Coimisiún na Scrúduithe Stáit
State Examinations Commission

LEAVING CERTIFICATE 2010

MARKING SCHEME

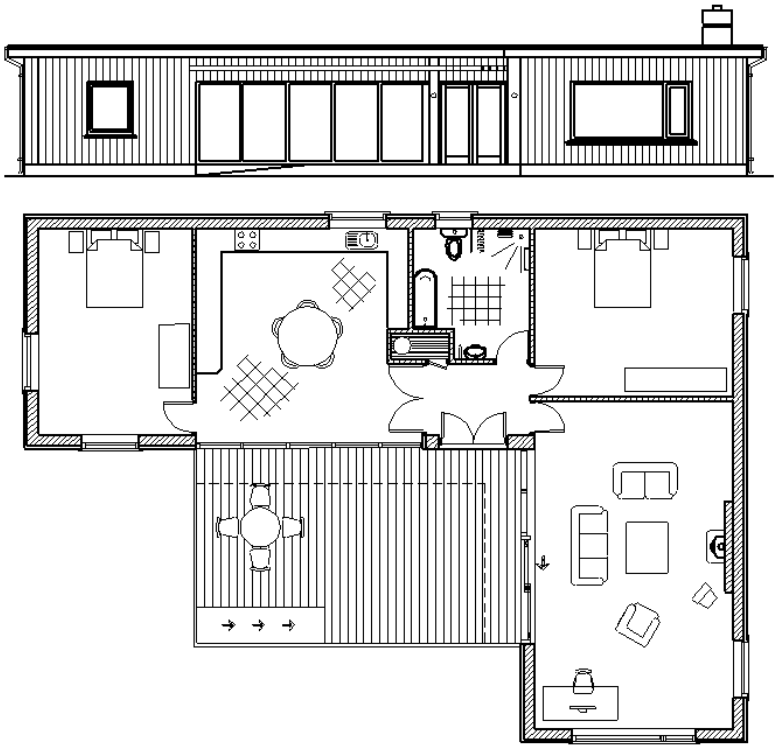
CONSTRUCTION STUDIES

HIGHER LEVEL

Coimisiún na Scrúduithe Stáit
State Examinations Commission

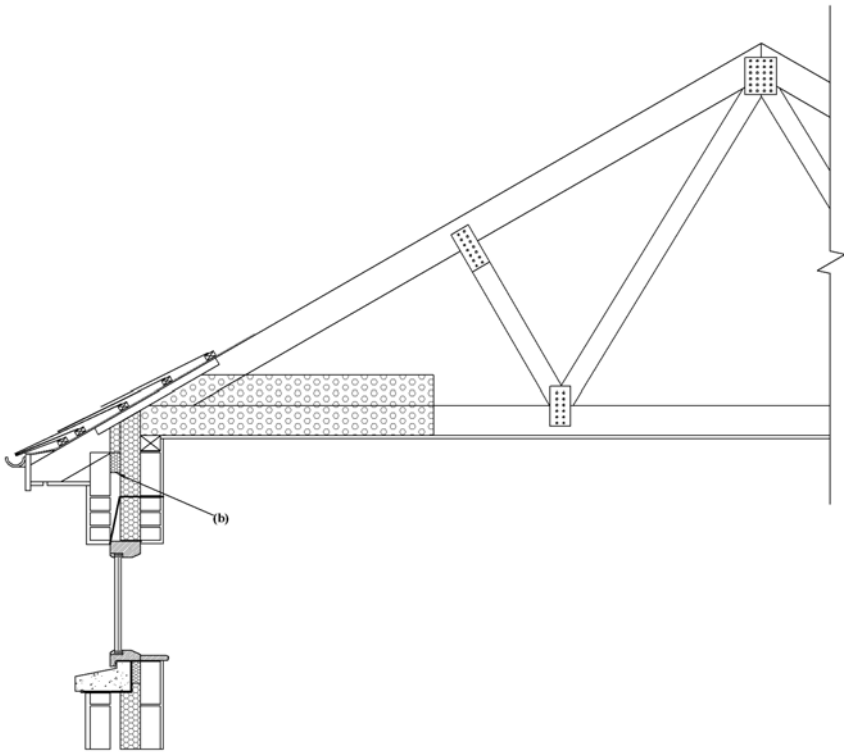
Scrúdú Ardteistiméireachta 2010

Staidéar Foirgníochta
Teoiric – Ardleibhéal

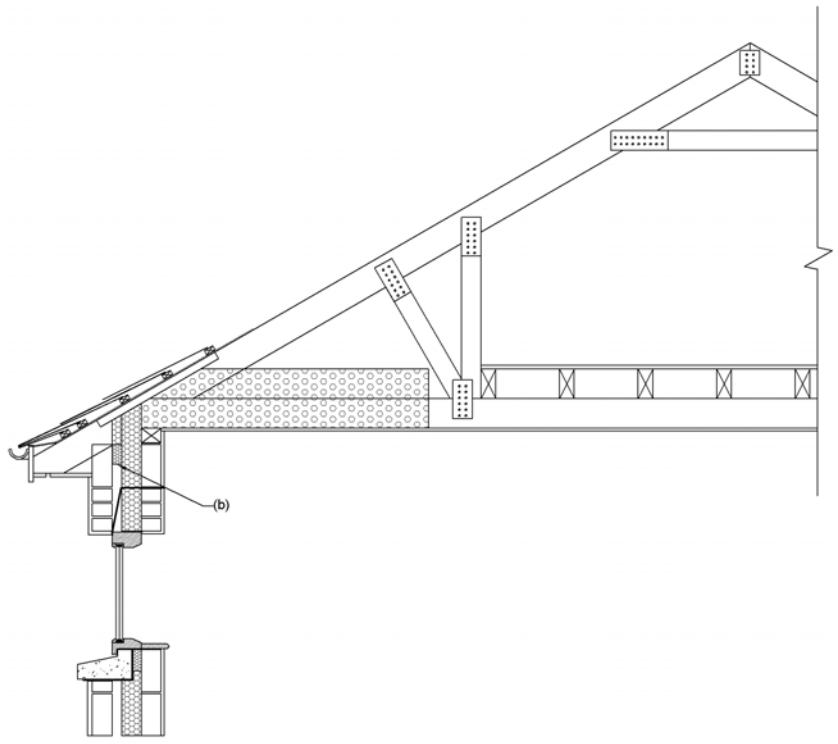


Construction Studies
Theory – Higher Level
SOLUTIONS

Ceist 1(a)



Alternative solution

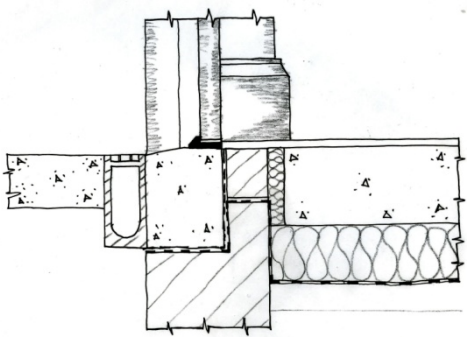


Typical roof sizes

- Wallplate 100×75
- Ceiling 150×50
- Rafter 150 × 50
- Strut 100 × 50
- Slating batten 50 ×30

Ceist 2 (a)

Threshold – Door

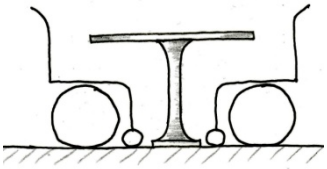


- Level Entrance min turning circle 1500 mm diameter
- Ramp to level entrance maximum slope. 1:20
- Drainage channel fitted beside threshold to assist rapid removal of rain water
- Reinforced concrete threshold – slope 15 degree max.
- Damp proof tray behind R.C. threshold
- Proprietary threshold – trapper bar max. 15mm. high
- Front door & frame
- Radon barrier - Floor tile
- Vertical insulation to inside of inner leaf
- Horizontal insulation 150 mm min rigid polystyrene or the equivalent
- Inner leaf & skirting board
- Sand blinding 50 mm - Hardcore min 225mm compacted

