



## Level 3 Advanced Technical Extended Diploma in Constructing the Built Environment (Civil Engineering) (1080)

**Friday 23 March 2018**  
**09:30 – 12:30**

1 State the technical term used for loads that are

a) concentrated at one place

(1 mark)

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b) spread out over an area.

(1 mark)

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2 For the simply supported beam shown in Figure 1:

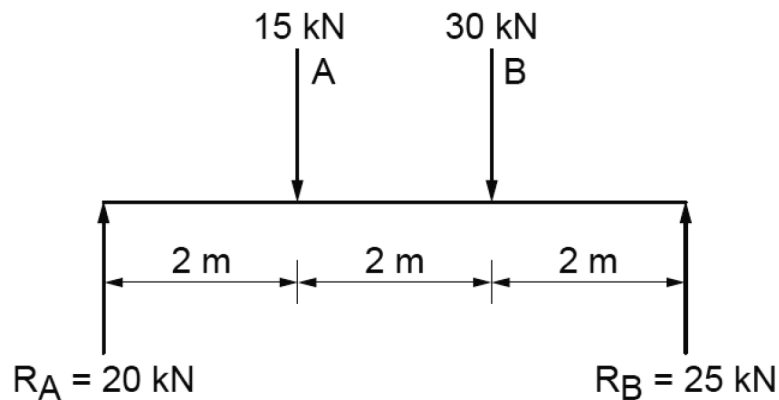


Figure 1

a) Determine the bending moment (BM) values at points A and B.

(2 marks)

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b) Produce a BM diagram for the beam.

(2 marks)

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3 State the meaning of **four** of the terms of the bending theory equation shown below.

$$\frac{M}{f} = \frac{I}{y}$$

(4 marks)

M = \_\_\_\_\_

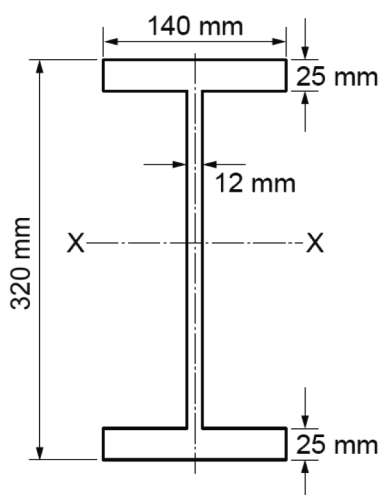
f = \_\_\_\_\_

I = \_\_\_\_\_

y = \_\_\_\_\_

- 4 State the units for:
- a) first moment of area (1 mark)
- \_\_\_\_\_
- b) second moment of area. (1 mark)
- \_\_\_\_\_

- 5 With reference to the section shown in Figure 2:



**Figure 2**

- a) Calculate the moment of inertia about the x-x axis. (4 marks)
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- b) Determine the moment of resistance of the beam, if the maximum bending stress in either tension or compression is  $165 \text{ N/mm}^2$ . (4 marks)
- You should indicate the correct units.
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

- 6 An excavation is to take place on a site of a foundation of depth 1.5 m.  
A site investigation has confirmed the presence of gas pipes in the ground.
- a) Identify **one** risk associated with the gas pipe to those working on site. (1 mark)

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- b) Identify **one** control measure to minimize the risk. (1 mark)

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- 7 Name the **four** components of the flexible highway construction shown in Figure 3. (4 marks)

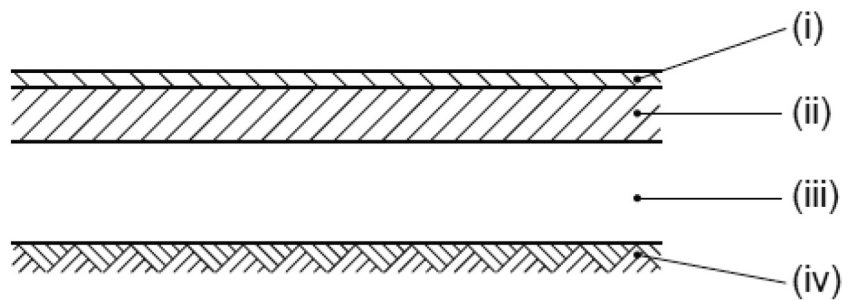


Figure 3

- i) 

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- ii) 

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- iii) 

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- iv) 

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- 8 Explain the disadvantages of a rigid highway construction form. (3 marks)

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- 9 A fast food chain intends to build a number of new outlets. These outlets will have a pre-fabricated structural steel frame and will be delivered to the site ready for erection.

a) Name **three** items of health and safety legislation which should be applied during the design and construction phases of the project.

(3 marks)

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b) Explain why a pre-fabricated structural steel frame has been specified for the outlets.

(4 marks)

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- 10 Explain why a pile foundation would be preferred to a strip foundation for the construction of a low-rise commercial building.

(4 marks)

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- 11 a) Identify two different drawings used when designing a new building.

(2 marks)

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b) Identify two different types of arch.

(2 marks)

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12 State which piece of equipment, when used with a pen and pencil, is best suited to the following manual drawing tasks:

a) Drawing smooth lines of varying radii. (1 mark)

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b) Axonometric drawings. (1 mark)

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c) Creation of parallel horizontal lines. (1 mark)

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d) Finding the centre of a line without measuring. (1 mark)

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13 Evaluate the core activities, associated to the BIM overlay, in relation to the following stages of the RIBA plan of works:

a) Design (C, D & E). (6 marks)

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b) Construction (J & K). (2 marks)

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14 a) Define the term 'standard deviation'.

(2 marks)

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b) State the relationship between standard deviation and variance.

(1 mark)

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c) Describe what is meant by the term 'grouped data'.

(2 marks)

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15 a) Which calculus technique is used to determine a turning point on a curve?

(1 mark)

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b) Determine, by integration, the area enclosed by the curve  $y = 3x^2 + 4$ , the x-axis and the ordinates  $x = 0$  and  $x = 3$ .

(4 marks)

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- 16 Evaluate  $(1-0.03)^6$ , correct to **three** decimal places, using the binomial expansion theorem.

The binomial expansion theorem is  $(1 + x)^n = 1 + \frac{nx}{1!} + \frac{n(n-1)x^2}{2!} + \dots$  (4 marks)

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- 17 Concrete cubes were tested for compressive strength during concrete pours on two construction sites. The specified compressive strength of the concrete was 30 N/mm<sup>2</sup> in both cases.  
The test results for each site were:

Site	Median Strength (N/mm <sup>2</sup> )	Interquartile range (N/mm <sup>2</sup> )
1	31.3	6
2	29	3

Explain how the data shown above should be interpreted. (2 marks)

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- 18 A developer has planning permission for a three-storey office block. This is to be built from concrete cast in situ frame. The new building will be rectangular and have plan dimensions of 85 m x 25 m.

a) Explain how the effective length of a column affects its design.

(3 marks)

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b) Produce **one** sketch of a junction detail in the concrete in situ frame.

(3 marks)



- (12 marks)

[illegible]

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