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Pre-Leaving Certificate Examination, 2009

Construction Studies – Part 1 (Theory)

Marking Scheme

Ordinary Pg. 2

Higher Pg. 16

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Dublin Examining Board
Pre-Leaving Certificate Examination, 2009

Construction Studies – Part 1 (Theory)

Ordinary Level
Marking Scheme (200 marks)

Answer Question 1 and **three** other Questions.

All Questions 50 Marks

1. The sketch shows an extension, which has been added to the rear of an existing dwelling to provide more living space. The external wall of the extension is a 300 mm concrete block wall with an insulated cavity and is plastered on both sides. The foundation is a traditional strip foundation. The extension has a solid concrete ground floor with a timber finish. (50)

- (a) To a scale of 1:5, draw a vertical section through the external wall and ground floor. Show all the construction details from the bottom of the foundations to 400 mm above the finished floor level.



Any 12: (12 × 3m)

Scale (4m), Draughtsmanship (4m)

- | | |
|--|---------------------------------|
| – internal plaster / | – concrete sub-floor (100 mm) / |
| – external plaster / | – insulation / |
| – inner leaf 100 mm / | – vapour check / |
| – insulation 60 mm / | – DPM / radon barrier / |
| – wall ties at correct centres / | – sand / clinker / |
| – external leaf / | – hardcore / |
| – D.P.C. in correct position in wall / | – strip foundation (W = 3T) / |
| – skirting board / | – cavity fill / |
| – flooring 22 mm / | – depth below ground / etc. |
| – battens / | |

- (b) On your drawing, show a method of preventing moisture reaching the inside of the building at floor level.

- Design detail clearly shown (6m)



2. Thermal insulation is widely used in the construction of all new domestic dwellings. (50)

(a) Discuss in detail **two** advantages of using thermal insulation at the construction stage of new buildings.

Any 3: (3 × 4m)

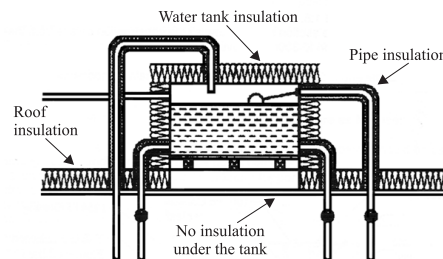
- helps to reduce heat loss in a building /
- saves money on heating costs /
- improves comfort levels in building /
- helps to reduce danger of condensation on surfaces /
- eliminates cold bridge effect at windows and doors /
- insulation on pipes helps to prevent pipes bursting due to freezing / *etc.*

(b) Using notes and **neat freehand sketches**, show how thermal insulation could be fitted in an old dwelling, at the following locations:

Any 2: (2 × 15m)

Note (5m), Sketch (10m)

- cavity wall with no insulation;
 - fitting of polystyrene particles in cavity /
 - holes drilled in walls at regular spacing (top and bottom) and foam pumped into cavity space at high pressure /
 - holes filled with mortar /
 - alternative method of using plasterboard on battens on inner wall surfaces /
 - this reduces size of room and causes mess in house / *etc.*
- cold water storage tank in attic.
 - tank covered with insulation, rigid well-sealed insulation or fibre glass wrapped around tank /
 - lid fitted to top of tank - insulation on lid /
 - 150 mm insulation fitted between joists /
 - all pipes insulated with insulation / *etc.*



(c) Suggest a suitable type of insulation for **each** of the above.

Any 2: (2 × 4m)

- cavity wall with no insulation;
 - glass fibre /
 - rockwool fibre /
 - polystyrene bead /
 - pumped into walls through series of holes drilled in external leaf of cavity wall / *etc.*
 - cold water storage tank in attic.
 - rigid insulation board fitted around tank /
 - glass fibre quilt wrapped around tank / *etc.*
- ** Note: No insulation placed under the tank.

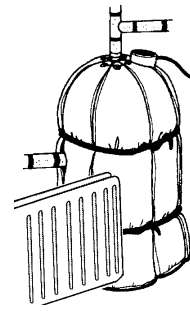
3. (a) Using a **single-line labelled diagram**, sketch an indirect hot water system. Include the following in your diagram:

(50)

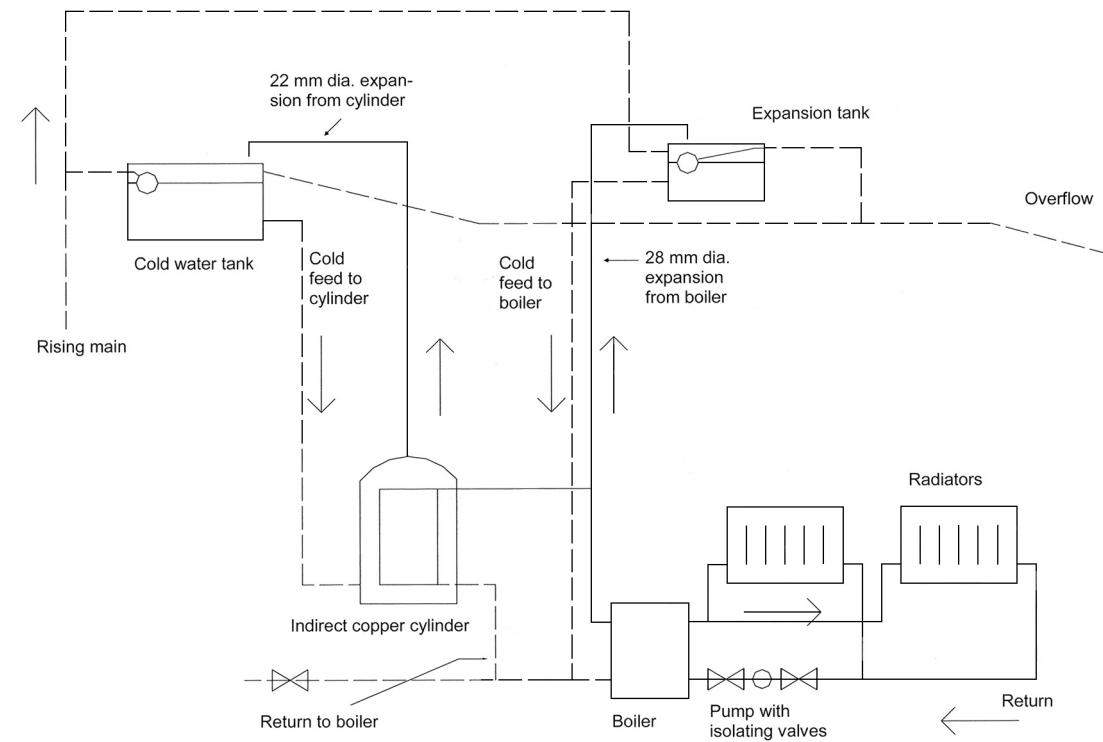
- rising main and cold water storage tank;
- hot water cylinder;
- boiler;
- all pipe work for hot water;
- two radiators;
- all necessary valves.

Any 8: (8 × 4m)

Sketch (8m)



- | | |
|---|--|
| - cylinder and coil / | - primary flow from boiler to cylinder / |
| - boiler with safety valve / | - primary return from cylinder to boiler / |
| - cold water storage tank / | - drain valve / |
| - expansion pipe cylinder to storage tank / | - circulation pipe / |
| - rising main / | - flow pipe to radiators / |
| - expansion tank with mains/overflow / | - return pipe from radiators / |
| - hot water flow to bathroom / kitchen / | - insulation on pipes and cylinder |



- (b) On the diagram, use arrows to indicate the direction of flow of the water in the system.

