

CONSTRUCTION

SUMMER PROJECTS **YEAR 11 STUDENTS**

BRICKLAYING:
HEALTH AND SAFETY
TOOL IDENTIFICATION
PRINCIPLES OF BUILDING
CONSTRUCTION,
INFORMATION AND
TECHNOLOGY
BRICKLAYING LEVEL 2



HEART OF
WORCESTERSHIRE
COLLEGE

KICK START YOUR STUDY AT HOW COLLEGE WITH ONE OF OUR CURRICULUM BRIDGING PROJECTS

Background:




This assignment is set out to encourage you to research different aspects within the construction industry and will kick start your study programme as you will gain a better understanding and knowledge of the construction industry. You will familiarise yourself of current health and safety legislation, safety/warning signs, relevant tools and materials and the principles of construction.







This assignment will help you in the skills and knowledge you will need to complete your course and either progress to Level 2 or 3, or enter the workforce. You will learn about the wider construction industry and how it works, as well as the skills and techniques you will need to work as a bricklayer. You will be able to work safely on site using the correct tools and equipment to lay bricks and blocks in order to produce masonry structures.


Task 1 - Health and Safety





Safety Signs

Identify the category of the sign, what information is it telling you and where would it be located?

	Category: _____ Information: _____ _____ Location: _____
	Category: _____ Information: _____ _____ Location: _____
	Category: _____ Information: _____ _____ Location: _____

	<p>Category: _____</p> <p>Information: _____</p> <p>Location: _____</p>
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	<p>Category: _____</p> <p>Information: _____</p> <p>_____</p> <p>Location: _____</p>
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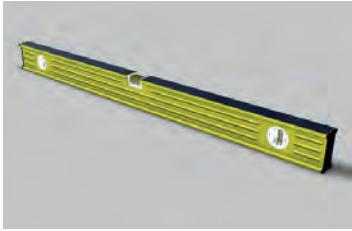



Task 2 - Tool Identification

During your course you will need to learn the names and types of tools that you will be using as a trainee bricklayer.

Can you identify the following tools from the illustrations below, the maintenance requirement and safety for each.

	<p>Tool Name: _____</p> <p>Maintenance: _____</p> <p>_____</p> <p>_____</p> <p>Safety: _____</p> <p>_____</p>
	<p>Tool Name: _____</p> <p>Maintenance: _____</p> <p>_____</p> <p>_____</p> <p>Safety: _____</p> <p>_____</p>
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MIXING MORTAR FOR BRICKLAYING

The first known mortar was nothing more than just 'a paste of mud'. About 3200 B.C., Egyptian bricklayers added sand to make it stronger. Still had real strength. Bricklayers relied mostly on the weight of the walls to hold the bricks in place. Later, about 200 B.C., cement was discovered by the Romans, modernising the bricklaying industry.

Most mortar is made up of four ingredients:

1. Cement.
2. Hydrated Lime.
3. Sand.
4. Water.

Cement gives the mortar its strength., Cement is made up of five elements: a powder of alumina, silica, lime, iron 'oxide and magnesia. They are burned together in a kiln and finely pulverized.

Cement commonly-used for bricklaying is Portland cement. It gets its name from Portland, England, where the process for making it began.

Lime is the second ingredient, made up of calcium oxide, often together with magnesia, which is obtained by pulverizing limestone. Lime is the ingredient that holds the other ingredients together and makes it workable. Care should be taken in adding lime to the mixture because the more lime that is added, the less strength the mortar will have.

The third ingredient is sand. Hardened mortar is approximately 75 percent sand. However, sand has no cementing value. Its main purpose is as a mortar filler. Sand also prevents the mortar from shrinking.

Last, but not least, is the water. Water is the ingredient that combines all ingredients into what it's called mortar. Water must be clean. A good rule of thumb is any water that is clean enough for drinking is clean enough-for mortar. Any impurities or dirt in the water might weaken or discolour the mortar. Experience in mixing and working with mortar will help you judge how much water to add. Too little water will make mortar dry, hard to spread, and create a weak bond, because the units that are to be laid will absorb even more water out of it and not allow it to cure slowly and evenly. Too much water will make mortar 'soupy and hard to handle. Wet or soupy mortar will shrink as the water evaporates, causing it to crack.

On average the amount of mortar produced by a batch will be about equal to the amount of sand used. The reason is that the cement, lime and water in the mortar-mix will fill the spaces already present between the grains of sand.

Other key factors to bear in mind when adding the amount of water required to mix mortar to the proper consistency depends on, the richness of the mix desired, how soon the mortar will be used, and the temperature of the area: When working in hotter temperatures, the water will evaporate faster than when working in cooler temperatures.

Mortar is the element that bonds bricks or other masonry units together and provides structural capacity to the wall or other structure. There are four main types of mortar mix: N, O, S, and M. Each type is mixed with a different ratio of cement, lime, and sand to produce specific performance characteristics such as flexibility, bonding properties, and compressive strength. The best mortar mix type for any project depends on the application and the various design specifications for the masonry construction. The architect will decide the type of mortar to be used, after considering the type of structure to be built

Type N Mortar Mix

Type N mortar is usually recommended on exterior and above-grade walls that are exposed to severe weather and high heat. Type N mortar mix has a medium compressive strength and it is composed of 1-part Portland cement, 1-part lime, and 6-parts sand. It is considered to be a general-purpose mix, useful for above grade, exterior, and interior load-bearing installations. It is also the preferred mortar mix for soft stone masonry. Type N is the mortar most often used by homeowners and is the best choice for general application.

Type O Mortar Mix

Type O mortar mix has relatively low compressive strength. It is used primarily interior, above-grade, non-load-bearing walls. Type O can be used as an alternative to Type N for some interior applications, but its exterior use is limited due to its low structural capacity. It is not recommended in areas subjected to high winds. However, type O mortar mix is ideal for repointing and similar repair work on existing structures, due to its consistency and ease of application.

Type S Mortar Mix

Offering a high compressive strength and a high-tensile bond strength, type S mortar is suitable for many projects at or below ground. It performs extremely well to withstand soil pressure and wind and seismic loads. Type S is the common choice for many below-ground applications, such as masonry foundations, inspection chambers (manholes), retaining walls, and sewers, as well as at-ground projects like brick patios and walkways.

Type M Mortar Mix

Type M mortar mix has the highest amount of Portland cement and is recommended for heavy loads and below-grade applications, including foundations, retaining walls, and driveways. While type M mortar provides compressive strength, it offers relatively poor adhesion and sealing properties, making it unsuitable for many exposed applications. Type M is preferred for use with natural stone because it offers similar strength to that of stone.

