JEE MAIN PRACTICE PAPER -1

(1) The orbital angular momentum of 4f electron is-
(A) 4 $\hbar$ (B) $\sqrt{12}\hbar$ (C) $\sqrt{6}\hbar$ (D) $\sqrt{2}\hbar$

(2) The speed of electron in the first orbit of hydrogen atom is 2.19 X 10^6 m s^{-1}. Its speed in the second orbit of the He^+-
(A) 2.19 X 10^6 m s^{-1} (B) 1.10 X 10^6 m s^{-1}
(C) 4.38 X 10^6 m s^{-1} (D) 3.29 X 10^6 m s^{-1}

(3) Suppose that we change U_{RMS} of gas in a closed container from 5×10^{-2}cm/sec to 10×10^{-2} cm/sec, which one of the following might correctly explain how this change was accomplished
(A) By heating the gas we double the temperature
(B) By removing 75% of the gas at constant volume we decrease the pressure to one quarter of its original value
(C) By heating the gas we quadruple the pressure
(D) By pumping in more gas at constant temperature we quadruple the pressure.

(4) The correct order of bond dissociation enthalpy in kJ $mole^{-1}$ is
(A) $F_2 < B_2 < O_2 < C_2$ (B) $B_2 < C_2 < O_2 < F_2$
(C) $F_2 < O_2 < C_2 < B_2$ (D) $B_2 < C_2 < F_2 < O_2$

(5) The Vander Waal's constant for some gases are given

Gas	a ($L^2atmmol^{-2}$)	b ($L\ mol^{-1}$)
NH_3	4.17	0.037
CO_2	3.59	0.043
CH_4	2.25	0.043
O_2	1.36	0.032

The gas with highest critical temperature is
(A) NH_3 (B) CO_2 (C) CH_4 (D) O_2

(6) Which of the following molecules have same geometries
I - FNO II - CCO III - FCO IV – NCO
(A) I and III (B) II, III and IV (C) I, II and IV (D) all

(7) In the molecule of SO_2, sulphur is linked with oxygen. The bond between sulphur and oxygen is of-
(A) sp^2- p bond (B) sp^2- d bond (C) Bond A and B(D) sp-p bond

(8) Which of the following molecules has the shortest nitrogen – nitrogen bond-

A) N_2H_4 (B) N_2O (C) N_2 (D) N_2O_4

(9) In which of the case, the former has higher lattice energy than later compound-

(A) KI and LiI (B) MgO and Na_2O

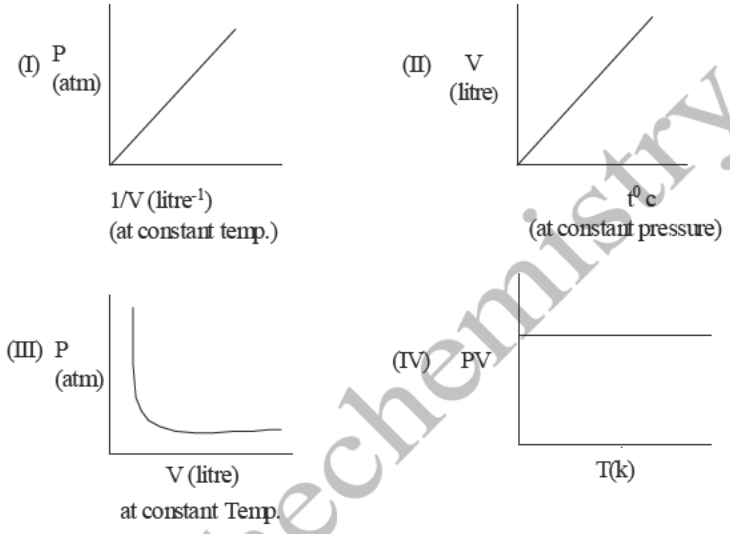
(C) KBr and NaBr (D) LiBr and LiF

(10) $BX_{3\,(g)} \rightarrow BX_2^+ + X^-$, $\Delta H = +$ E kJ mol^{-1}

For which of the following halogen (X) the ΔH value will be maximum-

(A) F (B) Cl (C) Br (D) I

(11) The correct graphical representation for an ideal gas is-



(A) I, II and III (B) I, III and IV (C) I and III (D) all

(12) On cooling to sample of air from 25°C to 0°C reduces the rms velocity of molecules by a factor of –

(A) 0.96 (B) 0.31 (C) 0.45 (D) 0.71

(13) A gaseous mixture of helium and oxygen is found to have density of 0.958 gm/L at 27°c and 760 torr. What is percent by mass of helium in this mixture?