Any 5 arrows: (5 × 2m)

4. The sketch shows the bottom portion of a closed string wooden stairs.

(50)

- (a) To a scale of 1:5, draw a vertical section through the bottom **three** steps in the stairs.
Include the following in your drawing:

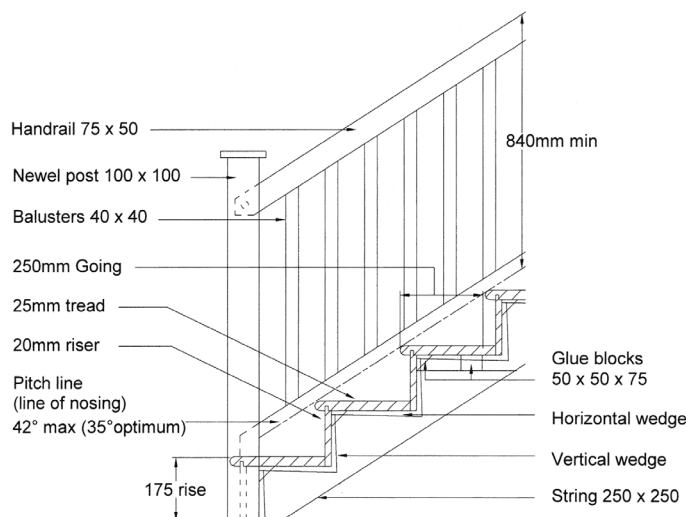
- newel post;
- string;
- balusters;
- handrail;
- risers;
- treads;
- wedges and angle blocks.



Any 8: (8 × 5m)

Drawing (4m), Labelling (1m)

- newel post 100 × 100 mm /
- string 250 × 28 mm /
- balusters 40 × 40 mm /
- handrail 75 × 50 mm /
- risers 25 mm /
- treads 25 mm /
- going /
- rise /
- wedges /
- glue blocks /
- pitch line /
- handrail height 840 mm / etc.

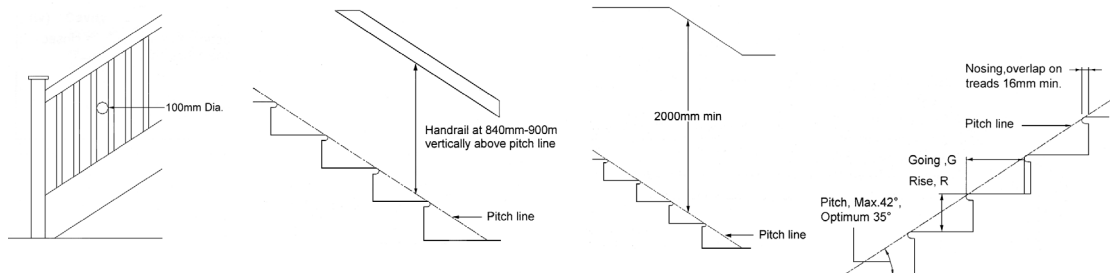


- (b) Using notes and *neat freehand sketches*, outline **two** safety considerations to be considered when designing a stairs for a domestic dwelling.

Any 2: (2 × 5m)

Note (3m), Sketch (2m)

- pitch not more than 42 degrees /
- $2R + G = 550 - 700$ /
- all treads same size /
- all risers same size /
- max number of treads = 16 /
- nosing overlap 16 mm min /
- proper guarding provided on stairs /
- min gap between balusters 100 mm /
- handrails fitted at correct height - 840 - 900 mm vertically of pitch line /
- sufficient headroom provided / etc.



5. (a) List **two specific** safety precautions to be observed in **each** of the following situations: (50)

- placing pre-stressed concrete lintels in position;

Any 2: (2 × 5m)

Note (3m), Sketch (2m)

- use of secure scaffolding with all necessary guardrails /
- workers properly trained in lifting techniques /
- two people required to lift /
- all necessary safety equipment worn by workers / *etc.*



- using a nail-gun to fix timber battens to a concrete wall;

Any 2: (2 × 5m)

Note (3m), Sketch (2m)

- ensure nail gun is held correctly /
- never point at people /
- correct safety equipment used /
- trained person /
- if working on scaffolding ensure it is correctly set up /
- correct power supply /
- care taken with cables / *etc.*

- cutting roof rafters using a skill-saw.

Any 2: (2 × 5m)

Note (3m), Sketch (2m)

- trained professional /
- all safety guards on machine /
- correct safety equipment worn /
- correct power supply (110v) /
- cables held in safe position /
- all machines regularly serviced and checked / *etc.*

(b) Give **one** reason why **each** safety precaution listed should be observed.

- placing pre-stressed concrete lintels in position;

Any 2: (4m + 3m)

e.g. use of secure scaffolding with all necessary guardrails

- provide safe platform for workers /
- prevent people falling off /
- prevent objects falling to ground that may result to injury to site personnel / *etc.*

e.g. workers properly trained in lifting techniques

- to avoid any unnecessary accidents /
- prevent personnel injury /
- prevent damage caused by lintel being dropped / *etc.*

e.g. two people required to lift

- to ensure even distribution of weight /
- helps to avoid personnel injury / *etc.*

e.g. all necessary safety equipment worn by workers

- gloves to protect hands /
- safety boots to give projection to feet / *etc.*

- using a nail-gun to fix timber battens to a concrete wall;
 - Any 2: **(4m + 3m)**
 - e.g. ensure nail gun is held correctly
 - to prevent backfire from the gun /
 - nails fixed in the correct location /
 - prevent misfire of gun / *etc.*
 - e.g. never point at people
 - gun may fire causing injury to personnel /
 - misfired nail could be fatal if it hit a worker on the site or could cause accident / *etc.*
 - e.g. correct safety equipment used
 - face protection to protect eyes /
 - hard hats, steel toe boots / *etc.*
 - e.g. trained person
 - workers trained in machine use /
 - trained on safety devices on gun / *etc.*
 - e.g. if working on scaffolding ensure it is correctly set up
 - provide safe platform for workers /
 - prevent people falling off / *etc.*
 - e.g. correct power supply
 - use of 110V machines to prevent serious accidents to workers / *etc.*

- cutting roof rafters using a skill-saw.
 - Any 2: **(3m + 3m)**
 - e.g. trained professional
 - workers trained in machine use /
 - trained on safety devices on saw / *etc.*
 - e.g. all safety guards on machine
 - guards designed to protect user while using the saw /
 - help machine to cut timber in a safe manner / *etc.*
 - e.g. correct safety equipment worn
 - ear protection worn to protect ears /
 - face guard to prevent dust getting into eyes of user / *etc.*
 - e.g. correct power supply (110v)
 - use of 110V machines to prevent serious accidents to workers / *etc.*
 - e.g. cables held in safe position
 - to prevent them being cut /
 - avoid people falling over them / *etc.*
 - e.g. all machines regularly serviced and checked
 - regular servicing of machine will help prevent accidents /
 - all guards to be checked to ensure they are working correctly / *etc.*

6. (a) Explain in detail **four** of the following terms as they apply to concrete production: (50)

Any 4: (4 × 11m)

