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In[4]:= BolhasHorizontais[n_, raio_, h_] :=
  bubbles = {{}, {}, {}, {}, {}};

numero = RandomVariate[PoissonDistribution[n]];
  variável aleatória  distribuição de Poisson
For[j = 0, j < numero, j++;
  para cada
  Rzone = raio * Sqrt[RandomReal[1]];
    raiz... real aleatório

β = RandomVariate[BetaDistribution[2, 2]];
  variável aleatória  distribuição beta
θ = 2 * π * β - π;
xvalue = Rzone Cos[θ];
  coseno
yvalue = Rzone Sin[θ];
  seno
zvalue = RandomReal[{0, h}];
  real aleatório
rvalue = RandomReal[{(1.1 - (0.1 + 0.4)) / (2 * raio) * xvalue + (1.1 + (0.1 - 0.4)) / 2,
  (1.1 - (0.1 + 0.4)) / (2 * raio) * xvalue + (1.1 + (0.1 + 0.4)) / 2}];

u = RandomReal[{0, 1}];
  real aleatório
t = j;

AppendTo[bubbles[[3]], {xvalue, yvalue, zvalue}];
  adiciona a
AppendTo[bubbles[[4]], rvalue]; AppendTo[bubbles[[1]], u];
  adiciona a
AppendTo[bubbles[[2]], t]; AppendTo[bubbles[[5]], Rzone];
  adiciona a

bubbles = SortBy[bubbles^T, First]^T;
  ordena por  primeiro
For[k = 1, k < Length[bubbles[[1]]] - 1, k++,
  comprimento
  For[l = k + 1, l < Length[bubbles[[1]]], l++,
    comprimento
    Δx = bubbles[[3, k, 1]] - bubbles[[3, l, 1]];
    Δy = bubbles[[3, k, 2]] - bubbles[[3, l, 2]];
    Δz = bubbles[[3, k, 3]] - bubbles[[3, l, 3]];
    If[√(Δx^2 + Δy^2 + Δz^2) < (bubbles[[4, k]] + bubbles[[4, l]]),
      se
      bubbles = Delete[#, {l}] & /@ bubbles]];
        deleta

For[i = 1, i ≤ Length[bubbles[[1]]], i++,
  para cada  comprimento

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lado vazio lado complementar
If[bubbles[[3, i, 3]] < bubbles[[4, i]] ||
 $\downarrow$  se
  bubbles[[3, i, 3]] + bubbles[[4, i]] > h || bubbles[[5, i]] + bubbles[[4, i]] > raio, i--;
  bubbles = Delete[#, {i + 1}] & /@ bubbles];
 $\downarrow$  deleta

AppendTo[bubbles, Sum[ $\frac{4}{3}\pi * (\text{bubbles}[4, i])^3$ , {i, Length[bubbles[[4]]]}]];
 $\downarrow$  adiciona a  $\downarrow$  soma  $\downarrow$  comprimento
 $\downarrow$   $\downarrow$   $\downarrow$ 
bubbles]

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In[6]:= Cilindro2[r_, h_] := ParametricPlot3D[{r Cos[\theta], r Sin[\theta], z},
 $\downarrow$  gráfico paramétrico 3D  $\downarrow$  cosseno  $\downarrow$  seno
  {\theta, 0, 2 \pi}, {z, 0, h}, Mesh \rightarrow None, PlotStyle \rightarrow {Opacity[0.5], LightGray}]
 $\downarrow$  malha  $\downarrow$  nenhum  $\downarrow$  estilo do gráfico  $\downarrow$  opacidade  $\downarrow$  cinza claro

