Coimisiún na Scrúduithe Stáit
State Examinations Commission

LEAVING CERTIFICATE 2009

MARKING SCHEME

CONSTRUCTION STUDIES

HIGHER LEVEL

Coimisiún na Scrúduithe Stáit
State Examinations Commission

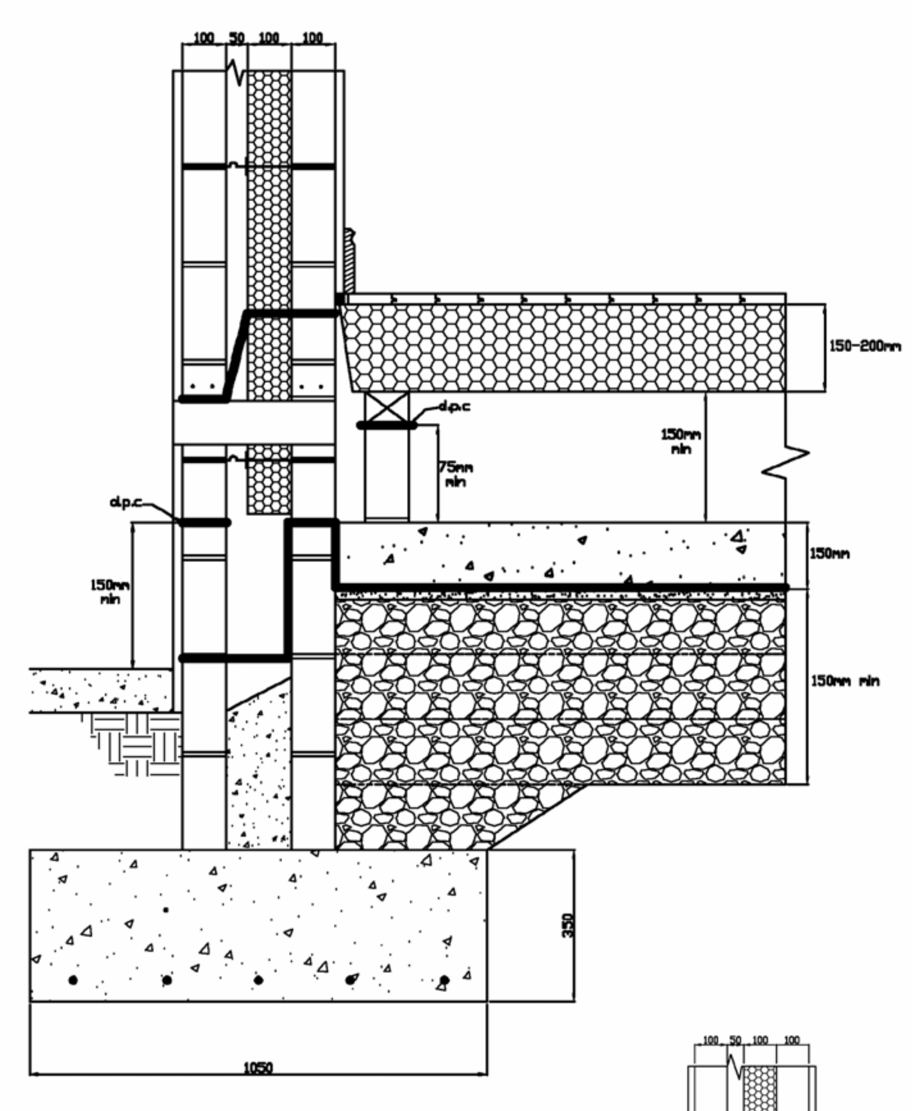
Scrúdú Ardteistiméireachta 2009

Staidéar Foirgníochta
Teoiric – Ardleibhéal

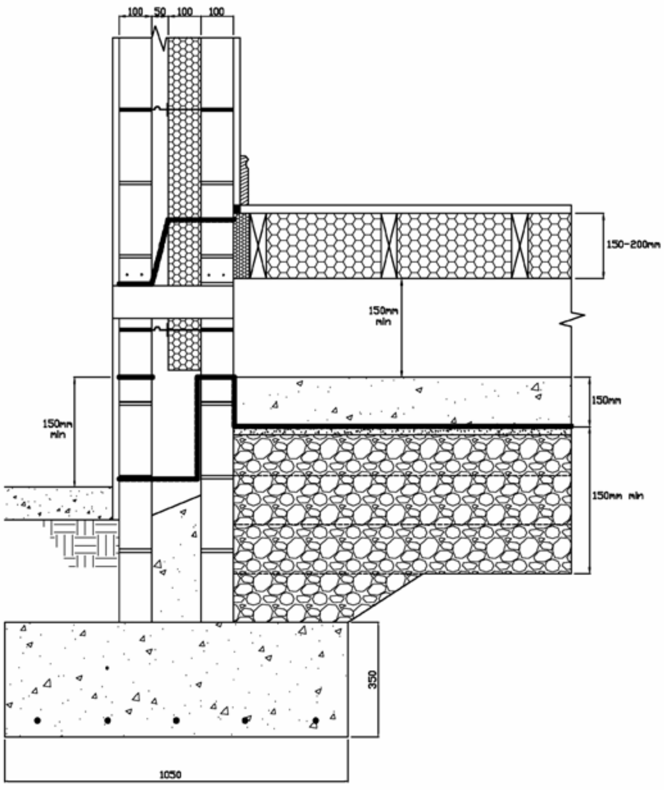
Construction Studies
Theory – Higher Level

SOLUTIONS

Ceist 1
(a)

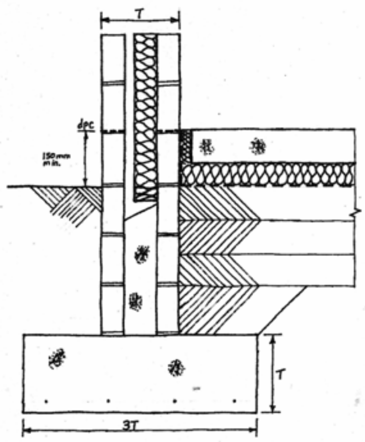


Alternative solution



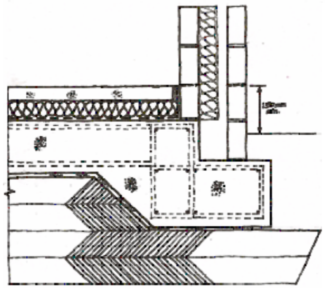
Ceist 2

(a) Two functional requirements of a foundation



- To distribute live and dead loads evenly over as great an area as possible
- To provide a level surface on which to build
- To anchor the structure to the ground
- To limit settlement
- To overcome movement due to seasonal variations in climate
- To prevent failure from any uneven stresses that may occur

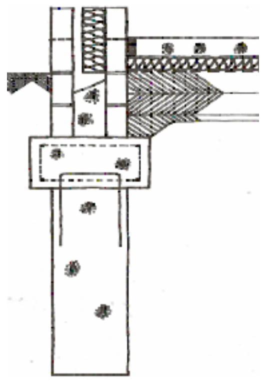
(b) Strip Foundation



- Perimeter load is carried evenly
- Economical way to support load
- Environmentally sustainable
- less concrete and steel – lower embodied energy

Raft Foundation

- Floats on the subsoil spreading the load over as wide an area as possible
- Used on sites where soil is of low bearing capacity
- Even settlement



Short-bored Pile Foundation

- Used where the soil near the surface is of low bearing capacity, but the soil at greater depth is of sufficient bearing capacity to support load
- Where the soil is prone to movement