Type K Mortar Mix

Type K mortar is rarely used for new construction but may be specified for restoration or other specialty applications. It offers a very low compressive strength because of its softness; type K is primarily used for restoring the masonry on historic or ancient buildings that require a special mix that is not significantly stronger than the existing masonry.

Mixing mortar to the proper consistency is important for the ease and the speed the bricklayer needs to work. Mortar that is too dry tends to separate, making it difficult to spread. Mortar that is mixed too wet has a tendency to 'slide off' the trowel instead of 'sticking' to it. If too much sand is added, the mortar will not stick, and too much lime and cement will cause it to be too sticky. Properly mixed mortar will help the bricklayer to keep up production and keep work clean and neat.

Mortar Type	Guide for Selecting the Right Mortar Type					
N	 above grade	 exterior	 interior	 load-bearing	 soft stone masonry	
O	 above grade	 interior	 non load-bearing			
S	 below grade	 masonry foundations	 manholes	 retaining walls	 sewers	 brick patios & pavements
M	 heavy loads	 masonry below grade	 foundations	 retaining walls	 driveways	

 the balance

Cement

Cement is made from a mixture of clay and limestone which, when heated together, form a new substance. Once cooled this substance is ground to a fine powder and gypsum is added to produce cement.

When water is added to cement a chemical reaction begins which causes the individual particles of cement to bind together. As the particles bind together, the concrete mix gradually becomes stiffer and harder to manipulate. Eventually the chemical bond becomes so strong that the concrete appears as a hard-solid mass. It is said to have 'set'. At this stage the chemical bonding is very weak and is easily broken if the mixture is disturbed.

The time taken for the cement to set depends on the temperature and the way the cement is used. In cold climates total setting can take five to six hours but in hot weather it can take less than one hour.

The chemical reaction continues after the cement has set and, as it does so, it becomes steadily harder and stronger.

Most of the reaction and strength development takes place over the first month but it continues at a gradually decreasing rate over many years. As the cement reacts with the water, heat is produced. In small quantities this is not a problem as increased temperature increases the rate of the chemical reaction. However, if the temperature rises too much it will drive water out of the mix which will prevent the cement from fully hardening. It can also cause the cement to crack, reducing the final strength of the mixture.

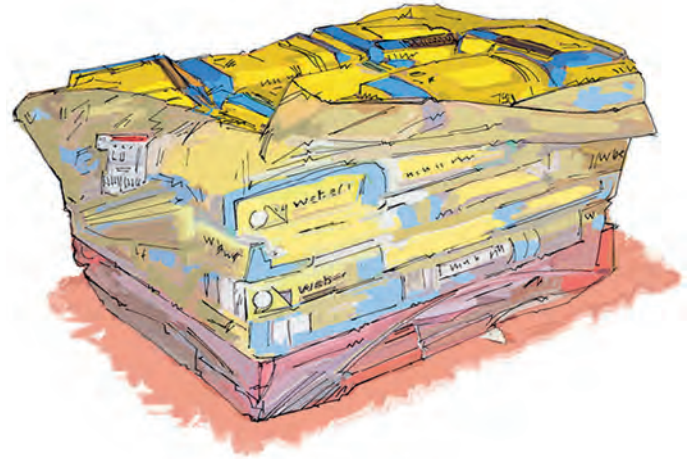
There are many different types of cement but by far the most common (and the one most likely to be present on the local market) is usually known as 'Ordinary Portland Cement'. This cement is suitable for most general uses such as concrete for small buildings and mortar for brick and block laying.



Storing and handling cement

Cement is a hazardous chemical and should be handled with care. Cement dust can damage skin and eyes. In theory, people working with cement should be provided with protective clothing, including overalls, goggles and gloves, and helmets where work extends above head height. In practice, especially during emergencies, it is unlikely that protective clothing will be available or worn.

Cement in small quantities is usually supplied in 25kg or 50kg bags. These bags are often made of paper and are not waterproof and must therefore be protected from water. Some water will gradually be absorbed from the atmosphere and will react with the cement to start the hardening process. Cement bags should preferably be stored inside a building, off the floor. If that is not possible, store the bags on pallets laid on flat ground and covered with plastic sheeting. Do not store more than four bags high as compressing the cement will assist the hardening process. Even under good storage conditions, cement loses significant strength if stored for more than four to six weeks.



Cement stocks should be rotated so that the oldest is used first and bags are regularly checked for damage.

Damaged cement

Cement that contains lumps of hardened cement that cannot be broken by hand will have lost strength. If better quality cement is available, those bags containing hard lumps should be discarded. If cement containing lumps is all that is available, the lumps should be discarded. The remaining cement will have lost some strength and should be used with caution.

The quality of the remaining cement cannot be assessed from visual inspection. As a guide, the proportion of such cement added to mortar should be increased by between 10 and 20%.

Note:

Cement is a hazardous chemical substance and should be handled with extreme care, can cause cement burns to the skin



Concrete mixes

Mix ratios

Different mix ratios are used for different applications. In general, the stronger the mortar required, the larger the proportion of cement in the mix.

