Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate 2014

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

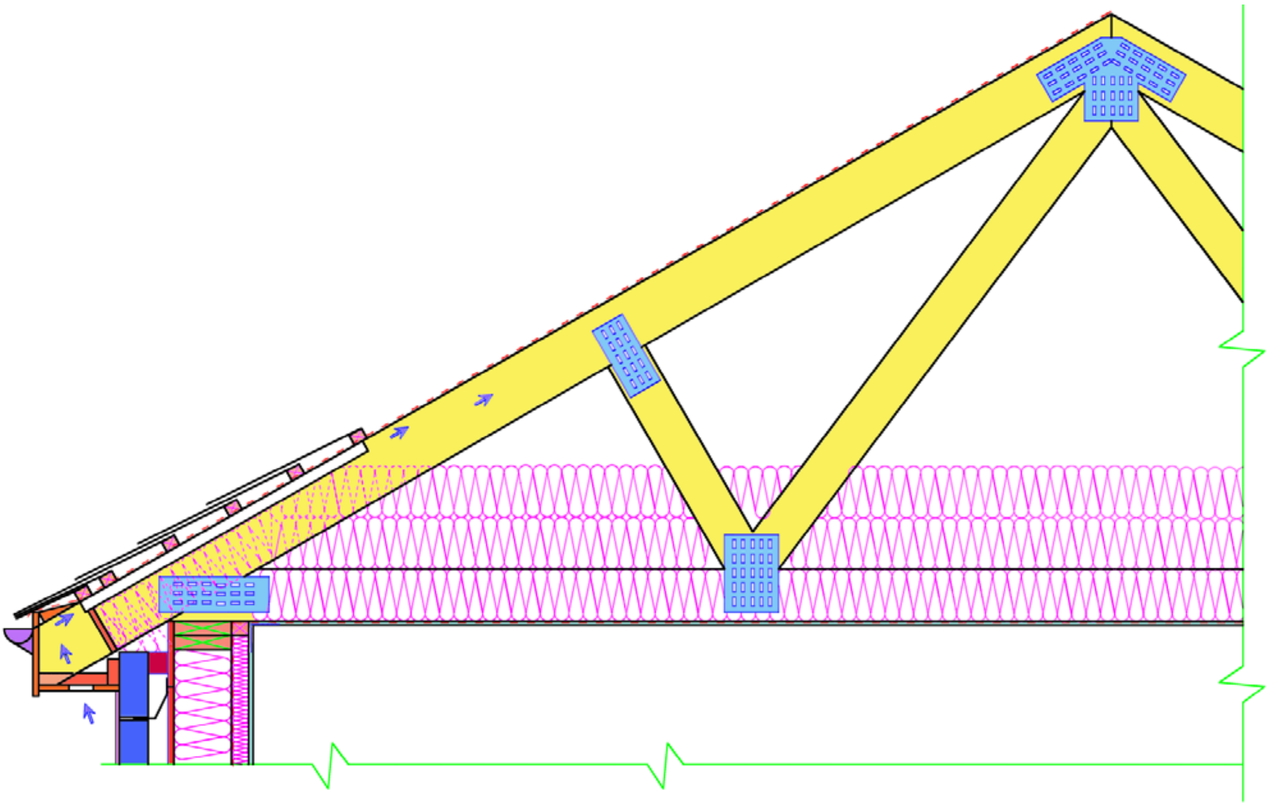
Scrúdú Ardteistiméireachta 2014

Staidéar Foirgníochta
Teoiric – Ardleibhéal

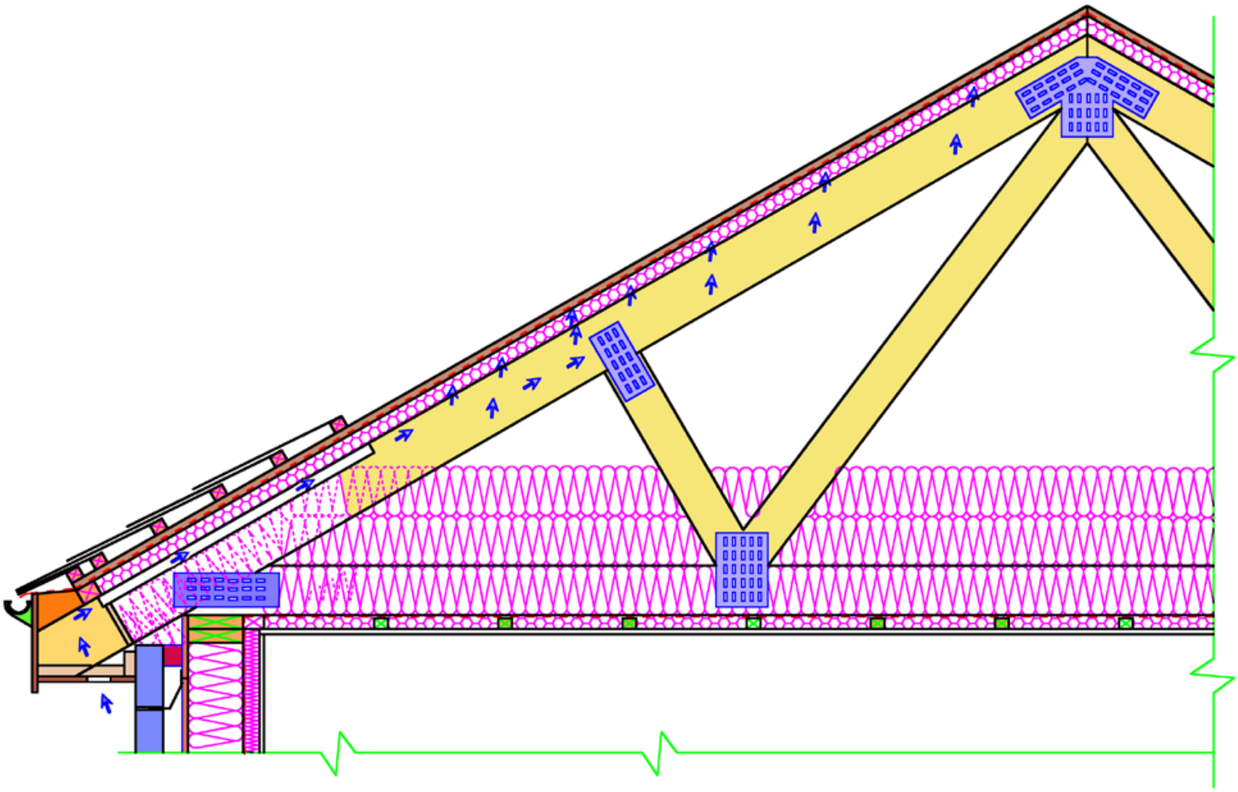
Construction Studies
Theory – Higher Level

Ceist 1(i) - Typical wall and roof details

(i) Typical details



(ii) Best practice details - wall and woodfibre board to roof for windtightness and insulation, vapour diffusion membrane, counter battens for ventilation, service cavity to ceiling



Wall

- Head plate and top rail 200 × 50 mm
- Vertical stud framework 200 × 50 @ 400 mm centres
- Horizontal bridging 200 × 50 mm
- Insulated service cavity 60 mm
- Vapour barrier to ceiling and wall – joints sealed and taped
- Vapour barriers at junction of wall and ceiling taped for airtightness
- 12.5 mm plasterboard - *best practice* - 2 × 12.5 mm gypsum plasterboard
- Skim finish to ceilings and walls
- Scrim/tape at wall and ceiling junction to ensure airtightness
- Insulation to timber frame - 200 mm
- Racking board 12 – 20 mm OSB or plywood with taped joints
- Breather membrane with taped joints
- Vapour diffusion clear cavity 50 – 75 mm
- Stainless steel wall ties
- Fireproof cavity closer
- 100 concrete block outer leaf
- 15 mm render – 2 coats.

Typical details - roof

- Slates on battens 50 × 40 mm – *best practice* - counter battens 50 × 40 mm
- Hygroscopic insulation layer – *best practice* – woodfibre board insulation for windtightness
- Breather membrane sealed and taped
- Prefabricated roof trusses at 400 - 600 mm centres - rafters and ceiling joists 180 × 50 mm
- 150 × 50 mm struts secured with nail gang plates
- Insulation 300 mm – *best practice* 600 mm insulation to ceiling
- 2 × 12.5 mm gypsum plasterboard to ceiling with vapour barrier on warm side of insulation
- Airtightness tape
- Fascia, soffit and gutter with continuous vent at soffit.

Other appropriate detailing accepted

Ceist 2 (a) Upgrading the entrance to a dwelling house

Threshold and access ramp - such as

- Door width clear opening min 800 mm – best practice 900 mm -1000 mm
- Glass panel in door to observe who is at door
- Lever handles to door – height 900 - 1200 mm
- Remote control activation of door for person in wheelchair
- Level threshold, max height at threshold 15 mm
- Level surface 1800 × 1800 mm min – turning circle at door
- Ramp to main entrance - slope 1:20
- Ramp clear width min 1200 mm – best practice 1800 - 2000 mm
- 75mm raised kerb on open sides of ramp or to soil level
- Slip-resistant surface to ramp
- Tactile strips located at landings.

Other appropriate detailing accepted

Weather protection - such as

- Canopy to door for weather protection when waiting
- Design to architect specification
- Sturdy protection for security in high winds – securely braced and fixed
- Extends 1800 mm min for weather protection.

Suitable lighting

- Combination of low and high level lighting
- Inset lights to ramp and landing
- Low voltage lighting for economy
- Sensor activated lighting for economical use.

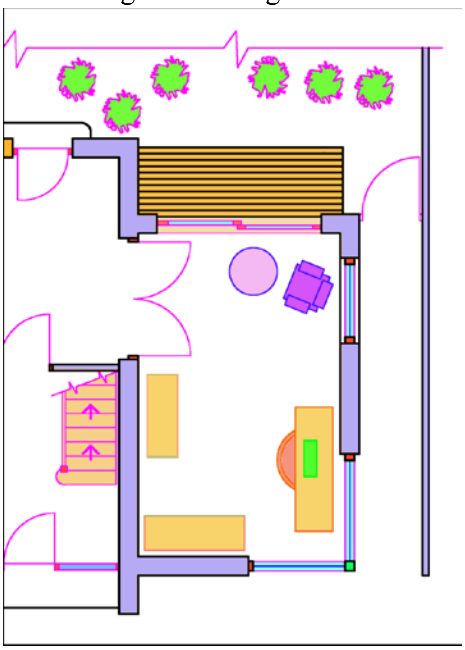
***2(b) Two** reasons why provision for lifetime use should be considered at the design stage – such as*

- Discussions with architect on personal preferences and within budget
- Lifetime use decisions made before construction begins, little need to modify afterwards
- Later modifications means demolishion and retrofit, expensive
- Holistic approach – do the creative thinking first
- Layout to be flexible, agile and capable of modification with ease
- Movable partitions, consideration to plumbing and lighting from the outset
- No structural members to be altered, lintels fitted where future alterations required – easy to open up a divided space.

Ceist 3

***Any three** functional requirements of attractive study space – and proposed layout such as:*

- **thermal comfort** – easily and cheaply heated, fresh air supply - natural ventilation - cross ventilation, openable windows, mechanical ventilation if needed, passive heating and cooling temperature regulation, thermal mass, no extremes.
- **acoustic comfort** - the space supports solitude – quiet, soundproof space.
- **visual comfort** - natural light, daylight maximised – light drenched – rooflight windows – responding to the sun path, winter solar gain, summer solar shading, low energy lighting – task lighting – desktop lighting, flexible movable lighting for tasks, pleasant visual space, visual interest, views to outside – bringing rear garden in – *see sketch.*
- **ergonomic comfort** - desk, chair, worktops at right height, worktop heights adjustable to suit person, chair adjustable, desk, chair on castors for ease of movement.
- **olfactory comfort** - fresh air, fresh smells, - indoor plants for air cleanliness, plants for pleasant indoor atmosphere.
- **multi-functional space** - for study and relaxation – can easily be reconfigured, moveable study desk, foldabe chairs, area to listen to Internet/tapes and area for relaxation, bright colours to maximise daylight.



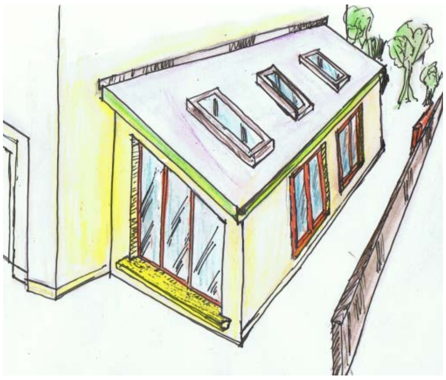
- **agile space** - can be used as additional space – used as bedroom/relaxation space when required, getting more from less, convertible couch - pleasant pastel colours for quiet but stimulating study space.

