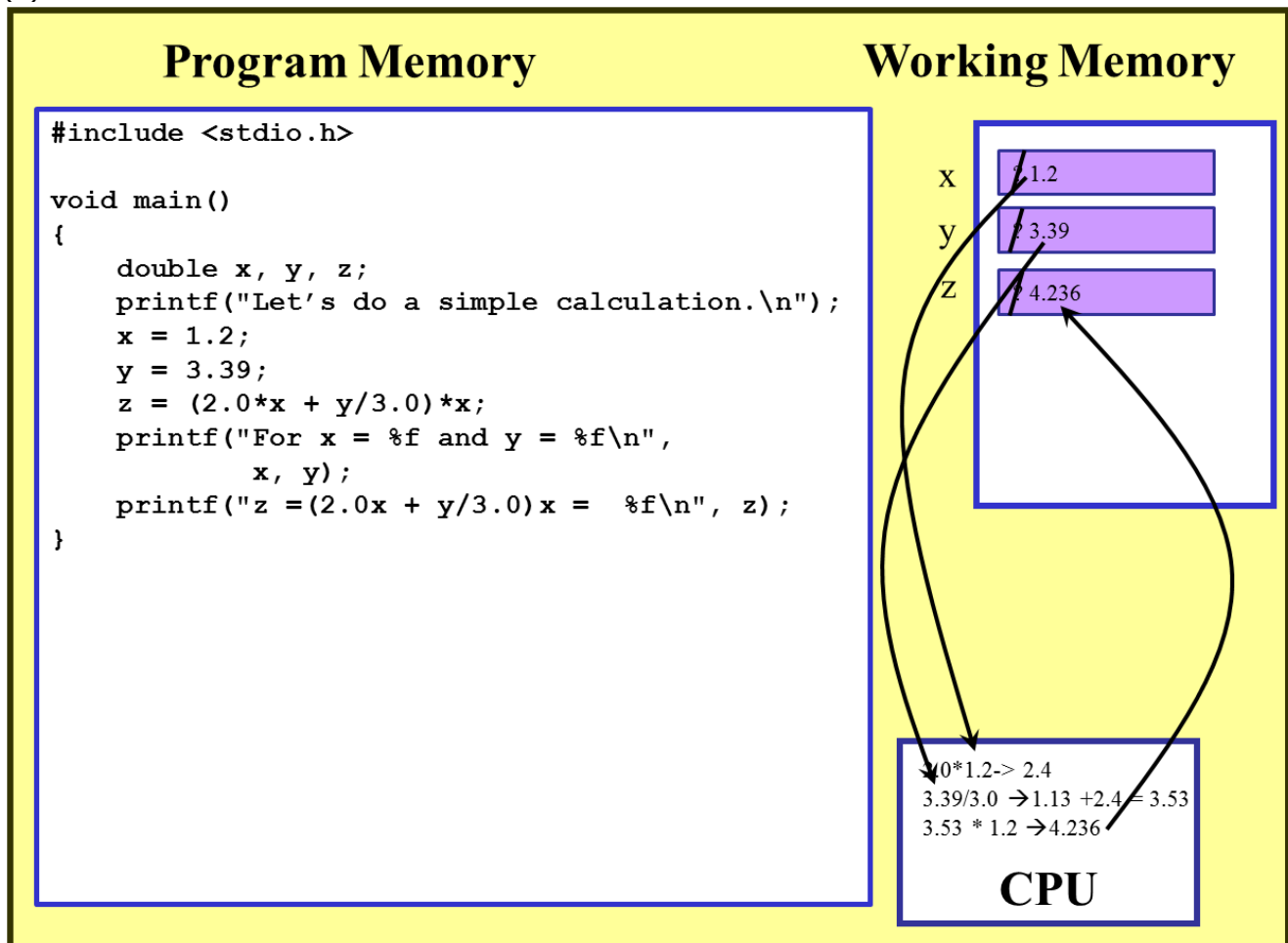


# GNG1106 Fall 2016 - Assignment 1 - Solution