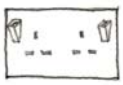
Reference; "Building for Everyone, Inclusion Access and Use: National Disability Authority 2002

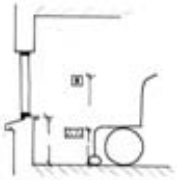
2(b)

Dining Area



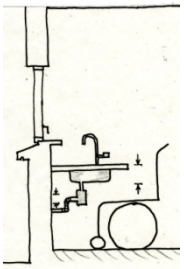
- Circular dining table for ease of movement
- Lower height table or adjustable height suitable for wheelchair 800mm (700mm min)
- Table supported on central pedestal to facilitate leg room
- Adequate space between table and adjacent walls
- Trolley to facilitate transfer of cooking and food related items
- Non-slip level floor surface
- Light switches – 900 - 1200mm above floor level
- Rocker light switches preferred
- On/off switches to sockets preferred at the edge of socket
- Sockets higher circa 900 - 1200mm above floor level



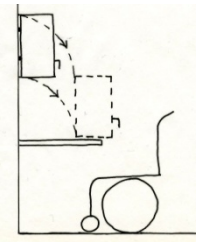


- Window cill height low – to enable wheelchair user appreciate view and access window
- Lever window handles positioned low

Kitchen Area



- Sink, cooker and fridge closely grouped – triangular layout
- Distance between cooker & sink not greater than 1800 mm.
- Worktop space on both sides of cooker
- No presses under worktop space at sink for ease of access
- Eye level oven facility preferable
- Extractor fan and cooker – mains switch easily accessible

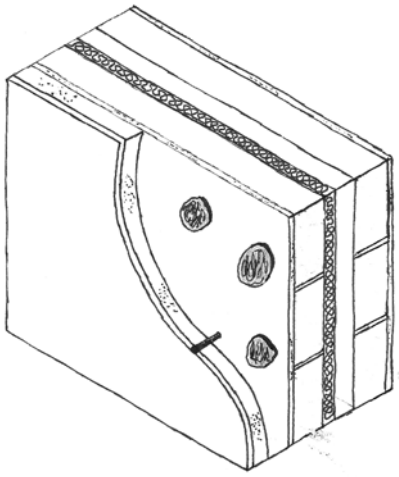


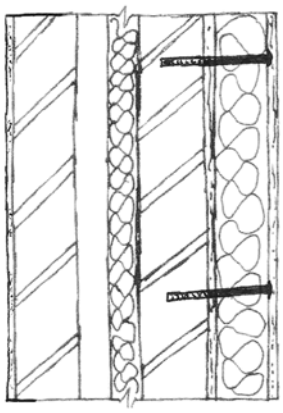
- Sink fitted low – c. 800 mm. Preferably with height adjusted pneumatically or electrically with flexi waste pipe
- Sink taps – lever type fitted to left and right sides of sink. Alternatively, water flow may be regulated by sensor and timer
- Dishwasher & other appliances to have worktop space to one side
- Over worktop presses to have motorised mechanism to facilitate being lowered & raised

- Open plan layout of living room, kitchen & dining areas preferred
- Enable doors to slide or open both ways using sensors , no saddles to doors
- Doors minimum width 800 mm clear openings - 1000mm preferable

Ceist 3 (a)

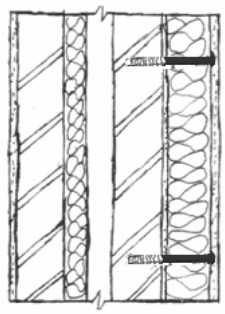
Internal insulation system: Insulated Dry-Lining Plasterboard

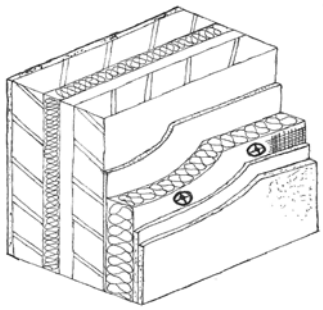




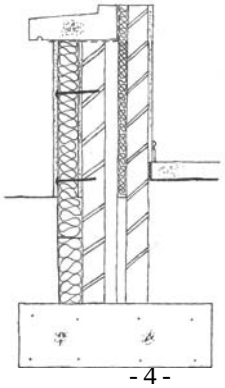
- Fixed with adhesive dabs or mechanical fixings
- Rigid Phenolic Foam insulation 80mm min with a 12.5mm plasterboard facing *or*
- Cork, wood particle board
- Skim finish may be applied to plasterboard to obtain smooth finish

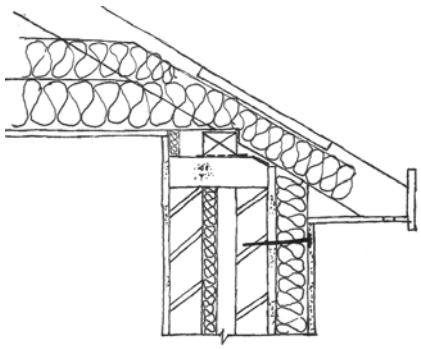
External insulation system



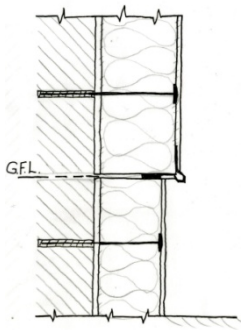


- Fixed with Mechanical Fixings
- Rigid Phenolic Insulation 100 mm to 300 mm thick
- Expanded polystyrene system 100mm min
- Acrylic render applied - 2 coats each 3mm thick with fibreglass mesh or equivalent





(a) Fitting External Insulation

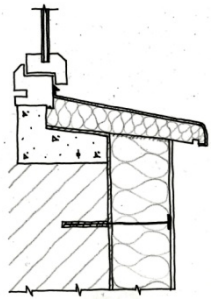


- Wall cleaned & brushed
- Apply base coat of adhesive over existing external render / surface
- Rigid Phenolic Foam 80 mm to 300 mm Expanded Polystyrene or equivalent bonded to external wall using base coat adhesive
- PVC/ stainless steel anchor bolts used to secure the insulation board
- Fibreglass mesh overlaid on insulation board
- Two coats of polymer or acrylic specialist renders applied to mesh & insulation board
- Specialist angle bead required for external corners and plinth
- Mastic type sealants used at soffit, door and window frames

Any other relevant points

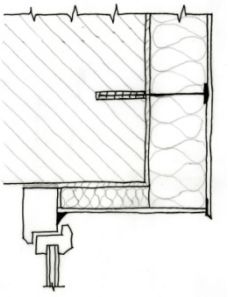
External Insulation - Window Cill Detail

- Existing cill may be cut flush with the external wall
- Apply base coat of adhesive to existing external wall
- Bond rigid phenolic foam 80 – 300 mm to the external wall using the base coat adhesive
- mushroom head anchor bolts to secure insulation - fibre glass mesh to external
- Apply two coats of polymer or acrylic specialist external renders
- Fit pre-formed phenolic foam/stainless steel window cill using base coat adhesive applied over the top surface of the existing window cill
- Fit pre-formed aluminium or PVC cladding window cill over Phenolic foam window cill
- Sealant applied at all junctions between cill and wall



External Insulation -Window Head Detail

- Apply base coat adhesive to existing external wall surface / render
- Fit rigid Phenolic foam 80 – 200 mm (or equivalent) using the base coat adhesive to the external wall
- Use PVC anchor bolts to secure the insulation board
- Fit high density rigid phenolic foam or equivalent to the head and reveals of window – using proprietary adhesive
- Apply two coats of polymer or specialist acrylic external renders
- Proprietary angle bead to all external corners
- Mastic sealants used at all junctions between window and new externally insulated and rendered surface



Any other relevant points

Internal Insulation Method

Rigid Board Insulation to Internal surface of the wall

- Composite – Plasterboard and Rigid Phenolic Foam or equivalent with integral vapour barrier
- The cavity may also be filled

Timber battens and Rigid Insulation

- Battens at 400mm centres. Rigid or semi-rigid insulation such as glass or rock wool fibre between and composite plasterboard as described fitted over battens.

