



$$e = mc^2$$



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Pre-Leaving Certificate Examination, 2010

Construction Studies

– Part 1 (Theory)

Marking Scheme

Ordinary Pg. 2

Higher Pg. 15

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Dublin Examining Board

Pre-Leaving Certificate Examination, 2010

Construction Studies – Part 1 (Theory)

Ordinary Level Marking Scheme (200 marks)

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

All Questions 50 Marks

1. This sketch shows a double-glazed, outward opening, hardwood window fitted in a cavity wall of a new building. The wall is a 350 mm concrete block external wall with an insulated cavity of 100 mm. The wall is plastered on both sides.



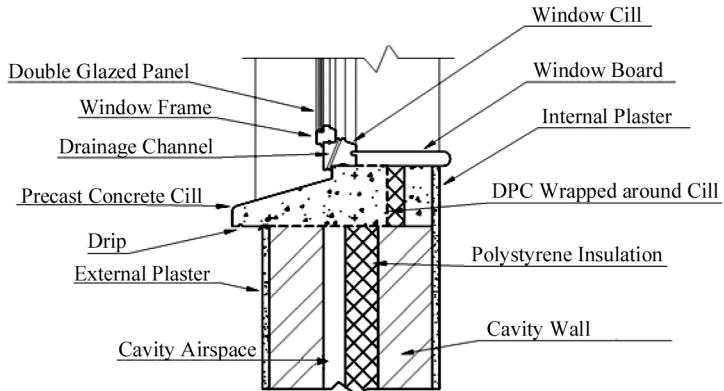
(50)

- (a) To a scale of 1:5, draw a vertical section through the cill detail of the window. Show all the construction details from 300 mm below to 200 mm above the concrete cill.

Construction details

Any 9: (9 × 4m)

- external plaster 19 mm //
- outer leaf 100 mm //
- cavity air space 50 mm //
- insulation 100 mm //
- inner leaf 100 mm //
- internal plaster 13 mm //
- DPC wrapped around cill //
- precast concrete cill //
- throating //
- concrete backfill //
- window cill //
- double glazing //
- window board //
- cavity closed with proprietary cavity barrier //
- insulation at back of cill (prevent cold bridge) // etc.



Scale (4m), Draughtsmanship (4m)

- (b) Indicate on your drawing **one** design detail that would prevent the cold-bridge effect at the window cill.

Any 1: (6m)

- DPC wrapped around cill //
- insulation in position to prevent cold bridge // etc.



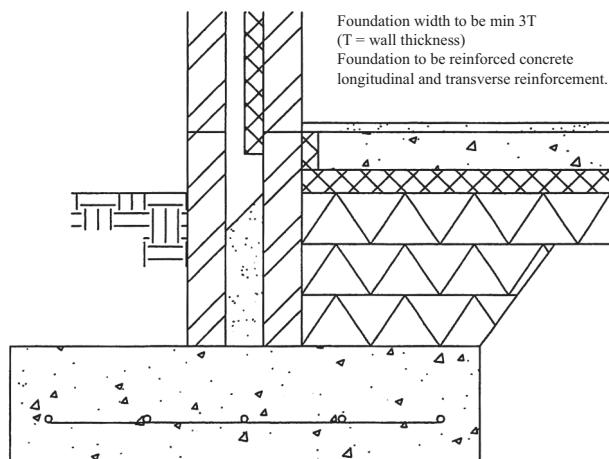
2. A soil investigation carried out on a new site for a domestic house indicates that the soil has loose particles of low bearing capacity. Consideration is being given to using either a wide strip foundation or raft foundation. (50)

- (a) Show, using notes and ***neat freehand sketches***, the design details for these **two** types of foundations.

- wide strip foundations

Note (8m), Sketch (8m)

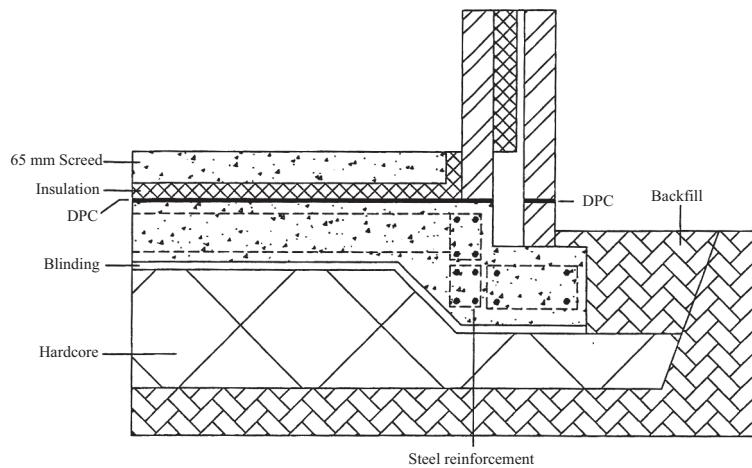
- width of foundation (1200 cm) //
- depth below ground level //
- reinforcement in correct position //
- end of bars turned up in concrete // etc.



- raft foundations

Note (8m), Sketch (8m)

- 200 mm / 400 mm concrete reinforced slab over required area //
- slab deepened under walls to give support //
- contains a lot of reinforcement // etc.



(b) Recommend **one** of these foundations and give **one** reason for your choice.

Any 1: **(2m)**

- wide strip foundations

Any 1: **(4m)**

- used when load bearing capacity of soil is low //
- reinforcement bars are placed in concrete //
- require less excavation than traditional strip foundation // etc.

- raft foundations

- used in ground liable to subsidence //

- load spread evenly over entire site //

- reinforcement reduces possibility of differential settlement //

- shallower excavation required //

- easy to set out and construct // etc.

(c) Outline **three** safety considerations to be taken into account when excavating trenches for foundations in this soil type.

Any 3: **(3 × 4m)**

- support required for trench //
- proper clothing and safety equipment to be worn by all building personnel //
- all workers to have received proper training and supervision //
- all support work carried out by qualified personnel //
- all machinery kept back from edges of trench // etc.



3. (a) Using a **single-line labelled diagram**, sketch a system to supply hot water to a wash-hand basin, as shown in the accompanying sketch.

(50)

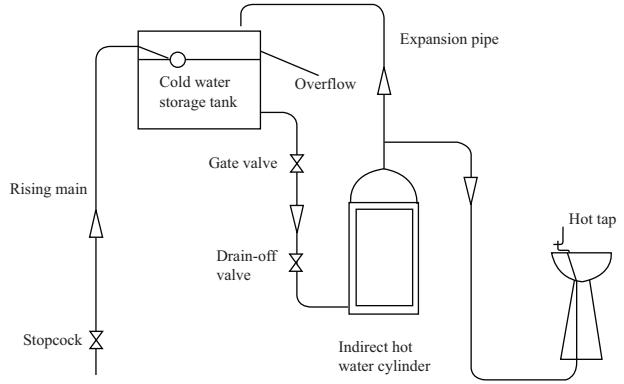
Include the following in the diagram:

- hot water cylinder
- water storage tank
- all pipe work
- all necessary valves.



Labels

- Any 8: (8 × 4m)
- rising main 12 mm //
 - stopcock //
 - ballcock and valve //
 - water storage tank //
 - overflow 28 mm //
 - gate valve //
 - cold feed 22 mm //
 - drain-off valve //
 - expansion pipe //
 - indirect hot water cylinder //
 - connection to WHB // etc.



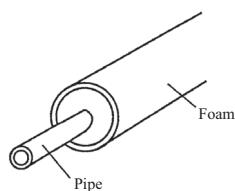
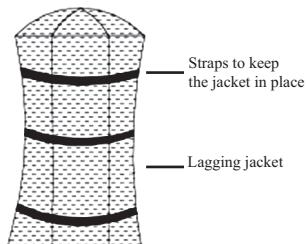
** Award maximum of 2 marks if included but not labelled.

Sketch quality (8m)

- (b) Using notes and **neat freehand sketches**, show **one** method of preventing heat loss from the hot water system. (10m)

Note (5m), Sketch (5m)

- insulate pipes //
- have short runs //
- insulate the hot water cylinder //
- use pre-insulated hot water cylinder //
- use zoned heating // etc.



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

- placing fibreglass insulation in an attic space between ceiling joists

Any 2: (2 × 5m)

Note (3m), Sketch (2m)

- always wear gloves and protective clothing //
- wear dust mask //
- make sure area is well lit //
- make sure that the access to the attic space is secure and safe //
- adequate walking boards provided in the loft area // etc.

- using a pillar drill in the Construction Studies room

Any 2: (2 × 5m)

Note (3m), Sketch (2m)

- trained person //
- all necessary safety equipment worn //
- all guards to be fitted on the machine //
- machine set to correct speed for job //
- correct power supply connected to the machine // etc.

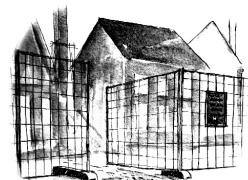
- erection of scaffold.

Any 2: (2 × 5m)

Note (3m), Sketch (2m)

- adequate training provided for all workers involved in erecting scaffolding //
- scaffold must be built on an suitable level base //
- regular inspection on scaffolding to be carried out //
- structure to be adequately tied to building //
- all platforms to be fully boarded //
- protective guard rails / toe boards fitted //
- structure to be fitted with braces and ties to keep rigid //
- all workers must wear necessary protective clothing // etc.

(b) List **four** items of personal protection equipment that should be worn by all construction workers and discuss the importance of **each** item for personal safety.



