

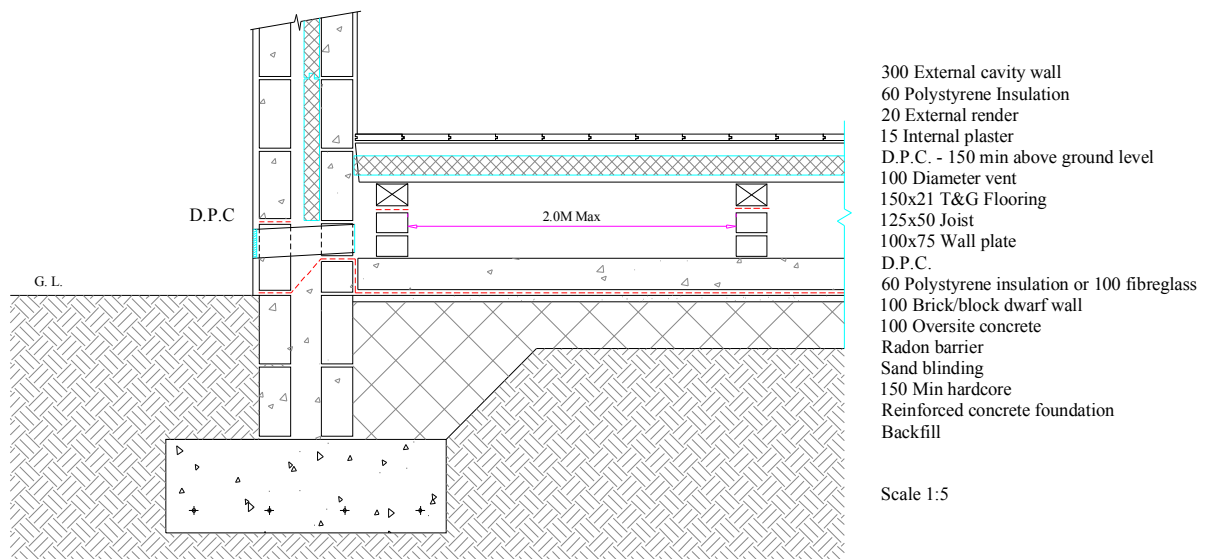


Staidéar Foirgníochta
Teoiric – Gnáthleibhéal

Construction Studies
Theory - Ordinary Level

Scéim Mharcála
Marking Scheme

Q1 - Leaving Certificate Construction Studies
 Ordinary Level 2002



Question No. 1

Details.

Marks

300 Cavity Wall.	4
Reinforced Concrete Foundation showing reinforcement.	4
Cavity Fill below D.P.C.	4
Insulation to Wall and Floor.	4
Plaster: Internal and External.	4
Tongue & groove Flooring Boards : 150 x 21	4
Joists: 125 x 50.	4
Wall Plate : 100 x 75	4
Sleeper Wall with D.P.C. Brick or Block 100mm thickness.	4
Oversite Concrete: 100 Thickness Minimum.	4
Radon Barrier or Membrane.	4
Sand Blinding: Minimum 30mm.	4
Hardcore: Minimum 150mm.	4
D.P.C. on external leaf. Minimum 150mm above Ground Level.	4
Backfilling.	4
External ground level lower than sub-floor inside.	4
Vent	4

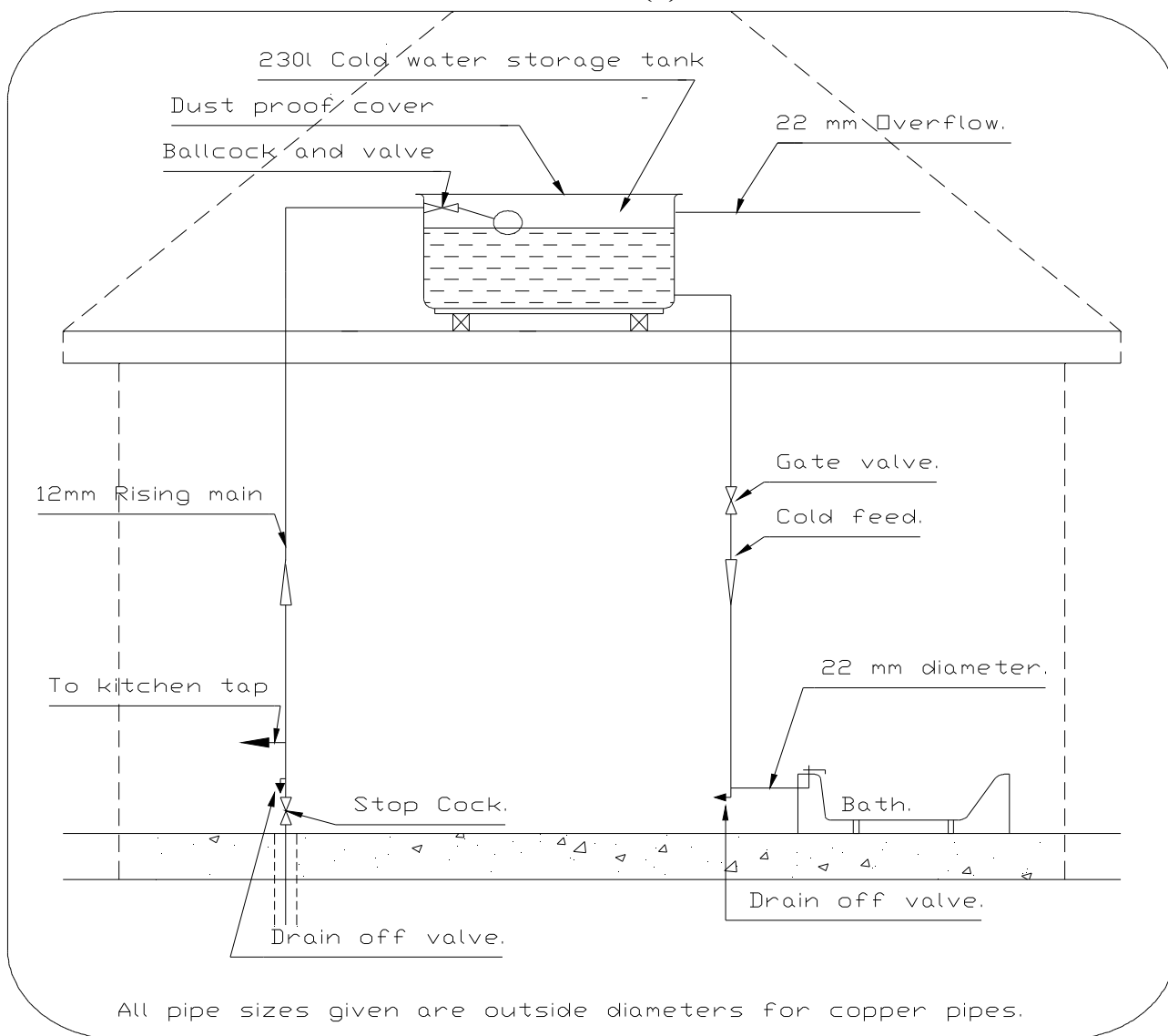
Any 11 of above (4marks each)

44

Draughtsmanship and scale:	6
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Total: 50 Marks.

Question 2 (a)