(c) Two factors to ensure maximum strength of concrete

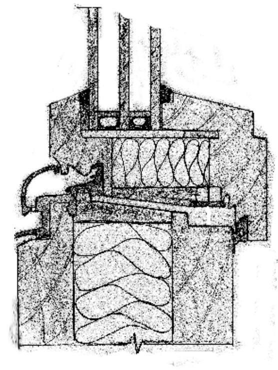
- Water – Cement ratio: The proportion of water to cement in the mix affects the performance of both fresh and hardened concrete. The ease with which freshly mixed concrete can be worked is usually referred to its consistency.
- Clean aggregate
- Batching: Term used to accurately select the quantities of cement and aggregate to be used in a mix of concrete. Batching by weight or volume.
- Mixing: Ready-mixed concrete is batched by weight and the mixing plants are computer controlled.
- Compaction: To remove air - vibration with specialist equipment. Screeds used where a shallow depth of concrete is placed.
- Curing: Treatment of concrete after placement to ensure adequate hydration and hardening. It is important that concrete does not dry out too quickly and to protect from frost.
- Reinforcement: Steel used to strengthen concrete where tension is applied. Reinforcement bar is usually of mild steel, with a knurled surface for better adhesion.
- Transportation and placing: not dropping from height – segregation

Any other relevant details

Ceist 3

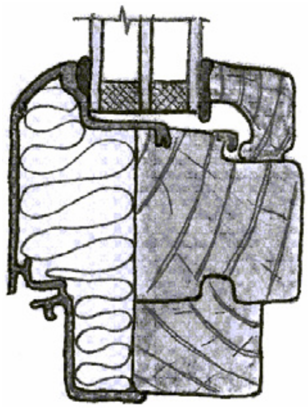
(a) Functional requirements of a contemporary glazing system

- To provide ventilation to habitable rooms - opening minimum 5% of floor area
- To provide light – 10% floor area
- To resist the elements (rain, wind, snow etc)
- To provide occupants with an outside view
- To provide a means of escape in the event of fire. The window should be a minimum area of 0.33m^{2}, with a minimum height and width of 450mm)
- To trap heat from the sun to heat the inside (passive solar gain)
- To provide sound and thermal insulation
- The window frame should be durable - low maintenance
- To provide air tightness and prevent air leakage
- To provide security and prevent unauthorised access into the building



(b) Design of the window - *Environmental considerations*

- Minimise the use of materials such as aluminium (these materials require a lot of energy and resources to produce (high embodied energy)
- Use of renewable and sustainable materials such as wood.
- Ideally softwood from a managed forest
- Use of the aluminium external cladding makes the window more durable and increases its life span.
- Use of softwood treated with preservative to prolong the lifespan of the wood



Thermal properties

- Include a thermal break in the window design, this reduces the overall heat loss due to the cold bridge effect. (the outer aluminium cladding is separated by insulation from the inner wooden frame)
- Approximately 25% of energy lost from a house is lost through the windows. Use of triple glazing provides greater reduction in heat loss. This will result in a saving in fuel costs
- Use wood in the window construction. Wood is a reasonably good insulator

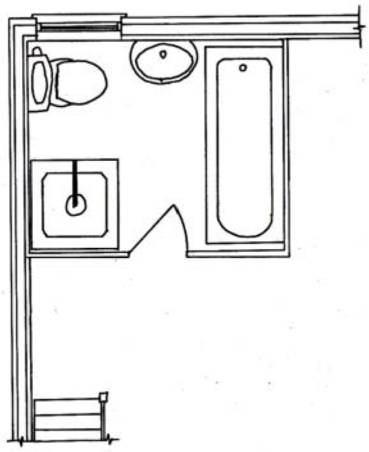
(c) Recommendations

- Low-e glazing has a special coating which allows short wave radiation from the sun to enter the building but reflects back most of the long wave radiation which comes from heat sources inside the house. This system reduces the amount of heat lost, reducing heating bills and also reducing the impact on the environment
- Self-cleaning system. This glass contains a special coating which is activated by UV light. This coating reacts with organic dirt helping to break it down and reduce its adherence to the glass. Water in the form of rain then washes the organic dirt off. These windows do not need to cleaned, this saves time and money. This system is ideal for windows which are in hard to reach locations
- Argon filled double or triple glazing units. Argon reduces conductive and convective heat transfers from the inside of the house thus reducing heat loss. It works best when combined with low-e glazing

Any other relevant details

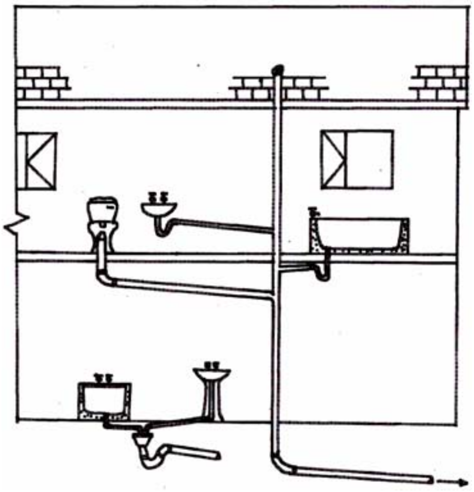
Ceist 4

(a) Two design considerations when locating bathroom on first floor



- **Accessibility**
  - Ensure access for all users including disabled and children
  - Centrally located for easy access from bedrooms
  - Ensure minimum unobstructed width of corridor 900mm for ease of circulation
- Safety – safe distance of bathroom door to staircase

Located on an external wall
  - Natural light through window
  - Natural ventilation is desirable
  - Short pipe runs to SVP
- First floor space as living space
- Ease of removal of waste
- Ensure privacy

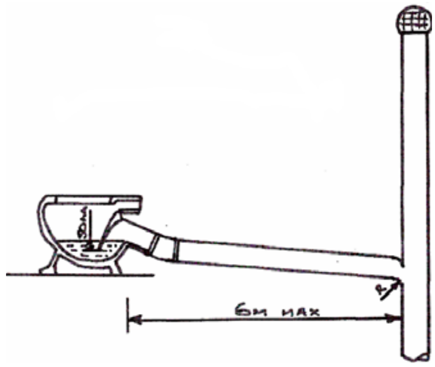


(b) Pipework necessary for safe discharge of waste from:

Wash hand basin
- Wash hand basin discharges via branch pipe to 100mm stack or a gulley on ground floor
- Branch pipe has a max. 1.7m length for typical 32mm diameter pipe
- Slope of branch pipe between 18-90mm/m
- P-trap, S-trap or deep-seal trap fitted directly under outlet. Trap should be 32mm minimum diameter and 75mm in depth.