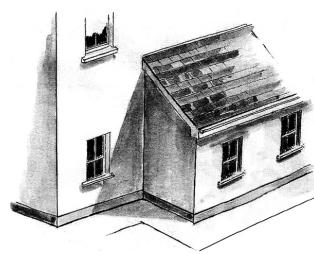
Items (4 × 2m)

Importance (4 × 3m)

Any 4:

- | | |
|------------------------------|--|
| - safety helmets // | - protect wearer from falling objects // |
| - goggles // | - protect wearer if they fall and hit their head // etc. |
| - high-visibility jackets // | - protect eyes when using power tools on site // |
| - ear muffs // | - prevent damage to eyes // etc. |
| - steel-toed boots // | - help workers to be seen // |
| - gloves // etc. | - identify workers on a building site // etc. |
| | - protect feet if objects fall on them // etc. |
| | - prevent injury when handling timbers etc. // |
| | - give protection to workers' hands // etc. |

5. A small utility room extension has been built onto a dwelling house as shown in the accompanying sketch. The external wall is 350 mm concrete block wall with a 150 mm cavity. There is 100 mm rigid insulation fixed in the cavity. The wall is plastered on both sides. The floor is solid concrete finished with a screed. The walls are supported on a strip foundation 1050 mm wide.



(50)

To a scale of 1:5, draw a vertical section through the external wall and the floor detail. Show all the construction details from the bottom of the foundation to 300 mm above the finished floor screed.

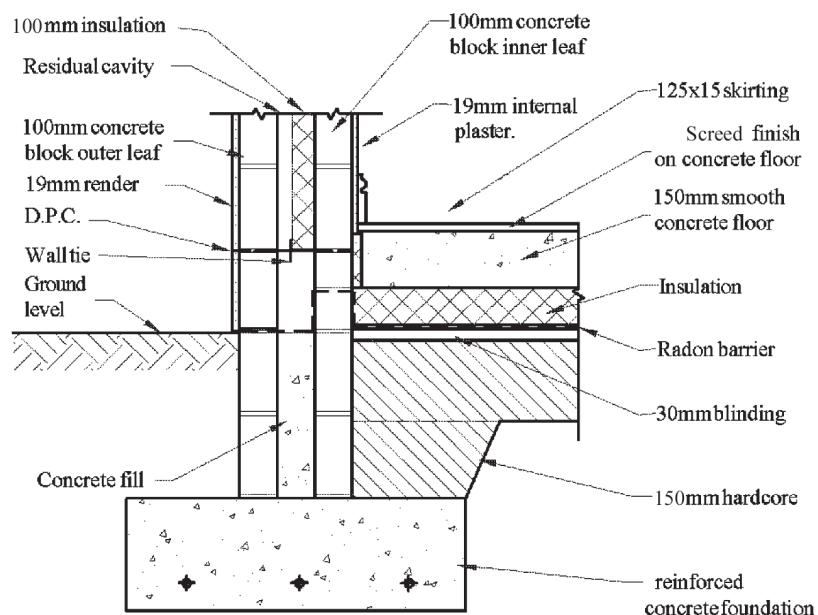
Construction details

Any 11: (11 × 4m)

Note (2m), Sketch (2m)

- screed //
- flexible sealant between wall and floor //
- concrete slab 150 mm //
- insulation 100 mm //
- DPM / radon barrier //
- hardcore 150 mm //
- blinding //
- external plaster //
- outer leaf 100 mm //
- cavity 50 mm //
- rigid insulation 100 mm //
- inner leaf 100 mm //
- internal plaster //
- D.P.C. in wall //
- cavity fill //
- strip foundation // etc.

Scale (3m), Draughtsmanship (3m)



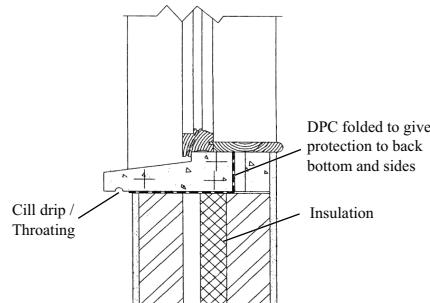
6. If correct detailing is not used at the construction stage of a building it can lead to damp penetration.

(50)

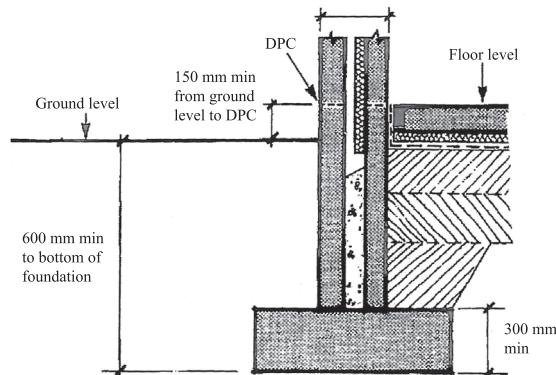
- (a) Using notes and ***neat freehand sketches***, show correct detailing at the following locations to overcome this problem.

- window cill
- cavity wall construction
- head of a window
- suspended ground floors.

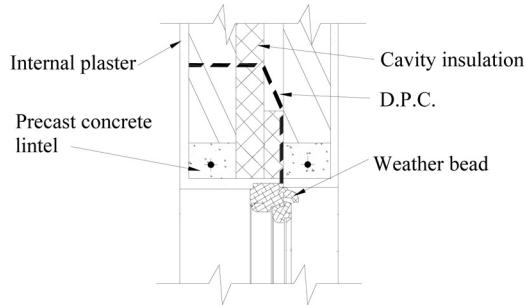
- cill of a window **(10m)**
Note (4m), Sketch (6m)
 - DPC wrapped around cill // etc.



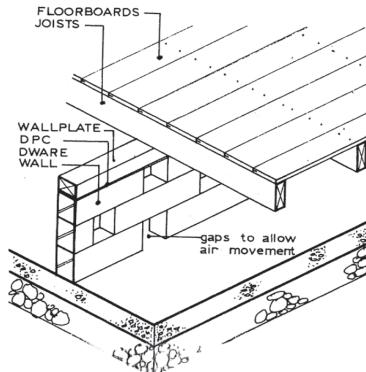
- cavity wall construction. **(10m)**
Note (4m), Sketch (6m)
 - DPC in correct position //
 - 150 mm minimum above ground //
 - 225 maximum above ground // etc.



- head of a window (**10m**)
Note (4m), Sketch (6m)
 - stepped DPC //
 - higher on internal leaf // etc.



- suspended ground floors (**10m**)
Note (4m), Sketch (6m)
 - DPC placed in correct position // etc.



- (b)** Name **two** materials commonly used to prevent damp penetration in a building.
State where they are used.

Name ($2 \times 3m$)

Use ($2 \times 2m$)

- plastic DPC //
 - head and cill of windows / walls // etc.
- lead DPC // etc.
 - in roofs //
 - flashing details in valleys / chimneys / abutments // etc.

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

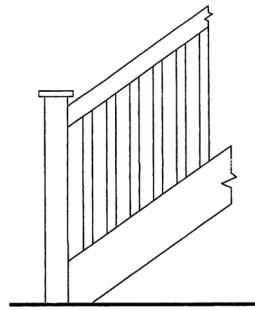
(50)

Any 5: (**5 × 10m**)

Note (5m), Sketch (5m)

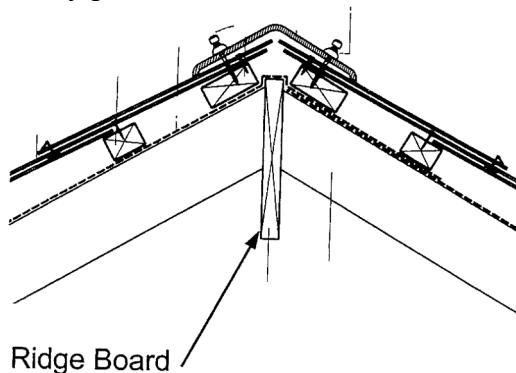
- newel post

- post at the end of a flight of stairs //
- it supports the handrail and string //
- normally made from timber //
- may be decorative in appearance //
- normally 100 mm × 100 mm // etc.



- ridge board

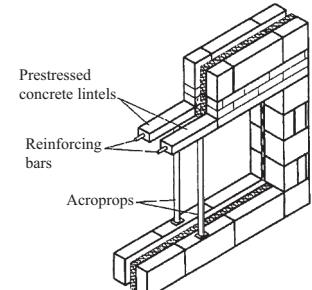
- it is the horizontal member at the top of the roof //
- the top of the rafters are fixed //
- generally made of softwood and treated with a preservative //
- size varies from 150 mm-175 mm wide and 25 mm-40 mm thick //
- supported at ends by gable ends // etc.



Ridge Board

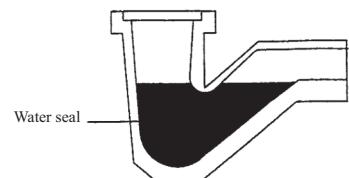
- prestressed concrete lintel

- used to span window and door openings //
- provides support for brick / block work //
- available in various sizes //
- can be ready made to any sizes //
- speeds up the construction work //
- reinforcement bars are stretched during manufacture // etc.

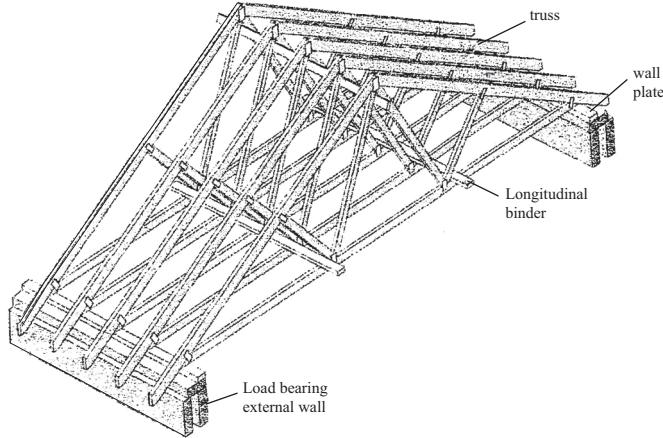


- gully trap

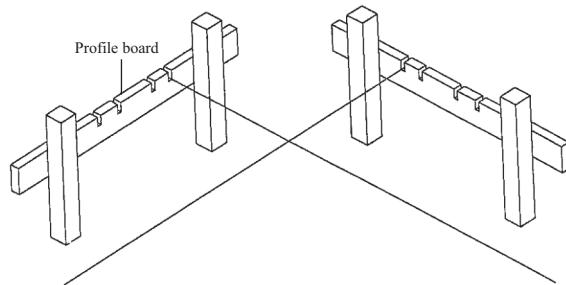
- all waste outlets discharge into a gully trap //
- contains water seal to prevent foul smells back into the building //
- also prevents vermin entry into the building //
- fitted to the head of a drain that takes rainwater or waste // etc.



