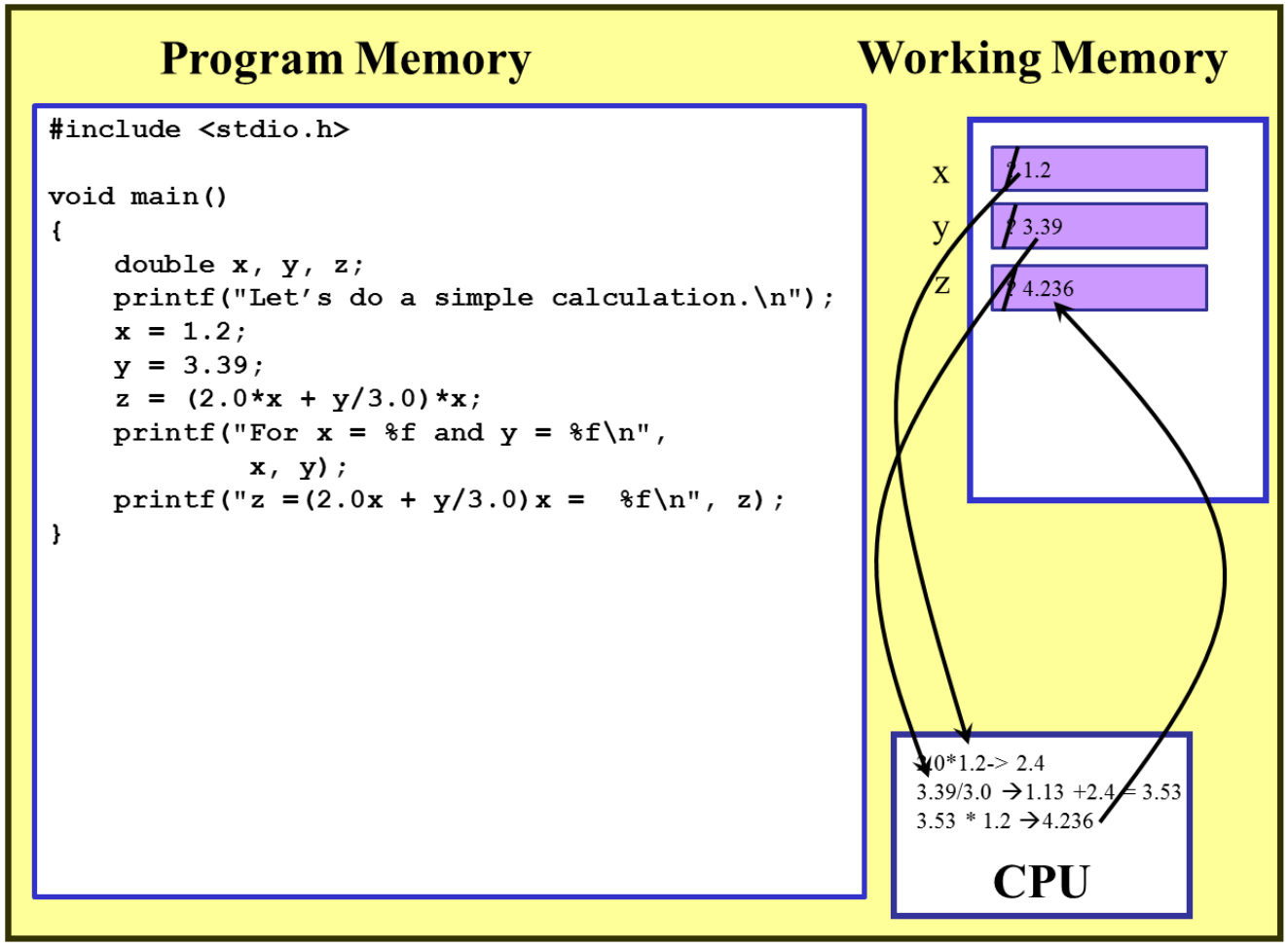
GNG1106 Fall 2016 - Assignment 1 - Solution

