AVIRAL
JEE | NEET | FOUNDATIONS

WEEKLY TEST MEDICAL PLUS -01 TEST - 12 Balliwala SOLUTION Date 04-08-2019

[PHYSICS]

1. (c) $\frac{A}{B} = \frac{\text{Force}}{\text{Force}} = [M^0 L^0 T^0]$

$Ct = \text{angle} \Rightarrow C = \frac{\text{Angle}}{\text{Time}} = \frac{1}{T} = T^{-1}$

$Dx = \text{angle} \Rightarrow D = \frac{\text{Angle}}{\text{Distance}} = \frac{1}{L} = L^{-1}$

$\therefore \frac{C}{D} = \frac{T^{-1}}{L^{-1}} = [M^0 L T^{-1}]$

2. (d) Maximum error in measuring mass = 0.001 g, because least count is 0.001 g. Similarly, maximum error in measuring volume is 0.01 cm^3.

$\frac{\Delta\rho}{\rho} = \frac{\Delta M}{M} + \frac{\Delta V}{V} = \frac{0.001}{20.000} + \frac{0.01}{10.00}$

$= (5\times10^{-5}) + (1\times10^{-3}) = 1.05\times10^{-3}$

$\Delta\rho = (1.05\times10^{-3})\times\rho$

$= 1.05\times10^{-3}\times\frac{20.000}{10.00} = 0.002\ \text{g cm}^{-3}$

3. (d) Diameter = M.S.R. + C.S.R × L.C + Z.E.

= 3 + 35 × (0.5/50) + 0.03 = 3.38 mm

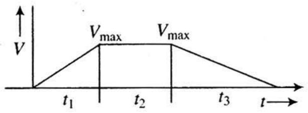
4. (d) $\frac{C^2}{g} = \frac{L^2T^{-2}}{LT^{-2}} = [L]$

5. (b) Given $7x = \frac{g}{2}(2n-1)$ and $x = \frac{1}{2}g(1)^2$

Solving these two equations, we get $n = 4$ s.

6. (c) Graphically, the area of v–t curve represents displacement.

$$S = \frac{1}{2} v_{max} t_1 \quad \text{or} \quad t_1 = \frac{2S}{v_{max}}$$



$$2S = v_{max} t_2 \quad \text{or} \quad t_2 = \frac{2S}{v_{max}}$$

$$5S = \frac{1}{2} v_{max} t_3 \quad \text{or } t_3 = \frac{10S}{v_{max}}$$

$$v_{av} = \frac{\text{Total displacement}}{\text{Total time}} = \frac{S + 2S + 5S}{\frac{2S}{v_{max}} + \frac{2S}{v_{max}} + \frac{10S}{v_{max}}}$$

$$\frac{v_{av}}{v_{max}} = \frac{8S}{14S} = \frac{4}{7}$$

Alternative:

$$\frac{v_{av}}{v_{max}} = \frac{\text{Total displacement}}{2\begin{pmatrix}\text{Total displacement} \\ \text{during acceleration} \\ \text{and retardation}\end{pmatrix} + \begin{pmatrix}\text{Displacement} \\ \text{during uniform} \\ \text{velocity}\end{pmatrix}}$$

$$\frac{v_{av}}{v_{max}} = \frac{8S}{2(S + 5S) + 2S} = \frac{8}{14} = \frac{4}{7}$$

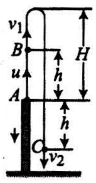
7. (c) $H = \frac{u^2}{2g}$; given $v_2 = 2v_1$ (i)

A to B : $v_1^2 = u^2 - 2gh$ (ii)

A to C: $v_2^2 = u^2 - 2g(-h)$ (iii)

Solving (i), (ii) and (iii), we get the value of u^2 as $10gh/3$ and then we get the value of H by using

$H = \frac{u^2}{2g}$ (Fig. S2.15)



8. (a) Let the particle be thrown up with initial velocity u.