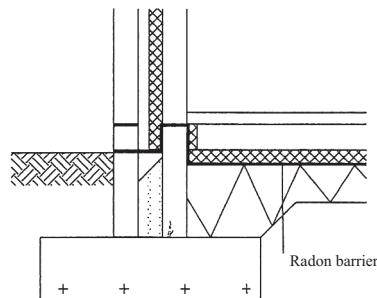
- truss rafter
 - assembled in workshop //
 - smaller sections of timber than in cut-roof construction //
 - lifted into position on site by crane //
 - very quick assemble time //
 - difficult to convert attic space // etc.



- profile boards
 - profile consists of a timber horizontal rail fixed to two vertical posts, that are fitted into the ground //
 - used to mark the position and the width of the foundation trenches //
 - they also show the width of the walls //
 - profiles are set up clear of the trenches so as not to obstruct excavation work //
 - placed at all corners and at the end of cross walls // etc.

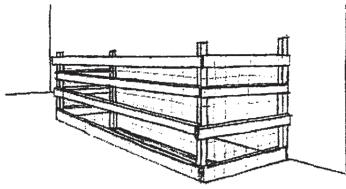


- radon barrier.
 - prevents radon gas entering the building //
 - it also acts as a damp-proof membrane //
 - usually installed by a specialist //
 - the membrane must be continuous and correctly taped and joined //
 - laid over total floor area // etc.



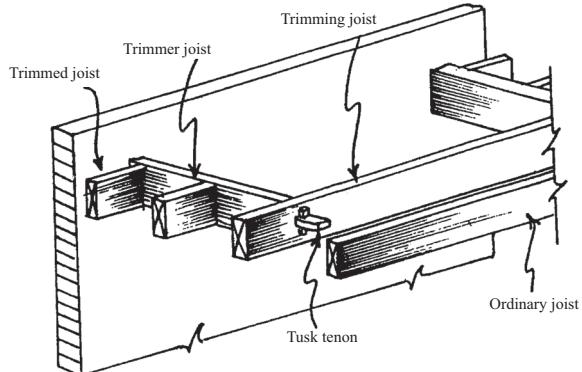
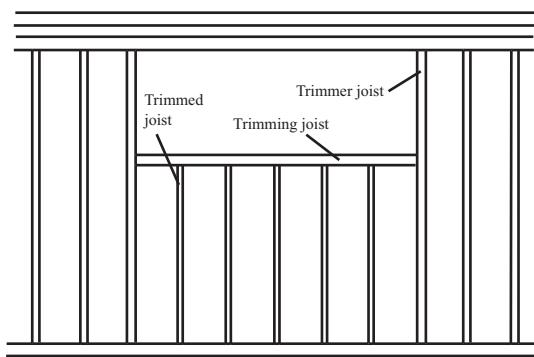
8. Shown in the sketch is an opening in a first floor to accommodate stairs. (50)

- (a) Using notes and ***neat freehand sketches***, explain the layout of joists for an opening in an upper floor to accommodate a stairwell. The stairwell is located along an external wall of the house.



Include the following in your sketch:

- trimming joist
 - trimmer joist
 - trimmed joist
 - ceiling joist.
- good sketch of joist layout (**10m**)
 - trimmer joist shown and labelled (**3m**)
 - trimmed joist shown and labelled (**3m**)
 - trimming joist shown and labelled (**3m**)
 - flooring joists shown and labelled (**3m**)

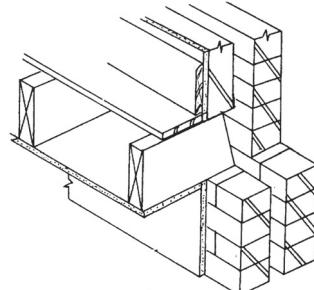
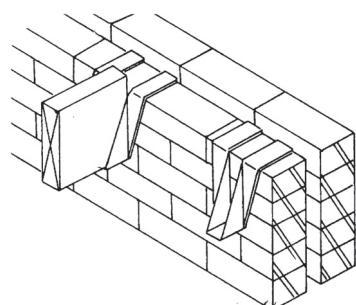


- (b) Using notes and ***neat freehand sketches***, show **two** methods of supporting the ends of the joists at an external cavity block wall.

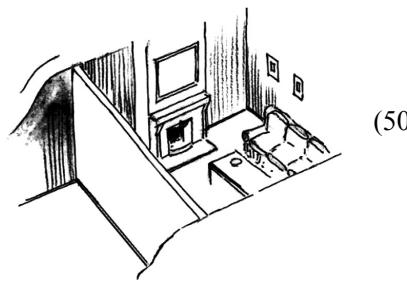
Any 2: (**2 × 14m**)

Note (8m), Sketch (6m)

- galvanised steel joist hangers //
- used to support the ends of joists where they abut the wall
- joist hangers are placed in position when the blockwork reaches required level
- ensure that all are level
- the hangers are nailed to the joists using galvanised twist nails // etc.
- building them into the walls // etc.
- they must have at least 90 mm bearing on the wall
- ensure that they do not project into the cavity
- treat the ends of the joists with preservative // etc.



9. A large room in a dwelling is to be subdivided to make two smaller rooms by constructing a non load-bearing timber stud partition as shown on the accompanying sketch. The partition will be finished with plasterboard on both sides.



- (a) Using notes and ***neat freehand sketches***, describe the construction of the stud partition. Indicate on your sketches the name and sizes of the component parts.

Description (14m)

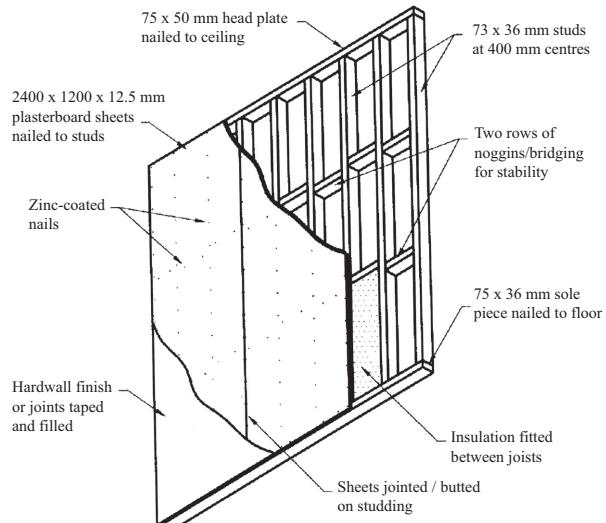
- stud partitions consist of a layer of plasterboard nailed or screwed to timber studs
- studs centred at 400 centres
- studding normally 75 mm x 50 mm
- noggin placed between studs to make structure more rigid
- services can be fitted in partition
- plasterboard is fixed using screws or galvanized or coated nails
- care required not to damage plasterboard
- plasterboard joints staggered
- fibreglass can be fitted between studding to improve thermal qualities // etc.

Component parts

Any 8: (8 × 2m)

- size / centres for components //
- head of partition //
- sole plate //
- studs //
- noggin //
- insulation //
- plasterboard //
- joint taping //
- hardwall finish //
- skirting board // etc.

Sketch quality (8m)



- (b) Describe **one** method of providing a surface finish to the plasterboard prior to painting.

Description (12m)

- plasterboard fixed in position using nails / screws
- reinforce all internal corners with 90 mm jute scrim / tape and fill
- tape and fill all nail holes
- apply joint filler to all holes
- plasterboard jointing taped
- smooth off filler and finish with sponge
- skim coat plaster using steel float, giving a smooth finish
- surface allowed to dry before painting // etc.

Notes:





Dublin Examining Board

Pre-Leaving Certificate Examination, 2010

Construction Studies – Part 1 (Theory)

Higher Level Marking Scheme (300 marks)

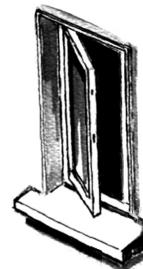
Answer Question 1 and **four** other Questions.

All Questions 60 Marks

1. This sketch shows a double-glazed hardwood window fitted in a cavity wall of a new building. The wall is 350 mm concrete block external wall with an insulated cavity. The wall is plastered on both sides. (60)

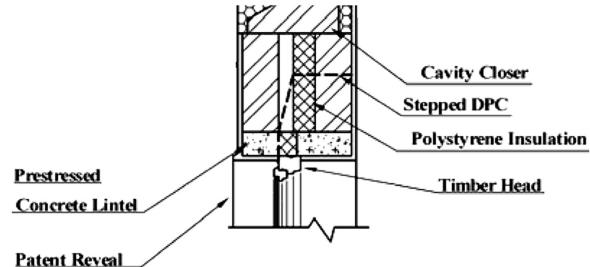
- (a) To a scale of 1:5, draw a vertical section through the wall, showing the head and cill detail for the double-glazed window. Include **four** typical dimensions on your drawing.