(b)

Advantages of Internal insulation system

Advantages of Internal Insulation

- The external elevations not altered - planning permission not required
- Character of period or historic buildings maintained
- No loss of external fabric such as window cills and costs reduced
- Faster warm up period for internal rooms
- Increases the U-value of the wall to current building regulations
- Easy to install, Energy saving, Faster warm up period for room

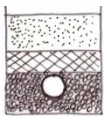
Advantages of External Insulation - such as

- Increases the U-value of the wall to current building regulations
- Upgrades the appearance of existing buildings
- No loss of internal floor space
- No disruption internally
- No internal redecoration costs, can live in house
- Higher BER rating, less CO_2 emissions, lower fossil fuel demand, cleaner environment
- Reduced costs as no dismantling of radiators, electrical required
- Minimum disturbance to internal fabric.
- No need for removal of skirting board and subsequent repairs to internal rendered surfaces
- Increased thermal comfort as the external wall provides thermal mass which stores the heat initially and then releases it back into the internal spaces

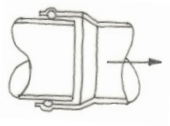
Any other relevant points

Recommendation .....

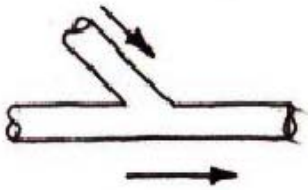
Ceist 4



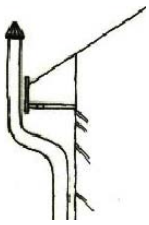
a) 3 Functional requirements



- Watertight, correct sealing of joints
- Self cleansing
- Correct gradient
- Access,
- Self ventilating
- Straight runs where possible
- Junctions properly designed - traps and seals



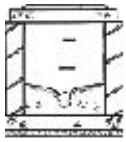
- Flexible jointing to allow for differential movement/adequately protected from accidental damage from traffic, ground settlement, tree roots
- Avoid blockages/ be accessible for clearing blockages and general maintenance/connections to be made obliquely/laid in straight lines where possible
- Resistant to corrosive elements occurring naturally in the soil
- Hygienic and adequate disposal of effluent



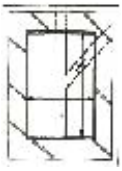
- Ventilation to prevent foul air entering the dwelling from the drainage system and build up of methane
- Correct depth of traps/seals

Any other relevant points and sketches

b) Constructional details through manhole



- 150 mm min mass concrete base - 20 N
- Branch pipes laid obliquely
- Where half round channels are used the branches should discharge into the channel at or above the level of the horizontal diameter



- Channels and branches should be benched at least up to the top of the outgoing pipe
- Benching should be rounded off
- Rendered internally and externally
- Mass concrete or high density concrete block
- Where branch angle is more than 45 degrees, a ¾ section branch should be used
- Access provided at junction of branch, change of pipe size, bend, change of gradient
- Manhole for depths of over 1m. Internal dimensions depend on depth - min internal size - 1200 x 750 to 1200 x 840 (internal sizes)
- Should have removable non ventilating covers of durable material such as cast iron pressed steel, precast concrete
- Manholes deeper than 1m should have step irons or fixed ladders

c) Testing for water tightness

Water test

- Test should be carried out prior to backfilling
- End of pipe plugged
- Head of water 1.5 m above invert level
- Drain is filled and left for 2 hrs and topped up - allow for absorption and escape of air bubbles
- Leakage over 30 minutes should not be more than 0.05litres per m run (100mm dia pipe)

Air Test

- Length of drain is plugged and air is pumped into the drain
- Excessive drop in pressure will indicate leak
- May be difficult to detect location of the leak
- Air pressure may also be affected by temperature changes

Smoke test-

- Smoke inserted into pipes, visual check for leaks – not recommended for uPVC pipework

Ceist 5 (a)

Material Element	Conductivity k	Resistivity r	Thickness T(m)	Resistance R
Ext. Render		2.17	0.016	0.03472
Wall		1.190	0.225	0.26775
Plaster Int.		6.250	0.013	0.08125
Ext. Surface				0.048
Int. Surface				0.122
				0.55372 $\mathbf{R^t}$

Formulae: **R=T/k** **R=T x r** **U= 1/R^t**

U Value: U = 1 / 0.55372 = 1.805 **W**/m^2/ K

Q.5 (b)

To find the Resistance for a U-value of 0.27 W/m^2 /K

Use formula U= 1/Rt. & Solve for R.

R = 1/ U-value R = 1/ 0.27 = 3.703 m^2 /K/W

Resistance for required U-value of 0.27 = 3.703 m^2 /K/W

Resistance for existing U-value of 1.8 = 0.55372 m^2 /K/W

Difference in Resistance = 3.703 - 0.55372 = 3.15 m^2/K/W

Note: 1 Kelvin (K) = 1 ºC *written* 1 K = 1 ºC i.e. a change in temperature of 1 K is the same as a change in temperature of 1 ºC.

To find the thickness of insulation required

Use the formula R= T/k & solve for T.

3.15 = T/0.025

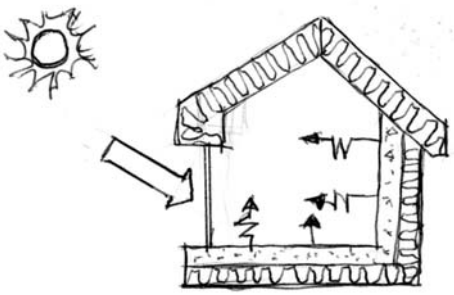
T = 3.15 x 0.025 = 0.07875 metres

To convert to mm - multiply by 1000

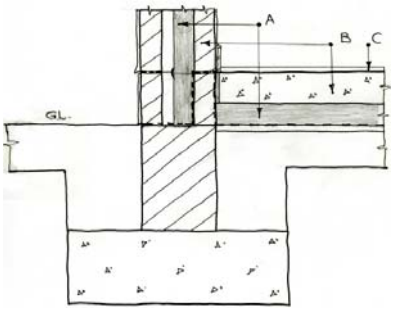
Thickness of required Phenolic Foam insulation = 78.75mm (79mm)

Ceist 5 (c)

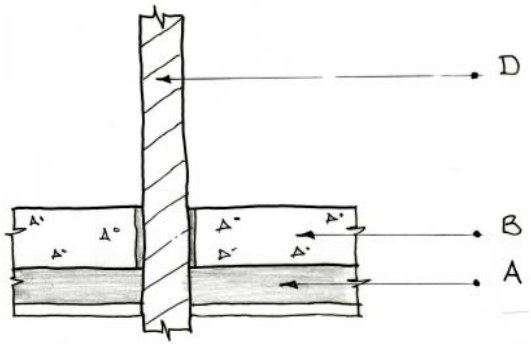
Thermal mass or fabric energy storage

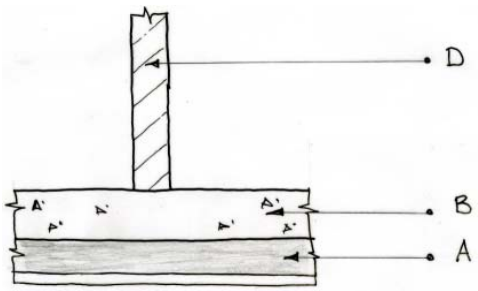


- thermal mass improves thermal performance and enchance thermal comfort thus requiring less use of fossil fuels
- Dense materials such as brick, stone, concrete, glass, marble are most effective in storing and releasing substantial quantities of thermal energ
- Buildings that utilise thermal mass to increase thermal comfort depend on the principles of passive solar heating: Passive Solar Collection & Passive Solar Storage
  In Ireland's mild climate solar gain can make a substantial contribution (20%) to space heating requirements



- Thermal mass may best be utilised as a passive heating strategy in residential buildings
  - A: Rigid insulation; B: Concrete
  - C: Ceramic tile; D: Concrete internal walls





Passive Solar Collection

- Orientation – South +/- 15 degrees due South best
- Large south facing glazed areas
- Tall windows allow deeper penetration into rooms
- Design for a mass to glass ration of 6:1
- Windows – double or triple glazed with soft low-e coatings improve solar heat gain

Passive Solar Storage

- Locate thermal mass elements in south facing spaces that receive large amounts of sunlight
- Thermal mass elements positioned in direct sunlight are 30% more efficient
- Increase thermal mass elements i.e. the largest surface area as possible within spaces
- 100 mm thick high density elements provide optimum thermal benefit
- Use brick, block or concrete internal partition walls for thermal
- Concrete floor slabs without carpets or wooden flooring
- Ceramic tiling – dark colours offer optimum benefits
- Avoid internal dry lining to externally insulated masonry walls

Thermal Inertia:

- Buildings / spaces utilising the heat storing capacity of dense materials (thermal mass) will have a lower average internal temperature, however this will be maintained for a longer period of time

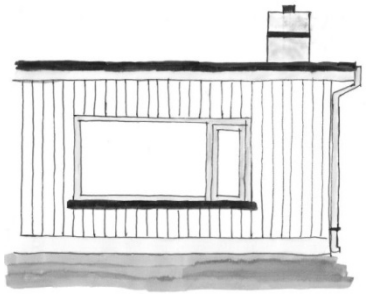
Thermal Preservation:

- Heat gained from thermal mass will be lost if the building is not adequately insulated - air tight.