Bath
- Bath discharges via branch pipe to 100mm stack or gulley on ground floor
- Branch pipe has a max. 3.0m length for typical 40mm diameter pipe
- Typical slope of branch pipe between 18-90mm/m
- P-trap, S-trap or deep-seal trap fitted directly under outlet. Trap should be 32mm minimum diameter and 75mm in depth
- Ensure all small sized connections (<65mm) are offset by 110mm on a 100mm stack

(c) Design detail to prevent penetration of sewer gases at W.C.
- Ensure stack is ventilated above eaves
- Water and air tight seal at W.C. - 75mm diameter and 50mm deep integrated trap
- Ensure the installation of branch pipework length and slope do not exceed recommendations - W.C. max 6.0m from stack, slope of branch pipe 9mm/m.
- Sweep 50mm min for branch connection to stack



Any other relevant details

Question 5 (a)

Material Element	Conductivity k	Resistivity r	Thickness T(m)	Resistance R
Ext. Render	1.430		0.012	0.00839
Concrete Block(ext)	1.440		0.100	0.0694
Cavity			0.150	0.0.170
Insulation	0.018		0.100	5.555
Concrete Block (int.)	1.440		0.100	0.0694
Int. Plaster	0.430		0.015	0.0348
Ext. Surface				0.048
Int. Surface				0.122
				$R^t = 6.0769$

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

U Value: U = 1 / 6.0769 = 0.1645 **$W/M^{2\,0}C$.**

(b) (i) Cost of Heat Lost per year:

- Heat loss formula: = U Value x area x temp. diff

  0.1645 x 152 x 11 = 275.044 Watts.(Joules / sec)

- Heating period p/a:

  60 x 60 x 11 x 7 x 41 = 11,365,200 seconds (3,157hours)

- Kilo joules P.A. :

  $\frac{11,365,200 \times 275.044}{1000} = 3125930$ kj

- Litres P.A.: (Note: Calorific value of 1 litre oil = 37350 kj)

  $\frac{3125930}{37350} = 83.69$ litres

- Cost P.A.: (Note: 1 litre oil costs 65cent.)

  83.69 x 0.65 = € 54.39

(b) (ii) Cost of heat lost per year for 1970s house - U Value = 1.8 W/m^2 °C

$$\frac{0.1645}{1.8} = \frac{54.39}{X}$$

$$0.1645X = 1.8 \times 54.39$$

$$X = \frac{1.8 \times 54.39}{0.1645}$$

$$= €595.14$$

Alternative method – Cost of heat loss p.a. for 1970s house.

- Heat loss formula: = U Value x area x temp. Diff

  1.8 x 152 x 11 = 3009.6Watts (Joules/sec.)

- Heating period p.a.:

  60 x 60 x 11 x 7 x 41 = 11,365,200 seconds (3157hours)

- Kilo joules p.a. :

  $$\frac{11{,}365{,}200 \times 3009.6}{1000} = 34204705 \text{ kj}$$

- Litres p.a.: (Note: Calorific value of 1 litre oil = 37350 kj)

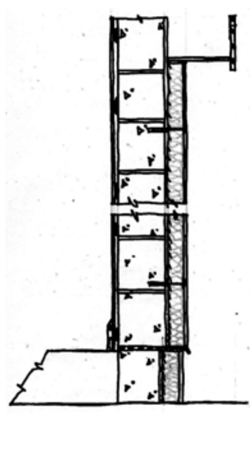
  $$\frac{34204705}{37350} = 915.78 \text{ Litres}$$

- Cost p.a.: (Note: 1 litre oil costs 65cent.)

  915.78 x 0.65 = € 595.26

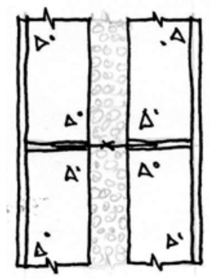
(c) External Insulation.

- Cavity block wall (typical of 1970 s construction)
- Dry lined internally using 12mm plasterboard fixed with “dabs or spots”.
- Rendered externally 15mm nap finish.
- Expanded Polystyrene 100-120mm or Phenolic Foam 80mm.
- Base coat / adhesive applied to external render and insulation board affixed.
- Fibreglass mesh overlaid on insulation board.
- P.V.C. Mushroom type anchor bolts to secure both the insulation board and fibre glass mesh.
- Two coats of polymer or acrylic specialist renders applied.
- Specialist angle bead required for external corners and at plinth.
- Mastic type sealants employed at soffit, door and window frames.

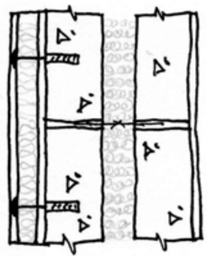


Alternative Insulation Methods.

Cavity Injected Insulation.

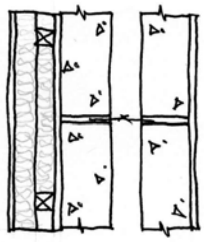


- Cavity filled with insulation- blown or injected through holes drilled in the external wall at regular intervals.
- Choice of: Glass or Rock Wool Fibre; Polystyrene Bead; Foams- including Phenolic, Polyurethane or Polyisocyanurate.
- All insulation matrerials to be Water Repellant, Rot Proof and non combustible.



Rigid Board Insulation to internal surface of the wall.

- Composite – Plasterboard and Rigid Phenolic Foam with integral Vapour Barrier.
- The cavity may also be filled.



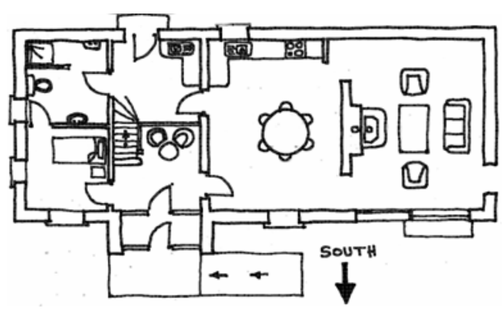
Timber battens and Rigid Insulation.

- 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.

Ceist 6

(a) Three advantages of designing a house to have a low environmental impact:

- Small in scale requires less materials and minimises cost
- Restricted palette of materials - the less is the more
- Economical use of expensive, scarce and limited natural resources
- The visual impact on the landscape is minimised in terms of setting
- Southern orientation helps maximise passive solar gain, reduces energy demand and costs for fossil fuels
- Reduced CO_2 emissions due to reduced use of fossil fuels
- High insulation standard conserves heat and reduces demand, quantity and costs
- Wind energy also reduces demand for the use of fossil fuels
- Choosing locally produced and available materials minimises transport and fuel costs (embodied energy)



(b)

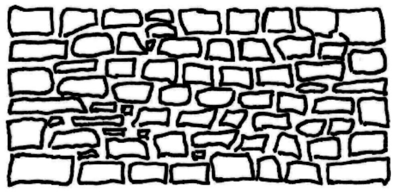
Scale and Layout

- Narrow plan, one room wide allows passive solar energy to reach all rooms
- The house is small in scale – requires smaller quantities of materials and therefore less embodied energy to build.

- Combined kitchen, dining and living areas are very economical in the use of space.
- Small footprint of building – less materials less embodied energy.
- Utilise roof space. This avoids the need for a building with a larger foot print – less materials – less embodied energy.
- Rooms of a human scale and size. Economic use of space conserves heat and reduces energy needs in addition to requiring fewer materials and therefore less embodied energy.

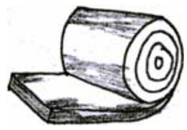
Selection of Materials

- The embodied energy of a house refers to the energy it takes to build it. This includes the energy used for extraction, processing, manufacture and transportation costs of the raw materials as well as the energy used to prepare the site including the installation of the services and the construction of the house.
- Where possible materials should be selected that require the minimum amount of embodied energy in terms of manufacture and transport.



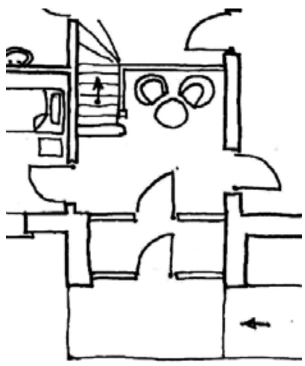
- The small scale design of narrow plan buildings enables the use of timbers of minimum cross section, capable of being harvested from sustainable forests.
- Where stone is incorporated in the design utilise local stone e.g. limestone or granite window cills / chimney cappings.
- Roof coverings of a type traditionally used e.g. natural slate or locally manufactured slate or tiles.

