

Please check the examination details below before entering your candidate information

Candidate surname

Other names

Centre Number

Learner Registration Number

Pearson BTEC  
Level 3 Nationals  
Extended Diploma

**Tuesday 15 January 2019**

Morning (Time: 1 hour 30 minutes)

Paper Reference **20075K**

**Construction and the Built  
Environment**  
**Unit 1: Construction Principles**

**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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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 development company is building a large warehouse. The design of the warehouse will be of a pre-fabricated structural steel form.

The warehouse design will need to incorporate concrete paved loading bays for heavy goods vehicles delivering materials.

(a) Identify **one** property that allows the concrete to be fully compacted.

(1)

- A** Hardness
- B** Malleability
- C** Toughness
- D** Workability

(b) State **two** advantages of using steel for the structural frame of the warehouse.

(2)

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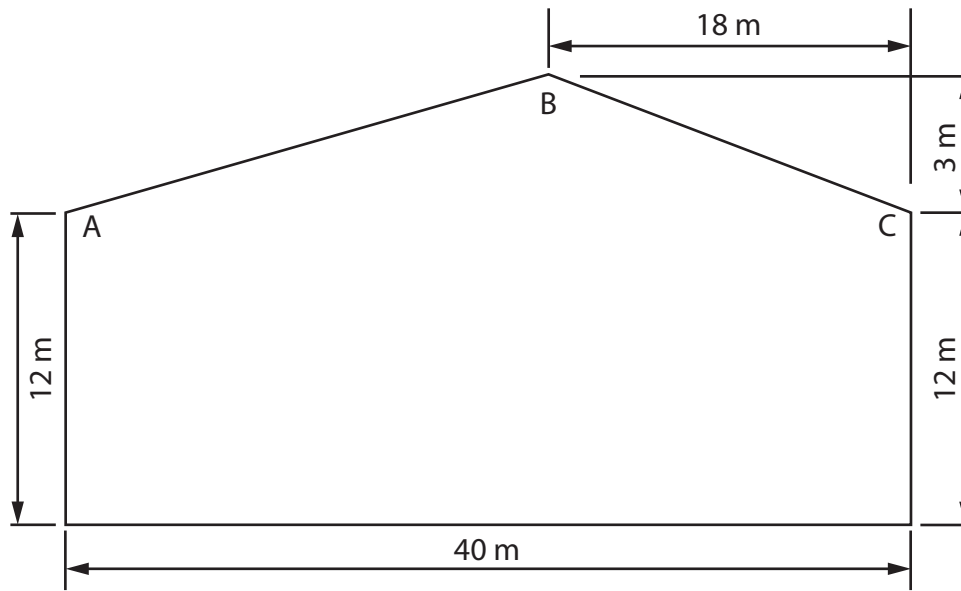
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**QUESTION 1C BEGINS ON THE NEXT PAGE.**



(c) **Figure 1** shows one end wall of the warehouse. The end wall is to be brick cladded.



**Figure 1**

**Diagram not to scale**

(5)

Calculate the area of the brick wall.

Give the correct units for your answer.

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The warehouse shown in **Figure 1** has a roof made from sheet panels.

(d) Calculate the slope length of the roof between points **B** and **C**.

(3)

(Total for Question 1 = 11 marks)



2

A client has commissioned an architect to design and build a two-storey shopping centre.

- (a) State **one** performance-related benefit of using discharge lamps in a shopping centre.

(1)

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- (b) Explain **two** properties of float glass that make it suitable for shop display windows.

(4)

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(c) The architect has calculated the loadings on the upper floor of the building.

Explain **two** reasons why the architect would need to consider the dead and live loads on the upper floors of the building.

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(d) The upper floor is supported by square concrete columns.

Each column is 0.5m by 0.5m in cross section.

The architect has determined that each column will support a load of 8.5 kN.

Calculate the stress in each column giving your answer in  $\text{kN/m}^2$ .

