Cavity insulation: Continue wall cavity insulation down to meet the floor insulation
- Minimise thermal paths: Avoid exposed concrete or structural elements bridging inside and outside. Use thermal blocks where floor slab abuts external wall.

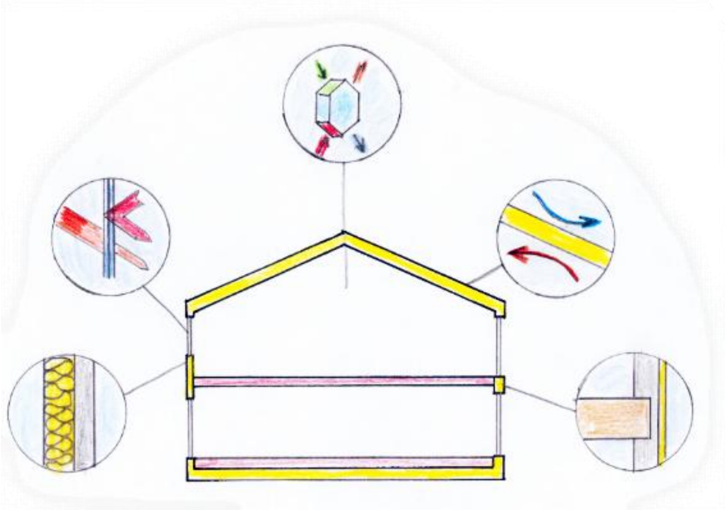
(b) Benefits to the homeowner of eliminating thermal bridging

- Prevents heat loss through the building fabric at critical junctions
- Improves the thermal comfort for the occupants of the house
- Saves money as less energy is required for space heating resulting in a reduction in the amount of fossil fuels - oil/gas - needed to heat home
- Reduces carbon footprint and CO^2 emissions of the building
- Thermal bridging can cause condensation, which can cause dampness and mould growth, therefore eliminating thermal bridging results in healthier living environment
- Increases the home’s market value as eliminating thermal bridging helps secure a superior BER rating
- Plaster, wood, steel and other building materials can be compromised and fail as a result of thermal bridging over long periods of time, therefore eliminating thermal bridging preserves the integrity of the structure
- The heating system will operate in a more efficient manner and will consume less energy to heat the building.

Any other relevant points

Question 10

(a) Building Fabric Areas for EnerPHit Retrofit:



1. External Walls (Thermal Insulation)

- Retrofit: Application of External Wall Insulation (EWI) or high-performance pumped cavity bead
- Reason: To significantly reduce the U-value of the wall and eliminate thermal bridging at floor and roof junctions, ensuring heat is retained within the building structure

2. Ground Floor (Sub-floor Insulation)

- Retrofit: Excavation of existing floors to install a high-thickness PIR or EPS insulation board (e.g., 150mm+) under a new concrete slab
- Reason: In older bungalows, the floor is often a major source of heat loss. Insulating the floor completes the thermal envelope and prevents thermal cold-bridging at the wall-to-floor junction

3. The Roof / Attic (Cold or Warm Roof)

- Retrofit: Increasing glass wool or cellulose insulation to 400mm+ in the attic, or insulating between rafters for a warm roof
- Reason: As heat rises, the roof is the most critical area for heat loss. Proper insulation ensures a consistent thermal barrier and helps maintain stable internal temperatures

4. Windows and External Doors

- Retrofit: Replacing existing units with Triple Glazed high-performance windows and insulated doors with airtight seals.
- Reason: To minimise heat loss through glazing and frames. EnerPHit requires very low U-values to prevent cold spots and condensation

5. Airtightness Layer

- Retrofit: Installation of a continuous airtightness membrane and specialised tapes at all joints, service penetrations, and structural junctions
- Reason: To prevent infiltration (uncontrolled draughts). Achieving a low air-change rate (measured by a blower door test) is essential to ensure the efficiency of the ventilation system

6. Thermal Bridge Elimination

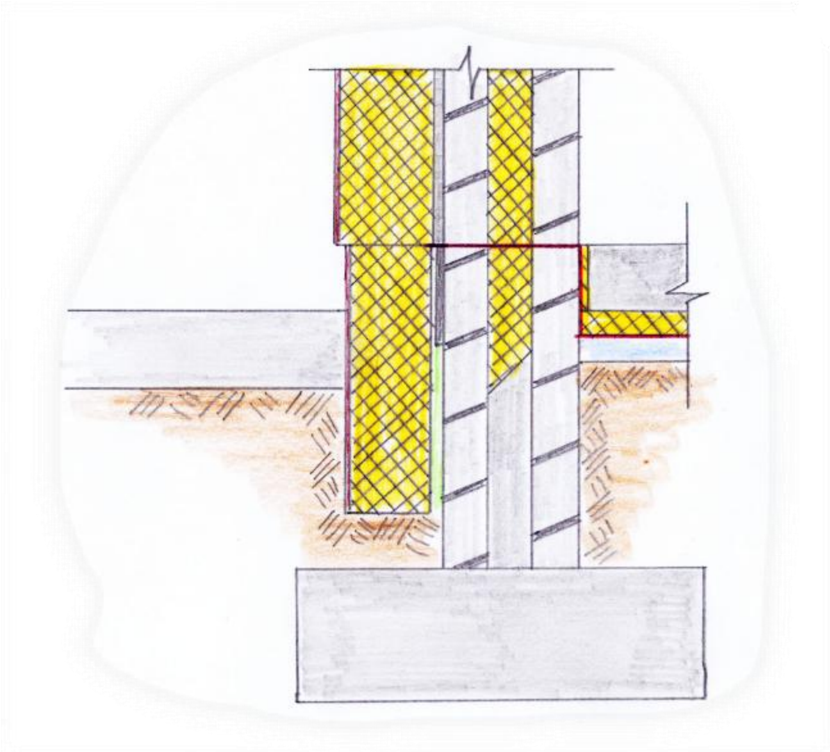
- Retrofit: Using thermal breaks at junctions (e.g., where the wall meets the roof or window sills)
- Reason: To prevent cold paths where heat can bypass insulation. This is vital in EnerPHit to prevent mould growth and structural dampness caused by interstitial condensation

Any other relevant points

(b) Method to retrofit the specified area to achieve the EnerPHit Passive House standard:

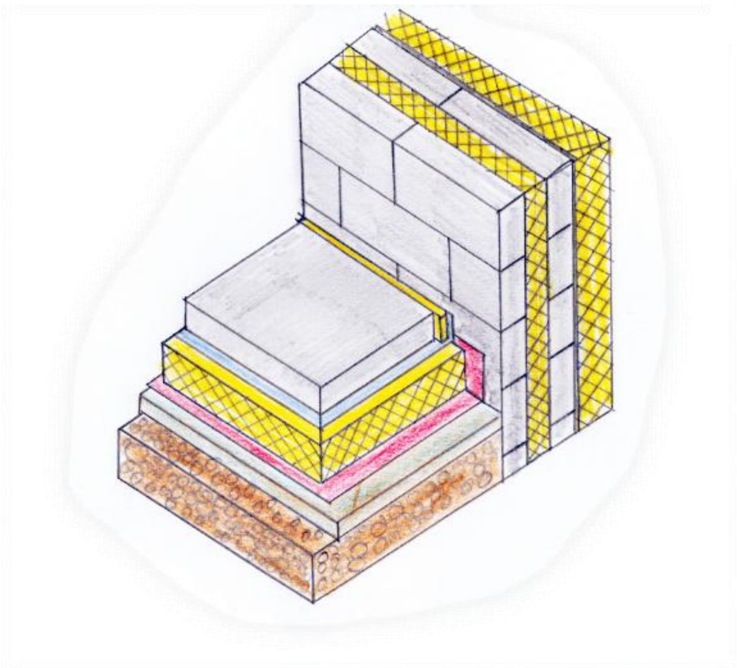
1. External Wall Retrofit (External Wall Insulation)

- Method: Applying a high-performance insulation layer to the outside of the existing masonry wall. This is preferred in EnerPHit as it wraps the house like a tea cosy, eliminating thermal bridges at floor and wall junctions
- Process: Fix 200 mm+ EPS (Expanded Polystyrene) or Mineral Wool boards to the cleaned external leaf using adhesive and mechanical fixings. Apply a base coat with an integrated fibreglass mesh to prevent cracking. Finish with a silicone-based breathable render
- Key Detail: The insulation must extend below the DPC (Damp Proof Course) and reach down to the foundation footing (Perimeter Insulation) to prevent toe thermal bridging at the floor edge.



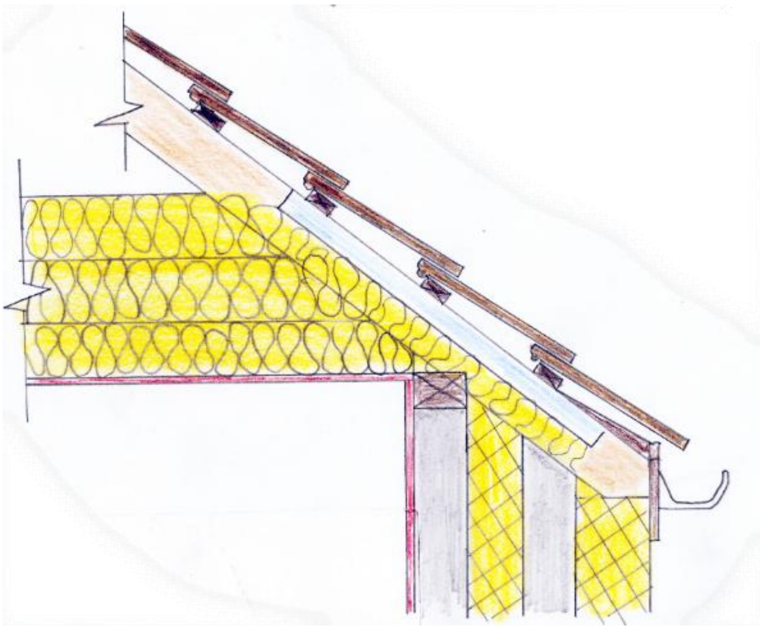
2. Ground Floor Retrofit (High-Performance Floor Insulation)

- Method: Removing the existing floor to install a new, highly insulated ground slab.
- Process: Excavate existing floor/hardcore. Lay new blinding, hardcore and a Radon Barrier/DPM. Install 150mm – 200mm of high-density PIR or EPS insulation. Crucially, install vertical perimeter insulation (upstand) around the edge of the floor to meet the wall insulation. Pour a new concrete slab (or sand/cement screed) over the insulation
- Key Detail: The junction between the floor insulation and the wall insulation must be continuous to ensure no heat escapes through the floor-to-wall joint.



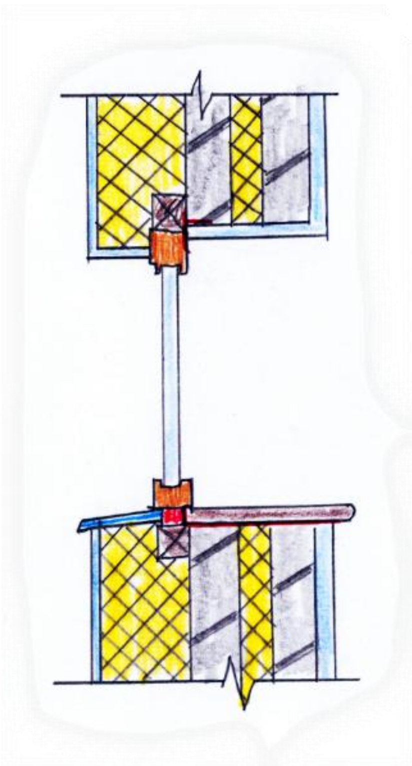
3. Roof/Attic Retrofit (Airtightness and Insulation)

- Method: Upgrading the attic to a Super-Insulated standard while ensuring complete airtightness
- Process: Install an Airtightness Membrane on the warm side of the ceiling (the underside of the joists). Tape all laps and joints with specialised airtight tape. Roll out 400mm of mineral wool insulation in cross-piled layers (to minimise gaps) or pump in cellulose fibre. Ensure a 50mm ventilation gap is maintained at the eaves between the insulation and the roof felt to prevent timber rot. Key Detail: Seals around service penetrations (pipes, wires, loft hatches) must be meticulously taped to prevent air leakage.



4. Window Retrofit (Triple Glazed & Airtight)

- Method: Replacing old units with Passive House certified triple glazing, positioned specifically within the insulation layer
- Process: Install Triple Glazed units. Positioning: Move the window frame outward so it sits in line with the new External Wall Insulation (EWI). This reduces the thermal bridge effect of the masonry reveals. Airtight Sealing: Use internal and external airtight tapes to seal the window frame to the wall structure/membrane
- Key Detail: Expanding foam is used for insulation, but only Airtight Tape provides the necessary air seal.



