



**2007 Building Construction**

**Higher**

**Finalised Marking Instructions**

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## SECTION A

Marks

Attempt all the questions in this Section (total 40 marks)

1. (a) State **three** objectives of a site investigation.

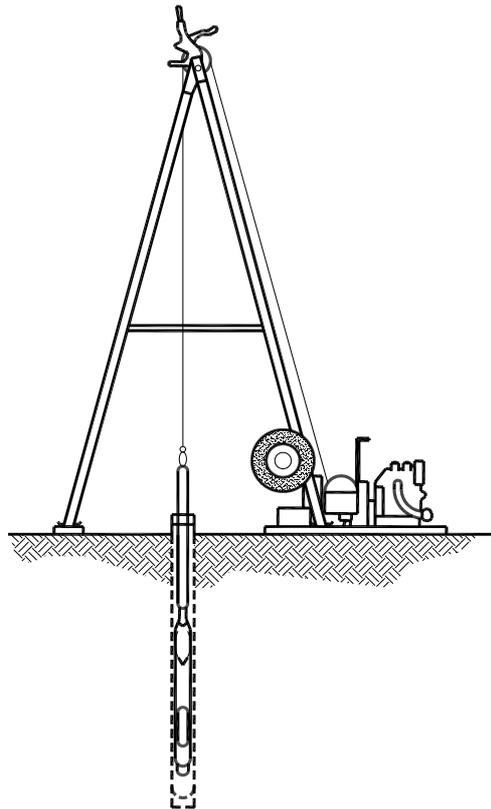
Any three from the following list:

- assess the suitability of the site for the proposed construction
- examine the ground conditions so that the most appropriate type of foundation can be selected
- plan the best method of construction; to avoid difficulties and delays due to unforeseen ground conditions
- eliminate structural defects which would result from unacceptable ground movements
- prevent chemical attack on foundations
- assess the impact of the work on adjacent sites/properties.

3

(b) **Figure Q1** shows a common way to carry out ground investigation.

State the name given to this exploration technique.



**Fig.Q1**

Light Percussion drilling (Shell and Auger will be acceptable).

1

2. *A developer proposes to construct ten new detached houses on a greenfield site.*

(a) *Briefly describe the temporary on-site accommodation that will be required by the contractor.*

Welfare facilities to include sanitary and washing facilities, canteen/rest facilities, facilities to change and store clothing.

Office accommodation

Storage accommodation for tools and materials

4

(b) *State **four** factors which should be considered when deciding where the temporary accommodation will be located.*

Locate close to the site entrance

Locate close to existing services

Vehicle parking for site personnel, visitors and materials delivery.

Not too far from the construction work

Security of the site and accommodation **(any 4, ½ mark each)**

2

3. *Foundations for buildings in the United Kingdom are constructed from concrete.*

(a) *State **four** materials used in the manufacture of a concrete mix.*

Any four from the following list:

- Portland cement
- Fine aggregate (sand)
- Course aggregate (stone)
- Water
- Admixture
- Pulverised Fuel Ash (PFA)
- Ground Granulated Blastfurnace Slag (GGBS) **(½ mark each)**

2

(b) *Briefly explain how a contractor may obtain a supply of concrete for the foundations and state **one** reason why he may do so.*

Contractor may obtain a supply of concrete from a local Ready Mixed Concrete supply depot. One reason he may do so is to maintain a consistent supply of quality concrete.

2

4. A contractor proposes to build five new houses on a greenfield site.

(a) State **two** reasons for the removal of top soil to spoil heaps prior to excavating for the foundations.

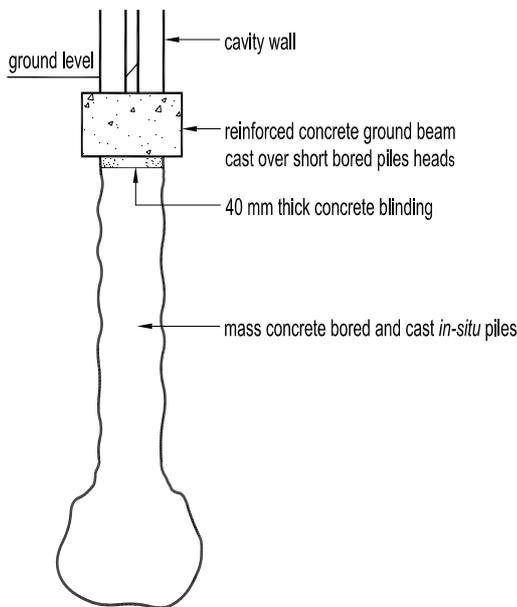
Top soil has very low bearing capacity  
 It is humus-rich and provides support for plant life  
 Major use is in landscaping and it is a valuable resource. **(any 2)**

2

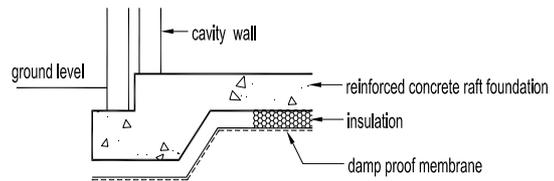
(b) Prepare an annotated sketch to show a typical vertical cross-section through **each** of the following foundations:

- A short bored pile supporting ground beam and external wall
- A raft foundation
- A pad foundation supporting an isolated masonry pier.