- curing;
 - process of preventing excessive loss of moisture from concrete as it sets /
 - let concrete dry slowly /
 - keep concrete damp for period of time /
 - keep formwork in position for 28 days /
 - keep covered during frosty periods / *etc.*
- formwork;
 - generally made from timber / steel / plastic /
 - holds concrete in place while setting /
 - designed to support concrete /
 - designed to be easily removed and not damage concrete /
 - should be left in position for 28 days / *etc.*
- slump test;
 - used to check water content of batches of concrete /
 - test carried out to ensure the consistent workability and strength of concrete /
 - test also used to check the water/cement ratio of a mix /
 - test carried out using a truncated cone, steel tamping rod, measuring tape and smooth surface /
 - 0-50 mm slump = low workability /
 - 50-75 mm slump = medium workability /
 - test used widely on site to check workability of mix / *etc.*
- water/cement ratio;
 - most important factor influencing the strength of concrete /
 - usually 0.4 to 0.7 /
 - if mix is too dry then cement and aggregate will not set /
 - if mix is too wet then liquid will run off /
 - allowances made for wet/dry aggregates / *etc.*
- batching;
 - method of measuring the correct quantities of materials in a mix /
 - usually done by weight – preferred method as more accurate /
 - can be done by volume /
 - the amount of cement / aggregates and water in a mix determine how strong and durable the mix will be / *etc.*
- reinforced concrete.
 - steel bars / mesh are placed in position and concrete is poured into position /
 - used to increase the tensile strength of a concrete mix /
 - steel is ribbed or twisted to give better bond with concrete /
 - used in floor, lintel, cill, beams, columns, foundation constructing /
 - important that reinforcement is correctly placed to give maximum strength /
 - important that reinforcement is not exposed / *etc.*



- (b) List **two** situations where ready-mixed concrete is usually used in the construction of a new dwelling house.

Any 2: (**2 × 1m**)

- foundations /
- concrete sub floors /
- screeds /
- construction of piers / columns /
- concrete roofs /
- concrete work using formwork / *etc.*

- (c) Outline **two** advantages of using ready-mixed concrete in preference to concrete mixed on site.

Any 2: (**2 × 2m**)

- greater control over quality of mix /
- less storage space required on site to store necessary materials /
- concrete can be placed easily in position by truck or a pump can be used /
- speeds up time to place concrete / *etc.*

7. A family wishing to relocate to a country area is searching for a suitable site to construct a new family dwelling. (50)
- (a) Outline **four** main considerations they should take into account when selecting a suitable site for their new dwelling.

Any 4: (4 × 9m)

Location

- distance from towns, cities, schools, shops and amenities /
- where it is in relation to work /
- what is in the surrounding areas, industries, farms, *etc.* as noise and smells from these may be unknown at the time of purchase / *etc.*

Cost

- is it within budget /
- will its value increase or decrease in future /
- is there availability of workers, contractors, *etc.* in the area / *etc.*

Services

- water availability - council supply or does a well need to be bored /
- electricity - is it available or will you require to have it directed to your site /
- sewage system /
- telephone, transportation, refuse collection, gas supply / *etc.*

Planning permission

- will planning permission be granted /
- are there planning restrictions in the area /
- what is the 5 year development plan for the region / *etc.*

Site

- the size and shape of the site /
- is it sheltered or exposed /
- views /
- type of sub-soil /
- right of ways /
- liable to flood /
- history of surrounding land area / *etc.*

Access

- is it easy to get to the site /
- what is the condition of the surrounding roads /
- safe entry and exit to site from main road /
- is there a local transport system that can be used / *etc.*

Future developments

- what are the plans for the area, *i.e.* new roads, motorways, factories, housing developments / *etc.*

- (b) Describe the purpose of any **two** of the following as they apply in the application of planning permission:

Any 2: (**2 × 7m**)

- newspaper notice;
 - notice must be printed in newspaper circulating within the area /
 - published two weeks prior to the application /
 - planning application must be made within 2 weeks of publication /
 - type of application must be specified in notice /
 - 2 copies sent to planning office with application / *etc.*
- site notice;
 - this is placed on the site seeking planning permission /
 - should be A4 size sheet and positioned in a clear visible position on site /
 - must be set up 2 weeks before making a planning application /
 - left in position 5 weeks after application has been made /
 - damaged signs must be replaced /
 - notice must contain the following:
 - date notice was set up /
 - name of planning authority /
 - type of permission being sought /
 - brief description of proposed development /
 - details where application can be inspected /
 - signature of applicant or agent / *etc.*
- percolation test;
 - test carried out to determine percolating rate of the soil and helps calculate the percolation area /
 - test holes (0.3m × 0.3m × 0.4m) are dug below invert level of percolation pipe /
 - 50 litres water required /
 - hole filled with water up to depth of 300 mm and this is maintained until sub-soil becomes saturated /
 - once soil is saturated time required for water level to drop 100 mm is recorded /
 - the time expressed in minutes divided by the time for the water to drop 25 mm = the percolation value T / *etc.*
- site layout map.
 - this map gives the location of the site /
 - must show the following:
 - outline the site in red /
 - O.S. sheet number /
 - north point /
 - scale of map - 1:2500 /
 - map must be an original copy

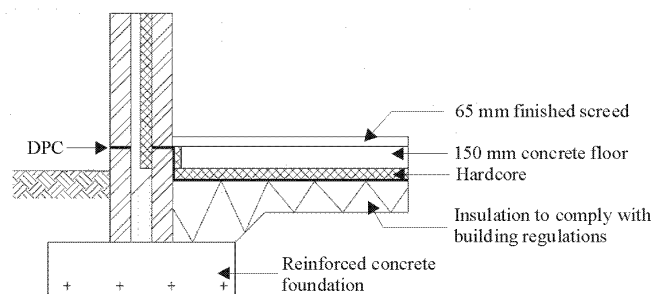
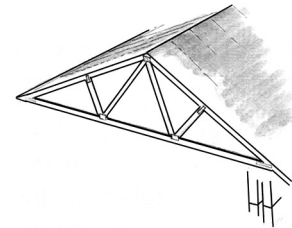
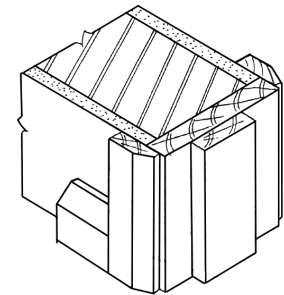
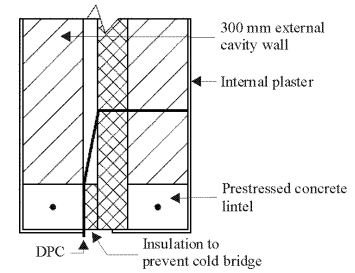
8. Explain, with the aid of notes and *neat freehand sketches*, any **five** of the following:

(50)

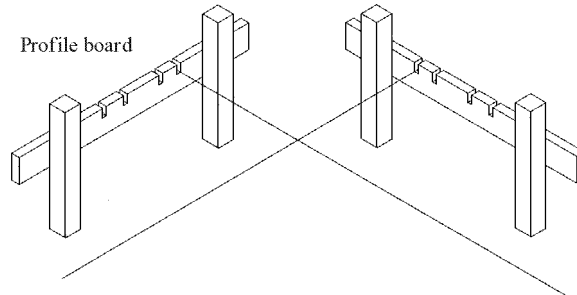
Any 5: (5 × 10m)

