Monthly Progressive Test (Solution)

Class: XI

Subject: PCMB

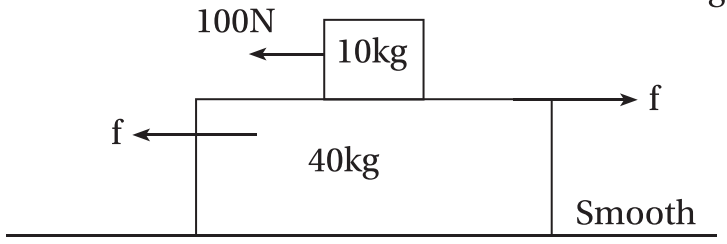
Academic Excellence Programme TECHNO ACE

Test Booklet No.: MPT05 | Test Date: 22 08 2024

Physics

1. Ⓐ

$g = 9.8\ ms^{-2}$
$m = 10\ kg$
$M = 40\ kg$

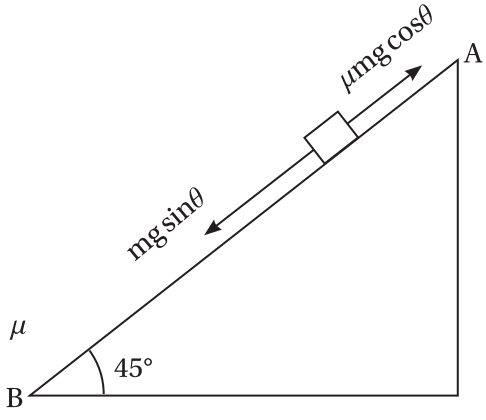


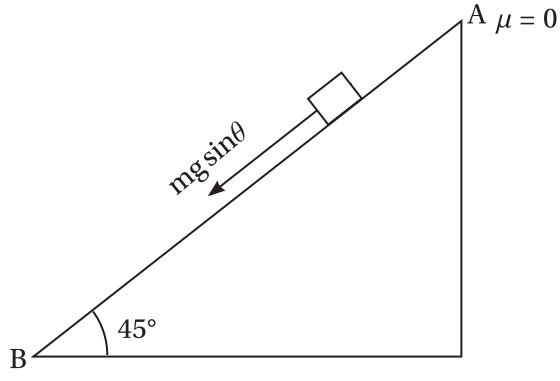
$f = \mu mg = 0.4 \times 10 \times 9.8 = 39.2\ N$

acceleration of 40 kg block

$$A = \frac{f}{M} = \frac{39.2}{40} = 0.98\ ms^{-2}$$

2. Ⓐ





Acceleration down rough plane

$$a' = g(\sin\theta - \mu\cos\theta)$$

$$= g\left(\frac{1}{\sqrt{2}} - \frac{\mu}{\sqrt{2}}\right)$$

$$= \frac{g}{\sqrt{2}}(1-\mu)$$

Acceleration down smooth plane

Cont.. 2

$a = g\sin\theta = \frac{g}{\sqrt{2}}$

In first case $AB = \frac{1}{2}a'(2t)^2 = \frac{a'}{2}.4t^2 = 2a't^2 = \frac{2g}{\sqrt{2}}(1-\mu)t^2$

In second case $AB = \frac{1}{2}at^2 = \frac{g}{2\sqrt{2}}gt^2$

Therefore $\frac{2}{\sqrt{2}}.g(1-\mu)t^2 = \frac{g}{2\sqrt{2}}t^2$

$$2(1-\mu) = \frac{1}{2}$$

$$1-\mu = \frac{1}{4}$$

$$\mu = 1-\frac{1}{4} = \frac{3}{4}$$

3. ©

$\vec{F} = 4\hat{i}+3\hat{j}$ $\qquad 0\hat{i}+4\hat{j}+3\hat{k}$

$\vec{r_1} = 2\hat{i}+5\hat{j}$ $\qquad \mp 2\hat{i}\pm 5\hat{j}\pm 0\hat{k}$

$\vec{r_2} = 4\hat{j}+3k$ $\qquad 2\hat{i}-\hat{j}+3\hat{k}$

$\therefore \quad \vec{r_2}-\vec{r_1} = +2\hat{i}-\hat{j}+3\hat{k}$

Hence $W = \vec{F}.\left(\vec{r_2}-\vec{r_1}\right)$

$$= \left(4\hat{i}+3\hat{j}\right)\bullet\left(2\hat{i}-\hat{j}+3\hat{k}\right)$$