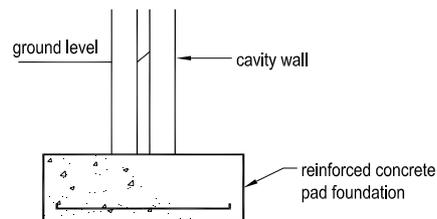
(A maximum of 2 marks for each sketch)



**Short bored pile (2 marks)**



**Raft foundation (2 marks)**



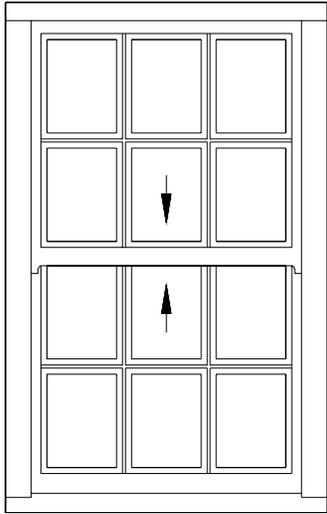
**Pad foundation (2 marks)**

6

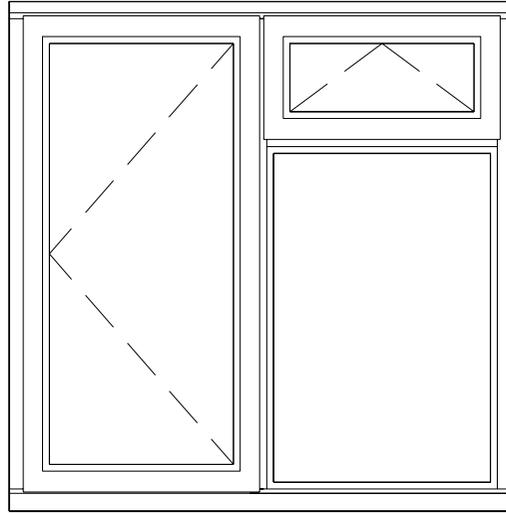
5. (a) **Worksheet Q5(a)** shows the elevation of three timber window types in common use. State, on the **worksheet**, the name given to each window type.

The attached Worksheet Q5(a) indicates the solution

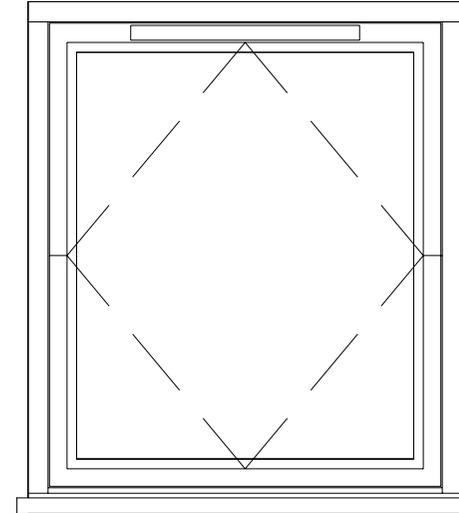
3



(i) Sash & Case Window (1 mark)

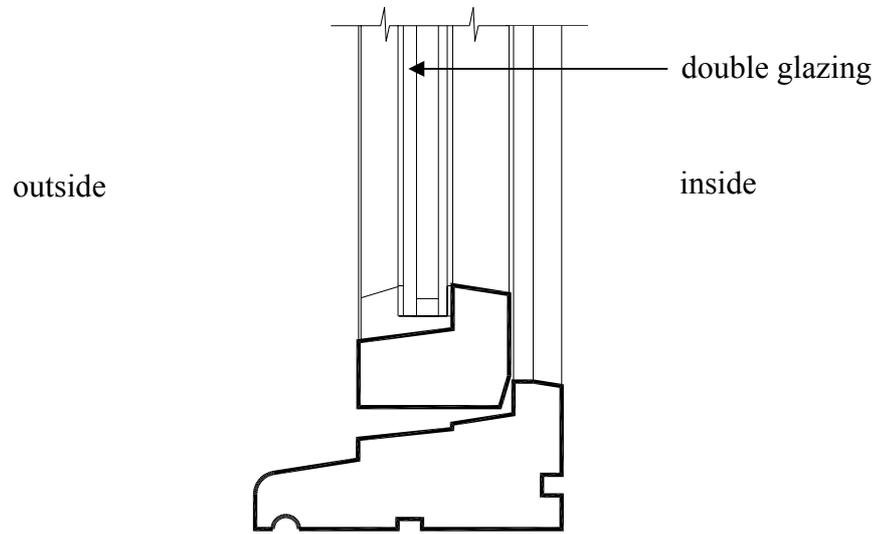


(ii) Casement Window (1 mark)



(iii) Horizontal Pivot Window (1 mark)

- (b) *Worksheet Q5(b)* shows an incomplete vertical section through the sill of a window opening. The simplified vertical section through a timber window frame is shown in Fig Q5(b).