Thermal comfort – light drenched space**–** *see sketch*

- triple glazed, low-e, thermally broken frames throughout
- largest glazed area to south, rooflight windows
- increased height, sloped ceiling and volume to give pleasant spacious interior space
- locate windows and doors to provide morning, noon and evening natural light/sunlight
- *brise-soleil* to southern glazing for solar shading and to prevent glare
- careful positioning of windows to allow cross ventilation and prevent build up of stale air.

Acoustic comfort - supporting solitude, quiet soundproof space

- block wall with cavity between main house and storeroom with good sound insulation properties – mass, completeness, isolation
- high quality glazed doors between study and kitchen/dining room, compressible seal to door to prevent noise transfer, completeness
- door to be of 50 – 80 mm solid wood frame and double/triple glazed panels for soundproofing
- glazed panel in door to allow borrowed light to dining area
- door to have flexible seal to frame to prevent sound transfer.



Visual comfort - bringing rear garden in

- access to garden – pleasant space for relaxation
- sliding/bi-fold doors to rear
- view to garden – wooden patio for study and relaxation
- glazing to floor level for maximum impact, plants for seasonal colour.

Olfactory comfort

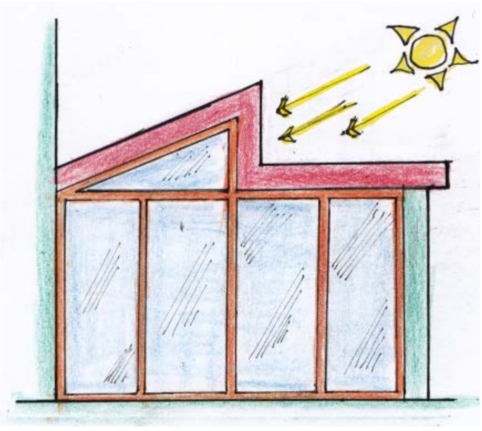
- scent from shrubs/plants
- indoor plants for air cleansing
- decking to extend the interior – study in shade
- benefits to health and well-being.

Flexible, agile space – can be easily reconfigured as additional space

- sustainable - doing more with less
- sleeping area such as convertible couch, fold-away bed
- movable desk on wheels, foldable, stackable / foldable chairs.

3(c) External design to enhance visual appearance - Design subject to planning permission

- Blend in or contrast with neighbourhood
- Takes advantage of light and orientation
- Flat or sloping roof
- Rooflights to capture sunlight
- Full height glazing to elevation.



Any thoughtful, modern or traditional design which displays creativity and flair to enhance appearance of study, does not look like a garage but is rather an integral part of the house.

Ceist 4 (a)
Restoring a house in vernacular tradition
Advantages of step by step approach...such as

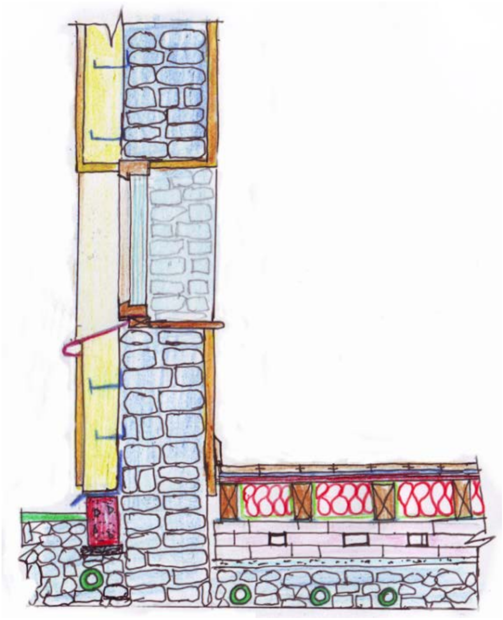
- Allows for phased upgrading as finance becomes available, not huge initial costs
- Can be done through savings, prevents large loan and interest repayments
- Allows time for research between upgrades
- Schedule of upgrading can be planned, areas to be upgraded can be chosen with care
- Best practice approach can be carefully planned, type, thickness of insulation, interior or exterior or both
- Energy bills reducing as upgrade progresses
- Occupants can live in house as upgrades are carried out.

Disadvantages of step by step approach...such as

- Upgrading disruptive over long period, workers coming and going over number of years
- Difficult to maintain momentum over time, especially while living in house
- High energy bills for number of years until refurbishment is complete
- Phased approach, difficult to apply best practice, e.g. moving windows to meet insulation
- Areas of house not liveable in for certain periods – upgrading floors
- Overall upgrade difficult to coordinate.

(b) External Wall

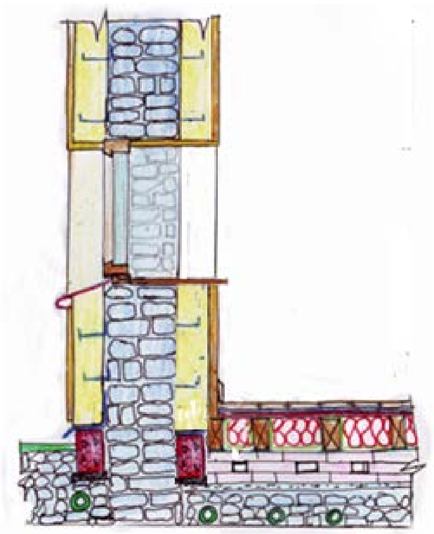
General



- Conservation officer, architect or engineer to give advice on best practice
- No "one size fits all" solution for older dwellings – optimum solution developed for each dwelling – each dwelling has its own micro climate and character
- Ideally maintain the walls and roof as breathing structures – few barriers as in original
- A breathable structure allows moisture exchange readily between the indoor and outdoor environment, moisture is not trapped within the structure
- Natural materials allow breathability, such as lime, hemp, woodfibre boards, sheep's wool, earth based mortars, renders, plasters and limewashes
- Permeable materials absorb the moisture from the air when the humidity is high and release it when the air is dry
- Adding vapour barriers and materials that are highly resistant to the passage of water vapour are not normally appropriate for older buildings
- Hygroscopic properties of the insulation to allow water vapour to move through the structure of the wall
- Breathability prevents surface and interstitial condensation occurring - as water vapour is not trapped but is gradually released
- Useful rule of thumb – all layers of an insulated solid masonry wall should become progressively more permeable from the interior to the exterior.

Suitable materials for external insulation include:

- o Hemp-lime composites
- o Mineral wool
- o Wood fibre panels
- o Lime renders
- o Natural plasters
- o Natural paints – not acrylic or waterproof paints.



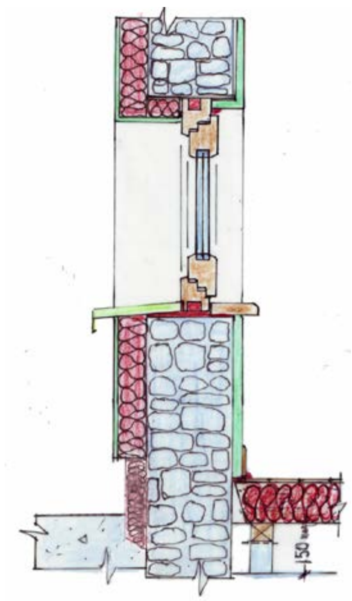
Materials less suitable include

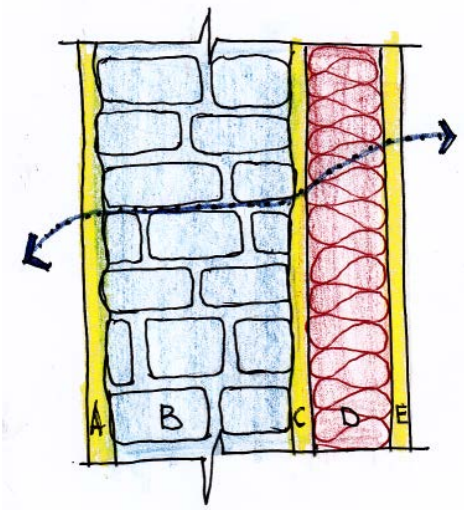
- o Plastic-based insulations
- o Closed-cell foam insulations
- o Acrylic and oil based non-permeable paints.

External insulation of Hempcrete with hemp/lime plaster or lime plaster -

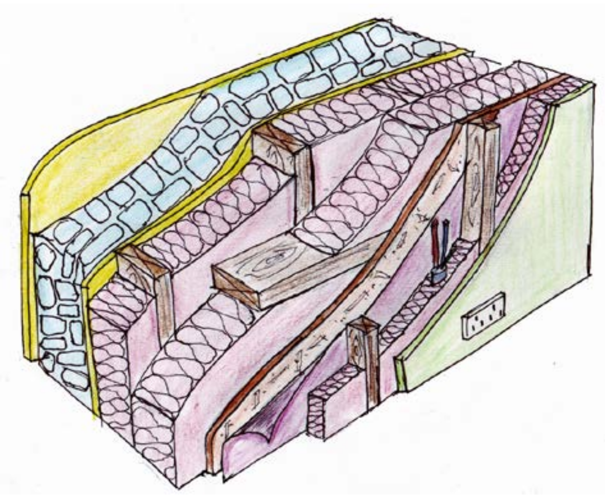
- Hempcrete – mixture hemp shivs, water and a lime binder that sets to hardened state
- Gives breathable wall, a wall that allows moisture pass through, plastered with a lime render to allow moisture pass through
- No vapour barriers, lime plaster used to form airtight barrier
- Old plasters removed and replaster inside and outside of wall surface is uneven with lime or lime/hemp plaster
- French drain all around to prevent rising damp
- Foundation built to carry hempcrete – see sketch
- DPC laid on foundation and carried up wall
- Stainless steel straps bolted to wall to anchor hempcrete
- Formwork erected and hempcrete compacted in layers
- Location of window moved to meet hempcrete insulation
- Stainless / powdered steel cill
- Hempcrete allowed to fully dry out before applying lime plaster – six weeks
- Hempcrete can be sprayed or built in layers with shuttering
- Can be applied to outside or inside or preferable to both for increased insulation.

External and /or internal Woodfibre insulation board and lime plaster - hygroscopic and breathable

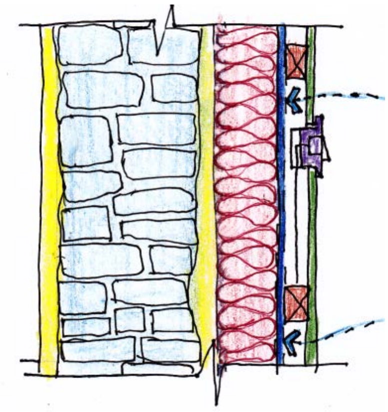


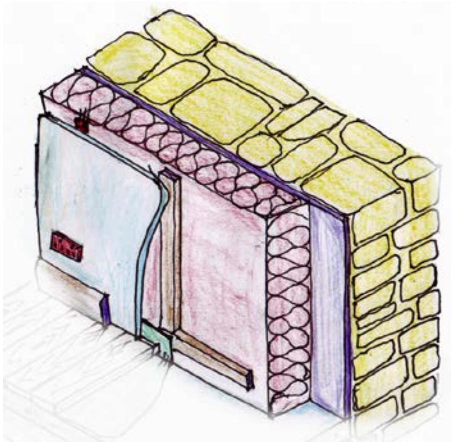


Internal impermeable insulation with vapour barrier and service cavity



See www.seai.ie
Retrofitted Passive Homes – Guidelines for upgrading dwellings in Ireland to Passivhaus standard.



