Write your name here

Surname	Other names

Pearson BTEC Level 3 Nationals Extended Certificate

Centre Number | | | | | | |

Learner Registration Number | | | | | | | | |

Construction and the Built Environment

Unit 1: Construction Principles

Wednesday 6 June 2018 – Morning
Time: 1 hour 30 minutes

Paper Reference
20075K

You must have:
a non-programmable calculator, a ruler and HB or 2B pencil to sketch, information booklet for Unit 1.

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and learner registration number.
- Answer **all** questions.
- Answer the questions in the spaces provided – *there may be more space than you need*.
- Show your working when requested.

Information

- The total mark for this paper is 75.
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question*.
- You may use a non-programmable calculator that does not have the facility for symbolic algebra manipulation or allow the storage and retrieval of mathematical formulae.

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question, showing all your working, use the appropriate units in your answers and always answer to an appropriate degree of accuracy.
- Check your answers if you have time at the end.

Turn over ▶

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P 5 9 6 5 4 A 0 1 2 0

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Answer ALL questions.

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

1 A construction company is building a housing development on the site of an old factory.

The development will consist of 3 and 4 bedroom houses.

(a) The load bearing walls of the houses will be constructed from high density concrete blocks.

Identify **one** property that makes high density concrete blocks suitable for load bearing walls.

(1)

☒ **A** Compressive strength

☒ **B** Workability

☒ **C** Tensile strength

☒ **D** Plasticity

(b) The upper floor of the houses will be constructed with timber joists and chipboard.

Explain **one** advantage of using chipboard for the upper floor.

(2)

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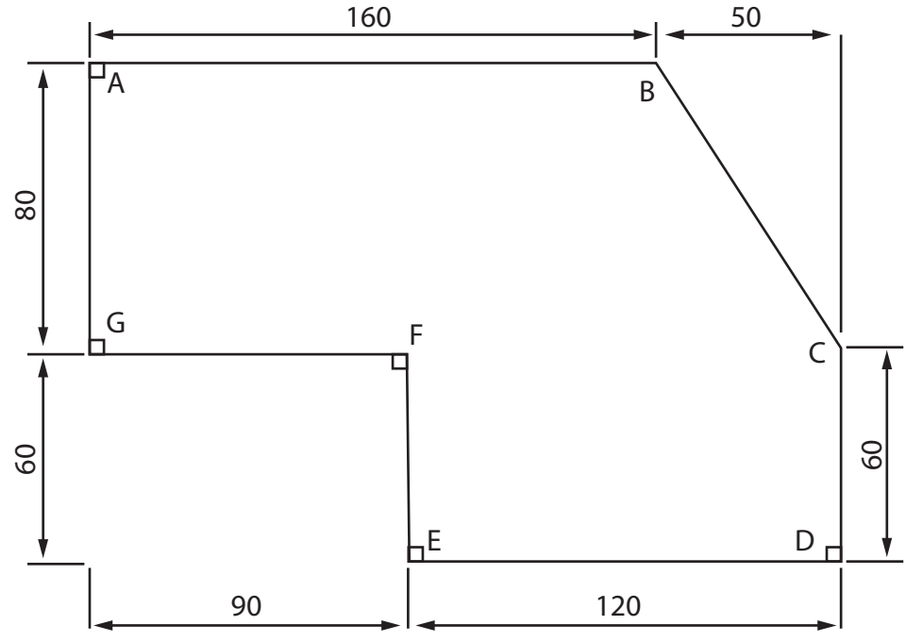
QUESTION 1C BEGINS ON THE NEXT PAGE.

(c) The houses will be constructed on the site shown in Figure 1.



All dimensions in metres

Diagram not to scale

Figure 1: Site plan

Calculate the area of the site.

(4)

(d) The construction company will build a fence around the site.

Calculate the length of the fence between points B and C on the site plan.

Give your answer to 1 decimal place.

(3)

(Total for Question 1 = 10 marks)

2 A reinforced concrete bridge, which crosses a river, is to be replaced with a steel bridge. The bridge will be supported on a pier and abutments, constructed from Class A engineering bricks, on concrete foundations.