5. Airtightness Layer

- Method: Creating a continuous, unbroken barrier around the entire internal volume of the house
- Process: Use Airtight Tapes at the floor-to-wall junction, wall-to-ceiling junction, and around all window/door frames. Use Airtight Grommets for any pipes or cables passing through the envelope
- Key Detail: Without a high level of airtightness the heat recovery ventilation (MVHR) system will not function efficiently

(c) Blower Door Test (Airtightness Testing):

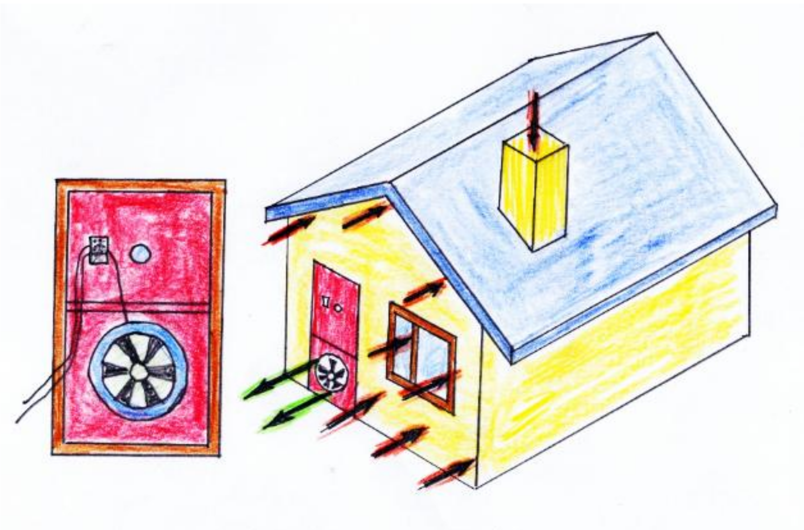
The Blower Door Test measures the airtightness of a building by quantifying how much air leaks through the building envelope. For EnerPHit certification, the house must achieve a result of 1.0 air changes per hour (ACH) at a pressure of 50 Pascals

Test Equipment and Setup

- A temporary flexible fabric frame is fitted into an external door opening (usually the front door)
- A calibrated variable-speed fan is mounted within this frame
- A manometer (pressure gauge) is connected to the fan and a computer to measure the pressure difference between the inside and outside of the house

Testing Procedure

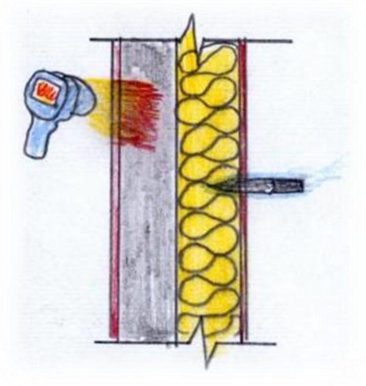
- All external windows and doors are closed. Internal doors are left open to treat the house as a single zone
- All intentional ventilation (mechanical vents, MVHR) is temporarily sealed
- The fan is used to either depressurise (suck air out) or pressurise (blow air in) the house to a constant pressure of 50 Pascal



- The computer calculates the volume of air required to maintain that pressure, which identifies the total leakage rate of the dwelling

Identifying Leaks during the Test

While the house is under pressure, the assessor can identify specific failure points in the retrofit (e.g., around window seals or service penetrations) using:



- Thermal Imaging Cameras: Showing cold air entering through gaps
- Smoke Pens/Smoke Pencils: Showing smoke being pulled through cracks in the building fabric
- Anemometers: Measuring the velocity of air through specific leak

Any other relevant points

Question 10

"It would be reasonable to assume that ensuring good indoor air quality would be a key factor when designing and constructing buildings. The term sick building syndrome became well known in the 1980's and still lingers today, though largely associated with poorly air-conditioned offices. However, the health impacts of buildings are still poorly understood and rarely taken into account as a key priority when buildings are designed or renovated. Architects, when specifying building materials are mainly concerned with cost, availability, robustness and aesthetics, not their impacts on health."

Adapted from: ***Building Materials, Health and Indoor Air Quality: No Breathing Space***
by Tom Wooley
Published by: Routledge. ISDN: 978-1138934498

(a) Discuss the above statement in detail.

Discussion of the above statement– such as:

- Ensuring good indoor air quality should be one of the central priorities in the design and construction of buildings because people spend a significant proportion of their lives indoors.
- The statement highlights the contradiction that, although buildings are intended to provide safe and healthy environments, the impacts of construction methods and materials on human health are often overlooked in favour of cost, appearance, durability, and availability.
- While awareness of "sick building syndrome" emerged strongly in the 1980s, concerns regarding the relationship between buildings and occupant health remain highly relevant today.
- The term "sick building syndrome" refers to situations where occupants of a building experience symptoms such as headaches, fatigue, eye irritation, respiratory problems, dizziness, and poor concentration that appear linked to time spent within the building. These symptoms were particularly associated with poorly ventilated office buildings that relied heavily on mechanical air-conditioning systems. Poor maintenance of ventilation systems, mould growth, dust, and chemical emissions from furnishings and finishes contributed significantly to unhealthy indoor environments.
- Modern buildings are becoming increasingly airtight in order to improve energy efficiency and reduce heat loss. While airtightness is essential for sustainable construction and reduced energy consumption, it can unintentionally create unhealthy indoor environments if ventilation is not carefully designed.
- One of the major contributors to poor indoor air quality is the use of building materials and products that release harmful chemicals. Many paints, adhesives, flooring products, insulation materials, furniture finishes, and cleaning products emit VOCs into the indoor environment. Prolonged exposure to these substances may contribute to respiratory illnesses, allergies, and other health problems. Formaldehyde emissions from composite wood products and synthetic materials are a particular concern in poorly ventilated spaces.
- Moisture management is another critical factor affecting indoor environmental quality.
  Poor detailing, inadequate ventilation, and thermal bridging can lead to condensation and mould growth within buildings. Mould spores can significantly impact respiratory health, particularly for vulnerable occupants such as children, older people, and those with asthma. In Ireland's damp climate, proper moisture control is especially important.
- Architects and builders often focus on structural performance, compliance with regulations, cost control, and aesthetics because these are more visible and measurable factors. Health impacts,

however, are more difficult to quantify and may only become apparent years after construction. Furthermore, healthier materials are sometimes more expensive or less readily available, making them less attractive in competitive construction markets.

- Passive House and EnerPHit standards, for example, place strong emphasis on controlled ventilation systems with heat recovery to ensure a continuous supply of fresh air while maintaining energy efficiency.
- The use of low-VOC materials, natural daylighting, non-toxic finishes, and biophilic design principles are becoming more common in sustainable architecture.
- Building regulations and certification systems have also evolved to place greater emphasis on occupant wellbeing. These standards and certification systems specifically assess indoor environment qualities such as air quality, lighting, thermal comfort, and material safety. These developments indicate a growing understanding that buildings should support both physical and mental health, not simply provide shelter.

Any other relevant, cogent, well-argued points

(b) Propose three best practice guidelines that would ensure a healthy indoor environment in our homes.

