## **Question 7**

The Atomium in Brussels is one of Belgium's most famous landmarks.

It consists of 9 identical spheres joined by two types of cylindrical pipes.

(a) The Atomium is modelled on an iron atom that has been magnified 165 billion times. Given that a billion is a thousand million, write 165 billion in the form  $a \times 10^n$ , where  $n \in \mathbb{Z}$ , and  $1 \le a < 10$ .



(55 marks)

Picture: Squonk11 www.flickr.com/photos/squonk

(b) The diameter of each sphere in the Atomium is 18 metres.

(i) Find the radius of each sphere.

## (ii) Find the volume of each sphere, correct to 2 decimal places.

(c) Find the combined surface area of all 9 spheres in the Atomium, correct to the nearest  $m^2$ .



(d) Each of the 8 cylindrical pipes extending from the centre sphere has a radius of 1.65 m and a length of 23 m.

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(i) Find the sum of the curved surface areas of all 8 pipes, correct to the nearest  $m^2$ .

(ii) The other 12 cylindrical pipes connect the outer spheres to each other. Each pipe has a radius of 1.45 m. All 12 pipes are equal in length. The sum of the curved surface areas of the 12 pipes is 3170 m<sup>2</sup>. Find the length of one pipe. Give your answer correct to the nearest metre.



(iii) The curved surfaces of the 20 pipes and 9 spheres are covered in stainless steel. Stainless steel costs €70 per square metre. Use the areas you have calculated or have been given above to find the approximate cost of the stainless steel required to resurface the Atomium.



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