Any 12: (10 × 4m)
Drawing (3m), Notation (1m)



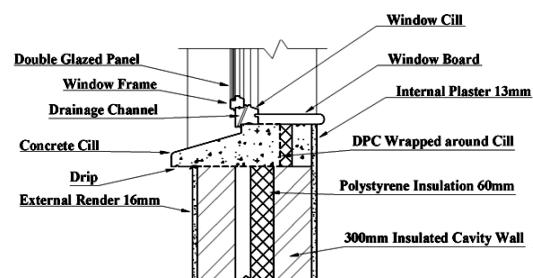
Head detail

- pre-stressed concrete lintel //
- stepped DPC //
- cavity closed with insulation //
- window frame in position //
- cavity wall construction // etc.



Cill detail

- concrete cill //
- DPC in correct location //
- drip on cill //
- insulation at back of cill //
- infill //
- external / internal plaster //
- outer leaf //
- 50 mm air space //
- 100 mm insulation //
- wall ties at correct centres //
- cavity closed with proprietary cavity barrier //
- window section //
- window board // etc.

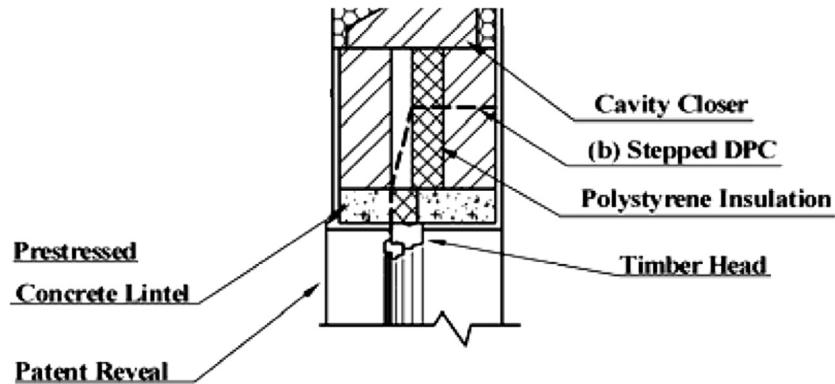


Scale (5m), Draughtsmanship (5m)

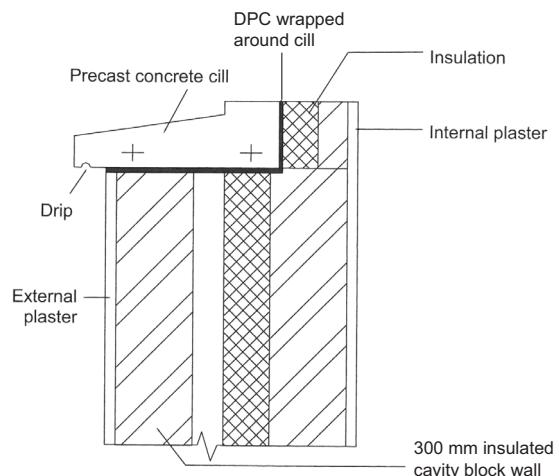


- (b)** Indicate clearly on your drawing the design detailing which ensures that moisture does not penetrate to the inner wall. (**2 × 5m**)

- stepped DPC and insulation //



- wrap around DPC and insulation // etc.



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

(60)

- Erecting a scaffold around a building
 - Tiling a pitched roof on a new building
 - Working around a stairwell on an upper floor before the stairs is fitted.
- Erecting a scaffold around a building
 - Any 2: **(2 × 4m)**
 - collapse due to instability, scaffolding placed on a soft or uneven surface, or inadequate bracing / ties //
 - risk of a fall due to inadequate guard rails, missing or loose boards //
 - incorrect use of scaffolding, *i.e.* overloading with building materials such as blocks / brick //
 - failure to tie ladders to the scaffolding, increasing the risk of a fall //
 - risk of object falling from scaffold onto workers // etc.
- Tiling a pitched roof on a new building
 - Any 2: **(2 × 4m)**
 - risk of falling from a height //
 - risk of items falling from roof onto the ground //
 - weather conditions when working from a height //
 - risk of slipping on wet surface //
 - risk of falling through the roof // etc.
- Working around a stairwell on an upper floor before the stairs is fitted.
 - Any 2: **(2 × 4m)**
 - risk of falling through the stairwell opening //
 - building items and debris falling through the opening //
 - risk of falling if unguarded // etc.

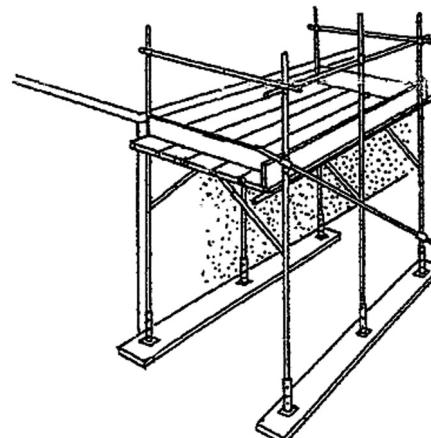


- (b)** Using notes and ***freehand sketches***, outline **two** safety precautions that should be observed to eliminate **each** risk identified at **(a)** above.

- Erecting a scaffold around a building

Any 2: **(2 × 4m)**

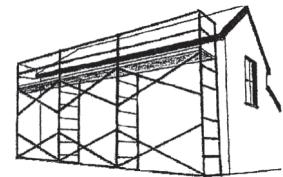
 - suitably prepared base for the scaffold to be built on //
 - braces or ties to be fitted as scaffolding is being erected to keep structure rigid //
 - all platforms to be fully boarded //
 - structure must be adequately tied to the building //
 - toe board position //
 - heights guard rails //
 - safety mesh netting must be provided to protect workers and general public from falling debris //
 - braces in correct positions //
 - proper couplings used // etc.



- Tiling a pitched roof on a new building

Any 2: **(2 × 4m)**

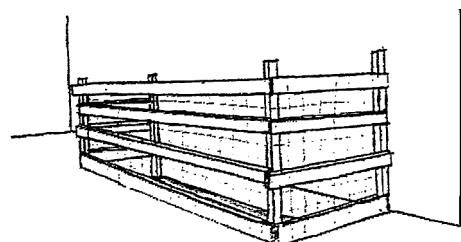
 - secured platform at eaves to provide access to the roof //
 - toe boards and netting provided to prevent risk of tools or tiles falling off //
 - proper roofing ladders and crawling boards must be used to access the roof //
 - correct safety clothing worn by workers, rubber-soled shoes provide better grip //
 - workers fitted with a safety harness // etc.



- Working around a stairwell on an upper floor before the stairs is fitted.

Any 2: **(2 × 4m)**

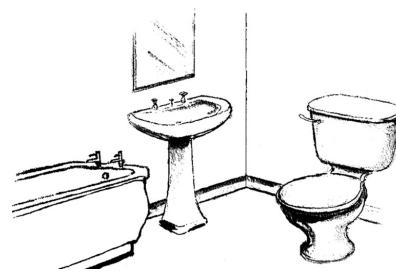
 - provide warning signs around danger //
 - guard rail to be fitted around the opening //
 - use of netting and toe boards to prevent items falling through opening // etc.



- (c)** Working on a building site has many dangers attached. Outline **three** strategies that could help to encourage safe working practices by workers on a building site.

- Any 3: **(3 × 4m)****
- regular on-site training in safety procedures //
 - regular maintenance of equipment //
 - regular maintenance of tools / plant //
 - regular safety inspections //
 - personal safety equipment to be worn at all times // etc.

3. (a) Draw a neat ***single-line diagram***, of a cold water distribution system for a two-story house. The diagram should include mains supply, kitchen sink and upstairs bathroom consisting of water closet, wash-hand basin and bath. Include in your diagram all necessary valves and suggest suitable sizes for all pipe work.



(60)

Labelled components (6 × 3m)

Sizes (6 × 3m)

Any 6:

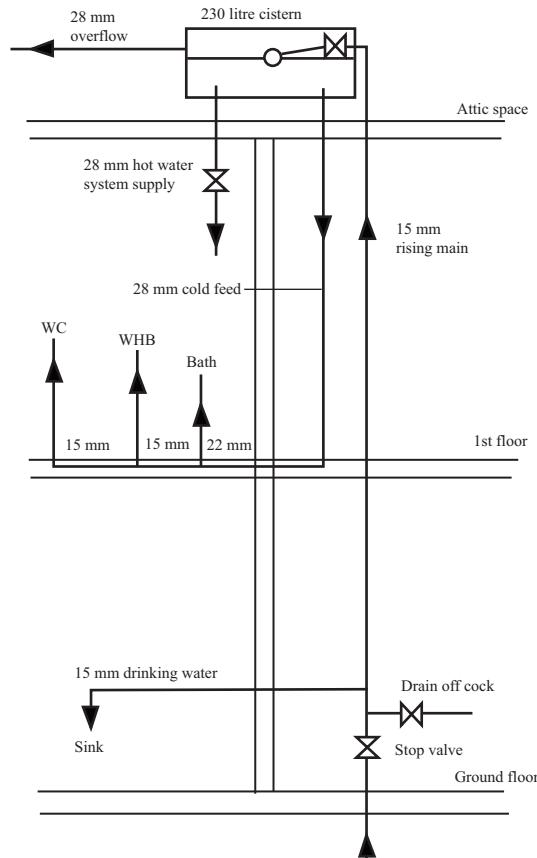
- 45 litre min header / expansion tank //
- 230 litre min cold water storage tank //
- 28 mm min overflow warning pipe to discharge externally //
- 15 mm cold feed to indirect primary circuit //
- 28 mm cold feed to cylinder //
- 22 mm cold feed to bathroom //
- 15 mm cold pipes to WC and WHB //
- 22 mm cold feed to bath//
- 12 mm rising main in protective ducting //
- heavy duty plastic water mains piping at least 760mm below ground level //
- cast iron or heavy duty plastic cover to stop valve / water meter //
- water mains // etc.