Note (5m), Sketch (5m)

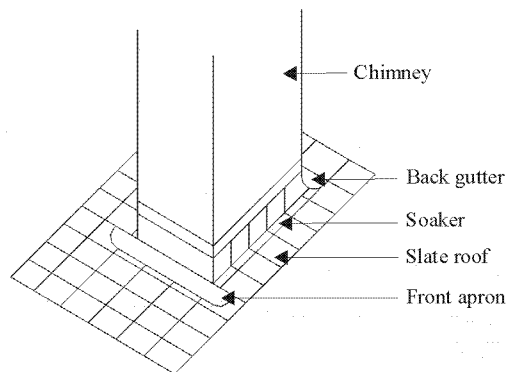
- wall plate;
 - usually placed on block work /
 - 100 × 75 mm normal section /
 - used at eaves to fix rafters in roof work /
 - distributes load from roof to walls /
 - to hold floor joists in position in suspended ground floors /
 - placed on D.P.C. on tassel wall /
 - usually white deal treated with a preservative / *etc.*
- architrave;
 - decorative moulding around door frame /
 - hides joint between door frame and block work /
 - available in hardwood and softwood /
 - usually moulded on a spindle mauling /
 - may be glued, nailed or screwed into position /
 - available in large variety of profiles /
 - normally 100 × 20 mm in section / *etc.*
- truss rafter;
 - assembled in workshop /
 - smaller sections of timber than in cut-roof /
 - lifted into position on site by crane /
 - very quick assembly time /
 - difficult to convert attic space / *etc.*
- hardcore;
 - made up of crushed rock /
 - placed under building to provide stability /
 - compacted in position - layers no more than 225 mm /
 - maximum stone size 100 mm /
 - free from sand, gravel and clay / *etc.*



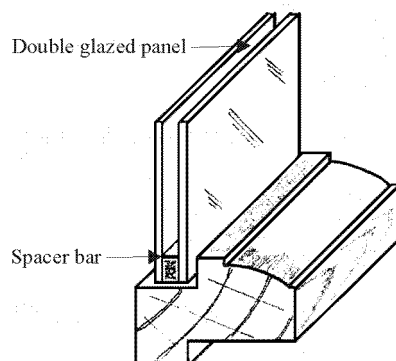
- profile boards;
 - set up around a building before excavation takes place /
 - horizontal pieces of timber attached to legs /
 - indicate the width of foundation and walls on them /
 - placed at all corners and at the end of cross walls /
 - positioned so as not to obstruct excavation work / *etc.*



- soaker;
 - made from coated sheet metal /
 - used to make chimney watertight where it intersects roof /
 - placed along side of chimney /
 - same length as roof tiles /
 - width generally 100 mm /
 - up stand a minimum of 75 mm / *etc.*



- double glazing;
 - consists of double layer of glass /
 - used to prevent heat loss in a building /
 - helps to keep out unwanted noises /
 - gives lower U-value than single glazing /
 - airspace varies from 12 - 20 mm / *etc.*



9. The accompanying sketch shows the wooden front door of a newly constructed dwelling house. (50)

(a) Choose a suitable wood, for the door and give **two** reasons for your choice.

Timber named

Any 1: (2m)

- red deal /
- teak /
- mahogany /
- oak /
- ash

Reason for choice

Any 2: (2 × 4m)

e.g. red deal

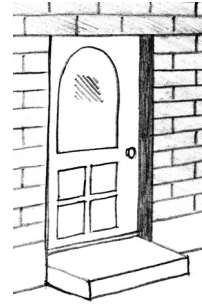
- easy to work, plane and cut /
- provides good finish when painted or varnished /
- reasonably priced /
- strong and stable /
- easily available / *etc.*

e.g. teak

- resistant to moisture and insect attack /
- very stable timber /
- provides a good surface for painting or varnishing /
- it glues and works well /
- hardwood material /
- expensive and becoming scarce and difficult to obtain / *etc.*

e.g. oak

- very resistant to decay /
- very strong and heavy timber /
- provides a good surface for painting or varnishing /
- it glues and works well /
- hardwood material / *etc.*



(b) Explain using notes and **neat freehand sketches**, the steps involved in preparing and painting the new wooden door.

Any 7: (7 × 4m)

- ensure weather conditions are correct (dry, calm day) if painting is done outdoors /
- ensure the wood has a moisture content of less than 18% /
- make sure the surface of the wood is clean, dry and free from dust and dirt /
- a preservative should be applied to protect the wood /
- timber should be sanded to provide smooth surface for paint with all dust removed using a clean cloth and white spirits /
- any knots in the timber should be treated with knotting to prevent resin seeping through the paint /
- fill any cracks or holes with a suitable wood filler, allow to set and sand smooth /
- coat of primer is first applied to the timber and allowed to dry /
- undercoat is applied - 1 or 2 coats may be required - sand lightly between coats /
- apply a coat of gloss paint using a good quality clean paint brush / *etc.*

- (c) List and explain **two** safety precautions that should be observed when preparing and painting the new timber door.

Any 2: **(2 × 6m)**

- work in a well ventilated area /
- have dust extraction on sanders /
- wear protective clothing and dust masks /
- avoid paint coming into contact with skin /
- always work in proper ventilated spraying booth if applying paint by spraying / *etc.*



Dublin Examining Board
Pre-Leaving Certificate Examination, 2009

Construction Studies – Part 1 (Theory)

Higher Level
Marking Scheme (300 marks)

Answer Question 1 and **four** other Questions.

All Questions 60 Marks

1. Shown in the accompanying sketch is a hardwood front door. The door is fixed into a standard 300 mm external block wall with an insulated cavity. The house has a solid concrete ground floor

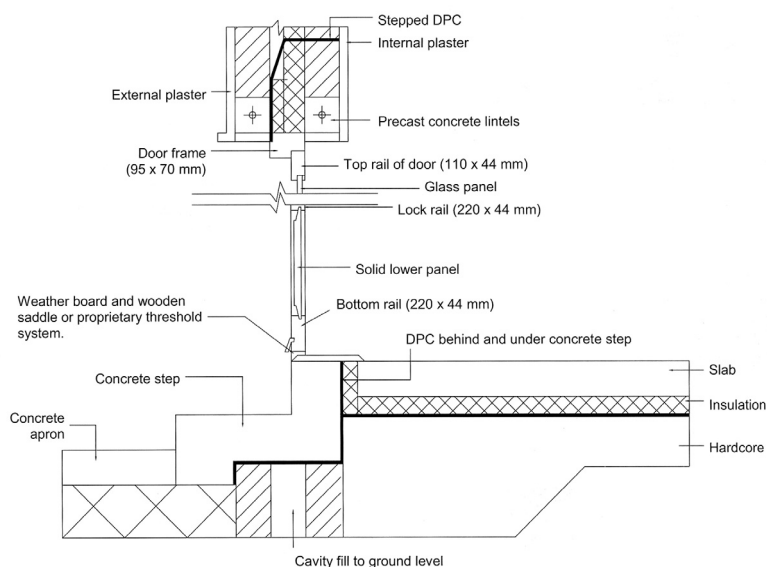
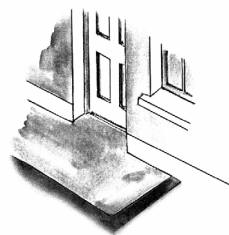
(60)

- (a) To a scale of 1:5, draw a vertical section through the door showing the threshold, door, door frame and head detail. The section should show 300 mm below the bottom of the door and 300 mm above the head of the door.

