

Please check the examination details below before entering your candidate information

Candidate surname

Other names

Pearson BTEC
Level 3 Nationals
Extended
Diploma

Centre Number

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Learner Registration Number

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Tuesday 12 January 2021

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

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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 developer has bought an apartment block which requires refurbishment. Existing residents complain that the apartments suffer from high levels of condensation, whilst a survey has found that the soffits need to be replaced.

As part of any refurbishment programme an initial survey of the apartment block is required to be undertaken.

A surveyor has been asked to measure the levels of humidity in the apartments.

(a) Identify **one** instrument that is used to measure humidity. (1)

- A** Anemometer
- B** Barometer
- C** Hygrometer
- D** Thermometer

Humidity has been identified as one of the causes of condensation in the apartments.

(b) Describe how humidity in the apartments could lead to condensation. (2)

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Figure 1 shows the plan of external walls at roof level, roof plan and eaves details for the apartment block.

The roof of the apartment block will be hipped, with a 300 mm soffit overhang all around the building.

All dimensions are given in mm

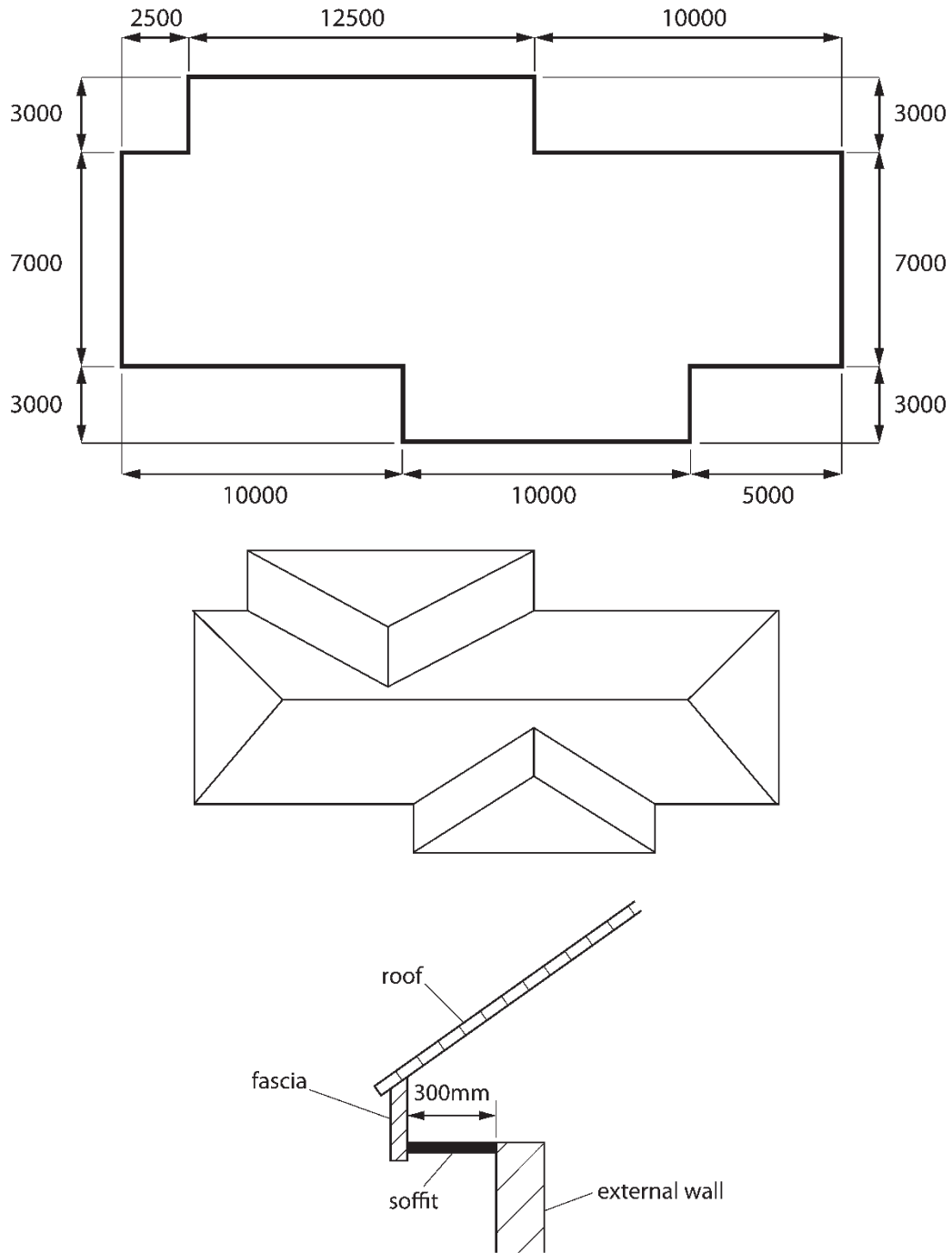


Figure 1

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(c) Calculate the centre line length of the soffit board.

(5)



Answer = mm

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The developer will be replacing the existing soffit boards with new ones manufactured from unplasticised polyvinyl chloride (uPVC).

(d) Explain **one** reason why uPVC is a suitable material for the soffit boards.

(2)

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External walls in the apartment block incorporate window openings.

(e) Explain **one** reason why the daylight factor may vary in different parts of a room.

(2)

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2

A contractor is building a two-storey extension to a house. The house is constructed with a traditional brick and block cavity wall. The external walls of the house are rendered.

The extension will adjoin the existing building and use the same method of construction as the existing house and will have a kitchen on the ground floor and a home-office on the upper floor.

(a) State **one** advantage of using common bricks for the outer skin of the cavity wall. (1)