- Use locally available materials such as dry stone fill from the local quarry.
- The use of locally available materials reduces transport costs together with reducing CO_2 emissions from the burning of fossil fuels.
- Insulation that utilises wool and recycled paper with low embodied energy.
- Low-e triple glazing windows have a high U value and reduce costs by saving on the quantity of fossil fuel burned - also reduces CO_2 emissions.

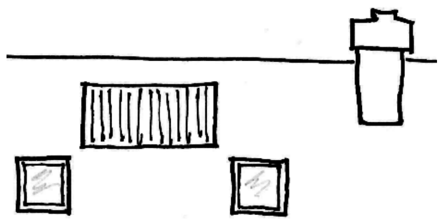


- Straw bale and Cob – low embodied energy.

Energy Requirements:

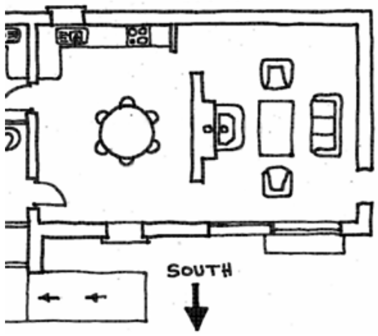


- Stairs lobby is partitioned off and separated by a door which minimises heat loss to the ground floor room.
- Enables at least two "zoned" areas to be formed- economical in terms of any heating system. (Solid fuel or Fossil fuel)
- Porch has large glazed area that attracts solar heat
- Solar panels on roof to heat domestic water (up to 60%) and reduce the overall energy requirements.



- The six roof lights are more efficient than dormers and allow maximum daylight into the upstairs rooms
- All rooms have windows reducing artificial light requirements.
- Large glazed area to the living room enables passive solar gain – provide well insulated windows with U-value, (0.76 W/m^2 °C)) triple glazed with a low-e coating,

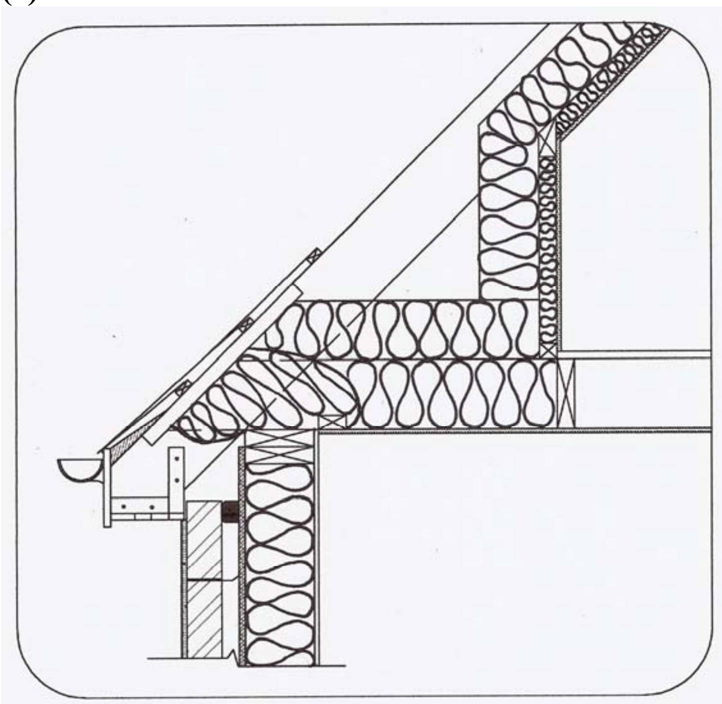
- The large, glazed double doors on the south elevation enable maximum passive solar gain to the principal living area. These double doors may be opened easily to allow cooling in the warmer periods.
- Orientate building to maximise passive solar gain - principal elevation is south facing or 15° East or West of due South.
- The absence of windows on the North Elevation reduces heat loss to that "colder" elevation.
- A wood burning stove is carbon neutral and provides between 2.5 and 9 kilowatts of heat. The open plan living area is ideally suited to this form of heating.



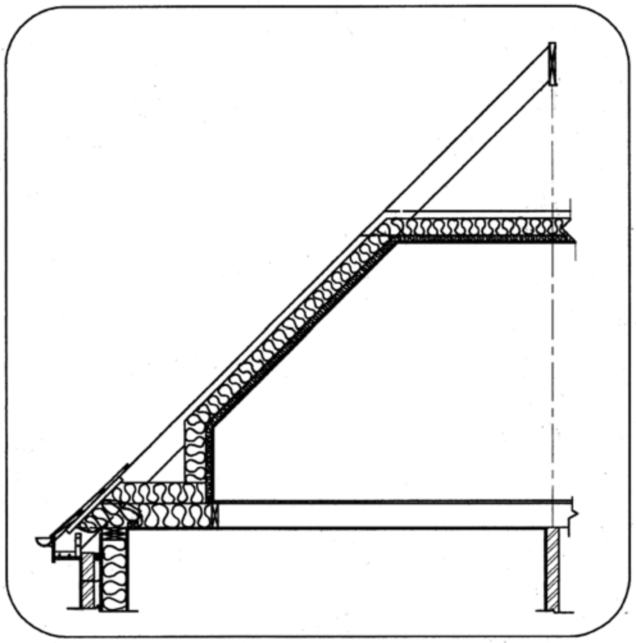
Any other relevant details

Ceist 7

(a)



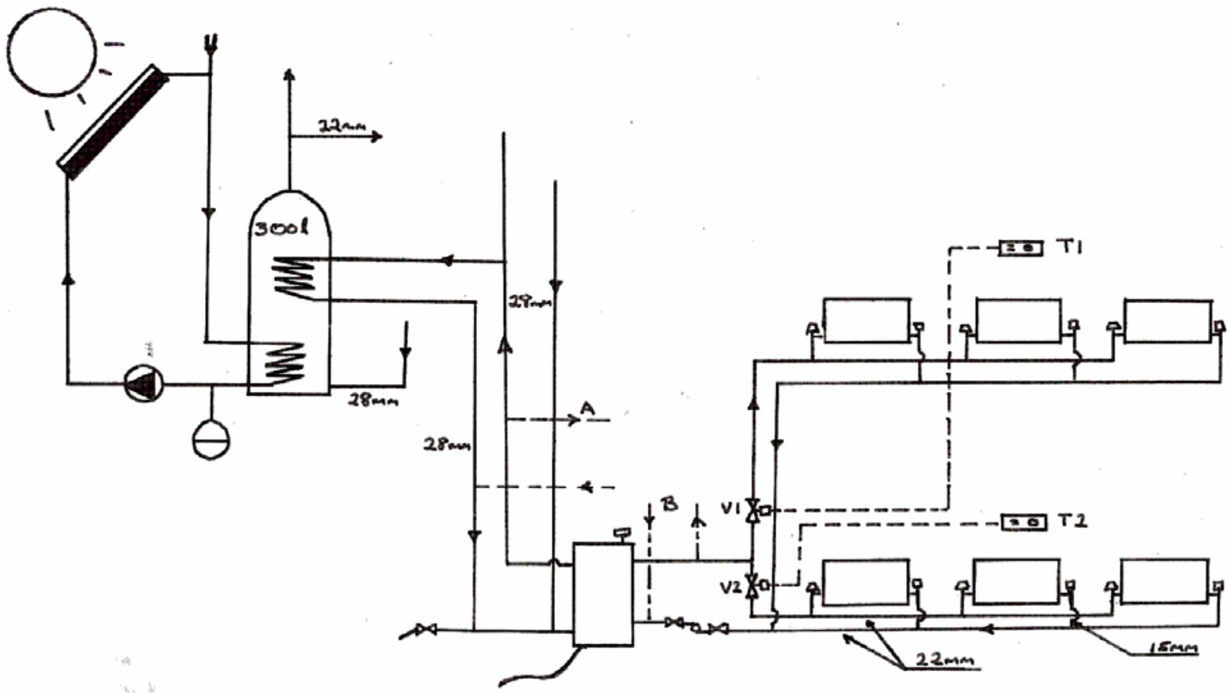
Any other relevant details



Ceist 8

(a) Oil fired and zoned heating system
Note:

- Control valves at V1 and V2 can be manual or two port valves.
- Control valves should be located on the return if they are constructed of plastic due to excess heat.
- At each radiator a handwheel valve or thermostatic valves on flow, lockshield valves on the return.