- **Provide continuous, balanced ventilation**
  Use demand-controlled or MVHR systems to ensure consistent fresh air supply while effectively removing moisture and pollutants.
- **Control moisture at source**
  Incorporate robust vapour control layers, airtight construction, and effective extract ventilation in kitchens, bathrooms, and utility spaces to prevent condensation and mould.
- **Ensure high levels of airtightness with planned ventilation**
  Minimise uncontrolled air leakage while providing intentional ventilation, improving indoor air quality and thermal comfort.
- **Maximise daylight while avoiding glare**
  Design window sizes and orientations to provide good daylight levels, supporting occupant wellbeing and circadian rhythms.
- **Use low-VOC and non-toxic materials**
  Specify paints, adhesives, sealants, and finishes with low volatile organic compound emissions to protect indoor air quality.
- **Maintain stable indoor temperatures**
  Use high levels of insulation and thermal-bridge-free detailing to reduce cold surfaces and draughts.
- **Prevent thermal bridging**
  Carefully detail junctions at floors, walls, roofs, and openings to avoid cold spots that can lead to surface condensation and mould growth.
- **Design for acoustic comfort**
  Control external noise and internal sound transfer using appropriate construction, layout, and materials to reduce stress and improve wellbeing.
- **Ensure good indoor air filtration**
  Where mechanical ventilation is used, include effective filtration to reduce outdoor pollutants such as pollen and fine particulates.
- **Enable user control and adaptability**
  Provide occupants with clear, intuitive control over heating, ventilation, and shading systems, supporting comfort and healthy daily use.

Any other relevant, cogent, well-argued points

Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination 2026

Construction Studies

Theory – Higher Level

Marking Scheme

Question 1

PERFORMANCE CRITERIA	MAXIMUM MARK
(a) Vertical section through one half of the roof structure, eaves, and external wall ***External wall*** ***Roof structure*** ***Eaves*** ***3 × 4 marks*** ***4 × 4 marks*** ***4 × 4 marks*** (3 for drawing, 1 for annotation)	
External Wall – typical detailing • External & internal render • Cavity wall - 100 mm external and internal leaf • Wall ties • 250 mm full-fill insulated cavity • Cavity closer • 100 mm × 75 mm wallplate/s.	4 4 4
Roof Structure – typical detailing • 200 mm × 50 mm rafters @ 400 mm centres • Ceiling joist @ 400 mm centres • 225 mm × 75 mm purlin • Strut supporting the purlin • Hanger • Collar tie at each couple or @ 1200 mm centres • Ridge-board • Plasterboard and 350 mm insulation laid in 3 layers.	4 4 4 4
Eaves detail – typical detailing • Tilting fillet • Facia board, soffit, and gutter (any 2) • 25 mm facia ventilator and 50 mm proprietary eaves ventilator • Wind tightness barrier • Breather membrane laid over roof rafters • 50 mm × 30 mm slating batten • 3 courses of slates.	4 4 4 4
Four typical dimensions	4
Scale - 4 marks **Drafting** - 4 marks *Excellent* *Good* *Fair* *8* *6* *4*	8
(b) Typical design detailing that will ensure airtightness at the junction of the ceiling and the external wall. (4 marks)	
Design detailing identified to ensure airtightness at the junction of the ceiling and the external wall.	4
TOTAL	**60**

Question 2

PERFORMANCE CRITERIA	MAXIMUM MARK
(a) Best-practice guidelines that should be followed when designing for lifetime use at the entrance access and bathroom ***(32 marks)***	
Entrance access - (2 details)	
Detail 1 Notes (4)	4
Detail 1 Sketches (4)	4
Detail 2 Notes (4)	4
Detail 2 Sketches (4)	4
Bathroom - (2 details)	
Detail 1 Notes (4)	4
Detail 1 Sketches (4)	4
Detail 2 Notes (4)	4
Detail 2 Sketches (4)	4
(b) Discuss three specific design considerations for the open-plan kitchen/dining and living area that ensure ease of use by a person with reduced mobility. ***(20 marks)***	
Design consideration 1 Notes	3
Sketches	3
Design consideration 2 Notes	3
Sketches	3
Design consideration 3 Notes	3
Sketches	3
Dimensions - Any two	2
(c) Reasons for Considering Lifetime Use at the Design Stage ***(8 marks)***	
Reason **1** (2 for point, 2 for discussion)	4
Reason **2** (2 for point, 2 for discussion)	4
TOTAL	**60**

QUESTION 3

PERFORMANCE CRITERIA	MAXIMUM MARK
(a) Revised internal layout for the ground floor	***(27 marks)***
Revised internal layout for the ground floor including extension	**18**
Notes Create an open-plan kitchen/dining and living area	**3**
Optimising daylight into the ground floor	**3**
Retaining a downstairs bathroom and bedroom	**3**
(b) Three reasons for your proposed layout	***(21 marks)***
Reason 1 (3 for point, 4 for discussion)	**7**
Reason 2 (3 for point, 4 for discussion)	**7**
Reason 3 (3 for point, 4 for discussion)	**7**
(c) Benefits to occupants when revising an internal layout	***(12 marks)***
Benefit 1 (3 for point, 3 for discussion)	**6**
Benefit 2 (3 for point, 3 for discussion)	**6**
TOTAL	**60**

Question 4

PERFORMANCE CRITERIA	MAXIMUM MARK
(a) Steps involved in upgrading the thermal performance of each area selected (40 marks)	
Area 1	
Notes	**8**
Sketches	**12**
Area 2	
Notes	**8**
Sketches	**12**
(b) Discuss the importance of any two of the following when restoring traditional heritage buildings (20 marks)	
Discussion/notes **1**	**10**
Discussion/notes **2**	**10**
TOTAL	**60**

QUESTION 5

PERFORMANCE CRITERIA	MAXIMUM MARK
***(a) U-value of* external wall**	***(36 marks)***
Tabulation	**3**
External surface resistance	**3**
External render	**3**
External concrete block	**3**
Clear cavity	**3**
OSB	**3**
Insulation	**3**
OSB	**3**
Plasterboard	**3**
Internal surface resistance	**3**
Total resistance	**3**
Calculation of U-value (w/m^2 °C or w/m^2k)	**3**
(b) Cost of annual heat loss through external wall	***(15 marks)***
Heat loss formula and calculation	**3**
Heating duration for one year	**3**
k/Joules calculation for one year	**3**
Kgs of wood pellets for one year	**3**
Annual cost of heat loss	**3**
(c) Design detailing to prevent the build-up of moisture in the timber frame structure	***(9 marks)***
Notes/discussion	**3**
Sketch	**6**
TOTAL	**60**

QUESTION 6

PERFORMANCE CRITERIA	MAXIMUM MARK
(a) ***Three features of low environmental impact*** ***(36 marks)***	
Design Feature 1	
Notes	**6**
Sketches	**6**
Design Feature 2	
Notes	**6**
Sketches	**6**
Design Feature 3	
Notes	**6**
Sketches	**6**
(b) ***Two features of the design that contribute to increasing the occupants' connection with nature.*** ***(16 marks)***	
Design Feature 1	
Notes	**4**
Sketches	**4**
Design Feature 2	
Notes	**4**
Sketches	**4**
(c) ***Two advantages for connecting to nature*** ***(8 marks)***	
Advantage **1** (2 for point, 2 for discussion)	**4**
Advantage **2** (2 for point, 2 for discussion)	**4**
TOTAL	**60**