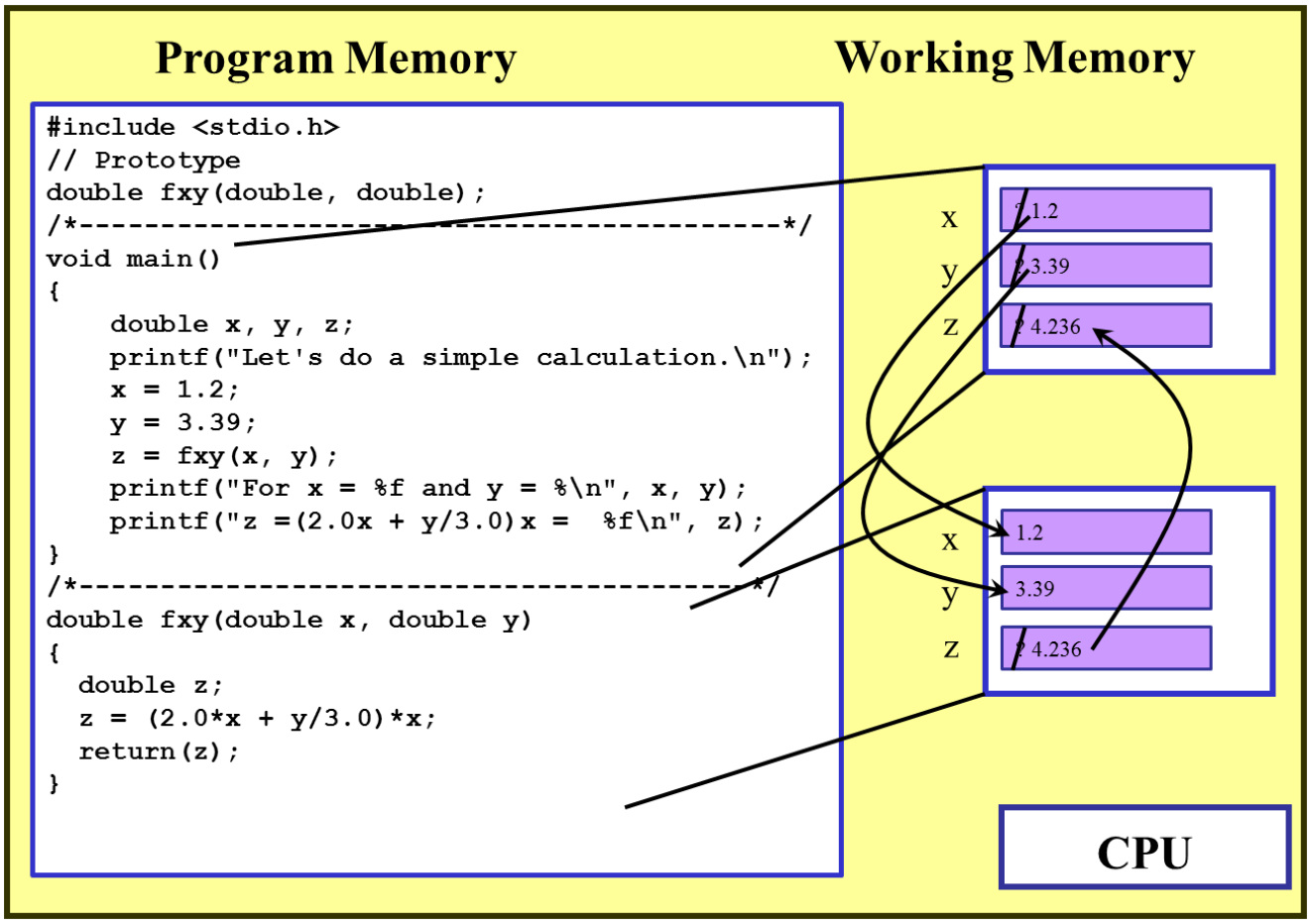
Question 1 (10 marks)