- 22mm pipe on flow and return, 15mm pipe at upstands.
- Room thermostats (T1 and T2) can control the motorised valves for each zone.
- Position A shows an alternative location to connect the flow and return to the heating system.
- Position B shows an alternative location for the primary circuit to the hot water storage tank. This connection must occur before the valves that control heating.

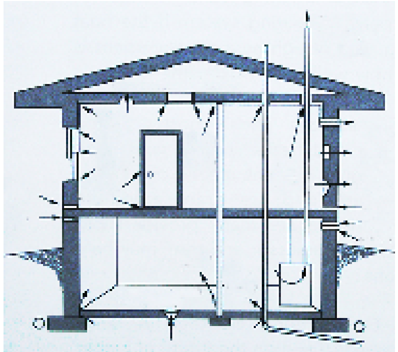
(b) Advantages roof mounted solar collector

- Sources are renewable and sustainable
- Environmentally friendly, no CO^2 released
- Requires no extra space in house
- Grant aided
- Can be supplemented by boiler
- Easy to install, maintenance free and long lasting
- Continuous supply of warm water – up to 60% of domestic requirements
- Results in substantial savings compared to conventional methods
- Cost will not increase

  Any other relevant details

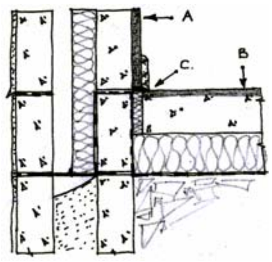
Ceist 9

(a) Three possible air leakage routes:



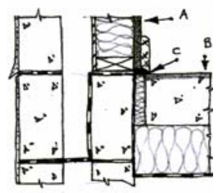
- Junction/concrete ground floor and external concrete block wall.
- Junction/concrete Ground Floor and Timber Frame inner leaf.
- Junction/Suspended Timber Ground Floor and External Concrete block wall.
- Junction/Window cill/frame / board and External Concrete block wall
- Junction/Window head and External Concrete block wall.
- Eves/External Concrete block wall.
- Trapdoor.
- Any other relevant air leakage route.

Concrete Ground Floor and External Concrete block wall.



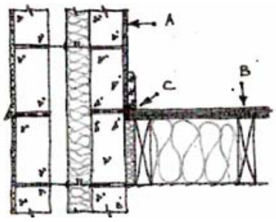
- Air Barrier Continuity**.**
- Seal between Wall (A) and Floor (B) barriers with a flexible sealant. (C)
- Seal between Skirting and Floor with a flexible sealant.(C)

Concrete Ground Floor and Timber Frame inner leaf.



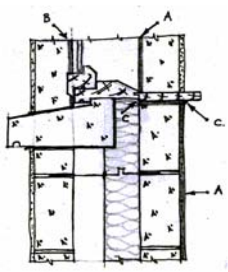
- Air Barrier Continuity.
- Seal between Wall (A) and Floor (B) barriers with a flexible sealant. (C)
- Seal between Skirting and Floor with a flexible sealant.(C)

Suspended Timber Ground Floor and External Concrete block wall.



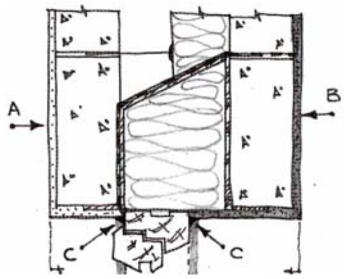
- Air Barrier Continuity**.**
- Seal between Wall (A) and Floor (B) barriers with a flexible sealant. (C)
- Seal between Skirting and Floor with a flexible sealant.(C)

Window cill / frame / board and External Concrete block wall.

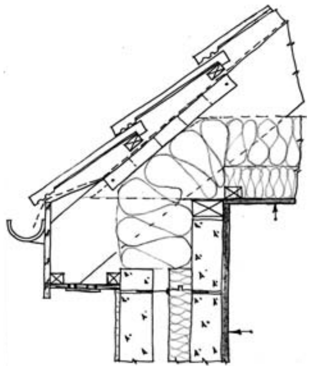


- Air Barrier Continuity**.**
- Apply flexible sealant (C) to all interfaces between the internal air barrier (A) and the window frame / board.
- Seal the interface between the external wall(B) and the window frame with a flexible sealant.(C)

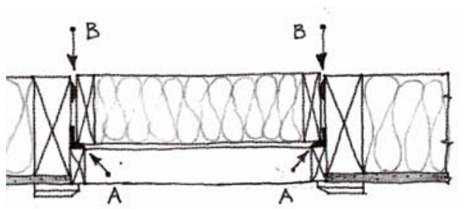
Window head and External Concrete block wall.
- Air Barrier Continuity.
- Seal the interface between the internal air barrier(B) and the window frame with a flexible sealant.(C)
- Seal the interface between the external wall(A) and window frame with a flexible sealant.(C)



Eves / External Concrete block wall.
- Air Barrier Continuity.
- Seal the interface between the internal air barriers(A) - wall and ceiling plaster using an approved tape (C) -Part D of the Building Regulations Materials and Workmanship.



Trapdoor
- Air Barrier Continuity.
- On site manufactured trap doors should utilise:
  - Tape to seal the junction between the ceiling joist and trimming to the trap door (A)
  - Rubber type draught stripping (B)
- Alternative Proprietary manufactured trap doors should be used where possible.



(b) Two Advantages:
- Reduce heat losses significantly
- Eliminate unwanted cold air – draughts but must be designed for continuous fresh air supply
- Increased thermal comfort and saving in fuel and energy costs.

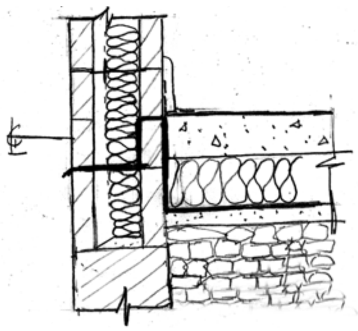
Any other relevant details

Ceist 10
(a) Designing a Passive Solar house

Insulated building envelope
- Passivhaus Institute, Darmstadt, Germany researched and developed design concept of the passive house. Proposed to have Passivhaus standard as the EU standard in 2016

Fundamentals of passive solar house:
- A1 Building Energy rating (BER) <25 kWh/m^2/pa
- Super insulated building envelope
- Airtight envelope, joints taped to prevent air infiltration
- High performance windows and doors – triple glazing, double draught proof
- Low thermal bridging – very high specification and workmanship
- Significantly reduced structural air infiltration – blow door test to measure airtightness
- Efficient space and water heating – an annual space heating requirement of 15 kWh/m^2/K and an 86% reduction on current energy use