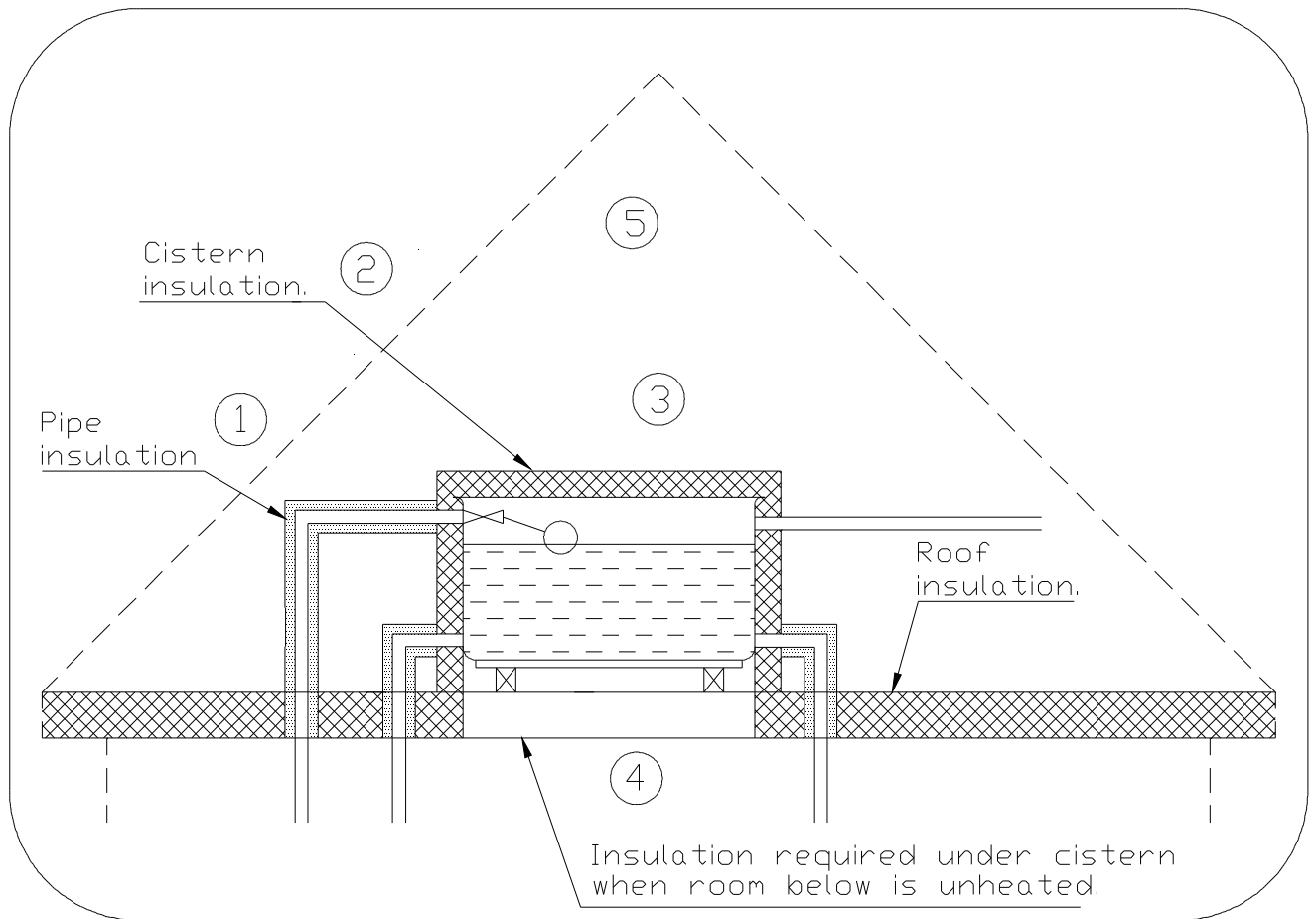
Details.

Marks.

Stop cock.	5
Drain off valve.	5
To kitchen tap.	5
12 mm Rising main.	5
Ballcock and valve.	5
Dust proof cover.	5
Water storage tank.	5
22 mm Overflow.	5
Gate valve.	5
22 mm cold feed.	5
Connection to bath.	5

Any 8 of above (5 marks each) = 40 marks.

Question 2(b) contd.



Attics are much colder nowadays because ceilings in most houses are well insulated. Water storage tank and copper pipes tend to freeze up in very cold weather.

1. Insulate all pipes with pipe insulation or with fibreglass wrapped and tied around the pipe.
2. Insulate the water storage tank with a rigid insulation that is well sealed or with fibreglass wrapped and tied around the tank.
3. Place the tank and all pipe work centrally in the attic space where possible. It should be at least 750 mm away from an external wall or roof surface.
4. Remove insulation from underneath the cold-water storage tank to allow warm air up from below.
5. Install a frost stat (thermostat) and a heating device.

Any one of above (5 marks + 5 marks) = note + sketch. = 10 marks.

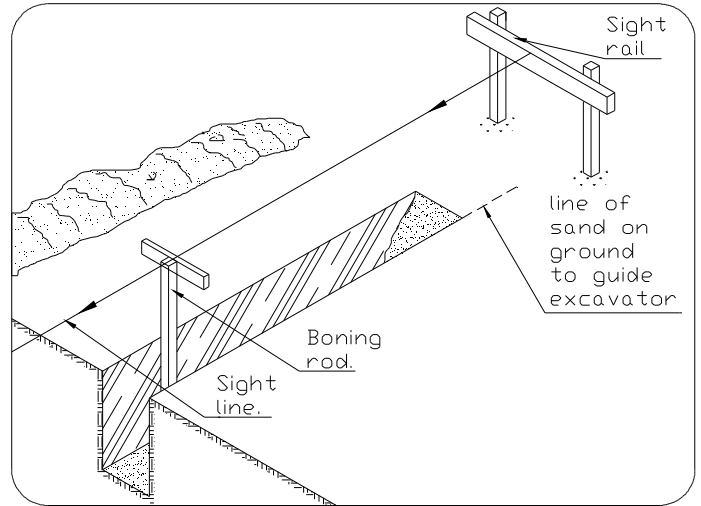
TOTAL MARKS = 50 marks.

Question 3.

- The layout should be straight and as simple as possible with pipes laid to an even slope or gradient.
- The system should be ventilated by a flow of air and access points should be provided to clear blockages.

(i) Excavation of trench;

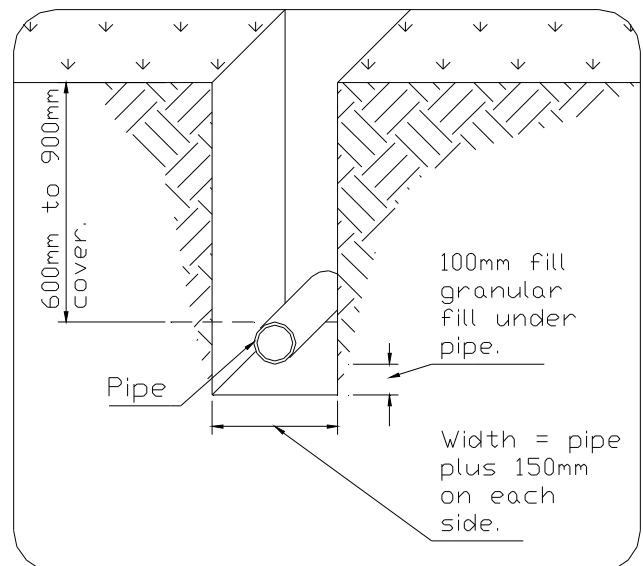
- Excavation of narrow trenches for domestic dwellings can be carried out by hand or machine.
- Digging of trenches should not take place too long before pipe laying.
- Backfilling should take place as soon as possible after pipe laying.
- The excavated soil should be kept at least 0.5m back from the trench.
- All loose and/or heavy stones should be removed from the heap.



(6 marks + 2 marks) or (2 marks + 6 marks) = Note + Sketch = 8 marks.

(ii) Depth and width of trench;

- The trench width should be kept to a minimum but not less than the pipe plus 150 mm on each side.
- The depth of the trench is determined by the depth of the back filling.
- The depth of cover should not be less than 900 mm for driveways or 600 mm for gardens or agricultural land.
- The depth will depend on connections, e.g. gullys, access junctions etc. but should mainly comply with above.

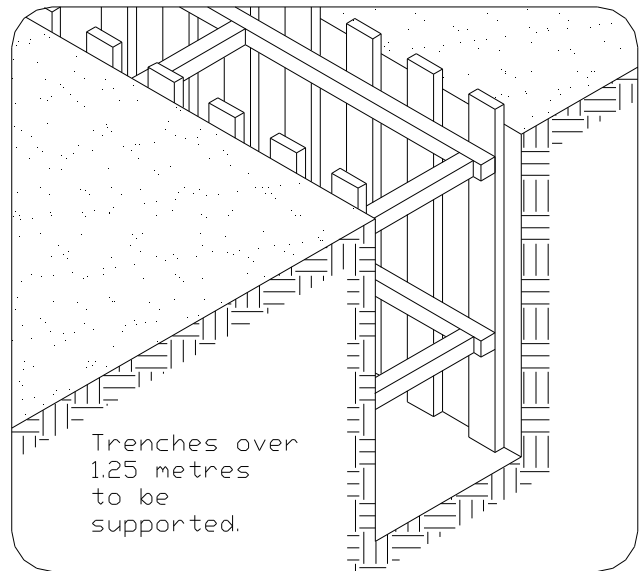


(6 marks + 4 marks) or (4 marks + 6 marks) = Note + Sketch = 10 marks.

Question 3 contd.