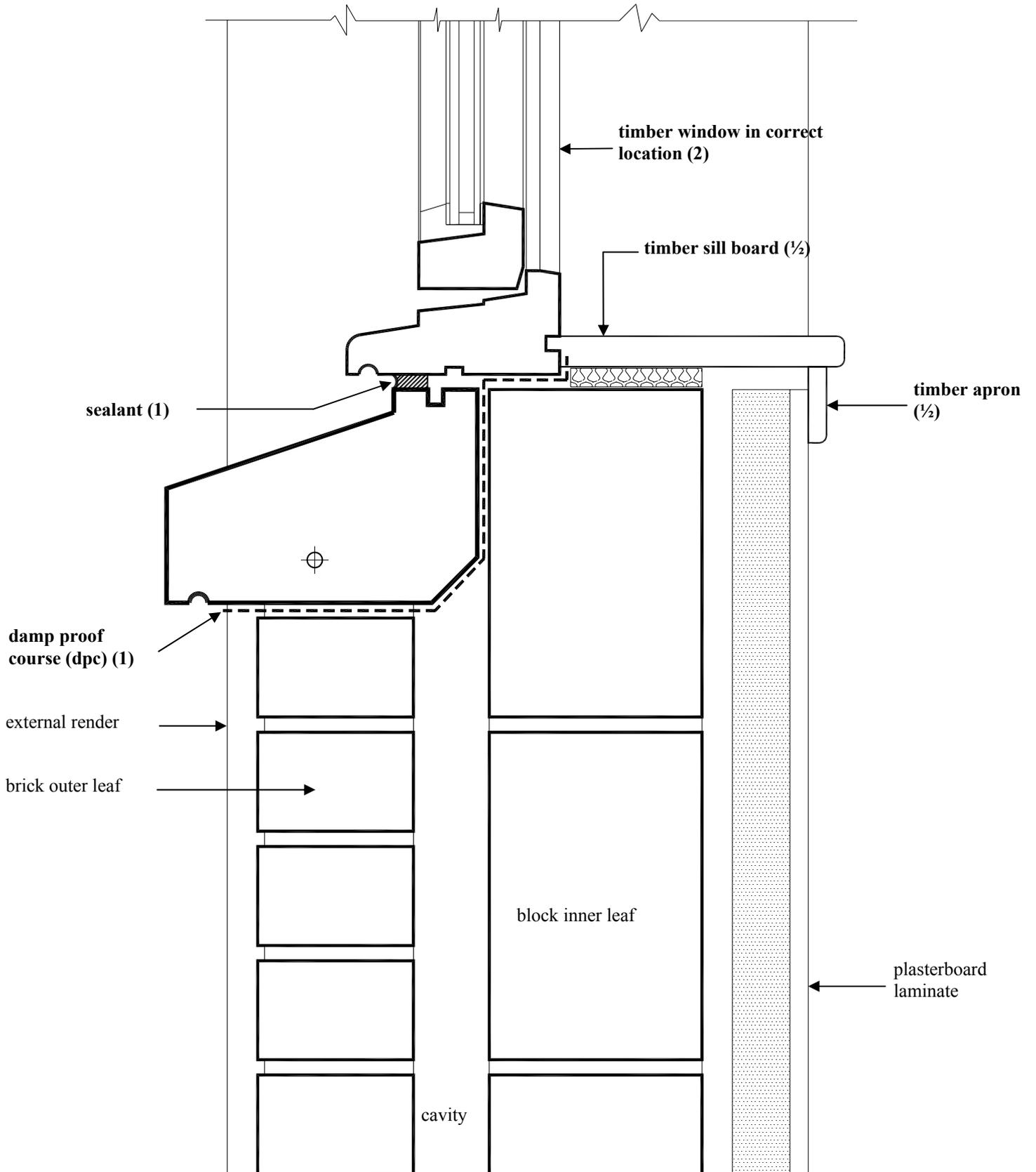
**Fig Q5(b)**

*On the worksheet, sketch this vertical section to complete the sill detail. Show the location of the window frame and all adjoining components and finishes.*

The attached Worksheet Q5(b) indicates one solution.  
Marks should be awarded as follows:

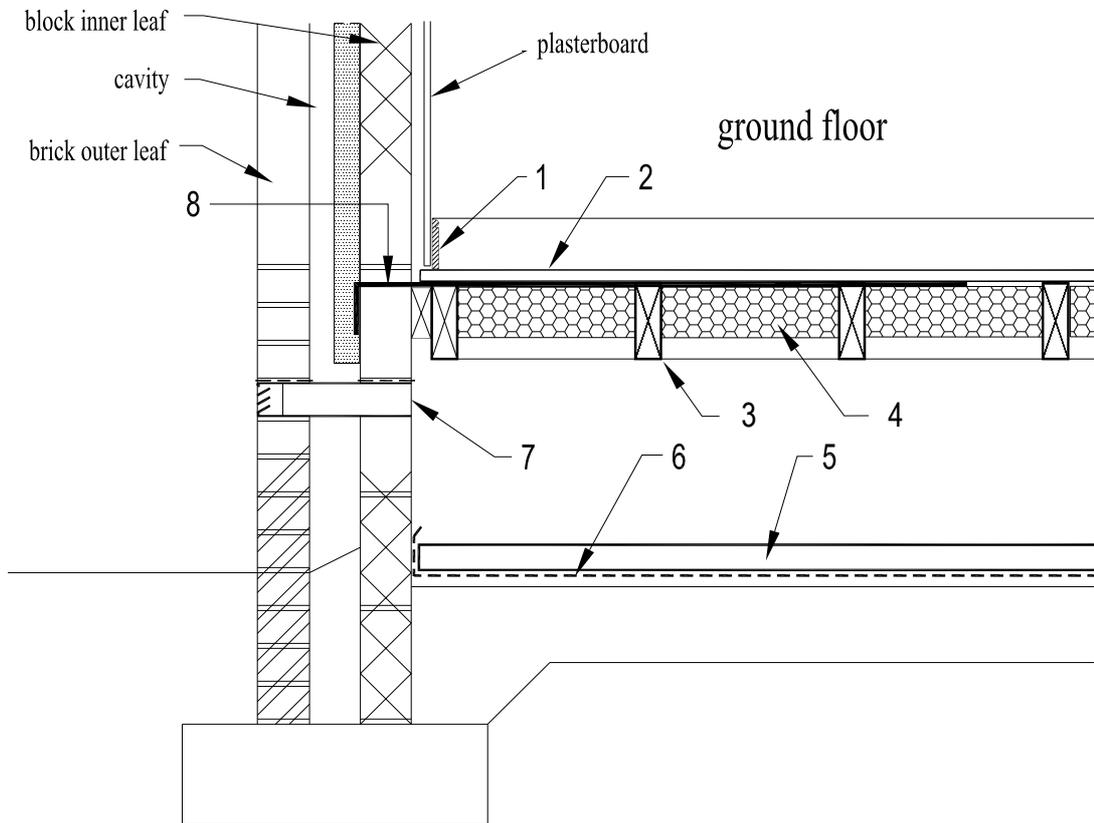
- Correct location of window - 2 marks
- Damp proof course (dpc) in correct location - 1 mark
- Sealant between timber and concrete sill - 1 mark
- Internal finish: timber sill board - ½ mark and  
timber apron - ½ mark

WORKSHEET Q5(b)



(5 marks total)

6. **Figure Q6** shows a vertical cross section through a suspended timber ground floor of a dwelling house.  
 State the name of the component parts numbered 1 to 8 and explain the purpose of component number 8.



