

SET	A/B/C
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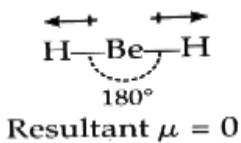
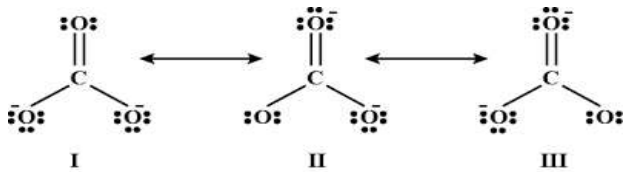
INDIAN SCHOOL MUSCAT  
HALF YEARLY EXAMINATION 2023  
**CHEMISTRY (043)**

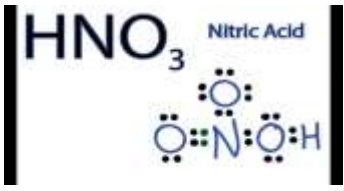
CLASS: XI

Max. Marks: 70

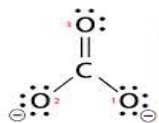
MARKING SCHEME			
SET	QN.NO	VALUE POINTS	MARKS SPLIT UP
		<b>SECTION A</b>	
A	1	(b) Balmer series	1
A	2	(c) d block	1
A	3	(d) 0	1
A	4	(b) Spin quantum numbers	1
A	5	(b) $\text{Al}_2\text{O}_3$	1
A	6	(a) $\text{LiF}$	1
A	7	(b) 2	1
A	8	(b) $\text{Be}^-$	1
A	9	(c) (ii) and (iii) are correct	1
A	10	(d) $\text{Be}^{3+}$ ( $n=2$ )	1
A	11	(c) $\text{PF}_5$	1
A	12	(b) Pyramidal	1
A	13	(b) Assertion and reason both are correct but reason is not the correct explanation for assertion	1
A	14	(b) Assertion and reason both are correct but reason is not the correct explanation for assertion.	1

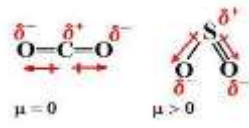
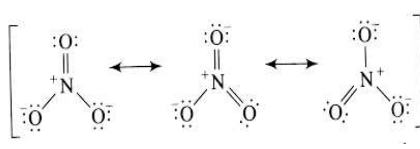
A	15	(a) Assertion and reason both are correct and reason is the correct explanation for assertion.	1
A	16	(c) Assertion is correct statement but reason is wrong statement.	1
		<b>SECTION B</b>	
A	17	$\ominus \text{:}\ddot{\text{O}}-\ddot{\text{N}}=\ddot{\text{O}}\text{:}$ $\frac{1}{2}$ FC on N = $5-2-3 = 0$ $\frac{1}{2}$ FC on single bonded O = $6-6-1 = -1$ $\frac{1}{2}$ FC on double bond O = $6-4-2 = 0$ $\frac{1}{2}$	2
A	18	(i) Element E $\frac{1}{2}$ (ii) Element C $\frac{1}{2}$ (iii) Element B $\frac{1}{2}$ (iv) Element F $\frac{1}{2}$	2
A	19	Any two limitation with example	2
A	20	<p>In halogens family, as we move down the group tendency to gain electron decreases due to increase in atomic size and less nuclear force of attraction for incoming electron. Hence reactivity decreases down the group.</p> <p>In alkali metals, tendency to lose electron increases due to increase in atomic size and decrease in effective nuclear charge, less energy is needed to remove electron. Hence reactivity increases down the group.</p>	2
A	21	$\lambda = h/mv$ $= (6.626 \times 10^{-34}) \div (9.1 \times 10^{-31} \times 2.19 \times 10^6)$ $= 0.332 \times 10^{-9} \text{ m}$	2
		<b>OR</b>	
		(b) $n=1, l=1$ is not possible. L can have value from $0, 1 \dots (n-1)$ 1 (d) Not possible n cannot have zero value 1	
		<b>SECTION C</b>	
A	22	(a) [Ar] $3d^3$ 1 (b) Hund's rule 1	3