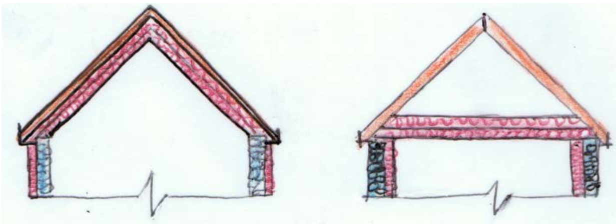


Roof – best practice detailing – that respects the character of the house and reduces waste

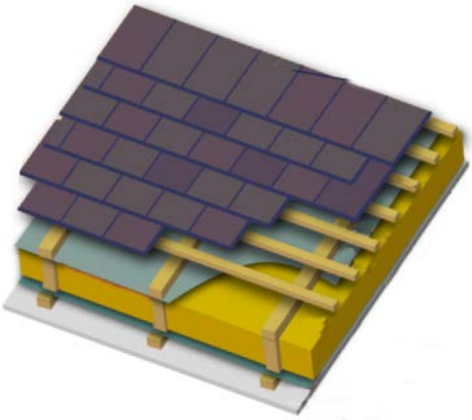
Two options –

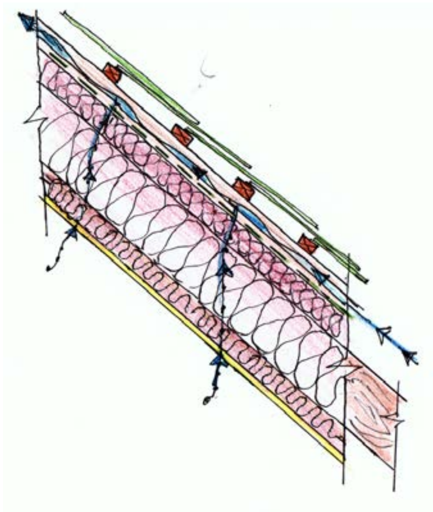
1. **Breathable roof structure –** all insualtion materials natural and hygroscopic, with no vapour barriers and water vapour diffuses at counter battens through roof vent

Warm roof and cold roof



- The aim of the repair is to minimise the intervention and to retain as far as possible the historic fabric of the roof
- Remove slates, number each row and store
- Reuse slate of existing and replace with similar
- Slate from rear placed on front roof to maintain uniformity of colour, shape and size
- Remove impermeable sarking felt – to be replaced with vapour diffuse membrane
- Inspect all roof members for decay and replace only the decayed portions – see sketch
- Remove decayed end of rafters and splice, inspect wall plate and replace if necessary with the same type of wood to maintain the historical integrity of the original roof
- Replace decayed fascia where necessary, identical profile, treat with preservative - boron
- Insulate roof – all insulation materials to be hygroscopic – allow water vapour pass though
- Sheeps wool between rafters, woodfibre board above and beneath rafters, lime plaster to fibreboard beneath rafters to allow moisture through
- Slating battens – replace existing battens and nails
- Counter battens for ventilation of roof
- Fit vapour diffuse membrane beneath battens to allow any vapour diffuse to air – no sarking felt, impermeable as condensation occurs beneath.



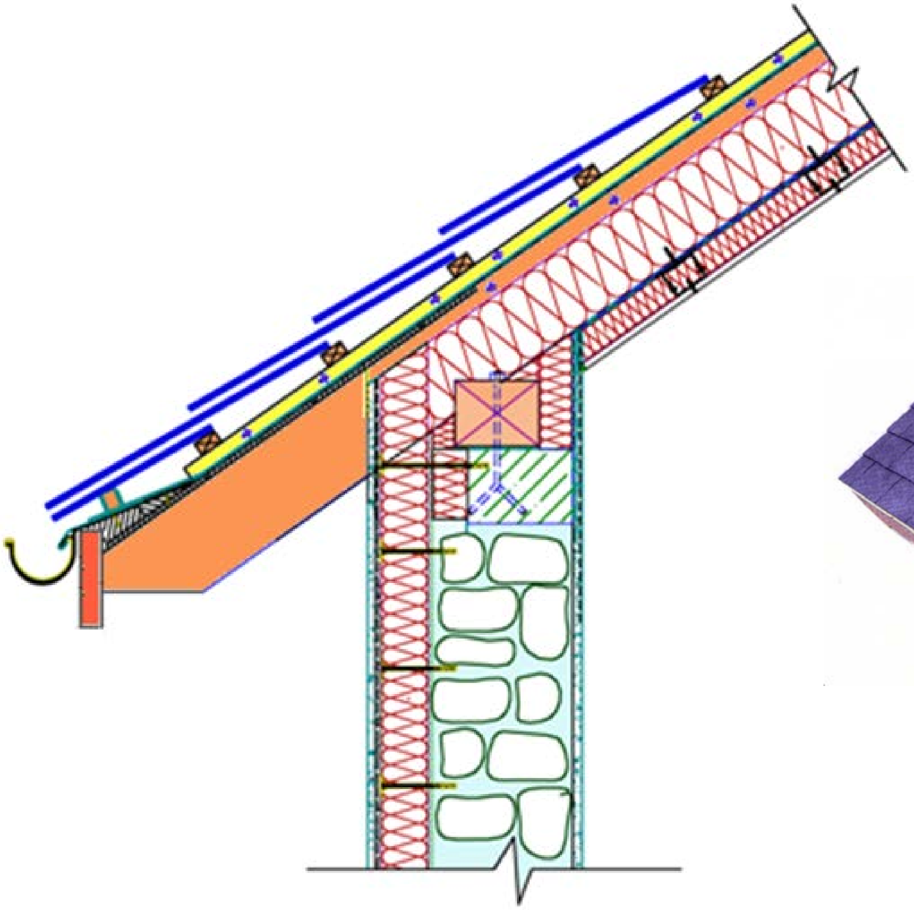


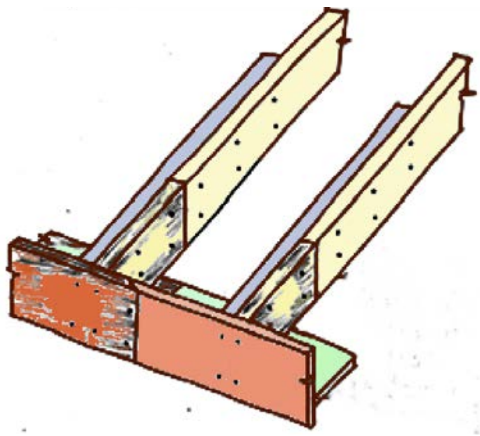
Option 2

- Insulation to roof with ventilation path, or full-fill blown cellulose
- Continuous vapour barrier on warm side of insulation, taped and joined to plaster layer
- Insulated service cavity of hemp or wool - electrical services not to puncture vapour barrier
- Plasterboard with skim to ceiling
- Vertical insulation to prevent cold bridge at wallplate.

Roofs – a guide to the repair of historic roofs - Government of Ireland 2010 - Environment, Heritage and Local Government – ISBN: 0-7557-7540-6
Energy efficiency in Historic Buildings – english-heritage.org.uk
Hemp Lime Construction: A Guide to Building With Hemp Lime Composites: Rachel Bevan, Tom Woolley, Brepress.
Building With Hemp: Steve Allin, Seed Press.

Any other relevant information



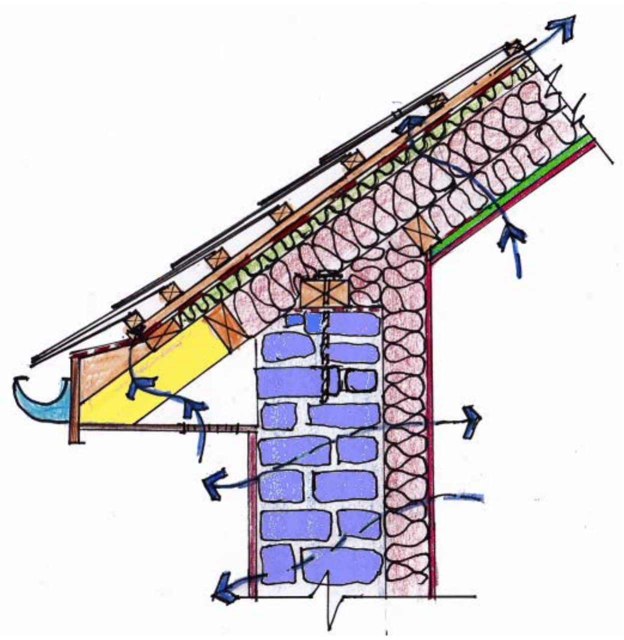


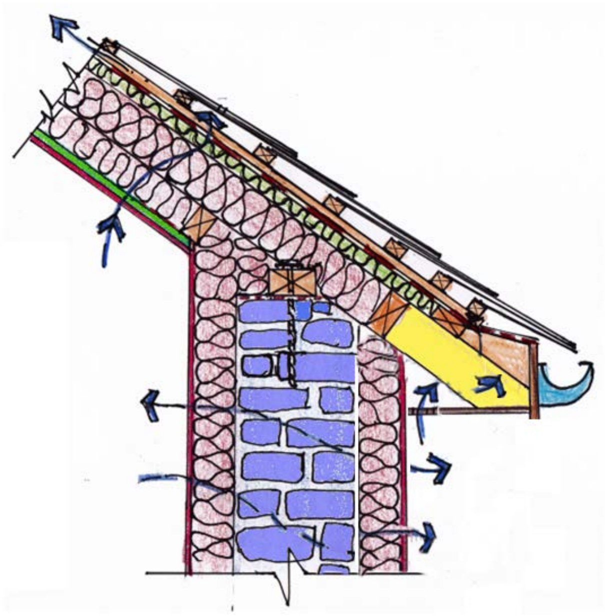
Option 3 - Warm Roof

- Slate
- Battens and counter battens
- Breathable membrane
- Woodfibre board insulation – breathable and hygroscopic
- Hemp insulation to roof
- Counter rafter and hemp insulation
- Vapour permeable ceiling board to form permanent shuttering to inside face such as Heraklith, Sasmox, Fermacell or similar
- Lime plaster or hemp/lime finish.

Wall and roof with hempcrete

- External lime render or hemp/ lime render
- Tradical Hemcrete or similar hemp/lime - sprayed or cast to 150 mm min thickness on both inside and outside of wall
- Limetec or similar to inside – optional
- Natural paint finish – breathable - optional
- No vapour barriers, open diffuse structure to roof and walls
- Hemp insulation to roof
- Counter rafter beneath and hemp insulation.



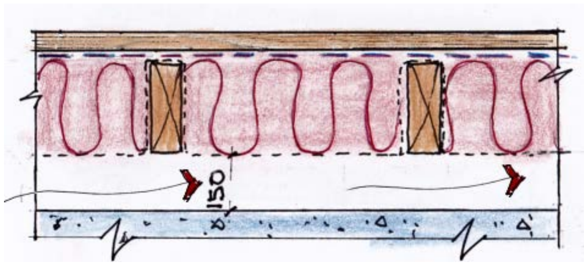


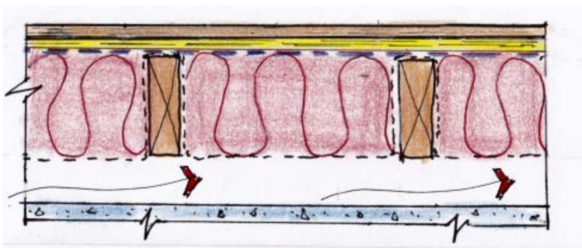
Floors

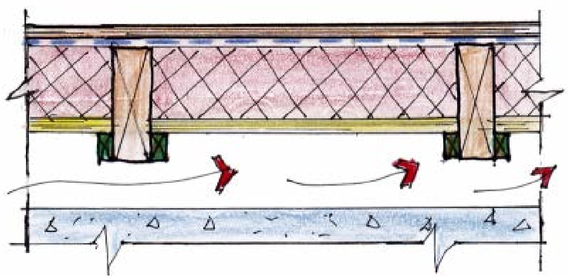
- Determine historical significance of floor
- Label/number floorboards and draw room plan
- Lift skirting and floorboards and store carefully
- Check sub-floor ventilation
- Examine for any decay of joists or boards and replace
- Spread netting and lay soft insulation between joists.

or

- Fix battens and lay OSB or plywood
- Fix rigid insulation between joists – cut accurately, no gaps
- Fix breather membrane, and replace floorboards as originally labelled ***or***
- Fix breather membrane, plywood and replace floorboards and skirting as originally labelled.







Ceist 5 (a): U-value

Material Element	Conductivity k	Resistivity r	Thickness T(m)	Resistance R
Top surface of floor				0.1040
Conc. floor slab	0.160		0.125	0.7813
Insulation	0.031		0.200	6.4516
DPM	0.450		0.00030	0.0006
Sand blinding	0.160		0.030	0.1875
Hardcore	1.260		0.225	0.1786
			Sum of (R)	**7.70**

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

U-value: U = 1 / 7.7 = **0.1298 W/m^{2}K**

(b) (i) Cost of heat lost per year:

- Heat loss formula: = U-value × area × temp. diff
- Note : Area of room ; 13.0 metres × 7.0 metres = 91 m^2
- HLF = 0.1298 × 91 × 14 = 165.36 Watts.(Joules / sec)
- Heating period P/A: 12 × 7 × 39 = 3,276 hrs

  3,276 × 60 × 60 = 11,793600 seconds

  $\frac{11,793600 \times 165.36}{1000}$ = 19,50189.69 kJ / sec

- Litres p/a (*Note*: *Calorific value of 1 litre oil = 37350 kJ*)

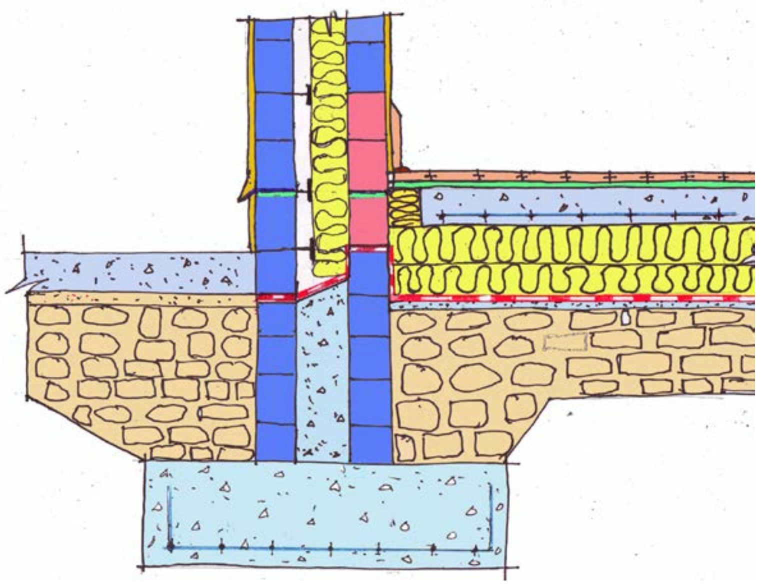
  $\frac{1950189.69}{37350}$ = 52.2 litres (*1 litre oil costs 95cent*)

  Cost p/a: 52.2 × 0.95 = **€49.59**

- Cost of heat lost per annum year through the concrete floor = **€49.59**

(c) Typical detail of abutment of cavity wall and solid concrete ground floor

Notes and sketch



Any other relevant detail / information

Ceist 6 (a)

Steep pitched roof
- Allows for three extra bedrooms and bathroom which is economical in terms of space and materials required – one compact foundation – two floors and roof space used
- Reduced costs and energy requirements – small footprint with attic space used
- Enables maximum use of attic as a habitable space
- Less materials as form is compact – lower embodied energy, lower CO_2.