Walls

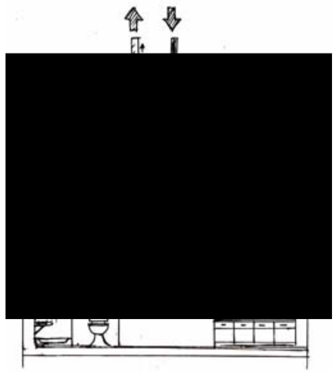


- Walls to Passive house standard of U-value of 0.175 W/m^2/K
- Insulated cavity 200mm - 300mm in width
- Wider inner leaf in timber frame for thicker insulation
- Insulated block from foundation to skirting
- Joints japed at all junctions to increase air tightness

Roof
- Roof to have U-value of 0.15 W/m^2/K
- Greater width of rafter to accommodate greater insulation
- Insulation laid between rafters and across rafters – thickness of 400 mm to 600 mm
- Insulation such as rigid urethane board fitted to underside of rafters where attic has living space
- All joints taped to increase air tightness

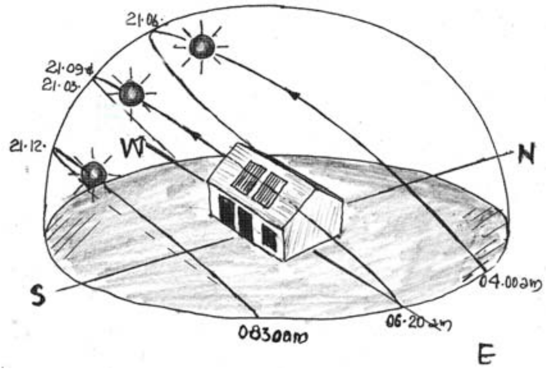
Floors
- Floor to have U-value of 0.15 W/m^2/K
- insulation min 150 mm, joints staggered and taped to prevent thermal bridges
- High density edge insulation to floor slab
- Insulated blockwork from foundation slab to obviate thermal bridge (sketch)
- Insulated floor slab to prevent heat loss into ground
- Finish floor materials to have thermal mass, such as quarry tiles, terra cotta tiles etc.

Controlled air changes



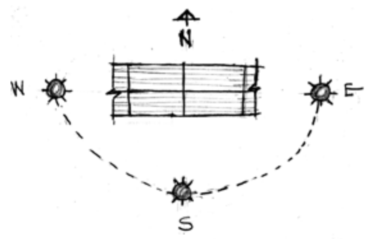
- Air leakage not to exceed 0.6 air changes per hour using 50Pascals over pressurisation and under pressurisation testing
- Joints taped at all junctions to increase air tightness
- Mechanical Heat Recovery and Ventilation (MHRV) system to extract heat from air in kitchen, bathroom etc and heated by preheated air in chamber and thus raise the temperature of incoming air
- Air mechanically circulated and flow controlled
- Fresh cold air and hot stale air never mix, so no contamination or sick building syndrome – a continuous supply of fresh filtered air from outside which is preheated by exhaust air
- Necessary to change the filters to ensure fresh air

Optimum benefit from passive solar gain



- Mass of walls and floors to act as heat sink, thick concrete walls and floors, tiled floors
- Sun path, elevation 78°in mid summer, 30° in mid-winter
- Reduced glazing to the north
- Living rooms on the southern elevation
- Compact form to minimise surface to volume ratio
- Solar panels on southern roof at 45° pitch to optimise solar gain
- Maximise glazing on southern façade to maximise solar gain - triple glazing, low-e argon filled
- Window and door frames to be insulated and thermally broken to prevent heat loss through frames

(b) Preferred orientation

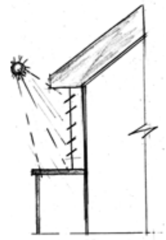


- East west orientation allowing longest facade of house facing south, as shown
- Long axis east west, glazed façade to the south

Justification

- No sun in northern sky
- Maximum gain from southern orientation
- Little used spaces such as bathroom, utility room and circulation spaces on the northern elevation

(c) Overheating in summer



- Balconies, large roof overhangs, brise-soleil, blinds, curtains, awnings to shade and reduce overheating in summer,
- Buffer zone/winter garden inside glazing to separate glazed area from rooms
- Tinted glass to reduce glare, low-e glass restricts incoming short wave radiation
- Window layout to aid circulation – opposite walls and open sections

Any other relevant details

Ceist 10

Points may include:

Remedying a lot of mistakes made at all scales, from regional planning down to house design

- Regional planning – siting estates and one- off without regard to energy costs results in huge carbon footprint – transport to and from work, schools, shopping, leisure. Little time left for involvement in community activities – social capital diminished
- Poor insulation in individual houses, now in need retro fitting to raise insulation standards.
- Poor house design – orientation and scale a constant demand on scarce energy resources to heat and light

Architects leading the way with green agenda

- An ethical crusade by architects to show that green design is the way forward. A raising of awareness, models of good practice in individual houses and in estates such as the Village project in Cloughjordan, Co. Tipperary and Adamstown in Dublin
- Green design shaping a new design paradigm with designs based on local materials and skills and new environmental awareness
- Low transportation costs, reduced CO_2, emissions, houses sympathetic to surrounding built using local materials - stone, earth, clays, wood and using local knowledge and skills

Light, form and space

- Orientate living/working areas on east-west axis with main elevation to the south.
- Careful situation of glazed areas on southern elevation to give light and passive heat so that energy requirements for both lighting and heating are kept to the minimum
- Re- interpretation of vernacular as inspiration for new house design
- Simplicity of form, elegant proportions, restful to the eye, careful consideration of demands of household, building close to amenities
- Smart design - passive solar design, modern glass technology and orientation, building mass to store sun's energy, airtight and mechanical ventilation and heat recovery (MVHR) to control and preheat fresh air

- Smart metering and smart technologies to reduce energy needs
- Space – careful consideration of layout, no long corridors, unlit or unheated rooms

A lot of these things were forgotten and not questioned

- Rate of change fast, inherited knowledge regarding location and orientation lost
- Traditional deep knowledge of place, flooding planes, siting for sun, shade and shelter needs to be redeemed
- Eco- friendly design with materials having low embodied energy to reduce carbon footprint, use of green building techniques, use of natural toxin-free materials
- Principles of universal design - a house to meet needs of all inhabitants from small children to old people - for lifetime use

We got used to the idea of being able to cancel out poor orientation with heating.

- Poor environmental awareness, pattern book house designs with no regard for local sources skills or materials
- Cheap oil – could ignore orientation and still heat rooms cheaply, no longer an option, more purposeful consideration of all options required
- Energy cost of transportation, embodied energy of materials, impact of climate change
- Use of renewable energies - solar panels, on-site generation of electricity where possible, energy saving electrical fittings, LEDs, A-rated appliances
- Houses of low-environmental impact – embodied energy calculated for all materials used

Three guidelines for sustainable housing development…such as

- Energy analysis of any design…low embodied energy design
- Raise public awareness of sustainable design principles
- Non-toxic materials
- Modest scale to meet needs
- Build close to amenities where possible
- Build in clusters where possible
- Use sustainable energies –wind, solar
- Grants to encourage sustainable design

Any other relevant recommendations supported by cogent argument and development.