(a)



Marking Scheme:

Defining the three variables in memory	1 marks
Assigning values to the variables	1 marks (give 0.5 for ?)
Results for each operation	1.5 marks (0.5 for each operation)
Showing flow from working memory to CPU	1.5 marks (0.5 for each arrow)
Total	5 marks



Marking Scheme:

Variables in working memory for main	1.5 marks
0.5 for variables	
0.5 for ?	
0.5 for values	
Variables in working memory for function fxy	2.0 marks
0.5 for variables	
0.5 for parameters (? should not be present)	
1 for z (0.5 for ? and 0.5 for updated value)	
Exchange of values between working memory	1.5 marks
0.5 for each arrow	
Total	5 marks

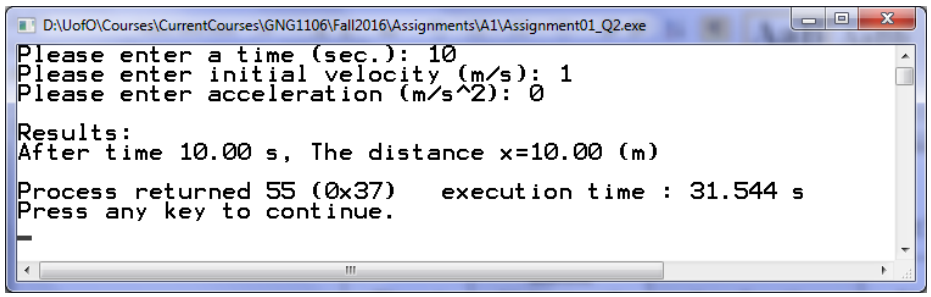
Question 2 (10 marks)

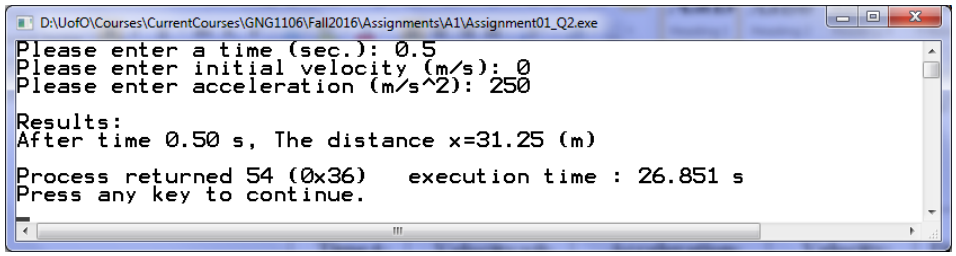
C Source Code

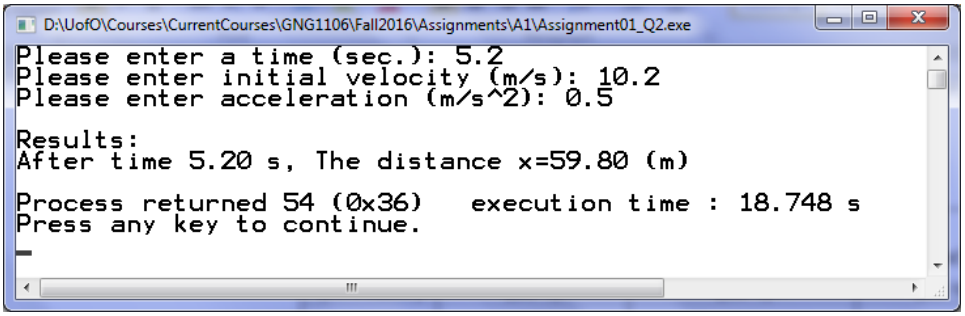
```
/*-------------------------------------------------------
File:
Author: FirstName Last Name XXX
Description:
      This program calculates the velocity and displacement of
      an object moving at a constant velocity after a given
      time t.
-------------------------------------------------------*/
#include <stdio.h>
// Function Prototype
double calculateDistance(double, double, double);
/*-------------------------------------------------------
Function: main
Description: Requests from the user time traveled,
             object acceleration, and the object's
             initial velocity. Calls calculateDistance
             function to compute the distance traveled by
             the object after the given time and then
             displays the results to the user.
-------------------------------------------------------*/
void main(void)
{
    //Variables declarations
    double a,v0,t,x;

    //initialize the variables
    printf("Please enter a time (sec.): ");
    scanf("%lf",&t);
    printf("Please enter initial velocity (m/s): ");
    scanf("%lf", &v0);
    printf("Please enter acceleration (m/s^2): ");
    scanf("%lf",&a);

   // formulate the equations
    x = calculateDistance(t, v0, a);

    //Printing the results
    printf("\nResults:\nAfter time %.2f s, The distance x=%3.2f (m)\n",t, x);

}
/*-------------------------------------------------------
Function: calculateDistance
Parameters:
    t - the time the object travels
    v0 - the initial velocity of the object
    a - the objects acceleration
```

