2.8 Scientific notation for floating-point literals

Scientific notation is useful for representing floating-point numbers that are much greater than or much less than 0, such as 6.02 x 10^{23}. A floating-point literal using ***scientific notation*** is written using an e preceding the power-of-10 exponent, as in 6.02e23 to represent 6.02 x 10^{23}. The e stands for exponent. Likewise, 0.001 is 1 x 10^{-3} and can be written as 1.0e-3. For a floating-point literal, good practice is to make the leading digit non-zero.

Figure 2.8.1: Calculating atoms of gold.

```
#include <iostream>
using namespace std;

int main() {
   double avogadrosNumber = 6.02e23; // Approximation of atoms per mole
   double gramsPerMoleGold = 196.9665;
   double gramsGold;
   double atomsGold;

   cout << "Enter grams of gold: ";
   cin  >> gramsGold;

   atomsGold = gramsGold / gramsPerMoleGold * avogadrosNumber;

   cout << gramsGold << " grams of gold contains ";
   cout << atomsGold << " atoms" << endl;

   return 0;
}
```

```
Enter grams of gold: 4.5
4.5 grams of gold contains 1.37536e+22 atoms
```

Feedback?

PARTICIPATION ACTIVITY 2.8.1: Scientific notation.

1) Type 1.0e-4 as a floating-point literal with a single digit before and four digits after the decimal point. Note: Do not use scientific notation.

Correct

0.0001

The e-4 shifts the decimal point four places to the left.

0.0001

Check Show answer

2) Type 7.2e-4 as a floating-point literal with a single digit before and five digits after the decimal point. Note: Do not use scientific notation.

0.00072

Check Show answer

Correct

0.00072

The e-4 shifts the decimal point four places to the left.

3) Type 540,000,000 as a floating-point literal using scientific notation with a single digit before and after the decimal point.

5.4e8

Check Show answer

Correct

5.4e8

Represents $5.4x10^{8}$.

4) Type 0.000001 as a floating-point literal using scientific notation with a single digit before and after the decimal point.

1.0e-6

Check Show answer

Correct

1.0e-6

Represents $1.0x10^{-6}$. Note: Although 0.1e-5 is also correct, good practice is to start with a non-zero digit.

5) Type 623.596 as a floating-point literal using scientific notation with a single digit before and five digits after the decimal point.

6.23596e2

Check Show answer

Correct

6.23596e2

The e2 shifts the decimal two places to the right, thus adjusting 6.23596 into the desired 623.596.

Feedback?

CHALLENGE ACTIVITY 2.8.1: Acceleration of gravity.

Compute the acceleration of gravity for a given distance from the earth's center, distCenter, assigning the result to accelGravity. The expression for the acceleration of gravity is: $(G * M) / (d^2)$, where G is the gravitational constant 6.673×10^{-11}, M is the mass of the earth 5.98×10^{24} (in kg) and d is the distance in meters from the earth's center (stored in variable distCenter).

```
#include <iostream>
using namespace std;

int main() {
   double G = 6.673e-11;
   double M = 5.98e24;
   double accelGravity;
   double distCenter;

   cin >> distCenter;

   /* Your solution goes here  */
   accelGravity =  (G * M) / (distCenter*distCenter);

   cout << accelGravity << endl;

   return 0;
}
```

Run ✓ All tests passed

✓ Testing with distance 6.38e6 (earth's surface)

Your value `9.803495445209855`

✓ Testing with distance 2*6.38e6 (2x earth's radius)

Your value `2.4508738613024637`

✓ Testing with distance 0.5*6.38e6 (1/2 earth's radius)

Your value `39.21398178083942`

✓ Testing with distance 1.000000 (at earth's core)

Your value 399045400000000

Feedback?