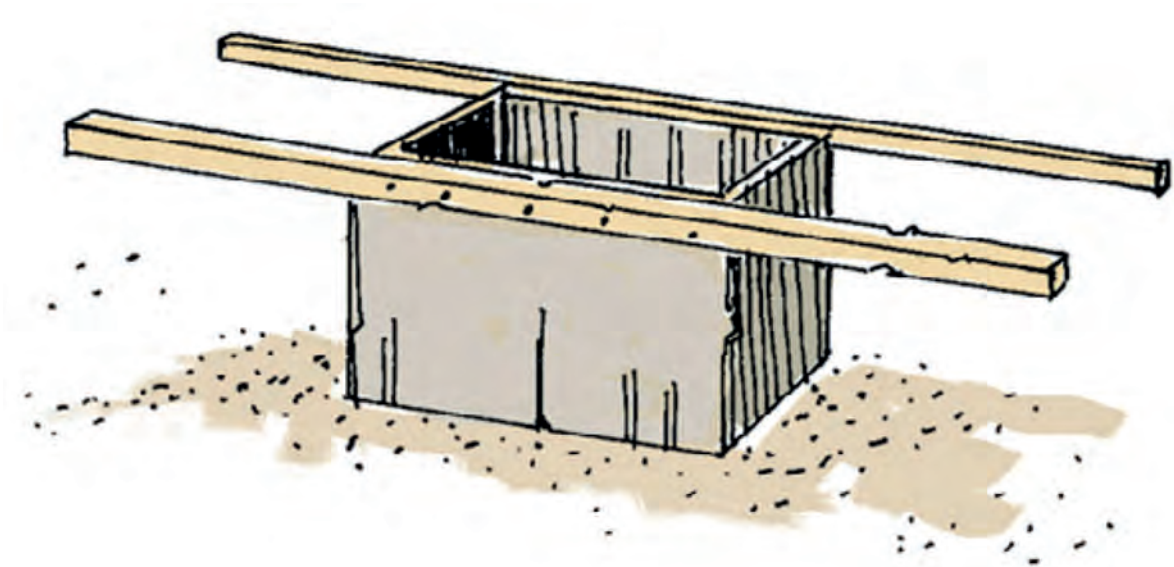
Mixing

The mortar mix is the proportion of each element (cement: sand: lime). Mixes can be prepared by weight or by volume. Of the two, mixing by weight is more accurate. (This is usually called 'weigh batching').

If large weighing scales are not available, then mixing by volume is usually the only practical option. When mixing by volume, use containers of known volume to measure the proportions. A bucket levelled off with a straight edge or a prefabricated gauge box is best.

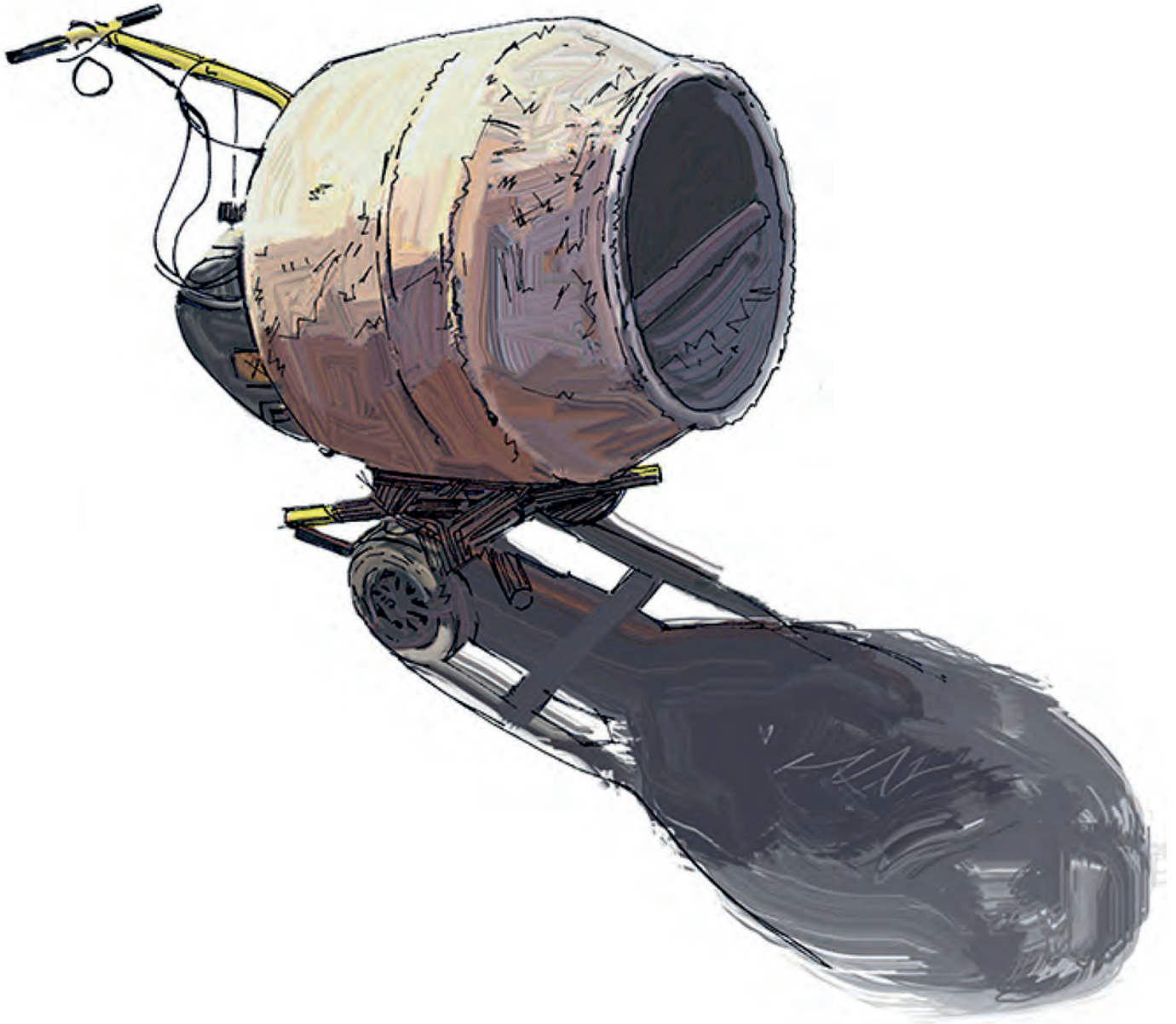
Gauge boxes

A simple wooden box fitted with handles can be fabricated of known volume. For example, a box 300mm high x 400mm wide x 540 mm long has a volume of 65litres. Two boxes full of aggregate will be sufficient to mix with a 25kg bag of cement when making 1:2:6 mix mortar.



Mechanical mixing

The best way to mix mortar is in a mechanical mixer. Mechanical mixers need less water to ensure complete mixing and produce a more consistent mortar. If possible, use a mixer that will hold enough material to use a full bag of cement. As a rough guide a 200 litre mixer will hold the aggregates needed to mix with a 25 kg bag of cement.





Try and identify all the tools and materials necessary for mixing mortar, also include all appropriate Personal Protective Equipment (PPE) that is required when mixing cement mortar by hand.

List the appropriate tools and materials?