Any 8: (**8 × 6m**)

Drawing (4m), Draughtsmanship and annotation (2m)

- walls and cavity /
- insulation or inner leaf /
- D.P.C. stepped over lintel /
- lintels /
- door frame and rebate /
- door, top rail / lock rail / bottom rail /
- internal/external plaster /
- panels/glass in door /
- threshold /
- floor D.P.C. and insulation /
- hard core and cavity fill /
- step and D.P.C.



- (b) Indicate clearly on the drawing the specific design detailing that ensures rainwater is removed from the threshold area and does not penetrate to the inner surfaces surrounding the door.

Any 2: **(2 × 6m)**

- correct position of D.P.C. at lintels /
 - threshold /
 - section through jamb and vertical D.P.C. / *etc.*
- ** Accept any other correct detailing.

2. (a) Identify **two** possible risks to personal safety associated with **each** of the following: (60)

(i) carrying out deep excavation on a building site;

Any 2: (2 × 4m)

- risk of people falling into excavation /
- any excavation deeper than 1.25 m deep can cause injury to workers in trench due to collapse /
- deep excavation may cause other structures to collapse if close to them /
- important that all underground services are located before a deep excavation takes place / *etc.*



(ii) erecting scaffolding around a building;

Any 2: (2 × 4m)

- adequate training for all workers involved in erecting scaffolding /
- must have a suitably prepared base for the scaffold to be built on /
- scaffolding must have protective guard rails and toe boards /
- regular inspection must always be carried out on scaffolding /
- safety mesh netting must be provided to protect workers and general public from falling debris /
- braces or ties to be fitted as scaffolding is being erected to keep structure rigid /
- all platforms to be fully boarded /
- structure must be adequately tied to the building /
- protective clothing to be worn by all workers erecting the scaffolding / *etc.*

(iii) applying wood preservatives to timber.

Any 2: (2 × 4m)

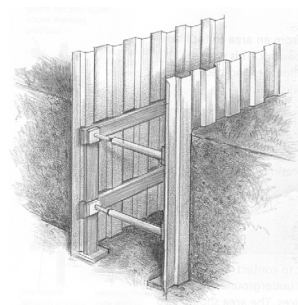
- correct personal safety equipment worn, *i.e.* gloves, mask, suitable clothing /
- work carried out in adequately ventilated area /
- careful storage of preservatives when work is finished /
- always read the safety instructions on the back of the can / *etc.*

(b) Using notes and **freehand sketches**, outline **two** safety procedures that should be observed to eliminate **each** risk identified at (a) above.

(i) carrying out deep excavation on a building site;

Any 2: (2 × 3m)

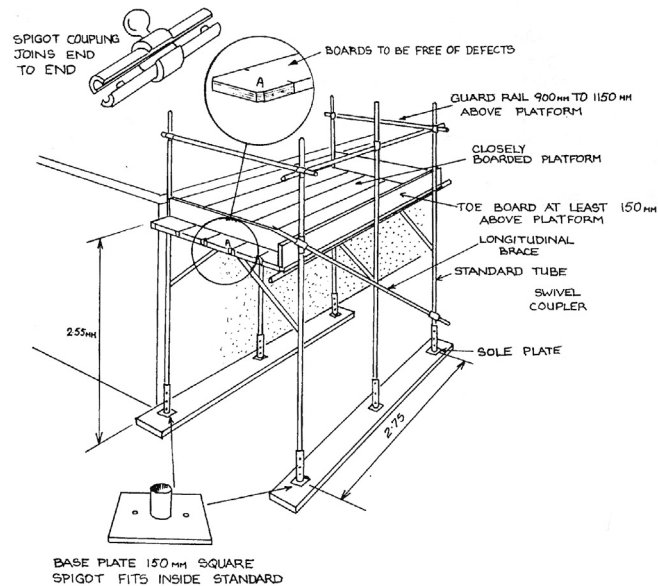
- sides angled back to prevent collapse /
- trench support placed in position /
- proper bracing of structures close by /
- proper warning signs in place /
- area sealed off / *etc.*



(ii) erecting scaffolding around a building;

Any 2: (2 × 3m)

- base plate support /
- tie to building /
- guard rail heights /
- toe board position /
- braces in correct positions /
- proper couplings used / *etc.*



(iii) applying wood preservatives to timber.

Any 2: (2 × 3m)

- ventilated area /
- proper clothing to protect skin /
- mask / personal protection equipment /
- adequate storage of materials / *etc.*

(c) Under Health and Safety guidelines all construction companies must produce a Health and Safety document. Write a brief note outlining **three** guidelines in this document.

Any 3: (3 × 6m)

Outline (2m), Discussion (4m)

- legal document /
- hazard identification and control /
- emergency plans /
- accident planning /
- safe procedures in using machines and plant /
- maintenance and inspection of equipment /
- training procedures /
- safe pass / *etc.*

3. A new double-glazed window is to be fitted into the kitchen of an old house. (60)

(a) Using the following data, calculate the U-value for the new window:

New window: height 1.5 m
length 4.0 m
Glass: double glazing thickness 5 mm
Space between panes width 10 mm

Thermal data of glazing:

- Conductivity of glass (k) 1.02 W/m °C
- Resistance of internal surface of glass (R) 0.12m² °C/W
- Resistance of external surface of glass (R) 0.08m² °C/W
- Resistance of airspace between glass (R) 0.15m² °C/W

Any 6 lines: (6 × 4m)

Layers	Thickness	Conductivity	Formula	Resistance
Units	Metres	W/m °C		m ² °C/W
External Surface				0.08
Glass (outer)	0.005	1.02	T/K	0.0049
Air space				0.15
Glass (inner)	0.005	1.02	T/K	0.0049
Internal Surface				0.12
Total Res				0.3598

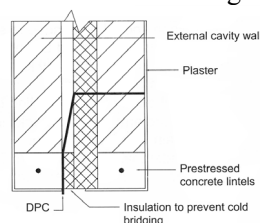
- U-Value (4m)
= 1/Total Resistance
= 1/0.3598
= 2.779 W/m²°C

(b) Calculate the rate of heat loss through the window when there is a difference of 20 degrees between the inside and outside temperatures.

