The Sphere Class

Write a program to calculate the surface area and volume of a sphere. Your program should also display a message explaining the purpose of the program and should input the units of measurement.

The equation for the surface area of a sphere is: *4πr2*, where r is the radius

The equation for the volume of a sphere is: *4/3πr3*,where r is the radius

**To Do:**

1. Write an IPO diagram for the **Sphere** class in the table provided here.

|  |  |  |
| --- | --- | --- |
| Program Input | Process | Program Output |
| r, unitOfMeasurement | Declare numeric r, volume, surfaceArea Declare String unitOfMeasurement   1. Display sentence explaining what the program does 2. Prompt for and read unitsOfMeasurement 3. Prompt for and read r 4. Calculate surfaceArea 5. Display surfaceArea 6. Calculate volume 7. Display volume | surfaceArea, volume |

1. Complete the **Calculation** and **Expected output** columns in test cases below. Use 3.14 for *π.*

| **Test Plan for Sphere Program** | | | | |
| --- | --- | --- | --- | --- |
| **Test Case** | | **Input Data** | **Calculation** | **Expected output** |
|  | Use an integer radius | radius = 2  units of measurement = centimeters | SphereArea = 50.27  SphereVolume = 33.51 | The surface area of a sphere with a radius of 2 centimeters is 50.24 square centimeters.  The volume of a sphere with a radius of 2 centimeters is 33.49333 cubic centimeters. |
|  | Use a real number radius | radius = 4.33  units of measurement = centimeters | SphereArea = 235.61  SphereVolume = 340.06 | The surface area of a sphere with a radius of 4.33 centimeters is 235.48618 square centimeters.  The volume of a sphere with a radius of 4.33 centimeters is 340.05745 cubic centimeters. |

1. Code the **Sphere** class. Use the **Math.PI** constant for *π*. Round the results to 5 decimal places. An example of the Console window for the program is shown here.

This program calculates the surface area and volume of a sphere.

What are the units of measurement? centimeters

What is the radius of the sphere? 123.6547

The surface area of a sphere with radius, 123.6547 centimeters is 192145.89927 square centimeters.

The volume of a sphere with radius, 123.6547 centimeters is 7919914.51029 cubic centimeters.

1. Test the program using the test cases above. (Note that since your test cases use 3.14 for π the results might be slightly different.)