Displacement (s) at any time t is $S = ut - \frac{1}{2}gt^2$.

The graph should be parabolic downwards as shown in option (b).

9. (c) Maximum height will be attained at 110 s. Because after **110 s,** velocity becomes negative and rocket will start coming **down.** Area from 0 to 110 s is

$$\frac{1}{2}\times 110\times 1000 = 55{,}000 \text{ m} = 55 \text{ km}$$

10. (d) Here relative velocity of the train w.r.t. other train is $V-v$. Hence, $0-(V-v)^2 = 2ax$

or $a = -\frac{(V-v)^2}{2x}$ Minimum retardation $=\frac{(V-v)^2}{2x}$

11. (c) $x = at^2 - bt^3$

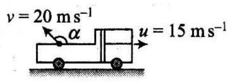
Velocity $=\frac{dx}{dt} = 2at - 3bt^2$

and acceleration $= \frac{d^2x}{dt^2} = 2a - 6bt$

Acceleration will be zero if

$2a - 6bt = 0 \Rightarrow t = \frac{2a}{6b} = \frac{a}{3b}$

12. (b) $\sin\alpha = \frac{u}{v} = \frac{\sqrt{3}}{2} \Rightarrow \alpha = 60°$



$\Rightarrow \quad \theta = 90° + \alpha = 150°$

13. (a) For the person to be able to catch **the ball, the horizontal** component of velocity of the ball should be same as the speed of the person, i.e.,

$$v_0\cos\theta = \frac{v_0}{2} \quad \text{or } \cos\theta = \frac{1}{2} \quad \text{or } \theta = 60°$$

14. (d) Let $u_x = 3 \text{ m s}^{-1}, a_x = 0$

$v_y = u_y + a_y t = 0 + 1\times 4 = 4 \text{ m s}^{-1}$

$v = \sqrt{v_x^2 + v_y^2} = \sqrt{3^2 + 4^2}$

Angle made by the resultant velocity w.r.t. direction of initial velocity, i.e., x-axis, is

$\beta = \tan^{-1}\frac{v_y}{v_x} = \tan^{-1}\frac{4}{3}$

15. **(a)** Time to reach the maximum height,

$t_1 = \frac{u}{g}$

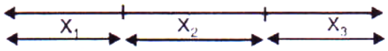
If t_2 be the time taken to hit the ground, then

$-H = ut_2 - \frac{1}{2}gt_2^2$

But $t_2 = nt_1$ (given)

$\Rightarrow -H = u\frac{nu}{g} - \frac{1}{2}g\frac{n^2u^2}{g}$

16.

17. 

Starting from rest $x_1 = \frac{1}{2} a (10)^2$ ....(1)

$x_1 + x_2 = \frac{1}{2} a(20)^2$ ....(2)

$x_1 + x_2 + x_3 = \frac{1}{2} a(30)^2$ ....(3)

From (2) – (1) $x_2 = \frac{1}{2} a (300)$

From (3) – (2) $x_3 = \frac{1}{2} a (500)$

$\Rightarrow$ $x_1 : x_2 : x_3 :: 1 : 3 : 5$

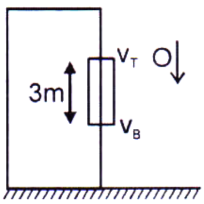
18. $s = \frac{(u+v)}{2} t$

$3 = \frac{(v_T + v_B)}{2} \times 0.5$

$v_T + v_B = 12$ m/s

Also, $v_B = v_T + (9.8)(0.5)$ .... (2)

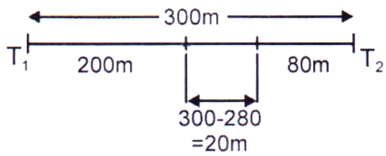
$v_B - v_T = 4.9$ m/s



19. Initial distance between trains is 300 m. Displacement of 1st train is calculated by area under V-t.

curve of train 1 = $\frac{1}{2} \times 10 \times 40 = 200$ m.