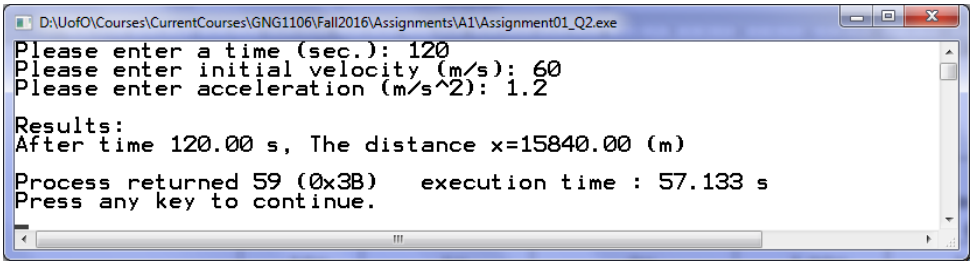
```
Description: For the given time, acceleration, and initial
             velocity, calculates the distance that the
             object has traveled.
-------------------------------------------------------*/
double calculateDistance(double t, double v0, double a)
{
    // Variable declaration
    double x;  // the distance traveled
    // Calculation
    x=v0*t+0.5*a*t*t;   // Calculate displacement
    return(x);
}
```

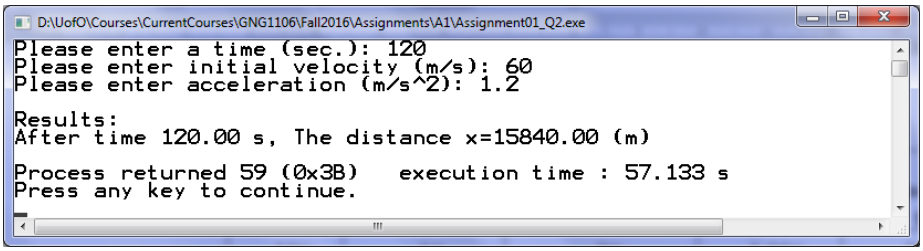
Output











Marking Scheme:

C Program	
Main function	
Comments (header)	1 mark
Variable Declaration	0.5 mark
Input from user	1 mark
Call to calculateDistance	1 mark
Display results	0.5 mark
Function calculateDistance	
Comments (header)	1
Function header/prototype	1 mark
Variable declaration	0.5 mark
Calculation	0.5 mark
Return instruction	0.5 mark
Output	2.5 marks (0.5 per output)
Total	10 marks

Question 3 (15 marks)