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(b) Explain **one** property of high-density concrete blocks that makes them suitable for the inner leaf of the cavity wall. (2)

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The kitchen and the office will have different acoustic requirements.

(c) Explain **two** reasons why the acoustic requirements of the rooms will differ.

(4)

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The office will be illuminated using a single light source that will be located above where the desk area is expected to be. The surface of the desk will be 1.4 m from the light source.

The light source has an illuminance of 15 lux at a distance of 2 m.

Calculate the illuminance of the light on the desk.

(5)

Answer = lux

(Total for Question 2 = 12 marks)

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3 A design and build developer is constructing a number of industrial units. Each unit will be identical in layout and have a workshop area, offices and staff rooms for employees.

The buildings will be constructed of:

- a structural frame constructed from high strength steel
- pre-cast reinforced concrete floors
- insulated cladding panels.

The design of the industrial units will need to take into account comfort levels within the offices and staff rooms to reduce the effects of airborne and impact sounds.

(a) Explain **one** difference between airborne and impact sounds.

(2)

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(b) An example of a prescribed concrete mix is C30P.

Explain **two** benefits of using a specific prescribed mix of concrete for the workshop floors.

(4)

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(c) The workshop areas in the industrial units will be lit using ballast lamps.

Explain **two** advantages of ballast lamps for lighting large areas such as workshops.

(4)

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The structural frames of the industrial units will be constructed from high strength steel.

(d) Discuss the different types of loading which will be placed on the frame and why they need to be considered in the design.

(9)

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(Total for Question 3 = 19 marks)

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- 4 A civil engineering contractor has been appointed to construct a road bridge across a railway line.

The bridge deck will be constructed from steel beams supporting concrete slabs. The bridge deck will be supported by piers constructed from class B engineering bricks.

The bridge deck is a simply supported beam.