(iii) Safety;

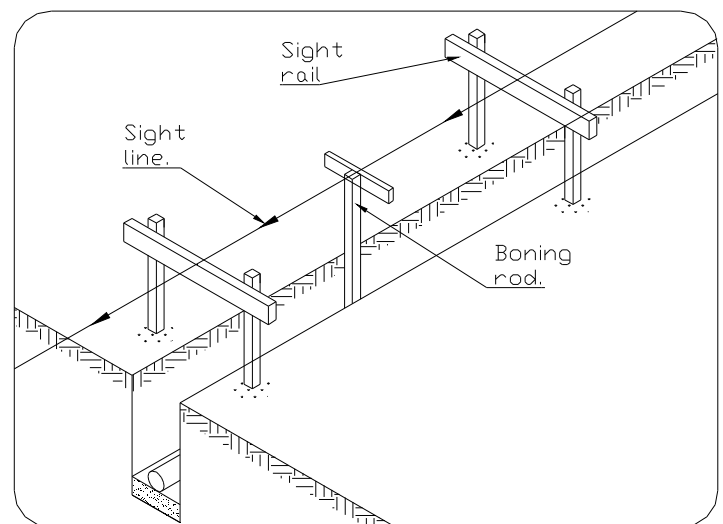
- Trench boxes or timbering should be used to support trenches more than 1.25 metres in depth.
- Or, sides of trenches more than 1.25 metres deep could be sloped at a safe angle.
- Care should be taken to avoid material falling into trenches.
- Trenches should be highlighted to prevent people falling into unprotected trenches.
- Wear a helmet and steel toecap boots. Wear a high visibility jacket when working close to machines.
- Care should be taken to avoid underground services.



(6 marks + 2 marks) or (2 marks + 6 marks) = Note + Sketch = 8 marks.

(iv) Slope or gradient of trench;

- The slope for 100 mm flexible piping 6 metres long is 1:40, 1:60 or 1:80.
- A traveller or boning rod can be used with profiles to maintain the proper slope or gradient.
- A straight edge with the slope taken off the bottom or a laser beam can also be used to mark the proper slope of the trench.
- Pegs driven into the bottom of the trench can be used to keep the pipe at the correct gradient.

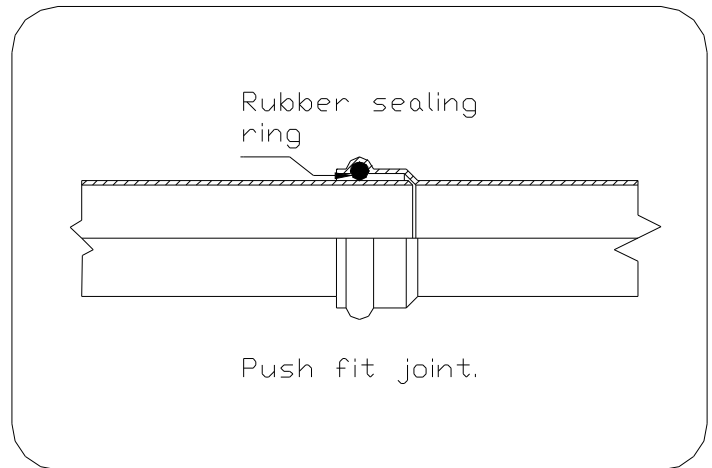


(6 marks + 2 marks) or (2 marks + 6 marks) = Note + Sketch = 8 marks.

Question 3 contd.

(v) Pipework;

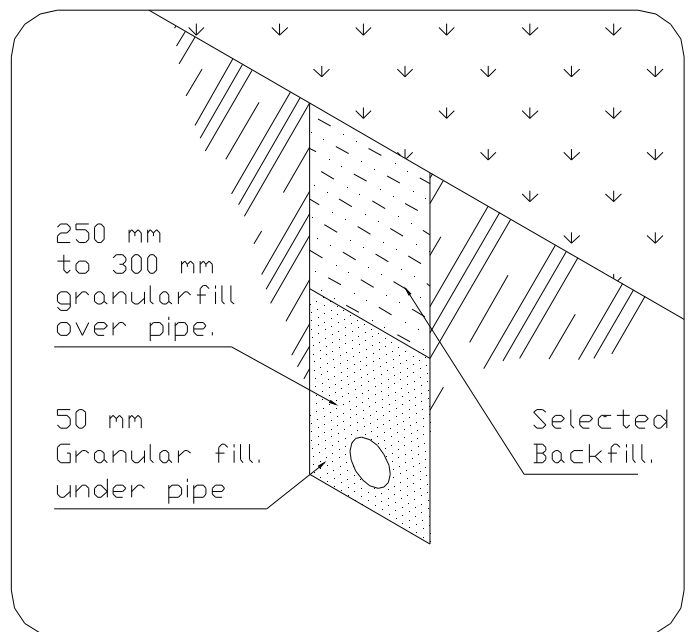
- Flexible uPVC piping 100 mm in diameter and 6 metres long, e.g. Wavinsewer, is the most commonly used piping for domestic dwellings.
- Connections should be at an angle and in line with the flow.
- Pipes should be laid in a straight line with changes in direction kept to a minimum.
- Collars with a flexible seal that are water and airtight are used to join the pipes.
- The socket end should face uphill.



(6 marks + 2 marks) or (2 marks + 6 marks) = Note + Sketch = 8 marks.

(vi) Backfilling;

- A 50 mm layer of fine granular material e.g. pea gravel, is placed under the pipe while a layer of 200 –250 mm is placed over the pipe. This is to protect the pipe from damage.
- The remainder of the trench is filled with earth free from heavy stones, large lumps of clay or other objects.
- The backfill is compacted every 300 mm.
- All joints should be sealed and tested before backfilling takes place.
- The backfill should be placed in such a manner so as not to disturb the layout of the pipe.

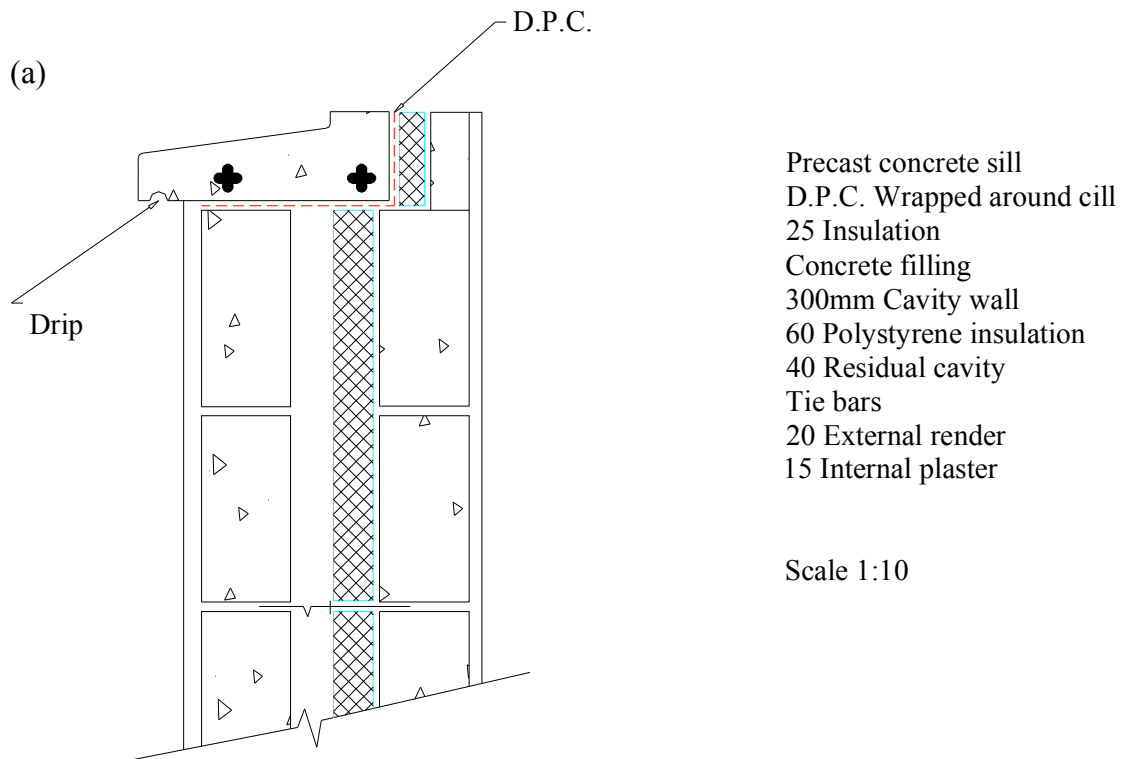


(6 marks + 2 marks) or (2 marks + 6 marks) = Note + Sketch = 8 marks.

**(5 notes + 5 sketches) x 8 marks = 40 marks.
(1 note + 1 sketch) x 10 marks = 10 marks.**

TOTAL = 50 MARKS.

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- (b) (1) Drip on cill prevents water from reaching the wall under the cill.
(2) D.P.C. prevents dampness from reaching the inner leaf of the wall

Question No. 4.
Window Cill Detail.

(a)

Details.

Marks

300 Cavity Wall.	4
Internal Plaster External Render.	4
Residual Cavity.	4
Insulation within Wall.	4
Pre-cast Concrete Cill.	4
Steel Reinforcement to Cill.	4
Slope on Cill.	4
Insulation behind Cill.	4
Concrete Fill behind Insulation.	4
Wall Ties.	4

Any 8 of above (4marks each)

32

Draughtsmanship and Scale.	6
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Part (b).