**Figure Q6**

Component Part No	Name	
1	Skirting	½
2	Tongued & Grooved Chipboard flooring (other material acceptable)	½
3	Floor joist	½
4	Insulation	½
5	Concrete solum	½
6	Damp proof membrane (polythene)	½
7	Fresh air inlets (sub-floor vents)	½
8	Horizontal restraint strap	½

These straps, manufactured from galvanised steel or stainless steel, provide the floor with horizontal lateral restraint to an external wall where the floor joists run parallel with the wall.

2

**Total 6**

7. *The external render wall finish to a dwelling house is to be a dry dash finish. The building is in a geographical area of moderate exposure and is constructed with masonry cavity walls.*

*Briefly describe how the render would be applied to the structure.*

**External render with a dry dash finish**

The sequence should include most of the following points:

- Preparation of the background by brushing down with a hard broom to remove dust and loose particles. ½
- Immediately before applying the undercoat check background for excessive suction. Dampen but do not soak backgrounds as appropriate. ½
- Apply the undercoat mix by laying on with a trowel to a thickness of between 8 mm and 10 mm. Trowel with pressure to remove air. Key the undercoat with a comb to scratch the surface. Cure the undercoat before applying top coat. 1½
- Apply butter coat of rendering to a uniform thickness of 8 mm and while it is still plastic throw washed aggregate onto the surface to a uniform dense coverage. Immediately tamp the aggregate lightly into the butter coat to ensure a good bond is obtained. 1½

**Total 4**

Attempt any TWO questions in this Section (total 60 marks)

8. (a) (i) *Site investigation is to be carried out using trial pits dug by a mechanical backhoe excavator. Briefly explain the advantages and disadvantages of this exploration technique.*

**Advantages:**

Visual inspection of in-situ soil conditions  
 Detailed examination of soil variability  
 Observation of water seepage and its measurement  
 The carrying out of large scale soakaway tests  
 Obtaining low cost detailed coverage of a site  
 Obtaining large bulk samples for testing.

**Disadvantages:**

They disturb the ground in which they are excavated.  
 They do not provide any indication of conditions at depths below the base of excavation  
 The consideration of safety requires great care  
 The process of excavation means you have to check carefully for all services before commencing.

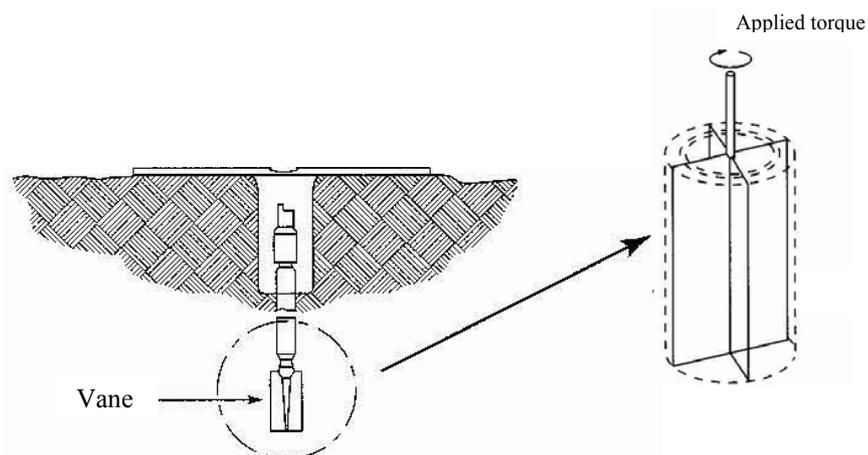
(any 4 from both advantages and disadvantages)

4

- (ii) *Briefly explain, with the aid of an annotated sketch, the operation of the field vane test.*

Vane testing is aimed at determining the *in-situ* shear strength of very soft to firm cohesive soils by determining the torque necessary to turn a cruciform shaped vane which has been pushed into undisturbed soil.

4



**Field Vane Test Equipment**

- (iii) Briefly explain why laboratory tests are carried out on soil samples. Give **two** examples of tests carried out during site investigation for a low rise housing development.

Laboratory test are carried out in order to :

Examine the natural variability of the soil (index tests)

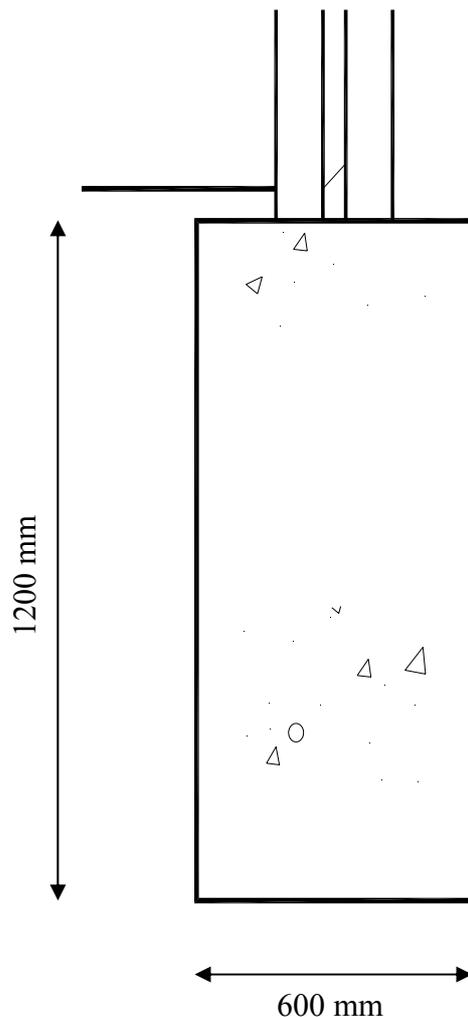
Classify the soils into groups (classification tests)

Determine parameters and values for engineering design and calculation.

The most common tests are: Moisture content, Atterberg limit, particle size distribution, pH and sulphate tests.