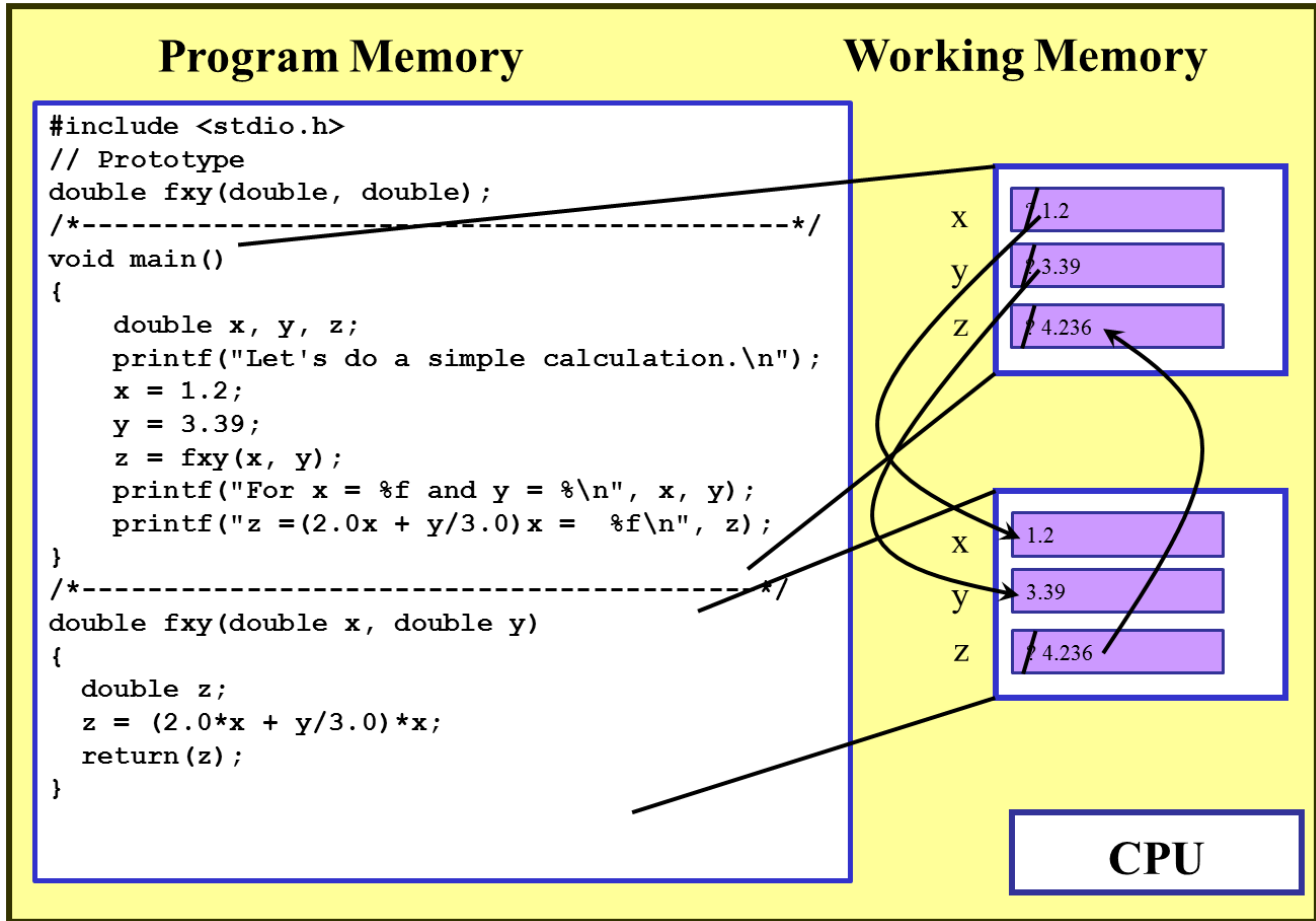
## Question 1 (10 marks)

(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)