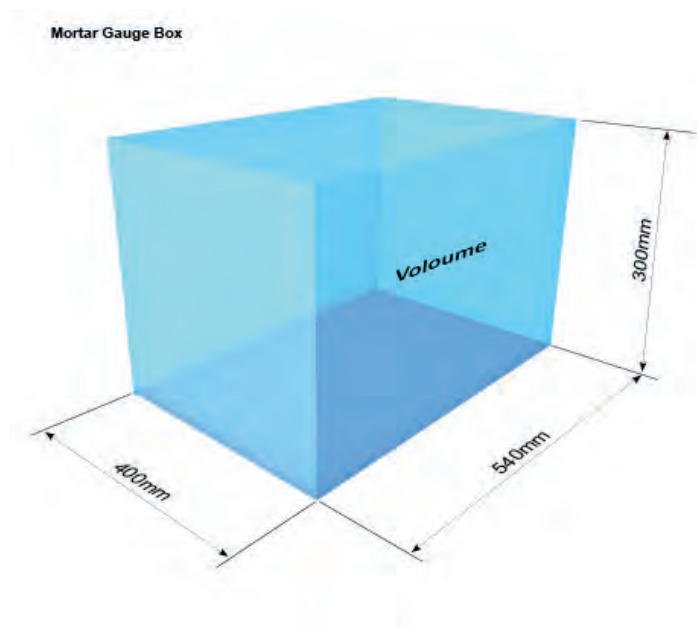
[illegible]

List the appropriate PPE when mixing mortar?

[illegible]

Calculation – Volume

You are required to calculate the volume of the proposed gauge box.



Calculation:

.....

.....

.....

.....

.....

What is meant by the term 'Batching' materials?

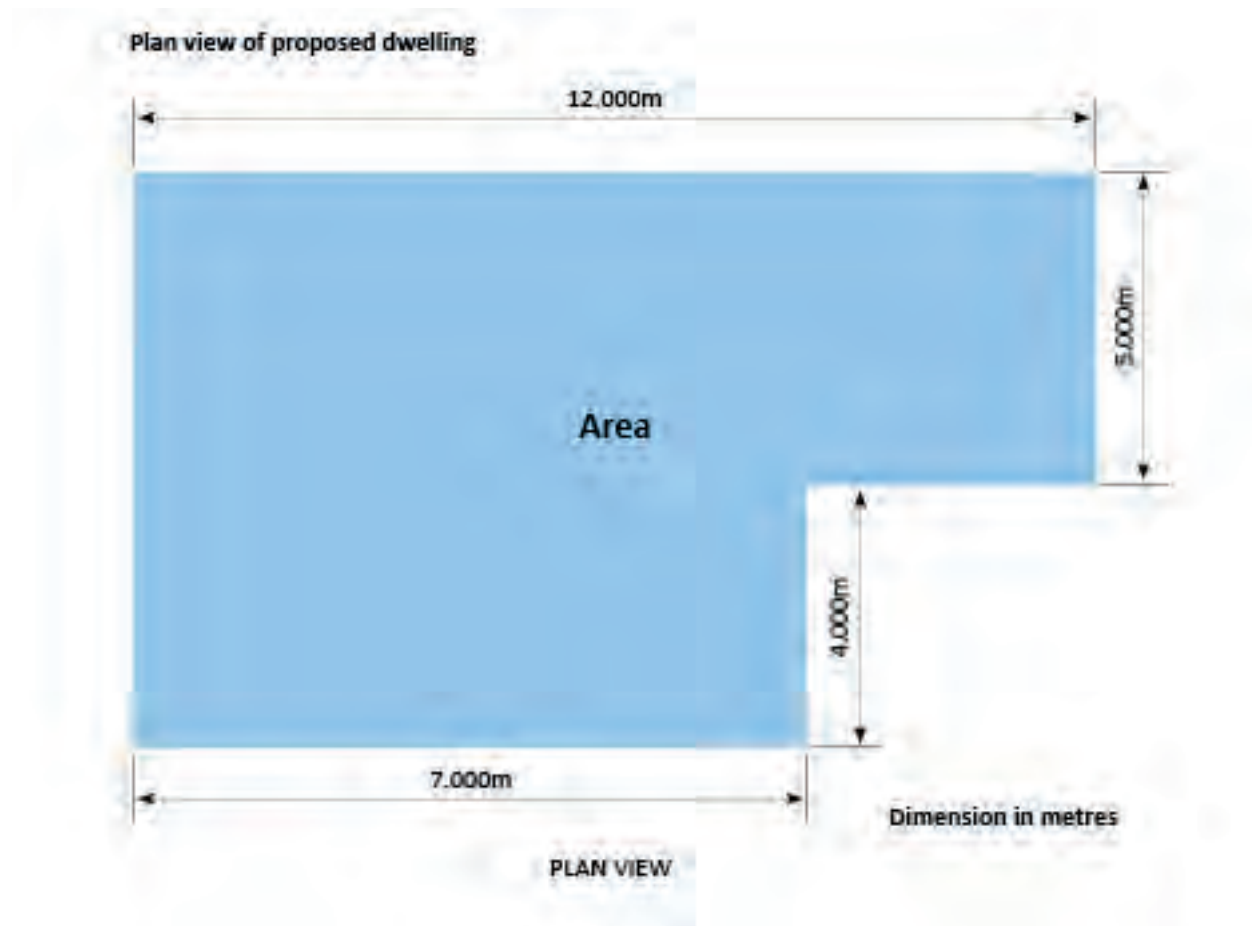
Name TWO ways of Batching Materials giving a brief description for both?

Option 1:

Option 2:

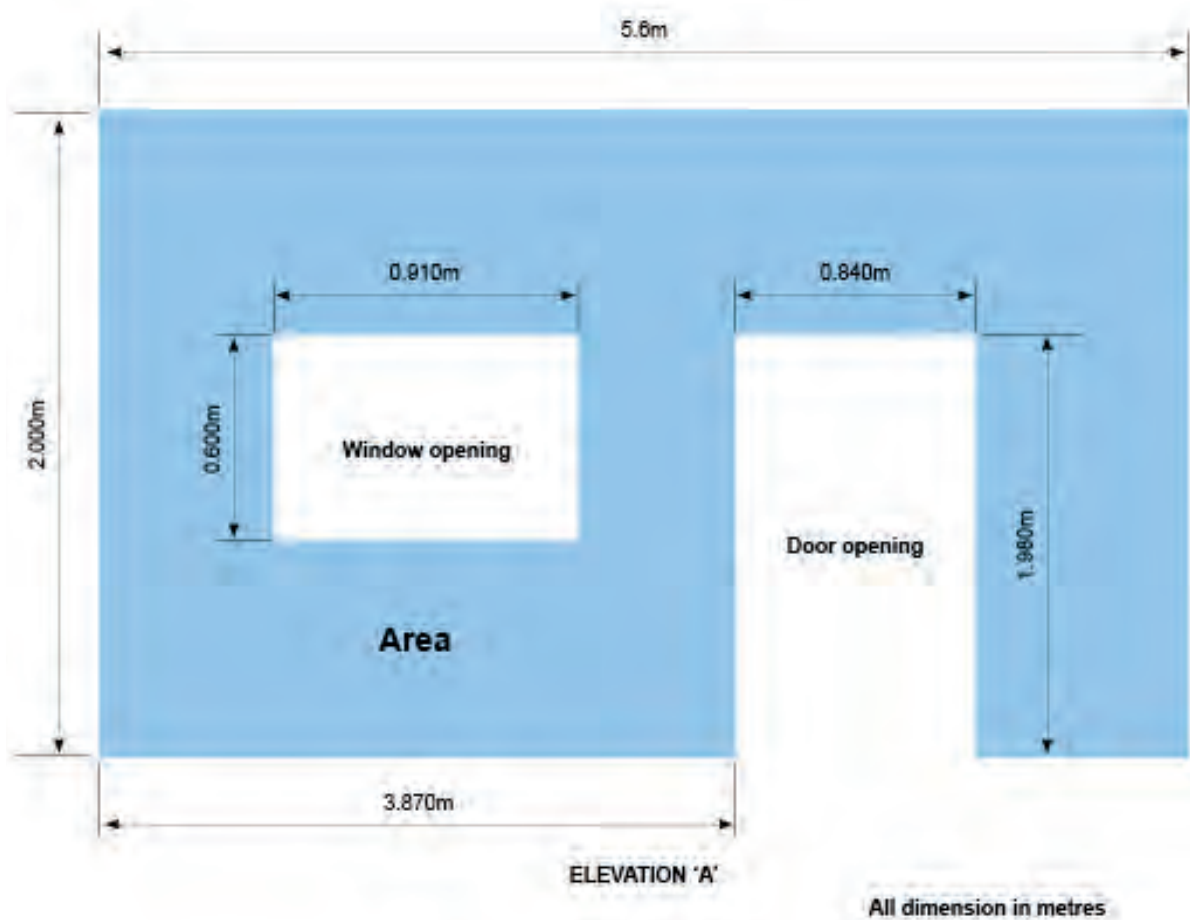
What is meant by the term 'Mortar'?

Find the area of the proposed dwelling?



Answer:

You are required to calculate the wall area of the proposed elevation and the number of bricks required to construct the wall.



Number of bricks per sq. m = 60

Calculation:

.....

.....

.....

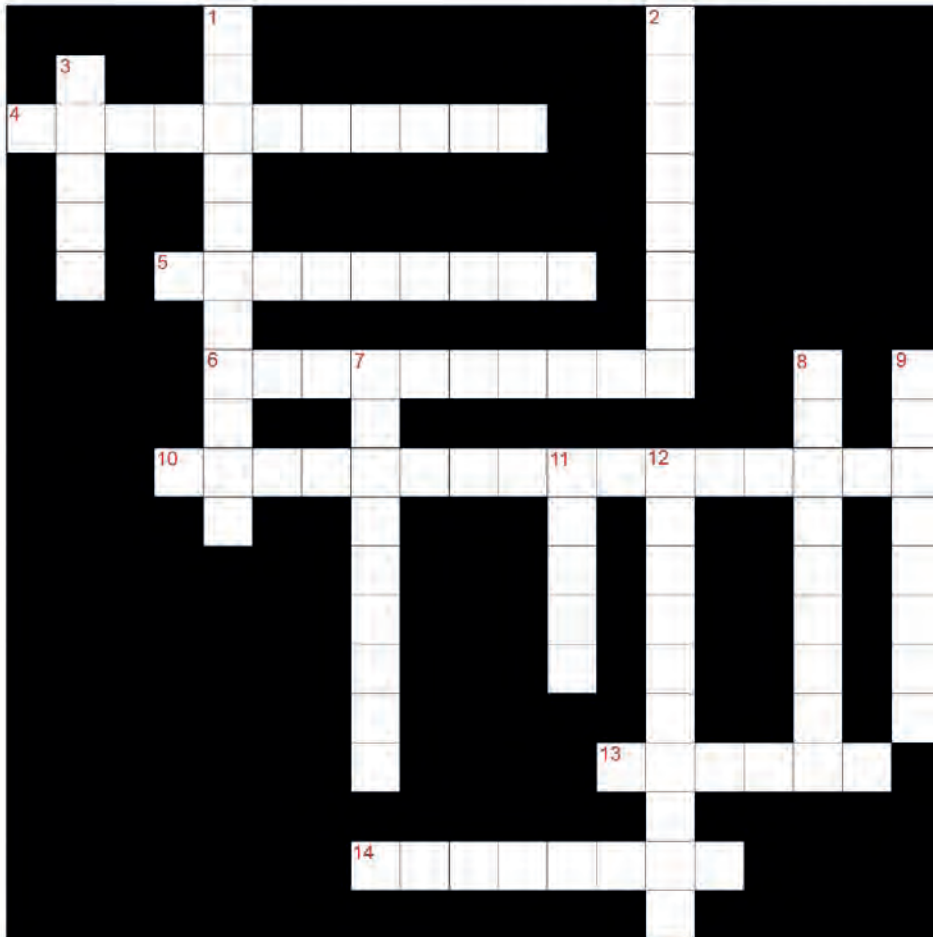
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Mortar Crossword

As a bricklayer you will use large quantities of mortar with different ratios when laying bricks and blocks, therefore, you are requested to attempt the following crossword relating to specific terms associated with the use and manufacture of mortar.