(A) 5 (B) 30 (C) 10 (D) 20

(14) Which of the following statement(s) is not correct-

(A) Pressure-temperature law is known as Amonton's law.

(B) The difference in pressure of moist gas and dry gas at particular temperature does not depend upon nature of gas.
(C) If fixed mass of a gas is allowed to diffuse at same temperature but different pressures, the ratio of rate of diffusion = $\sqrt{\frac{P_1}{P_2}}$
(D) According to kinetic theory of gases average kinetic energy of a gas at a particular temperature doesn't depend upon the nature of gas.

(15) One molecule of hemoglobin combines with four O_2 molecules. If 1 gm of hemoglobin combines with 3.10 ml of O_2 at body temperature (37°c) and 1 atm pressure, the molecular mass of hemoglobin is –
(A) 16420 (B) 4105 (C) 32840 (D) 8210

(16) The most favorable conditions for a real gas to liquefy-
(A) High temperature, low pressure (B) High temperature, high pressure
(C) Low temperature, high pressure (D) Low temperature, low pressure

(17) One mole of a mixture of CO and CO_2 requires exactly 20 gram of NaOH in solution for complete conversion of all the CO_2 into Na_2CO_3. How many moles more of NaOH would it require for conversion into Na_2CO_3 if the mixture (one mole) is completely oxidized to CO_2:
(A) 0.2 (B) 0.5 (C) 0.4 (D) 1.5

(18) 10 gm of hydrofluoric acid gas occupy 5.6 litre of volume at NTP. If the empirical formula of the gas is HF, then its molecular formula will be (F = 19)
(A) H_2F_2 (B) H_3F_3 (C) HF (D) H_4F_4

(19) Which of the following statement is incorrect about Van der Waal's equation for real gases.
(A) The constant 'a' stands for attractive forces between gas molecules
(B) b stand for repulsive force between molecules
(C) P term in equation is the value of pressure of gas if gas behaves ideally
(D) P is the pressure of real gas as predicted by Van der Waal's equation

(20) If a proton and alpha particle are accelerated through the same potential difference, the ratio of de Broglie wavelength λ_p and λ_{alpha} is
(A) 2 (B) 1 (C) $2\sqrt{2}$ (D) 3

(21) For the radial probability distribution curves ($4\pi r^2 R_{nl}$ Vs r graph), which of the following statements is correct for an orbital
(A) The number of maxima is n.
(B) The number of nodal points is n–*l*–1
(C) The radius for maximum charge density increases in the order 3s < 3p < 3d
(D) The number of angular nodes for an orbital is equal to *l*

(22) The CN^- & N_2 are isoelectronic but in contrast to CN^-, N_2 is chemically inert because of
(A) Low bond energy (B) Absence of bond polarity
(C) Unsymmetrical electron distribution (D) Presence of more number of electrons in bonding orbitals.

(23) The melting point of AlF_3 is 104° *C* and that of SIF_4 is - 77° *C* (it sublimes) because:
(A) There is a very large difference in the ionic character of the Al – F and Si – F bonds.
(B) In AlF_3, Al^{+3} interacts very strongly with the neighbouring F^- ions to give a three dimensional structure but in SiF_4 no interaction is possible.
(C) The silicon ion in the tetrahedral SiF_4 molecule is not shielded effectively from the fluoride ions whereas in AlF_3, Al^{+3} the ion is shielded on all sides.
(D) The attractive forces between the SiF_4 molecules are strong whereas those between the AlF_3 molecules are weak.

(24) Give the correct order of initials **T** (true) or **F** (false) for following statements.
(I) If an ion has 2 electrons in K shell, 8 electrons in L shell and 6 electrons in M shell, then number of s orbital electrons present in that element is 6.
(II) The maximum number of electrons in nth subshell of is given by $2n^2$.
(III) If electron has magnetic number –1, then it cannot be present in s-orbital.
(IV) Only one radial node is present in 3p orbital.