D. P. C. around Cill.	6
Drip on underneath of Cill outside.	6

Total: 50 Marks.

Question 5 (a).

5(a) (i) Aggregates;

- Aggregate is any granular material used as the main constituent of concrete.
- Aggregates may be Coarse, Fine or All-in.
- Coarse aggregate is usually natural gravel, or crushed rock, or stone that is retained on a 5 mm test sieve.
- The fine aggregate is material passing through the 5 mm test sieve and fills in the spaces between the coarse aggregate.
- All-in aggregate is a natural mixture of coarse and fine aggregates and is suitable for mass concrete where strength is not important.
- It can be natural or artificial. Artificial aggregates are mainly lightweight.

Good explanation = 8 marks.

(ii) Water / Cement ratio;

- The ratio of mixing water to cement in concrete. This ratio is the total mass of water divided by the mass of cement.
- Allowances should be made for the absorption of dry aggregate and for surface moisture of wet aggregate.
- Only a portion of water combines chemically with the cement during the hydration process.
- The greater the quantity of water the more porous the dry hardened concrete will be. A reduction in strength and durability will occur.
- Too high of water cement/ratio may draw the water paste from the surface of the aggregates and weaken the bond between the aggregates.
- The water/cement ratio usually ranges from 0.4 to 0.6. A ratio of less than 0.5 will produce a concrete that is difficult to compact by hand.

Good explanation = 8 marks.

(iii) Slump test;

- An easy method for determining the workability of freshly mixed concrete by measuring the slump of a test sample.
- It gives an indication of the consistency of various batches.
- It can be used as an indirect check on the water/cement ratio of the concrete.
- A special set of instructions is used to carry out the test.
- The following items are used to carry out the test: truncated cone, steel tamping rod, measuring tape and a flat smooth impervious surface.
- Types of Slump are: true, shear and collapse. 0 – 50 mm slump = Low workability, 50 – 75 mm slump = Medium workability.
- The test is widely used for on-site checks although not suitable for dry mixes as it gives low or zero slump.

Good explanation = 8 marks.

Question 5 (a) contd.

(iv) Reinforced concrete;

- Concrete in which steel reinforcement is placed in such a way that the two materials act together in resisting forces.
- Concrete is strong in compression but weak in tension and where tension occurs steel bars are introduced to provide the tensile strength.
- Reinforced concrete is a material widely used in the load bearing structure of buildings e.g. beams and columns.
- The steel must be free from loose rust, grease, paint or anything to impair the bond between steel and cement and concrete.
- The steel may be ribbed or twisted to give a better bond.
- The position of the steel can vary to where the stress is within the concrete – top or bottom.
- The steel must have sufficient cover within the concrete.

Good explanation = 8 marks.

Good explanation = (4 x 8 marks) = 32 marks.

Question 5 (b).

Examples of reinforced concrete.

- Reinforced concrete lintels or beams.
- Reinforced concrete cill.
- Reinforced concrete column or pillar.
- Reinforced concrete foundations.

Any 2 examples x 2 marks = 4 marks.

Reinforced concrete lintels or beams.

- Lintels span openings and concrete is weak in tension so steel is added to improve the tensile strength.
- Lintels support the loads overhead.
- Lintels are often pre-stressed to improve strength.

Reinforced concrete cill.

- Steel gives strength to the cill.
- Steel prevents cracking of the cill.
- Pre-cast or cast in-situ with steel reinforcement.

Reinforced concrete column or pillar.

- The steel stabilizes the column, joins the column to a beam and reinforces it where necessary.
- The steel anchors the column to the foundation.
- Generally columns are cast in-situ with steel reinforcement.
- The steel must have sufficient cover within the concrete.

Question 5 (b) contd.

Reinforced concrete foundations.

- Steel adds strength to concrete.
- Steel helps to prevent failure of foundations.
- It supports the wall.
- It transmits the weight of the wall to the ground.
- The steel must have sufficient cover within the concrete.

Good explanation = (Any 2 x 7 marks) = 14 marks.

TOTAL MARKS = 50 marks.

Question No. 6

(a)

	Marks
i. Safety Helmets must be worn.	4
ii. Crane operating overhead or beware of overhead loads.	4
iii. Ear Protection must be worn	4
iv. Danger overhead power lines <i>or</i> Danger High Voltage.	4

(b)

Safety precautions to be observed when using power tools out of doors are as follows:

- Ensure that all leads, plugs and sockets are in good condition.
- The equipment should be used in dry conditions.
- The correct voltage should be used for the power tool.
- Work on good solid ground or correct scaffolding.
- The power tool should be properly earthed.
- R. C. D. (Residual Current Device) may be used.

2 x 5 marks each = 10

(c)

Scaffolding is a temporary working platform erected around the perimeter of a building or structure in order to provide a safe working position at a convenient height. Scaffolding is usually required when the working height is 1.5 m or more above ground level. Working at heights can be dangerous, and the following are some safety precautions that should be observed when using scaffolding on a construction site.

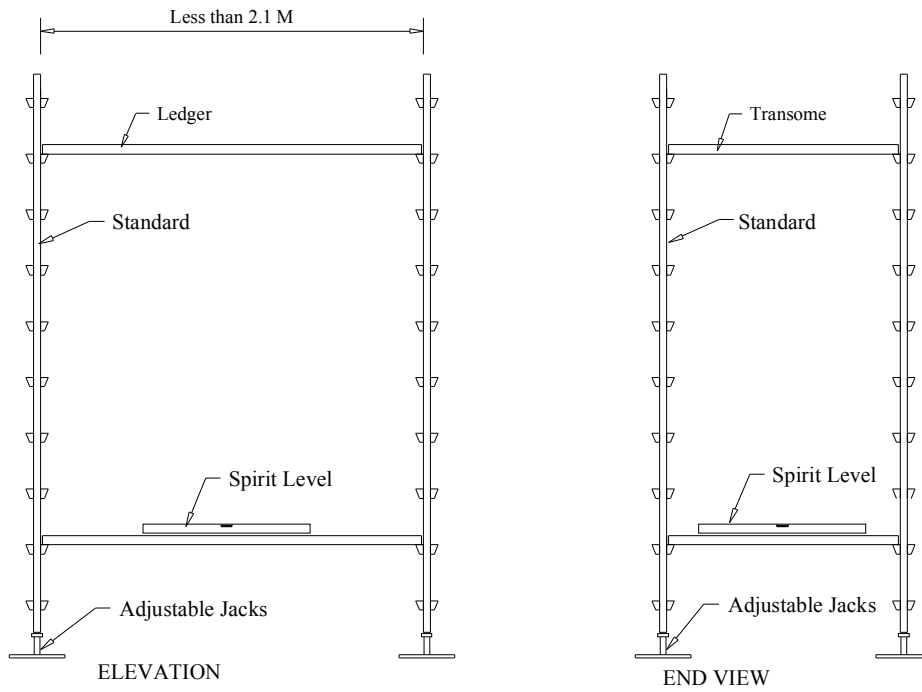
- Ensure a suitable base is prepared and checked before the erection of scaffold begins. The ground should be firm and solid capable of supporting the scaffold and any loads imposed. This will prevent sinking or slippage.
- Scaffold must be set level using a spirit level and adjustable jacks. This ensures that all parts fit together correctly and firmly.
- Braces and ties must be fixed in place as the scaffold is being erected. This prevents collapse of the scaffold and keeps the whole framework rigid.
- Platforms should be fully boarded giving a level uninterrupted walking area. This prevents accidents as people walk and work.
- Guard- rails and toe-boards must be fitted at every side from which a person may fall when working height exceeds 2.0 Mts. Toe-boards min 150mm. high prevent loose material falling off the scaffold. Guard-rails prevent workers falling off the scaffold. They are fixed to the outside ledgers at a height of 950 – 1200 mm. above the working platform.
- Scaffold must be tied to the building at various points. It may be tied at window or door openings or special ring-bolts fixed to the wall. This prevents the total scaffold structure falling away from the building itself.
- Ladders should be properly secured, in case of accidental movement.
- On street or public areas scaffold should be padded and adequately lit for protection of the general public.

Any three precautions plus three reasons = 3 (3 + 2) = 15 Marks.