Across

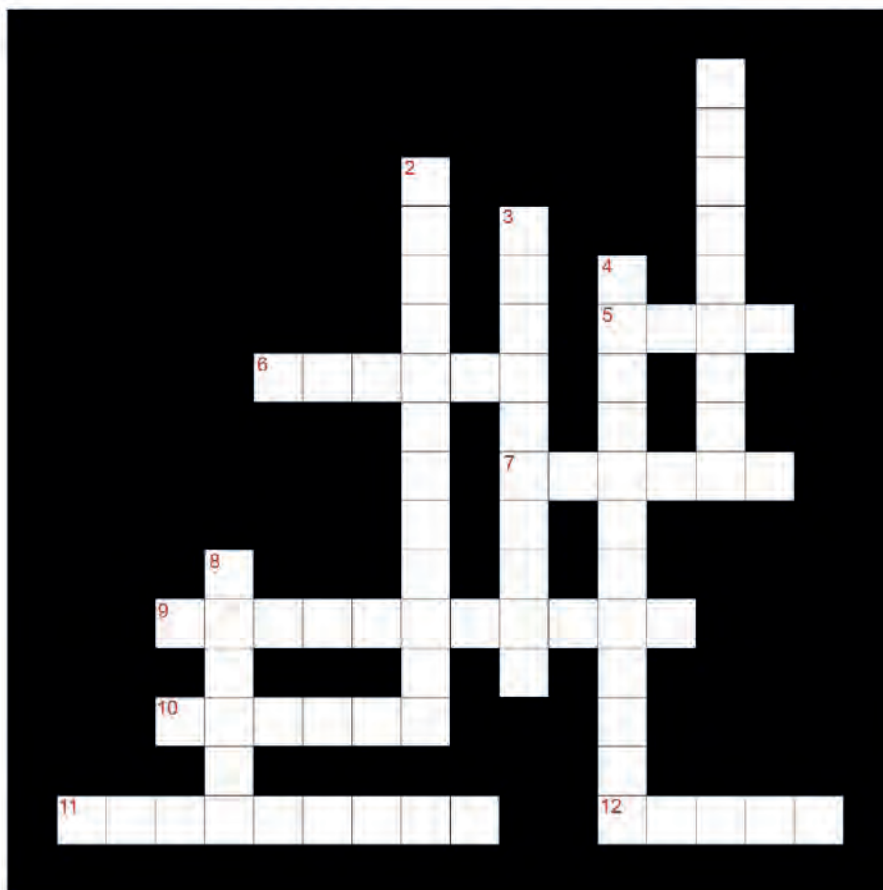
4. Mortar should contain sufficient lime or plasticiser to improve the mortars.
5. Portland cement is made by burning clay and what other material.
6. All aggregates manufacture for the use in mixing mortar should be free from.
10. The final strength of the mortar should not exceed that of the bricks used. The use of too much cement will produce a rigid mortar which may cause.
13. What is the term used for measuring out the ingredients when mixing mortar.
14. High temperatures are used in the manufacturing process to produce lime, combined with water a chemical reaction takes place changing it into what type of lime.

Down

1. What other ingredient can be used as an alternative to lime.
2. If a cement/lime/sand mix is to be used for the mortar for clockwork, the maximum volume of fine aggregate to one part cement and one part lime shall not be more than.
3. Bricklayers commonly refer to a cement, lime, and sand mortar as what.
7. It is good practice to ensure that all the materials are available for the whole work and are accurately gauged and mixed to ensure what type of colour mortar.
8. When limestone is burnt at a high temperature it is turned into a product known as.
9. What is the name of the ingredient that is added to colour mortar.
11. A raw material from which building lime is manufactured.
12. Sand and Shingle are commonly known as.

Measurement Crossword

As a bricklayer you will be setting out, measuring walling lengths and establishing position for doors and windows, therefore, you are requested to attempt the following crossword relating to specific terms associated with the use of measurement in brickwork.



Across

5. On the elevation (side) view of a wall, by multiplying the length by its height will determine the.
6. The amount of space within a three-dimensional object is known as the.
7. When constructing walls with corners the bricklayer will measure the diagonals to determine..
9. The length of FOUR bricks including the cross joints is.
10. Unless otherwise stated all measurements on a working drawing are shown in.
11. The height of six courses of brickwork is.
12. To assist the builder all architectural drawings are drawn to.

Down

1. All the measurements around a rectangular building add up to the.
2. When setting out has been completed it should be carefully checked for accuracy by re-check all.
3. All measurements on a working drawing are known as.
4. what must a bricklayer perform to determine the number of bricks required to build a wall.
8. All length measurements are referred to as.

Measurement Word Search

You are required to complete the following word search from the word list in the table at the bottom of this page.

MEASUREMENT WORD SEARCH

C	N	E	O	V	X	D	W	D	K	H	A	D	L	E	N	W	A	K	V
V	L	V	K	X	G	I	R	E	U	U	B	C	E	P	F	G	M	Z	Q
S	N	A	E	L	M	V	H	C	E	C	H	S	N	R	H	H	G	T	D
I	Y	E	G	F	H	I	K	I	L	G	Z	Q	G	O	B	A	R	H	E
B	Y	D	Q	C	W	D	V	M	M	G	Q	P	T	J	X	D	K	B	G
G	N	S	I	V	Y	I	Z	A	T	H	P	R	H	E	W	H	M	P	R
G	J	U	F	C	C	N	H	L	U	L	B	N	T	C	B	Q	I	C	E
P	B	B	N	P	E	G	F	S	L	W	K	G	Y	T	D	Q	L	W	E
E	Y	T	A	Y	V	N	P	S	W	V	C	S	Q	I	F	S	L	X	S
R	S	R	Y	G	V	S	T	Z	A	A	G	F	G	O	L	C	I	B	Y
I	R	A	X	H	F	N	D	I	Y	Z	H	E	E	N	I	O	M	H	K
M	N	C	Y	Q	H	W	E	H	M	F	D	X	A	S	K	T	E	S	U
E	S	T	B	Z	J	C	N	C	H	E	C	A	P	A	C	I	T	Y	Z
T	J	I	U	H	I	M	S	V	K	D	T	H	R	L	J	Q	R	B	D
E	A	O	R	N	Q	R	I	W	M	Z	S	R	Z	M	E	W	E	C	I
R	R	N	R	T	H	O	T	H	M	M	S	V	E	M	B	X	S	U	G
G	K	S	H	L	S	U	Y	V	C	C	X	Z	Q	S	X	K	Y	B	W
J	B	J	F	K	P	M	A	C	C	U	R	A	C	Y	W	H	U	I	K
W	I	D	T	H	K	I	U	J	Q	B	C	K	N	X	J	F	N	C	O
W	J	C	A	L	C	U	L	A	T	I	O	N	S	Q	K	M	I	Q	X

MEASUREMENT RELATED WORDS

ACCURACY	CALCULATIONS	CAPACITY
CENTIMETRES	CUBIC	DECIMALS
DEGREES	DENSITY	DIVIDING
LENGTH	MILLIMETRES	PERIMETER
PROJECTIONS	SUBTRACTION	WIDTH

Mortars

You are required to fill in the gaps, using the words from the list provided below

In order to press bricks down by hand, bricklayers need _____ mortars, but if they contain too much _____ or _____ admixtures they will be _____, causing even the most skilful bricklayers to _____ the face. Bricklayers are responsible for adjusting the _____ and _____ of _____ to suit the type of _____ being used. But they must not, without the _____ of the _____ or engineers, adjust the _____ of cement, _____ and sand as this can _____ the _____ of mortars.

_____ should be made from _____ sand containing fine, medium and coarse. Well-graded sands used in mortars help _____ mixing water long enough for the mortar to develop its _____ strength, durability and _____. Sand containing only large particles makes _____ or _____ mortar, allowing mixing water to run on the spot board and/or down the _____ face.

