How many Molecules of SiO_2 are in my Quartz Sphere?

Quartz Sphere:
m = 346.3 g
D = 6.30 cm => R = 3.15 cm
=> $V = [(4/3)\pi R^3] = 130.9\ cm^3$
Density = $\rho = m/V = m/[(4/3)\pi R^3] = 346.3g/130.9\ cm^3 = 2.645\ g/cm^3 =$ **2.65** g/cm^3

Given Density and Volume => Mass: $m = \rho V = 346.3$ g

What is the mass of one Molecule of SiO_2 (Quartz)?

Z ≡ Atomic Number of an Element = # of Protons in Nucleus = # of electrons in atom
N ≡ = # of Neutrons in Nucleus ≈usually≈ Z

A = Atomic Weight of an Atom of an Element ≈ Z + N
is given in units called: amu = Atomic Mass Units

1 amu ≡ (1/12){Mass of Carbon 12 (with Z + N = 6 + 6 = 12)}
= $1.66053886 \times 10^{-24}$ grams
1 amu ≈ mass of the proton ≈ mass of the Neutron ≈ mass of a Nucleon
≈ mass of a Hydrogen Atom (since electrons have mass ≈ amu/1823)
≈ $[1/(6.02 \times 10^{23})]$ grams = [1/(Avogadro's Number] grams
where: **1 mole ≡ Avogadro's Number = 6.02×10^{23}**
==>: (6.02×10^{23}) amu = 1 gram
or: Mass of a mole of Nucleons = 1 gram

MW = Molecular Weight of SiO_2:
≈ $[A_{Si} = Z + N = 2*Z_{Si} = 2*14 = 28] + 2*[A_O = Z + N = 2*Z_O = 2*8 = 16]$
= 60 amu = # of Protons + # of Neutrons
= 28.0855 + 2*15.9994 = 60.0843 amu (from Tables or a good Periodic Table)

Mass in grams of SiO_2 = 60.0843 amu $[1.66053886 \times 10^{-24}$ g/amu] = 9.977×10^{-23} g
$[1.661 \times 10^{-24}$ g/amu] =
$[1/(6.02 \times 10^{23})$ g/amu] =
$[1g / (6.02 \times 10^{23}$ amu)] =

Mass in grams of SiO_2 = 60.0843 amu [1g / (mole amu)] since mole = 6.02×10^{23}
= 60 grams/mole
==> Mass of 1 mole in grams of SiO_2 = 60 grams = MW in grams
In General: MW in grams = Mass of a Mole of Molecules

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n = # of Molecules in Quartz Sphere = [mass of n Molecules]/[mass of 1 Molecule]
= [mass of our Sample]/[mass of 1 Molecule]
= $[346.3\ g]/[9.977 \times 10^{-23}\ g]$
= 3.471×10^{24} Molecules

= 3.47×10^{24} Molecules [1 mole/6.02×10^{23} Molecules]
= 5.77 moles of molecules

or equivalently:

# of moles of Molecules in Quartz Sphere = [mass of our Sample]/[mass of 1 mole]
= [346.3 g]/[60 g]
= 5.77 moles

Remember:
1 amu ≈ mass of the proton ≈ mass of the Neutron ≈ mass of a Nucleon
≈ mass of a Hydrogen Atom (since electrons have mass ≈ amu/1823)
≈ $[1/(6.02 \times 10^{23})]$ grams = [1/(Avogadro's Number] grams