Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson BTEC Level 3 Nationals Extended Diploma

Centre Number | | | | | | |

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

Tuesday 14 January 2020

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 civil engineering contractor is constructing a new railway line in an urban area.

Parts of the railway line will be at ground level with other parts carried by reinforced concrete viaducts above the ground.

The steel used for a railway track needs to resist abrasive wear.

(a) Identify a property that enables steel to resist abrasive wear.

(1)

- ☒ **A** Ductility
- ☒ **B** Hardness
- ☒ **C** Stiffness
- ☒ **D** Resistivity

(b) The railway line will have stations for passengers to get on and off a train. At each station a minimum level of illuminance is required.

Describe what is meant by the term minimum level of illuminance.

(2)

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Figure 1 shows the cross section of a reinforced concrete pier used to support the railway viaduct.

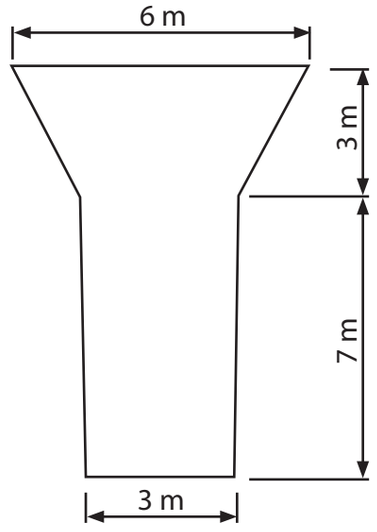

Figure 1 (Diagram not to scale)

(c) Calculate the cross sectional area of the reinforced concrete pier.

(4)

..... m^2

The railway line will pass through a number of areas of housing.

(d) Describe how airborne sound from passing trains may affect residents of the housing.

(2)

Reinforced concrete will be used to support the railway line.

(e) Explain **two** ways in which the failure of reinforced concrete can be prevented.

(4)

1

2

(Total for Question 1 = 13 marks)

2 A contractor has been commissioned to renovate a block of flats to make it attractive to new residents.

The flats were built in the 1960s. Some of the materials that were used in the original construction of the flats show evidence of degradation.

(a) Some of the causes of degradation of construction materials come from natural processes.

State **one** cause of degradation from natural processes.

(1)

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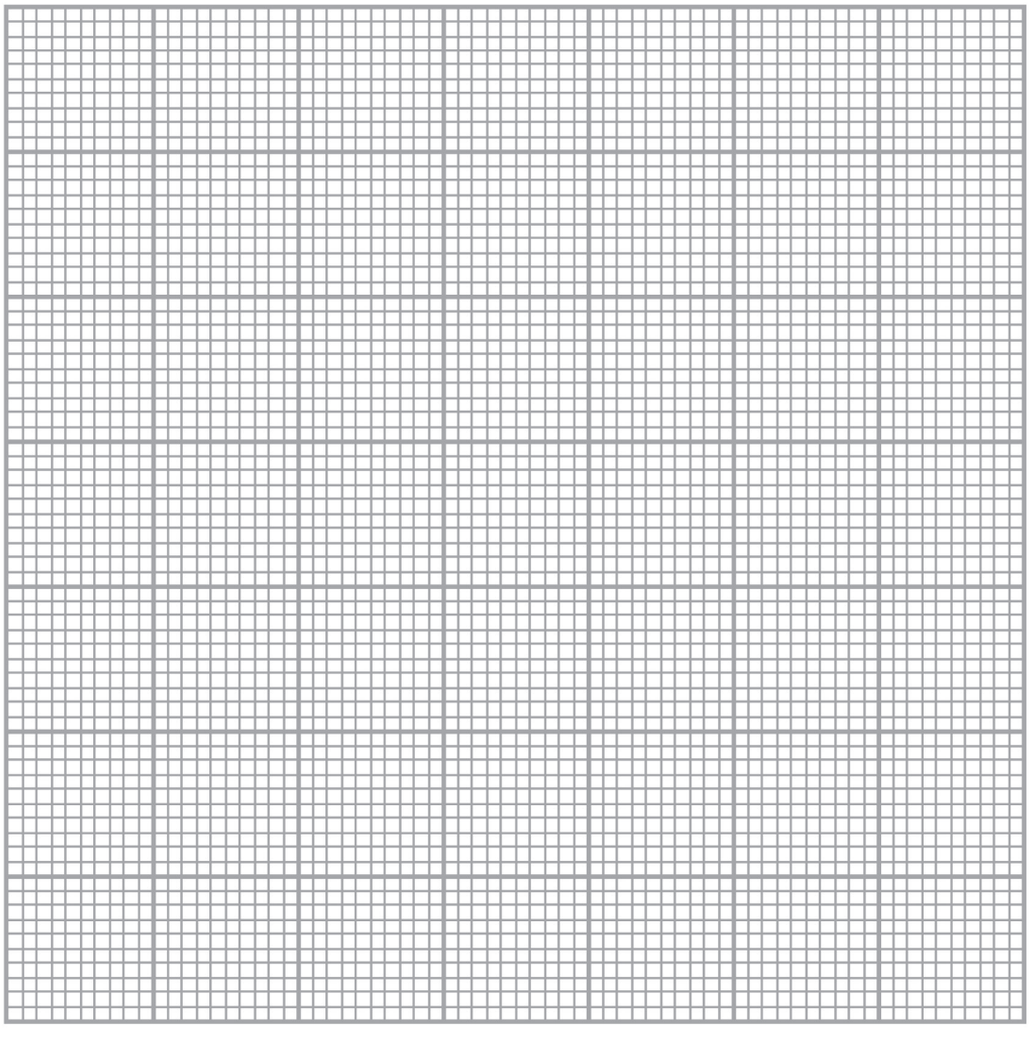
The percentage resident occupancy of the block of flats is shown in the table below.