Roof lights
- Provide increased daylight over a longer period than dormers
- Reduced need for artificial light
- Reduced demand for fossil fuels and reduced lighting costs.

Glazing – to maximise solar gain and thermal comfort
- South facing principal elevation to maximise solar gain
- Fewer and smaller windows on the North elevation reduces heat loss
- Tall and large South facing windows allow for maximum solar gain to the living areas
- East facing window enables morning solar gain to the sitting room – less heating required as solar gain is maximised.

Solid Fuel Heating
- Wood burning stoves are carbon neutral
- Stoves are up to 70% efficient - open fires are at best 30% efficient
- Chimney stack on internal wall radiates stored heat to adjoining spaces.

Orientation of house
- Long elevation on an east-west axis
- Large areas of high performance windows on southern elevation allow for maximum solar gain
- Passive heating reduces costs and the demand for scarce and expensive fossil fuels

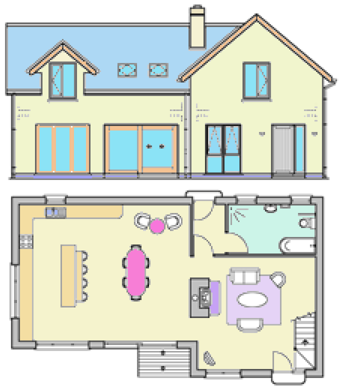
Flexibility of design
- Small internal spans allow for ease of redesign and lower costs – standard materials
- Largely open plan living, kitchen and dining areas to facilitate ease of movement for persons of all ages and degrees of reduced mobility - temporary or permanent
- Entire ground floor at one level - no ground floor steps – allowing for ease of movement – more versatility with less obstacles
- Fit doors to reduce open plan, easier to heat.

Timber – Frame buildings
- Locally grown timber has less embodied energy costs and reduced transport costs,timber - carbon neutral
- Timber species that are sustainable and renewable i.e. capable of being harvested between 25-40 years from managed forests
- Some timbers are more naturally durable i.e. European Larch, Douglas fir, cedar and do not require treatment with chemical preservatives
- Use of sustainable, renewable, and durable timbers reduce the volume of concrete required which has a high embodied energy - less damage to the environment
- Concrete made from Portland cement has high embodied energy
- Portland cement produces 900 Kg of CO_2 emissions for 1000 Kg of cement
- Ground Granulated Blast furnace Slag/Cement (GGBS) is manufactured from a waste product produced by the steel industry - recycling / upcycling
- Concrete made from GGBS cement has a low embodied energy
- Low Carbon Concrete uses 50% Normal Portland Cement and 50% GGBS cement which reduces the CO_2 emissions by almost 40%
- While GGBS is imported into Ireland the embodied energy value is still considerably low compared to that required to extract raw material from the landscape and its subsequent manufacturing costs.
- Concrete or concrete products should, ideally be manufactured using low carbon concrete

- Important to use materials that are renewable, that grow and replenish - ensures that there will be an ample supply of building materials for future generations
- Much less energy is required to process materials like wood as compared to cement which requires large amounts of energy to manufacture
- 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.

Modest in scale / *Economy of scale*

- The footprint of the building is small
- Less materials used in the construction of the dwelling
- Requires less excavation and therefore less disruption of the environment
- Structure is one room wide - easier to heat due to passive solar gain
- Keeping the building compact reduces the surface to volume ratio. This helps to minimise heat loss
- Minimal quantities of materials and reduced building costs
- Building is one room in depth allowing for maximum solar gain and reduced running costs
- The living area consists of only two spaces, kitchen and dining room combined - a multifunctional space
- Modest floor area to living room.
- Absence of corridor space in living area – economical use of space
- Prevents the need for heating of large corridor area – reduced running costs
- Attic area incorporates three bedrooms and a bathroom - minimising footprint



- Small scale building reduces the heating requirements and running costs to a minimum – lower environmental impact
- The two levels enable heating to be zoned – controlling and minimising heating requirements – lower environmental impact.

Any other relevant points

Ceist 6 (b) Solar collector panels:

- A solar array may be fitted to the south facing side of the roof to obtain maximum solar gain
- These are capable of providing between 40% - 60% of domestic hot water requirements - depends on time of year
- Reduced dependency on finite and expensive fossil fuels
- Solar collectors reduce the output of CO_2
- Angle of the suns inclination varies with seasons; Elevation 78° summer and 30° in winter.
- The steeply pitched south facing roof is suitable for the installation of solar panels.
- Rule of thumb for Ireland - angle of inclination of 45°
- Thermodynamic solar panels are being developed
- They work on ambient or diffuse light , suitable for northern latitudes
- Flat plate or Evacuated tube systems must be located on South elevation, up to 60% efficient
- Works in daylight, back- up systems essential … immersion, oil or gas.

Photovoltaic solar panels:

- Photovoltaic solar panels generate electricity from sunlight
- The given design - roof pitch 45°- allows for the fitting of photovoltaic solar panels

- Photovoltaic solar panels may be fitted along with passive solar collector panels
- The average annual consumption of electricity per household is 3.0 - 4.5 kW
- Approximately 21.0 square metres of photovoltaic panels have the potential to produce 3.12 kW
- Surplus electricity may be sold into the national grid
- The production of electricity from a renewable source is of benefit to the environment
- Reduced dependency on scarce, expensive and finite resources of fossil fuels
- Reduced CO_2 emissions - better for the environment
- Contributes to local employment and the local economy
- Photovoltaic solar panels have the potential to last for 15 – 20 years
- They are low maintenance – requiring cleaning twice per year
- Inverter and switch gear required
- DC cut off switch protects power supply from PV modules
- AC cut off switch protects power supply from the inverter to the metre box
- Photovoltaics are connected to the mains supply via the consumer unit

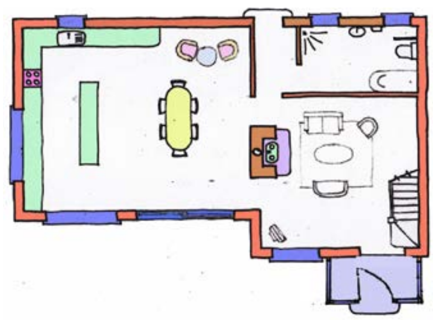
- Smart metre installed to track which source of electricity is being used… Grid or PV
- Three types of photovoltaic panels are common - monocrystalline silicon photovoltaic, polycrystalline silicon photovoltaic solar panels and thin film photovoltaic panels.

Winter garden:

- A glazed area may be constructed at South elevation of the kitchen dining multifunctional space
- This would allow for increased solar gain and greater thermal comfort.

Porch & or Internal draught lobby

- A porch may be erected outside the front door on the South elevation, to create a draught lobby for increased thermal comfort
- Reduce heat loss and reduce demand for fossil fuels
- Reduced CO_2 emissions - lower environmental impact
- An internal draught lobby may be erected inside the front door
- A draught lobby may be created inside the back door on the North elevation.

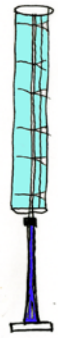


Internal Doors:

- Two internal doors may be positioned to either side of the chimney breast. These would enable both the living and kitchen areas to be independently zoned for heating purposes
- Such a design would reduce the demand for heating and improve thermal comfort.

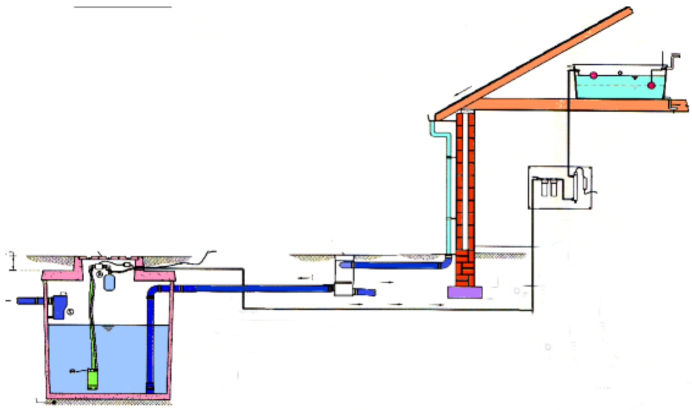
Wind turbines:

- Wind turbines are not efficient when fitted to roofs of domestic buildings. This is due to the currents created by the roof and chimneys
- Stand alone wind turbines (vertical & horizontal) are permissible provided they meet certain requirements
- Wind turbines up to 6.0 metres in height are exempt from planning permission.
- Exemptions must be applied for to the local authority in question
- Wind turbines generate direct current and therefore must have an inverter plus batteries
- The prevailing winds come from the South West, however, site specific wind data is essential if they are to be positioned so as to maximise their potential for harnessing renewable energy.



Rain water harvesting:

- Increased use of rainwater reduces quantity of treated drinking quality water to be produced
- Rain water may be collected from all roof surfaces
- Above-ground storage system – reduced installation costs
- Modular storage units allow for increased storage capacity at minimum cost
- Above ground, slim-line, modular storage containers are better suited to urban dwellings where space is limited and placing storage facilities underground can be problematic with risk of encountering services etc
- Rainwater may be used to water gardens, lawns and to flush toilets – filter required
- Below ground storage systems for rainwater harvesting are an option where space is not an issue
- There are two options available for underground systems:
    - stored rain water to be pumped back to the house and used only in toilets… provided a filter is used
    - stored rain water to be processed using a combination of filters, charcoal blocks and treated to ultra violet light before being pumped directly to dishwashers and washing machines. Alternatively this processed rain water may be pumped to a storage tank before distribution to individual appliances.