** Award maximum of 2 marks if included but not labelled.

Valves

Any 3: (3 × 3m)

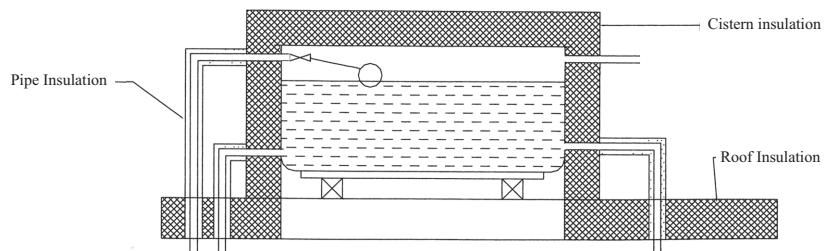
- valves on supply //
- stop valve for mains supply outside private boundary //
- stop valve on cold supply to bathroom //
- stop valve and drain off cock inside house //
- stop valve on cold water to cylinder //
- drain valve at sink //
- drain valve at boiler //
- ball valve in water tanks //
- other valves as necessary // etc.



- (b)** It is necessary to replace an old water storage tank with a new tank. Using notes and *freehand sketches*, show clearly all necessary pipe work, fittings, insulation and supports surrounding the tank.

Any 5: (5 × 3m)

- insulation in position //
- no insulation under tank //
- tank supported on joists //
- overflow pipe //
- expansion pipe //
- distribution pipes for hot / cold water //
- ball valve // etc.



4. A house built over thirty years ago has an external cavity wall with the following specifications: (60)

External cement render	thickness	19 mm
Concrete block outer leaf	thickness	100 mm
Uninsulated cavity	width	100 mm
Concrete block inner leaf	thickness	100 mm
Internal plaster	thickness	16 mm

Thermal data of the external wall:

Resistance of external surface	(R)	0.048 m ² °C/W
Conductivity of rendering and plaster	(k)	0.460 W/m °C
Conductivity of concrete blocks	(k)	1.440 W/m °C
Resistance of cavity	(R)	0.170 m ² °C/W
Conductivity of internal plaster	(k)	0.460 W/m °C
Resistance of internal surface	(R)	0.122 m ² °C/W
External temperature	(T)	11°C
Internal temperature	(T)	21°C

- (a) Using the data given above, calculate the U-value of the external cavity wall.

- U-value

Calculation

8 lines: (8 × 3m)

Layers	Thickness	Conductivity	Formula	Resistance
Units	Metres	W/m °C		m ² °C/W
Outer Leaf Concrete Block	0.100	1.440	T/K	0.06944
Cement Rendering	0.019	0.460	T/K	0.04130
Inner Leaf Concrete Block	0.100	1.440	T/K	0.06944
Plaster	0.016	0.460	T/K	0.03478
External Surface				0.048
Internal Surface				0.122
Cavity				0.170
Total Res				0.55496

– formula: U-value = 1/Total Resistance
 $= 1/0.55496$

Correct Answer (3m)

$$= 1.802 \text{ W/m}^2\text{°C}$$

- (b) The owner wishes to increase the insulation properties of the wall and may choose either of the following methods:

- filling the cavity with urea formaldehyde foam
or
- fixing insulated plasterboard sheeting to the inside wall surfaces. The insulated sheeting consists of 50mm rigid urethane and 12.5mm plasterboard.

Calculate the U-value for **each** of the above options given the following thermal data:

Conductivity of urea formaldehyde foam	(k) 0.040 W/m °C
Conductivity of rigid urethane	(k) 0.023 W/m °C
Conductivity of plasterboard	(k) 0.160 W/m °C

- filling the cavity with urea formaldehyde foam

U-value

Calculation

Layers	Thickness	Conductivity	Formula	Resistance
Units	Metres	W/m °C		m ² °C/W
Urea Formaldehyde Foam	0.075	0.040	T/K	1.875

Urea Formaldehyde Foam Resistance (3m)

$$= 1.75 \text{ m}^2 \text{ °C/W}$$

Total resistance (3m)

$$\begin{aligned} - \text{ formula: } &= \text{Old Resistance} + \text{Resistance of Foam} - \text{cavity} \\ &= 0.55496 + 1.875 - 0.170 \\ &= 2.25996 \text{ m}^2 \text{ °C} \end{aligned}$$

$$\begin{aligned} - \text{ formula: U-value} &= 1/\text{Total Resistance} \\ &= 1/2.25996 \end{aligned}$$

Correct Answer (3m)

$$= 0.44248 \text{ W/m}^2 \text{ °C}$$

- fixing insulated plasterboard sheeting to the inside wall surfaces. The insulated sheeting consists of 50 mm rigid urethane and 12.5 mm plasterboard.

U-value

Calculation

3 lines: (3 × 3m)

Layers	Thickness	Conductivity	Formula	Resistance
Units	Metres	W/m °C		m ² °C/W
Rigid Urethane	0.050	0.023	T/K	2.1739
Plasterboard	0.0125	0.160	T/K	0.0781
Total Res				2.2520

Total resistance (3m)

$$\begin{aligned} - \text{ formula: } &= \text{Old Resistance} + \text{Resistance of Rigid Urethane} + \text{Plasterboard} \\ &= 0.55496 + 2.2520 \\ &= 2.807 \text{ m}^2 \text{ °C} \end{aligned}$$

$$\begin{aligned} - \text{ formula: U-value} &= 1/\text{Total Resistance} \\ &= 1/2.807 \end{aligned}$$

Correct Answer (3m)

$$= 0.3562 \text{ W/m}^2 \text{ °C}$$



- (c) Recommend a preferred method to increase the thermal properties of the wall and give **two** reasons to support your recommendation.

Preferred method

- Any 1: **(3m)**
- Urea Formaldehyde Foam //
 - Rigid Urethane and Plasterboard // *etc.*

Reasons

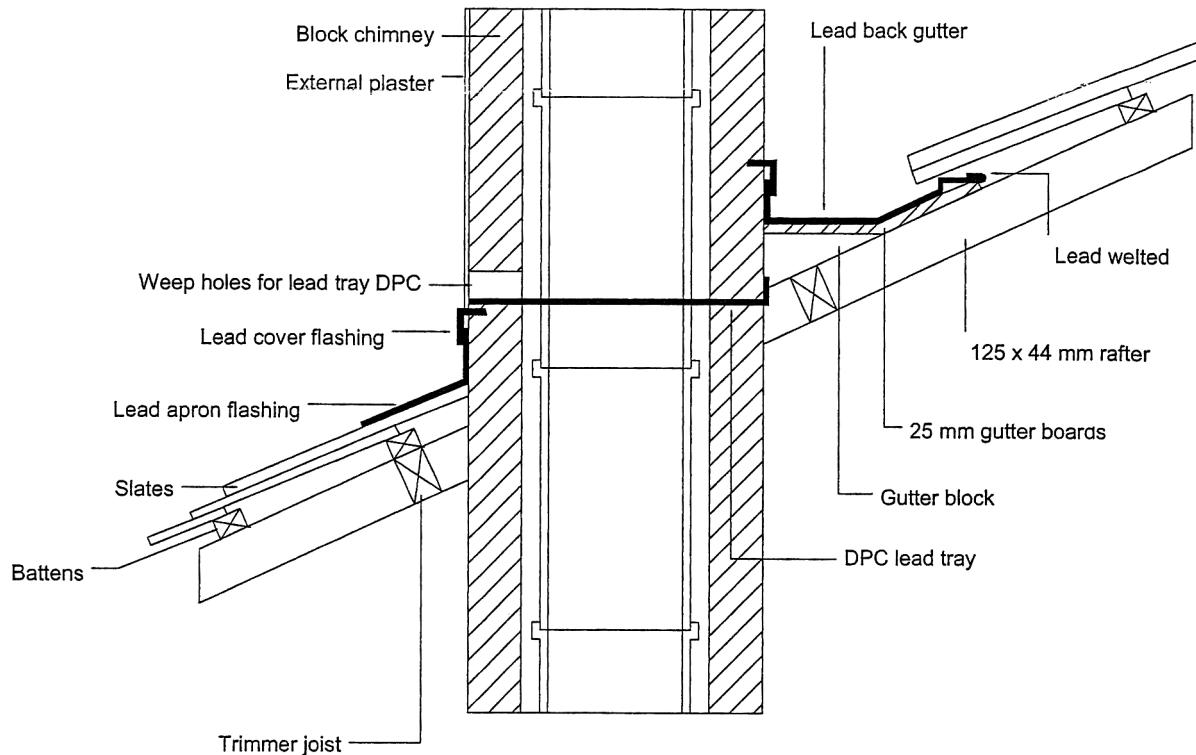
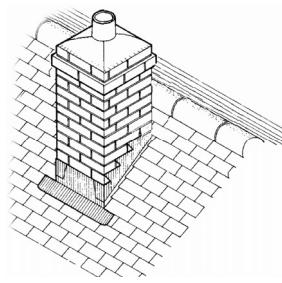
- Any 2: **(2 × 3m)**
- will achieve best results //
 - easy to install //
 - minimum disruption //
 - holes drilled in walls, no mess in the house // *etc.*
 - also reduces U-value //
 - reduces room size //
 - will need to re-fix pipe work, radiators, electrical sockets //
 - more tradesmen to redo work // *etc.*

5. A concrete block chimney passes through a pitched roof as shown on the sketch.

(60)

- (a) To a scale of 1:5, draw a vertical section through the roof. Show all the construction details at the roof and chimney intersection. Include **two** courses of slates both sides of the chimney.

- Any 9: (**9 × 4m**)
- blockwork for chimney //
 - flue liner in position //
 - external plasterwork //
 - DPC lead tray in correct position //
 - weep holes for lead DPC tray //
 - lead cover flashing //
 - rafters //
 - trimmer joist //
 - felt //
 - slating laths //
 - slates //
 - back gutter block //
 - lead back gutter // etc.