(A) TTFF (B) FFTF (C) TFTT (D) FFTF

(25) According to Bohr's atomic theory, which of the following is correct:
(I) Kinetic energy of electron $\propto Z^2/ n^2$

(II) The product of velocity of electron and shell number 'n' $\propto Z^2$
(III) Frequency of revolution of electron in an orbit Z^2/ n^3
(IV) Coulombic force of attraction on the electron $\propto Z^3 / n^4$
(A) I, III, IV (B) I, IV (C) II (D) I

(26) In the 15th group (nitrogen family), the H–M–H bond angle in the hydrides gradually becomes closer to 90° on going from N to Sb. This shows that gradually.
(A) The basic strength of the hydrides increases.
(B) Almost pure p-orbitals are used for M–H bonding.
(C) The bond energies of M–H bonds increase.
(D) The bond pairs of electrons become nearer to the central atom.

(27) Amongst NO_3^-, AsO_3^{3-}, CO_3^{2-}, ClO_3^-, SO_3^{2-} and BO_3^{3-} the non-planar species are
(A) CO_3^{2-}, SO_3^{2-} , BO_3^{3-} (B) AsO_3^{3-}, ClO_3^-, SO_3^{2-}
(C) NO_3^-, SO_3^{2-} and BO_3^{3-} (D) NO_3^-, SO_3^{2-} and BO_3^{3-}

MARK YOUR ANSWERS

1		11		21	
2		12		22	
3		13		23	
4		14		24	
5		15		25	
6		16		26	
7		17		27	
8		18		28	
9		19		29	
10		20		30	

JEE MAIN PRACTICE PAPER -1 solutions

1	B	11	C	21	
2	A	12	A	22	B
3	C	13	B	23	C
4	A	14	B	24	C
5	A	15	C	25	A
6	B	16	C	26	B
7	C	17	D	27	A
8	C	18		28	
9	B	19		29	
10	A	20	C	30	

1. Answer: B
Angular momentum = $\sqrt{\ell(\ell+1)}\hbar \Rightarrow \sqrt{3\times4}\hbar = \sqrt{12}\hbar$

2. Answer: A
$V_n = \frac{z}{n}.V_o \Rightarrow V_2 = \frac{2}{2}.V_o$

3. Answer: C
$v_{rms} = \sqrt{\frac{3RT}{M}} = 5x10^{-4}\ m/s$
v_{rms}= 10 x 10^{-4} m/s ,
$\frac{v_{rms}}{v'_{rms}} = \frac{1}{2} = \sqrt{\frac{T_1}{T_2}}$
$T_2 = 4T_1$ hence (A) is wrong
By removing 75% of gas at constant temperature $P_{new} = P/4$ hence (B) is wrong.
$P_{new} = 4P$, therefore T' = 4T hence (C) is correct
For (D) if T remains same V_{rms} will also remains same.

4. Answer: A
Bond Enthalpy in kJ $mole^{-1}$
F_2 = 159.6 O_2 = 498.7 C_2 = 627.6 B_2 = 288.7
Bond order of C_2 and O_2 = 2
Bond order of F_2 and B_2 = 1, then compare their atomic size.

5. Answer: A ; Higher the value of 'a' more easy to liquefy the gas.

6. Answer: B

$\ddot{F}-N=O$ (bent) $\ddot{C}=C=\ddot{\underset{\cdot\cdot}{O}}$ (Linear) $F-C\equiv O$ (Linear)

$N-C\equiv O$ (Linear)

7. answer C S = [Ne] $3s^2$, $3p^2$

8. Answer: C

Hint: $N\equiv N$; the bond order = 3 so high bond dissociation energy.

9. Answer: B

Hint: Fajan's rule

10. Answer: A

Hint: Due to effective back bonding in the BF_3 case.

11. Answer C

PV = constant (at constant temperature for fixed mass of gas)

$P \propto 1/V$ graph is rectangular hyperbola.