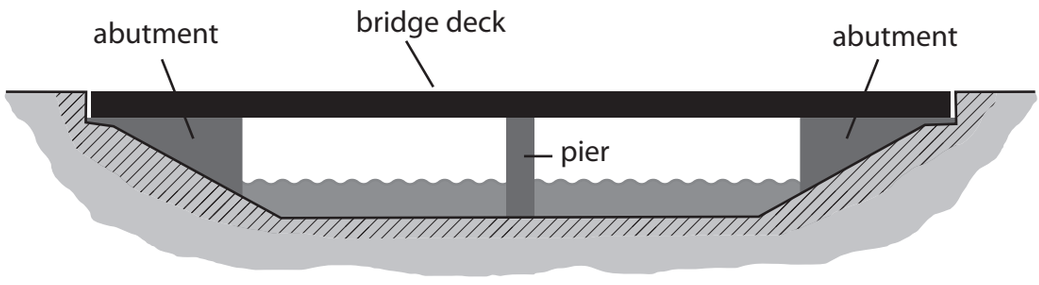


Figure 2: Bridge

(a) The original reinforced concrete bridge is going to be replaced because it is showing signs of failure.

State **one** cause of failure of reinforced concrete used in construction projects.

(1)

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(b) The pier and abutments of the new bridge will be constructed using Class A engineering bricks.

Explain **two** reasons why the properties of Class A engineering bricks are suitable for use in this situation.

(4)

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(c) Samples of the concrete used in the foundation have been tested seven days after casting.

The design compressive strength of the concrete for the foundation is C30 (30N/mm^2).

The results of the tested samples are shown in Figure 3.

Strength of the concrete (N/mm^2)	Number of samples/ frequency	Midpoint x	fx
$28 \leq S \leq 29$	2		
$29 < S \leq 30$	3		
$30 < S \leq 31$	8		
$31 < S \leq 32$	5		
$32 < S \leq 33$	2		

Figure 3: Results of the tested samples

Complete the table in Figure 3 and find:

(i) the mean strength of the concrete

(4)

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(ii) the median strength of the concrete

(2)

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(iii) the mode class width of the concrete.

(1)

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(Total for Question 2 = 12 marks)

3 An architect has been commissioned to design a mixed-use building. The building is located near to a town centre and close to a busy road.

The building will include office space, retail units and restaurants.

The architect plans to use smart glass within the building.

(a) Describe **two** benefits of smart glass that make it a suitable material for use in this building.

(4)

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(b) Explain **two** reasons why the architect will need to consider glare when designing the retail units.

(4)

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(c) Discuss the reasons why sound insulation and sound reduction will be required in the mixed-use building.

(9)

(Total for Question 3 = 17 marks)

4 A construction company has been contracted to build a drive-through restaurant for a fast food chain.

(a) The architect has specified that aluminium alloys are to be used for the doors and window frames in the restaurant.

Explain **one** advantage of using aluminium alloys for doors and window frames.

(2)

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(b) The outside seating area will feature fixtures and furniture constructed from mild steel.

Describe **two** benefits of using protective coatings on mild steel.

(4)

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QUESTION 4C BEGINS ON THE NEXT PAGE.

(c) The fast food restaurant will have a sign illuminated by a floodlight.

The intensity of the light is 300 cd.

