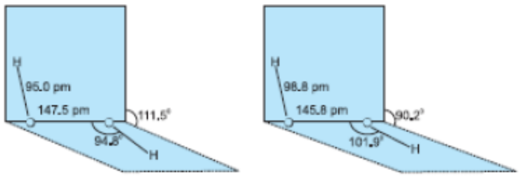
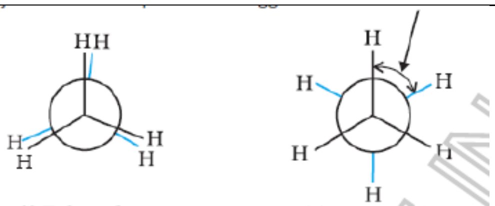
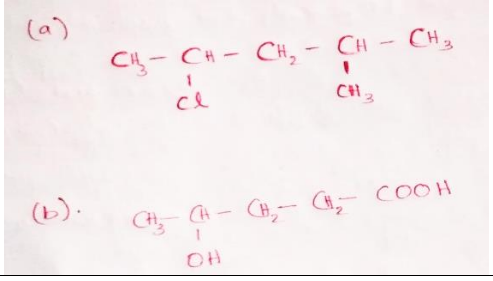
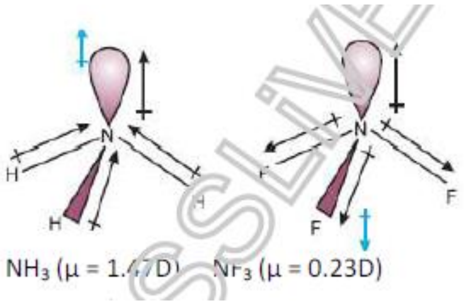
CHEMISTRY MODEL EXAMINATION, FEB-2020

KEY

<table>
<tr><th>Sl.No</th><th>Solution</th><th>Marks</th></tr>
<tr><td>1</td><td>(b) Lyman line</td><td>1</td></tr>
<tr><td>2</td><td>(a) Weak base</td><td>1</td></tr>
<tr><td>3</td><td>(b) Alkali metals</td><td>1</td></tr>
<tr><td>4</td><td>(c) fig</td><td>1</td></tr>
<tr><td>5</td><td>(a) O_3</td><td>1</td></tr>
<tr><td>6</td><td>(b) The presence of H bond</td><td>1</td></tr>
<tr><td>7</td><td>Disproportionation reaction</td><td>1</td></tr>
<tr><td>8</td><td>Hyperconjugation</td><td>1</td></tr>
<tr><td>9</td><td>Ethene</td><td>1</td></tr>
<tr><td>10</td><td>(a) Statement
(b) Ununquadium (flerovium)</td><td>1
1</td></tr>
<tr><td>11</td><td>(a) Law of Definite Proportions (Law of definite composition
(b) statement</td><td>1
1</td></tr>
<tr><td>12</td><td>(a) half filled atomic orbitals are stable
this is because N has half filled electronic configuration ($1s^2 2s^2 2p^3$), which is more stable and so more energy is required to remove an electron
(b) This is because when an electron is added to F, it enters into the smaller 2nd shell. Due to the smaller size, the electron suffers more repulsion from the other electrons. But for Cl, the incoming electron goes to the larger 3rd shell. So, the electronic repulsion is low and hence Cl adds electron more easily than F.</td><td>1
1</td></tr>
<tr><td>13</td><td>P= 1 atm
R= 0.0821 $L.atm.mol^{-1}K^{-1}$
T= 27^0C = 300K
d= 256g/L
Molar mass M= $\frac{dRT}{P}$
$= \frac{256\times0.0821\times300}{1}$
= 6305.28g/mol</td><td>1
1</td></tr>
<tr><td>14</td><td><table><tr><th>Extensive property</th><th>Intensive property</th></tr><tr><td>Enthalpy
Entropy</td><td>Density
Specific heat capacity</td></tr></table></td><td>2</td></tr>
<tr><td>15</td><td>(a) KCl – Neutral (KOH+HCl)
CH_3COOK- Basic (CH_3COOH+KOH)
NH_4Cl- Acidic(NH_4OH+ HCl)
(b) It is defined as the product of the molar concentration of hydrogen ion (hydronium ion) and hydroxyl ion in water or in any aqueous solution.
Kw = $[H^+][OH^-] = 10^{-7}$ x $10^{-7} = 10\text{-}^{14}M^2$</td><td>1
1</td></tr>
</table>