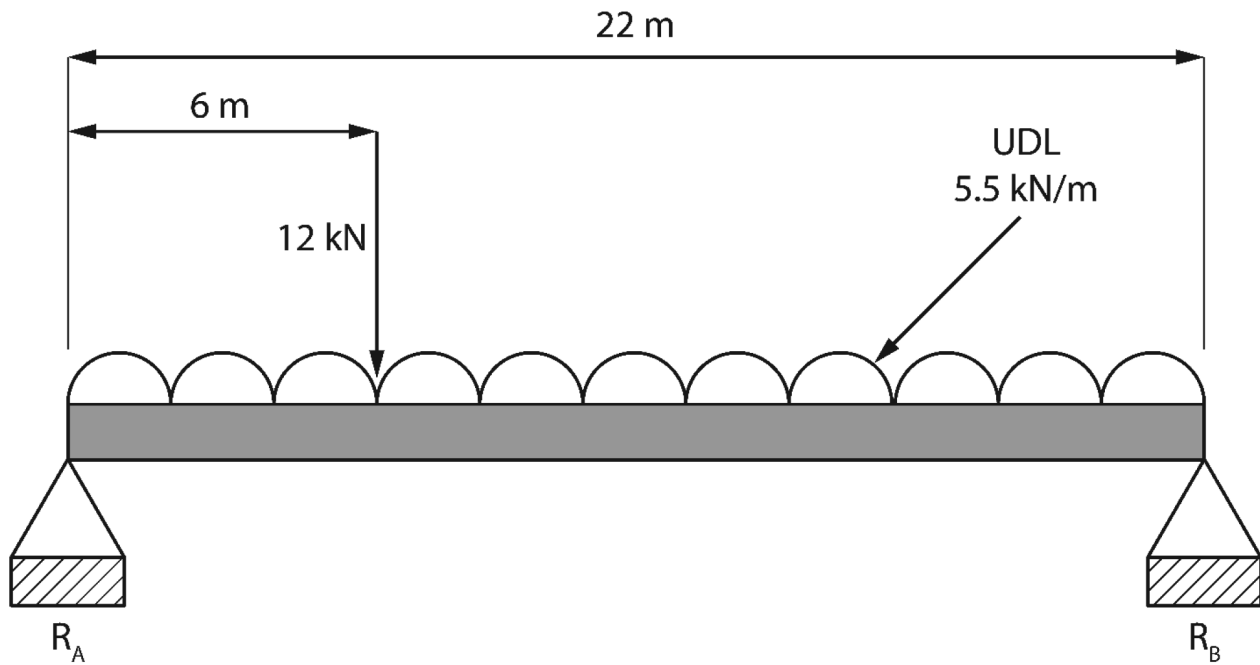


Figure 2

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(a) Calculate the reaction force R_B .

(6)



$R_B = \dots\dots\dots$ kN

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The bridge piers will be constructed from Class B Engineering bricks.

(b) Explain **two** properties of Class B Engineering bricks that make them suitable for use in the piers of the bridge.

(4)

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(Total for Question 4 = 10 marks)

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

The location of a new housing development is shown as point **X** on the maps shown in Figure 3. The information shown in Figure 3 indicates the average annual mean maximum temperature and the average annual mean wind speed for the whole of the UK.

Figure 4 shows the maximum and minimum temperatures, days of air frost, hours of sunshine and rainfall for the location of the site.

The proposed housing development will consist of two blocks of three-storey town houses.

The foundations will be constructed from concrete.

It is expected that the external walls of the town houses will be constructed using a combination of components / materials, including:

- Foil-backed plasterboard
- Timber frame
- Polyurethane insulation board
- Plywood
- Breather membrane.

Refer to Figures 3 and 4 for climatic information for the development.

A construction company is planning to build two blocks of town houses in the location shown on the map.

Sulphate resistant cement will be used in the mortar for the brickwork and the concrete foundations in the construction of the town houses.

(a) Explain **two** reasons why sulphate resistant cement may be required for this development.

(4)

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(b) The town houses will be separated by twin-leaf timber framed party walls.

Explain **three** methods to reduce heat transfer between adjoining town houses.

(6)

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Refer to Figures 3 and 4 for climate information and Figure 5 for information about the wall.

- (c) Evaluate the combined use of a timber frame, facing bricks, breather membrane, plywood, polyurethane insulation board and foil-backed plasterboard as materials for the external walls of the town houses.

(12)

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(Total for Question 5 = 22 marks)

TOTAL FOR PAPER = 75 MARKS





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