6

- (b) Site investigation has shown the ground conditions where a two-storey house is to be built consist of a weak soil to a depth of 1.2 metres on top of firm clay. Show, by means of an annotated sketch, a suitable foundation for the house.



A deep strip foundation taken down through the weak soil would be one possible foundation solution.

Other solutions possible.

4

(c) Briefly explain the following terms relating to fresh concrete indicating how each is achieved in practice and why they are important to the quality of finished concrete.

- compaction
- curing.

**Compaction of the concrete:** important to remove air from the concrete and may be undertaken by using either a poker vibrator or a beam vibrator. The poker vibrator (one of the most common) is inserted into the concrete during pouring/placing operations. The beam vibrator is designed for concrete slabs. If air is not removed, finished concrete surface may be honeycombed.

4

**Curing:** Concrete must be protected during curing from the harmful effects of dry air, hot sunshine, drying winds and frost. The main reasons for curing are to assist strength development and improve the durability of the concrete. Premature loss of water must be prevented, for the full benefits of cement hydration on the properties of hardened concrete to be realised.

Any of the following methods may be used to prevent premature loss of moisture:

- Covering concrete in damp Hessian
- Covering concrete in plastic sheeting
- Sprayed-on curing membranes

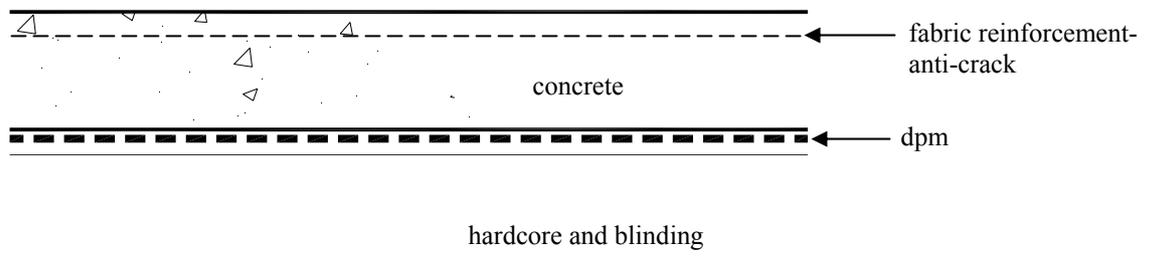
4

(d) State **two** types of reinforcing steels available to a contractor undertaking the construction of a reinforced in-situ ground supported floor slab for a garage. Show with the aid of an annotated sketch where the steel would be located in the slab.

Single steel ribbed bars fixed together with tying wire.

Welded fabric (various references and bar diameters) often referred to as mesh, is a machine welded grid arrangement for reinforcing bars.

2



SECTION THROUGH GARAGE FLOOR

Sketch 2

**Total 30**

9. (a) Briefly describe how the following materials should be correctly stored on a site.

- Portland cement
- Concrete blocks
- Plasterboard laminate.

**Portland cement**

Must be stored in a dry weatherproof enclosed hut with a dry floor. Store on a timber platform away from the walls and cover with polythene.

2

**Concrete blocks**

May be delivered loose, palleted or banded. Off-loaded units should be stacked carefully on a prepared, clean, level, firm area to minimise soiling, chipping and breakage. Stacks should be protected from inclement weather and from soiling from the ground and passing traffic. Whenever possible air should be allowed to circulate around and through the stacks.

2

**Plasterboard laminate**

Store horizontally on a dry level base consisting of a timber platform or by bearers at least 100 wide laid across the width of the boards at centres not exceeding 400 mm to prevent distortion of the boards. Do not stack boards to a height of more than 1000mm. Boards must be protected from the rain and rising damp with a waterproof sheet secured all round. Ideally they should be stored under cover.

2

(b) Briefly explain **four** advantages of beam and block floor construction.

- Speed of installation
- Quality of insulation provided
- Fire resistant floor
- Simple accommodation of site services
- Use of proprietary lightweight concrete blocks
- Spans up to 9 metres possible

(any 4 from 6)

6

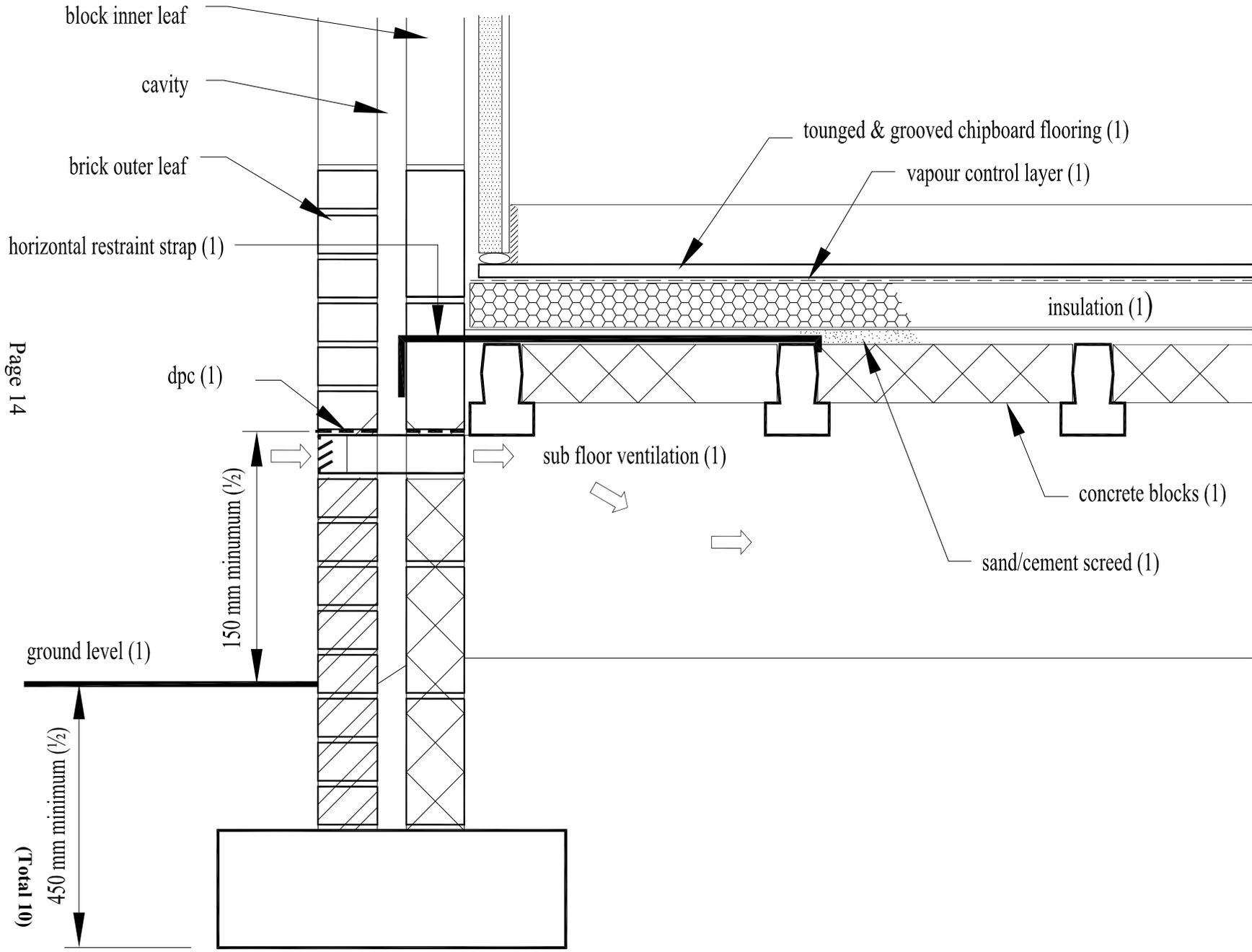
(c) **Worksheet Q9(c)** shows an incomplete detail drawing of a foundation and suspended concrete beam and block floor to a dwelling house.