Coimisiún na Scrúduithe Stáit
State Examinations Commission

Scrúdú Ardteistiméireachta 2009

Staidéar Foirgníochta
Teoiric – Ardleibhéal

Construction Studies
Theory – Higher level
Scéim Mharcála
Marking Scheme

Ceist 1

PERFORMANCE CRITERIA	MAXIMUM MARK
Any 12 points x 4 marks (Drawing 3 Annotation 1)	
Reinforced foundation	**4**
Cavity wall	**4**
Cavity wall insulation	
Internal and external plaster	**4**
Skirting board	
Hardcore min 150 mm	**4**
Blinding sand	**4**
Radon barrier	
100 / 150 mm concrete subfloor, oversite concrete	**4**
Tassle wall & dpc	
Wallplate	**4**
Joist	**4**
150-200 mm Polystyrene Insulation or equivalent	
25mm T & G flooring	**4**
Flexible sealant/tape	
Lintels over vent	**4**
Vent	**4**
Dpc tray over vent	
Indication of ground level	**4**
Four typical dimensions x 1 marks	**4**
Scale & drafting	**4**
(b) ***4 marks for indicating the position of the Radon Barrier***	
Position of Radon Barrier	**4**
Total	**60**

Ceist 2

PERFORMANCE CRITERIA	MAXIMUM MARK
(a) ***Two functional requirements (2 x 6 marks)***	
Functional requirement 1 (4 for point, 2 for discussion)	**6**
Functional requirement 2 (4 for point, 2 for discussion)	**6**
(b) Three foundation types (3 x 12 marks) Max 8 if only note or sketch	
Foundation type 1 Note and sketch	**12**
Foundation type 2 Note and sketch	**12**
Foundation type 3 Note and sketch	**12**
(c) ***Two factors to ensure maximum strength of concrete (2 x 6 marks)***	
Factor 1 *(4 for point, 2 for discussion)*	**6**
Factor 2 *(4 for point, 2 for discussion)*	**6**
Total	**60**

Ceist 3

PERFORMANCE CRITERIA	MAXIMUM MARK
(a) ***Two Functional Requirements (2x10 marks each)*** *(Sketch or note only maximum 7 marks)*	
Note and sketch 1	**10**
Note and sketch 2	**10**
(b) ***Discussion of window design (4x5 marks each)***	
Environmental considerations 1	**5**
Environmental considerations 2	**5**
Thermal properties 1	**5**
Thermal properties 2	**5**
(c) ***Preferred window frame and glazing system***	
Frame recommendation and reason Glazing recommendation and reason	**10** **10**
Total	**60**

Ceist 4

PERFORMANCE CRITERIA	MAXIMUM MARK
(a) ***Two design considerations (2x12 marks each)*** *(Sketch or note only maximum 8 marks)*	
Note and sketch 1	**12**
Note and sketch 2	**12**
(b) ***Pipework for above ground drainage*** *(max 6 marks if only sketch or note)*	
Note and sketch wash hand basin	**9**
Note and sketch bath	**9**
Typical size of pipework for WHB (any two)	**3**
Typical size of pipework for bath (any two)	**3**
(c) ***Design detail to prevent sewer gases penetrating at W.C.*** *(Sketch or note only maximum 8 marks)*	
Note and sketch	**12**
Total	**60**

Ceist 5

PERFORMANCE CRITERIA	MAXIMUM MARK
(a) ***11** points x **3 marks** for each point*	
Correct tabulation	3
External render	3
Concrete block - external	3
Cavity	3
Insulation	3
Concrete block - internal	3
Internal plaster	3
External surface.	3
Internal surface	3
Total resistance	3
U Value. (Formula 1 mark)	3
(b)* (2 x 6 marks) 1 mark for each of the following** ***Formula, Apply Formula, Heating Period, Kj Lost per Annum, Litres per Annum, Cost	
Annual cost of heat loss for new dwelling house.	6
Annual cost of heat loss for 1970's house.	6
(c)(15 marks)	
Notes and sketches	15
Total	60

Ceist 6

PERFORMANCE CRITERIA	MAXIMUM MARK
(a) Three advantages: (3x10 marks)	
Advantage 1 (6 for adv, 4 for discussion)	**10**
Advantage 2 (6 for adv, 4 for discussion)	**10**
Advantage 3 (6 for adv, 4 for discussion)	**10**
(b) ***Three features ensuring low environmental impact (3 x 10 Marks)*** *Note only max 7 marks*	
Scale and layout. Notes and sketches	**10**
Selection of materials Note and sketch	**10**
Energy requirements Note and sketch	**10**
Total	**60**

Ceist 7

Performance Criteria	Maximum Mark
(a) *12 points x* **4 marks; *(Drawing 3 Annotation 1)***	
(7 points – Ext .wall & roof)	
Facia, soffit and gutter (any 2)	
Eaves ventilator and vent at eaves	4
Rafter and felt	4
Slates, battens	
Ceiling joist and flooring	4
Insulation	4
Collar tie and ridge board/ridge tile (any 2)	
Strut, runner, purlin (any 2)	4
Stud partition and internal lining.	4
Internal load bearing wall	4
Sealing of all joints to ensure air tightness	
(5 points –Timber frame)	
Outer block & plaster	4
Vertical stud - inner leaf	4
Wall ties	4
Sheathing material and breather membrane	
Insulation - inner leaf	4
Vapour control membrane	4
Plasterboard internal lining	
Cavity barrier	
Header	
Scale and Drafting	4
Four typical dimensions (4 x 1 marks each)	4
(b) Indication of design detailing to show continuity of insulation	4
Total	**60**

Ceist 8

PERFORMANCE CRITERIA	MAXIMUM MARK
(a) Any 10 x 3 marks (Sketch 2 Annotation 1)	
Boiler	3
Floor 1 Radiators	3
Floor 2 Radiators	3
Flow pipes to radiators	3
Return pipes to radiators	3
Thermostatic or handwheel valve	3
Lockshield valve	3
Pump with valves	3
Control Valve 1	3
Control Valve 2	3
Room Thermostat	
Sizes of pipework (2)	
(b) Any 8 x 3 marks (Sketch 2 Annotation 1)	
Connecting solar collector	
200 litre min twin coil cylinder	3
Solar Collector	3
Return from solar collector	3
Flow to solar collector	3
Pump	3
Expansion vessel	3
Air vent	3
Hot water expansion and take off	3
Primary flow	
Primary return	
Cold feed to hot water cylinder	
Advantage 1	3
Advantage 2	3
Total	**60**

Ceist 9

PERFORMANCE CRITERIA	MAXIMUM MARK
***(a) Any 3 x 12 marks** (Note only – max of 8 marks)*	
Air leakage - Route 1	**12**
Note and sketch	
Air leakage - Route 2	**12**
Note and sketch	
Air leakage - Route 3	**12**
Note and sketch	
(b) Two advantages: 2x 12marks.	
Advantage 1 (8 for point, 4 for discussion)	**12**
Advantage 2 (8 for point, 4 for discussion)	**12**
Total	**60**

Ceist 10

PERFORMANCE CRITERIA	MAXIMUM MARK
(a) ***Design of Passive Solar House (2 x 10marks)*** ***(Sketch or note only maximum 7 marks)***	
Point 1 Note & sketch	**10**
Point 2 Note & sketch	**10**
(b) ***Design layout (2 x 10 marks)*** ***(Sketch or note only maximum 7 marks)***	
Preferred orientation Note and sketch	**10**
Justification of choice	**10**
(c) ***2 Design details to help prevent overheating (2 x 10 marks)*** *(Sketch or note only maximum 7 marks)*	
Design detail 1 Note and sketch	**10**
Design detail 1 Note and sketch	**10**
Total	**60**

Ceist 10 (Alternative)

PERFORMANCE CRITERIA	
Discussion of Statement (3x10 marks)	
Discussion – point 1 (6 for point, 4 for discussion) Discussion – point 2 (6 for point, 4 for discussion) Discussion – point 3 (6 for point, 4 for discussion)	**10** **10** **10**
Three Guidelines (3x10 marks)	
Guideline 1 (6 for point, 4 for discussion)	**10**
Guideline 2 (6 for point, 4 for discussion)	**10**
Guideline 2 (6 for point, 4 for discussion)	**10**
Total	**60**