Test Cases

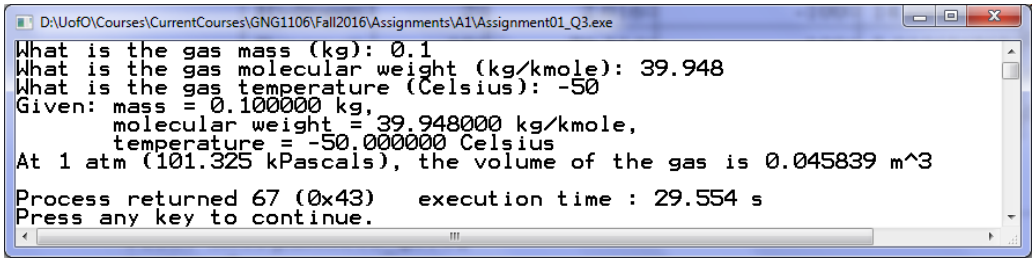
	Mass (kg)	Mol Weight (kg/kmole)	Temp (Celsius)	Volume m^3
Argon	0.1	39.948	-50	0.045834791
Hydrogen	2	2.016	-100	14.09468491
Benzene	10	78.114	100	3.919656203
Nitrogen	0.001	28.0134	-150	0.000360713
R-114	100	179.93	30	13.8244353

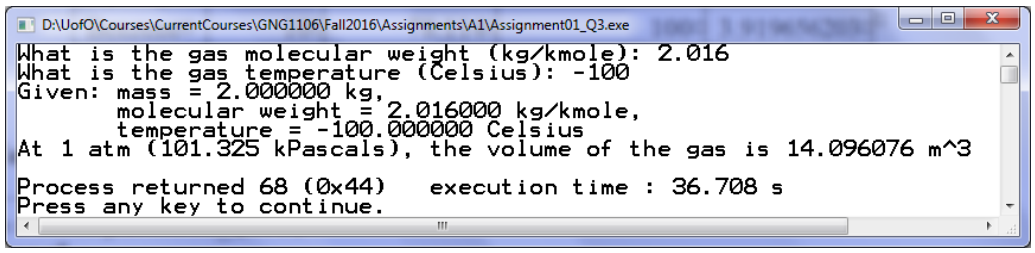
C Source Code

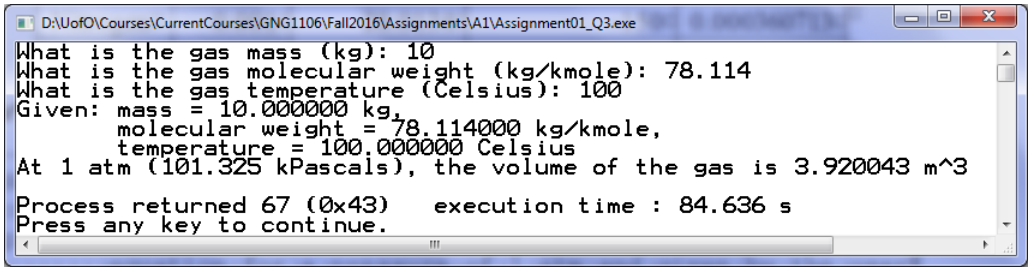
```
/*-------------------------------------------------------------------
File: Assignment01_Q3.c
Author:
Description: Calculates the volume of a gas using the ideal gas
             equation for a pressure of 1 atm and given by the user
             mass, molecular weight and temperature.
-------------------------------------------------------------------*/
#include <stdio.h>
// function protyptes
double gasVolume(double, double, double);
/*-------------------------------------------------------------------
Fonction: main
Author: FirstName LastName, Student no, Date
Description: Obtains from the user the mass, molecular weight, and temperature
             of a gas, calls gasVolume to compute the gas's volume, and
             displays results to user.
-------------------------------------------------------------------*/
void main(void)
{
    // Variable declarations
    double mass; // mass (kg)
    double molWeight; // molecular weight (kg/kmole)
    double temperatureC; // Temperature (Celsius)
    double volume;  // gas volume (m^3)
    // Instructions
    // Get values from the user
    printf("What is the gas mass (kg): ");
    scanf("%lf", &mass);
    printf("What is the gas molecular weight (kg/kmole): ");
    scanf("%lf", &molWeight);
    printf("What is the gas temperature (Celsius): ");
    scanf("%lf", &temperatureC);
    // Calculate the volume
    volume = gasVolume(mass, molWeight, temperatureC);
    // Print Results
    printf("Given: mass = %f kg,\n       molecular weight = %f kg/kmole,\n
temperature = %f Celsius\n",
           mass, molWeight, temperatureC);
    printf("At 1 atm (101.325 kPascals), the volume of the gas is %f m^3\n",
volume);
}
```

