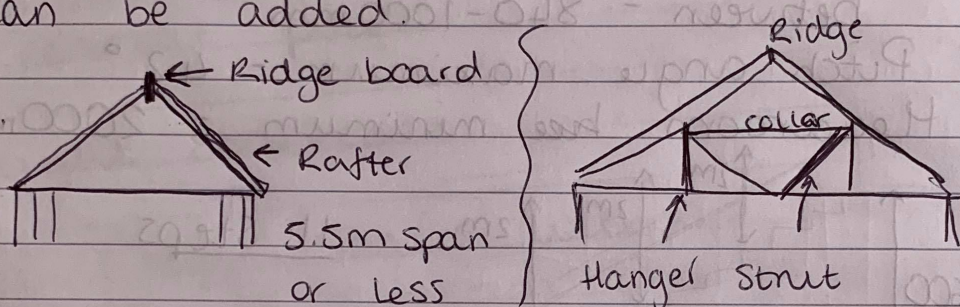


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Question 5

(5A) Cut roof -

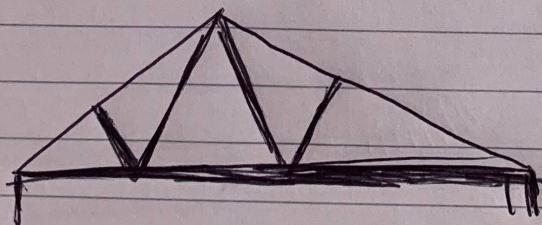
Constructed on site with pieces cut and fitted to its neighbours.
For larger roofs support called struts can be added.



(5B) Trussed rafter roof -

Made up of frames which combine the joist, rafter and struts.
Truss structures can be designed in many variations. They are in complete equilibrium with each other, either in tension or compression.

↑ The trusses are

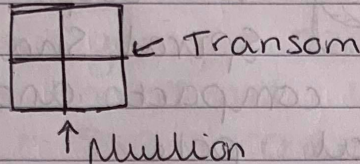


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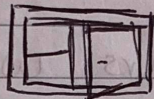
(3B)

Mullion - Vertical divisions between windows.

Transom - Horizontal divisions between windows.

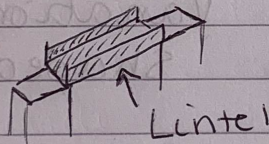


Casement - A window that is attached to its frame by one or more hinges.

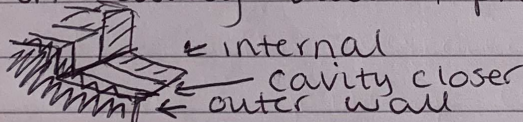


Opening light - The portion of the window which can be opened.

Metal lintel - Horizontal block which spans the space between the inner and outer leaf.

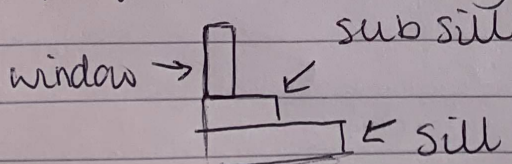


Cavity closer - Rigid material, used to close openings in cavity walls, prevents vapour and damp.



Sill - Shed rain that runs down the window away from opening / wall.

Sub sill - (Subsidiary) Causes water to drip further away from the wall.

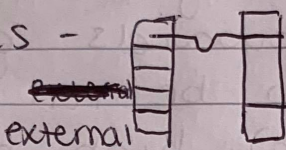


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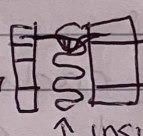
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Question 2

(2A) Common ways that walls are built -

Cavity walls -  internal
external

Linked with wall ties, cavity usually same. Wall ties allow water to drip down the cavity. Inner skin remains dry.

Filled cavity -  internal
external
↑ insulation

Buckling can occur when the wall is too tall compared to its thickness. This can be solved by a number of ways, increasing the thickness, connecting internal and external walls by joints. When walls are overloaded the foundation can fail, causing overturning. The foundation can be reinforced or increased in width. To prevent damp the walls ^{joints} can be filled with mortar.