$$= 4\times 2 + 3(-1) + 0.3 = 8-3 = 5J$$

4. ©

$$\frac{4}{3} = \frac{y}{4.5-3}$$

$$\Rightarrow \quad \frac{y}{\frac{3}{2}} = \frac{4}{3}$$

$$\Rightarrow \quad y = \frac{12}{6} = 2$$

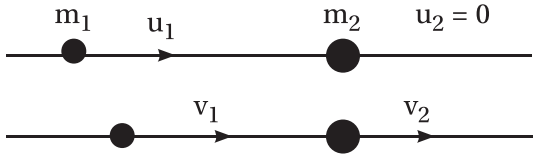
Area under F-t graph is Impulse

$$\frac{1}{2}\times 3.4 - \frac{1}{2}\cdot(1.5)\cdot 2 = 6-\frac{3}{2} = 4.5 \text{ N.s}$$

Change in momentum = 4.5 Ns

$$KE = \frac{p^2}{2m} = \frac{4.5\times 4.5}{2\times 2} = 5.06J$$

5. Ⓑ



$m_1u_1 = m_1v_1 + m_2v_2$ ...(1) $\qquad v_1 = \frac{2}{3}u_1 = \frac{2}{3}u$

$\frac{1}{2}m_1u_1^2 = \frac{1}{2}m_1v_1^2 + \frac{1}{2}m_2v_2^2$

$\Rightarrow \quad m_1u_1^2 = m_2u_1^2 + m_2v_2^2$ .... (2)

$m_1u = m_1 \cdot \frac{2}{3}u + m_2v_2$

$\Rightarrow \quad m_1u = -\frac{2m_1u}{3} = m_2v_2$

$\Rightarrow \quad \frac{1}{3}m_1u = m_2u_2$ .... (3) $\qquad \Rightarrow \quad v_2 = \frac{m_1u}{3m_2}$

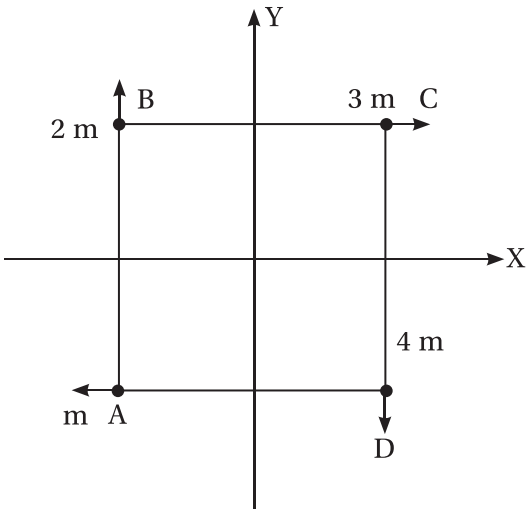
$m_1u^2 = m_1 \cdot \frac{4}{9}u^2 + m_2u_2^2$

$\Rightarrow \quad m_1u^2 - \frac{4m_1u^2}{9} = m_2u_2^2$

$\Rightarrow \quad \frac{5}{9}m_1u^2 = m_2u_2^2 = m_2 \cdot \frac{m_1^2u^2}{9m_2^2}$

$\Rightarrow \quad \frac{5}{9} \cdot \cancel{m_1}\cancel{u^2} = \frac{\cancel{m_1^2}\cancel{u^2}}{9\cancel{m_2}} \Rightarrow \frac{m_1}{m_2} = \frac{5}{1}$