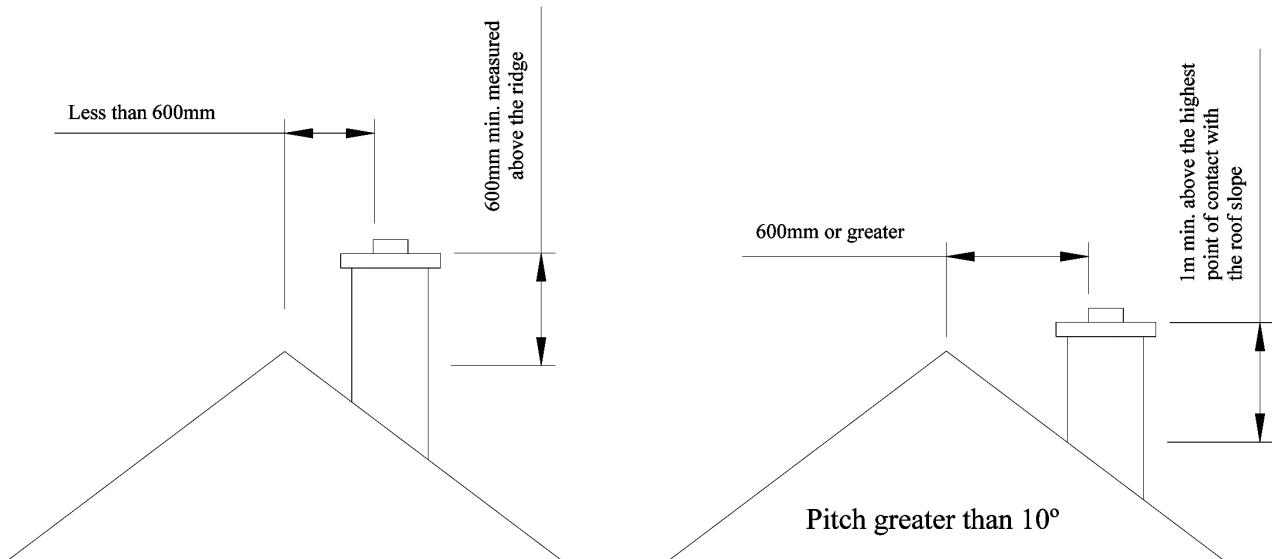


Scale (**3m**), Draughtsmanship (**3m**)

- (b) Using notes and *freehand sketches*, show **three** design details necessary to prevent the occurrence of down draught in a chimney.

Any 3: (3 × 6m)

- the chimney should be a minimum of 1 m above a flat roof //
- chimney a minimum of 4.5 m above the top of the fireplace //
- advisable that all chimneys extend above ridge level //
- if chimney is at or within 600 mm of the ridge a minimum height of 600 mm should be measured above the ridge line - otherwise minimum height of 1 m above the highest point of contact with the roof slope //
- good fireplace design will help eliminate down draught //
- top of fireplace not more than 550 mm above level of grate //
- throat of 300 x 100 mm assists draught //
- smoke shelf may reduce down draught //
- gathering or precast fireplace lintel aids the flow of flue gases //
- correct size flue liners, 200 mm nominal diameter for open fires //
- offset no less than 52.5° to horizontal and as short as possible //
- design of house to take into account the site // etc.



6. A house over one hundred years old is shown below. Although functional for its time, it now has a problem with dampness throughout the building. (60)

- (a) Describe **four** locations where dampness may penetrate this building.

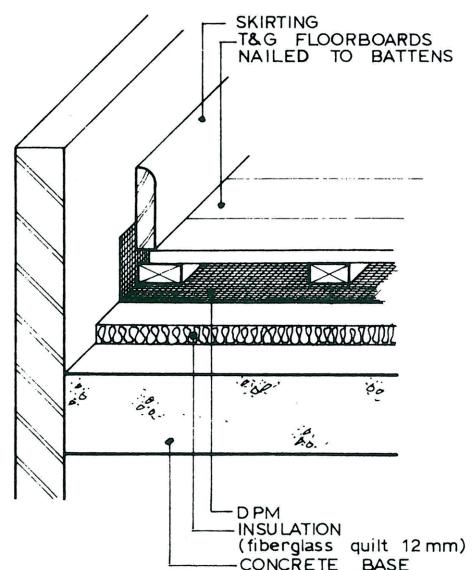
Any 4: (4 × 5m)

- floors //
 - rising damp will be a problem if a damp-proof membrane was not laid. Water particles rise through capillary action and damp spots will occur throughout the floor of the dwelling // etc.
- roof //
 - broken tiles/slates may be allowing dampness to penetrate into the building. Old building may have no roofing felt. Poor detailing around chimney stack. Blocked gutters and down pipes can lead to damp penetration in these areas // etc.
- walls //
 - rising damp will affect walls. Solid block / stone walls would have been used with no cavity. These, eventually, will transmit damp from the external surface to the internal surface // etc.
- windows and doors // etc.
 - window sills are an exposed part of a building where dampness often penetrates. At the time of construction, no DPC would have been incorporated into the design. The door threshold is also very vulnerable to the entry of water // etc.



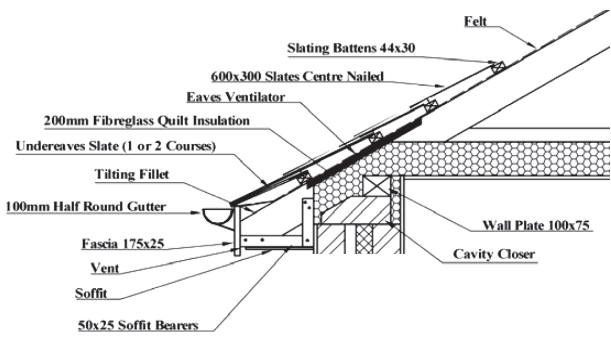
- (b) Using notes and *freehand sketches* describe how damp penetration can be eliminated at **each** location mentioned in 6(a) above. (4 × 8m)

- floors
 - the floor should be covered with an integrated layer of damp proof membrane and a raised suspended floor built above this // etc.



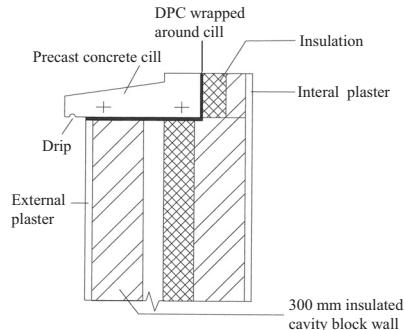
– roof

- roof structure should be recovered, felt included and all broken slates replaced. All gutters / downpipes cleared of any materials blocking them. Repair work on DPC and lead flashings around the chimney stack // etc.



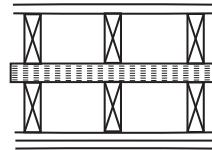
– windows and doors

- effective window sills could be added. These must: project out from the wall; contain a continuous drip; be wrapped in DPC.
- a new threshold should be properly fitted and sealed. A weatherboard will help to prevent the entry of water // etc.



– walls

- the internal walls could be dry-lined. Battens are attached to the walls and hardwall plasterboard with an integrated vapour barrier is attached // etc.



(c) List **two** materials used to prevent damp penetration in buildings at the construction stage and give **two** reasons in favour of **each** material listed.

Material (2 × 2m)

Reasons (2 × 2m)

Any 2

- Flexible DPC //
 - suitable in most locations //
 - used over openings and bridging of cavities //
 - easily shaped // etc.
- Semi-rigid DPC //
 - suitable for thick walls //
 - good resistance to high water pressure //
 - mastic asphalt is best example // etc.
- Rigid DPC // etc.
 - dense rock and slates //
 - suitable for high bond strength //
 - only a barrier to the capillary rise moisture // etc.

7. Proper installation of electrical circuits is of great importance to safeguard people from personal injury.

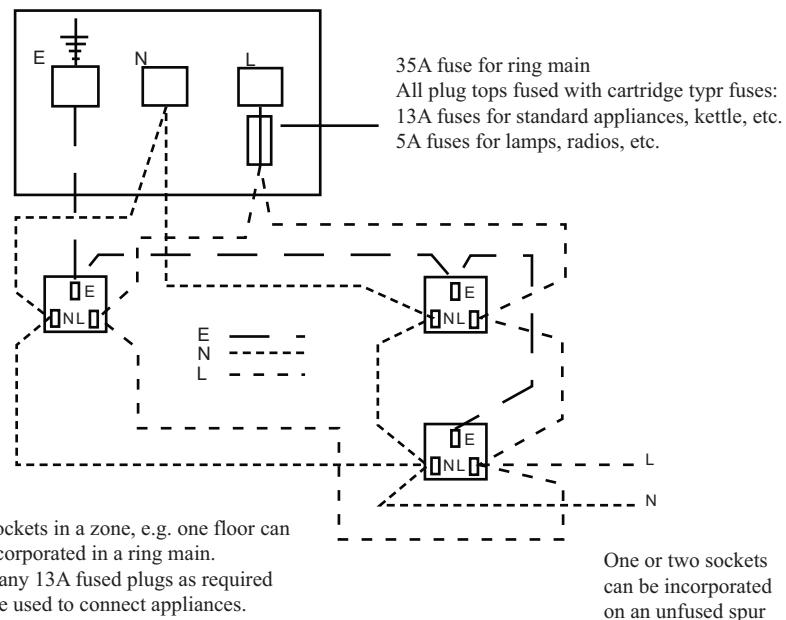
(60)



- (a) Using notes and *freehand sketches*, show the correct wiring for two sockets in a ring system of a domestic electrical installation.

Sketch (12m)

Notation (12m)



- (b) Explain, using notes and *freehand sketches*, the principles of earthing in a domestic electrical installation.