Any other relevant point, detail or sketch

Ceist 6

(a) Design features that reduce the environmental impact



External wooden cladding

- Locally sourced material with low embodied energy :- (Energy required to produce, transport & install)
- Renewable material when harvested from locally grown managed forests
- Reduces the amount of concrete required - less CO_2 produced as a result

Passive solar heat gain

Large glazed area at ± 30° due south

- North facing side of house has small windows to reduce heat loss – rooms grouped around glazed area
- Multi function kitchen dining
- Tiled floor area which provides thermal mass. This absorbs heat during the day and gives out heat slowly at night
- Infrequently used rooms are situated on the cold north side of the house

Compact form

- Less materials used in the construction of the dwelling, house has small ecological footprint
- Modesty of scale – house - requires less excavation, less materials and therefore less disruption of the natural environment – sustainable, leaving more and taking less
- Structure is one room wide - easier to heat using passive solar
- Keeping the building compact reduces the surface to volume ratio. This helps to minimise heat loss
- Flat roof reduces the amount of materials required

Any other relevant details

(b) Renewable

- Important to use materials that are renewable, that grow and replenish. This ensures that there will be an ample supply of building materials for future generations
- Much less energy is required to process materials like wood
- Low embodied energy, less pollution
- Reduce processing of materials where possible, timber in the round for fencing, railings etc
- Less fossil fuels used during production of renewable materials
- Many renewable materials are carbon neutral. Some materials such as hemp are carbon neutral. (Hemp absorbs carbon from the atmosphere as it grows)
- Renewable materials which have reached their end of life use have a smaller impact on the environment and may be recycled, up-cycled
- Low carbon concrete made from recycled products – ground granulated blast furnace slag (GGBS)

Durable

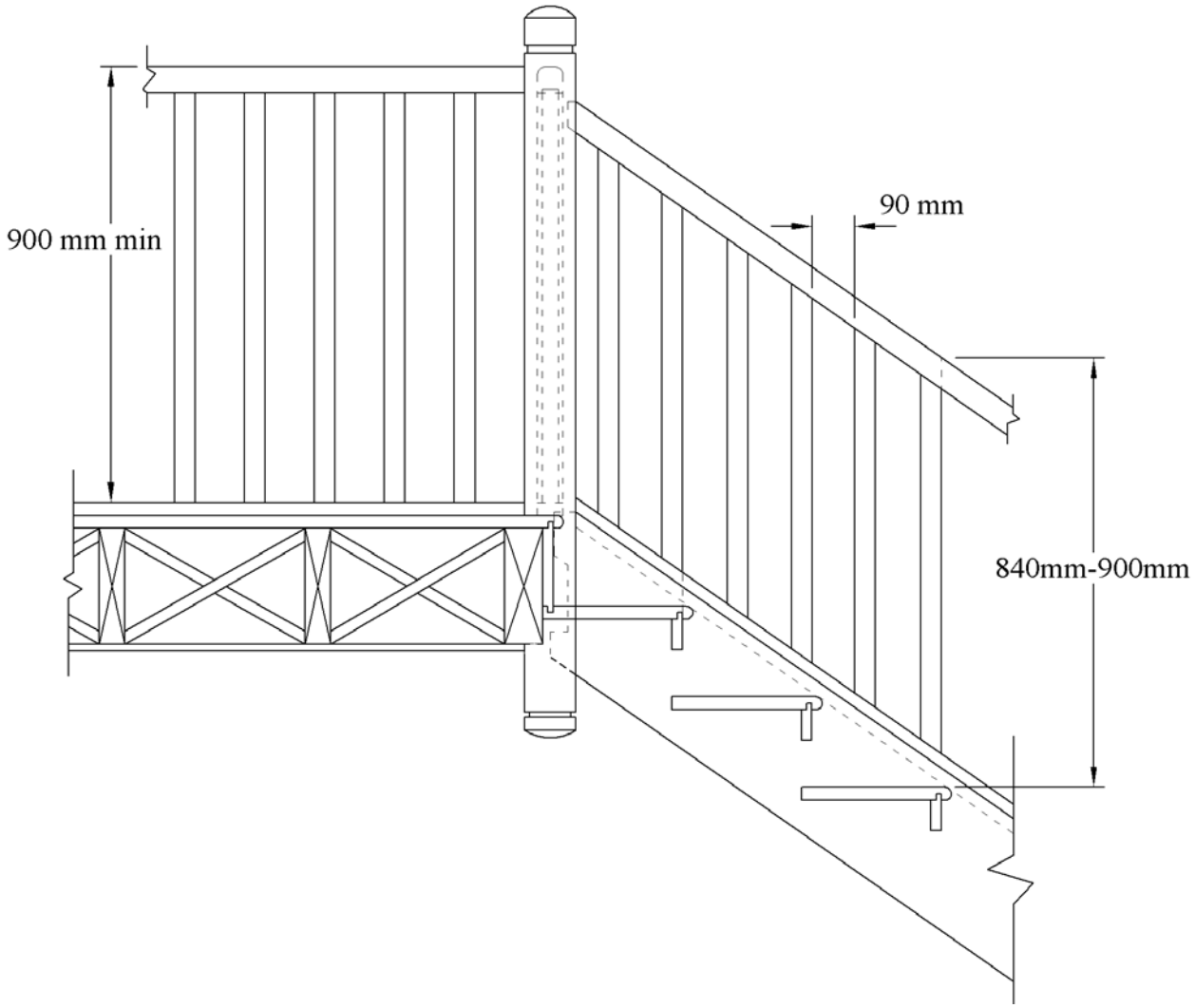
- Careful selection of materials is important as some are more naturally durable than others e.g. cedar, Douglas fir, oak for outside use - Pressure treating less durable woods with Boron increases the lifespan
- Using materials that will be long lasting, e.g. stone, glass, helps the environment by reducing demand, balance between embodied energy and life span - glass
- Durable materials require less maintenance and will save the occupier money
- Materials used on the exterior must be water resistant. This will prevent mould and rot from developing.

Locally Sourced

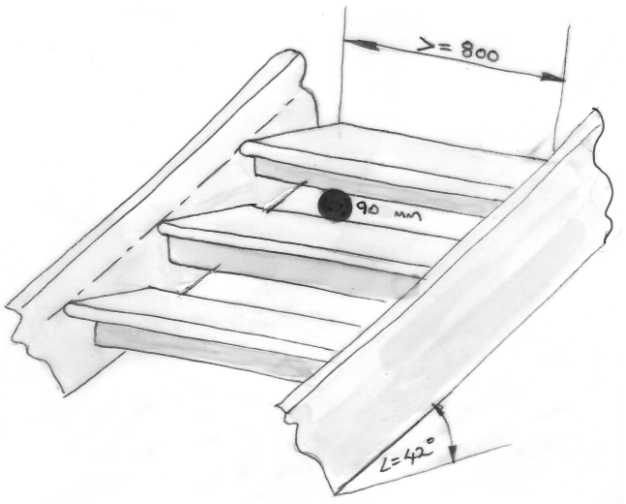
- Material locally sourced reduces the amount of fossil fuels needed to transport the material to the site (low carbon miles)
- Use of local materials helps integrate the building into the surrounding environment
- Sustains local enterprise, crafts, skills and employment and cultivates sense of local place

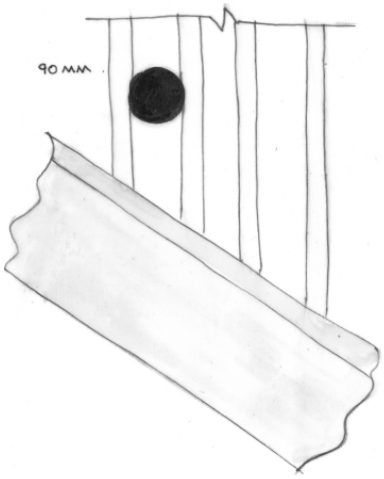
Any other relevant details

Ceist 7
(b) Design features that ensure that the stairs is safe for all users.