6. Ⓐ



$$\vec{R}_{CM(a)} = \frac{m\vec{a_1} + 2m\vec{a_2} + 3m\vec{a_3} + 4m\vec{a_4}}{m + 2m + 3m + 4m}$$

$$= \frac{-\hat{i}ma + 2m\hat{j}a + 3mia - 4m\hat{j}a}{10m}$$

$$= \frac{2ma\hat{i} - 2ma\hat{j}}{10m}$$

$$= \frac{2ma}{10m}\left(\hat{i} - \hat{j}\right)$$

$$= \frac{a}{5}\left(\hat{i} - \hat{j}\right)$$

7. Ⓐ

$$F = \frac{-du}{dr} = \frac{2a}{r^3} - \frac{b}{r^2}$$

Again $\frac{dF}{dr} = 0$ gives $r = 3\left(\frac{a}{b}\right)$

$$r = 3 \cdot \frac{2}{4} = \frac{3}{2}$$

$$\therefore \quad F_{max} = \frac{32}{27} - \frac{16}{9} = (-)\frac{16}{27}$$

8. Ⓐ

$M > m$

$P = p \quad \Rightarrow MV = mv$

Retardation to bigger mass $M = \frac{F}{M} = A$

Retardation to smaller mass $m = \frac{F}{m} = a$

$V = At_1$

$\Rightarrow \quad t_1 = \frac{V}{A} = \frac{VM}{F} = \frac{P}{F}$ (independent of mass)

Identically $v = at_2$

$\Rightarrow t_2 = \frac{v}{a} = \frac{mv}{F} = \frac{p}{F}$ (independent of mass)

Since $P = p \quad \Rightarrow t_1 = t_2$

So Assertion and Reason both are true and Reason justifies Assertion.

9. Ⓒ

For constant force and fixed displacement

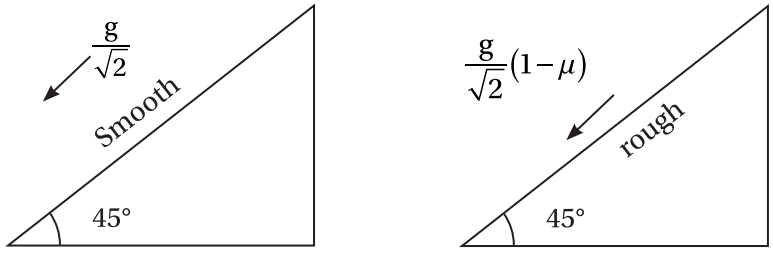
$$v^2 \propto \frac{1}{m}$$

$$\Rightarrow v \propto \frac{1}{\sqrt{m}}$$

Assertion is true

Reason is false

10. ©



$$\frac{1}{2}\cdot\frac{g}{\sqrt{2}}t_1^2 = d \qquad \frac{1}{2}\cdot\frac{g}{\sqrt{2}}(1-\mu)t_2^2 = d$$

$$\Rightarrow t_1^2 = \frac{2\sqrt{2}d}{g} \qquad \Rightarrow t_2^2 = \frac{2\sqrt{2}d}{g(1-\mu)}$$

Now $t_2 = nt_1$

$$\Rightarrow t_2^2 = n^2 t_1^2$$

$$\Rightarrow \frac{2\sqrt{2}d}{g(1-\mu)} = n^2\frac{2\sqrt{2}d}{g}$$

$$\Rightarrow n^2(1-\mu) = 1$$

$$\Rightarrow 1-\mu = \frac{1}{n^2}$$

$$\Rightarrow n^2(1-\mu) = 1$$

$$\Rightarrow \mu = 1-\frac{1}{n^2}$$

Alt: $\left[s = \frac{1}{2}\cdot\sin\theta\cdot t^2 = \frac{1}{2}\cdot g(\sin\theta-\mu\cos\theta)(nt)^2 \right.$

