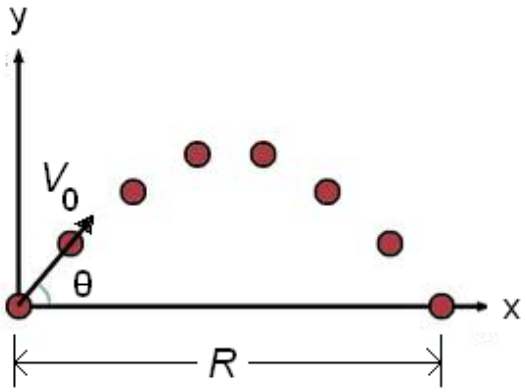
Computer Laboratory - lab sheet 3

Task 1

Copy the program given below. Save (as `projectile.cpp`), compile and run it.

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

/* Program to compute the range of a projectile
   Given the initial speed, and angle of elevation.
   The solution is over simplistic:
   R = v0^2 SIN(2*theta) / g
*/

int main(){
  const double g = 9.8;
  double v0, theta, range;

  // get the values
  cout << "Input the speed (in m/s): ";
  cin  >> v0;
  cout << "Input the angle (in degrees): ";
  cin  >> theta;

  // convert angle into radian
  theta = theta * M_PI/180.0;

  // calculate range
  range = v0*v0 * sin(2.0*theta)/g;
  cout << "Range = " << range << " m." << endl;

  return 0;
}
```



(a) Verify that it works correctly.

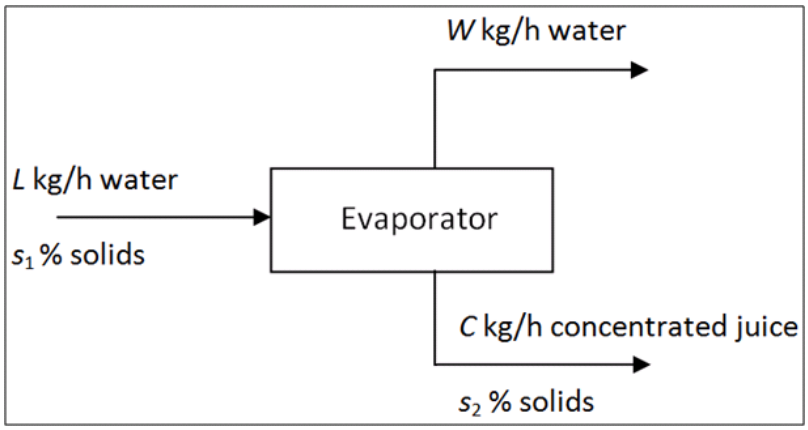
(b) Modify the program to also output the time-of-flight, $T = 2\, v_0 \sin(\theta)/g$, of the projectile.

(c) Modify for program for a projectile launched on the moon.

Task 2

In the concentration of orange juice, fresh juice containing s_1(%) solids is fed to a vacuum evaporator at a rate of L(kg/hour). In the evaporator, water is removed at a rate of W(kg/hour) and the solid content is increased to s_2(%).

Write a C++ program that calculates the outlet concentrated C(kg/hour) for the input values L, s_1 and s_2.



EXAMPLE:
For L=1000 kg/h, s1 = 7.08% and s2 = 58.0%
Material balance : 1000 = W + C
*Mass flow : 1000*0.0708 = W*0 + C*0.58*
Solving these two equations gives:
C = 122.1 kg/h concentrated juice.
W = 877.9 kg/h water.

Task 3

Write a program that reads a logarithm base, b, and value x and outputs the result of $\log_b x$.
Hint use `log()` or `log10()` function defined in `cmath` library.