- 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)
- Guarding on landing should be a minimum height of 900mm





Any other relevant details

Ceist 8

(a) ***Degree of efficiency method.***

Formula: $Li = Lo \times WF \times E \times \frac{\text{Window area}}{\text{Floor area}}$

Li = Lux required

Lo = Standard Overcast Sky (C.I.E. = 5,000 Lux)

WF = Window factor is the reduction in incident light due to Window Position – on a Vertical Wall. Constant value of 0.5

E = Efficiency coefficient: - Reduction for Reflections, Obstructions, Glass, etc. Constant value of 0.4

$$150 = 5{,}000 \times 0.5 \times 0.4 \times \frac{\text{Window area}}{5.0 \times 3.8}$$

$$150 = 5{,}000 \times 0.5 \times 0.4 \times \frac{\text{Window area}}{19.0}$$

$$150 = 1{,}000 \times \frac{\text{Window area}}{19.0}$$

$$150 = \frac{1{,}000\ W}{19.0}$$

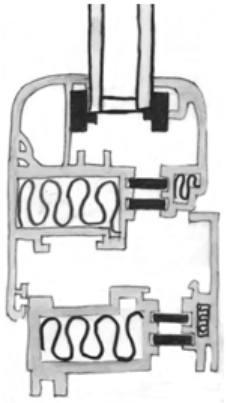
$$150 \times 19 = 1{,}000\ W$$

$$2850 = 1000\ W$$

$$W = \frac{2850}{1{,}000}$$

Window area = 2.85 m²

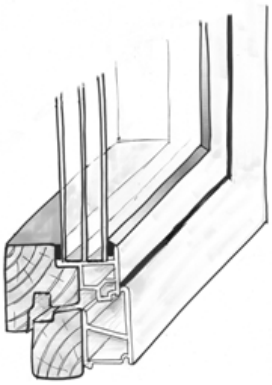
(b)Two design considerations for a contemporary frame and glazing system window frame



- Wooden frame thermally broken
- Frame from composite materials with good insulating properties
- Include a thermal break in the window design. This greatly reduces heat loss due to cold bridging. This is achieved by separating the outside of the frame from the inside by means of low-conductive material
- Good seals between the sash and frame prevents air infiltration and reduces heat loss
- Low energy window system - dwell vent system, Two separate glazed frames are used. They are not sealed. The outside frame has an opening at the bottom and the inside frame has an opening at the top. Incoming air enters at the bottom and is preheated by solar action in the air space between the two frames. The preheated air then enters the house. It is estimated that a 10-15% of saving on heating costs can be achieved.

Any other relevant details

Glazing system



- Double/ triple/quadruple glazing.
- Solar factor - low-e glazing is a metallic coating on one of the panes. This coating reflects heat back into the house
- Inert gas filled cavities. Gases such as argon, krypton and xenon have a much lower thermal conductivity and are recommended
- Using insulated spacers between the panes reduces the heat loss
- A glazed unit that combines some or all of the above would provide the best thermal performance
- Insulated frames to prevent condensation- condensation factor
- Air leakage – tightness of window assembly

Any other relevant details

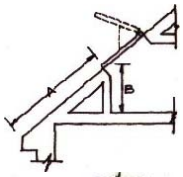
(c) Two environmental considerations

- Make the window frame out of a renewable material. Renewable materials generally have low embodied energy. (Wood requires a lot less energy to produce than aluminium)
- Sustainability - local, easily replaced, easily coated/painted
- Using materials with good insulation characteristics will reduce heat loss and hence reduce the amount of fossil fuels needed to heat the house.
- Using durable materials that are resistant to the elements will have to be replaced less frequently. Weather resistant finishes - Cladding the timber in an aluminium skin greatly increases its lifespan
- End of life use - biodegradable or can be recycled.

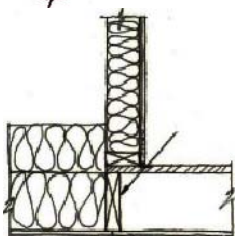
Any other relevant details

Ceist 9

a) Functional requirements of an attic living space



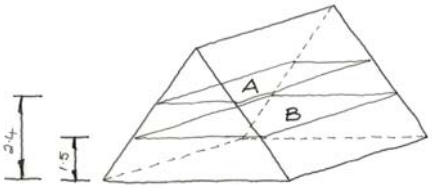
- Adequate floor area and height dimensions
- Adequate light and ventilation
- Fire Resistance
  - Fire grade plasterboard to provide half hour fire resistance
  - Adequate fire stops
  - Encasement of steel beams
  - Fire retardant insulation
  - Safe means of escape, (A 600-1100, B 1700 max)



- Sound insulation
  - Floating floor (avoid impact sound)
  - Isolation of floor from joists
  - Ensure completeness (avoid air borne sound penetration)

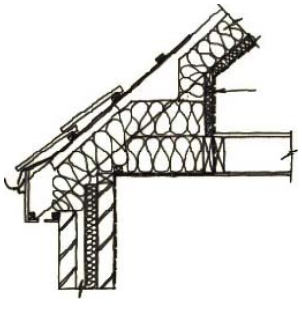
- Adequate access
- Structural integrity
  - Correct sizing of structural members, including sizing floor joist for span
  - Use of vapour barrier on warm side of insulation/air continuity barrier
  - Ensure adequate ventilation of the roof structure to avoid build up of condensation
  - Area A not less than area B/2

- Thermal insulation
  - Avoid thermal bridging
  - Adequate insulation to achieve 0.2 W/m^2 K for the roof

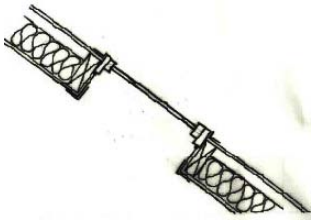


b) Two possible air leakage routes

- Junction of wall with floor/ junction at sloping ceiling and vertical
  - Seal between skirting wall and floor with flexible sealant / tape at floor level
  - Continuity of air barrier, taped at junctions
  - Ensure joints with plaster boards are properly sealed with flexible sealant or taped
  - Ensure insulation is cut to fit exactly into the space between studs
  - Void for services, no puncture of vapour barrier



- Roof light
  - Tape around window to stop draught at the edges
  - Apply appropriate flexible sealant
  - Tape may be applied on outer edge to provide continuity with roof felt/membrane
  -



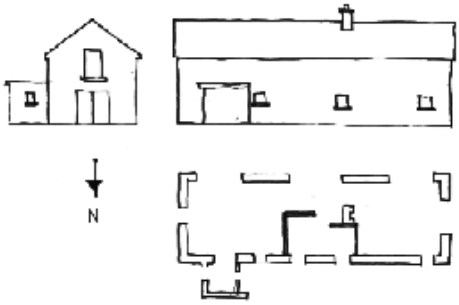
- Services i.e. lights , plugs, switches, pipes etc if barrier is punctured
  - Grommets to seal around service pipes to draught proof the opening
  - Consider using proprietary gasket/grommet socket boxes and membranes
- Any other relevant points

c) Two advantages of air tightness in the attic space....such as

- Build tight and ventilate right
- Uncontrolled air leakages increase the amount of heat loss as warm air is displaced by colder air from the outside
- Good levels of air tightness eliminates cold draughts
- Prevents condensation of indoor moist warm air penetrating the structure resulting in interstitial condensation
- Reduces risk of decay of building fabric
- Air leakage can amount to up to half of all heat losses in modern buildings
- Key to reduction in heat loss is to provide adequate insulation and ensure the building envelope is as airtight as possible
- Reduced Carbon Emissions: Air leakage accounts for a large proportion of the energy wasted in buildings.
- 5 : 1 rule
- The revised Building Regulations require mandatory ‘Air Tightness Test'