On the **worksheet**, complete the drawing, in proportion, to show the following:

- how moisture is prevented from entering the building
- finished ground level
- floor structure and finish
- insulation
- ventilation
- two critical dimensions.

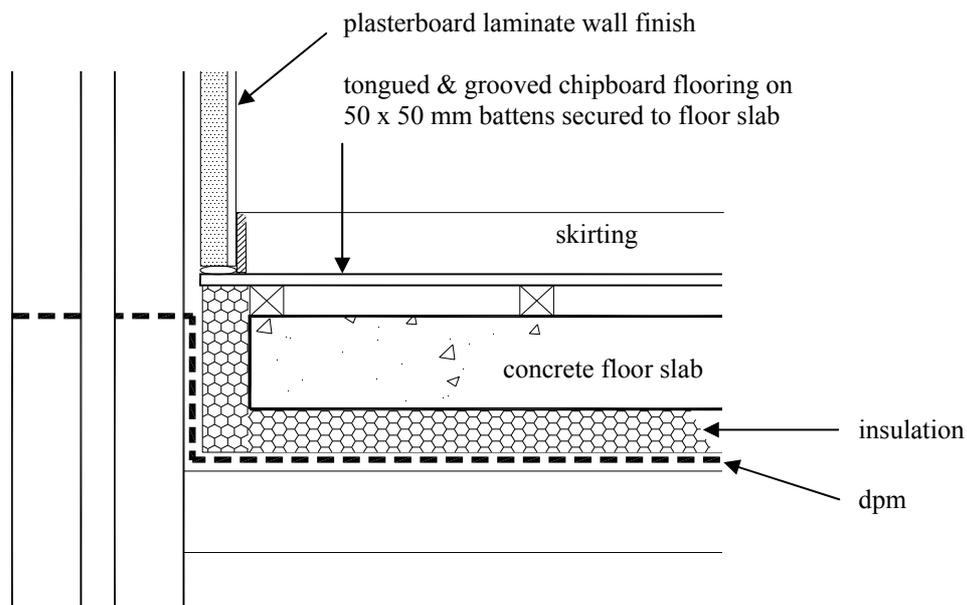
The attached Worksheet Q9(c) indicates one solution.

10



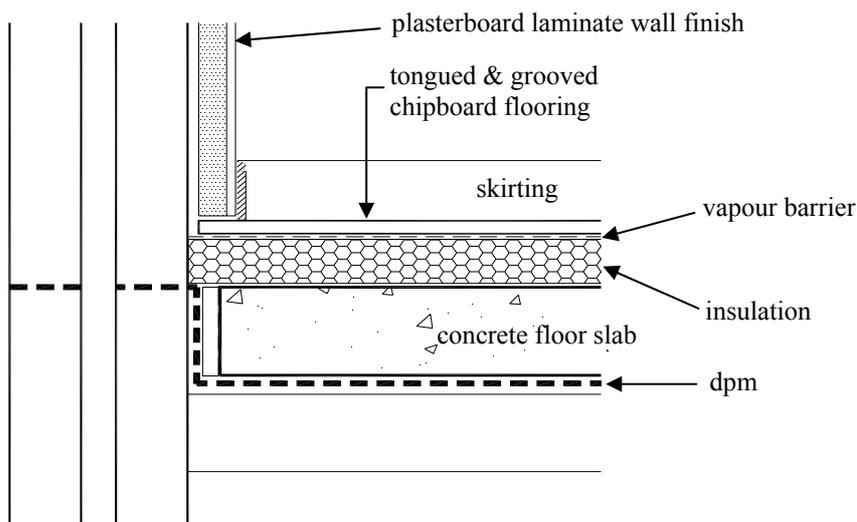
- (d) In the design of an in-situ concrete ground supported floor slab, thermal insulation may be located either above the structure or below the structure.

For **each** situation, prepare an annotated sketch to show the junction of the ground supported floor slab with an external masonry wall. The location of the insulation, damp proofing and floor finish should be clearly shown.