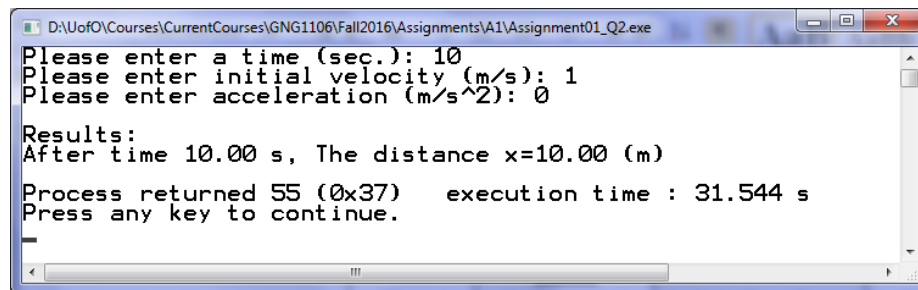
### C Source Code

```
/*-----  
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.

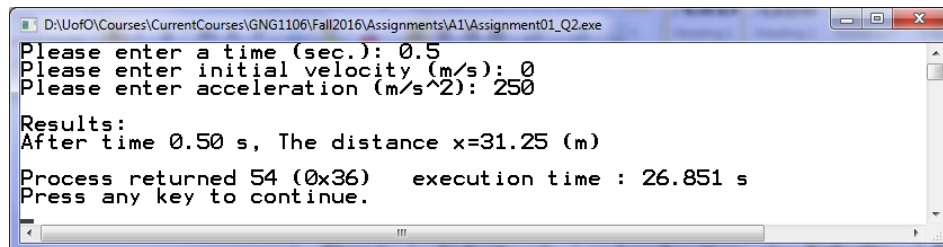
```
-----*/
double calculateDistance(double t, double v0, double a)
{
    // Variable declaration
    double x; // the distance traveled
    // Calculation
    x=v0*t+0.5*a*t*t; // Calculate displacement
    return(x);
}
```

## Output



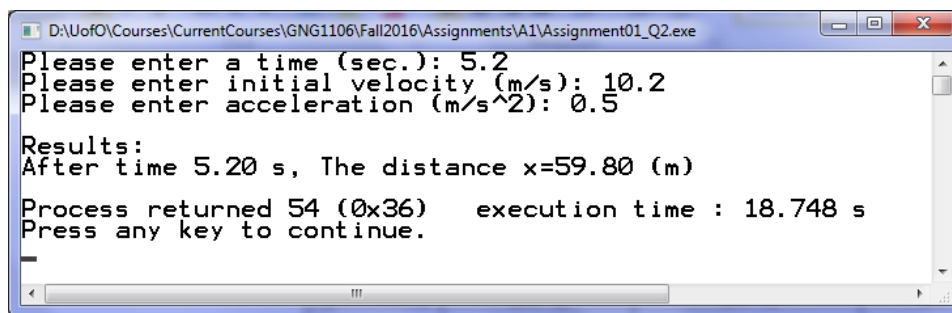
```
D:\UofO\Courses\CurrentCourses\GNG1106\Fall2016\Assignments\A1\Assignment01_Q2.exe
Please enter a time (sec.): 10
Please enter initial velocity (m/s): 1
Please enter acceleration (m/s^2): 0

Results:
After time 10.00 s, The distance x=10.00 (m)
Process returned 55 (0x37)   execution time : 31.544 s
Press any key to continue.
```



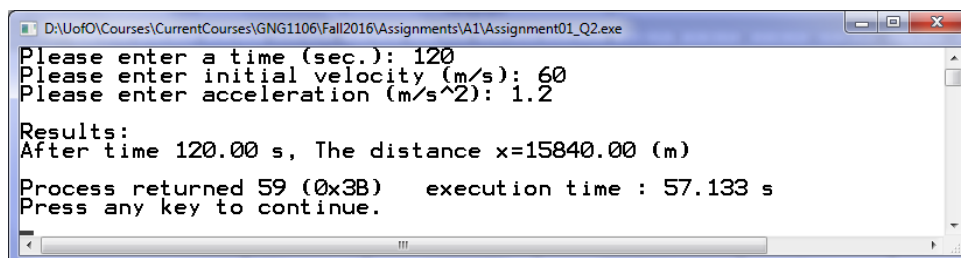
```
D:\UofO\Courses\CurrentCourses\GNG1106\Fall2016\Assignments\A1\Assignment01_Q2.exe
Please enter a time (sec.): 0.5
Please enter initial velocity (m/s): 0
Please enter acceleration (m/s^2): 250

Results:
After time 0.50 s, The distance x=31.25 (m)
Process returned 54 (0x36)   execution time : 26.851 s
Press any key to continue.
```



```
D:\UofO\Courses\CurrentCourses\GNG1106\Fall2016\Assignments\A1\Assignment01_Q2.exe
Please enter a time (sec.): 5.2
Please enter initial velocity (m/s): 10.2
Please enter acceleration (m/s^2): 0.5

Results:
After time 5.20 s, The distance x=59.80 (m)
Process returned 54 (0x36)   execution time : 18.748 s
Press any key to continue.
```



```
D:\UofO\Courses\CurrentCourses\GNG1106\Fall2016\Assignments\A1\Assignment01_Q2.exe
Please enter a time (sec.): 120
Please enter initial velocity (m/s): 60
Please enter acceleration (m/s^2): 1.2

Results:
After time 120.00 s, The distance x=15840.00 (m)
Process returned 59 (0x3B)   execution time : 57.133 s
Press any key to continue.
```

```

D:\UofO\Courses\CurrentCourses\GNG1106\Fall2016\Assignments\A1\Assignment01_Q2.exe
Please enter a time (sec.): 120
Please enter initial velocity (m/s): 60
Please enter acceleration (m/s^2): 1.2

Results:
After time 120.00 s, The distance x=15840.00 (m)

Process returned 59 (0x3B)   execution time : 57.133 s
Press any key to continue.

```

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 <sup>3</sup>
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 prototypes
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

```

D:\UofO\Courses\CurrentCourses\GNG1106\Fall2016\Assignments\A1\Assignment01_Q3.exe
What is the gas mass (kg): 0.1
What is the gas molecular weight (kg/kmole): 39.948
What is the gas temperature (Celsius): -50
Given: mass = 0.100000 kg,
        molecular weight = 39.948000 kg/kmole,
        temperature = -50.000000 Celsius
At 1 atm (101.325 kPascals), the volume of the gas is 0.045839 m^3
Process returned 67 (0x43)   execution time : 29.554 s
Press any key to continue.

```

```

D:\UofO\Courses\CurrentCourses\GNG1106\Fall2016\Assignments\A1\Assignment01_Q3.exe
What is the gas molecular weight (kg/kmole): 2.016
What is the gas temperature (Celsius): -100
Given: mass = 2.000000 kg,
        molecular weight = 2.016000 kg/kmole,
        temperature = -100.000000 Celsius
At 1 atm (101.325 kPascals), the volume of the gas is 14.096076 m^3
Process returned 68 (0x44)   execution time : 36.708 s
Press any key to continue.

```

```

D:\UofO\Courses\CurrentCourses\GNG1106\Fall2016\Assignments\A1\Assignment01_Q3.exe
What is the gas mass (kg): 10
What is the gas molecular weight (kg/kmole): 78.114
What is the gas temperature (Celsius): 100
Given: mass = 10.000000 kg,
        molecular weight = 78.114000 kg/kmole,
        temperature = 100.000000 Celsius
At 1 atm (101.325 kPascals), the volume of the gas is 3.920043 m^3
Process returned 67 (0x43)   execution time : 84.636 s
Press any key to continue.

```

```

D:\UofO\Courses\CurrentCourses\GNG1106\Fall2016\Assignments\A1\Assignment01_Q3.exe
What is the gas mass (kg): 0.001
What is the gas molecular weight (kg/kmole): 28.0134
What is the gas temperature (Celsius): -150
Given: mass = 0.001000 kg,
        molecular weight = 28.013400 kg/kmole,
        temperature = -150.000000 Celsius
At 1 atm (101.325 kPascals), the volume of the gas is 0.000361 m^3
Process returned 67 (0x43)   execution time : 35.570 s
Press any key to continue.

```

```

D:\UofO\Courses\CurrentCourses\GNG1106\Fall2016\Assignments\A1\Assignment01_Q3.exe
What is the gas mass (kg): 100
What is the gas molecular weight (kg/kmole): 179.93
What is the gas temperature (Celsius): 30
Given: mass = 100.000000 kg,
        molecular weight = 179.930000 kg/kmole,
        temperature = 30.000000 Celsius
At 1 atm (101.325 kPascals), the volume of the gas is 13.825800 m^3
Process returned 68 (0x44)   execution time : 23.328 s
Press any key to continue.

```

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)