Pearson BTEC Level 3 Nationals Extended Diploma

Tuesday 14 January 2020

Morning (Time: 1 hour 30 minutes) | Paper Reference **20075K**

Construction and the Built Environment

Unit 1: Construction Principles

Information Booklet

Do not return this booklet with the question paper.

Instructions

- You will need the information in this booklet to answer some questions.
- Read the information carefully.
- You must **not** write your answers in this booklet.
- Only answers given in your question paper booklet will be marked.

Turn over ▶

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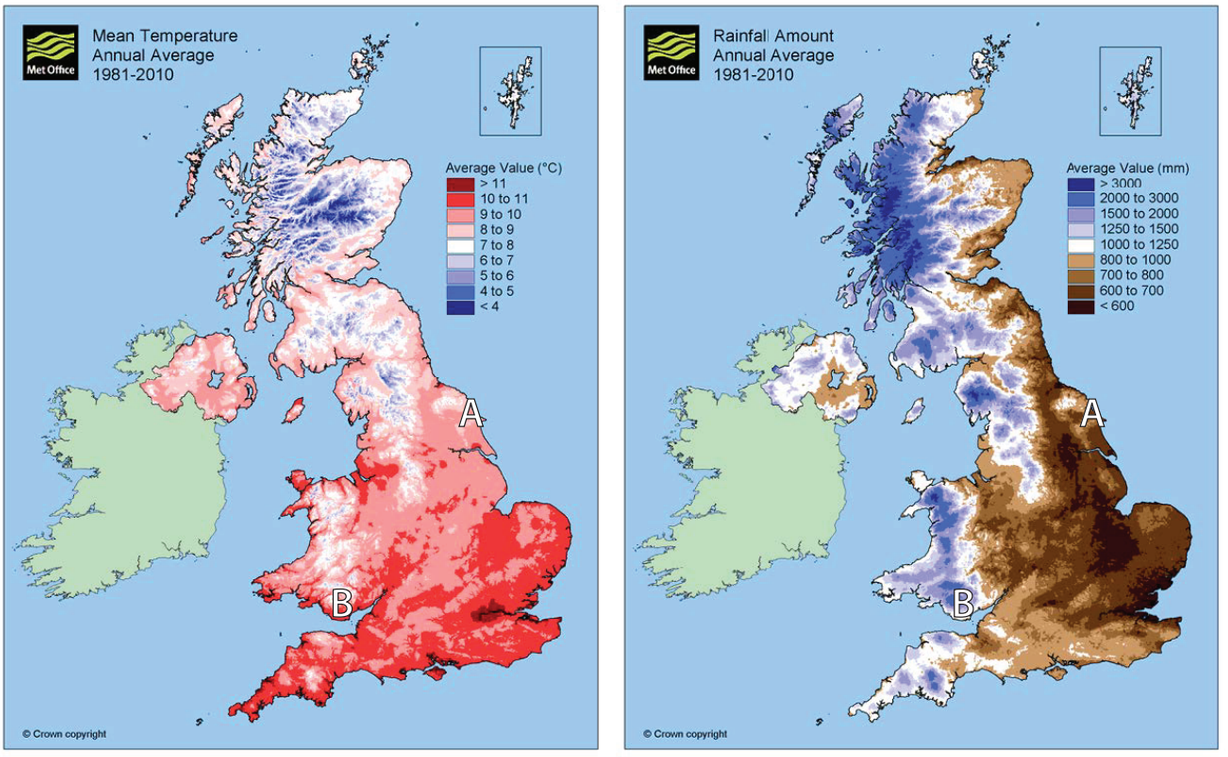
Climatic information for use with Question 5



(Source: Met Office © Crown copyright.)

Figure 2

Mean temperature annual average 1981–2010 and rainfall amount annual average 1981–2010

Month	Sunshine (hours)		Days of air frost (days)		Monthly mean wind speed (at 10m) (knots)	
Location	**A**	**B**	**A**	**B**	**A**	**B**
January	56	54	7	7	11	14
February	79	80	7	8	10	13
March	120	112	3	3	10	13
April	179	156	1	1	9	11
May	222	206	0	1	9	11
June	217	191	0	0	8	10
July	224	205	0	0	8	9
August	192	190	0	0	8	10
September	161	142	0	0	8	11
October	105	104	1	1	10	12
November	68	65	2	2	11	12
December	51	51	6	7	10	14

Figure 3

Hours of sunshine, days of air frost and mean monthly wind speed for the two proposed development locations

