### UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
### Online End Semester Examination, May 2021

**Course** : Chemistry of s & p-block elements, States of matter, Chemical kinetics  **Semester** : IV
**Program** : B.Sc. (H) Physics/Mathematics                                    **Time** : 03 hrs
**Course Code: CHEM 1010 GE**                                                  **Max. Marks: 100**

### Section A

**Instructions:**
**1. Each Question will carry 5 Marks**
**2. Complete the statement /select the correct answer(s)**
**3. Answer should be fill in blank, true or false.**

| S. No. | Question | CO |
|---|---|---|
| Q 1 | (i) Potassium, Rubidium and Cesium can form all types of oxides, when burnt in air. True/False<br><br>(ii) Potassium ion has…charge and …......polarizing power than barium ion. higher/lower<br><br>(iii) …………………of group-I can form only normal oxide and peroxide.<br><br>(iv) X, Y and Z of group-II can form only normal oxides. Write down the name of the elements X, Y, and Z.<br><br>(v) Beryllium does not react with steam. True/False                    **(1* 5= 5 Marks)** | CO1 |
| Q 2 | Bauxite- [a], Classiterite- [b], Salt Petre- [c], Karnalite- [d] and Calamine [e] are the ores of which metals. Write their name citing a, b, c, d and e.                    **(1* 5= 5 Marks)** | CO2 |
| Q 3 | (i) Diborane can be prepared by the reaction of …with…………..<br><br>(ii) The shape of $PCl_5$ is …………..<br><br>(iii) Peroxomonosulphuric acid is also known as…………<br><br>(iv) The shape of the $SF_4$ molecules is ……………..<br><br>(v) Mention any two examples of pseudohalogens.                    **(1*5= 5 marks)** | CO1 |
| Q 4 | (i) In $C_{60}$, the number of pentagons are …and hexagons are ….<br><br>(ii) The order of acidity in boron trihalides is $BF_3 > BBr_3 > BCl_3$. (True/False)<br><br>(iii) Among $B_5H_9$, $B_4H_{10}$ and $B_{12}H_{12}^{2-}$, which one will show closo structure?<br><br>(iv) The order of the first ionization potential is Mg < Al<P<S  True or False)<br><br>(v) Atoms in a P4 molecule of white phosphorus are arranged regularly at the center and corners of a tetrahedron (True or False)                    **(1*5= 5 marks)** | CO1 |

| Q 5 | (i) The total pressure (in atm) of a gaseous mixture containing 4 gm of oxygen and 3 gm of hydrogen, confined in a total volume of one liter at 20 $^0$C, will be…<br><br>(ii) The compressibility factor (z), for an ideal gas is….<br><br>(iii) The $v_{rms}$ of certain gas at 27 $^0$C is b m/sec. Its $v_{rms}$ at 927 $^0$C will be…. **(3+ 2*1= 5 marks)** | **CO3** |
|---|---|---|
| Q 6 | (i) Polonium has simple cubic unit cell (n=1). The atomic mass of the same is 209 gm/mol, while its density is 0.0915 gm/cm$^3$. Find out the edge length of the unit cell of Polonium in cm.<br><br>(ii) The SI unit of coefficient of viscosity is Kg-m/sec. (True/False)<br><br>(iii) A liquid rises in a capillary tube is due to …………… **(3+ 2*1= 5 marks)** | **CO3** |

## Section B

**Instructions:**

**1. Each question will carry 10 marks**
**2. Write short/brief notes of 1-2 page answer.**
**3. Question 5 has internal choices, and hence you have to attempt only one out of two questions.**
**4. Draw the neat diagram, to justify your answer.**

| Q 1 | (i) The value of 'k' for a first order reaction is 0.00154 sec$^{-1}$. Find out the $t_{1/2}$ of the reaction.<br><br>(ii) The rate constant of a second order reaction (in liter/mole-sec) is 0.00057 & 0.00164 at 25 $^o$C and 40$^o$C respectively. Find out the activation energy of the reaction in KCal. **(4+6= 10 marks)** | **CO2** |
|---|---|---|
| Q 2 | Discuss the<br><br>(i) Differential and (ii) Half-life method for the determination of the order of the chemical reaction.<br><br>**(2*5=10 marks)** | **CO2** |
| Q 3 | (i) Discuss in detail about the differences between Lithium and other alkali metals.<br><br>(ii)  Describe the structure of the Orthosilicates, Pyrosilicates. **(2*5=10 marks)** | **CO1** |
| Q 4 | Discuss the synthesis of any three Oxoacids of halogens, citing their structures too. **(10 marks)** | **CO1** |
| Q 5 | Starting from van der Waal's equation, derive the values of critical volume ($V_c$) and critical pressure ($P_c$) in terms of van der Waal's constant 'a' and 'b'.  Calculate the $V_c$ and $P_c$ for $CO_2$, if the values of 'a' is 3.6 atm dm$^6$/ mol$^2$ and of 'b' is 4.28 x10$^{-2}$ dm$^3$/mol respectively.<br><br><div align="center">**OR**</div><br>Derive the kinetic gas equation considering the appropriate assumptions. **(10 marks)** | **CO3** |

**Section C**

**Instructions:**

**1. Question is of 20 marks**
**2. Write long answer of 2-3 page.**
**3. Draw the neat diagram to justify your answer.**
**4. Internal choices is there and hence you have to attempt only one question.**

| Q 1 | (i) Derive a relationship between the interplaner spacing of a crystal and the wavelength of X-ray diffracted by it.<br><br>(ii) Water passes through a viscometer in 30 seconds. The same volume of oil required 2263.7 seconds. If the viscosity of water is 0.00101 kg/m-sec, density of water is 998 kg/m$^3$ and density of the oil is 1100 kg/m$^3$, find out the viscosity of the oil.<br><br><div align="center">**OR**</div><br>(i) Discuss the working principle and details of the Ostwald method for the determination of the viscosity.<br><br>(ii) A body centered cubic element of density 10.3 gm/cm$^3$ has a cell edge of 314 pm. Find out the atomic mass of the element, considering the $N_A$= 6.023 x 10$^{23}$ gm/mole.       **(12+8= 20 marks)** | CO3 |