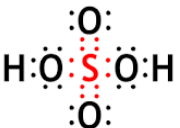
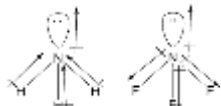
		Electron pairing will not take place in orbitals of same energy until each orbital is singly filled. 1	
A	23	<p>(a) 6s has lower energy, (n + l) value of 4f is 7 while that of 6s is 6. The lower the (n + l) value of an orbital lower is the energy. 2</p> <p>(b) Al : valency = 6, oxidation state = 3 <math>\frac{1}{2} + \frac{1}{2}</math></p>	3
		<b>OR</b>	
		<p>(i) Be – <math>1s^2 2s^2</math>  B – <math>1s^2 2s^2 2p^1</math>  The energy required to remove an electron from completely filled 2s orbital is higher than the energy required to remove electron from 2p orbital.</p> <p>(ii) Electronegativity definition</p>	
A	24	<p>(a) BeH<sub>2</sub> molecule is linear. The resultant dipole moment of two Be-H bonds cancelled and give zero dipole moment.</p> <div style="text-align: center;">  </div> <p style="text-align: right;">1½</p> <p>(b) Due to resonance, all C-O bond are equivalent.</p> <div style="text-align: center;">  </div> <p style="text-align: right;">1½</p>	3
A	25	$\bar{\nu} = 1.09677 \times 10^7 \{1/2^2 - 1/4^2\} = 0.2056 \times 10^7 \text{ m}^{-1}$ $\lambda = 4.8628 \times 10^{-7} \text{ m}$	3
A	26	PCl <sub>5</sub> – sp <sup>3</sup> d, trigonal bipyramidal SF <sub>6</sub> – sp <sup>3</sup> d <sup>2</sup> , octahedral	3
A	27	<p>(i) Due to smaller size of F than Cl. The electron-electron repulsion in 2p subshell of F is large and the incoming electron is not accommodated with the ease as is accommodate in larger 3p subshell of Cl.</p> <p>(ii) N- <math>1s^2 2s^2 2p^3</math>  O - <math>1s^2 2s^2 2p^4</math></p>	3

		<p>In case of N, electron is to be removed from half-filled p-orbitals. Hence energy required to remove the valence electron is high i.e. ionization enthalpy is high. O has 4 valence electrons in 2p orbital. Due to increased electron-electron repulsion, electron can be easily removed from 2p orbital of O.</p> <p>(iii) Na has 11 electrons and 11 protons whereas <math>\text{Mg}^+</math> has 12 protons and 11 electrons. Due to higher effective nuclear charge in case of <math>\text{Mg}^+</math>, removal of electron from it requires more energy.</p>	
A	28	$\Delta x = h/4\pi m \Delta v$ $\Delta v = (600 \times 0.005)/100 = 0.03 \text{ m/s}$ $\Delta x = (6.626 \times 10^{-34}) / (4 \times 3.14 \times 9.1 \times 10^{-31} \times 0.03) = 1.93 \times 10^{-3} \text{ m}$	3
		SECTION D	
A	29	<p>(a) Red colour because it has highest wavelength and lowest energy</p> <p>(b) dig of <math>2p_x</math>, <math>3d_{x^2-y^2}</math></p> <p>(c) <math>E = h\nu</math>  <math>= 6.626 \times 10^{-34} \times 5 \times 10^{14}</math>  <math>= 33.13 \times 10^{-20} \text{ J}</math></p> <p style="text-align: center;"><b>OR</b></p> <p>Angular momentum <math>l</math> for 3p and 4p orbitals will be same because <math>l = 1</math> for p orbital</p>	4
A	30	<p>(a)</p> <div style="text-align: center;">  </div> <p>(b) <math>sp^2</math></p> <p>(c) Lattice enthalpy definition. Larger the lattice enthalpy of an ionic compound larger is its stability.</p> <p style="text-align: center;"><b>OR</b></p> <p>Sigma bond is stronger than pi bond. This is because sigma bond is formed by head on overlapping of orbitals, extent of overlapping is large. On the other hand, pi bond is formed by sideways overlapping.</p>	4

		SECTION C	
A	31	<p>Any 5 questions</p> <p>(i) Lithium due to similar size, charge/radius ratio</p> <p>(ii) <math>(n-1)d^{1-10}ns^{1-2}</math></p> <p>(iii) The arrangement of the given species in order of their increasing ionic radii is as follows: <math>Al^{3+} &lt; Mg^{2+} &lt; Na^+ &lt; F^- &lt; O^{2-} &lt; N^{3-}</math></p> <p>(iv) Period = 4, Group = 3</p> <p>(v) Group 16</p> <p>(vi) <math>F &gt; O &gt; Cl &gt; N</math></p> <p>(vii) Ununennium, Uue</p>	5
A	32	<p>(a) HF is more polar as compared to HCl because F is more electronegative than Cl. Greater the difference in electronegativity, more will be the polarity, higher will be the dipole moment.</p> <p>(b) <math>N_2</math> have high bond enthalpy than <math>O_2</math> due to the presence of triple bond in <math>N_2</math> whereas <math>O_2</math> has double bond.</p> <p>(c) Explain <math>sp^2</math> hybridization in <math>C_2H_4</math> with dig</p> <p style="text-align: center;"><b>OR</b></p> <p>(a) Formation <math>H_2</math> molecule on basis of VBT</p> <p>(b) <math>sp^3d^2</math>, Square pyramidal</p> <p>(c) Both <math>NH_3</math> and <math>H_2O</math> has <math>sp^3</math> hybridization. In case of <math>NH_3</math> only one lone pair of electrons is present on N where as in <math>H_2O</math>, 2 lone pairs is present on O. Since lp-lp repulsion is greater than lp-bp repulsion, the two lp of oxygen pushes the bp closer than one lp on N. This leads to small angle in <math>H_2O</math>.</p>	5
A	33	<p>(a) <math>\lambda_A = h/p_A</math>  <math>\lambda_B = h/p_B</math>  <math>P_B = P_A/2</math>  <math>\lambda_B = 10^{-7}m</math></p> <p>(b) Any two difference</p> <p>(c) Frequency - Number of waves passes through a given point in one second.</p> <p style="text-align: center;"><b>OR</b></p> <p>(i) <math>E_n = (-2.18 \times 10^{-18} \times Z^2) / n^2 = 0.545 \times 10^{-18}J</math></p>	5