$$\sin\theta = (\sin\theta - \mu\cos\theta)\cdot n^2$$

$$\frac{1}{n^2} = 1-\frac{\mu}{\tan\theta} \qquad \theta = 45°$$

$$\frac{1}{n^2} = 1 - \mu$$

$$\Rightarrow \mu = \left(1 - \frac{1}{n^2}\right)\Big]$$

11. Ⓐ

F = 40N

f = 20N

$$a = \frac{F - f}{m} = \frac{40 - 20}{10} = 2 ms^{-2}$$

12. Ⓐ

m = 150 g

v = 20 ms^{-1}

$\Delta t = 0.1$ s

$$F = \frac{mv}{\Delta t} = \frac{0.150 \times 20}{0.1} = 30N$$

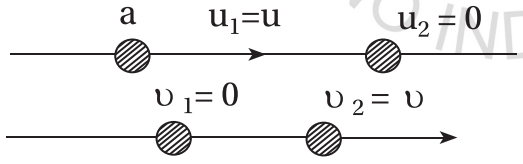
13. Ⓒ

$(5)\,(10)\cos\theta = 25 \Rightarrow \theta = 60°$

14. Ⓑ

Power = (F) (V)$\cos\theta$ = FV $\cos 0°$ = FV

15. Ⓒ



$u_1 - u_2 = u$

$\upsilon_2 - \upsilon_1 = \upsilon$

$\upsilon = eu$

$$K_{initial} = \frac{1}{2}mu^2$$

$$K_{final} = \frac{1}{2}mu^2$$

$$\frac{1}{2}mv^2 = \frac{1}{2}\left(\frac{1}{2}mu^2\right)$$

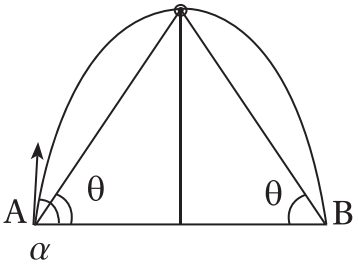
$$\Rightarrow \frac{1}{2}mv^2 = \frac{1}{4}mu^2$$