12. Answer: A

Hint: $\frac{V_{rms}\,at\,0^{\circ}c}{V_{rms}\,at\,25^{\circ}c}=\sqrt{\frac{273}{298}}=0.96$

13. Answer: B

Hint: $\rho=\frac{P\,M_{avg}}{R\,T}\Rightarrow M_{avg}=23.6$ Let mol% of helium is x,

$4x+(1-x)\times 32=23.6$; x = 0.3 or 30%

14.

for statement B

$P_{moist}=(n_{gas}+n_{H_2O})\frac{RT}{V}$

$P_{dry}=n_{gas}\frac{RT}{V}$

$\Delta P=P_{moist}-P_{dry}$

$\Delta P=n_{H_2O}\frac{RT}{V}$

It is right statement

For statement C : $\frac{r_1}{r_2}=\frac{P_1}{P_2}$

15. Answer: C
Hint: $n_{O_2} = \frac{PV}{RT}$; moles of hemoglobin = ¼ x mol of O_2
1 gm/M = 3.045 x 10^{-5} M = 32840 gm/mol

16. Answer C
High pressure and low temperature favors liquification.

17. Answer : D
Let CO_2 = x mole,
CO = (1-x) mole
Moles of NaOH = 20/40 = ½ mole
2 NaOH + $CO_2 \rightarrow Na_2CO_3 + H_2O$
by the equation moles of CO_2 = x moles = ½ x ½ = ¼
CO = ¾ moles
Total moles of NaOH required = 2
Extra moles of NaOH = 2 – ½ = 1.5 moles

18. n = 5.6/22.4 moles, If molecular weight is M
$\frac{10}{M} = \frac{5.6}{22.4} \Rightarrow M = 40$, Molecular formula = H_2F_2

19. $\left(P + \frac{a}{V_m^2}\right)$ is ideal pressure.

20. Answer: C
$\lambda = \frac{h}{\sqrt{2mE}}$ where E is the kinetic energy
$\lambda = \frac{h}{\sqrt{2m(qV)}}$ where V is potential difference with which the particle has been accelerated.
$\lambda_\alpha = \frac{h}{\sqrt{2m_\alpha (2.e)V}}$ $\lambda_p = \frac{h}{\sqrt{2m_p e.V}}$,
$\frac{\lambda_p}{\lambda_\alpha} = \sqrt{\frac{m_\alpha \times 2e}{m_p \times e}} = \sqrt{\frac{4m_p \times 2}{m_p}} = 2\sqrt{2}$

21. The number of maxima is (n-l)
The number of modal points in the graph is (n-l-1) ie Radial nodes

22. Answer: B ; It is Fact

23. Answer: B ;It is Fact

24. Answer C
(I)$1s^2$, $2s^2$ $2p^6$, $3s^2$ $3p^4$total s electron = 6 electrons
(II) The maximum number of electrons in nth shell = $2n^2$
(III) for s orbital azimuthal (l) and magnetic quantum number (m) is always zero.
(IV) 3p orbital radial node = (n-l-1)

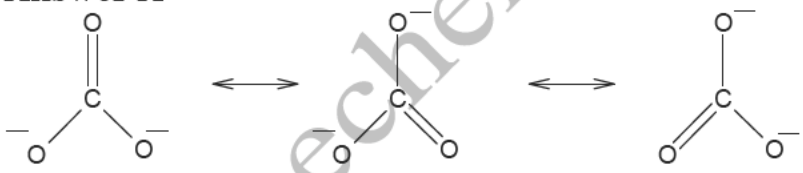
25. Answer: A
KE = Z^2/n^2. E_0 (where E_0 is the KE of electron in ground state.)
V = Z/n .V_0 (where V_0 is velocity of electron in ground state.)

$$\text{Frequency} = V/2\pi r = \frac{\left(\frac{Z}{n}\right).V_0}{2\pi\times\left(n^2/Z\right).r_o} = \frac{Z^2}{n^3}.\text{Constant}$$

$$F = \frac{KZe^2}{\left(\frac{n^2}{Z}\right)^2.r_0^2} = \frac{Z^3}{n^4}.\text{Constant}$$

26. Answer B , fact based explanation for bond angle varaition

27. Answer A



Similarly for SO_3^{2-} and BO_3^{3-} resonance is applied.