Displacement of train 2 = $\frac{1}{2} \times 8 \times (-20) = -80$ m.



Which means it moves towards left.

$\therefore$ Distance between the two is 20 m.

20. At $t = \frac{T}{4}$ and $t = \frac{3T}{4}$, the stone is at same height,

Hence average velocity in this time interval is zero.

Change in velocity in same time interval is same for a particle moving with constant acceleration.

Let H be maximum height attained by stone, then distance travelled from t = 0 to $t = \frac{T}{4}$ is $\frac{3}{4}$H and from $t = \frac{T}{4}$ to $t = \frac{3T}{4}$ distance travelled is $\frac{H}{2}$.

From $t = \frac{T}{2}$ to t = T sec distance travelled is H and from $t = \frac{T}{2}$ to $t = \frac{3T}{4}$ distance travelled is $\frac{H}{4}$.

21. The retardation is given by $\frac{dv}{dt} = -av^2$

integrating between proper limits $\Rightarrow$ $-\int_u^v \frac{dv}{v^2} = \int_0^t a\,dt$ or $\frac{1}{v} = at + \frac{1}{u}$

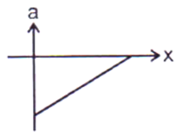
$\Rightarrow \frac{dt}{dx} = at + \frac{1}{u}$ $\Rightarrow$ $dx = \frac{u\ dt}{1+aut}$

integrating between proper limits$\Rightarrow$ $\int_0^s dx = \int_0^t \frac{u\,dt}{1+aut}$ $\Rightarrow$ $S = \frac{1}{a}\ell n\,(1 + aut)$

22. The linear relationship between V and x is
V = – mx + C where m and C are positive constants.
∴ Acceleration

$a = V\frac{dV}{dx} = -m(-mx + C)$ ∴ $a = m^2x - mC$

Hence the graph relating a to x is :



23. $x_A = x_B$

$10.5 + 10t = \frac{1}{2}at^2$ $a = \tan 45° = 1$

$t^2 - 20t - 21 = 0$ $t^2 - 21\,t + t - 21 = 0$

$t(t-21) + 1\,(t-21) = 0$ $\Rightarrow$ $t = 21, -1$

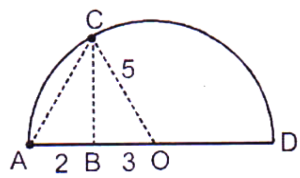
rejecting negative value $t = 21$ sec.

24. From triangle BCO $\Rightarrow$ BC = 4

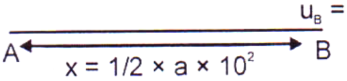
From triangle BCA $\Rightarrow$ $AC = \sqrt{2^2 + 4^2} = 2\sqrt{5}$

$AC = u_1\,t$, $BC = u_2\,t$

∴ $\frac{u_1}{u_2} = \frac{AC}{BC} = \frac{2\sqrt{5}}{4} = \frac{\sqrt{5}}{\sqrt{4}}$



25. After 10 sec



$\overrightarrow{u_B} = 2 \times 10 = 20$

$x = 1/2 \times a \times 10^2$
$= 100$

Now $x_A = (40\,t)$

$x_B = 100 + (ut) + \frac{1}{2}(2)\,t^2 = 100 + 20\,t + t^2$

A will be ahead of B when

$x_B < x_A$ $\Rightarrow$ $100 + 20\,t + t^2 < 40\,t$

$\Rightarrow$ $t^2 - 20\,t + 100 < 0$

$t^2 - 10t - 10\,t + 100 < 0$

$t(t-10) - 10\,(t-10) < 0$

$(t-10)^2 < 0$

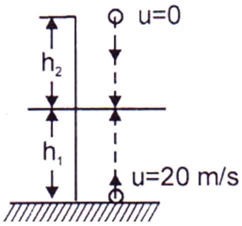
which is not possible

26. Height of the building

$H = h_1 + h_2$

$= \frac{1}{2}gt^2 + ut - \frac{1}{2}gt^2$

$=$ ut = 60 m.