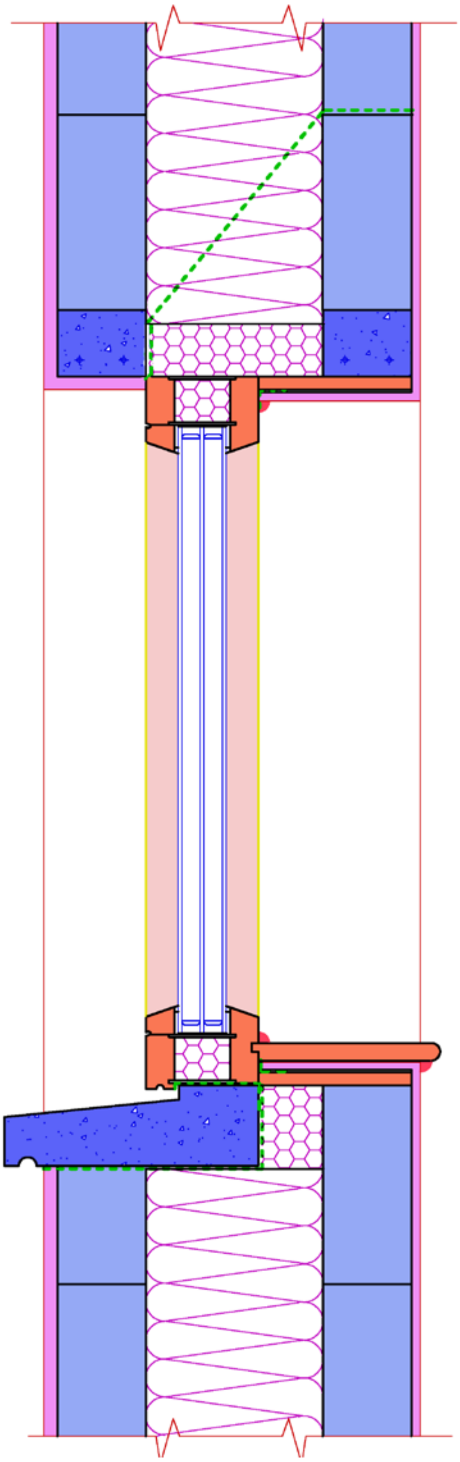
Any other relevant points

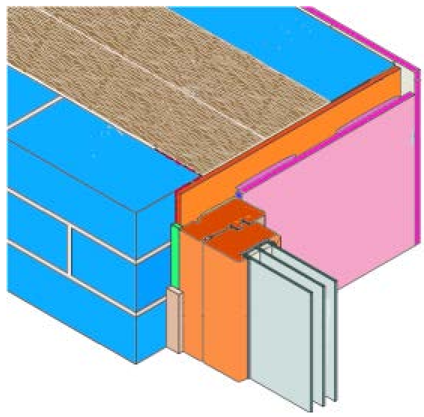
Ceist 6 (c)

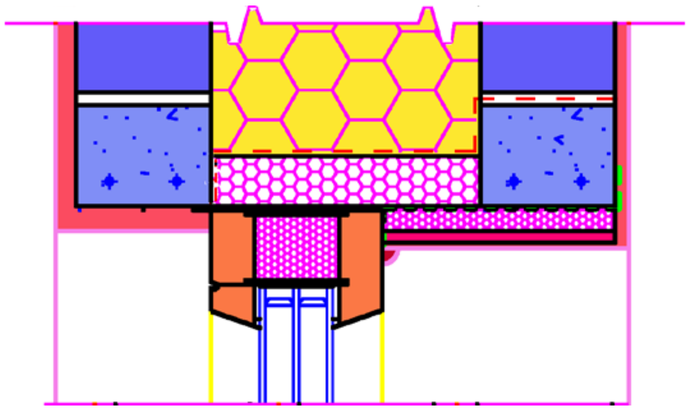
- Economical use of expensive and finite natural resources
- Buildings of a human scale leaving more natural resources for future generations
- Less materials result in reduced impact on the landscape e.g. mining, drilling for oil and gas
- Less risk of damage to areas of outstanding natural beauty and their habitats
- Reduced carbon footprint and reduced CO_2 emissions
- Universal design principles better for the future generations as less need for change which reduces demand for more materials and the associated scarce resources and costs that accompany such changes in a building's design
- Less embodied energy by using local materials and helping to sustain local employment.

  Any other relevant points

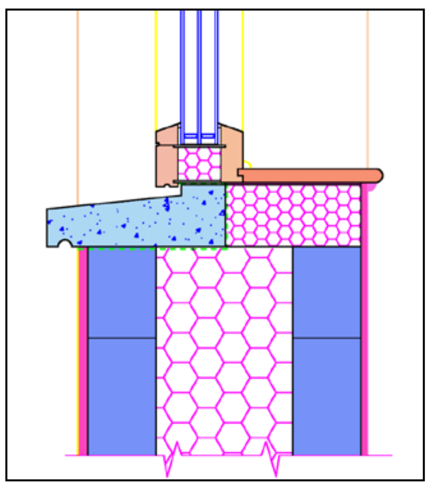
Ceist 7







Proprietary cavity closer and fire stop



Ceist 8 (a)

Door

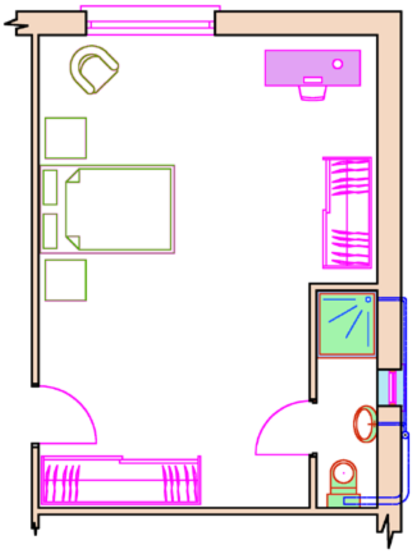
- Outward opening door may be used to reduce space requirement
- Positioned to avoid direct view to WC.

Window

- Located opposite door to increase ventilation
- consideration given to privacy.

Shower

- Range of shower trays available to suit space
- Common sizes range from 800 mm × 800 mm and up
- Quadrant style can be used if space is limited
- Ventilation required to avoid build up of moisture
- Non slip floor covering
- Best practice - locate on external wall to reduce run of pipe work
- Extractor fan to be used to reduce condensation
- Wet room can also be used – tanking and tiling instead of shower tray can be used.

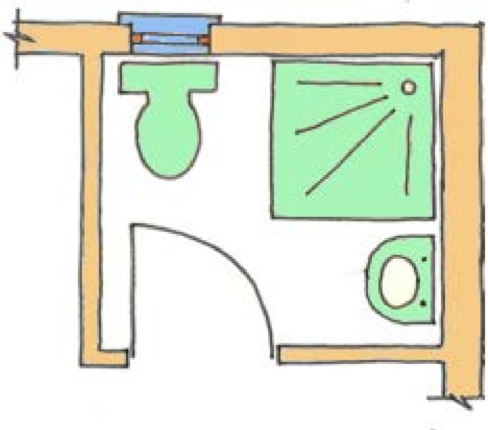


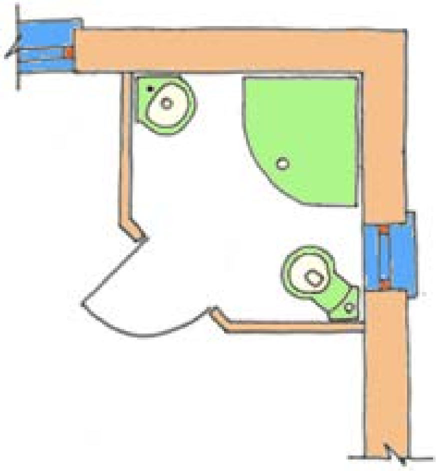
Wash hand basin

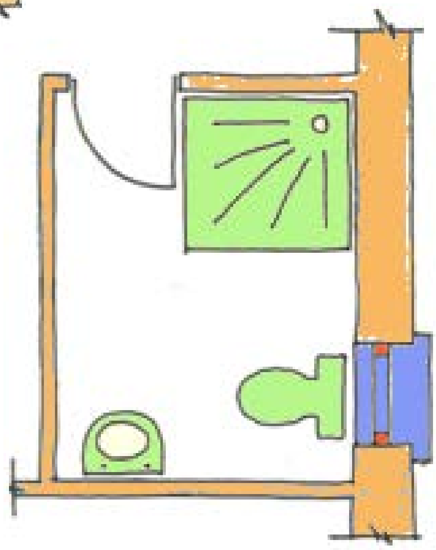
- Corner unit may be used to reduce space requirement
- Single tap unit may be used

Water Closet

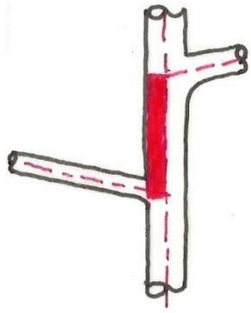
- Located on external wall to minimise run to SVP
- Located adjacent to window.







Pipework necessary for safe removal of waste

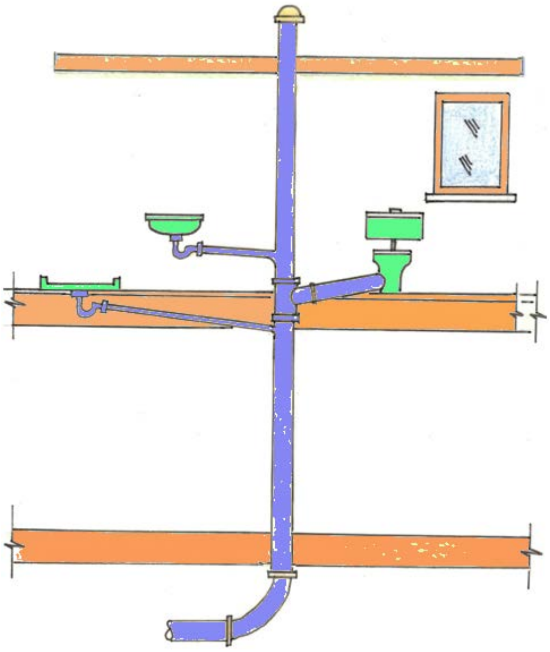


Shower

- 40 mm discharge branch pipe to 100 mm stack
- Max length of branch pipe for 40 mm pipe is 4.0 m
- Slope of 18 to 90 mm/m recommended
- Deep seal trap recommended.

Wash hand basin

- 32 mm discharge branch pipe to 100mm stack
- Max length for 32 mm pipe is 1.7m
- Slope of 18 to 90 mm/m recommended
- Deep seal trap recommended.



Water Closet

- 100mm discharge branch pipe to 100mm stack
- Max length of 6.0 m for single WC
- Slope of 9mm/m recommended
- 50mm depth of seal
- Offset of 200 mm at stack connection.

Design considerations - WC

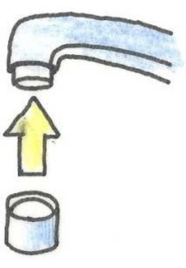
- The use of rainwater /grey water to flush toilets
- 70% of typical water use from bathroom
- Toilet flushing accounts for up to 30% of water consumption.
- A standard flush of 10 -14 litres can be reduced to 4-6 litres in modern cisterns
- Use a displacement device - hippo bag -in water cistern
- Change to dual flush cisterns.

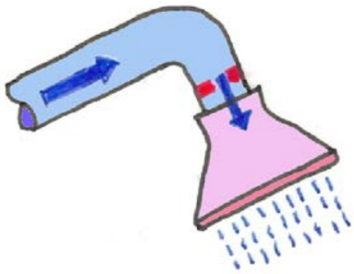
Wash hand basin

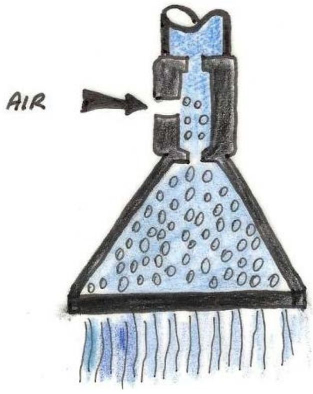
- Aerators introduce air into the water stream, producing a larger and whiter stream and thus reduces the water requirements
- Flow restrictors restrict the flow of water from the tap without reducing water pressure.
- Fit motion sensor taps, which are activated by infrared controls
- Fit push button taps
- Small, conical shaped WHB to reduce volume of water used.

Shower

- Power shower may use up to 125 litres per minute - wasteful
- Fit air jet shower head
- Fit a flow rate reducer
- Pulsating showers reduce water usage by pulsating the water.



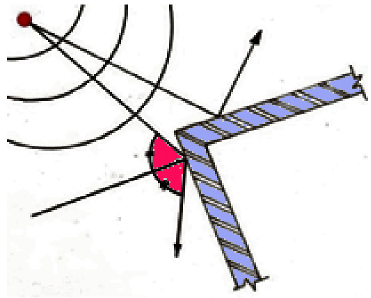




Ceist 9(a)

Sound reflection

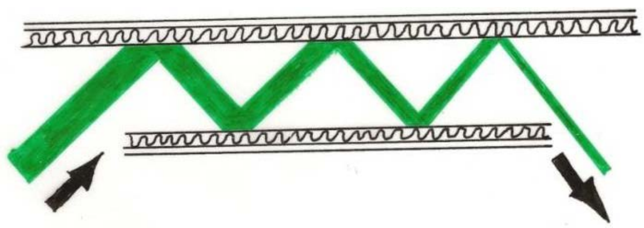
- Sound reacts similar to light in the sense that the angle of reflection is equal to the angle of incidence to a surface
- Sound reflection is used to alter the acoustics in a room, ensuring even distribution in a room
- This principle is very important in entertainment theatres.



Incident wave

Sound absorption

- Amount of sound absorbed by the surfaces and materials in a room.
- Hard shiny surfaces absorb very little sound
- Usually they reflect sound which causes it to echo
- Soft surfaces such as carpet, curtains and furnishings absorb sound.

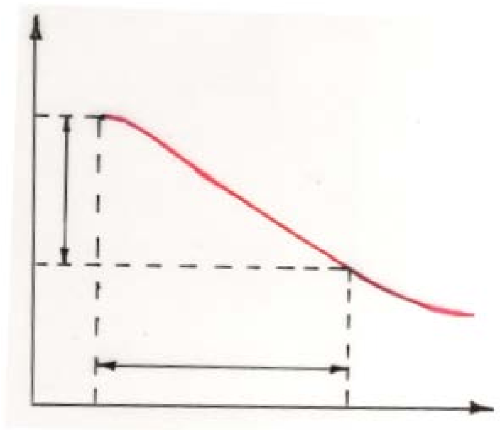


Reverberation time

- This is the amount of time it takes for a sound to decline by 60dB.
- This will vary depending on the size of room and the furnishings in it
- Surfaces that reflect sound will have a longer reverberation time than soft surfaces.