		(ii) Heisenberg's uncertainty principle It is impossible to determine the exact position and velocity of an electron simultaneously. (iii) Degenerate orbital definition.																										
B	1	(a) Brackett series	1																									
B	2	(b) p block	1																									
B	3	(c) 1	1																									
B	5	(a) $s > p > d > f$	1																									
B	7	(b) 4	1																									
B	8	(a) Cs	1																									
B	12	(b) Square planar	1																									
B	13	(c) Assertion is correct statement but reason is wrong statement.	1																									
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B	17	<div><p><b>Formal Charge of <math>\text{CO}_3^{2-}</math></b></p><p><math>q_f = V - N - B/2</math></p><table><thead><tr><th></th><th>V</th><th>N</th><th>B</th><th><math>q_f</math></th></tr></thead><tbody><tr><td>C</td><td>4</td><td>0</td><td>8</td><td>0</td></tr><tr><td>O1</td><td>6</td><td>6</td><td>2</td><td>-1</td></tr><tr><td>O2</td><td>6</td><td>6</td><td>2</td><td>-1</td></tr><tr><td>O3</td><td>6</td><td>4</td><td>4</td><td>-2</td></tr></tbody></table><p>Formal charge = -2</p><p><small><math>q_f</math> = Formal charge (FC)    V = No. of valence electrons N = No. of lone electrons    B = No. of bonding electrons</small></p></div>		V	N	B	$q_f$	C	4	0	8	0	O1	6	6	2	-1	O2	6	6	2	-1	O3	6	4	4	-2	2
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	22	(a) $[\text{Ar}]3d^9$	3																									
	23	(i) C- $1s^2 2s^2 2p^2$ B- $1s^2 2s^2 2p^1$	3																									

		<p>Nuclear charge of C is more than that of B. Hence first ionization enthalpy of C is high. After the removal of one electron, the second electron to be removed from C is from 2p whereas that from B is from 2s. Hence second IE is high for B.</p> <p>(ii) electron gain enthalpy definition</p> <p style="text-align: center;"><b>OR</b></p> <p>(a) 7s based on n+l rule, 7s has (n+l) value 7 and that of 5f is 8. 7s has low value n+l value, i.e. low energy.</p> <p>(b) oxidation state 3, covalency -6</p>	
	24	<p>(a) CO<sub>2</sub> is linear molecule, bond moments are equal and opposite, therefore cancel each other and net dipole moment is zero.</p> <p>SO<sub>2</sub> is bent molecule, it has net dipole moment.</p>  <p>(b) Due to resonance</p> 	3
	25	$\nu = 3.29 \times 10^{15} (1/n_1^2 - 1/n_2^2) Z^2$ $= 3.29 \times 10^{15} \times 21 \times 4 \times 10^{-2}$ $= 276.3 \times 10^{13} \text{ Hz}$ $\lambda = c/\nu = 3 \times 10^8 / 276.3 \times 10^{13}$ $= 0.01097 \times 10^{-5} \text{ m}$	3
	27	<p>(i) Noble gas has stable configuration. Therefore, energy is absorbed when electron is added to these i.e. electron gain enthalpy is positive</p> <p>(ii) Anions are formed by gaining of electron. Thus, increase in no. of electrons in atom occurs whereas nuclear charge remains same. Greater no. of electron is attracted by same nuclear charge after anion formation. O<sup>2-</sup> has 8 protons and 12 electrons whereas O atom has 8 protons and 8 electrons.</p>	3
	28	$\Delta\nu = (3 \times 10^7 \times 0.5) / 100 = 1.5 \times 10^5 \text{ m}$ $\Delta x = h/4\pi m \Delta\nu$ $= 0.21186 \times 10^{-12} \text{ m}$	3
	29	<p>(b) Shape of 2p<sub>y</sub> and 3d<sub>z</sub><sup>2</sup></p>	4

		(c) $\lambda = h/mv$ $m = h/\lambda v = (6.626 \times 10^{-34}) / (5 \times 10^{-12} \times 3 \times 10^8) = 0.4417 \times 10^{-30} \text{ kg}$	
	30	(b) 	4
B	32	(i) Al, due to similar size and charge/radius ratio (vii) unbiennium ,ube	
	32	(a)  <p>In <math>\text{NH}_3</math> , dipoles are being added and they are towards lone pair of electrons , where as in <math>\text{NF}_3</math> ,the resultant dipole is opposite to the lone pair of electrons because F is more electronegative than N. Hence <math>\text{NH}_3</math> has high dipole moment.</p> <p>(c) Bonding in ethyne with hybridization</p>	5
B	33	(i) $E_n = (-2.18 \times 10^{-18} \times Z^2) / n^2 = 0.3488 \times 10^{-18} \text{ J}$	5
C	2	(c) d block	
C	3	(d) 0	