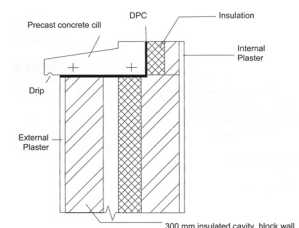
- formula: rate of heat loss = U-Value × Area of Window × Temp Difference (4m)
- U-Value = 2.779 Wm² °C
- Temp Diff = 20°
- Area of Window = 1.5 × 4 = 6 m²
- Rate of heat loss = 2.779 × 20 × 6 (4m)
= 333.48 W (4m)

(c) Using notes and *freehand sketches*, describe correct detailing that would ensure there was no thermal bridge at the:

(i) head of the window; (10m)



(ii) cill of the window. (10m)



4. An oil boiler is used as the heat source to provide hot water and central heating in a two storey house. (60)

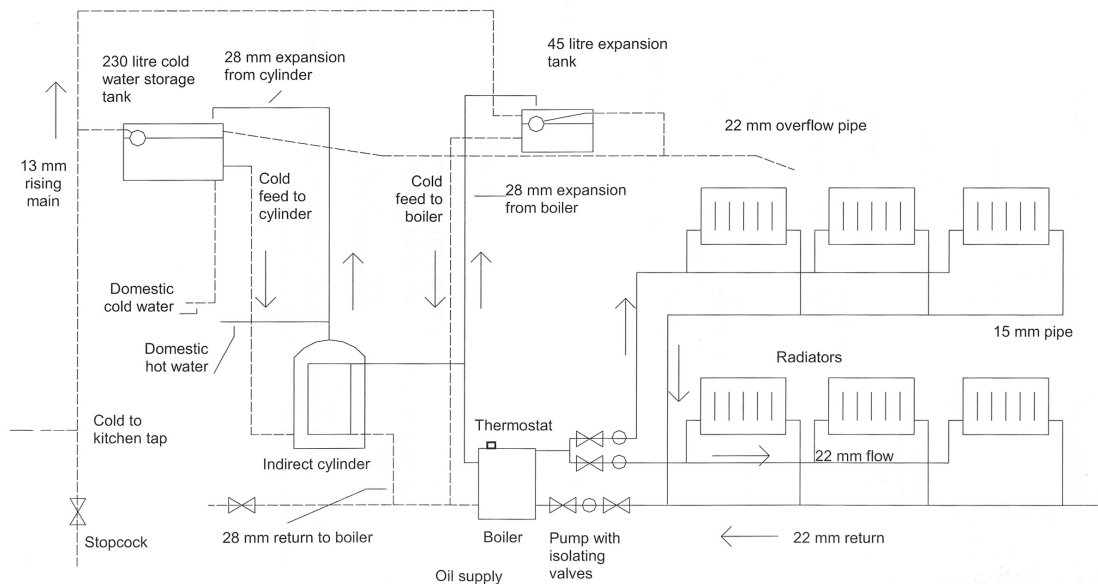
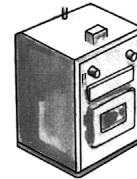
- (a) Using notes and a **single-line diagram**, show a typical pipework layout required to provide heating and hot water in the dwelling. Include **two** radiators on ground floor and **three** radiators on first floor.

Domestic hot water supply

Any 5: (5 × 3m)

Sketch (2m), Annotation (1m)

- rising main /
- ballcock /
- cold water storage tank /
- overflow pipe /
- hot water cylinder /
- primary flow and return /
- boiler /
- hot water draw off /
- expansion pipe



Central heating supply

Any 6: (6 × 3m)

Sketch (2m), Annotation (1m)

- radiators /
- header/expansion tank /
- expansion pipe /
- pipes to radiators /
- return pipes from radiators /
- thermostatic valve /
- lock shield valve /
- gate and drain valve

** Award 3m for quality of sketch.

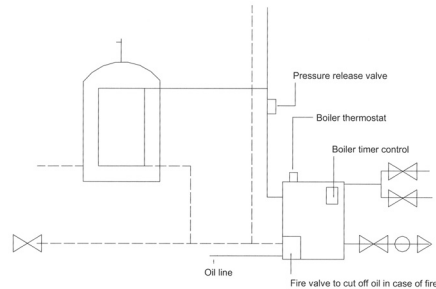
- (b) Indicate on the drawing **three** necessary valves to ensure safe running of the system and write a short note explaining their function.

Any 3: (3 × 4m)

Sketch (2m), Note (2m)

Safety valves

- fire valve to cut off oil supply to the boiler in case of fire /
- thermostat on boiler to cut off heating if temperature gets too high /
- pressure release valve on the primary flow / *etc.*



- (c) Outline **three** design details for a system to ensure economic use of fuel.

Any 3: (3 × 4m)

- allow for different temperatures to be achieved in different zones /
- allow the on and off timing of the heat in a house to be set for the different zones /
- allow zones to be isolated for maintenance without affecting the heating in another zone /
- give more control to householder in heating the house / *etc.*

5. The development of plastic has seen many products of this material used widely in the construction industry today.

(60)

Using notes and *freehand sketches* where appropriate write a detailed note on the following

(i) types of plastic; (**2 × 5m**)

- thermosetting plastics /
 - heat resisting hard plastic /
 - cannot be remoulded /
 - examples: urea, formaldehyde, polyurethane / *etc.*
- thermoplastics /
 - can be repeatedly softened and remoulded /
 - examples: polystyrene, polyvinylchloride (PVC), acrylic sheet / *etc.*

(ii) properties of plastics;

Any 5: (**5 × 4m**)

- very strong and versatile /
- available in large range of colours /
- require very little maintenance /
- weather resistant /
- can be moulded into intricate shapes /
- easily machined, cut and jointed /
- can be made to resist heat and corrosion /
- disposal is difficult / *etc.*

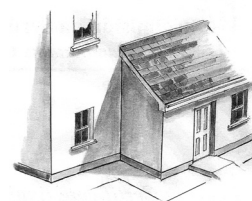
(iii) **five** areas where plastics are used in a new house construction.

Any 5: (**5 × 6m**)

Note (3m), Sketch (3m)

- windows and doors /
 - thermoplastic /
 - uPVC (unplasticised polyvinyl chloride) heated raw material is moulded into sections /
 - available with timber finish /
 - provide excellent draught seals /
 - little maintenance /
 - long life /
 - provide good insulation materials /
 - moulded and shaped to required shapes /
 - draught proof qualities in doors/windows /
 - maintenance free / *etc.*
- bath tubs /
 - thermoplastic /
 - acrylic sheet /
 - moulded to required shape / *etc.*
- foam for thermal insulation materials /
 - thermoplastic /
 - polystyrene /
 - used insulation foam cavity walls / concrete ground floors / *etc.*
- damp proof membrane /
 - thermoplastic /
 - polythene, low density /
 - used in sheet form underground floors as D.P.M. /
 - high density for plastic buckets / *etc.*
- electrical fittings /
 - thermosetting plastic /
 - polyester resins mixed with hardener /
 - used for sockets / light switches / *etc.*
- rigid insulator material /
 - polyurethane /
 - thermosetting plastic /
 - used to insulate water storage tanks /
 - hot water cylinder insulation /
 - used in refrigerators /
 - used in soft form for furniture upholstery and mattresses / *etc.*

6. A new porch 1.7 m wide has been added to the rear of an existing house. The roof is slated/lean-to type and pitched at 30 degrees. The walls of the extension are standard 300 mm concrete block walls with insulated cavity. The walls are rendered on the outside and plastered on the interior. A horizontal ceiling of plasterboard is fitted.