**Sketch 1 – insulation below the structure**

4



**Sketch 2 – Insulation above the structure**

4

**Total 30**

10. (a) Briefly explain, with the aid of an annotated sketch, how any **two** of the following finishes would be applied to the structure of a building:

- clay quarry tiles
- ceramic wall tiles
- hardwood flooring.

Brief explanation of the preparation and application of any **two** of these materials/finishes to the structure.

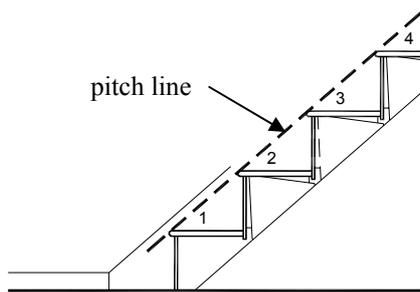
Sketches required.

(4 marks for each)

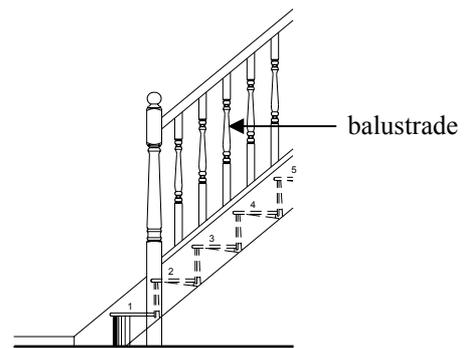
8

(b) Prepare annotated sketches to illustrate the following terms relating to a stair:

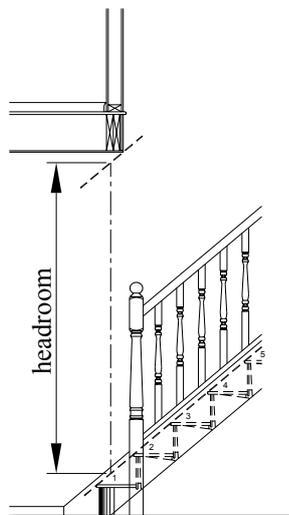
- (i) pitch line
- (ii) balustrade
- (iii) headroom
- (iv) quarter landing.



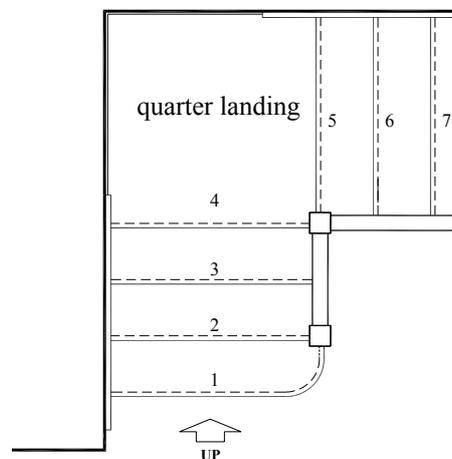
(i) pitch line (1 mark)



(ii) balustrade (1 mark)



(iii) headroom (1 mark)



(iv) quarter landing (1 mark)

- (c) *Worksheet Q10(c)* shows a plan view of a new timber private stair which rises to the first floor of a dwelling house.

On the *worksheet* clearly identify the following:

- (i) *stringer*
- (ii) *landings*
- (iii) *newel post*
- (iv) *handrail*
- (v) *tread*
- (vi) *nosing*

The attached Worksheet Q10(c) indicates the solution

3

- (d) Refer to *Worksheet Q10(c)*

Assuming that the private stair is to comply with the recommendations made in current standards:

- (i) *Select a suitable rise and going for a single step of the stair and calculate the pitch of the stair you have designed.*

The minimum going of a private stair is 225 mm.

Select a suitable rise to begin – say 190 mm.

Carry out checks:

Twice rise plus going to be between 550 mm and 700 mm

Therefore:  $(2 \times 190) + 225 = 605$  mm therefore that is fine.

Now check pitch:

$$\tan \theta = 190 \div 225 = 0.8444$$

$$\text{therefore } \theta = \text{inverse tan } 0.8444 \\ = \mathbf{40.18 \text{ degrees}}$$

Since the maximum rise permitted under current standards is 42 degrees, this stair complies.

Summary:

rise 190 mm, going 225 mm and the pitch is 40.18 degrees.