Coimisiún na Scrúduithe Stáit

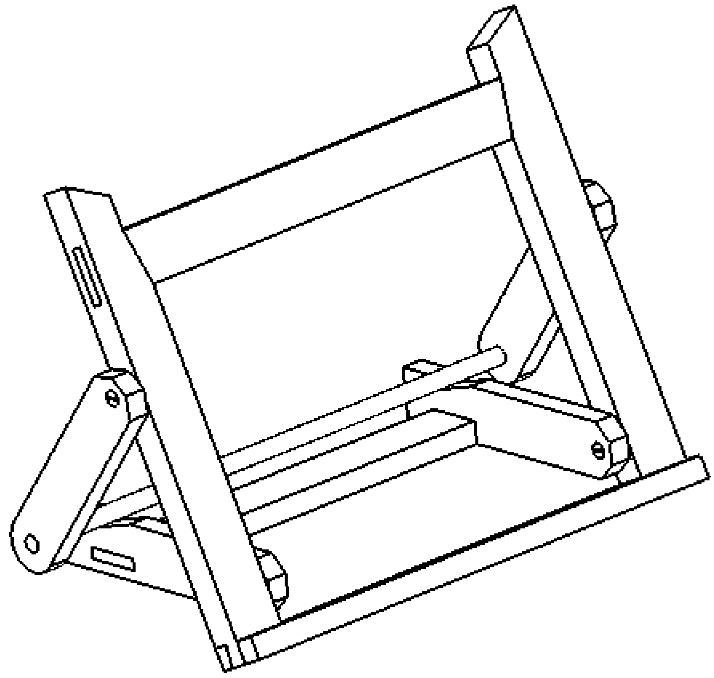
State Examinations Commission

Scrúdú Ardteistiméireachta 2009

Leaving Certificate Examination 2009

Scéim Mharcála
Marking Scheme

(150 marc)



Staidéar Foirgníochta
Triail Phraiticiúil

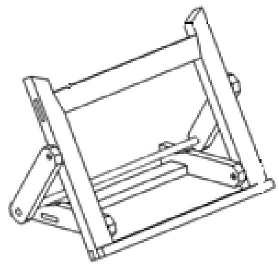
Construction Studies
Practical Test

Construction Studies 2009 - Marking Scheme - Practical Test

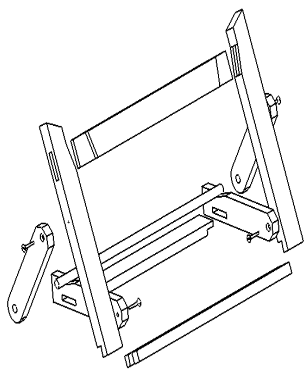
Note:

The test piece is to be hand produced by candidates without the assistance of machinery- except a battery powered screwdriver which is allowed.

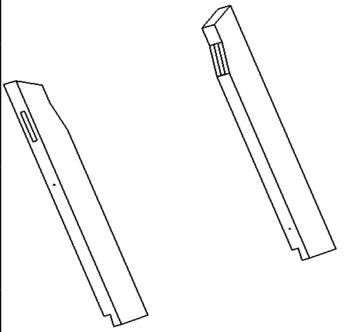
Where there is evidence of the use of machinery for a particular procedure a penalty applies. The component is marked out of 50% of the marks available for that procedure.

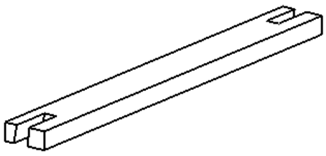


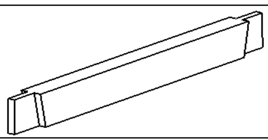
A	OVERALL ASSEMBLY	MARKS
1	Overall quality of assembled artifact	**10**
2	Dowel located and fitted correctly	**4**
3	Design and applied shaping of edge • design *(4 marks)* • shaping *(4 marks)*	**8**
	Total	**22**

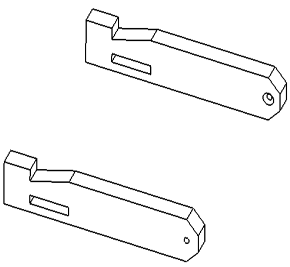


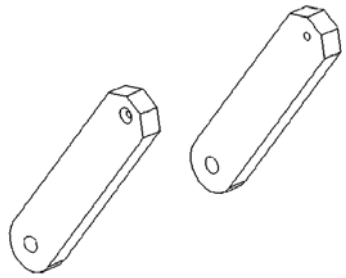
B	MARKING OUT	Marks
1	Left side - vertical • joints - mortice ***(2 marks)*** - dovetail ***(2 marks)*** • top slope ***(1 mark)*** • vertical line ***(1 mark)*** • sloped shoulder ***(2 marks)***	**8**
2	Right side – vertical • joints - mortice ***(2 marks)*** - dovetail ***(2 marks)*** • top slope ***(1 mark)*** • vertical line ***(1 mark)*** • sloped shoulder ***(2 marks)***	**8**
3	Bottom rail • dovetail joints ***(2 x 2 marks)***	**4**
4	Top rail • tenon joints ***(2 x 2 marks)*** • sloped shoulder ***(2 marks)***	**6**
5	Left and right horizontal supports • mortice joint ***(2x2 marks)*** • notch ***(2 marks)*** • shape of end ***(2 marks)***	**8**
6	Left and right strut - semi-circles and shaping ***(6 x 1 marks)***	**6**
7	Back horizontal rail ***(2 x 2 marks)***	**4**
	Total	**44**

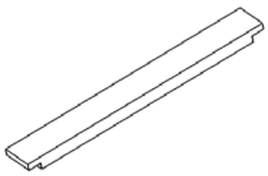
TWO SIDES	C	PROCESSING	Marks
	1	Shaping sloped top *(2 x 1 mark)*	2
	2	Two mortices • mortices *(2 x 3 marks)* • shaping *(2 x 2 marks)*	10
	3	Two dovetails *(2 x 3 marks)* • **Slope** *(2 marks)* • **Shoulder** *(1 mark)*	6
		Total	**18**

BOTTOM RAIL	D	PROCESSING	Marks
	1	Two dovetail pins *(2 x 5 marks)*	10
		Total	**10**

TOP RAIL	E	PROCESSING	Marks
	1	Two tenons *(2 x 8 marks)*	16
		Total	**16**

HORIZONTAL SUPPORTS	F	PROCESSING	Marks
	1	Shaping sloped ends *(4 x 1 mark)*	4
	2	Notches • sawing vertically *(2 x 1 mark)* • shaping slopes *(2 x 2 marks)*	6
	3	Two mortices *(2 x 3 marks)*	6
	4	Drilling and countersinking screws *(2 x 1 mark)*	2
	5	Attaching supports *(2 x 1 mark)*	2
		Total	**20**

TWO STRUTS	G	PROCESSING	Marks
	1	Shaping • slopes ***(4 x 1 mark)*** • curve ***(2 x 3 marks)***	**10**
	2	Drilling and countersinking screws ***(2 x 1 mark)***	**2**
	3	Attaching supports ***(2 x 1 mark)***	**2**
		Total	**14**

BACK RAIL	H	PROCESSING	Marks
	1	Two tenons • sawing with grain ***(2 x 2 marks)*** • sawing across grain ***(2 x 1 mark)***	**6**
		Total	**6**