## 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 $1 \leq a<10$.
(55 marks)


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

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(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.

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

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

(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 $3170 \mathrm{~m}^{2}$. 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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