27. $\vec{r} = (t^2 - 4t + 6)\hat{i} + t^2\hat{j}$; $\vec{v} = \frac{d\vec{r}}{dt} = (2t-4)\hat{i} + 2t\hat{j}$, $\vec{a} = \frac{d\vec{v}}{dt} = 2\hat{i} + 2\hat{j}$

if $\vec{a}$ and $\vec{v}$ are perpendicular

$\vec{a}.\vec{v} = 0$ $\quad (2\hat{i} + 2\hat{j}).((2t-4)\hat{i} + 2t\hat{j}) = 0 \quad 8t - 8 = 0 \quad$ t = 1 sec.

28. At t = 0 $\frac{dx}{dt} = 0$ for particles 1,2 and 3 and $\left|\frac{d^2x}{dt^2}\right| > 0$ for t > 0

and $\frac{dx}{dt} = -3.4$ m/s for particle 4 and $\frac{d^2x}{dt^2}$ is negative for t > 0

Therefore for t > 0 ; $\left|\frac{dx}{dt}\right|$ is increasing in all.

29. $s = 4t + \frac{1}{2}(1)t^2 = 2t + \frac{1}{2}(2)t^2$

$4t + 0.5t^2 = 2t + t^2$

Solving we get, t = 0 and t = 4s.

So, $s = 4 \times 4 + \frac{1}{2}(1)4^2 = 24$ m

30. $0 = 30t + \frac{1}{2}(-10)t^2 \Rightarrow t = 6$

31. $d = \int |\vec{v}|\, dt = \int_0^4 |t-2|\, dt$

$= \int_0^2 (2-t)dt + \int_2^4 (t-2)\, dt = 4\text{metre}$

32. Let h be height of building. Hence

$-h = ut_1 - \frac{1}{2}gt_1^2$ ....(i)

$-h = ut_2 - \frac{1}{2}gt_2^2$ ......(ii)

$-h = -\frac{1}{2}gt_3^2$ .....(ii)

From (1) and (3) :

$\frac{1}{2}g\frac{t_3^2}{t_2} = -u + \frac{g}{2}t_1$

From (1) and (3) :

$\frac{1}{2}g\frac{t_3^2}{t_2} = u + \frac{g}{2}t_2$

Adding above two questions : $t_3 = \sqrt{t_1 t_2}$

33. Let v the river velocity and u the velocity of the swimmer in still water. Then

$$t_1 = 2\left(\frac{\omega}{\sqrt{u^2 - v^2}}\right)$$

$$t_2 = \frac{\omega}{v+u} + \frac{\omega}{u-v} = \frac{2u\omega}{u^2 - v^2}$$

$$t_3 = \frac{2\omega}{u}$$

And It is obvious from the above that

$$t_1^2 = t_2 t_3$$

34. $$12 = u(1) + \frac{1}{2}(a)(1)^2 = u + \frac{a}{2} \qquad ......(i)$$

$$12 = (u+a)\left(\frac{3}{2}\right) + \frac{1}{2}(a)\left(\frac{3}{2}\right)^2$$

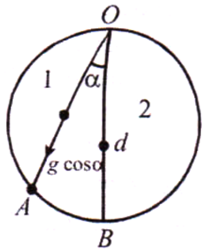
$$= \frac{13u}{2} + \frac{21}{8}a \qquad .....(ii)$$

Solving a = – 3.2 m/s^2

35. $h = \frac{u^2 \sin^2\theta}{2g}$, hence $\frac{\Delta h}{h} = 2.\frac{\Delta t}{u}$

Since, $\frac{\Delta u}{u} = 2\%$, hence $\frac{\Delta T}{T} = \frac{\Delta h}{h} = 4\%$