Question 7

Performance Criteria	Maximum Mark
(a) ***Vertical section through centre of an open riser stairs*** ***8 × 5 marks + 6 marks*** (4 for drawing, 1 for annotation)	
• Closed string • String capping • Newel post • Riser • Tread • Handrail • Balusters • Nosing • Pitch line • Jointing - hand rail to newel post • Jointing - string to newel post • Jointing - riser to tread • Jointing - baluster to handrail/string	**5** **5** **5** **5** **5** **5** **5** **5**
Three dimensions	**6**
Scale - 4 marks **Drafting** - 4 marks *Excellent* *Good* *Fair* *8* *6* *4*	**8**
(b) Design details to ensure the stairs is safe for all users	***(6 marks)***
Design detail **1**	**3**
Design detail **2**	**3**
Total	**60**

Question 8

PERFORMANCE CRITERIA	MAXIMUM MARK
(a) ***Discuss two considerations that should be taken into account when planning the drainage layout of a first floor bathroom*** ***(16 marks)***	
Consideration **1** *(4 for point, 4 for discussion)* Consideration **2** *(4 for point, 4 for discussion)*	**8** **8**
(b) ***Above-ground pipework necessary for the safe removal of waste*** ***(32 marks)***	
Typical layout above-ground: (to include shower, wash basin, and water closet) Notes Sketch Typical dimensions - Any four	 **12** **16** **4**
(c) ***Design detailing to prevent foul odours entering the building*** ***(12 marks)***	
Design Detailing Notes Sketches	 **6** **6**
TOTAL	**60**

Question 9

PERFORMANCE CRITERIA	MAXIMUM MARK
(a) ***Best practice design detailing to prevent thermal bridging***	***(48 marks)*** ***(6 × 8 marks)***
Area 1	**8**
Note	**8**
Sketches	
Area 2	**8**
Note	**8**
Sketches	
Area 3	**8**
Note	**8**
Sketches	
(b) ***Benefits to the homeowner of eliminating thermal bridging***	***(12 marks)***
Benefit 1 (3 for point, 3 for discussion)	**6**
Benefit 2 (3 for point, 3 for discussion)	**6**
TOTAL	**60**

Question 10

PERFORMANCE CRITERIA	MAXIMUM MARK
(a) ***Selection of 3 areas of the building fabric for EnerPHit Retrofit***	***(18 marks)***
Selection **1** *(1 for selection, 5 for reason)*	**6**
Selection **2** *(1 for selection, 5 for reason)*	**6**
Selection **3** *(1 for selection, 5 for reason)*	**6**
(b) Method to retrofit the specified area to achieve the EnerPHit Passive House standard	***(30 marks)***
Retrofit area 1 (5 for notes, 5 for sketches)	**5** **5**
Retrofit area 2 (5 for notes, 5 for sketches)	**5** **5**
Retrofit area 3 (5 for notes, 5 for sketches)	**5** **5**
(c) Testing method to determine efficiency of the retrofit	***(12 marks)***
Method Notes Sketches	 **6** **6**
TOTAL	**60**

Question 10 (Alternative)

PERFORMANCE CRITERIA	MAXIMUM MARK
(a) Discussion of Statement (Ensuring good indoor air quality)	***(30 marks)***
Discussion Point **1** *(5 for point, 5 for discussion)*	**10**
Discussion Point **2** *(5 for point, 5 for discussion)*	**10**
Discussion Point **3** *(5 for point, 5 for discussion)*	**10**
(b) Propose three best practice guidelines that would ensure a healthy indoor environment in our homes.	***(30 marks)***
Guideline **1** *(5 for point, 5 for discussion)*	**10**
Guideline **2** *(5 for point, 5 for discussion)*	**10**
Guideline **3** *(5 for point, 5 for discussion)*	**10**
TOTAL	**60**

Coimisiún na Scrúduithe Stáit

State Examinations Commission

Leaving Certificate Examination 2026

Construction Studies

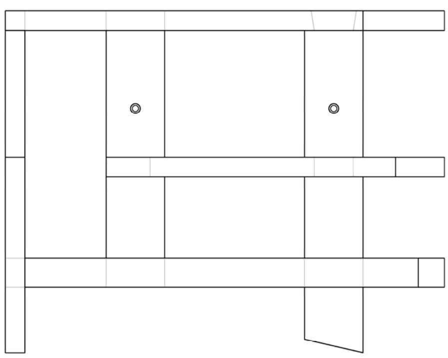
Practical Test

Common Level

(150 marks)

Marking Scheme

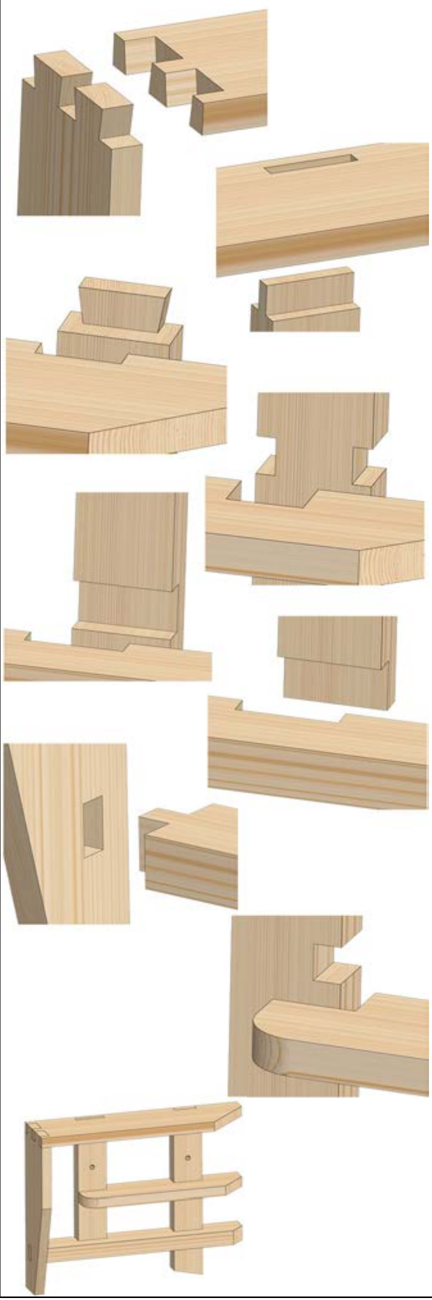
Day 1



Note:

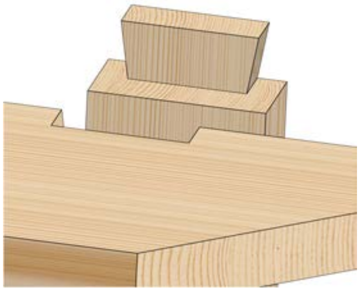
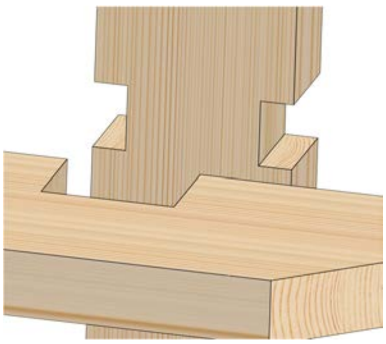
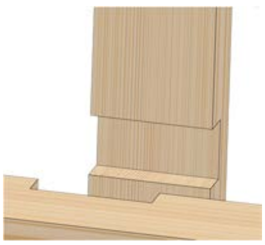
- The artefact is to be hand produced by candidates without the assistance of machinery.
- The use of a battery powered screwdriver is allowed.
- Where there is evidence of the use of machinery for a particular procedure a penalty applies.
- Component is marked out of 50% of the marks available for that procedure.

