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| **DEPARTMENT OF CHEMISTRY****FOURAH BAY COLLEGE****UNIVERSITY OF SIERRA LEONE**CHEM 211The Physical Properties of Gases and Solutions**Unit 1 – The Physical Properties of Gases****CONTINUOUS ASSESSMENT****ASSIGNMENT**This assignment must be submitted no later than 2 pm on Friday March 23rd 2018You must submit this cover sheet with your assignment.Name: ……………………………………………………Admission No. ………………..Note: CHEM211 Unit 1 Continuous Assessment is worth 15% of the total marks for CHEM211Your score will be divided into three parts:Lecture and Tutorial Attendance 10%Assignment 40%Test 50% |

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| **1.** | (a) | Describe the main postulates of the kinetic model of matter |
|  | (b) | What is an ideal gas? |
|  | (c) | Under which conditions is a gas most likely to display ideal behaviour? Which gases will show ideal behaviour over the widest range of conditions?[5] |
| **2.** | (a) | State the ideal gas equation and use it to explain the meaning of the term “equation of state” |
|  | (b) | Calculate the density of carbon dioxide at 100 kPa and 298 K |
|  | (c) | Show, from first principles, that PV = $\frac{m\_{r}nu^{2}}{3}$ |
|  | (d) | Use the expression from Q2b and the proportionality of kinetic energy to temperature to derive: |
|  |  | (i) | the ideal gas equation |
|  |  | (ii) | the expression KE = $\frac{3nRT}{2}$ |
|  | (e) | Show that the molar heat capacity of a gas at constant pressure (Cp) is $\frac{5R}{2}$[15] |
| **3.** | (a) | Calculate the total pressure in a 10 dm3 vessel containing 5 g of butane and 10 g of oxygen at 80 oC. |
|  | (b) | Calculate the kinetic energy of 10 g of oxygen at 80 oC |
|  | (c) | Calculate the root mean square velocity of oxygen at 80 oC[10] |
| **4.** | (a) | Sketch the Maxwell-Boltzmann of molecular velocities in a sample of nitrogen gas at 25 oC |
|  | (b) | On the same axes, sketch the Maxwell-Boltzmann of molecular velocities in a sample of hydrogen gas at 25 oC |
|  | (c) | On the same axes, sketch the Maxwell-Boltzmann of molecular velocities in a sample of nitrogen gas at 0 oC |
|  | (d) | Explain the origin of the Maxwell and Boltzmann components of the distribution. |
|  | (e) | Calculate the root mean square velocity, the average velocity and most probable velocity of the molecules in a sample of methane gas at 0 oC.[15] |
| **5.** | (a) | Show that the number of times a particle will collide with another particle in one second is given by $\frac{Nπd^{2}v\sqrt{2}}{V}$ |
|  |  | Hence derive expressions for |
|  | (b) | (i) | The collision frequency per unit volume |
|  |  | (ii) | The mean free path |
|  | (c) | Calculate the mean free path, and the collision frequency per unit volume, in a vessel containing N2O4 at 40 oC and 1 kPa[10] |

**TOTAL 55 MARKS**