36. OA = d$\cos\alpha$, $a_{OA} = g\cos\alpha$



Along

⇒ $v_A^2 = 2g\cos\alpha.\cos\alpha$

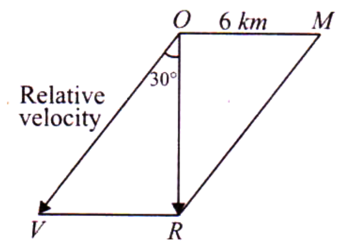
Along OB

$v_B^2 = 2gd$

⇒ $\frac{v_B}{v_B} = \cos\alpha$

Hence, (C) is correct option.

37. Velocity of rain = Velocity of man + Relative velocity of rain OR gives the actual velocity.



$$\tan 30° = \frac{VR}{OR}$$

$$= \frac{1}{\sqrt{3}} = \frac{6}{OR}$$

OR $= 6\sqrt{3}$

∴ Hence, the answer is (B)

38. $$t = \frac{AB}{\sqrt{5^2 - 3^2}} = \frac{3}{4} = 45 \text{ minutes}$$

∴ Answer is (C)

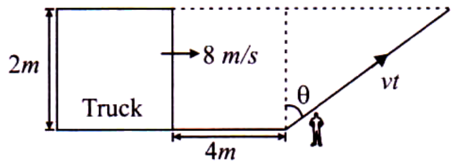
39. Disance covered in 15 minutes $= 5\text{km/hr} \times \frac{15}{60}\text{hr} = 1.25$ km

Extra distance along river covered $= \sqrt{(1.25)^2 - (1)^2} = 0.75$ km

Velocity of river $= \frac{0.75}{(15/60)\text{hr}} = \frac{0.75 \times 4}{1} = 3\text{km/hr}$

$\therefore$ Answer is (B)

40.



vt = 2secθ

Distance covered by truck = 8t = 4 + vtsinθ = 4 + 2 tanθ

$\Rightarrow$ $8.\frac{2\sec\theta}{2+\tan\theta} = 4 + 2\tan\theta$

$\Rightarrow$ $v = \frac{8\sec\theta}{2+\tan\theta} = \frac{8}{2\cos\theta \times \sin\theta}$

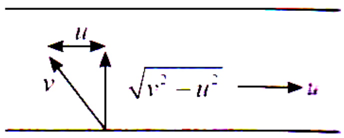
For minimum velocity, $\frac{dv}{d\theta} = 0$ $\Rightarrow \tan\theta = \frac{1}{2}$

$\therefore$ $V_{min} = \frac{8\sqrt{1+1/4}}{2+1/2} = 1.6\sqrt{5}$

Hence (A) is correct option.

41. Let velocity of man in still water be v and that of water with respect to ground be u. Velocity of man downstream = v + u

As given, $\sqrt{v^2 - u^2}\ t = (v+u)T$



$\Rightarrow$ $(v^2 - u^2)t^2 = (v+u)^2T^2$

$\Rightarrow$ $(v - u)^2 = (v+u)T^2$

$\therefore$ $\frac{v}{u} = \frac{t^2 + T^2}{t^2 - T^2}$

$\therefore$ (C) is correct option

[CHEMISTRY]

46. **(c)** In law of reciprocal proportions, the two elements combining with the third element, must combine with each other in the same ratio or multiple of that Ratio of S and O when combine with C is 2 : 1. Ratio of S and O is SO_2 is 1 : 1

47. **(c)** Mol in each case

$$7\text{ g } N_2 = \frac{7}{28} = 0.25;\ 2\text{ g } H_2 = \frac{2}{2} = 1.0;$$

$$16\text{ g } NO_2 = \frac{16}{46} = 0.34;\ 16\text{ g } O_2 = \frac{16}{32} = 0.50$$

Thus hydrogen has maximum moles, hence maximum molecules.