(60)

Draw to a scale of 1:5 a vertical section through the lean-to roof. The section should show:

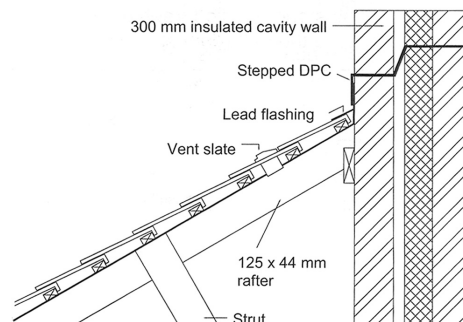
- (i) all construction details from 300 mm below the ceiling joists;

Wall detail

Any 6: (6 × 3m)

Drawing (2m), Annotation (1m)

- external plaster /
- outer leaf 100 mm /
- 40 mm air space /
- 60 mm insulation /
- wall-ties at appropriate centres /
- inner leaf 100 mm blockwork /
- internal plaster

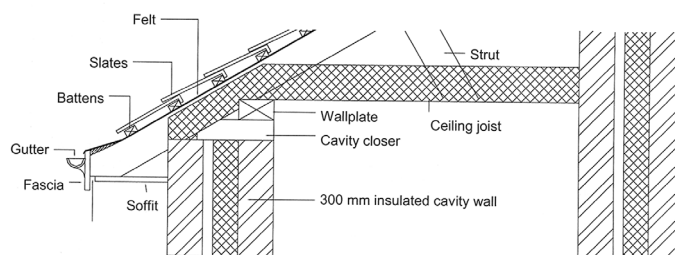


Eaves detail

Any 8 (8 × 3m)

Drawing (2m), Annotation (1m)

- soffit /
- fascia /
- ventilation gap /
- roof vent /
- gutter /
- cavity closer /
- wall plate (100 × 75 mm) /
- ceiling joist (150 × 44 mm) /
- insulation in roof (150 mm) /
- rafter (125 × 44 mm) /
- correct birdsmouth /
- tilting fillet /
- felt /
- slating laths /
- slates



- (ii) all construction details from 300 mm above the abutment.

Any 6: (6 × 3m)

Drawing (2m), Annotation (1m)

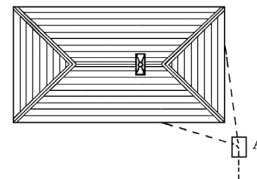
- rafter (125 × 44 mm) /
- underlay felt / slating laths and slates /
- vent tile /
- wall plate bolted to wall /
- lead up-stand /
- lead flashing (overlaps lead up-stand) /
- cavity wall detail /
- insulation in cavity wall

7. A properly designed and constructed sewage system is essential for the safe removal of waste from a domestic house in a rural area. (60)

(a) Describe **three** hazards that could occur if this system is not properly designed.

Any 3: (3 × 7m)

- water pollution to nearby wells, streams, lakes and watercourses if the treatment system is not working correctly /
- the soil has a poor percolation rate /
- the run-off or discharge from the treatment system will cause problems if directed to a watercourse or drain /
- using a septic tank that is not properly constructed could lead to inadequate treatment and disposal of sewage



(b) Using notes and *freehand sketches*, show **three** considerations that should be taken into account when laying sewer pipes to ensure the safe removal of waste from a dwelling.

Any 3: (3 × 7m)

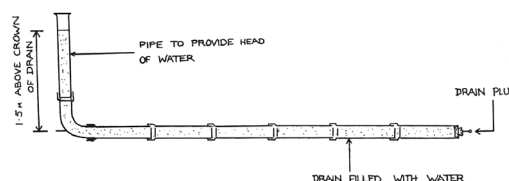
- self venting /
- self cleansing /
- allow ease of inspection /
- pipes laid straight to even gradients between inspection chambers, access junctions and manholes /
- must have adequate access points and roding points for cleaning /
- manholes maximum distance of 90 m apart /
- the system must have adequate ventilation /
- piping normally of uPVC material, usual lengths of 6 m long, easy to join and very strong /
- 100 mm diameter pipes normally used and laid to a gradient of 1 in 40

(c) Using notes and *freehand sketches* outline **two** tests that may be carried out on an underground drainage system to test air-tightness.

Any 2: (2 × 9m)

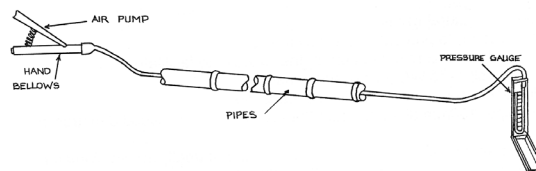
Water test

- one end pipe plugged /
- pipeline and up-stands are filled with water /
- this is maintained for twenty four hours /
- done before backfilling /
- popular and reliable test /
- pressure can be increased by increasing the height of up-stands



Air test

- temporary up-stand pipes with 90° bends are inserted into end of pipe runs /
- one end of pipe is sealed /
- pressure fitted /
- airline and pump connected to other end /
- air pumped into pipe /
- pressure is maintained for three minutes /
- easy test with instant results



Smoke test

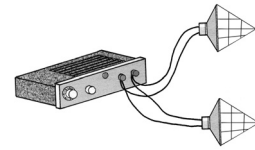
- carried out same way as air test /
- smoke is pumped through pipe before plugging end /
- pressure is maintained /
- pipe observed to see if smoke is escaping /
- test not recommended for uPVC pipework

8.

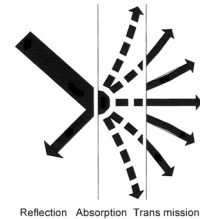
(60)

(a) Using notes and *freehand sketches*, explain the following:

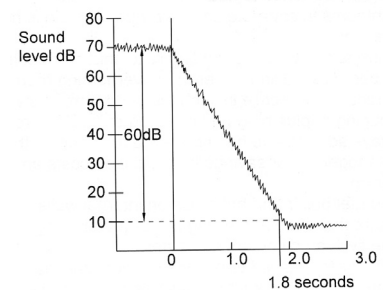
- (i) sound absorption; **(10m)**
- reduction in the sound energy reflected by the surfaces of a room /
 - hard surfaces absorb very little sound /
 - soft surfaces, *e.g.* curtains, carpets absorb much of the sound /
 - sound waves lose intensity as they are absorbed at each reflection



- (ii) sound reflection; **(10m)**
- reflected like light /
 - angle of reflection is equal to angle of incidence of wave /
 - reflecting surfaces in rooms are used to help even distribution of sound and increase the overall sound levels



- (iii) reverberation time. **(10m)**
- the time it takes for a sound to die away /
 - normally taken as 60dB /
 - depends on the nature of the surfaces in a room /
 - reflecting surfaces give a long reverberation time /
 - absorbing surfaces give short reverberation time



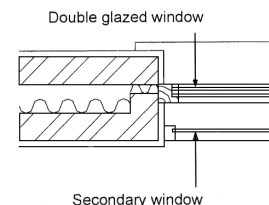
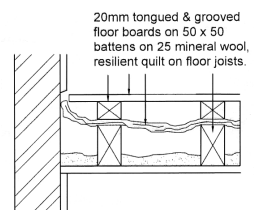
- (b) An upstairs bedroom equipped with a music system is to be renovated. The floor is tongued and grooved flooring supported on timber joists with plasterboard ceiling.

Using notes and *freehand sketches*, show **three** design details that will improve the sound insulation properties of the room.