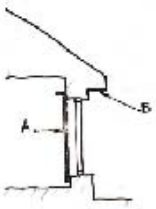
Any other relevant points

Ceist 10a



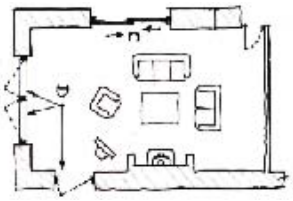
Shape and Form

- Deep plan, south facing – open plan to maximise solar gain
- Optimum roof pitch 45degrees for maximum benefit of solar panels
- Max glazing to south (living areas)
- Min glazing to North (least used spaces- utility spaces
- Draught lobby and sun trap to doors
- Direct access from sunspace to living areas
- Multi-function kitchen, dining-living space sunspace to utilise max solar gain i.e. thermal
- Compact form to minimise surface to volume ratio



Continuity of Insulation

- Rigid insulation in external wall extending down to foundation
- 300 mm min insulation continues under entire floor slab
- Continuity of insulation at eaves-ceiling and wall
- Edge insulation to ground floor concrete floor slab
- Triple glazed low -e. Window system with thermal break in frame



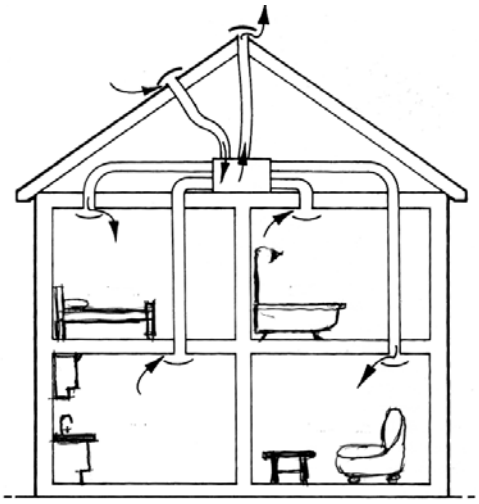
Reduced cold bridge

- Window reveals and head
- Top of wall at wall plate level
- Window cill and head
- Junction between ground floor and external wall

Any other location

10 (b)

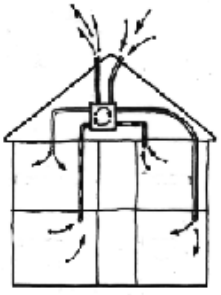
Mechanical Heat Recovery and Ventilating principles



- Removes pre-heated air from kitchen, bathroom and utility rooms
- Conducts this pre-heated air to air exchange unit where heat is extracted
- The extracted heat is used to heat fresh colder air.
- Warm fresh air is distributed throughout the house using a separate independent ducting system

Advantages

- Up to 93% of heat is recovered from exhaust air and therefore reduces heating costs
- Filters prevent pollen and allergens from entering
- Reduced dependency on fossil fuels – no conventional heating system required
- Reduces or eliminates risk of mould growth
- Removes foul and unpleasant odours from air tight building
- Constant flow of fresh air, especially to bedrooms
- Controlled temperatures within.



Overheating

- Brise soleil over large glazed area
- Extended soffit- overhang- but not excessive
- Blinds, curtains heavily lined or timber shutters to filter sun
- Openings positioned opposite each other for through and through ventilation
- Having opening sashes

Any other relevant points

Ceist 10 - Alternative
Sustainable Urban Development

Control of sprawl

- Build close to amenities, renew centres of towns and cities as living spaces, higher densities but carefully planned, sustainable development
- A sustainable city is a city that is attractive to live in. There are twelve criteria against which a city made be judged to determine if it is a sustainable city.

See: Urban Design Manual 2009, Dept of Environment, Heritage and Local Government

- Distinctiveness - creating a sense of place - areas designed to have recognisable features – not bland sameness. Distinctiveness to cultivate identity and emotional attachment to a sense of place
- **Content** – how the city respond to its surroundings – developments to be designed to contribute positively to the character and identity of the neighbourhood
- **Layout** – creating friendly safe streets and public spaces. Interconnected neighbourhoods, routes easy to navigate, hierarchy of spaces – not dominated by the car, traffic speed controlled by design, different road colours, rumble strips, narrowing of road to reduce speed designed public and private spaces
- **Integrated transport system -** good bus services and appropriate density to support regular public transport, rail and light rail where possible

Better quality public realms –

- Integrated public spaces designed to be overlooked by surrounding homes so that they are safe to use – overlooked safe play areas for children, roads and parking areas designed and integrated into development. Well managed public spaces that are attractive, easy to reach and open to all
- **Privacy and amenity** – homes designed to maximise dual aspect, windows located to avoid views in the home from other houses, adequate internal and external storage, decent standard of amenities

- *Cities that are diverse* - **Variety –** neighbourhood promotes a good mix of activities – diverse mix of shop types, facilities

- *Cities that are walkable* - well connected neighbourhoods with attractive safe and green routes for pedestrians and cyclists – safe walkable school routes to encourage students to walk and cycle to school

- *Building that are human scaled –*
- **Inclusivity** – buildings designed to universal design principles to facilitate ease of access by all – facilities for different ages, children, parents, elders, neighbourhoods that are compact and facilities within easy reach are used more often.
- **Adaptability** – how the buildings are designed to cope with change – a home office, attic space easily converted, homes designed for the challenges of climate change, energy efficient design
- **Efficiency** - developments designed to make appropriate use of resources –buildings situated to get maximum benefit from solar orientation – public spaces landscaped to enhance biodiversity
- **Parking** – secure and attractive parking , ease of reach to front door, parking overlooked by housing, parking provided communally, designed secure bicycle storage

Need for sustainable cities and towns –

- Fuel depletion, need for more people to live in towns and cities so as to maximise energy use, urban design to make positive contribution – landscaped public space, easy maintained trees, shrubs and plants. Homes easy to maintain, care of siting of flues, vents, bin stores to create pleasing neighbourhood which will attract people to live in towns and cities

Three recommendations for sustainable housing development…such as

- Energy analysis of any design…low embodied energy design, change existing paradigm to make urban living an attractive option, learning to live in community and not in isolation
- Modest scale of buildings, easy to heat, flexible design to meet changing needs from birth to old age, universal design principles applied, factor in impact of climate change
- Build close to amenities to allow people walk and cycle
- Use of renewable energies - solar panels, on-site generation of electricity where possible, energy saving electrical fittings, LEDs, A-rated appliances, orientation
- Houses of low-environmental impact – embodied energy calculated for all materials
- Build in clusters where possible to reduce energy needs and to encourage a sense of community and belonging
- Use sustainable energies – wind, solar, non-toxic materials
- Clear sustainable planning guidelines to be implemented for all rural and urban developments
- Grants to encourage sustainable design, education to focus on sustainability and energy use
- Promote concept of urban living as desirable and purposeful, considered design to achieve this end.