48. **(b)** 1. $BO_3^{3-} \longrightarrow 5 + 8 \times 3 + 3 = 32$
$CO_3^- \longrightarrow 6 + 8 \times 3 + 2 = 32$
$NO_8^- \longrightarrow 7 + 8 \times 3 + 1 = 32$
} ISO electronic

2.. $SO_3^- \longrightarrow 16 + 8 \times 3 + 2 = 42$
$CO_3^- \longrightarrow 32$
$NO_3^- \longrightarrow 32$
} not ISO electronic

3. $CN^- \longrightarrow 6 + 7 + 1 = 14$
$N_2 \longrightarrow 7 \times 2 = 14$
$C_2^- \longrightarrow 6 \times 2 + 2 = 14$
} ISO electronic

4. $PO_4^{3-} \longrightarrow 15 \times 8 \times 4 + 3 = 50$
$SO_4^- \longrightarrow 16 + 8 + 2 = 50$
$ClO_4^- \longrightarrow 17 + 8 \times 4 + 1 = 50$
} ISO electronic

49. **(c)** $ns^2\ p^1$ is the electronic configuration of III period. Al_2O_3 is amphoteric oxide

50.d

51. **(b)** $BeO < MgO < CaO < BaO$.
The basic character of the oxides increases down the group.

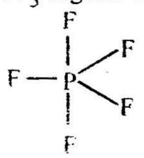
52. **(b)** In hydrides of 15th group elements, basic character decreases on descending the group i.e.
$NH_3 > PH_3 > AsH_3 > SbH_3$.

53. **(d)** **Larger the (+) charge, lower will be radii.**

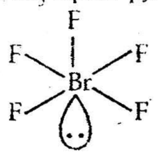
54. **(b)** The species having unpaired electron is paramagnetic

55. **(d)** The bond order of C–O in CO, CO_2 and CO_3^{2-} is 3, 2 & 1.33.
Hence bond length follows the order
$CO < CO_2 < CO_3^{2-}$

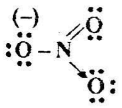
56. **(c)** PF_5 trigonal bipyramidal



BrF_5 square pyramidal (distorted)



57. **(b)** Hybridisation in NH_3 = sp^3, $[PtCl_4]^{2-}$ dsp^2 (inner complex); PCl_5 = sp^3d and BCl_3 is sp^2.

58. **(d)**  It has 4 bond pairs and none lone pair on N.

59. **(b)** $:N\equiv\overset{+}{N}-\ddot{\underset{\cdot\cdot}{O}}:^{-}$ octet of each atom is complete.

60. a

61. **(c)** Due to H-bonding in H – F its boiling point is more than HCl.

62. **(a)** The order of bond angles

$BF_3 > SiH_4 > NH_3 > H_2S$
120° 109°28′ 107° 92.5°

63. **(c)** $\left(P+\frac{a}{V^2}\right)(V-b)=RT$ at high pressure $\frac{a}{V^2}$ can be neglected

$PV - Pb = RT$ and $PV = RT + Pb$

$\frac{PV}{RT} = 1 + \frac{Pb}{RT}$

$Z = 1 + \frac{Pb}{RT}$; Z > 1 at high pressure

64. **(c)** The different type of molecular velocities possessed by gas molecules are

(i) Most probable velocity (α) $= \sqrt{\frac{2RT}{M}}$

(ii) Average velocity $\bar{v} = \sqrt{\frac{2RT}{M}}$

(iii) Root mean square velocity in all three cases

$v = \sqrt{\frac{3RT}{M}}$

In all the above cases

Velocity $\times \sqrt{T}$

65. **(c)** $r \propto u$ and $u = \sqrt{\frac{3RT}{M}}$

$\therefore \frac{r_1}{r_2} = \sqrt{\frac{T_1M_2}{T_2M_1}}$ or $\frac{r_{N_2}}{r_{SO_2}} = \sqrt{\frac{T_1 \times 64}{323 \times 28}} = 1.625$

or $T_2 = 373K$

66. **(d)** The value of *a* is a measure of the magnitudeof the attractive forces between the molecules of the gas. Greater the value of 'a', larger is the attractive intermolecular force between the gas molecules.
The value of *b* related to the effective size of the gas molecules. It is also termed as excluded volume.
The gases with higher value of *a* and lower value of *b* are more liquefiable, hence for Cl_2 "a" should be greater than for C_2H_6 but for it *b* should be less than for C_2H_6.