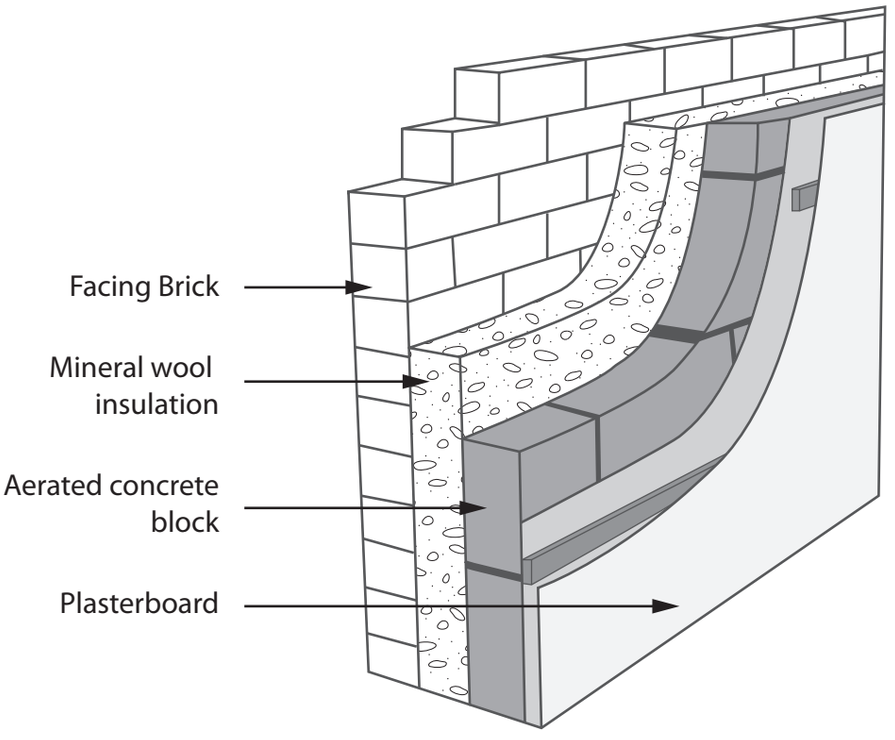


Figure 4

Wall construction detail

Formulae and constants

Surface areas of regular shapes

Total surface area of a cylinder, $TSA = 2\pi rh + 2\pi r^2$

Curved surface area of cone, $CSA = \pi rl$

Surface area of a sphere, $SA = 4\pi r^2$

Area of a sector of a circle, $A = \frac{1}{2} r^2\theta$

Volumes of regular shapes

Volume of a cylinder, $V = \pi r^2 h$

Volume of sphere, $V = \frac{4}{3} \pi r^3$

Volume of a cone, $V = \frac{1}{3} \pi r^2 h$

Geometric techniques

Pythagoras' theorem $a^2 = b^2 + c^2$, where angle A is a right angle

Radians, arc lengths and areas of sectors

Length of an arc of a circle, $s = r\theta$

Graphical techniques

Equation of a straight line, $y = mx + c$

Forces, stress, strain and modulus of elasticity

Relationship between force (load), mass and acceleration due to gravity, $F = mg$

Direct stress, $\sigma = \frac{F}{\mathrm{A}}$

Direct strain, $\varepsilon = \frac{\Delta L}{\mathrm{L}}$

Shear stress, $\tau = \frac{F}{\mathrm{A}}$

Shear strain, $\gamma = \frac{\alpha}{\beta}$

Modulus of elasticity, $E = \frac{\sigma}{\varepsilon}$

Hooke's law, $F = -Kx$

Resolution of forces in perpendicular directions, $Fx = F\cos\theta$, $Fy = F\sin\theta$

Equilibrium conditions to ensure stability of a beam $\Sigma Fx = 0$, $\Sigma Fy = 0$ and $\Sigma M = 0$

Moment of a force: moment = force × distance

Human comfort effect of temperature on construction materials while in situ

Thermal resistance (R_C) = $\dfrac{thickness\ of\ material}{thermal\ conductivity}$

Calculation of U-values: $U = \dfrac{1}{R_C}$, $U = \dfrac{thermal\ conductivity}{thickness\ of\ material}$

Application of mathematical methods to determine lighting requirements

Inverse square law of illumination, $E = \dfrac{I}{2}$

Cosine law of illumination, $E = \dfrac{I}{d^2}\cos\theta$

d is the distance between the light source and the point being illuminated

Application of mathematical methods for acoustic comfort

Absorption of a room, $A = \Sigma\, S_i\, \alpha_i$

Sound absorption coefficient, $\alpha = I_a / I_i$

Mean sound absorption coefficient, $\alpha_m = A / S$

Constants

Acceleration due to gravity, g = 9.81 m/s^2

π = 3.142

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