Question #73537, Chemistry / General Chemistry / Completed

Suppose you have Avogadro\'s number of mini marshmallows and use them to cover the state of Utah which has a land area of 8.214 × 104 mi2. Each mini marshmallow has a diameter of 0.635 cm and a height of 2.54 cm. Assuming the marshmallows are packed together so there is no space between them, to what height above the surface, in kilometres, will the mini marshmallows extend?

Solution

1 mi^2 equal to 2.59e+10 cm^3

8.214×10^4 mi^2 equal to 2.12742e+15 cm^3 – the area of the State in cm^3.

$S = \pi d^2/4 = 3.14 \cdot 0.635^2 / 4 = 0.3165$ cm^3 – the area of 1 marshmallow.

$2.12742e+15 / 0.3165 = 6.72 \cdot 10^{15}$ – the number of marshmallows in one single layer to cover the state area.

$6.02 \cdot 10^{23} / 6.72 \cdot 10^{15} = 8.958 \cdot 10^7$ – the number of layers.

$8.958 \cdot 10^7 \cdot$ height **=** $8.958 \cdot 10^7 \cdot 2.54$ cm $= 2.275 \cdot 10^8$ cm or 1413.6 miles.

Answer: $2.275 \cdot 10^8$ cm or 1413.6 miles.