$$\Rightarrow v^2 = \frac{u^2}{2}$$

$$\Rightarrow e^2 \cancel{u^2} = \frac{\cancel{u^2}}{2}$$

$$\Rightarrow e = \frac{1}{\sqrt{2}}$$

16. Ⓐ



$\tan\theta = \frac{1}{2}$

$\alpha = 45^0$

$\tan\alpha = \tan\theta + \tan\theta = 2\tan\theta$

$\tan 45^0 = 2\tan\theta$

$\tan\theta = \frac{1}{2}$

$t = 10\ s$

17. Ⓑ

$v = 7\sqrt{2}$ $\qquad$ $t = 10\ s$

$\vec{u} = 2\hat{i} + 4\hat{j}$

$\vec{a} = 0.1\hat{i} + 0.3\hat{j}$

$\vec{v} = \vec{u} + \vec{a}\,t$

$= 3\hat{i} + 4\hat{j} + (0.1\hat{i} + 0.3\hat{j})10$

$= 3\hat{i} + 4\hat{j} + \hat{i} + 3\hat{j}$

$= 4\hat{i} + 7\hat{j}$

$v = \sqrt{16+49} = \sqrt{65}$

18. Ⓐ

$\vec{u} = \hat{i} + 2\hat{j}$ $\qquad$ $g = 10\ ms^{-2}$

$u\cos\theta = 1$

$u\sin\theta = 2$

$u^2 = 1 + 4 = 5$

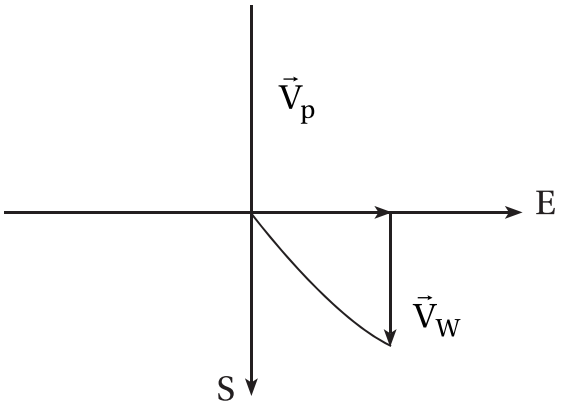
$\tan\theta = 2$

$y = x\tan\theta - \frac{gn^2}{2u^2\cos^2\theta}$

$= 2x - \frac{10x^2}{2.1}$

$\Rightarrow y = 2x - 5x^2$

19. Ⓐ



$\vec{V}_{PW} = \vec{V}_P - \vec{V}_W$ $\quad V_{PW} = \sqrt{V_P{}^2 + V_W{}^2}$

$= \sqrt{500^2 + 90^2}$

$= 508$

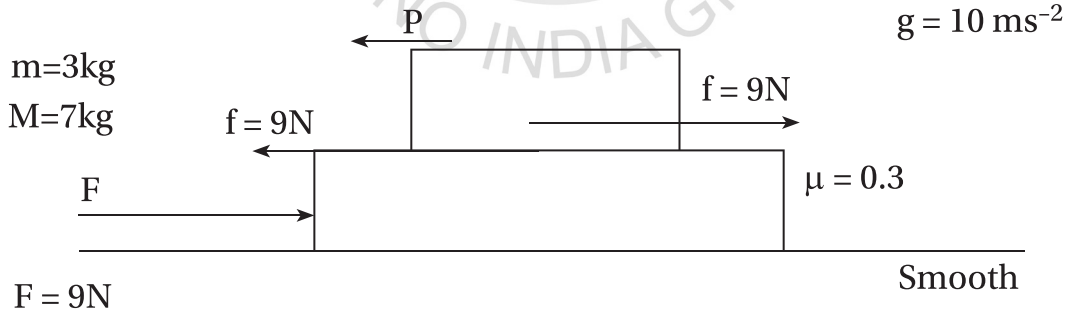
20. Ⓓ

Separation remains same

$h_1 = \frac{1}{2}gt^2$ $\quad h_1 - h_2 = 30\,cm$

$h_2 = \frac{1}{2}gt^2$

21. Ⓑ



F = 9N

f = μ mg = 0.3 ×3×10 = 9N

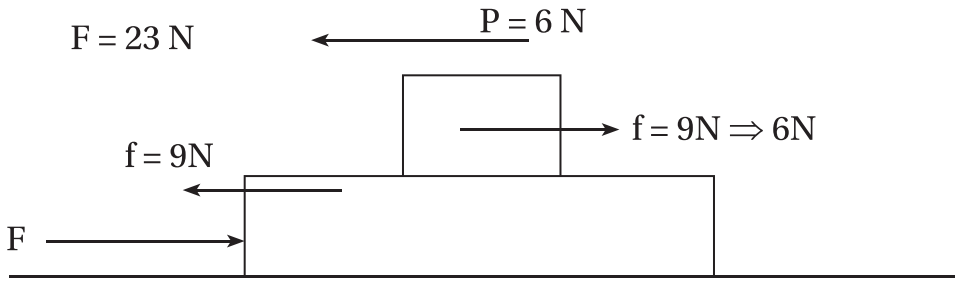
No detachment Combined acceleration of both blocks

$a_1 = a_2 = \frac{9N}{(3+7)\,Kg} = 0.9\ ms^{-2}$

psendo force developed on m, p = 3 × 0.9 = 2.7

So friction on top block self adjusts to develop 2.7 N and be at rest on M

22. Ⓐ



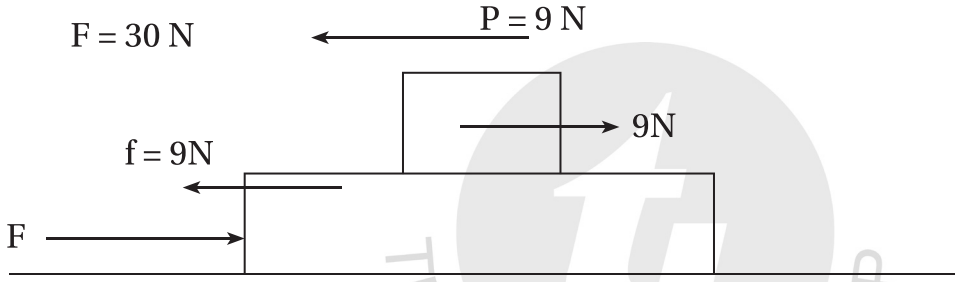
$$a_1 = \frac{23-9}{7} = \frac{14}{7} = 2\,ms^{-2}$$

$P = 3 \times 2\ N = 6\ N$

So, f on m adjusts to 6N and there will not be any relative separation.