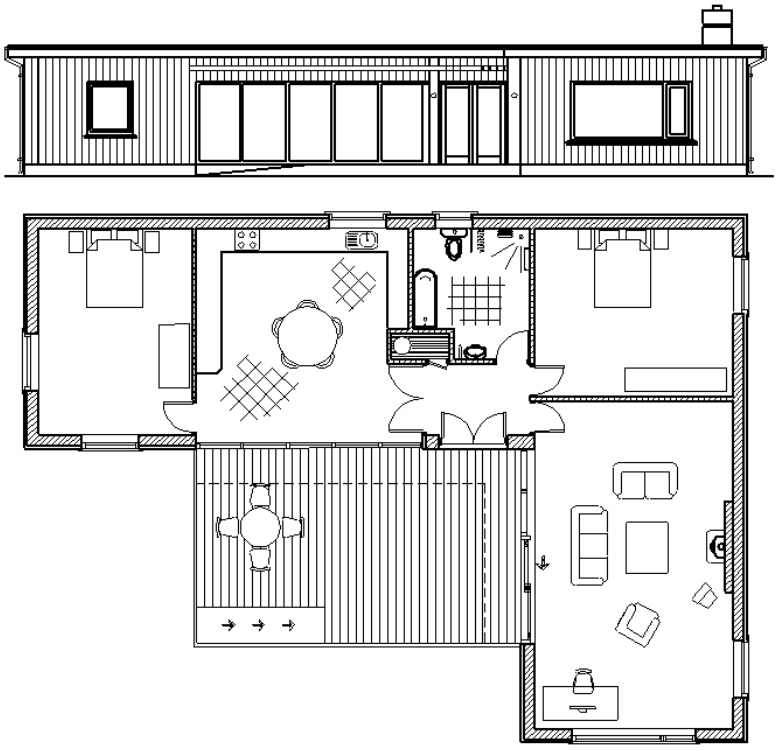
Any other cogent, well argued points

Coimisiún na Scrúduithe Stáit
State Examinations Commission

Scrúdú Ardteistiméireachta 2010

Staidéar Foirgníochta

Teoiric – Ardleibhéal



Construction Studies

Theory – Higher Level

MARKING SCHEME

CEIST 1

PERFORMANCE CRITERIA	MAXIMUM MARK
Any 12 details ×4 marks (Drawing 3, Annotation 1)	
Wall detail:	**4**
Internal and external leaf	
Internal and external plaster	**4**
150 cavity	
100 cavity insulation	**4**
Proprietary cavity closer/Block of insulation	
Concrete Lintels	**4**
Stepped dpc	
Window detail:	**4**
Concrete window cill	
Dpc behind cill	**4**
Wooden Frame cill	
Window board	**4**
Treble-glazed unit	
Window Frame Head	**4**
Proprietary cavity closer/Block of insulation behind cill	
Prefabricated Truss Rafter:	**4**
Fascia, soffit and gutter	
Eaves vent/ventilator	**4**
Felt and battens	
Slates	**4**
Ceiling Joist	
Attic insulation	**4**
Strut	
Four typical dimensions of roof structure	**4**
Scale & Drafting	**4**
(b) ***4 marks for indicating how cavity is closed at wallplate level***	**4**
Total	**60**

Ceist 2

PERFORMANCE CRITERIA	MAXIMUM MARK
Any two details. (2×16marks)	
(a) Design detail 1 - note 8 marks, sketch 8 marks	
Note	**8**
Sketch	**8**
Design detail 2 - note 8 marks, sketch 8 marks	
Note	**8**
Sketch	**8**
(b) Two areas selected (4×7 marks)	
Area 1 Note	**7**
Sketch	**7**
Area 2 Note	**7**
Sketch	**7**
Total	**60**

Ceist 3

PERFORMANCE CRITERIA	MAXIMUM MARK
(a) ***Correct design detail (12 × 4 marks each)***	
Internal Insulation System **(note 4 marks, sketch 4 marks)**	**4**
• Method of fixing	**4**
• Insulation materials and its thickness	**4**
• Surface finish	**4**
	4
	4
External Insulation System (note 4 marks, sketch 4 marks)	**4**
• Method of fixing	**4**
• Insulation materials and its thickness	**4**
• Surface finish	**4**
	4
	4
(b) ***Two advantages of each system (2×2 marks each)*** ***Recommendation (4 marks)***	
Advantage 1	**2**
Advantage 2	**2**
	2
	2
Recommendation	**4**
Total	**60**

Ceist 4

PERFORMANCE CRITERIA	MAXIMUM MARK
(a) ***3*** requirements, ***(note 4 marks, sketch 4 marks)***	
Functional requirement 1 Note Sketch	**4** **4**
Functional requirement 2 Note Sketch	**4** **4**
Functional requirement 3 Note Sketch	**4** **4**
(b) Note 8marks; Sketch 8 marks;. Dimensions 8 marks	
Note Sketch	**8** **8**
Typical dimensions	**8**
(c) ***Note and sketch (2×6 marks)***	
Note Sketch	**6** **6**
Total	**60**

CEIST 5

PERFORMANCE CRITERIA	MAXIMUM MARK
(a) *10 points×**3 marks** for each point*	
Correct Tabulation	**3**
External Render.	**3**
Wall	**3**
Internal Plaster.	**3**
External Surface.	**3**
Internal Surface	**3**
Total Resistance	**3**
U-value Formula $U=1/R^t$	**3**
U-value	**3**
Correct units **W**/m^2 °C or **W**/m^2 K	**3**
***(b)** (7×**3 marks** each)*	
Application of formula : R=1/U	**3**
Current Resistance from part (a)	**3**
Resistance required for a U- Value of 0.27	**3**
Difference in Resistances	**3**
Formula R=T/k	**3**
Application of formula	**3**
Required thickness of insulation	**3**
(c) *Note and sketch*	
Note	**5**
Sketch	**4**
Total	**60**

Ceist 6

PERFORMANCE CRITERIA	MAXIMUM MARK
(a) Three design features: (6 ×8 marks)	
Design feature 1	
Note	**8**
Sketch	**8**
Design feature 2	
Note	**8**
Sketch	**8**
Design feature 3	
Note	**8**
Sketch	**8**
(b) ***Discussion of materials (3 × 4 Marks)***	
Renewable	**4**
Durable	**4**
Locally sourced	**4**
Total	**60**

CEIST 7

PERFORMANCE CRITERIA	MAXIMUM MARK
(a) Any 6 details × 5 marks each ***(Drawing3 Annotation 1)***	
Closed String String capping Partial riser Thread Newel Post Handrail Balusters Trimmer Flooring Landing handrail Jointing of string to newel post Jointing of handrail to newel post	**5** **5** **5** **5** **5** **5**
Scale and Drafting	**4**
Handrail height to stairs Handrail height to landing Spacing between balusters	**2** **2** **2**
(b) ***Two design features that ensure the stairs is safe (4×5 marks)***	
Note Sketch	**5** **5**
Note Sketch	**5** **5**
Total	**60**

Ceist 8

PERFORMANCE CRITERIA	MAXIMUM MARK
(a) ***(7 × 2 marks) Formula***	
Formula	**2**
Correct entry into formula	**2**
Floor area	**2**
Lo×WF×E	**2**
Solve for w (window area) line 1	**2**
Solve for w (window area) line 2	**2**
Window area	**2**
(b) Window frame design (4×4 marks) Glazing system design (4×4 marks)	
Frame design 1	**4**
Note	
Sketch	**4**
Frame design 2	**4**
Note	
Sketch	**4**
Glazing system 1	
Note	
Sketch	**4**
Glazing system 2	**4**
Note	
Sketch	**4**
	4
(c) Two environmental considerations in choosing a preferred materials **(2 × 7 marks)**	
Environmental consideration 1	**7**
Environmental consideration 2	**7**
Total	**60**

Ceist 9

PERFORMANCE CRITERIA	MAXIMUM MARK
(a) *(3 requirements × **8 marks**)*	
Functional requirement 1	**4**
Note	
Sketch	**4**
Functional requirement 2	**4**
Note	
Sketch	**4**
Functional requirement 3	**4**
Note	
Sketch	**4**
(b)	
Air leakage 1	**5**
Design detail 1	
Note	**2**
Sketch	**2**
Air leakage 2	**5**
Design detail 2	
Note	**2**
Sketch	**2**
Specification of materials	**2**
(c)(2×8 marks)	
Advantage 1	**8**
Advantage 2	**8**
Total	**60**

Ceist 10

PERFORMANCE CRITERIA	MAXIMUM MARK
(a) ***Design of a passive house (4 × 4marks)***	
Note 1	**4**
Sketch	**4**
Note 2	**4**
Sketch 2	**4**
(b) ***Two operating principles (4 × 4 marks) advantages (2 ×4 marks)***	
Operating principle 1	**4**
Note and sketch 1	**4**
Operating principle 2	**4**
Note and sketch 2	**4**
Advantage 1	**4**
Advantage 2	**4**
(c) ***To prevent possible overheating (4 × 5 marks)***	
Design detail 1	**5**
Note	**5**
Sketch	
Design detail 2	**5**
Note	**5**
Sketch	
Total	**60**