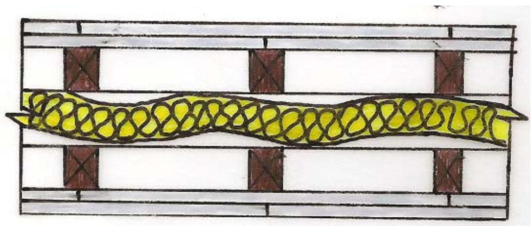
60dB

Sound level

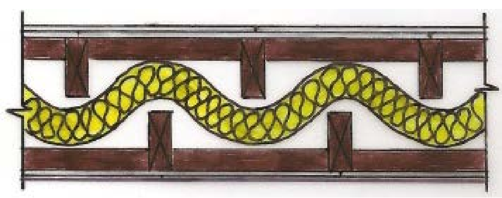


Reverberation time

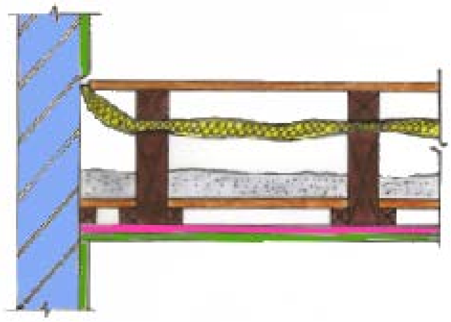
9 (b) Sound insulation of Stud Partition



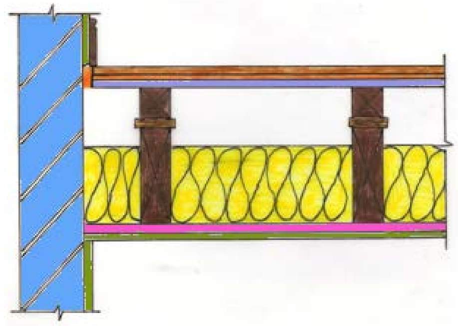
- Stagger the studs to form double partition wall, with a void between the partitions
- Two layers of plasterboard with staggered joints used to reduce the transmittance of sound - increase in mass
- An absorbent quilt placed in the cavity increases the sound insulation also
- Create a staggered partition, in which there is no material in contact with both sides of the partition.
- Absorbent quilt is woven between the studs to increase the sound insulation.



9 (b) Sound insulation in floor



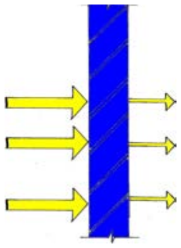
- A floating floor may be placed over the existing joists without being nailed. This eliminates flanking paths and increases sound insulation
- Absorbent quilt is placed between the battens and the joists
- Sand may be placed between the joists, its density reduces the transmittance of sound.
- Acoustic isolation strips may be placed between the floor and wall and also between the battens and joists
- Acoustic matting may be placed under the finished floating floor to reduce the transmittance of impact sound
- Absorbent quilt can be used between the joists and double slab the ceiling with staggered joints on the underside.



Sound insulation principles

Isolation:

- This usually involves the separating of surfaces of a wall or partition
- Discontinuity of construction where voids or cavities are created will reduce the transmittance of sound.



Mass:

- This relates to the mass law, which states that the sound insulation of a wall is proportional to its mass per unit area
- The more dense a material is, the better its sound insulating properties will be.

Flexibility:

- Flexible materials are better at absorbing sound than rigid materials
- The use of an absorbent quilt, acoustic matting/resilient layer reduces the transmission of sound.

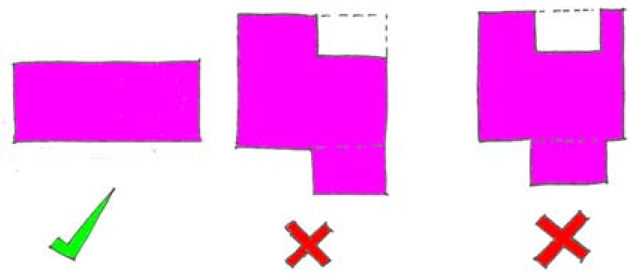
Completeness:

- Completeness is the elimination of small gaps in the structure, which increases its air-tightness
- High quality craftsmanship helps to achieve a more complete structure which will help overall acoustic properties.

Q 10 (a): Building Form –

Simplicity of form - advantages

- crucial in the design of both Passive House and Nearly Zero Energy Buildings(NZEB) - see sketch of complex and simple forms
- doing more with less as a design guideline
- simplicity of form for best practice in design
- compact form results in economical use of materials and easy to heat
- clean building lines, clean roof lines
- simplicity of roof plane ideal for location of evacuated tubes for hot water and photovoltaic cells for the generation of electricity



- less materials used, less labour required to construct
- ideal is to achieve a compactness ratio of 0.7 or less – ratio between surface area and volume enclosed - to have a large volume enclosed by the smallest surface area
- the compactness of a building is indicated by the surface area to volume (A/V) ratio. Buildings with the same U-values, air change rates and orientations may have different heating demands depending on their A/V ratio. The shape of a passive or low energy house should be kept as simple as possible, without compromising beauty. Complicated designs often result in extra thermal bridges and larger energy consumption.

Complex form - disadvantages:

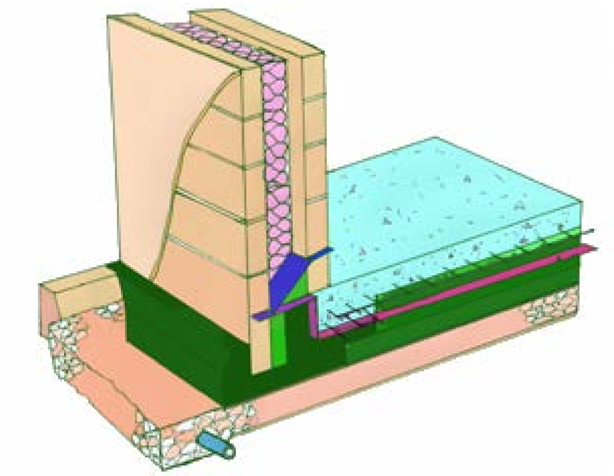
- greater wall and surface area, increased heat loss through walls and roof
- complex detailing – more difficult to tape and make airtight
- greater area for cold bridge at wall and floor junctions
- greater surface area for wind chill factor
- shadow and shade in complex forms reducing solar gain
- complex roof layout - hips and valleys - which are difficult to insulate adequately.

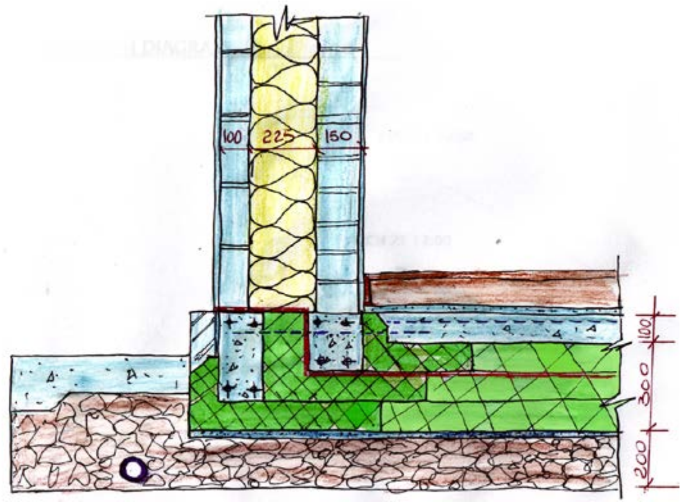
Indoor air quality:

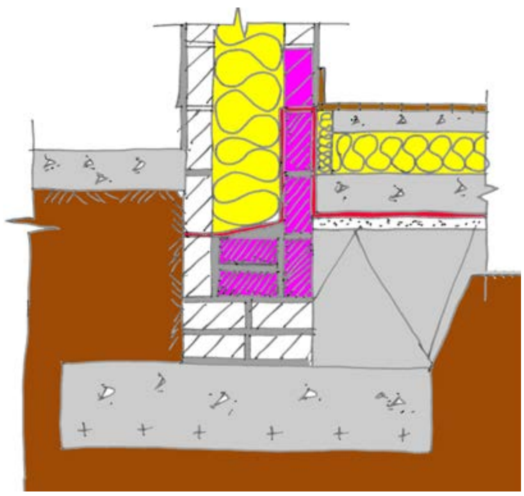
- build tight and ventilate right – no draughts, no air leakage
- MHRV unit to provide whole house ventilation and a regular controlled supply of fresh, cleaned air to all rooms
- moist, warm air is extracted from the kitchen, bathroom and utility room and drawn through a filter into the MHRV unit. At the same time, outdoor air is drawn through a separate filter into the MHRV unit
- the outdoor air passes through a fine filter to ensure dust, pollen and other contaminants are removed from the air - this provides clean, fresh to all the house
- MHRV system designed to provide minimum air temperature at 16.5° when outdoors at -10°
- MHRV designed for maximum of 0.6 ach/hr – air changes per hour
- house refreshed with constant supply of clean, filtered air
- windows can be opened in summer for fresh air and to cool the house if overheating
- indoor temperature at 21° throughout year
- filters in MHRV to be changed frequently
- insulated ducting to prevent condensation and mould growth
- relative humidity of the indoor air should be in the range 30% to 60% - within this range the benefits of water vapour in air are optimised – air not too dry
- filtered air prevents the growth of mould, dust mites and other viruses and bacteria, reducing respiratory illnesses
- internal CO_2 levels below 1000 ppm (parts per million)
- to prevent condensation and mould growth the temperature of internal surfaces (e.g. walls, ceilings, windows) should not fall below 12.6°C.

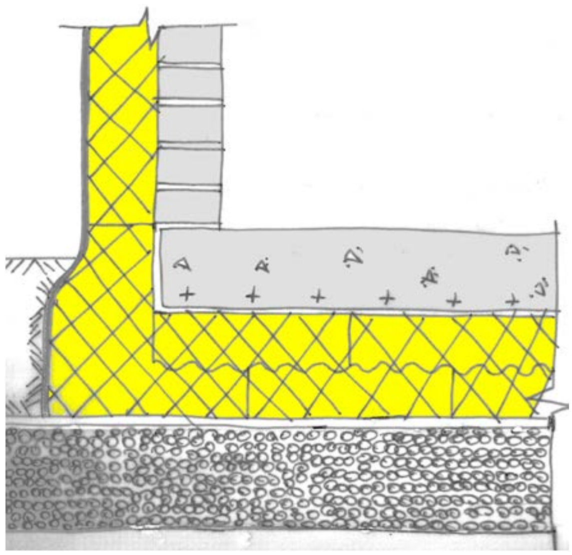
Foundation Design

- insulated foundation to reduce heat leakage from foundation slab to soil
- pre- moulded high density extruded polystyrene
- polystyrene laid on blinded, washed, mechanically compacted hardcore
- floor slab reinforced with mesh
- radon barrier fitted as shown.



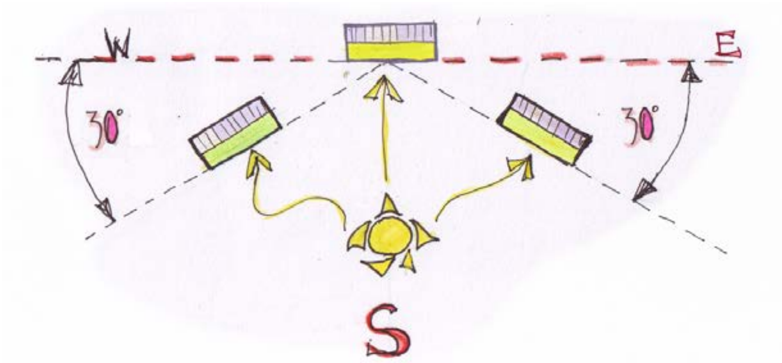






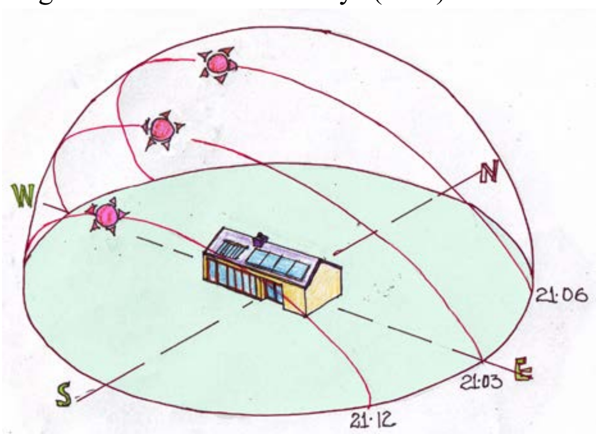
10(b) – Importance of orientation in siting Passive House

- ideally glazed facade of Passive House faced directly South
- glazed facade not more than 30° off the East/West axis
- long glazed facade on East/West axis – facing South
- house one room in depth ideally, to maximise solar gain – no rooms on the sunless North
- if ideal orientation not possible, insulation has to be increased
- careful positioning of the fenestration to ensure maximum solar gain and minimum heat loss through the building fabric
- to prevent overshadowing, spacing from other houses 1.5 to 2.5 times height of building – for 2 to 4 storey buildings 25 – 30 metres between buildings – urban street width of 25 to 30 metres.