$\therefore a_1 = a_2 = 2\,ms^{-2}$

23. ©

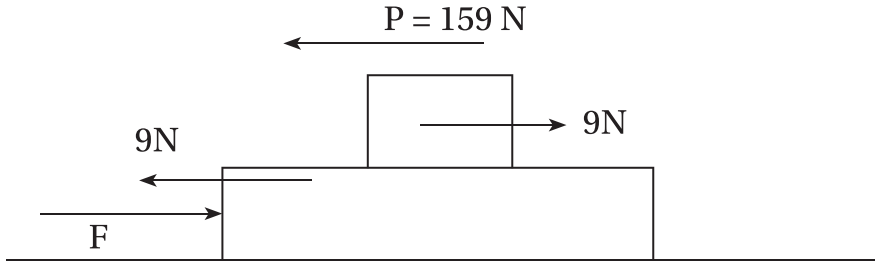


$$a_1 = \frac{30-9}{7} = \frac{21}{7} = 3\,ms^{-2} \text{ and } P = 3\times 3 = 9N$$

So f on m just balances psendo force of 9N and here also there will be no relative separation

$\therefore a_1 = a_2 = 3\,ms^{-2}$

24. Ⓓ



F = 44 N

$$a_1 = \frac{44-9}{7}$$

$$= \frac{35}{7} = 5\,ms^{-2}$$

$P = 5 \times 3 = 15\ N$

So, $a_2 = \frac{9-15}{3} = -\frac{6}{3} = -2\,ms^{-2}$ (backward)

25. Ⓓ

$$W = \int_0^1 (20 + 10y)dy$$

$$= \left[20y + 5y^2\right]_0^1 = 25J$$

Chemistry

26. Ⓑ

Bond order of $O_2 = 2$ and bond order of $O_2^{2-} = 1$

So, X = 1

Bond order of $H_2 = 1$ and bond order of $H_2^- = 0.5$

So, Y = 0.5

So, correct value of $[2(X + Y)] = 3$

27. Ⓒ

Glycerol can be form very strong intermolecular hydrogen bond. Hence, it shows the highest viscosity among the given compounds.

28. Ⓑ

In case of ideal gas, the value of PV remains same with the increase in pressure as in this case intermolecular force of attraction is considered as zero. But in case of real gases, higher pressure indicates the increase in the intermolecular force of attraction hence 'PV' value starts to decrease.

29. Ⓐ

Thermal stability of a solid substance depends on the nature of cation and anion. In this question, anion is constant. Now, higher the radius of cation indicates a strong lattice packing and this factor gives very high thermal stability.

30. Ⓑ

Both CH_2Cl_2 and CH_3Cl are polar molecules. Radius of Sn^{4+} is lower than Sn^{2+}. So, $SnCl_4$ is more covalent than $SnCl_2$.

Dipole moment of CO_2 is zero and that for SO_2 is more than zero.

Radius of Li^+ is lower than Na^+. Hence, water solubility of LiCl is more than NaCl at constant temperature.

31. Ⓐ

In H_2S molecule, 1s orbital of hydrogen molecule overlaps with 3p orbital of sulpher and this is a poor overlap with respect to the 1s and 2p overlap of hydrogen and oxygen in water molecule.

32. Ⓒ

Molecular weight of $SO_2 = 64$

Molecular weight of $O_2 = 32$

r = rate of diffusion of a gas

$$\frac{r_{SO_2}}{r_{O_2}} = \sqrt{\frac{32}{64}} = \frac{1}{1.4}$$

$$\therefore r_{O_2} = 1.4\, r_{SO_2}$$

33. Ⓐ

The term 'antibonding electron' is associated with molecular orbital theory, not with VBT and VSEPR theory.

34. Ⓓ

According to Fajan's rule, small cation and large anion combine with each other to form a compound having low ionic nature.