Any 3: **(3 × 10m)**

Sketch (5m), Note (5m)

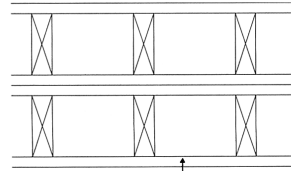
- floor /
 - floor more soundproof by creating a floating floor /
 - resilient material placed on joists and battens placed on top /
 - fibreglass normally used /
 - dry sand plugging may also be used / *etc.*
- walls (external) /
 - new stud wall constructed along existing wall /
 - new wall not touching existing wall /
 - sound resilient material placed in correct position /
 - using of double or triple glazing / *etc.*



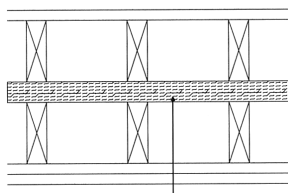
- walls (internal) /
 - solid construction /
 - new stud wall constructed along existing wall /
 - new wall not touching existing wall /
 - sound resilient material placed in correct position /
 - the thicker the studs the greater the sound proofing / *etc.*
 - stud partition walls /
 - fix second layer of plasterboard to existing plasterboard /
 - attach new stud partition to existing stud partition / *etc.*



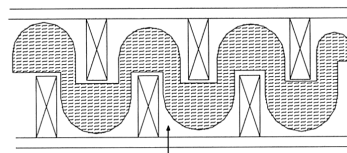
Fix a second layer of plasterboard to the existing plasterboard and stagger the joints



Attach a new stud partition to the existing stud partition

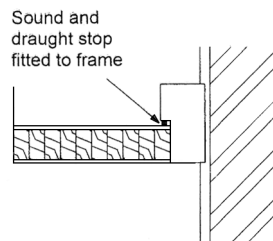


Create a double stud partition with a cavity and insulation separating the two partitions

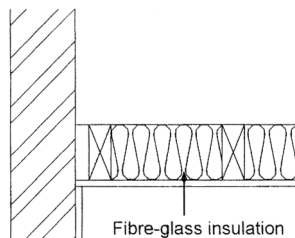


Create a staggered stud partition with sound insulating material between the studs

- doors /
 - fit a solid door /
 - fit with draught/sound stoppers /
 - good frame and saddle / *etc.*



- ceiling /
 - prevent sound travelling through ceiling space /
 - necessary to place 200 mm insulation / fibreglass /
 - place insulation between and on top of ceiling joists / *etc.*



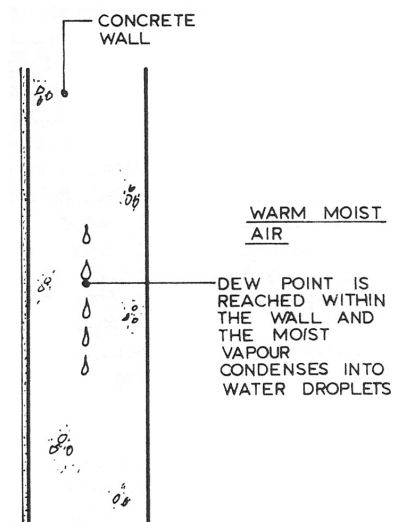
Fibre-glass insulation between joists

9. Recent research has indicated that condensation is a greater problem in modern houses than in houses built more than twenty years ago. (60)

(a) Explain what is meant by each of the following terms; (3 × 8m)

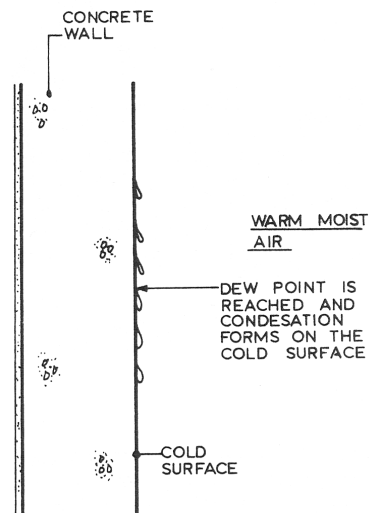
(i) interstitial condensation;

- condensation developing within the structure of the wall / roof /
- migration of water vapour through the building envelope /
- by diffusion or air leakage / *etc.*



(ii) surface condensation;

- occurs on inner surface of solid walls /
- warm moist air comes in contact with cold surface /
- wall acts as cold bridge /
- occurs mainly in kitchens and bathrooms / *etc.*



(iii) dew point.

- the temperature that a sample of air becomes saturated /
- the higher the vapour pressure the higher the moisture content /
- warm air holds more moisture / *etc.*

- (b) Outline the main causes of condensation in a building. Using notes and *freehand sketches*, outline the measures that should be taken to prevent condensation occurring.

Causes of condensation

Any 4: (3 × 4m)

- occurs when warm moist air meets surfaces below the dew point of the air /
- moisture sources /
- air temperatures /
- structural temperatures /
- ventilation /
- use of the building /
- older houses incorporated fireplaces for heating - these provided a ventilation source /
- modern windows and doors have hindered ventilation by being air-tight /
- buildings are occupied for shorter periods /
- air not getting chance to change in modern heated dwellings /
- 2-3 air changes per hour recommended for health purposes /
- 5 air changes per hour recommended for rooms with fire / *etc.*

To eliminate condensation

Any 4: (4 × 6m)

- difficult to fully eliminate /
- ensure adequate insulation in walls, roof space and floors at construction stage /
- ensure adequate ventilation in building, especially in kitchen area /
- vapour barriers should be used in walls and ceilings /
- surfaces may be painted with anti-condensation paint / *etc.*

10. A building of architectural merit is threatened with destruction to facilitate the construction of a ring road around a small village. (60)

(a) What arguments might be presented in favour of:

(i) preservation of the old building;

Any 5: (5 × 4m)

- building may have preservation order /
- building could be the focal point in the village /
- by-pass of village could kill off local industries living off passing trade /
- local wildlife could be damaged with construction of motorway /
- faster flow of traffic could lead to more serious accidents



(ii) construction of new motorway?

Any 5: (5 × 4m)

- improve living conditions in the village /
- less traffic on street /
- safer for locals /
- local business could improve as now more parking available on streets /
- motorways safer places to drive /
- saving fuel usage

(b) Make a recommendation to the planning authority on this proposal and give **three** reasons in support of your recommendation. (20m)

Recommendation (5m), Reasons (3 × 5m)

e.g. In support of proposal

- new motorway constructed and designed to provide easy and safe access into the village /
 - new layout will give the village back to locals /
 - less traffic in the village streets could help local business /
 - care to be given to local wildlife with constructing of motorway /
 - new motorway could lead to more people moving into the village area
- ** Can agree or disagree with proposal.

OR

10.

(60)

“The centres of cities and towns have been subject to depopulation, with a consequent fraying of the urban fabric. The trend towards less intensive urban patterns together with the increasing separation between home, work and town centre have exacerbated the growth in private car transport. This has led to increased energy use and emissions of air pollutants and has mitigated against the effectiveness of the public transport networks.

Ireland's Environment, 2004
Environmental Protection Agency (epa);

Discuss in detail the above statement and outline **three** recommendations to the planning authorities that would aid the renewal of the centres of cities and towns.

Discuss

Any 6: (6 × 6m)

- where we live is important /
- fashionable to move to suburbs, bigger houses and gardens /
- city centres associated with poverty and crime /
- increase in use of private cars to get people to work /
- children driven to schools means more cars on our roads, more use of fuels /
- depopulation of cities leads to closing of local facilities, *e.g.* libraries, leisure facilities, *etc.* /
- lead to urban decay, loss of traditional character /
- city centres become associated with trading only

Outline **three** recommendations

Any 3: (3 × 8m)

- challenge to develop cultural change, to transform the way we live and our dependence on cars /
- need to re-educate people in their attitudes /
- encourage the integration of dwellings and business /
- need to rediscover the charm of living in city / town centre /
- provide local active social areas, make areas child friendly /
- provision of cycle lanes, pedestrianised areas, car free areas /
- plan mixed dwellings in towns and city centres /
- provide incentives to bring people and business together

