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|  | 1. Why density of ice is less than that of liquid water? 2. Explain whether the following set of quantum numbers is permissible for an orbital or not.   n = 2, l = 1, ml = +2, ms = +1/2   1. Prove that half-life of a first order reaction is constant. 2. Why group 1 metals are called alkali metals? 3. Calculate [H3O+], pH, [OH-] and pOH of 0.5 M HNO3 solution. 4. What is line spectrum? What is the condition for generation of Lymen series for line spectrum of hydrogen atom? 5. Define activated complex and reaction intermediate. |  |

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| **2.** | 1. For the decomposition of one mole of calcium carbonate,   CaCO3 (s) CaO (s) + CO2 (g) ΔH = 177 kJ |  |
|  | 1. Write down the rate law and overall order for the given reaction. |  |
|  | 1. Draw the potential energy diagram for the reaction given above and mention every necessary terms in it. |  |
|  | 1. What are the pre-conditions for this reaction to occur according to collision theory? |  |
|  | 1. If the given reaction is a first order reaction then derive the integrated form of rate equation for this reaction. Also sketch the plot from which you can determine the rate constant for this reaction. |  |
|  | 1. For the above reaction, starting with a solution of concentration 1.00 molL-1 after 2.0 hrs the concentration decreased to 1.33 x 10-3 molL-1. Calculate the half-life in minutes for the decomposition of CaCO3. |  |

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| **3.** | 1. Write down the observations and decisions of Rutherford’s gold foil experiment. 2. Draw every possible pathways followed by alpha particles when a gold foil is bombarded with it. |  |
|  | 1. Using the Rydberg equation find out the wavelength of photon emitted (in nm) when a hydrogen atom undergoes transition from n = 4 to n = 1 level (Rydberg constant = 1.097 x 107m-1). |  |
|  | 1. Write down the physical significance of four different quantum numbers. Write a set of four quantum numbers for 4p orbital. |  |

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| **4.** | 1. Define acid and base according to Arrhenius concept with suitable example. What are the limitations of this concept? |  |
|  | 1. Arrange the following acids in increasing order of strength   HClO HNO3 H2SO3 HClO4 H2SO4 |  |
|  | 1. Derive the Henderson-Hasselbalch equation for an acidic buffer solution. Under which condition pH can be equal to pKa. |  |
|  | 1. Estimate the pH at 25oC for a solution containing 0.10 mole of sodium acetate and 0.20 mole of acetic acid per litre. Ka for CH3COOH = 1.8 X 10-5 |  |

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| **5.** | 1. Calculate the nuclear charge and effective nuclear charge for C and Mg2+. |  |
|  | 1. Balance the following redox reactions by half-reaction method: 2. Fe2+ (aq) + Cr2O72- (aq) + H+ (aq) → Fe3+ (aq) + Cr3+ (aq) + H2O (l) 3. FeCl3 (*aq*) + Mg (*s*) → Fe (*s*) + MgCl2 (*aq)* |  |
|  | 1. Why chlorine has a greater electron affinity than fluorine? |  |
|  | 1. Define disproportionation reaction with suitable example. |  |

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| **6.** | 1. Describe the hybridization for a PCl5 molecule. |  |
|  | 1. Write down the Lewis dot structure and also predict the geometry of the following molecules or ions, using VESPER method:   XeF4, BF3, I3- |  |
|  | 1. Write down the factors which influence the formation of ionic bond. |  |
|  | 1. Sketch the orbital diagram of ethyne depicting the name of the orbitals. |  |