67. **(c)** Wt. of nitrogen (w) = 7gm (given),
Temperature = 27 + 273 = 300 K
Molar. wt. of nitrogen (m) = 28 gm,

$P = 750.9 \text{ mm Hg} = \frac{750.9}{760} \text{ atm.}$

$(\because 1 \text{ mm Hg} = \frac{1}{760} \text{ atm})$

Gas constant, $R = 0.082 \text{ atm K}^{-1} \text{ mol}^{-1}$
By gas equation,

$PV = nRT$ or $PV = \frac{w}{m}RT \Rightarrow V = \frac{wRT}{mP}$

$= \frac{7 \times 0.082 \times 300}{28 \times \frac{750.9}{760}} = \frac{7 \times 0.082 \times 300 \times 760}{750.9 \times 28}$

$\Rightarrow V = 6.24$ litre

68. **(d)** NH_3 and HCl react to form NH_4Cl

69. **(c)** $P_{H_2} = X_{H_2} \cdot P_{total}$

Mass of H_2 = Mass of O_2 = W

$$= \frac{\frac{w}{2}}{\frac{w}{2} + \frac{w}{32}} \times 3.4 = \frac{16}{17} \times 3.4 = 3.2 \text{ atm}$$

70. d

71. **(b)** The relative rates of diffusion of gases with respect to molecular weights is given by the expression

$$\frac{r_1}{r_2} = \sqrt{\frac{M_2}{M_1}} = 4 \;;\; M_2 = 64 \text{ and } M_1 = 4$$

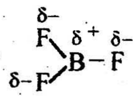
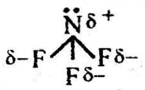
72. **(c)** A π-bond is formed by orbitals having same symmetry about the internuclear axis.

73. **(c)** $\sigma 1s^2, \sigma^* 1s^2, \sigma 2s^2, \sigma^* 2s^2,$

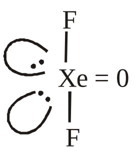
$\sigma 2p_z^2, \pi 2p_x^2, \pi 2p_y^2, \pi^* 2p_x^2, \pi^* 2p_y^2$

∴ No. of antibonding electron pairs = 4

74. **(b) AgCl**

75. **(d)** The shape of BF_3 is trigonal planar  and $\mu = 0$ hence it is non polar. The shape of NF_3 is pyramidal  and $\mu \neq 0$ hence it is polar.

76. [c] fact
77.[d] fact
78. [d] fact
79. [d] 6 e^- in valence shell of boron
80. [c] - Fact

81.[c] 

82.[b] Fact
83. [a]

84.[a] The average energy per bond in O_2 is greater than that in O_3 because dissociation of O_2 is endothermic

85.[b] $Li^- = 1s^2, 2s^2$ (EA_1 = – ve)
$Be^- = 1s^2, 2s^2 2p^1$ (EA_2 = + ve)

86. [a] A π bond nodal plane passing through the two bonded nuclei i.e molecular plane

87. (d) The mass of gas can be determined by weighing the container, filled with gas and again weighing this container after removing the gas. The difference between the two weights gives the mass of the gas.

88. (c) Nobel gases has no intermolecular forces due to inertness

89. (c) Boyle's law is $V \propto \frac{1}{P}$ at constant T

90. (d) According to Boyle's law $V \propto \frac{1}{P}$

$V = \frac{\text{Constant}}{P}$; VP = Constant.