Year of survey	Percentage (%) occupancy
2000	83
2005	91
2010	67
2015	42

(b) Draw a bar chart to show the level of occupancy over this time period on the grid provided.

(4)



(c) There is a need to upgrade the central heating systems in the flats by installing electronic control systems.

Explain **two** ways in which the use of electronic control systems could improve comfort levels for residents.

(4)

1 .....

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2 .....

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(d) The contractor is considering fixing insulation to the external wall to reduce heat losses through the walls.

Explain **two** disadvantages of using insulation fixed to the external face of the wall.

(4)

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(Total for Question 2 = 13 marks)

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3 A School Academy Trust has appointed a contractor to design and build a new teaching block.

The building will be a steel frame. It will feature internal stud walls with plasterboard linings. The floors will be constructed using reinforced concrete slabs.

(a) Explain **two** advantages of using plasterboard for the internal walls.

(4)

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The contractor has carried out tests on the concrete that has been used for the floor.

The original thickness of the concrete floor slab was 200 mm. During a test, a load applied to the concrete compressed it by 0.04 mm.

The stress in the concrete has been measured as 40×10^6 N/m^2.

(b) Calculate the modulus of elasticity of the concrete.

(4)

..... N/m^2

The structural frame of the teaching block will be constructed using steel.

(c) Discuss the reasons why a steel framed structure is a popular form of construction for buildings of this type.

(9)

(Total for Question 3 = 17 marks)

4 A construction company has been contracted to design and build a small industrial unit.

The industrial unit will have offices, a workshop area and a loading bay.

The loading bay has a 40 m^2 concrete floor. The walls have an area of 32 m^2 and are constructed from high density concrete blocks. The roof is steel and has an area of 40 m^2.

Material	Sound absorption coefficient
Concrete	0.2
High density concrete blocks	0.4
Steel roofing	0.7

(a) Calculate the mean sound absorption coefficient for the loading bay.

(4)

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(b) The workshop area will be constructed from a range of different materials.

Explain how interstitial condensation can affect construction materials.

(2)

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(c) The construction company plans to incorporate natural lighting into the new industrial unit.

Explain **two** benefits that natural lighting would provide.

(4)

1 .....

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2 .....

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(Total for Question 4 = 10 marks)

5 You will need to refer to **Figures 2, 3 and 4** in the Information Booklet to answer questions 5(a) and 5(c).

The locations of two proposed housing developments are indicated by the letters **A** and **B** on the maps shown in **Figure 2**. The data shown in these diagrams indicates the average annual mean temperature and rainfall for the whole of the UK.

Figure 3 gives climatic information for the location of the two sites.

The proposed housing developments will consist of detached bungalows and semi-detached houses.

It is expected that all buildings will be constructed using the same combinations of components/materials, including:

- brick and block cavity walls
- mineral wool insulation
- pantile roof coverings
- triple glazed windows
- plasterboard linings.

Refer to **Figures 2 and 3** for climatic information for the developments.

A construction company is planning to build a number of bungalows and houses at the two locations shown.

The construction company intends to use the same design of homes in both locations.

(a) Explain **two** performance characteristics of pantiles as roofing materials for use in these locations.

(4)

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(b) The construction company intends to install triple glazing with low emissivity glass.

Explain **three** advantages of using low emissivity glass.

(6)

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3 .....

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Figure 4 shows the wall construction detail for the houses and bungalows.

(c) Evaluate the combined use of facing bricks, aerated concrete blocks, mineral wool insulation and plasterboard as materials for the external walls of the dwellings.

(12)

(Total for Question 5 = 22 marks)

TOTAL FOR PAPER = 75 MARKS

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