16	(a) Any one method (b) structure  (a) Gas phase (b) Solid phase	**1** **1**
17	i. Both Li and Be are harder but lighter than other elements of the respective group. ii. Both react slowly with water. Their oxides and hydroxides are much less soluble and their hydroxides decompose on heating. iii. They do not form superoxides iv. Their carbonates decompose easily on heating to form oxides and CO_2. v. Their chlorides are soluble in ethanol and are deliquescent. **(any two)**	**2**
18	$1/\lambda = 109677 \times \left(\frac{1}{n1^2} - \frac{1}{n2^2}\right)$ $= 109677 \times (\frac{1}{2^2} - \frac{1}{4^2})$ $= 20564.4375\ cm^{-1}$	**2**
19	 (i) Eclipsed (ii) Staggered	**2**
20	(a) Three centre- two electron(3c-2e) bond or banana bond (b) the reaction of ammonia with diborane $3B_2H_6 + 6NH_3 \longrightarrow 2B_3N_3H_6 + 12H_2$	**1**
21	(a) On heating, borax first loses water molecules and swells up. On further heating it turns into a transparent liquid, which solidifies into glass like material known as borax bead. $Na_2B_4O_7.10H_2O \xrightarrow{\Delta} Na_2B_4O_7 \xrightarrow{\Delta} 2NaBO_2 + B_2O_3$ (Sodium (Boric anhydride) (b) Borax dissolves in water to give NaOH and orthoboric acid. $Na_2B_4O_7 + 7H_2O \rightarrow 2NaOH + 4H_3BO_3$ (Orthoboric acid)	**1** **1**
22	 (a) $CH_3-\underset{Cl}{CH}-CH_2-\underset{CH_3}{CH}-CH_3$ (b). $CH_3-\underset{OH}{CH}-CH_2-CH_2-COOH$	**2**

23	(a) **Atomic mass unit (amu):** 1/12 th the mass of a C^{12} atom is called atomic mass unit (amu). (b) Given $2\ KClO_3$ $2KCl + 3O_2$ 2×122.55g/ mol 2×74.55 3×32 245.1 g / mol 149.1g/mol 96g/mol The mass of oxygen produced when 50g $KClO_3$ heated $=\frac{50\times96}{245.1}$ = 19.58 g/mol	1 2
24	**(a)** Water(H_2O) - Inter molecular H bonding O-nitro phenol - Intra molecular H bonding **(b)** Both ammonia (NH_3) and nitrogen fluoride (NF_3) are pyramidal in shape. *Even though F is more electro negative than H, the net dipole moment of NF_3 is smaller than that of NH_3.* This is because in the case of NH_3, the orbital dipole due to lone pair is in the same direction as the resultant dipole moment of the three N – H bonds. But in NF_3, the orbital dipole is in the opposite direction to the resultant dipole moment of the three N-F bonds. So the dipole moments get partially cancelled.  	1 2
25	(a) **$(P + n^2a/V^2)$ (V- nb) = nRT** Where P is the pressure of the gas, V is the volume, R is the universal gas constant, T is the absolute temperature, n is the no. of moles, 'a' and 'b' are called van der Wall's constants. (b) i. Every gas contains a large number of minute and elastic particles (atoms or molecules). The actual volume of the molecules is negligible compared to the volume of the gas. ii. There is no force of attraction between the gas particles. iii. The particles of a gas are in constant and random motion in straight line. During this motion they collide with each other and also with the walls of the container. iv. The pressure of a gas is due to the wall collisions of the particles. v. All collisions are perfectly elastic. i.e. the total energy of particles before and after collisions remains the same. vi. At any particular time, different particles of a gas have different speed and hence different kinetic energy. vii. The average kinetic energy of gas molecules is directly proportional to absolute temperature. **(any four)**	1 2
26	(a) **When ΔG become -ve the process is spontaneous**	1