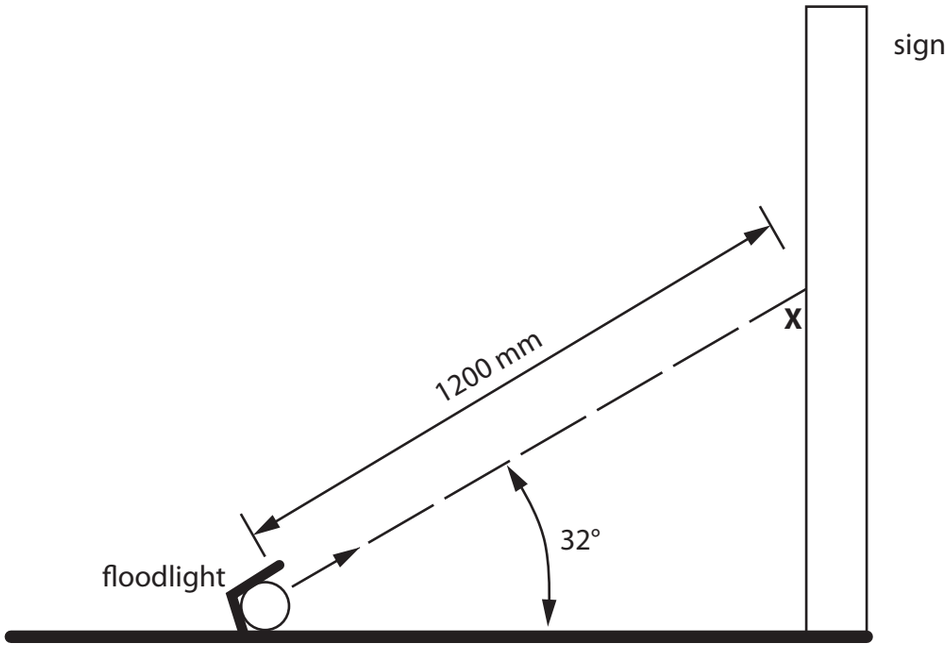

Figure 4: Side elevation of the sign and floodlight

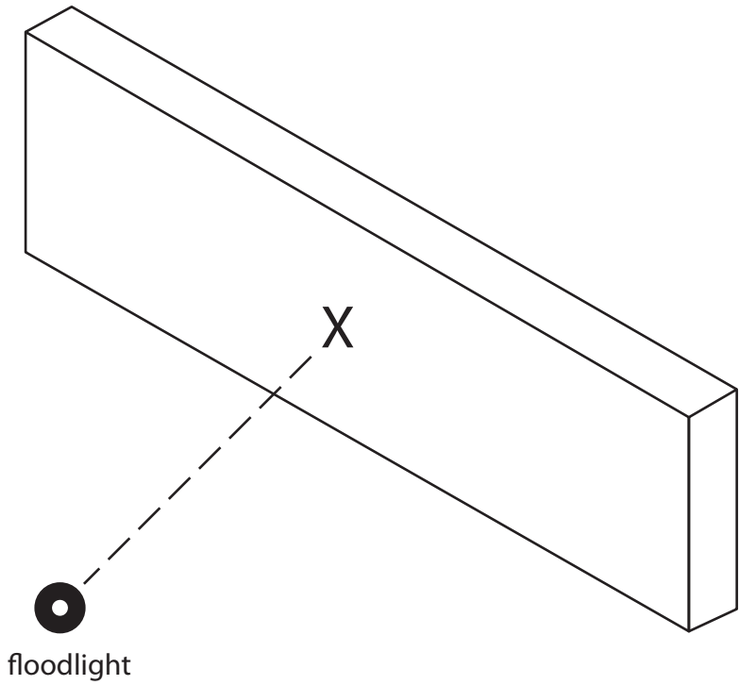

Figure 5: Location of point X on the illuminated sign

Figure 6: Floodlight and sign

Calculate the illuminance at point X on the sign.

(4)

(d) The fast food chain has decided that the illuminance of the sign is not bright enough.

Explain **two** methods of increasing the illuminance of the sign.

(4)

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(Total for Question 4 = 14 marks)

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QUESTION 5 BEGINS ON THE NEXT PAGE.

5 You will need to refer to Figures 7, 8, 9 and 10 in the information booklet to answer the questions.

The location of a housing development site is indicated by the letter X on the maps shown in Figures 7 and 8. The data in these diagrams shows the mean July temperature and the average annual rainfall for the whole of the UK.

Figure 9 shows a table that indicates climatic information for the location of the site.

All houses will be constructed using a variety of components/materials, including:

- exterior facing bricks
- concrete raft foundation
- timber wall and floor frames
- particle board sheathing.

A construction company plans to build houses in the location marked X on the maps.

(a) Explain **two** performance characteristics of external brickwork mortar for use in houses in this location.

(4)

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(b) The construction company is promoting the new housing development as energy efficient, which is partly achieved by making sure heat losses are kept to a minimum.

Explain **three** methods of how the houses could be designed to reduce heat loss.

(6)

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(c) Refer to Figures 7, 8 and 9 for climatic information. Figure 10 shows the wall and floor construction details for the houses.

Evaluate the use of facing bricks, concrete raft foundation, timber frames and particle board sheathing as materials for the structure of the houses in location X.

(12)

(Total for Question 5 = 22 marks)

TOTAL FOR PAPER = 75 MARKS

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