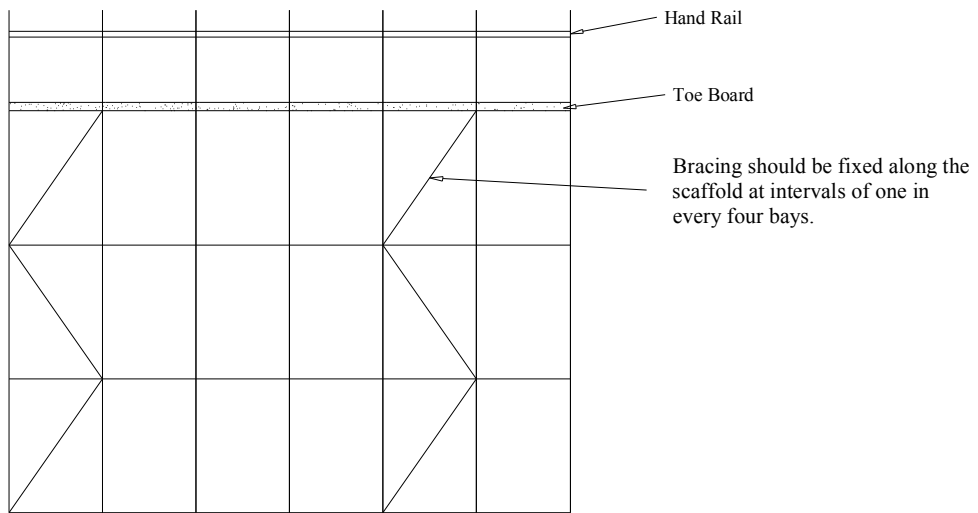
Three sketches : 3 x 3 marks each = 9 Marks.

Total Marks = 50.

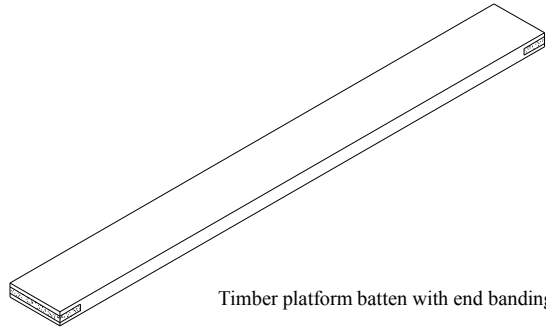
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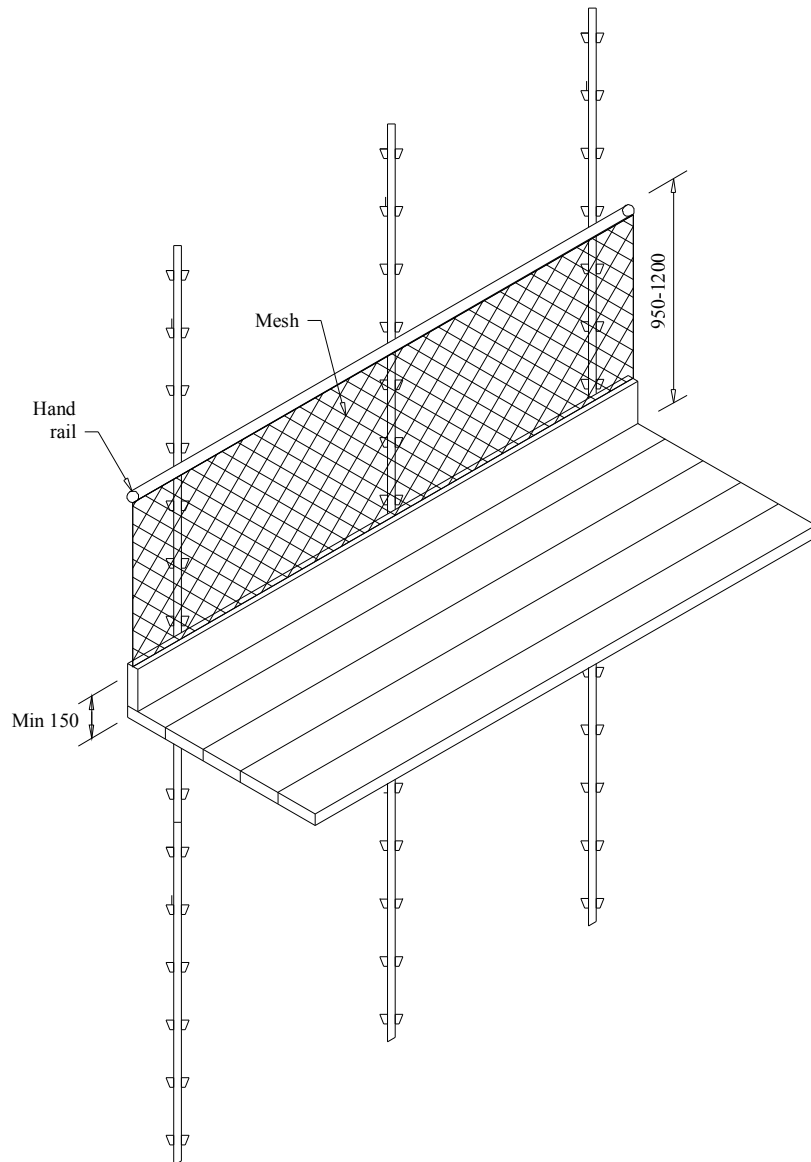
Ground should be firm and solid to prevent slipping or sinking



Q6 (c)- Leaving Certificate
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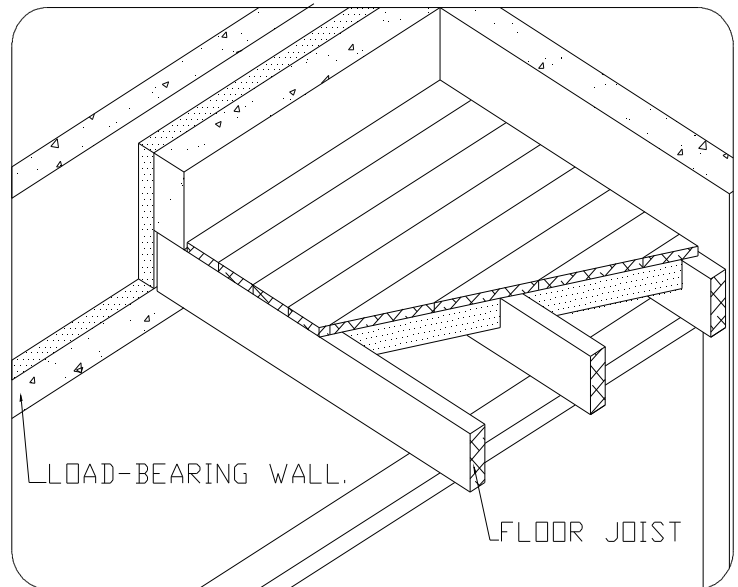
Timber platform batten with end banding



Question 7.

(i) Floor joist;

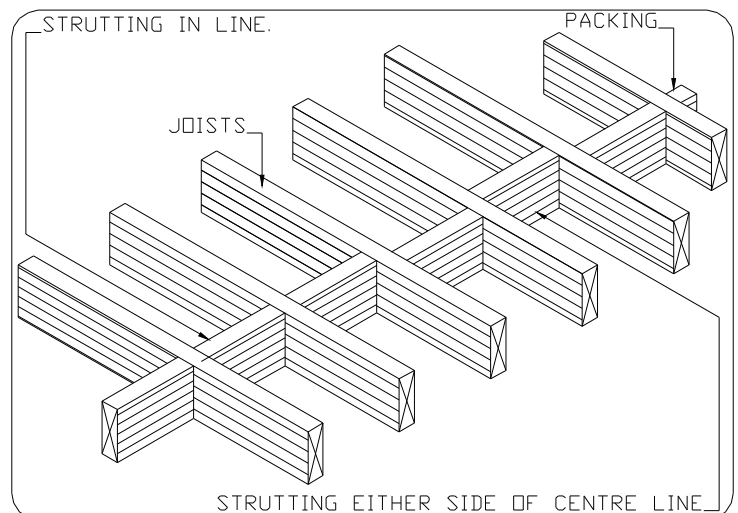
- Used in suspended timber ground and upper floors to carry all weights the floor has to support.
- Both ends of the joist rest on loading-bearing walls.
- Generally, the joist span the shortest distance between two walls or supports.
- The joists are spaced at 300,400,600 mm centres and made of softwood.
- Ends should be treated with preservative.
- Timber for floor joists should be stress graded showing the strength class.



(6 marks + 4 marks) or (4 marks + 6 marks) = note + sketch = 10 marks.

(ii) Solid bridging;

- Used in timber suspended floor to prevent twisting of joists.
- Consists of short boards fixed vertically between floor or roof joists.
- Struts are either staggered to allow for end nailing or in line, in which case skew nailing is used.
- Strutting usually occurs at mid-span of the joists or more frequently depending on the span of the floor joists.
- Strutting should be the same depth as the joist.
- Packing or folding wedges secures the gap between the last joist and the wall, on the line of the strutting.