(3)



(Total for Question 2 = 12 marks)

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3

A construction company has been commissioned to design and build a motorway service area.

The service area will include a petrol filling station, shops and dining areas.

- (a) The buildings will include a pitched roof design.

State **one** roofing material that can be used for the outer covering of the roofs.

(1)

- (b) The client wants to make sure that noise from traffic does not disturb customers.

State **one** method that can be used to measure sound.

(1)

- (c) Explain **two** ways in which sound insulation can be included in the design of the buildings.

(4)

1

2



(d) The client is concerned about lighting levels in each part of the buildings.

Discuss how different lighting levels may be needed depending on the use of each area in the buildings.

(9)

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(Total for Question 3 = 16 marks)

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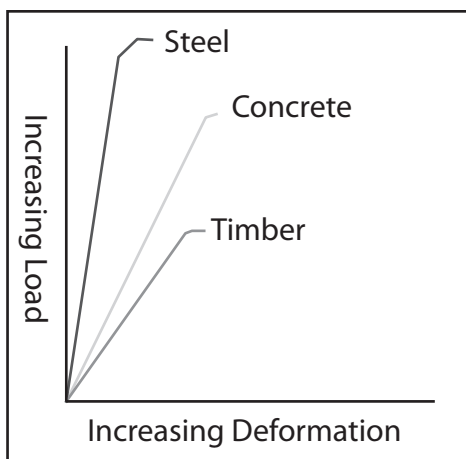


4

A building contractor has been commissioned to design and construct a covered seating area and changing rooms at an athletics track.

- (a) **Figure 2** shows the tensile test results of three materials that are being considered for the supporting columns for the covered seating area.

(1)



**Figure 2**

Identify which material has the highest modulus of elasticity.

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- (b) The covered seating area will be exposed to a range of weather conditions.

Explain **two** ways in which exposure can cause the degradation of construction materials.

(4)

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(c) The changing rooms will have high density concrete block walls.

Explain **two** reasons why high density concrete blocks are suitable for use in the changing rooms.

(4)

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(d) Explain **one** advantage of using underfloor heating for the changing rooms.

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(e) The changing rooms will incorporate showers and drying facilities.

Explain **two** ways that relative humidity can be controlled in the changing rooms.

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(Total for Question 4 = 15 marks)

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5 You will need to refer to **Figures 3, 4 and 5** in the information booklet to answer these questions.

The location of a housing development site is shown by the letter **X** on the maps in **Figure 3**. The data in Figure 3 shows the mean winter temperature and the average annual wind speed for the whole of the UK.

**Figures 4 and 5** give climatic information for the location of the site.

The housing development will include apartment blocks with either five or six floors.

All buildings will be constructed using the same combinations of components and materials, including:

- facing bricks
- concrete raft foundation
- mineral wool insulation
- plasterboard lining.

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

(a) The construction company plans to install polythene damp proof membranes (DPM) in each of the homes.

Explain **two** performance characteristics of polythene DPMs.

(4)

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(b) **Figure 6** shows information about the materials used in the construction of a wall.

(i) Complete the table to show the missing thermal resistance values for the materials.

(4)

Layer	Thickness (m)	Conductivity (W/mK)	Resistance (m <sup>2</sup> K/W)
Surface resistance			0.12
Plasterboard	0.025	0.14	
Mineral wool	0.100	0.04	
Insulation board	0.020	0.03	
Cavity			0.18
Facing brick	0.113	0.84	
Surface resistance			0.06
Total thermal resistance			

**Figure 6**

(ii) Calculate the U-value of a wall.

(2)



Refer to **Figures 3, 4** and **5** for climatic information.

**Figure 7** shows the wall construction detail for the apartment blocks.

- (c) Evaluate the combined use of facing bricks, cavity, insulation board, steel studs, mineral wool insulation and plasterboard as materials for the external structure of the apartment blocks in location X.

(12)

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**(Total for Question 5 = 22 marks)**

**TOTAL FOR PAPER = 75 MARKS**





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