02.5 - Fluid Mechanics

The Reynolds number is a key parameter used to determine whether fluid flow will be laminar or turbulent. For fluid flow through a pipe, the Reynolds number is given by

$$\mathrm{Re} = (Vd)/v$$

where Re is the Reynolds number (a dimensionless value), V is the velocity ($\mathrm{m/s}$ or $\mathrm{ft/s}$) of the fluid, d is the diameter of the pipe (m or ft), and v is the kinematic viscosity of the fluid ($\mathrm{m/s^2}$ or $\mathrm{ft/s^2}$). The kinematic viscosity, v, is a measure of the fluid's resistance to flow and stress.

Except when at extremely high pressures, a liquid fluid's kinematic viscosity is dependent on temperature and is independent of pressure. The following chart lists the kinematic viscosity of water at three different temperatures:

Temperature (°C)	Kinematic Viscosity ($\mathrm{m^2/s}$)
5	1.52×10^{-6}
20	1.00×10^{-6}
50	5.54×10^{-7}

Using this information, write a Python program that asks the user for the velocity of the water flowing through a pipe (V), for the pipe's diameter (d), and to select the water's temperature (T) from $5\,^{\circ}\mathrm{C}$, $20\,^{\circ}\mathrm{C}$, and $50\,^{\circ}\mathrm{C}$. Your program should then calculate the Reynolds number based on the input values.

Test your program with the following data:

Input			Output
$T(^{\circ}\mathrm{C})$	$V(\mathrm{m/s})$	$d(\mathrm{m})$	Re
5	3.5	1.5	3.45×10^6
20	0.001	0.15	1.50×10^2
50	0.9	0.02	3.25×10^4

Finally, format your program to match the sample below. Your output should exactly match the sample output, character for character, including all white space and punctuation. Hint: The string for printing ° is '`\u00B0`', which is the Unicode value for this symbol. Also note that the last line of output in each example broke across two lines because it was too long for the terminal. Your output should not include this line break. User input in the sample has been highlighted in Pappy's Purple to distinguish it from the program's output, but your user input does not need to be colored. Save your program as `fluid_mechanics_login.py`, where `login` is your Purdue login. Then submit it along with a screenshot showing a run of **all 3** test cases.

Terminal

```
$ python fluid_mechanics_login.py
Enter the temperature in °C as 5, 20, or 50: 5
Enter the velocity of water in the pipe (m/s): 3.5
Enter the pipe's diameter (m): 1.5
At 5.0°C, the Reynolds number for flow at 3.5 m/s in a 1.5 m diameter pipe
is 3.45e+06.
$ python fluid_mechanics_login.py
Enter the temperature in °C as 5, 20, or 50: 20
Enter the velocity of water in the pipe (m/s): 0.001
Enter the pipe's diameter (m): 0.15
At 20.0°C, the Reynolds number for flow at 0.001 m/s in a 0.15 m diameter
pipe is 1.50e+02.
```