(c) Reasons why Passive House may overheat – such as

- Passive standard – overheating occurs if internal temperature greater than 25° for 36 days (10%) days annually
- Inadequate or no over-shading of windows – no roof overhang, balcony nor brise-soleil
- insufficient ventilation – natural or mechanical
- little thermal mass
- poor design detailing, long unvented corridors, small isolated rooms, poor placement of windows
- large amounts of south facing glazing resulting in too much solar heat gain
- inadequate shading
- poor design
- in addition to solar heat gain, heat produced inside the house, lighting, appliances, hot water production and cooking can all add to overheating.



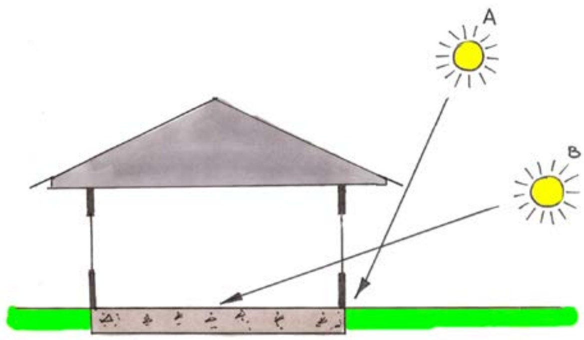
(c) Two design features that reduce the possibility of overheating – such as

Thermal mass:

- the ability of a material to absorb and store heat
- concrete floors and concrete block walls most common form of thermal mass in a Passive House
- thermal mass regulates indoor temperature
- solar gain is absorbed by the concrete floor and walls – a heat sink
- in the summer, this helps to stabilise the internal temperature and prevent overheating
- in winter solar energy absorbed by the floor and walls is released back into the building and helps to heat the home and reduce energy consumption
- surplus heat can be temporarily stored in the structure and then released when air temperatures falls.

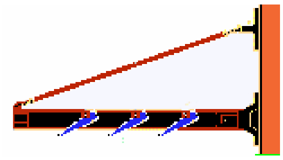
Extended roof overhang

- an overhang / extended eaves / to reduce the amount of solar heat gain in summertime
- The angle of the sun (A) is higher during the summer that it is during the winter (B). By using a correctly designed overhang, the amount of solar heat gained from the summer sun is reduced. Due to



the lower angle of the winter sun, winter solar heat gain will not be affected.

- The maximum angle of the summer sun can be calculated by using the following formula
  90° - Latitude + 23.5° = maximum sun angle
- The minimum angle of the winter sun can be calculated by using the following formula 90° - Latitude - 23.5° = minimum sun angle



Using the above information an appropriate overhang can be designed.

Brise Soleil

- This works on the same principal as the overhang and is used to reduce the amount of summer sun entering a building.

Adjustable Brise soleil

- movable shading can be adjusted to suit the weather conditions at a particular time
- sliding brise soleil as design feature – *see sketch*
- external roller blinds, awnings and sliding screens are the most common types.

Dynamic Glass

- standard float glass with an electrochromic coating applied on one of the surfaces
- automatically adjusts its tint in response to environmental conditions
- eliminates the need for blinds or shades
- allows visible light to enter the building while filtering out infra red and ultraviolet light.
- can be used in any situation where excessive solar heat gain is likely to be an issue, for example south facing glazing and conservatories.
- Dynamic glass allows control over the amount of infra red as well as solar gain that enters the building
- occupants can manually control tint of glass by apps on smart phones / tablets or by wall switches
- achieves a reduction of up to 20% in energy consumption
- provides an important advancement in sustainable design.

Adequate ventilation

- Use of efficient electrical appliances and low energy lighting
- Insulate cylinders and pipe work.

Balconies

- Balconies must be designed and sized to filter the light and reduce overheating.

Blinds and shutters

- Not as effective, but assist in reducing overheating.

Question 10 – alternative

"*Our common ground starts with the planet. As a species we have never been more vulnerable than we are today. The world is under stress and we are the cause of it. We are now at a tipping point and, as with all periods of great change, there is great opportunity. The world needs the way architects think, we should not keep ourselves aloof from the urgent situation we are in. The most resilient and sustainable form of human habitation is the town or the neighbourhood. We must build to create neighbourhoods. We must plan and design to avoid isolation and disconnection. We must design for what matters, which is ultimately happiness.*"

- the planet – our great task – to care for one another and to care for our home - the planet
- never more vulnerable – climate change, unpredictability of weather patterns, coastal flooding, rising sea levels, inland flooding
- *world under stress...a tipping point* – diminishing fossil fuels, potential nuclear accidents at generating stations, increase in CO_2 levels
- predicted temperature increase of 2° will be irreversible, leading to permanent ecological damage
- great change, how we live, where and how we build, a fundamental re-evaluation of how we manage the environment
- great opportunity – for a new paradigm in Construction Studies and in construction in general.

The world needs the way architects think, we should not keep ourselves aloof from the urgent situation we are in

- not stay aloof architects as part of the solution to live sustainably – to lead the new paradigm, creative thinkers, design led solutions - minimum standards gone, new paradigm is best practice, build deep green, nearly zero energy buildings(NZEB) with on-site generation of electricity
- architects designing aesthetically beautiful homes, zero carbon homes, using no fossil fuels to heat, with on-site micro generation for own electricity and excess sold into the grid

The most resilient and sustainable form of human habitation is the town or the neighbourhood

- towns and neighbourhoods as resilient and sustainable habitations - sustainability and environmental considerations at the heart of every design decision, live close to work and leisure, dispensing with long commute journeys in layered, mixed communities
- huge waste of energy and materials to service remotely located houses – requiring electrical, telephone, water services and roadways, wasteful of resources
- as part of the overall provision, high quality public spaces to be used by all residents, small private home gardens, but large green open public spaces and with provision for activities and relaxation
- the further away from distribution hub, the higher the material and labour costs to provide essential services required for modern living.

We must plan and design to avoid isolation and disconnection. We must design for what matters, which is ultimately happiness

- houses built within walking or cycling distance from daily destinations are more sustainable as proximity to services – to schools, shops, libraries, leisure facilities - will not require huge expenditure of energy – all people can access these services by cycling, walking, bus or rail - which is more sustainable than the continual use of the private car to meet all such needs
- over one third of all energy used to transport goods and people, building for mixed communities, old, young, families, singles, of all abilities
- the more isolated a house, the higher the transport costs required to access services, needing daily transport to school for young people, and young becoming sedentary etc.
- a new paradigm is needed to accept urban living as a desirable option – living in to proximity to schools, work and leisure facilities
- isolation, especially of old people and of people with mobility difficulties can lead to mental health issues such as depression
- living in urban areas, in eco-communities will need to be promoted as desirable
- buildings need to be considered as part of the greater whole – how design creates neighbourhoods not parallel monotonous rows of similar houses
- location affects the independence, mobility, health, longevity and quality of life of occupants.
- well designed and well connected neighbourhoods are walkable, are attractive neighbourhoods in which to live, giving a sense of belonging, a sense of community
- promote the concept of thinking globally but acting locally, ethical living.

Three guidelines that would promote the development of resilient and sustainable neighbourhoods in Ireland. …such as

- Universal design principles the norm - robust, agile, resilient and flexible housing suitable for all stages of life
- Design for resilient neighbourhoods which are affordable, with mixed scaled housing, one two three bedroom houses and apartments
- Upgrade building regulations to make sustainability a condition of planning
- Promote urban renewal / regeneration on sustainable principles, incentivise people to refurbish and upgrade urban buildings
- Adopt purposeful design strategies for neighbourhoods - to include cycle lanes and walking paths, interconnected green, car-free, safe walk/cycle routes
- Design for higher urban densities to reduce energy needs and to promote a sense of community and belonging
- Publish deep green planning guidelines to be implemented for all housing developments
- Promote urban living an attractive option, to live in community and not in isolation
- Design, as part of the overall provision, high quality public spaces to be used by all residents irrespective of age or social status with provision for activities and relaxation
- Design flexible buildings to meet changing needs from birth to old age – lifetime use and universal design principles applied, plan for climate change
- Design modest scale of buildings, easy to heat, maintain, clean
- Design multi-use buildings – retail ground floor, residential over
- Promote a holistic approach to neighbourhood development – not once-off housing,
- Promote housing clusters, eco -villages as exemplars of sustainable living
- Provide incentives to encourage sustainable design
- Education to focus on sustainability and energy use - low embodied energy design
- Promote concept of a good neighbourhood – one where one can spend all one's life with neighbours and friends and feel supported in all life stages through a culture of mutual care
- Promote concept of urban living as desirable, purposeful, supportive and communal.

Any other relevant, cogent, well argued points.

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Coimisiún na Scrúduithe Stáit
State Examinations Commission

Staidéar Foirgníochta

Teoiric – Ardleibhéal

Construction Studies

Theory – Higher Level

Marking Scheme

CEIST 1

PERFORMANCE CRITERIA	MAXIMUM MARK
Any 10 points × 4 marks (Drawing 3 Annotation 1)	
Wall details • Double headplate 200 × 50 mm • Vertical stud framework 200 × 50 @ 400 mm centres • Insulated service cavity 60 mm • Vapour barrier to ceiling and wall - joints sealed and taped • 12.5 mm gypsum plasterboard and hardwall skim finish • Airtight tape at wall and ceiling junction to ensure airtightness • Insulation 200 mm • Racking board 12 – 20 mm OSB or plywood with taped joints • Breather membrane with taped joints • Vapour diffusion cavity 50 – 100 mm • Stainless steel wall ties • Fireproof cavity closer • 100 concrete block outer leaf • 15 mm render – 2 coats **Typical roof details - *Prefabricated Truss Rafter:*** • Battens 50 × 40 mm • Breather membrane sealed and taped • Prefabricated roof trusses at 400 - 600 mm centres - rafters and ceiling joists 180 × 50 mm • 150 × 50 mm struts secured with nail plates • 300 – 600 mm insulation to ceiling • Gypsum plasterboard to ceiling with vapour barrier on warm side of insulation • Fascia, soffit & gutter (any 2)	4 4 4 4 4 4 4 4 4 4
Scale and Drafting	8
Three typical dimensions of roof structure	3
Three courses of slate at eaves	3
Ventilation path at eaves	3
(b) Design detail to ensure airtightness	3
Total	**60**

Ceist 2

PERFORMANCE CRITERIA	MAXIMUM MARK
(a) ***Design detailing (6 × 7 marks)***	
Threshold and access ramp	
Note and justification	**7**
Sketch	**7**
Weather protection	
Note and justification	**7**
Sketch	**7**
Suitable lighting	
Note and justification	**7**
Sketch	**7**
Dimensions *(any three)*	**6**
(b) Two reasons (2 × 6 marks)	
Reason 1 *(3 for point, 3 for discussion)*	**6**
Reason 2 *(3 for point, 3 for discussion)*	**6**
Total	**60**

CEIST 3

PERFORMANCE CRITERIA	MAXIMUM MARK
(a) ***Functional requirements of a study space (3 × 6 marks)***	
Functional requirement 1 *(3 for point, 3 for discussion)*	**6**
Functional requirement 2 *(3 for point, 3 for discussion)*	**6**
Functional requirement 3 *(3 for point, 3 for discussion)*	**6**
(b) Design layout for study (6 × 5 marks)	
Functional requirement 1	
Note	**5**
Sketch	**5**
Functional requirement 2	
Note	**5**
Sketch	**5**
Functional requirement 3	
Note	**5**
Sketch	**5**
(c) Revised external design ***(notes 6 marks, sketches 6 marks)***	
Notes and sketches	**12**
Total	**60**

CEIST 4

PERFORMANCE CRITERIA	MAXIMUM MARK
(a) Discuss step-by-step refurbishment (4 × 6 marks)	
Advantage 1 *(point 3 marks, discussion 3 marks)*	**6**
Advantage 2 *(point 3 marks, discussion 3 marks)*	**6**
Disadvantage 1 *(point 3 marks, discussion 3 marks)*	**6**
Disadvantage 2 *(point 3 marks, discussion 3 marks)*	**6**
(b) Survey of house any 2 areas (2 × 6 marks, 2 × 6 marks)	
External random rubble wall Note Sketch **Traditional cut roof** Note Sketch **Suspended timber ground floor** Note Sketch	**6** **6** **6** **6**
Character of the original house Reuse of materials	**6** **6**
Total	**60**