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(2B) Ways to improve insulation -

Best insulation are ones with atoms spaced apart, low density. Gases are good insulating materials. Air works as a good insulator but only if still, fibre glass can be used to trap the air so that it doesn't move. The choice of construction materials are very important. Timber frames are good for insulation as they can be filled. Some areas for concern for designers can be condensation ~~enrich~~, waterproofing, fire proofing and ventilation. Ventilation is especially important, poor design can cause damp and an uncomfortable environment.

Disadvantages:

- Acoustic: Timber frame construction doesn't provide as much sound insulation as block construction due to density.
- Rot can occur if not protected and constructed properly. Timber walls need to be designed with vapour barriers to prevent vapour getting through.
- Can take longer to design correctly.

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(1D) Nuclear power -

Advantages-

- Produces no greenhouse gases, doesn't contribute towards global warming.
- Plants can be run uninterrupted for years (one to two), high reliability.
- Creates millions of jobs worldwide and contributes billions to the economy.

Disadvantages-

- Disposal of radioactive waste is expensive, difficult and dangerous.
- Accidents can be catastrophic, as seen with previous events such as Chernobyl. Nuclear radiation has a long lifespan and can remain toxic for up to 30 years.
- Plants are expensive to build and maintain.

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(1c) Solar energy -

Advantages -

- It is clean energy, pollution free causing no greenhouse gases, in turn reducing your carbon footprint.
- It can lower traditional energy bills.
- Batteries can store extra energy to use at night.
- Low maintenance costs.

Disadvantages -

- Initial cost of buying the panels can be expensive.
- Not suitable for all properties. For example if your home is shaded by trees or by a big building.
- Solar energy cannot be collected at night. Particularly bad during winter months as the nights are longer.

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(4B)