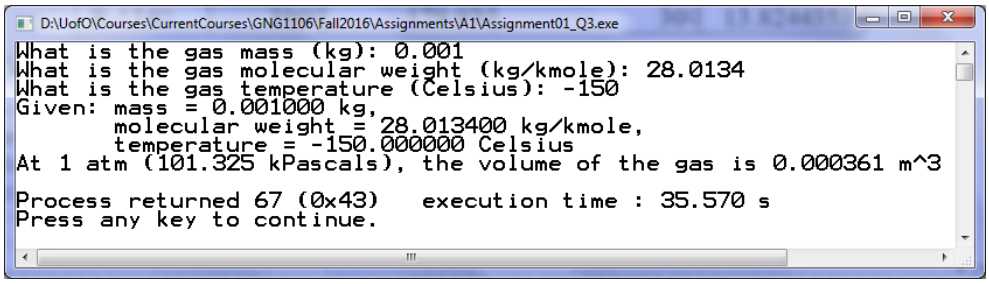
```
/*-------------------------------------------------------------------------
Function: gasVolume
Parameters:
    mass - gas mass (kg)
    molWeight - molecular weight (kg/kmole)
    tempC - temperature (degrees Celsius)
Return:  The gas volume in m^3.
Description: Uses the ideal gas equation to compute the volume of gas for
             the given parameter values. Note that the temperature must
             be converted into degrees Kelvin.  The volume (V) is calculated
             as
                  V = mRT / (PM)
             where m is the mass, R is ideal gas constant
             (8.314 kPa m^3), T is the temperature in Kelvin, P is the
             pressure (1 atm = 101.315 kPascals), and M is the molecular
             weight (kg/kmole).
-------------------------------------------------------------------------*/
double gasVolume(double mass, double molWeight, double tempC)
{
    // Variable declarations
    double volume;  // gas volume in m^3
    double tempK;   // temperature in Kelvin
    // Instructions
    tempK = tempC + 272.15;
    volume = (mass*8.314*tempK)/(101.315*molWeight);
    return(volume);
}
```

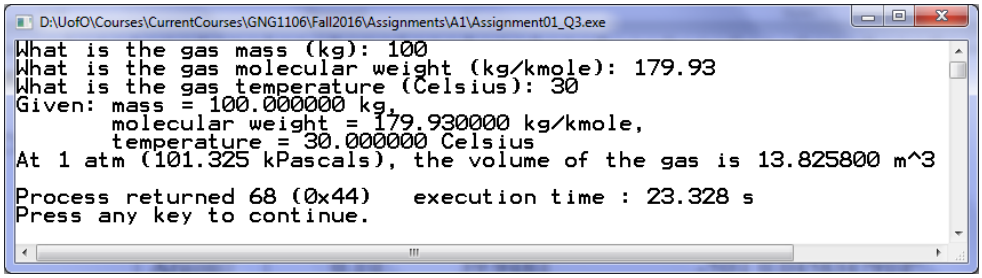
Output











Marking Scheme:

Test Cases	2.5 marks (0.5 per case)
Deduct 0.5 marks if mass values are varied sufficiently	
Main function	
Comments (header)	1 mark
Variable Declaration	1 mark
Input from user	1 mark
Call to calculateDistance	1 mark
Display results	1 mark
Function for computing the gas volume	
Comments (header)	1 mark
Function header/prototype	1 mark
Variable declaration	1 mark
Calculation	1 mark
Return instruction	1 mark
Output	2.5 marks (0.5 per output)
Total	15 marks
Function calculateDistance	
Output	2.5 marks (0.5 per output)