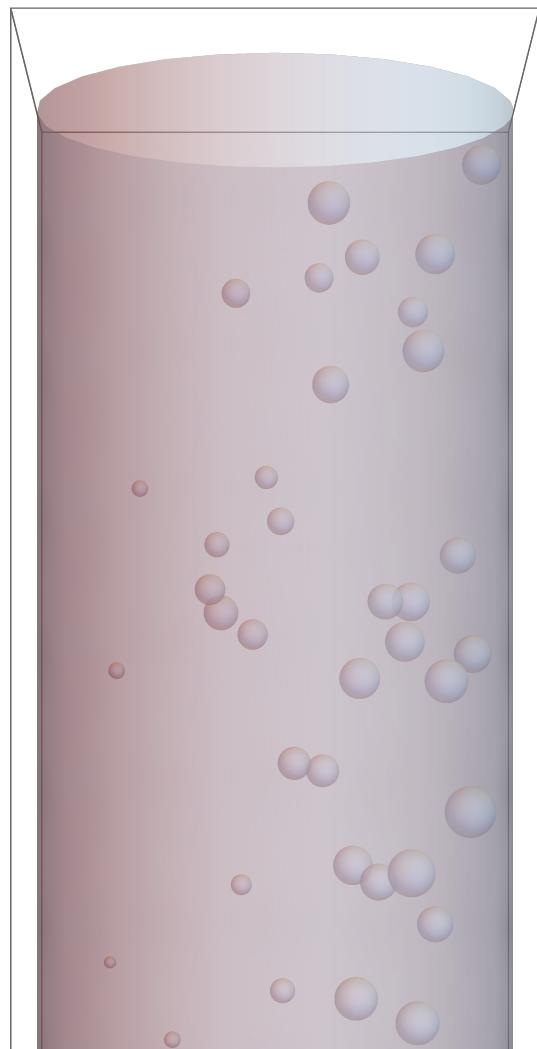
```

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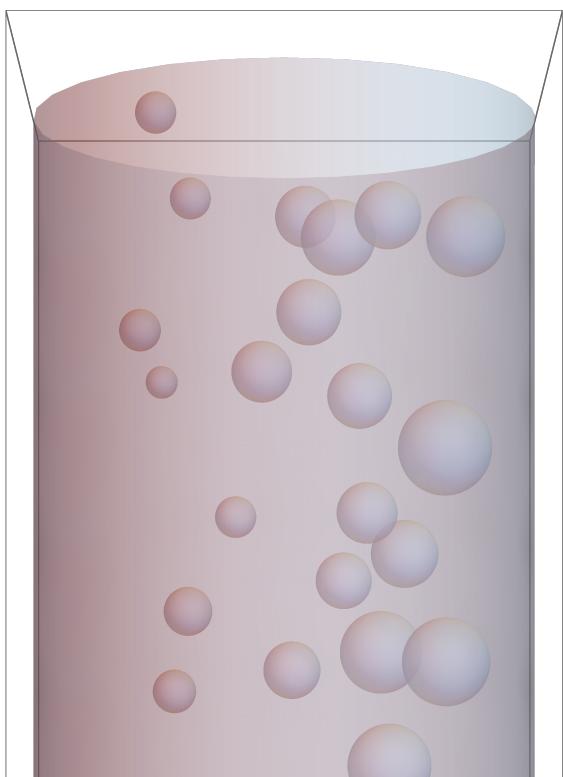
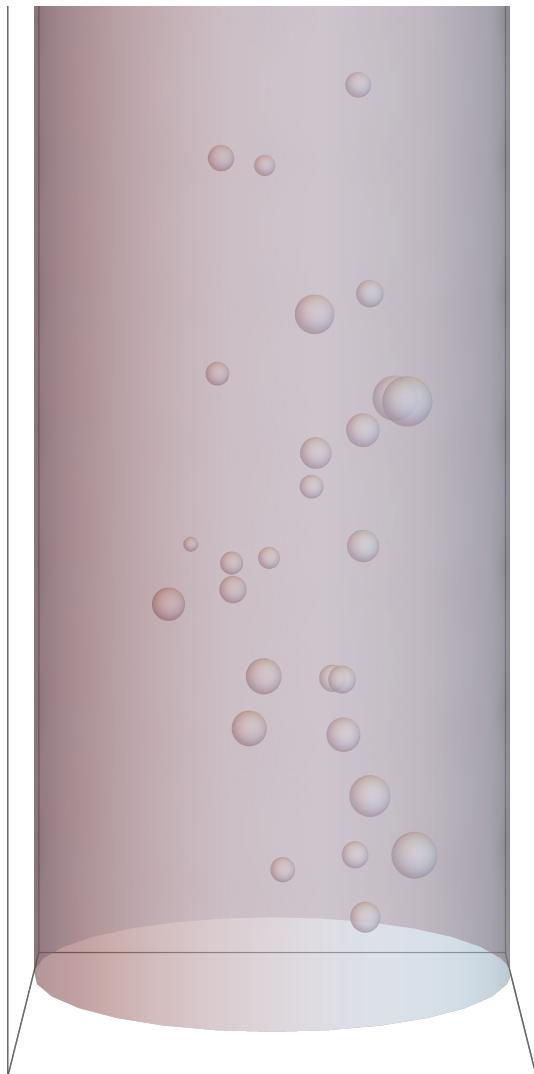
In[7]:= VistaBolhas3D[n_, r_, h_] := (bolhas = BolhasHorizontais[n, r, h];
 $\downarrow$  representação  $\downarrow$  opacidade
  Show[Graphics3D[{Opacity[0.5], Sphere[bolhas[[3]], bolhas[[4]]]}],
 $\downarrow$  esfera
  Cilindro2[r, h]])