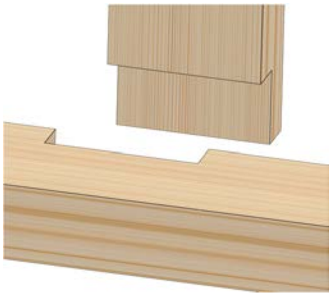
(i)	Overall Assembly	Marks
a.	Overall quality of assembled artefact	**10**
b.	Design and applied shaping to edge • design *1 mark* • shaping *1 mark*	**2**
	Total	**12**



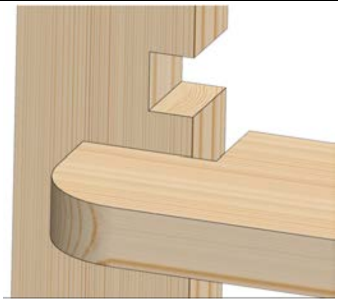
(ii)	Marking Out	Marks
a.	Box dovetail • tails *2 × 3 marks* • pins *2 × 3 marks*	**12**
b.	6 mm mortice and tenon • mortice *3 marks* • tenon *3 marks*	**6**
c.	Dovetail halving joint • tail *3 marks* • trench *3 marks*	**6**
d.	Double notch joint • trenches *3 × 2 marks*	**6**
e.	Cross halving joint • trenches *2 × 2 marks*	**4**
f.	Tee halving joint • trench *2 marks* • tenon *2 marks*	**4**
g.	10 mm mortice and tenon joint • mortice *3 marks* • tenon *3 marks*	**6**
h.	Single notch joint • trench *2 marks* • notch *2 marks*	**4**
i.	Slopes and curve • slopes *5 × 1 mark* • curve *1 mark*	**6**
		54

Processing of Display Unit

Box dovetail	**(iii)**	**Processing**	**Marks**
	a.	Tails *2 × 4 marks*	**8**
	b.	Pins • sawing with the grain *4 × 1 mark* • paring across the grain *2 × 2 marks*	**8**
		Total	**16**
6 mm mortice and tenon	**(iv)**	**Processing**	**Marks**
	a.	Mortice 3 *marks*	**3**
	b.	Tenon *4 marks*	**4**
		Total	**7**
Dovetail halving joint	**(v)**	**Processing**	**Marks**
	a.	Tail • sawing tail *6 × 1 mark*	**6**
	b.	Trench • saw across the grain *2 × 1 mark* • paring of trench to depth *2 marks*	**4**
		Total	**10**
Double notch joint	**(vi)**	**Processing**	**Marks**
	a.	Trench (horizontal) • saw across the grain *2 × 1 mark* • paring of trench to depth *2 marks*	**4**
	b.	Trenches (vertical) • saw across the grain *4 × 1 mark* • paring of trenches to depth *2 × 2 marks*	**8**
		Total	**12**
Cross halving joint	**(vii)**	**PROCESSING**	**Marks**
	a.	Trenches • saw across the grain *4 × 1 mark* • paring of trenches to depth *2 × 2 marks*	**8**
		Total	**8**

Tee halving joint	(viii)	Processing	Marks
	a.	Trench • sawing across the grain *2 × 1 mark* • paring of trenches to depth *2 marks*	**4**
	b.	Tenon *2 marks*	**2**
		Total	**6**

10 mm mortice and tenon	(ix)	Processing	Marks
	a.	Mortice *3 marks*	**3**
	b.	Tenon *4 marks*	**4**
		Total	**7**

Single notch joint	(x)	Processing	Marks
	a.	Trench • sawing across the grain *2 × 1 mark* • paring of trench to depth *2 marks*	**4**
	b.	Notch *2 marks*	**2**
		Total	**6**

Shaping & drilling	(xi)	Processing	Marks
	a.	Short slopes *4 × 1 mark*	**4**
	b.	Long slope *2 marks*	**2**
	c.	Curve *2 marks*	**2**
	d.	Drilling & counter sinking *2 × 2 marks*	**4**
		Total	**12**

Grand Total	**150**

Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination 2026

Construction Studies

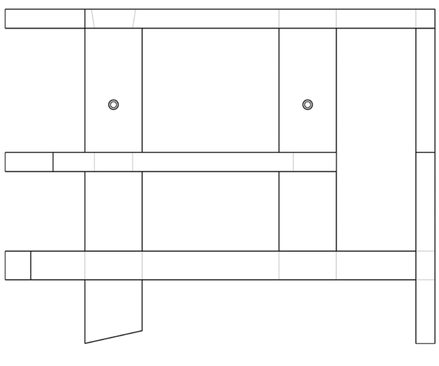
Practical Test

Common Level

(150 marks)

Marking Scheme

Day 2



Note:

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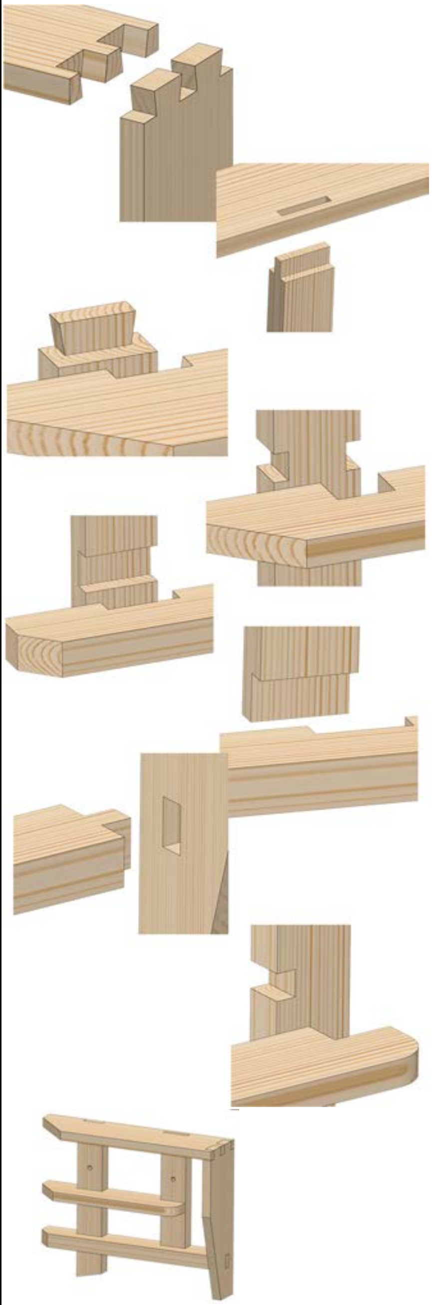
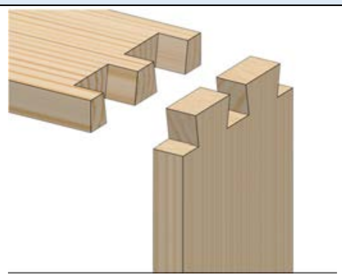
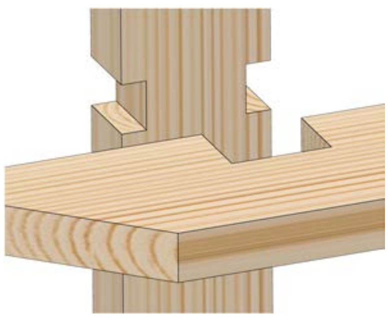
- The use of a battery powered screwdriver is allowed.
- Where there is evidence of the use of machinery for a particular procedure a penalty applies.
- Component is marked out of 50% of the marks available for that procedure.

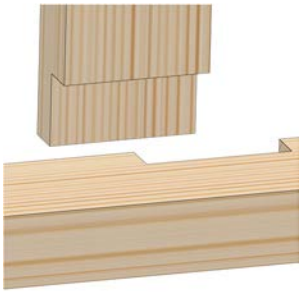
(i)	Overall Assembly	Marks
a.	Overall quality of assembled artefact	**10**
b.	Design and applied shaping to edge • design *1 mark* • shaping *1 mark*	**2**
	Total	**12**



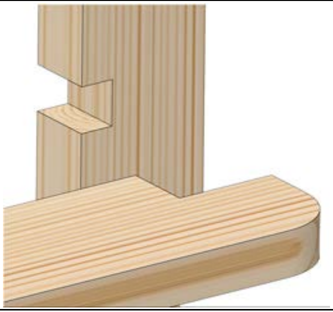
(ii)	Marking Out	Marks
a.	Box dovetail • tails *2 × 3 marks* • pins *2 × 3 marks*	**12**
b.	6 mm mortice and tenon • mortice *3 marks* • tenon *3 marks*	**6**
c.	Dovetail halving joint • tail *3 marks* • trench *3 marks*	**6**
d.	Double notch joint • trenches *3 × 2 marks*	**6**
e.	Cross halving joint • trenches *2 × 2 marks*	**4**
f.	Tee halving joint • trench *2 marks* • tenon *2 marks*	**4**
g.	10 mm mortice and tenon joint • mortice *3 marks* • tenon *3 marks*	**6**
h.	Single notch joint • trench *2 marks* • notch *2 marks*	**4**
i.	Slopes and curve • slopes *5 × 1 mark* • curve *1 mark*	**6**
		54

Processing of Display Unit

Box dovetail	**(iii)**	**Processing**	**Marks**
	a.	Tails *2 × 4 marks*	**8**
	b.	Pins • sawing with the grain *4 × 1 mark* • paring across the grain *2 × 2 marks*	**8**
		Total	**16**
6 mm mortice and tenon	**(iv)**	**Processing**	**Marks**
	a.	Mortice 3 *marks*	**3**
	b.	Tenon *4 marks*	**4**
		Total	**7**
Dovetail halving joint	**(v)**	**Processing**	**Marks**
	a.	Tail • sawing tail *6 × 1 mark*	**6**
	b.	Trench • saw across the grain *2 × 1 mark* • paring of trench to depth *2 marks*	**4**
		Total	**10**
Double notch joint	**(vi)**	**Processing**	**Marks**
	a.	Trench (horizontal) • saw across the grain *2 × 1 mark* • paring of trench to depth *2 marks*	**4**
	b.	Trenches (vertical) • saw across the grain *4 × 1 mark* • paring of trenches to depth *2 × 2 marks*	**8**
		Total	**12**
Cross halving joint	**(vii)**	**PROCESSING**	**Marks**
	a.	Trenches • saw across the grain *4 × 1 mark* • paring of trenches to depth *2 × 2 marks*	**8**
		Total	**8**

Tee halving joint	(viii)	Processing	Marks
	a.	Trench • sawing across the grain *2 × 1 mark* • paring of trenches to depth *2 marks*	4
	b.	Tenon *2 marks*	2
		Total	**6**

10 mm mortice and tenon	(ix)	Processing	Marks
	a.	Mortice *3 marks*	3
	b.	Tenon *4 marks*	4
		Total	**7**

Single notch joint	(x)	Processing	Marks
	a.	Trench • sawing across the grain *2 × 1 mark* • paring of trench to depth *2 marks*	4
	b.	Notch *2 marks*	2
		Total	**6**

Shaping & drilling	(xi)	Processing	Marks
	a.	Short slopes *4 × 1 mark*	4
	b.	Long slope *2 marks*	2
	c.	Curve *2 marks*	2
	d.	Drilling & counter sinking *2 × 2 marks*	4
		Total	**12**

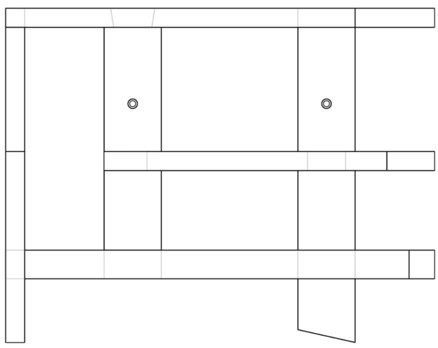
Grand Total	**150**

Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination 2026

Construction Studies
Practical Test
Common Level
(150 marks)