	i. If ΔH is negative and ΔS is +ve, ΔG is always –ve and the process is always spontaneous ii. If both ΔH and ΔS are positive, ΔG will be –ve when $T\Delta S > \Delta H$. This is possible at high temperature. iii. If both ΔH and ΔS are negative, ΔG will be –ve when $T\Delta S < \Delta H$. This is possible at low temperature **(b)** $\mathbf{\Delta G = \Delta H - T\Delta S}$**.** **(c)** **i.** Entropy decreases ii. Entropy increases	1 1
27	**(a)** **i.** Tin(IV)oxide **ii.** Chromium(III)oxide **(b)** i. S is oxidized ii. Cu is reduced iii. Cu_2S reducing agent iv. Cu_2O oxidising agent	**1** **2**
28	**(a)** Calcium chloride or magnesium chloride or magnesium sulphate **(b)** Treatment with washing soda Calgon’s method Ion-exchange method **(any one method)** **(c)** Boiler corrosion or explosion	**1** **1** **1**
29	**(a)** ***Calcium Sulphate (Plaster of Paris), $CaSO4\cdot\frac{1}{2} H_2O$*** **(b)** $2\ CaSO_4.2H_2O \rightarrow 2\ CaSO_4.H_2O + 3H_2O$ **(c)** Above 393 K, no water of crystallisation is left and anhydrous calcium sulphate ($CaSO_4$) is formed. This is known as ‘*dead burnt plaster*’.	**1** **1** **1**
30	**(a)** i. **X is 1-Bromopropane** ii. peroxide or Kharash effect or anti-Markovnikov addition reaction **(b)** $CaC_2 + 2H_2O \rightarrow Ca(OH)_2 + C_2H_2$ (acetylene)	**1** **1** **1**
31	**(a)** **i.** When the pH of the rain water drops below 5.6, it is called acid rain. **ii.** Oxides of nitrogen and sulphur (e.g. SO_2 and NO_2) are mainly responsible for acid rain. **(b)** CO_2, methane, water - vapour, chlorofluorocarbons (CFC’s), nitrous oxide and ozone	**1** **1** **1**
32	**(a)** It states that ***electron pairing takes place only after partially filling all the degenerate orbitals***. Orbitals having same energies are called degenerate orbitals. For example, the electronic configuration of N is $1s^2\ 2s^2\ 2px^1py^1pz^1$ and not $1s^2\ 2s^2\ 2px^2py^1$.	**2** **1**

	(b) it is impossible to determine simultaneously, the exact position and exact momentum (or velocity) of a moving microscopic particle like electron". **(c)** i. Principal Quantum Number (n) **ii.** Azimuthal Quantum Number [Subsidiary or orbital angular momentum Quantum number	**1**
33	For Calculating the bond orders Bond order of O_2= 2 Bond order of O_2^{2-} = 1 O_2 is more stable than O_2^{2-}	**3** **1**
34	(a) *It is the suppression of the dissociation of a weak electrolyte by the addition of a strong electrolyte containing a common ion*. For e.g. consider the dissociation of acetic acid (a weak electrolyte). $CH_3COOH(aq) = CH3COO^-(aq) + H^+(aq)$ If we add some sodium acetate (CH_3COONa) to the above equilibrium reaction, the concentration of acetate ion increases. Then according to Le-Chatlier's principle, the equilibrium will shift towards left or, the rate of forward reaction decreases. i.e. the dissociation rate of acetic acid decreases. This is known as common ion effect. (b) i. Solution which resists the change in pH on dilution or with the addition of small amount of acid or alkali is called Buffer solution. There are two types of buffer solutions – acidic buffer and basic buffer. ii. *solubility product constant* or simply the *solubility product. It is defined as the product of the molar concentration of ions of a sparingly soluble salt or in a saturated solution.* e.g. Solution of barium sulphate ($BaSO_4$) $BaSO_{4\,(s)} = Ba^{2+}_{(aq)} + SO_4^{2-}{}_{(aq)}$ The equilibrium constant, $K = \frac{[Ba^{2+}][SO_4^{2-}]}{[BaSO_4]}$ For a pure solid, the concentration remains constant. Therefore, $K.[BaSO_4] = [Ba^{2+}][SO_4^{2-}]$ Or, $Ksp = [Ba^{2+}][SO_4^{2-}]$	**2** **2**
35	(a) explanation of Dumas method (b) i. In heterolysis or heterolytic cleavage, the bond breaks in such a manner that the shared pair of electrons remains with one of the parts  ii. Order of stability $\dot{C}H_3 < \dot{C}H_2CH_3 < \dot{C}H(CH_3)_2 < \dot{C}(CH_3)_3$ Methyl free radical, Ethyl free radical, Isopropyl free radical, Tert-butyl free radical	**2** **1** **1**