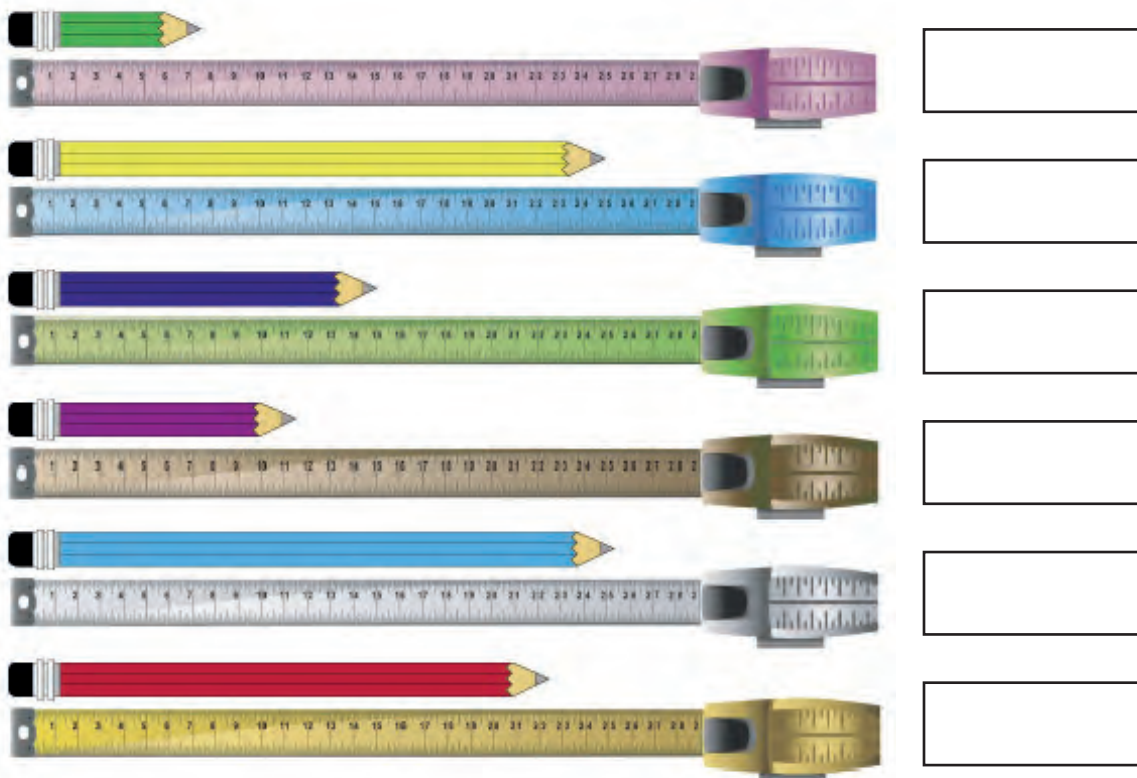
Factory produced _____ from reputable suppliers can be expected to contain suitable _____ sands. Builders merchants usually refer to such sand as _____.

workability	mortars	building	Mortars	bricks
proportions	permission	lime	durability	reduce
particles	wall	well-graded	architects	strength
smear	hungry	smooth workable	sloopy	retain
consistency	water	plasticising	hungry	adhesion
maximum	short	mortars	bleed out	sands

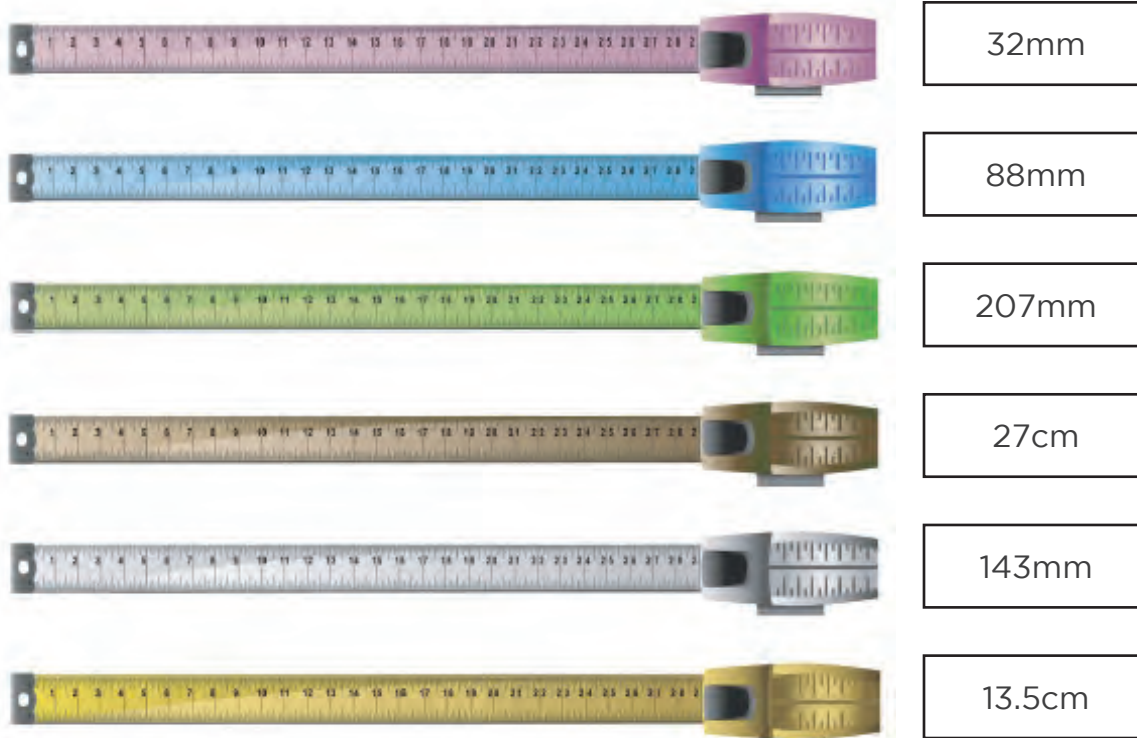
MEASUREMENT

- 1: Measure each coloured pencil and record your answer in millimetre, in the box provided
- 2: Draw an arrow on the tape measure indicating the measurement shown in the box

1:



2:



MIXING MORTAR & MEASUREMENT – SELF ASSESSMENT

Goal:

Has a bricklayer you will need to learn and understand the use of mortar and measurement relating to projects in construction

Performance Indicators:

Has a trainee bricklayer you will need to complete the following self-assessment relating to mortar and measurement.