Any 3: (3 × 8m)

Principle (4m); Sketch (4m)

- earthing ensures that current is transferred safely to ground and is neutralized preventing //
- the possibility that a person might become the conductor, resulting in injury or death //
- earthing is a safety measure in the case of failure of the neutral //
- earth leakage circuit breaker or consumer unit trips if there is any leakage to earth //
- 10 mm² earth wire to all metal pipes and fittings such as cast-iron baths. All pipes earthed or bonded //
- earthed to 2 m steel rod driven into ground //
- 16 mm² earth cable from rod to consumer unit //
- earth leakage CB on power circuits only. Prevents mishaps in case of corrosion //
- earth wire bonded to top of earth rod and taped to prevent corrosion // etc.

- (c) Outline **three** safety procedures when using electrically powered tools on a building site.

Any 3: (3 × 4m)

- use of 110v tools //
- cables in good condition //
- avoid work in wet conditions //
- sealed plug tops used //
- heavy-duty extension leads used //
- workers wear / use PPE // etc.

8. Modern building methods require that concrete production be of a high standard.

(60)

(a) Explain **any five** of the following which are used to ensure that concrete production is of a high standard.

- aggregates
- batching
- water / cement ratio
- slump test
- placing
- compacting
- curing.

Any 5: (5 × 8m)

- aggregates
 - consist of gravels, crushed stone and sand //
 - fine aggregates are 5 mm or less in size approx //
 - course aggregates are between 5 mm-20 mm in size //
 - they should be hard and clean //
 - durability // etc.
- batching
 - process of measuring the quantities of the different size of aggregates //
 - generally done by weight //
 - can be done by volume //
 - large mixers have facilities to weigh the aggregates prior to loading them into the rotating drum of the mixer //
 - a bottomless gauge box may also be used // etc.
- water / cement ratio
 - usually 0.4 to 0.7 //
 - too little water may not wet all the cement and aggregates sufficiently //
 - if too wet, the liquid will run off when hydration occurs //
 - allowances to be made for wetness of aggregates //
 - slump test used to test water / cement ratio // etc.
- slump test
 - used to determine the workability of concrete //
 - gives good indication of the water / cement ratio of the mix //
 - should be carried out on site //
 - test consists of hollow slump cone and tamping rod //
 - the cone is placed on a flat surface, filled and tamped at regular intervals //
 - the cone is lifted off and the drop in height measured to determine the slump // etc.
- placing
 - concrete should not be dropped more than 1 metre //
 - avoid segregation of large aggregates from the mix //
 - avoid air pockets and uneven distribution //
 - if mix is wet, formwork is required //
 - formwork should be clean and oiled before placing //
 - formwork must be correctly constructed to support concrete // etc.
- compacting
 - concrete to be placed in layers //
 - vibrate to eliminate air voids using mechanical vibrators //
 - use poker vibrators for columns, beams and trenches // etc.



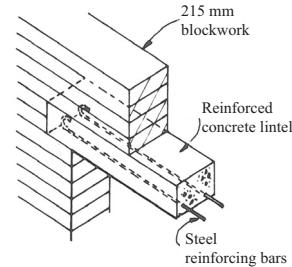
- curing.
 - let concrete dry slowly //
 - keep damp for some days //
 - protect from extremes of temperature //
 - keep formwork in place for 28 days //
 - when formwork is removed prevent fresh concrete from drying too quickly // etc.

- (b) Steel is used in concrete to increase its tensile strength. Using notes and *freehand sketches* describe **two** methods of including steel in the manufacture of concrete lintels.

Any 2: **(2 × 10m)**

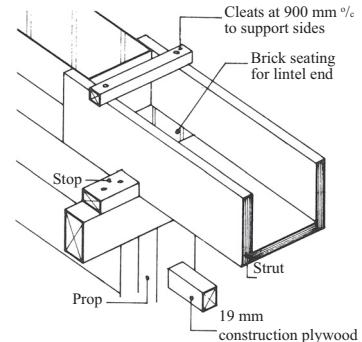
Note (6m); Sketch (4m)

- precast unit production //
 - steel can be pre-stressed by anchoring to bulkheads
 - when the concrete has achieved sufficient compressive strength the steel is released, transferring the force to the concrete
 - made under factory conditions
 - a mould is required
 - better control over strength and waterproofing qualities
 - lintels / cills / beams and flooring units
 - decrease time and cost of erection buildings // etc.



- in-situ production // etc.

- steel erected and tied together
- steel fixers normally carry out this work
- mould needs to be erected for concrete
- concrete needs to be poured in good weather conditions
- formwork needs to stay in position while concrete sets // etc.



9. The downstairs living room of a two-storey house is to be fitted with an elaborate music system. (60)

The walls and ceilings of this room have a smooth hardwall plaster finish. The laminate wood floor is laid over underlay onto a concrete base. The living room is separated from an adjacent study/office by a traditional stud partition. Renovations to improve the sound insulation of the room are to be carried out.

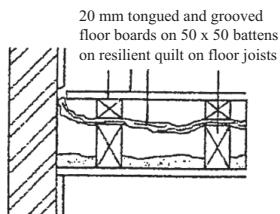
- (a) Describe **two** sound insulation principles on which effective sound insulation is based.

- Any 2: **(2 × 10m)**
- Isolation //
 - requires the mechanical separation of opposite surfaces of a wall so that there is a discontinuity of construction. Creating a cavity between the opposite surfaces will reduce the transmission of sound through the structure
 - Heaviness //
 - relates to the Mass Law, which states that the sound insulation of a wall is proportional to its mass per unit area. An increase in the mass will improve the sound insulation properties of a wall, combating the transmission of airborne noise
 - Flexibility //
 - flexible materials are good at absorbing sound. The use of an absorbent quilt / resilient layer reduces the transmission of sound through the structure.
 - Completeness // etc.
 - eliminating small gaps in the structure, improving air tightness and uniformity of insulation improves overall acoustic properties

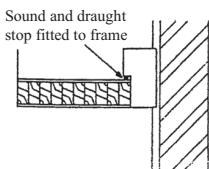
- (b) Using **freehand sketches**, show **two** design details that would improve the sound insulation properties of the room.

Any 2: **(2 × 10m)**
Note (4m), Sketch (6m)

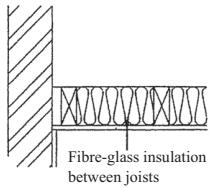
- Floor //
 - creating a floating floor will give more soundproofing //
 - resilient material placed on joists and battens placed on top //
 - fibreglass normally used //
 - dry sand plugging may also be used // etc.



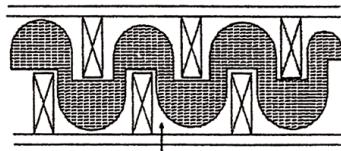
- Doors //
- fit a solid door //
- fit with draught / sound stoppers // etc.



- Ceiling //
- prevent sound travelling through ceiling place //
- necessary to place 200 mm insulation / glass fibre //
- between and on top of ceiling joists // etc.

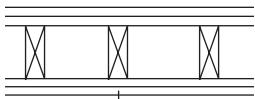


- Walls (internal) //
- new stud wall constructed along existing wall //
- new wall not touching existing wall //
- sound resilient material placed in correct position //
- using thicker studs gives greater sound proofing // etc.

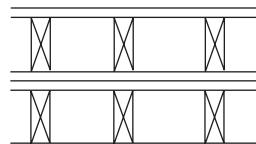


Create a staggered stud partition with sound insulating material between the studs

- Stud partition walls //
- fix second layer of plasterboard to existing plasterboard //
- attach new stud partition to existing stud partition //
- good frame and saddle // etc.

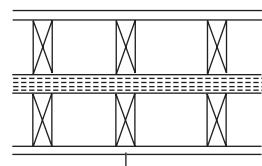


Fix a second layer of plasterboard to the existing plasterboard and stagger the joints



Attach a new stud partition to the existing stud partition

- Walls (external) // etc.
- using of double or triple glazing // etc.

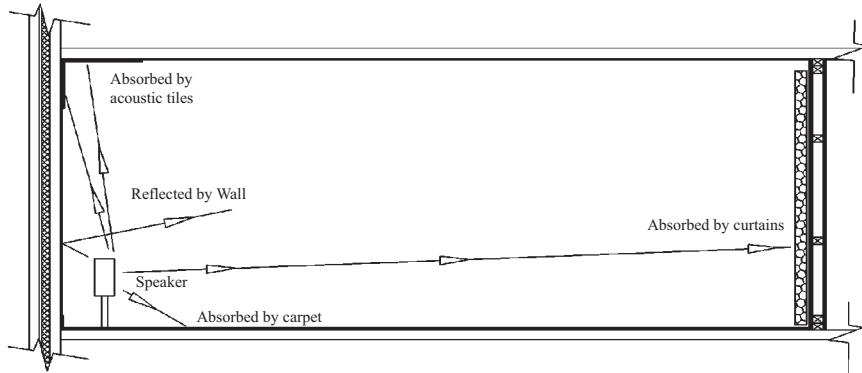


Create a double partition with a cavity and insulation separating the two partitions

- (c) Using notes and *freehand sketches* show **two** methods of enhancing the acoustic properties of the room.

Any 2: **(2 × 10m)**

- put a carpet on the concrete floor, as this will absorb some of the sound, thus improving the acoustic properties //
- hang curtains / drapes or other sound-absorbent materials on the walls //
- fix acoustic tiles or panels to part of the ceiling or walls //
- fix panels to some walls with an air space or absorbent material behind //
- position the speakers carefully to avoid undesirable reflection of sound // etc.