CEIST 5

PERFORMANCE CRITERIA	MAXIMUM MARK
(a) Insulated concrete ground floor (9 points × 3 marks)	
Correct tabulation	**3**
Surface resistance	**3**
Concrete Floor	**3**
Insulation	**3**
DPM	**3**
Sand	**3**
Hardcore	**3**
Total resistance	**3**
U-Value (1 mark for formula)	**3**
(b) Annual heat loss (5 points × 3 marks)	
Heat loss formula and calculation	**3**
Heating duration for one year	**3**
K/joules calculation for one year	**3**
Litres of oil for one year	**3**
Annual cost of heat loss	**3**
(b) Prevention of cold bridge (2 × 9 marks)	
Note – (*to include thermal blocks and vertical insulation)*	**9**
Sketch – *(to include thermal blocks and vertical insulation)*	**9**
Total	**60**

Ceist 6

PERFORMANCE CRITERIA	MAXIMUM MARK
(a) ***Low environmental impact design - three design features (6 × 5 marks)***	
Design feature 1	
Note	**5**
Sketch	**5**
Design feature 2	
Note	**5**
Sketch	**5**
Design feature 3	
Note	**5**
Sketch	**5**
(b) Two other design features (4 × 5 marks)	
Design feature 1	
Note	**5**
Sketch	**5**
Design feature 2	
Note	**5**
Sketch	**5**
(c) ***Low environmental impact design (10 marks)***	
Discussion *(4 for point, 6 for discussion)*	**10**
Total	**60**

CEIST 7

PERFORMANCE CRITERIA	MAXIMUM MARK
(a) ***Section through wall and window (8 × 5 marks)***	
External & internal leaf External & internal plaster 200 mm full-fill cavity insulation Lintels Stepped DPC Cavity closer Airtightness tape Thermally broken window frame – *(No thermal break - max 2 marks)* Triple glazing Window cill Window board Wrap around DPC Insulation behind cill	**5** **5** **5** **5** **5** **5** **5** **5**
3 typical dimensions	**3**
Scale and drafting (scale 3 marks) Draughting *excellent, good, fair* *(6 4 2)*	**9**
(b) Design detailing to prevent the ingress of water (2 × 4 marks)	
Detail at head	**4**
Detail at cill	**4**
Total	**60**

CEIST 8

PERFORMANCE CRITERIA	MAXIMUM MARK
(a) *En-suite bathroom design - sketch & preferred location (7 × 4 marks)*	
Sketch Preferred location	**4** **4**
Location (3 marks) Justification (1 mark) Door Window Shower Wash hand basin W.C.	**4** **4** **4** **4** **4**
***(b) Above ground drainage** (notes 2 marks, sketches, 2 marks)*	
Shower Wash hand basin WC Soil and Vent pipe	**4** **4** **4** **4**
Typical pipe sizes ***(4 × 1 marks)***	**4**
(c) *Design considerations (2 × 6 marks)*	
Design consideration 1 Design consideration 2	**6** **6**
Total	**60**

CEIST 9

PERFORMANCE CRITERIA	MAXIMUM MARK
(a) ***Acoustic design principles - Explain any 2 (4 × 6 marks)***	
Sound absorption Notes Sketch **Sound reflection** Notes Sketch **Reverberation time** Notes Sketch	**6** **6** **6** **6**
(b) Revised design detailing (6 × 4 marks)	
Floor detail	**4**
Note	**4**
Sketch	
Stud partition	**4**
Note	**4**
Sketch	
Materials to be used	**4**
Typical dimensions	**4**
(c) Sound insulating principles ***(2 × 6 marks)***	
Sound insulating principle 1	**6**
Sound insulating principle 2	**6**
Total	**60**

CEIST10

PERFORMANCE CRITERIA	MAXIMUM MARK
(a) ***Design of a passive house - any 2 (4 ×5 marks)***	
Building form Note Sketch **Indoor air quality** Note Sketch **Foundation Design** Note Sketch	**5** **5** **5** **5**
(b) Importance of orientation - notes & sketches (2 × 7) marks.	
Notes Sketches	**7** **7**
Sun path	**6**
(c) ***Reasons for overheating (2 × 4 marks)***	
Reason 1 for overheating Reason 2 for overheating	**4** **4**
Design details to reduce the possibility of overheating (4 × 3 marks)	
Design Detail 1 Notes Sketches **Design Detail 2** Notes Sketches	**3** **3** **3** **3**
Total	**60**

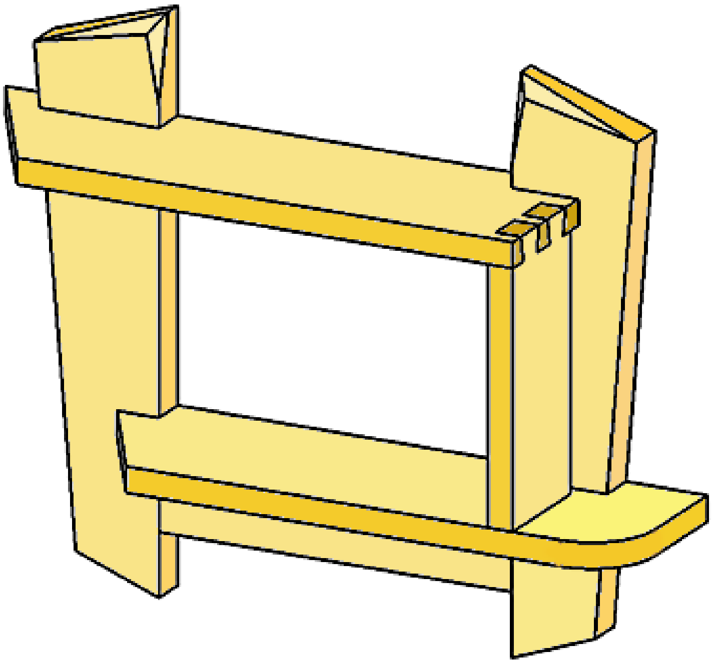
Ceist 10 (Alternative)

PERFORMANCE CRITERIA	
Discussion of Statement (3 × 10 marks)	
Discussion – point 1 *(4 for point, 6 for discussion)* Discussion – point 2 *(4 for point, 6 for discussion)* Discussion – point 3 *(4 for point, 6 for discussion)*	**10** **10** **10**
Three Guidelines (3 × 10 marks)	
Guideline 1 *(4 for point, 6 for discussion)*	**10**
Guideline 2 *(4 for point, 6 for discussion)*	**10**
Guideline 3 *(4 for point, 6 for discussion)*	**10**
Total	**60**

Coimisiún na Scrúduithe Stáit
State Examinations Commission

Scrúdú na hArdteistiméireachta 2014
Leaving Certificate Examination 2014

Scéim Mharcála
Marking Scheme
(150 marc)



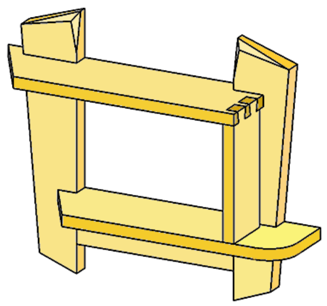
Staidéar Foirgníochta
Triail Phraiticiúil

Construction Studies
Practical Test

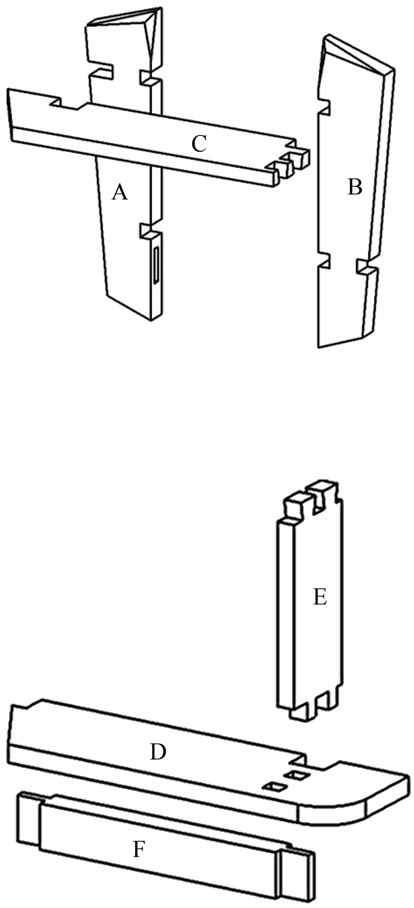
Construction Studies 2014
Marking Scheme – Practical Test

Note:

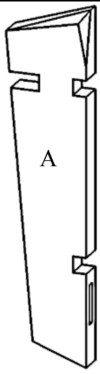
The artefact is to be hand produced by candidates without the assistance of machinery.
However the use of a battery powered screwdriver is allowed.
Where there is evidence of the use of machinery for a particular procedure a penalty applies.
Component is marked out of 50% of the marks available for that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

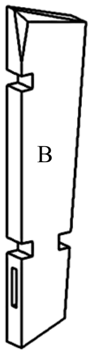


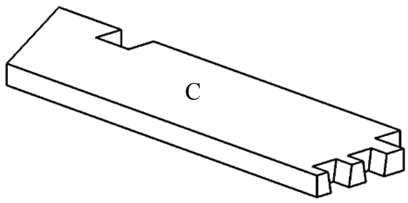
A	OVERALL ASSEMBLY	MARKS
1	Overall quality of assembled artefact	**10**
2	Design and applied shaping to edges • design *(4 marks)* • shaping *(4 marks)*	**8**
	Total	**18**

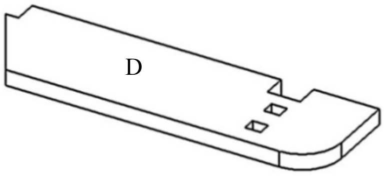


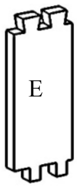
B	MARKING OUT	Marks
1	Piece **A** • joints - trenches *(3 × 2 marks)* - mortice *(2 marks)* • slopes and chamfers *(5 × 1 mark)*	**13**
2	Piece **B** • joints - trenches *(3 × 2 marks)* - mortice *(2 marks)* • slopes and chamfers *(5 × 1 mark)*	**13**
3	Piece **C** • joints - dovetail pins *(2 × 2 marks)* - trench *(2 marks)* - notch *(1 mark)* • slope *(1 mark)*	**8**
4	Piece **D** • joints - trench *(2 marks)* - notch *(1 mark)* - mortices *(2 × 2 marks)* • slope & curve *(2 × 1 mark)*	**9**
5	Piece **E** • joints - dovetails *(5 marks)* - tenons *(2 × 2 marks)*	**9**
6	Piece **F** • joints - tenons *(2 × 2 marks)*	**4**
	Total	**56**

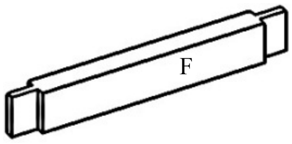
PIECE A	C	PROCESSING	Marks
	1	Trenches • sawing across the grain *(6 × 1 mark)* • paring trench *(3 × 1 mark)*	**9**
	2	Mortice *(2 marks)*	**2**
	3	Shaping • sloped edges *(3 × 1 mark)* • chamfers *(2 × 1 mark)*	**5**
		Total	**16**

PIECE B	D	PROCESSING	Marks
	1	Trenches • sawing across the grain *(6 × 1 mark)* • paring trench *(3 × 1 mark)*	**9**
	2	Mortice *(2 marks)*	**2**
	3	Shaping • sloped edges *(3 × 1 mark)* • chamfers *(2 × 1 mark)*	**5**
		Total	**16**

PIECE C	E	PROCESSING	Marks
	1	Dovetail pins • vertical sawing *(4 × 1 mark)* • cutting across grain *(2 × 2 marks)*	**8**
	2	Trench *(3 marks)*	**3**
	3	Notch *(2 marks)*	**2**
	4	Shaping *(1 mark)*	**1**
		Total	**14**

PIECE D	F	PROCESSING	Marks
	1	Two mortices *(2 × 2 marks)*	**4**
	2	Trench • sawing shoulders *(2 × 1 mark)* • paring trench *(1 mark)*	**3**
	3	Shaping • sloped edges *(1 mark)* • forming curve *(2 marks)*	**3**
	4	Notch *(2 marks)*	**2**
		Total	**12**

PIECE E	G	PROCESSING	Marks
	1	Two dovetails *(2 × 4 marks)*	**8**
	2	Two tenons *(2 × 3 marks)*	**6**
		Total	**14**

PIECE F	H	PROCESSING	Marks
	1	Tenons *(2 × 2 marks)*	**4**
		Total	**4**

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