Listed below are questions followed by a number of possible answers. ring your selection that answers the question correctly.

1. Who discovered cement?

- a. Chinese
- b. Egyptians
- c. Romans
- d. Russians

2. How many properties make up cement?

- a. 8
- b. 4
- c. 15
- d. 53.

3. Which ingredient does not belong?

- a. cement
- b. water
- c. pumice
- d. sand

4. What type of mortar is recommended for general use?

- a. Type K
- b. Type O
- c. Type M
- d. Type N

5. Identify 4 main advantages of machine mixing over hand mixing?

- a.
- b.
- c.
- d.

6. The basic unit of measure for mortar is?

- a. cubic yards.
- b. cubic meters
- c. cubic centimetres
- d. cubic inches

7. Too much sand causes mortar to?

- a. set to quickly
- b. set to slowly
- c. become to runny and weak
- d. be harsh and unworkable.

8. In this 1 : 1 : 6 mortar ratio, which ingredient does the 6 represent?

- a. cement
- b. water
- c. lime
- d. sand

9. What is the overall length of 4 bricks including the cross joints?

- a. 750mm
- b. 890mm
- c. 910mm
- d. 1115mm

10. What is added to colour mortar?

- a. liquid dye
- b. hydrated lime
- c. powder
- d. pigment

11. If a cement/lime/sand mix is to be used for the mortar for blockwork
The maximum volume of fine aggregate to one-part cement and one
part lime shall not be more than?

- a. five parts
- b. six parts
- c. seven parts
- d. eight parts

12. How is the mortar applied by the bricklayer when laying bricks and blocks?

- a. point trowel
- b. brick trowel
- c. gauging trowel
- d. brick jointer

13. Brick trowels are made in varying sizes and shapes, and are supplied in both
Right-Handed and Left-Handed versions? Is this true or false

- a. true
- b. false

14. Portland cement is made by burning a mixture of?

- a. limestone and shingle
- b. limestone and clay
- c. pumice and shingle
- d. shingle and clay

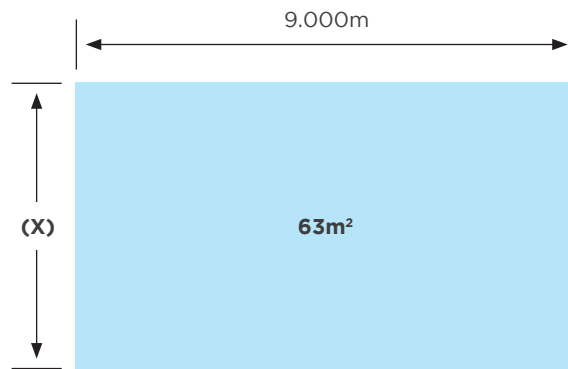
15. Hydrated lime is produced by?

- a. grinding limestone
- b. melting limestone
- c. burning limestone
- d. mixing quicklime with water

16. The volume of cement is supplied in weighted bags of?

- a. 15 kilo's
- b. 25 kilo's
- c. 35 kilo's
- d. 50 kilo's

17. From the information provided you are to find the width (x) of the rectangle?



Answer:

18. What is the scientific name for lime?

- a. calcium oxide
- b. calcium carbonate
- c. iron oxide
- d. carbon dioxide

19. In the ratio of mortar, what does aggregate refer to?

- a. cement
- b. lime
- c. sand
- d. water

20. Plasticiser's are sometimes used in the mixing of mortar, providing an alternative to which ingredient?

- a. cement
- b. lime
- c. sand
- d. water

Bricklaying Level 2 – Construct Detailed Brickwork

Written Assignment

Instruction to learner

In order for you to complete this assignment, you must show your assessor/trainer that you have incorporated the use of safe working practices throughout the assignment. You must show and use relevant safety equipment, including Personal Protective Equipment (PPE) and work to current legislation and regulations. If this has not been shown within this assignment your assessor/trainer will ask you to undertake the relevant sections again.

Background information.

You are the bricklayer working for a small building company specialising in renovation. Your supervisor has allocated a number of tasks.

You will need the following reference materials for this assignment:

- Building Regulations
- Relevant Trade literature
- The relevant Manufacturers' Catalogues

Written assignment (renovation project)

Your supervisor tells you to take charge of renovation work to an existing building. The building is made up of a 1920s brick-built town house with solid walls two bricks thick. There is an extension to the rear of the property, built in the 1980s, incorporating a kitchen and utility room using facing brick and blockwork cavity wall construction.

The work includes the following jobs:

1. Provide a damp-proof course to the 1920s building.
2. Create an open plan kitchen/dining area by demolishing a section of the original two brick thick rear wall of the building.
3. Set out and built a conservatory on the rear of the building.

Carry out the following preparation for these jobs.

1. a. Investigate the alternative methods of providing a damp-proof course to the existing building. Outline the alternatives and list the advantages and disadvantages of each.
b. Choose the method of providing a damp-proof course that you think is most appropriate, and produce a checklist showing the correct order of tasks to complete the job.

2. You need to support the walls and floors in order to install four 2.3m long rolled steel joists and form a 1.8m opening in the existing wall between the original property and the kitchen extension. Plan and detail the operations required. Include a risk assessment and method statement for the job.
3. The owner of the property has questioned the use of metal wall extension units that you intend to use to connect the conservatory walls to the existing building. Prepare a brief commentary to explain how to use the units and why they can prove better than alternatives such as block ties or indents.

1920s brick-built town house with solid walls two bricks thick



Planned Conservatory Construction at rear of property



Suggested Materials

Suggested materials to read or research, things to listen to or watch

Manufacturers catalogues, City and Guilds level 1 & 2 Diploma in Bricklaying, YouTube, www.City&Guilds.com www.Gov.co.uk www.hse.co.uk

Indicative time for this project:

Maximum of 40 hours

Instructions on how to submit this:

Please email your completed work to your Tutor, or alternatively print your completed work and submit upon enrolment to the programme.

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How will I benefit from this project:

This project will help you retain the information you will need to become a bricklayer and you can use this for reference in class and in the workshop. Become familiar with the terms and techniques and pay attention to the skills you need to master. If you put in the effort, you will be rewarded with a satisfying and successful career in construction.

What can I expect to get back after I submit my project work:

Your work will be assessed by your College Tutor and will contribute to your theoretical knowledge. Feedback will be provided upon marking and any amendments will be highlighted and resubmitted to you if necessary.

Key information you should include:

Your name

Your email address

A contact telephone number