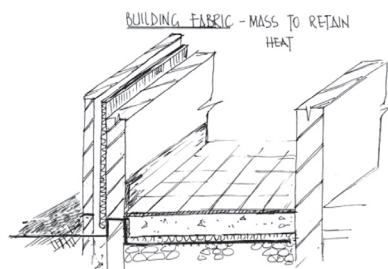
10. The accompanying sketch shows a bungalow dwelling in the countryside. The owners have decided to increase the energy efficiency of their home. They intend to upgrade the insulation in the house and add a conservatory to make use of natural sunlight in the area.

- (a) Outline, using notes and *freehand sketches*, two considerations to be taken into account that would help to maximise the solar gain from such a sunspace.

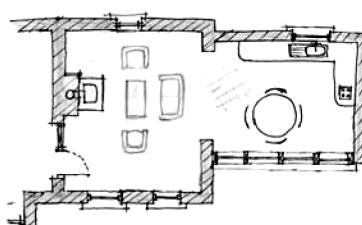
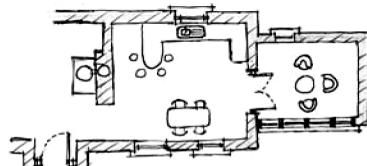
Any 2: (2 × 10m)

Note (4m); Sketch (6m)

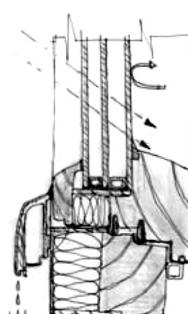
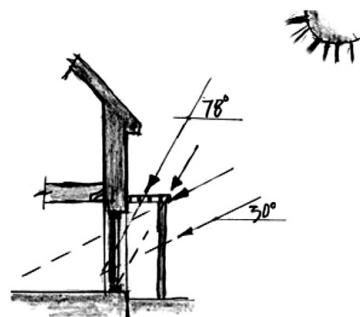
- include thermal mass in floor //



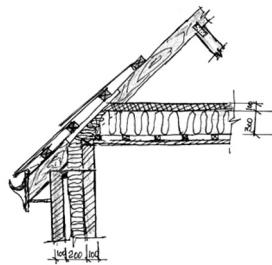
- design to ensure distribution of heat from sunspace to other areas of house //
- locate main living areas closely to sunroom //



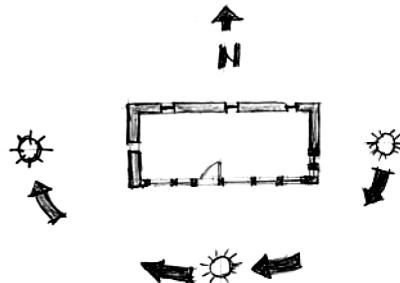
- use of heavy curtains / blinds / shutters to help retain heat at night time and in the winter //



- roof, walls and floors in the house to well insulated //



- ensure the sunspace is orientated to maximise sun exposure // etc.

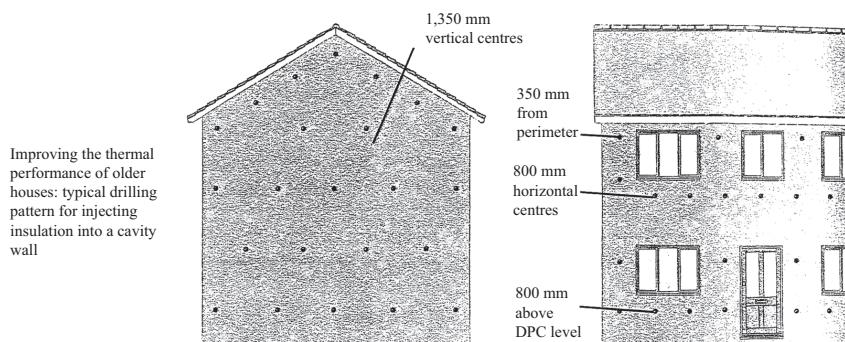


- (b)** Using notes and *freehand sketches*, describe **two** methods of increasing the thermal insulation of the external walls.

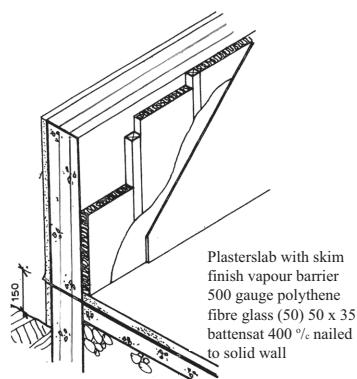
Any 2: **(2 × 11m)**

Note (5m), Sketch (6m)

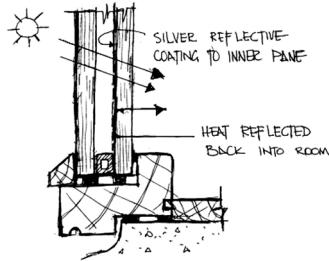
- walls to have cavities filled with insulation //



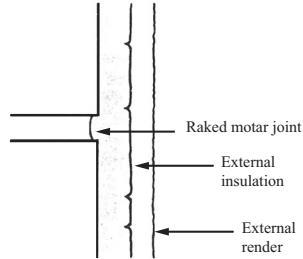
- insulation fixed on internal surfaces of walls and walls re-plastered //



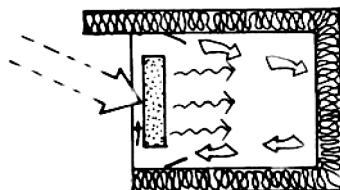
- use of high-performing / low-emissivity glazing //



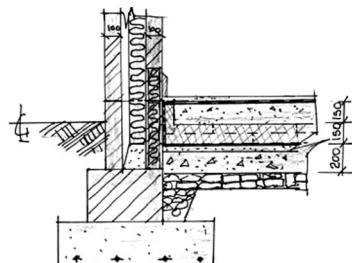
- use of external plasters with insulation properties //



- use Trombe wall to collect, store and distribute heat throughout house //



- include thermal mass in walls // etc.



(c) Discuss in detail **three** advantages of using thermal insulation.

- Any 3: (**3 × 6m**)
- reduces heat loss //
- reduces heating bills //
- improves comfort level //
- prevents leaks from burst pipes //
- reduces the amount of condensation in a dwelling as surfaces are warmer //
- house heats up more quickly //
- constant temperature can be maintained // etc.

OR

10.

(60)

“The suburban spread of settlements over the last decade could be viewed as having been wasteful both in terms of its impact on the existing fabric and infrastructure of towns, and in terms of continual erosion of the landscape. If this trend is to be reversed, the built fabric of towns and villages will need to be renewed, and dwellings and related facilities provided, which will attract families back to them.”

Developing a Government Policy on Architecture (1996)

Discuss the above statement in detail and propose **three** guidelines that would encourage the regeneration of urban areas.

Discuss

Any 3: (3 × 10m)

- one-off housing along existing roadways is wasteful of space, materials and services and the land would be better used if small clusters of houses were built
- erosion of landscape where the sense of the countryside being distinct is blurred by the continuation of lines of houses along roadways, leading to the sub-urbanisation of the countryside
- separate roads, sewerage, phones, electricity to each individual dwelling wastes resources
- unsustainable development - this model of urban sprawl does not consider the energy needs of future generations
- a paradigm of rural dwelling - a detached one-off house on its own site - being imported into the town without proper planning, the lost art of town planning
- where we live is as important as how we live - a properly functioning community has a sense of place, community and friends, linear development along busy roadways militates against the development of a community spirit, difficult to identify a shared space
- proper transport systems need a population density, scattered one-off dwellings do not provide this critical mass
- this linear development along roadways leads to the loss of the traditional character of towns as contained spaces, built in the form of streets, terraces, squares and open areas
- traditional town development was laid out differently, town development has its own configuration of interconnecting streets and lanes as well as public areas such as parks and squares, giving continuity, directness and safety // etc.

Guidelines

Any 3: (3 × 10m)

- the challenge is to develop a deep cultural change to break our dependence on the car, to transform the way we live and to revitalise the decline of towns and villages
- a change of mindset, breaking the separateness mindset, to learn to live again in connectedness with others
- learn from the past, towns and villages that developed between 1750 and 1850 concentrated on the street layout, providing a mixture of ground-floor trading spaces and residential spaces, giving a living community, close to facilities such as schools, churches and playing areas
- a need to rediscover and develop the charm of urban living
- depletion of fossil fuels and the consequent rise in prices challenges us to re-envision the way we structure our dwellings and communities
- humans exist in relationships, town dwelling helps break down the separateness of isolated single dwellings - especially for young and old
- families will be attracted back to towns and villages when we consciously plan for this end
- we will have to plan for more intentional lifestyles, close to amenities such as schools, churches, libraries, leisure centres, playing fields
- plan for communities, providing active social areas such as dedicated safe play areas for children active social / play areas integral to the streetscape so that children can be unobtrusively supervised - social areas encircled and protected by surrounding houses
- urban living provides a critical mass required to provide adequate public transport, dispersed dwellings do not, ease of travel will attract people back from the congestion of the roads
- limit the effect of the motor car on urban communities by providing dedicated parking areas, pedestrianised streets, dedicated areas for family relaxation
- provide walk and cycle lanes especially to schools for safety of children and teenagers
- plan mixed dwellings for old, middle aged and young, break the age segregation through thoughtful, purposeful planning - many old people return to the security of planned urban living and proximity to facilities
- urban living increases opportunities for positive social interactions and thus build a community sense
- provide incentives for people who buy houses in urban areas, such as for first time buyers
- plan for apartments of adequate floor area and facilities e.g. storage to accommodate families
- provide incentive for smaller trading outlets, family businesses, mixed living and trading
- develop model urban areas, where a new model of urban living can be observed and appreciated
- raise awareness of the need to limit waste and rediscover the advantages of urban living
- educate next generation to be more thoughtful, less wasteful and more respectful of people and the diminishing resources of the planet // etc.

** Any other valid, well-presented and argued reasons.



Notes:



