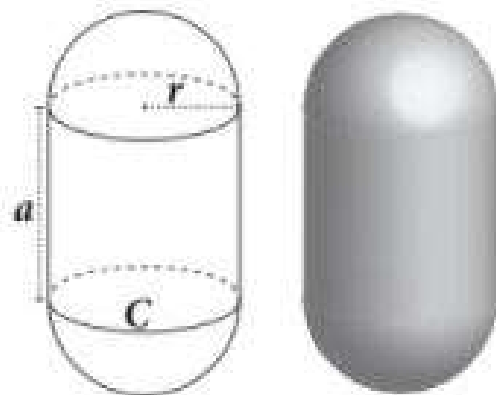


0.2 Question 1 (35 points)

A geometric solid capsule is a sphere of radius r that has been cut in half through the centre and the 2 ends are then separated by a cylinder of radius r and height (or side length) of a .

Write a python program that prompts for and reads the Circumference [in cm] and height (or side length) a [in cm] of a Capsule, it then calculates and displays the volume and surface area of Capsule. The volume and the surface area must be displayed with an appropriate message and in two decimal places. Your program must define π as a constant with the value 3.141592.



A two-dimensional orthographic projection at the left with a three-dimensional one at the right depicting a capsule

The volume, circumference, and surface area of a capsule are calculated by the following formulas:

$$\text{Volume} = \pi r^2 \left(\frac{4}{3} r + a \right)$$

$$\text{Circumference} = 2\pi r$$

$$\text{Surface Area} = 2\pi r(2r + a)$$

0.2.1 Sample Program run:

```
Enter the value of Circumference of a Capsule [cm]: 5.53
Enter the value of height (or side length) of a Capsule [cm]: 9
The radius of Hemisphere is 0.88 [cm]
Volume of Capsule :24.76 [cm^3]
Surface Area of Capsule 59.50 [cm^2]
```

In []:

```
1  %%writefile HW1Q1.py
2  ## Uncomment the above line after you finish your code, in order to generate the Python submission file.
3
4  ##
5  # This program calculates the volume and surface area of Capsule
6  #
7
8  # YOUR CODE HERE
9
10 PI = 3.141592
11
12 capsuleCircumference = float(input("Enter the value of Circumference of a Capsule [cm]: "))
13 capsuleHeight = float(input("Enter the value of height (or side length) of a Capsule [cm]: "))
14
15 radiusHemisphere = capsuleCircumference / (PI * 2)
16
17 capsuleVolume = PI * radiusHemisphere ** 2 * ((4 / 3) * radiusHemisphere + capsuleHeight)
18 capsulSurfaceArea = 2 * PI * radiusHemisphere * ( 2 * radiusHemisphere + capsuleHeight)
19
20 print("The radius of Hemisphere is %.2f" % radiusHemisphere, "[cm]")
21 print("Volume of Capsule :%.2f" % capsuleVolume, " [cm^3]")
22 print("Surface Area of Capsule %.2f" % capsulSurfaceArea, "[cm^2]")
23
```

0.3 Question 2 (25 points)

Write a program that calculates the speed of sound in ideal gas of given temperature T , adiabatic constant γ and average molecular mass M .

Formula to compute the speed of sound in ideal gas in m/sec:

$$\text{Speed of Sound} = \sqrt{\frac{\gamma RT}{M}}$$

Where:

- R = the universal gas constant = 8.314 J/mol K
- T = the absolute temperature
- M = the molecular weight of the gas in kg/mol
- γ = the adiabatic constant, characteristic of the specific gas

Your program should ask user to enter the absolute temperature in kelvin, the molecular weight of the gas in kg/mol and the adiabatic constant, it then calculates and displays the speed of sound of gas.

0.3.1 Sample Program run:

```
Enter the absolute temperature in kelvin: 300
Enter molecular weight of the gas in kg/mol: 0.02895
Enter adiabatic constant of the gas: 1.4
Speed of Sound in ideal gas = 347.300 m/s
```

In []:

```
1  ##writefile Hw1Q2.py
2  ## Uncomment the above line after you finish your code, in order to generate the Python submission file.
3
4  ##
5  # This program computes the speed of sound in ideal gas
6  #
7
8  # YOUR CODE HERE
9
10 from math import sqrt
11 UNIVERSAL_GAS_CONSTANT = 8.314 #the universal gas constant
12
13 #read the absolute temperature from the user in Kelvin (K)
14 temperature = float(input("Enter the absolute temperature in kelvin: "))
15
16 #read the the molecular weight of the gas in kg/mol from the user
17 molecularWeightGas = float(input("Enter molecular weight of the gas in kg/mol: "))
18
19 #read the adiabatic constant, characteristic of the specific gas from the user
20 adiabaticConstantGas = float(input("Enter adiabatic constant of the gas: "))
21
22 #compute the speed of sound in ideal gas in m/sec
23 speedSound = sqrt((adiabaticConstantGas * UNIVERSAL_GAS_CONSTANT * temperature) /molecularWeightGas)
24
25 print("Speed of Sound in ideal gas = %.3f" % speedSound,"m/s" )
```

0.4 Question 3 (40 points)

Write a program that computes a customer's monthly electricity bill. The bill includes a 10 (Riyals) monthly fee of meter, 15% tax on the total consumption cost, and plus the cost of electricity consumption per kilowatt/hour based on the New Electricity Tariffs for all categories of consumption.

The program asks the user to input customer's name, the bill actual number of days, amount of electricity consumption, and then the total cost of electricity consumption is calculated based on the following Consumption categories.

#	Consumption categories (per month)	(Halalah / kwh)
1	1 -> 6000	18
2	More than 6000	30

And by the following formulas (In case consumption exceeds consumption of first category):

$$\text{Consumption of the first category} = \text{Actual number of days} * \frac{6000}{30}$$

$$\text{Consumption of the second category} = \text{Amount of electricity consumption} - \text{Consumption of the first category}$$

$$\text{Total consumption cost} = \text{Consumption of the first category} * \frac{18}{100} + \text{Consumption for the second category} * \frac{30}{100}$$

$$\text{Tax} = \text{Total consumption cost} * \text{Tax rate}$$

$$\text{Bill amount} = \text{Monthly fee of meter} + \text{Total consumption cost} + \text{Tax}$$

0.4.1 Note:

In case consumption does not exceed that of first category, then the bill will be based on 18 halalh/kwh only.

Following is an example that explains how to calculate the value of electricity consumption in Arabic.

كيفية حساب قيمة الاستهلاك

مشترك كمية استهلاكه للكهرباء ٧٠٠٠ ك.وس وعدد الايام الفعلية ٢٧ يوم فستكون قيمة الاستهلاك ١٤٥٢ ريال كالتالي ،

كمية الاستهلاك للشريحة / ٣٠ يوم ، عدد الايام الفعلي (تاريخ القراءة السابقة - تاريخ القراءة الحالية)

$$٥٤٠٠ = ٢٧ \times ٣٠ \div ٦٠٠٠$$

المبلغ	قيمة كل ك.وس (هالة)	كمية الاستهلاك (ك.وس)	الشريحة
٩٧٢	١٨	٥٤٠٠	١
٤٨٠	٣٠	١٦٠٠	٢
١٤٥٢ ريال بدون رسوم خدمة العداد و ضريبة القيمة المضافة			المجموع

0.4.2 Sample Program run:

Sample run #1

```
Enter your name: Ali
Enter your bill actual number of days: 27
Enter your amount of electricity consumption: 7000
Mr. Ali, your bill amount is 1679.80 (Riyals)
(1452.000 total consumption cost, 217.800 tax, and 10 monthly meter service)
```

Sample run #2

```
Enter your name: Omar
Enter your bill actual number of days: 30
Enter your amount of electricity consumption: 6000
Mr. Omar, your bill amount is 1252.00 (Riyals)
(1080.000 total consumption cost, 162.000 tax, and 10 monthly meter service)
```

```

In [ ]: 1 %%writefile HW1Q3.py
        2 ## Uncomment the above line after you finish your code, in order to generate the Python submission file.
        3
        4 ##
        5 # This program computes the speed of sound in ideal gas
        6 #
        7
        8 # YOUR CODE HERE
        9 UPPER_LIMIT_18_TARIFF = 6000 #Upper Limit for First Categorie Tariff 18 (Halalah / kwh)
       10 NUMBER_DAYE = 30 # number of days in each month
       11 FIRST_CATEGORIE_TARIFF = 0.18 # cost of the First Categorie of Consumption
       12 SECOND_CATEGORIE_TARIFF = 0.30 # cost of the First Categorie of Consumption
       13 TAX_RATE = 0.15 # Saudi Arabia Sales Tax Rate
       14 MONTHLY_FEE_METER = 10 # monthly meter service fee
       15
       16 customerName = input("Enter your name: ")
       17 billActualNumberDays = int(input("Enter your bill actual number of days: "))
       18 amountElectricityConsumption = float(input("Enter your amount of electricity consumption: "))
       19 consumptionFirstCategorie = billActualNumberDays * (UPPER_LIMIT_18_TARIFF/NUMBER_DAYE)
       20 consumptionSecondCategorie = amountElectricityConsumption - consumptionFirstCategorie
       21 if consumptionSecondCategorie <= 0:
       22     print(1)
       23     totalConsumptionCost = consumptionFirstCategorie * FIRST_CATEGORIE_TARIFF
       24 else:
       25     print(2)
       26     totalConsumptionCost = consumptionFirstCategorie * FIRST_CATEGORIE_TARIFF + consumptionSecondCategorie \
       27         * SECOND_CATEGORIE_TARIFF
       28 totalTax = totalConsumptionCost * TAX_RATE
       29 billAmount = totalConsumptionCost + totalTax + MONTHLY_FEE_METER
       30
       31 print("\nMr. %s, your bill amount is %.2f (Riyals)"%(customerName,billAmount))
       32 print("(%.3f total consumption cost, %.3f tax,and %d monthly meter service) " %(totalConsumptionCost,totalTax,MONTHLY_FEE_
       33

```

1 End of the Homework

Good luck...