Ceist 10 (Alternative)

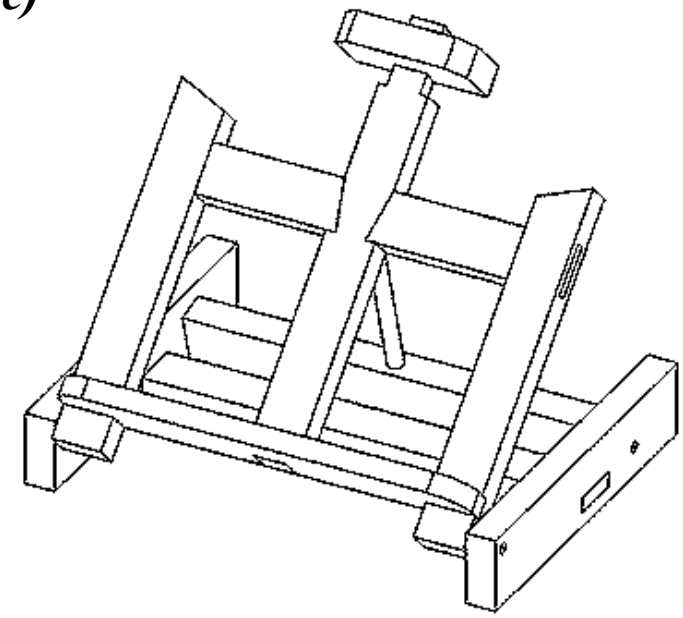
PERFORMANCE CRITERIA	
Discussion of Statement (3×10 marks)	
Point 1 - discussion	**10**
Point 2 - discussion	**10**
Point 3 - discussion	**10**
Three Guidelines (3×10 marks)	
Guideline 1	**10**
Guideline 2	**10**
Guideline 3	**10**
Total	**60**

Coimisiún na Scrúduithe Stáit
State Examinations Commission

Scrúdú Ardteistiméireachta 2010
Leaving Certificate Examination 2010

Scéim Mharcála
Marking Scheme

(150 marc)

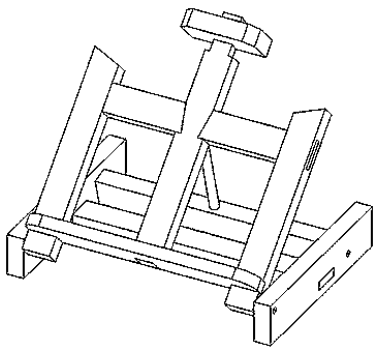


Staidéar Foirgníochta
Triail Phraiticiúil

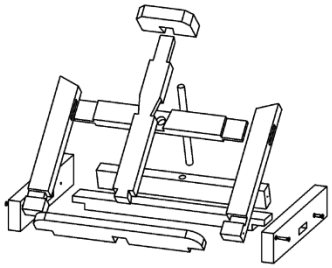
Construction Studies
Practical Test

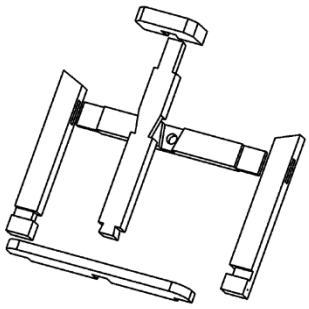
Construction Studies 2010
Marking Scheme – Practical Test

Note:
The artifact is to be hand produced by candidates without the assistance of machinery. However 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.

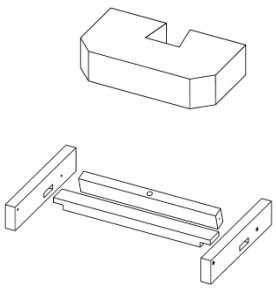


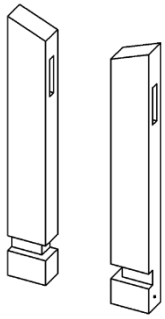
	A OVERALL ASSEMBLY	MARKS
1	Overall quality of assembled artifact	**8**
2	Dowel located and fitted correctly	**3**
3	Design and applied shaping in edges • design • shaping *(2 x 2 marks)*	**4**
	Total	**15**



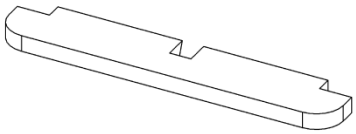


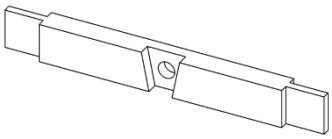
	B MARKING OUT	Marks
1	Left side - vertical • joints - mortice *(2 marks)* - housed *(2 marks)* • top slopes *(1 mark)*	**5**
2	Right side - vertical • joints - mortice *(2 marks)* - housed *(2 marks)* • top slopes *(1 mark)*	**5**
3	Middle - vertical • joints - dovetail-bottom *(2 marks)* - dovetail halving *(4 marks)* - top dovetail *(2 marks)*	**8**
4	Bottom rail • Joints - dovetail *(2 marks)* - notches *(2 x 2 marks)* • quadrants *(2 x 1 marks)*	**8**
5	Top rail • joints - tenons *(2 x 2 marks)* - dovetail halving *(4 marks)*	**8**

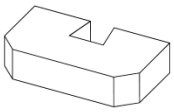
	6	Top sliding • dovetail pins *(2 marks)* • chamfers *(2 x 1 mark)*	**4**
	7	Base - left and right • mortices *(2 x 2 marks)*	**4**
	8	Base - middle rail tenons *(2 x 2 marks)*	**4**
		Total	**46**

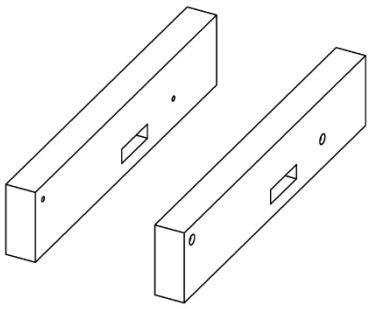
TWO SIDES	C	PROCESSING	Marks
	1	Shaping sloped ends *(2 x 1 mark)*	**2**
	2	Two mortices *(2 x 3 marks)*	**6**
	3	Two housed joints *(2 x 5 marks)*	**10**
		Total	**18**

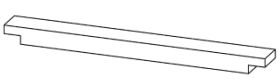
MIDDLE VERTICAL	D	PROCESSING	Marks
	1	Dovetail - bottom • Slopes *(2x2 marks)* • Shoulders *(2x1 marks)*	**6**
	2	Dovetail halving - centre • Sawing across grain *(4 x 1 marks)* • Shaping slopes *(2 x 2 marks)* • Paring trench *(2 marks)*	**10**
	3	Shaping top dovetail • Sawing/ paring vertically *(2 x 2 marks)* • Sawing shoulders *(2 x 1 marks)*	**6**
		Total	**22**

BOTTOM RAIL	E	PROCESSING	Marks
	1	Dovetail - centre	**3**
	2	Housed joint • sawing *(4 x 1 mark)*	**4**
	3	Shaping curves *(2 x 2 marks)*	**4**
		Total	**11**

TOP RAIL	F	PROCESSING	Marks
	1	Two tenons • sawing vertically *(4 x 2 mark)* • sawing shoulders *(4 x 1 mark)*	**12**
	2	Dovetail trench • sawing shoulders *(2 x 1 mark)* • trenching *(2 marks)*	**4**
		Total	**16**

TOP SLIDING	G	PROCESSING	Marks
	1	Chamfers	**2**
	2	Dovetail	**4**
		Total	**6**

BASE SIDES	H	PROCESSING	Marks
	1	Two mortices *(2 x 3 marks)*	**6**
	2	Holes - screws • drilling and countersinking screws + position *(4 x 1 marks)*	**4**
		Total	**10**

BASE MIDDLE RAIL	I	PROCESSING	Marks
	1	Two tenons *(2 x 3 marks)*	**6**
		Total	**6**