6

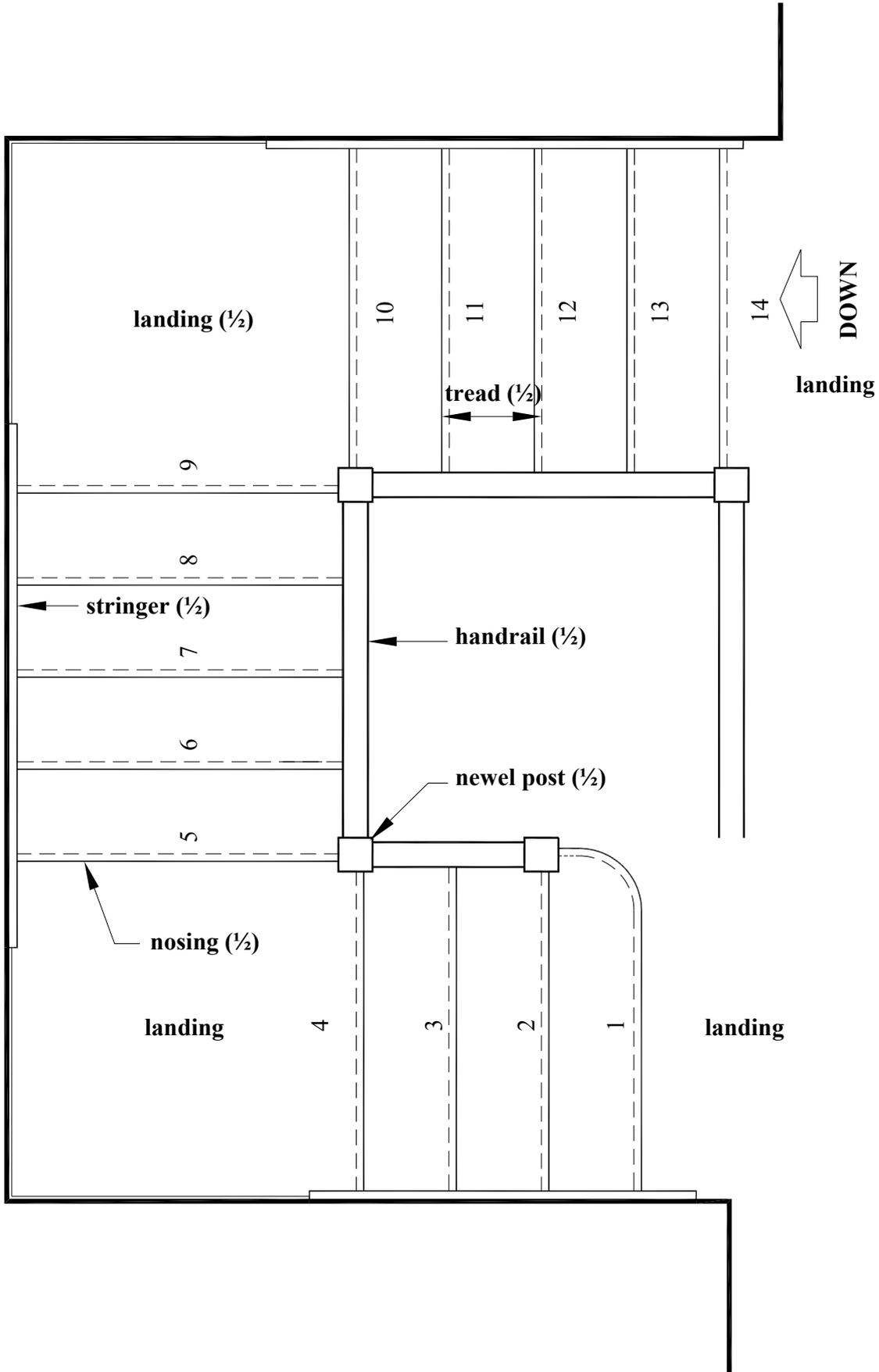
There are other solutions to this question depending on the assumptions the student makes to begin.

- (ii) *State the overall rise from finished ground floor level to finished first floor level.*

There are 14 risers to this stair. Since the rise is 190 mm the total going is  $14 \times 190$  mm = **2660 mm**

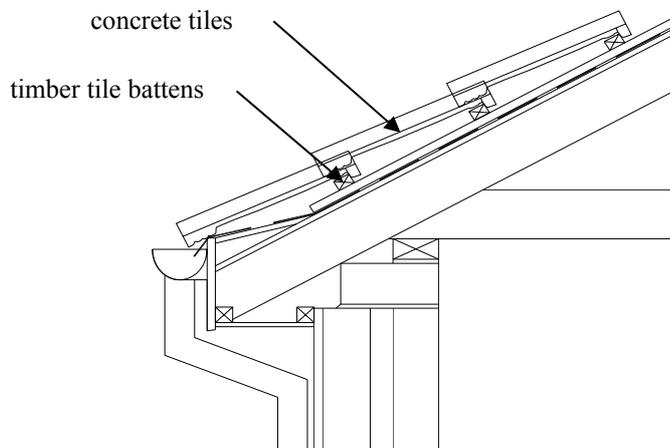
1

WORKSHEET Q10 (c)



(e) Briefly explain, with the aid of an annotated sketch, how each of the following roof finishes are applied and fixed to the structure of a building:

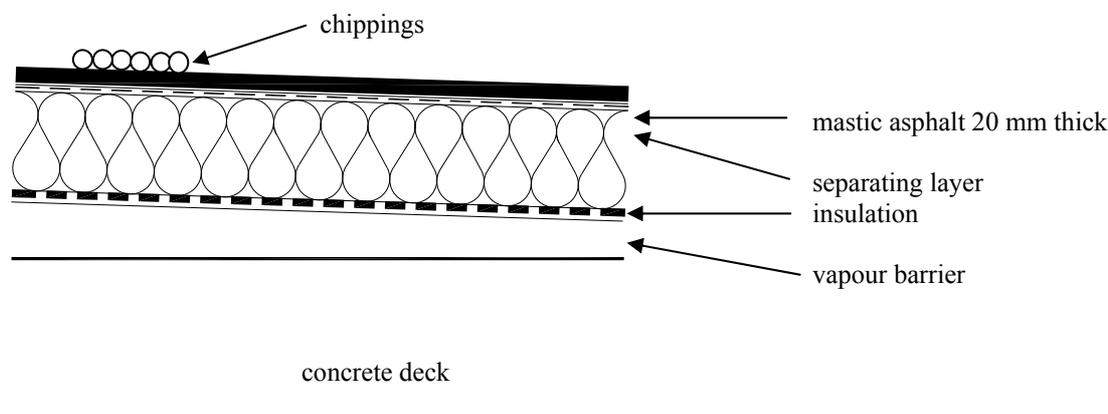
(i) single lap concrete roof tiles



Single lap concrete tiles are fixed over timber battens which run horizontally along a roof. There may or may not be counter battens. It is important that tiles are laid in accordance with manufacturers instructions. Exposure to wind results in tiles being mechanically fixed with clips. Fixing is generally at verges, eaves and approximately every second course of tiles.

4

(ii) mastic asphalt.



Asphalt is heated in a boiler to the required temperature until it is molten liquid when it is transferred to the work area and spread with a trowel to the required thickness. Generally laid in two 10 mm thick layers with each layer being lapped. Asphalt is only suitable for concrete decks, a fall is required together with insulation boards and a separating layer which may be building paper. Surface finish requires solar reflectant finish such as chippings or paint treatment.

4

**Total 30**

[END OF MARKING INSTRUCTIONS]