35. Ⓑ

For 1 mole ideal gas PV = RT

$$\therefore R = \frac{PV}{T} = \frac{\frac{\text{Force}}{\text{Area}} \times (\text{length})^3}{\text{Temperature}} = \frac{\frac{\text{Force}}{(\text{length})^2} \times (\text{length})^3}{\text{Temperature}}$$

36. Ⓓ

When temperature is increased then intermolecular force of attraction decreases and randomness increases.

37. Ⓐ

Kinetic theory of gas is associated with the movement of the gas molecules and all the collisions are elastic in nature.

38. Ⓒ

X = 1 One lone pair is on the sulpher atom in SF_4

Y = 2 Two lonepairs are on the xenon atom in XeF_4

Z = 4 Total 4 lonepairs in CO_2 molecules (2 lone pairs on each oxygen atoms)

So, [X + 2Y + Z] = 9

39. Ⓓ

Bronsted acidity depends on the extent of overlap between an element and hydrogen. Iodine has larger size and hence the extent of overlap with 1s orbital of hydrogen is poor. So, H^+ releasing capacity of HI is much higher than HCl. So, this is not associated with hydrogen bond formation.

40. Ⓐ

In CO_2 molecule, $\angle OCO = 180°$ In BF_3 molecule, $\angle FBF = 120°$

In NH_3 molecule, $\angle HNH = 107°$ In H_2O molecule, $\angle HOH = 104°$

41. Ⓑ

$$E_n = -13.6\frac{Z^2}{n^2} = -\left[\frac{13.6\times4\times4}{2\times2}\right] = -54.4\,eV$$

42. Ⓑ

The electronic configuration of the atom is $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^5$

So, 5 unpaired electrons are there in 3d orbital

Now, $\mu = \sqrt{15}$ BM means that there are 3 unpaired electrons

So, the atom has released 4 electrons (2 from 4s and 2 from 3d)

43. Ⓑ

2 gm hydrogen have $[2 \times 6.02 \times 10^{23}]$ electrons

0.05 gm hydrogen have $\left[\frac{2\times6.02\times1023\times0.05}{2}\right] = 301\times10^{20}$ electrons

44. Ⓒ

$$Na_2CO_3 + 2HCl \longrightarrow 2NaCl + CO_2 + H_2O$$

0.53 gm Na_2CO_3 will produce $\frac{22.4\times0.53}{106} = 0.112\,L\,CO_2$ at STP

0.53 gm Na_2CO_3 will produce $\frac{6.02\times10^{23}\times0.53}{106} = 3.01\times10^{21}$ water molecules

45. Ⓐ

When an anion comes contact with water then the δ^+ part of the water molecule is attracted by the electron cloud of the anion (ion - dipole interaction). Thus large anion can attract the water molecule more strongly with respect to the smaller anion and hence extent of hydration of I^- is much higher than Cl^- at a constant temperature.

46. ©

Dipole moment values of SF_6, PF_5, CCl_4, CS_2 are zero

47. Ⓑ

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

$$\therefore \frac{V_2}{V_1} = \frac{P_1T_2}{P_2T_1} = \frac{1.5\times 288}{1\times 298} \approx 1.5$$

$$\therefore V_2 \approx 1.5\, V_1$$

48. Ⓐ

In C_2H_6 only one bond is between two carbon atoms and double bond is in case of C_2H_4 and triple bond is in case of C_2H_2.

49. ©

Lower the size of the central atom, higher is the electronegativity and extent of overlap of np orbital and 1s orbital is the highest. So, $\angle$HOH bond angle is the highest.

So, correct order of $\angle$HMH bond angle $H_2O > H_2S > H_2Se > H_2Te$.

50. Ⓓ

In H_2O_2 molecule, there is only one bond between two oxygen atoms hence the extent of lone pair-lone pair repulsion is much higher than that in oxygen molecule. So, oxygen - oxygen bond length in H_2O_2 is much higher than O_2.