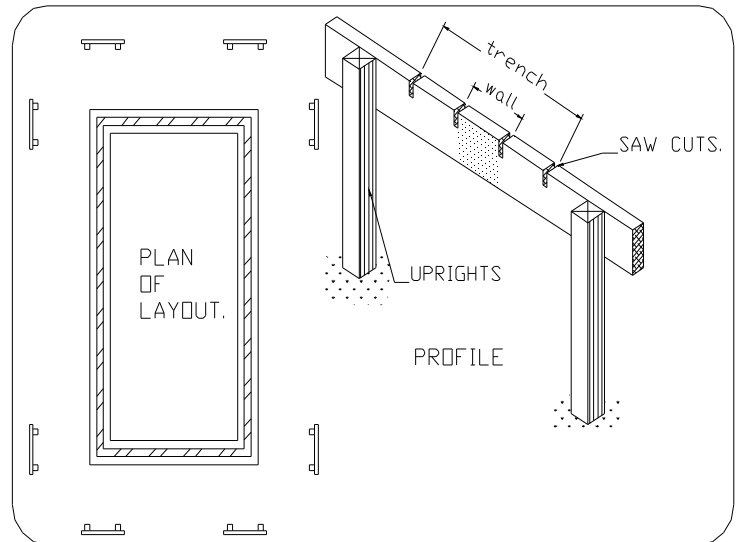


(6 marks + 4 marks) or (4 marks + 6 marks) = note + sketch = 10 marks.

Question 7 contd.

(iii) Profile;

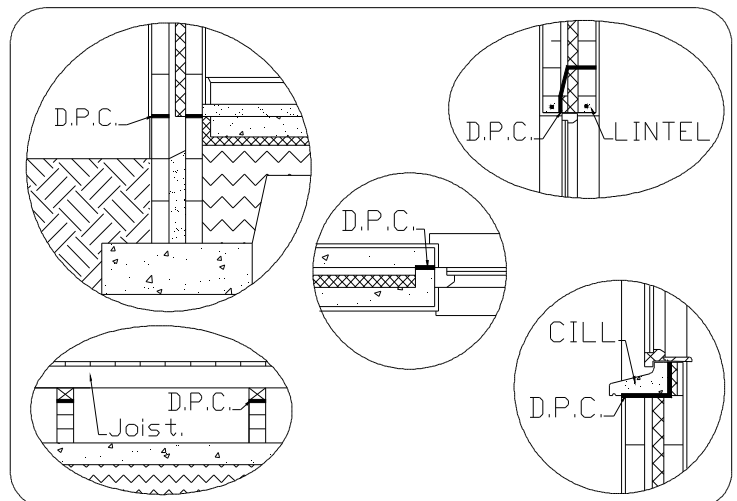
- Profile consists of a timber horizontal rail fixed to two vertical uprights or posts.
- Profiles can be set up to mark the position and width of trenches.
- The depth of the trench can be controlled if a boning rod or traveller is used with the profile.
- The level cross board should relate to site datum and fixed at a convenient height above the ground.
- Profiles should be set clear of trenches so they do not obstruct the excavation work.
- Profile is a vertical section of a ground surface or of an object e.g. half round moulding. Or a valid explanation of any profile as it relates to Construction technology.



(6 marks + 4 marks) or (4 marks + 6 marks) = note + sketch = 10 marks.

(iv) Damp-Proof Course; (D.P.C.)

- A strip of impervious material inserted in the wall to resist rising moisture
- At ground level D.P.C. is laid near the bottom of the wall at a minimum of 150 mm above ground level.
- At high-level D.P.C. is placed over the lintel to divert the moisture out of the cavity.
- D.P.C. is put in at areas where the outer leaf is in contact with the inner leaf to resist moisture entering the inner wall.
- It is generally the same width as a brick or block wall.
- D.P.C. can be rigid, semi-rigid or flexible.

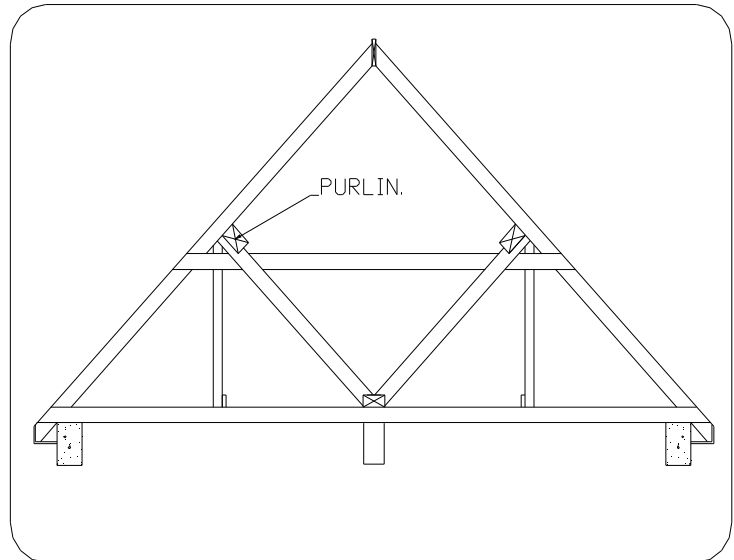


(6 marks + 4 marks) or (4 marks + 6 marks) = note + sketch = 10 marks.

Question 7 contd.

(v) Purlin

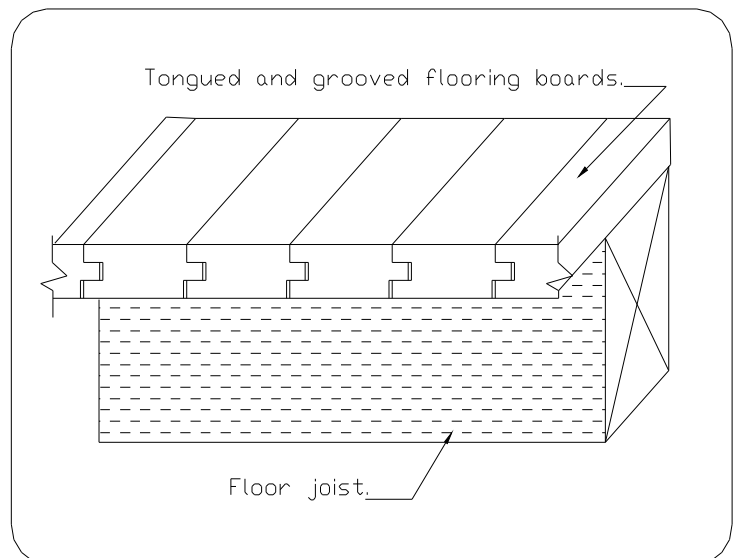
- A beam inserted into the roof frame to support common rafters between the ridge and the eaves.
- The purlin reduces the rafter span and enables smaller rafter section to be used.
- The purlin runs longitudinally along the roof and assists the rafters to carry the weight of the roof.
- It is placed at mid-span of the rafter.
- The purlin is supported by struts or built up internal walls.
- Timber for purlins should be stress graded showing the strength class.
- Sizes vary from 175 mm to 225 mm x 75 mm



(6 marks + 4 marks) or (4 marks + 6 marks) = note + sketch = 10 marks.

(vi) Tongued and grooved flooring boards;

- Boards machined with a tongue on one edge and a matching slightly narrower groove on the other edge, so that they fit closely when laid together.
- Used in upper floors.
- Boards are laid at right angles to the floor joists and nailed to the floor joists using floor brads.
- T & G boards are prepared from softwoods and good quality boards are quarter sawn to give edge grain.
- Width varies from 65 mm to 140 mm and thickness from 16 mm to 28 mm.
- The joined boards give a smooth floor surface and are relatively airtight even if the boards shrink.

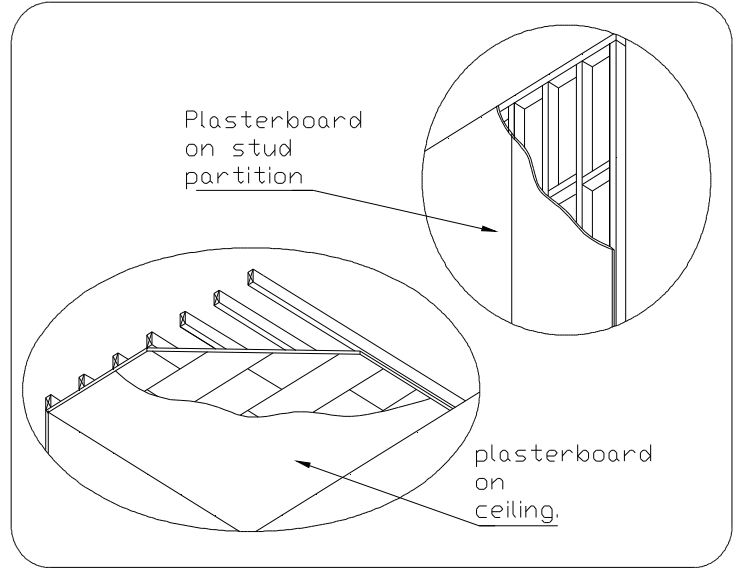


(6 marks + 4 marks) or (4 marks + 6 marks) = note + sketch = 10 marks.