```

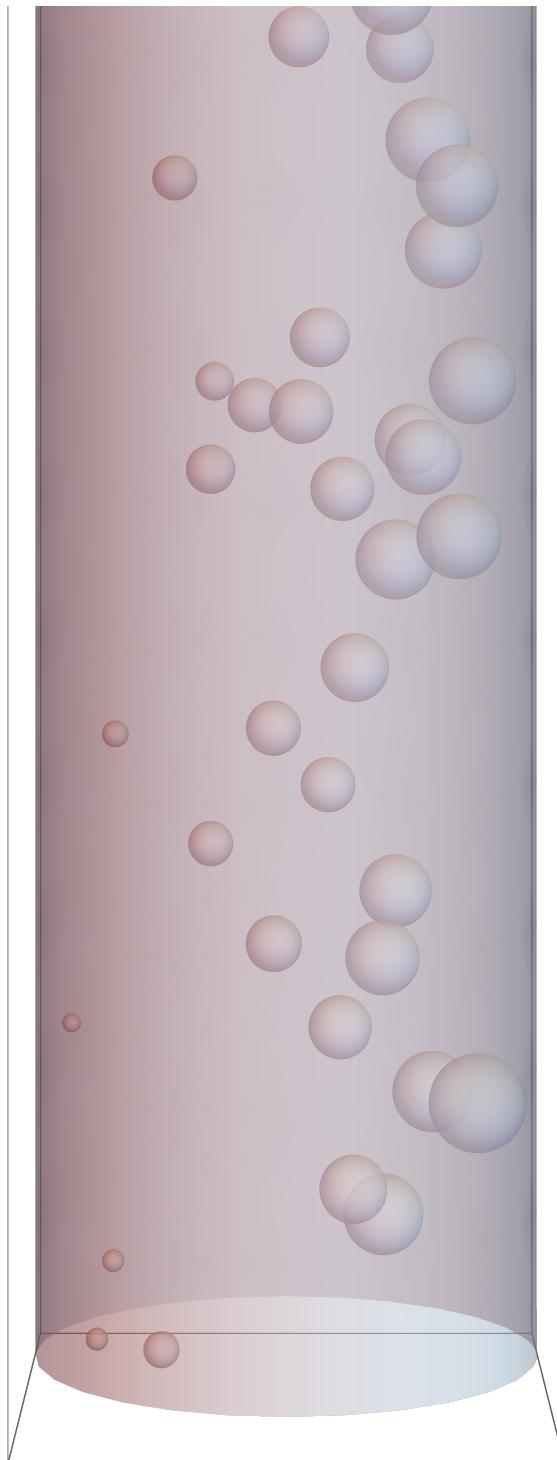
```
In[8]:= VistaBolhas3D[70, 9.5, 76]
```



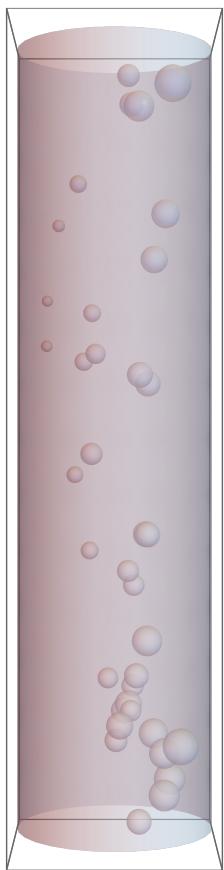
Out[\circ]=



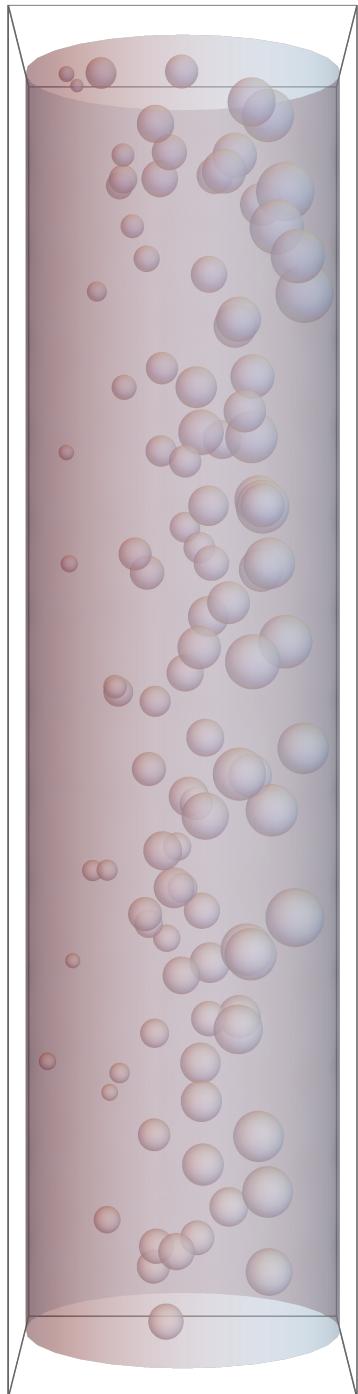
Out[\circ] =



Out[]=



Out[\circ] =



In[\circ] = **BolhasHorizontais[100, 9.5, 76]**

393.189

```
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