Regulation standards for private dwelling -

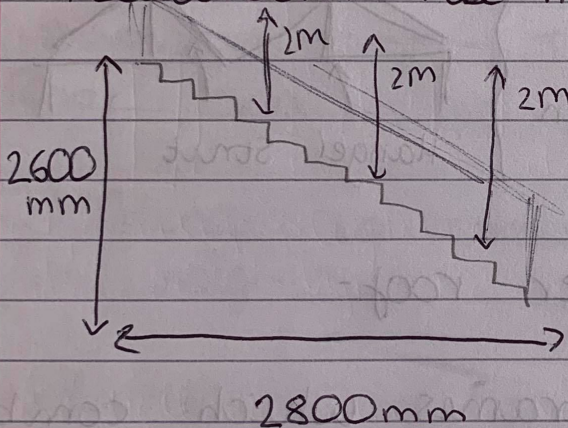
Maximum rise - 220mm

Minimum going - 220mm

Continuous handrail with height between - 840-1000mm

Pitch angle maximum - 42°

Headroom ~~here~~ minimum - 2000mm



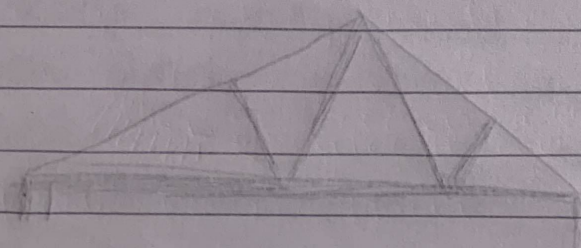
11 Steps

Rise = 21.67cm

Run = 25.45cm

Pitch angle = 40.4°

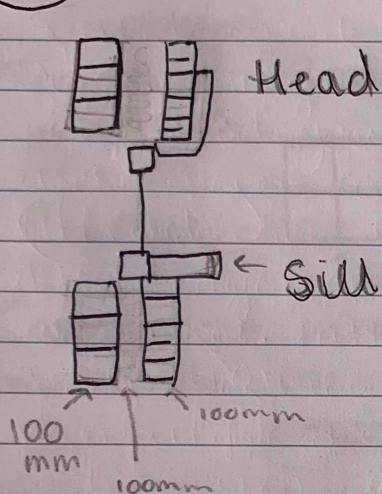
Handrail = 1000mm



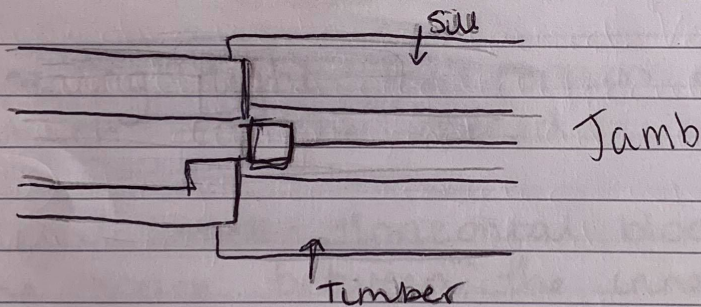
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Question 3

(3A)



100mm Brick outer leaf
100mm Cavity
100mm Block inner leaf



Cavity / closer - Block material, used to close openings in cavity walls, prevent's vapour and damp from entering the internal cavity.

Sill - Shed rain that runs down the window, away from the opening / jamb.

Sub Sill - (Substrate) prevents water to drop further away from the wall.

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(5C)

Advantages - cut roof

- Able to use the roof space

Disadvantages - cut roof

- Requires good construction skills and uses more materials.

Advantages - Trussed rafters

- Can be fabricated offsite.
- Very stable.
- Variation of designs.

Disadvantages - Trussed rafters.

- Roof space is difficult to use

(5D) Things to consider when designing a roof -

Insulation - Cold or warm roof.

Cold roof doesn't insulate structural supports. Warm roof insulates internal and structure.

Ventilation - Cold roof air gaps opposite sides of roof space.

Warm roof, ventilation path blocked on sloping roof, additional ventilation gaps below and above the blocked area.

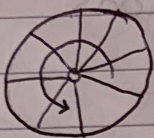
Condensation - To avoid use ventilation gaps or use a breathable material membrane as it won't let water through.

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Question 4

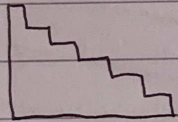
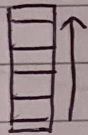
(4A) Spiral Staircase -



The steps follow a helix spiral shape.

They are compact and follow around a central pole.

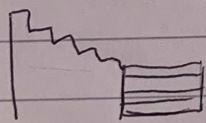
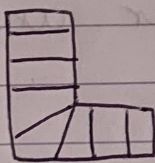
Straight Staircase -



Stairs without any direction change.

Landings are required every 12 steps for safety.

Winder Staircase -



Variation of a L shaped Staircase.

Instead of a flat landing they have triangular shaped steps at the corner.

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M4X01974 Technology and environment 1
Exam paper - May 2020

Question 1 - Sustainability, energy and environment

1a) Understanding of the term 'Sustainability' -

Sustainability meets the needs of the present without negatively affecting the future. Sustainability can be seen in a number of ways throughout society, products, ways of life and travel.

Sustainable development and energy could be seen as the most impactful on society. Sustainable development takes into consideration the materials used, carbon footprint created and the energy sources used.

1b)

Environmental
• Biodiversity • Pollution

Sustainability

Social

- Values
- Empowerment
- Inclusion

Economic

- Growth
- Efficiency
- Stability

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(2C)

Timber in external wall construction-

Advantages-

- Timber is a recyclable, sustainable material with a longlife of around 60 years. Timber construction requires less CO₂ than other construction materials, steel or concrete.
- Timber is more energy efficient. It can get to low U-values without increasing the width of the wall, insulation can be fitted inside the timber frame portion of the wall.
- Fire safety - Steel can fail at high temperatures. When timber burns, the outer chars and insulates against heat. The center is protected and won't collapse.

Disadvantages-

- Acoustics - Timber frame construction doesn't provide as much sound insulation as block construction due to density.
- Rot can occur if not protected and constructed properly. Timber walls need to be designed with vapour barriers to prevent vapour getting through.
- Can take longer to design correctly as more thought needs to be put in.