Question 7 contd.

(vii)Plasterboard;

- A rigid board having a gypsum core faced with strong durable paper on each side.
- Used to cover ceilings, stud partitions and dry lining for walls.
- Plasterboard has three different edge profiles: Tapered edge, Square edge and Bevelled edge.
- Plasterboard comes with an aluminium foil face that acts as a vapour barrier and an insulator.
- The boards are fixed to the joists with galvanized plasterboard nails.



(6 marks + 4 marks) or (4 marks + 6 marks) = note + sketch = 10 marks.

Any (5 notes + 5 sketches) x 10 marks = 50 marks.

TOTAL = 50 MARKS.

Question No. 8

(a)

The main objectives of applying a paint finish to a surface are, preservation, protection and decoration. It also provides a surface finish, which is clean attractive and easy to maintain. To prepare and paint new wood for external use, the following sequence of operations must be followed.

- The surface should be clean dry free of dust and grease.
- Wood should have a moisture content of less than 18%.
- All external wood should be treated with a suitable preservative.
- The wood should then be sanded by hand using a medium glasspaper 120/180 or an electric sander with Aluminium oxide paper.
- Any dust on the surface should then be cleaned off using a cloth with some White Spirits.
- Apply “Knotting” to all knots on the wood. This will prevent resin bleeding through the paint film later.
- A coat of Primer is next applied evenly using a good quality brush. The Primer should be worked well into the surface.
- Cracks and holes should be filled using a suitable filler.
- When the filler is dry the surface is sanded
- Two undercoats are applied. The colour of the undercoat should be compatible with the finish coat.
- The surface should be lightly sanded.
- One or two gloss coats are then applied. Good quality brush should be used. The paint should be applied evenly and worked well into the surface.

Any 6 points - 6 marks for each.

6 x 6 marks = 36.

(b)

Health Precautions to be observed when using Preservatives are as follows :

- Work in a ventilated area. Good ventilation allows the fumes to clear away from the work surroundings.
- Wear a suitable face - mask. A good quality mask should be worn as it prevents inhalation of the strong fumes, which are part of some preservatives.
- Wear protective gloves. Gloves protect the skin and helps prevent any irritation. The sign indicating that it is an irritant is marked on the tin containing the preservative.
- Wear protective clothing. Good protective clothing prevents splashes of the preservative getting in contact with the person who is carrying out the work.
- Do not eat food or drink any liquids while using Preservatives. It is important that none of the preservative comes in contact with food or drink.
- Keep away from children. Children do not see the danger. It is important that they are kept well away from the area when application of preservatives takes place.
- Do not use near pets or fish. Splashes and fumes are a danger to pets and fish life The preservative should not be used in their vicinity
- Some preservatives are flammable. Do not use near naked flame.

Two precautions - 7 marks for each.

2 x 7marks = 14.

Total Marks = 50.

Question No. 9 Part (a)

(i) Insulation of a pitched roof.

Thermal insulation reduces heat loss and cuts down on fuel bills. In accordance with the building regulations all new dwellings must have adequate insulation in the roof area. Insulation of a pitched roof is carried out as follows:

- Fixed between the joists and resting on the ceiling slab. Foil-backed plasterboard is used with the foil acting as a vapour barrier preventing moisture reaching the attic space and the insulation itself.
- Continuous eaves ventilation must be provided on the soffit board, at least equal to a continuous strip 10mm. wide.
- An eaves ventilator is fixed above the insulation to allow unobstructed circulation of air into the attic space. A clear gap of 50mm should be provided.
- Glass fibre quilt is the most common form of insulation used, with a minimum thickness of 150mm required.
- Insulation may also be installed following the pitch of the roof, again an unobstructed air path should be provided over the insulation with vapour barrier on the warm side.
- With attic development the insulation is placed between the joists, continued up along the stud partition and between the joists in the small attic. A vapour barrier is again installed on the warm side of the insulation. Again adequate ventilation must be provided with a minimum of 50mm. when next to the slope of the roof.

(12marks + 6marks) or (6marks + 12marks) = Note + Sketch = 18Marks

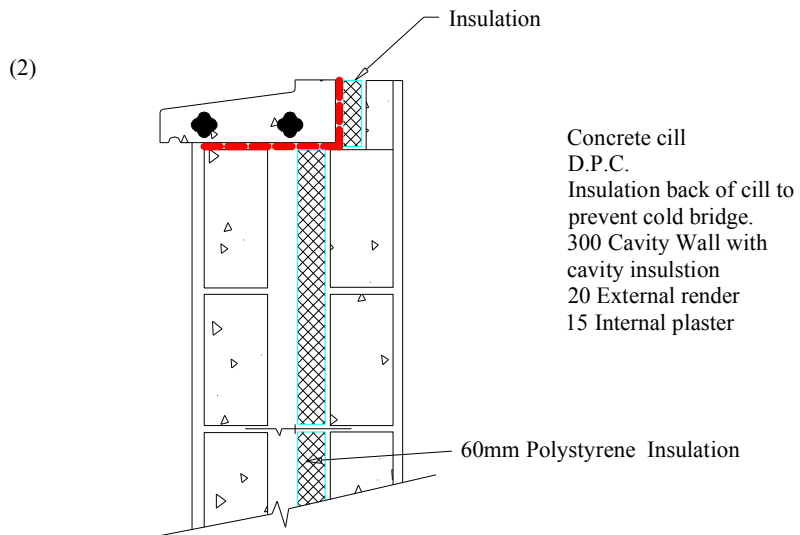
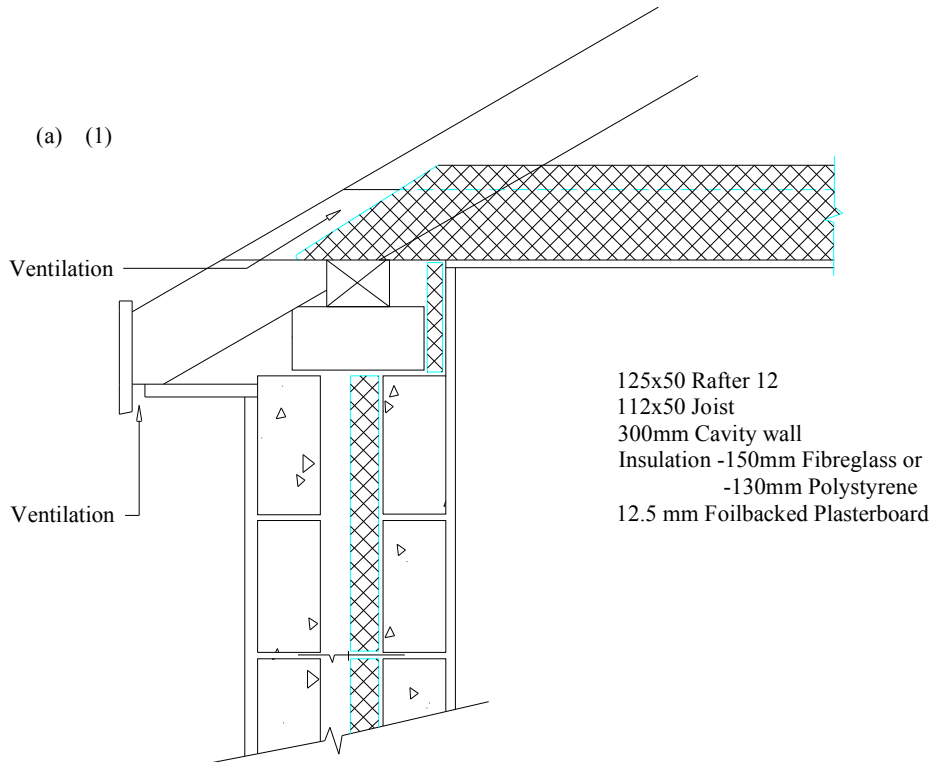
(ii) Insulation of an external cavity block wall.

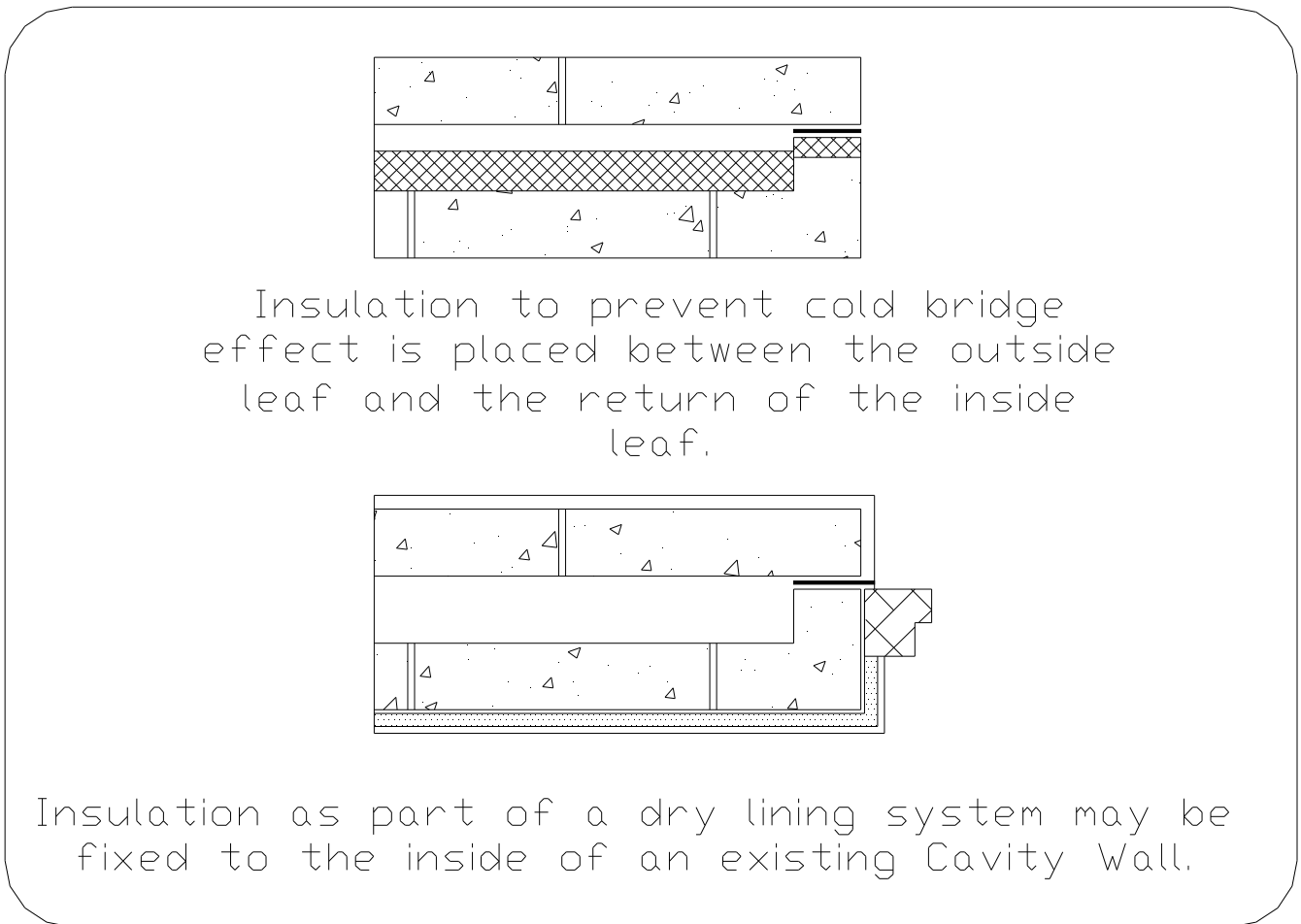
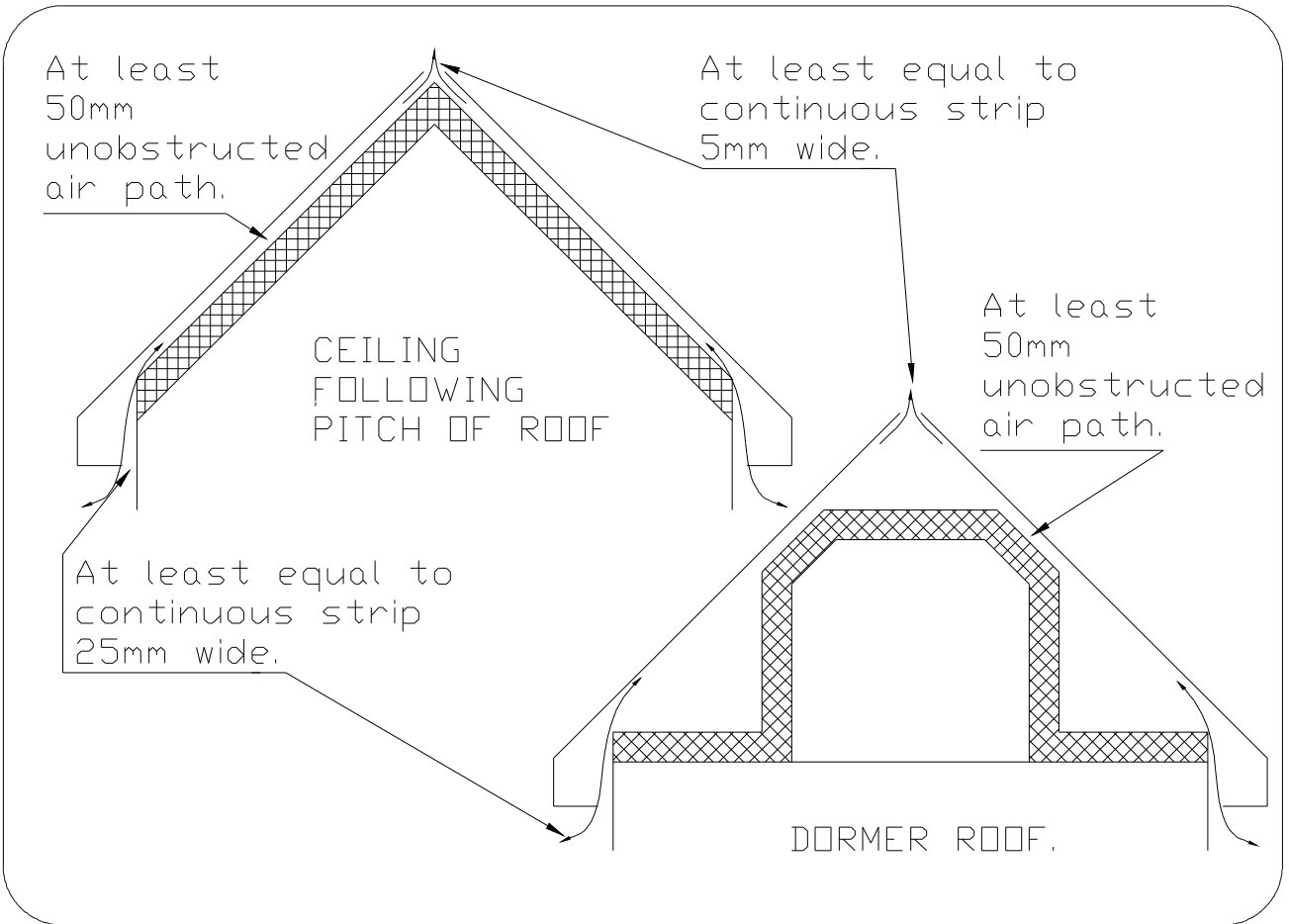
Thermal insulation in walls also leads to the conservation of fuel and energy. In modern day construction of cavity walls insulation is mandatory under the Building Regulations 1991. The U-Value must not exceed $0.45\text{W/m}^2 \text{K}$. Insulation of cavity block walls is carried out as follows:

- The method most widely used is where the solid slab of insulation is fitted as the building of the cavity wall progresses. It is fixed in the cavity to the inner leaf using special Tie-Bars, thereby leaving a residual cavity of 40mm.
- Insulation is fitted at the back of a window cill in a cavity wall. This prevents the cold bridge effect at this point.
- Jambs of windows and doors must also have solid insulation. This again is to prevent cold bridge effect.
- Polystyrene particles may also be used on an existing cavity wall. This material is pumped into the cavity at various points along the wall. It completely fills the cavity.
- An existing wall may also be Dry-Lined by fixing battens, insulation and foil-backed plasterboard to the inside of the wall.

(12marks + 6marks) or (6marks + 12marks) = Note + Sketch = 18Marks

Q9- Leaving Certificate Construction Studies
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Question No.9 Part (b)

The type of insulation and the thickness to be used in a *pitched roof* is as follows :

Glass fibre quilt	Minimum thickness 150mm.
Expanded Polystyrene Board	Minimum thickness 130mm.
Extruded Polystyrene Board	Minimum thickness 90mm.

Type of Insulation = 4 Marks.

Thickness of Insulation = 3 Marks.

The type of insulation and the thickness to be used in a *cavity wall* is as follows :

Expanded Polystyrene Board	Minimum thickness 60mm.
Glass fibre slab	Minimum thickness 60mm.
Extruded Polystyrene Board	Minimum thickness 40mm.

Type of Insulation = 4 Marks.

Thickness of Insulation = 3 Marks.

Total Marks = 50.