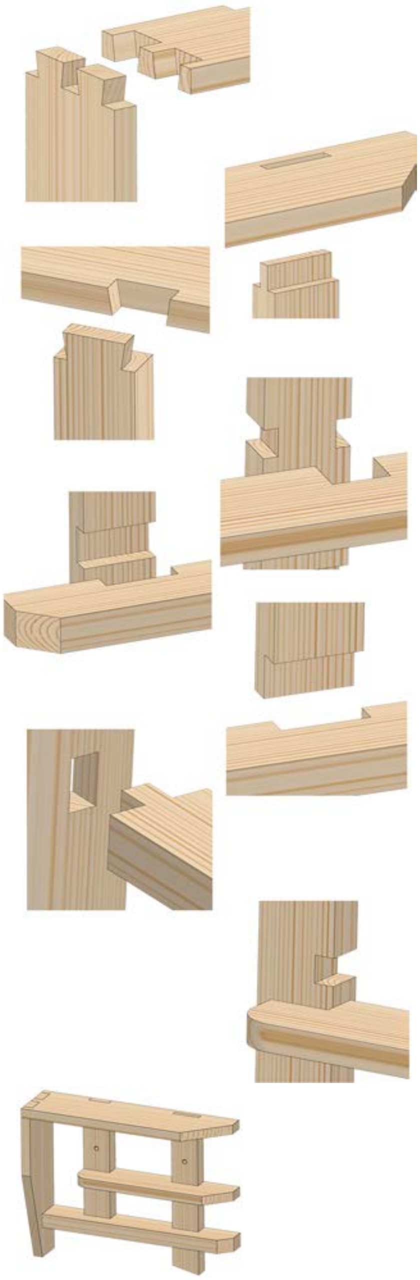
Marking Scheme
Day 3



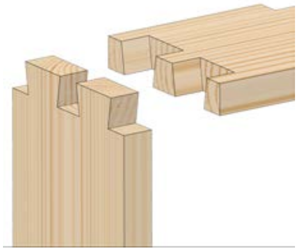
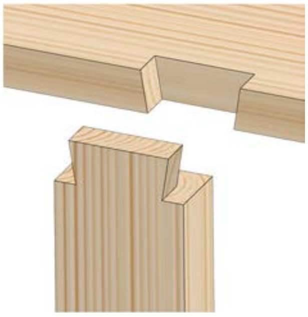
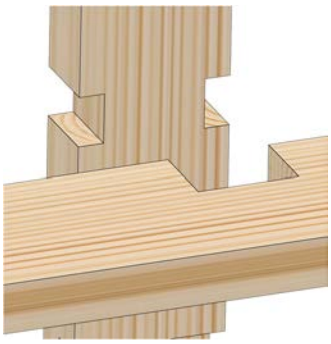
Note:

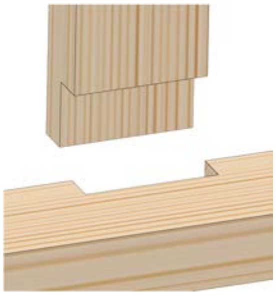
- The artefact is to be hand produced by candidates without the assistance of machinery.
- The use of a battery powered screwdriver is allowed.
- Where there is evidence of the use of machinery for a particular procedure a penalty applies.
- Component is marked out of 50% of the marks available for that procedure.

(i)	Overall Assembly	Marks
a.	Overall quality of assembled artefact	**10**
b.	Design and applied shaping to edge • design *1 mark* • shaping *1 mark*	**2**
	Total	**12**



(ii)	Marking Out	Marks
a.	Box dovetail • tails *2 × 3 marks* • pins *2 × 3 marks*	**12**
b.	6 mm mortice and tenon • mortice *3 marks* • tenon *3 marks*	**6**
c.	Dovetail halving joint • tail *3 marks* • trench *3 marks*	**6**
d.	Double notch joint • trenches *3 × 2 marks*	**6**
e.	Cross halving joint • trenches *2 × 2 marks*	**4**
f.	Tee halving joint • trench *2 marks* • tenon *2 marks*	**4**
g.	10 mm mortice and tenon joint • mortice *3 marks* • tenon *3 marks*	**6**
h.	Single notch joint • trench *2 marks* • notch *2 marks*	**4**
i.	Slopes and curve • slopes *5 × 1 mark* • curve *1 mark*	**6**
		54

Processing of Display Unit			
Box dovetail	**(iii)**	**Processing**	**Marks**
	a.	Tails *2 × 4 marks*	**8**
	b.	Pins • sawing with the grain *4 × 1 mark* • paring across the grain *2 × 2 marks*	**8**
		Total	**16**
6 mm mortice and tenon	**(iv)**	**Processing**	**Marks**
	a.	Mortice 3 *marks*	**3**
	b.	Tenon *4 marks*	**4**
		Total	**7**
Dovetail halving joint	**(v)**	**Processing**	**Marks**
	a.	Tail • sawing tail *6 × 1 mark*	**6**
	b.	Trench • saw across the grain *2 × 1 mark* • paring of trench to depth *2 marks*	**4**
		Total	**10**
Double notch joint	**(vi)**	**Processing**	**Marks**
	a.	Trench (horizontal) • saw across the grain *2 × 1 mark* • paring of trench to depth *2 marks*	**4**
	b.	Trenches (vertical) • saw across the grain *4 × 1 mark* • paring of trenches to depth *2 × 2 marks*	**8**
		Total	**12**
Cross halving joint	**(vii)**	**PROCESSING**	**Marks**
	a.	Trenches • saw across the grain *4 × 1 mark* • paring of trenches to depth *2 × 2 marks*	**8**
		Total	**8**

Tee halving joint	(viii)	Processing	Marks
	a.	Trench • sawing across the grain *2 × 1 mark* • paring of trenches to depth *2 marks*	**4**
	b.	Tenon *2 marks*	**2**
		Total	**6**

10 mm mortice and tenon	(ix)	Processing	Marks
	a.	Mortice *3 marks*	**3**
	b.	Tenon *4 marks*	**4**
		Total	**7**

Single notch joint	(x)	Processing	Marks
	a.	Trench • sawing across the grain *2 × 1 mark* • paring of trench to depth *2 marks*	**4**
	b.	Notch *2 marks*	**2**
		Total	**6**

Shaping & drilling	(xi)	Processing	Marks
	a.	Short slopes *4 × 1 mark*	**4**
	b.	Long slope *2 marks*	**2**
	c.	Curve *2 marks*	**2**
	d.	Drilling & counter sinking *2 × 2 marks*	**4**
		Total	**12**

Grand Total	**150**

Coimisiún na Scrúduithe Stáit
State Examinations Commission

Form A

Leaving Certificate Examination

Construction Studies

Practical Coursework
Marking Scheme

	Marking Criteria	Marks
A	**Planning of Project** • Coursework selection, exploration and management planning • Investigation and relevant research • Design development through annotated sketches, with working drawing(s) and/or models	40
B	**Report** • Sequence of manufacture including photographic evidence and/or sketches • Critical appraisal and conclusions from coursework experience • Overall quality of communication and presentation of the design folio	35
C	**Manipulative Skills** • Marking-out of materials • Processing and assembly of materials • Range and depth of skills evident in the artefact	40
D	**Completion of Project** • Artefact well finished • Creativity and appropriateness of coursework • Overall quality, coherence and presentation of coursework	35
	Total	**150**

Note: ***While the general headings and marks above will largely remain the same, breakdowns may vary for any given year.***