In ClF_3 molecule, two lonepairs of chlorine are placed at equatorial positions. Two fluorine atoms are placed at axial position while one at equatorial position. BF_3 is planar and NH_3 is pyramidal

Mathematics

51. ©

$$\left(x^3 + \frac{K}{x}\right)^6$$

$$T_{r+1} = {}^{6}C_r (x^3)^{6-r} \left(\frac{K}{x}\right)^r$$

$$= {}^{6}C_r \, x^{18-3r} \frac{(K)^r}{x^r}$$

$$= {}^{6}C_r x^{18-4r} (K)^r$$

For x^6, $18 - 4r = 6 \Rightarrow 4r = 12 \Rightarrow r = 3$

$\therefore T_{3+1} = {}^{6}C_3 x^6 (K)^3$

$\therefore$ Co-efficient of $x^6 = {}^{6}C_3 K^3 = 160$

$\Rightarrow 20 K^3 = 160$

$\Rightarrow K^3 = 8$

$\Rightarrow K = 2$

52. ⓓ

$$\left(\sqrt{x} - \frac{1}{\sqrt{x}}\right)^{10}$$

Number of terms = 10 + 1 = 11

$\therefore$ The middle term $= T_{5+1} = {}^{10}C_5 (\sqrt{x})^5 \left(-\frac{1}{\sqrt{x}}\right)^5$

$= (-1)^5 \, {}^{10}C_5$

$= -{}^{10}C_5$

53. ⓓ

Let the first term be a and common ratio be r.

$$\therefore S_{10} = \frac{a(r^{10} - 1)}{r - 1}$$

$$S_5 = \frac{a(r^5 - 1)}{r - 1}$$

$$\therefore \frac{a(r^{10} - 1)}{r - 1} = 244 \times \frac{a(r^5 - 1)}{r - 1}$$

$\Rightarrow r^5 + 1 = 244$

$\Rightarrow\ r^5 = 243 = (3)^5$

$\Rightarrow\ r = 3$

54. Ⓐ

$a + b + c + d = 2,\ M = (a + b)\,(c + d)$

Let $a + b = x,\ (c + d) = y$

$\therefore\ \dfrac{x+y}{2} \geq (xy)^{\frac{1}{2}}\quad (\because\ A.M \geq G.M.)$

$\Rightarrow\ \dfrac{a+b+c+d}{2} \geq \{(a+b)(c+d)\}^{\frac{1}{2}}$

$\Rightarrow\ \dfrac{2}{2} \geq (M)^{\frac{1}{2}}$

$\Rightarrow\ \sqrt{M} \leq 1$

$\Rightarrow\ 0 < M \leq 1\quad (\because\ M$is positive real value)

55. Ⓑ

Let two numbers be a and b.

$\therefore\ \dfrac{a+b}{2} = A,\ \sqrt{ab} = G$

$G^2 = ab$

$a + b = 2A\quad \Rightarrow\quad b = \dfrac{G^2}{a}$

$\Rightarrow\ a + \dfrac{G^2}{a} = 2A$

$\Rightarrow\ a^2 - 2Aa + G^2 = 0$

$\therefore\ a = \dfrac{2A \pm \sqrt{4A^2 - 4G^2}}{2}$

$= \dfrac{2A \pm 2\sqrt{A^2 - G^2}}{2}$

$= A \pm \sqrt{A^2 - G^2}$

$\therefore$ Numbers are $A \pm \sqrt{A^2 - G^2}$

56. Ⓓ

A line $\perp$ to the line $3x + y = 3$ is $x - 3y = K$.

It passes through (2, 2).

$\therefore\ 2 - 6 = K \Rightarrow K = -4$

$\therefore$ The line is $x - 3y = -4$

$\Rightarrow\ 3y = x + 4$

$\Rightarrow\ y = \frac{1}{3}x + \frac{4}{3}$

$\therefore\ y$ intercept $= \frac{4}{3}$

57. Ⓓ

$(p + 2q)x + (p - 3q)y = p - q$

$\Rightarrow\ p(x + y - 1) + q(2x - 3y + 1) = 0$

$\Rightarrow\ x + y = 1$

and $2x - 3y = -1$

Solving $x = \frac{2}{5},\ y = \frac{3}{5}$

58. Ⓐ

A : $(1 + ax)^n = 1 + 8x + 24x^2 + \ldots$

$\Rightarrow\ 1 + nax + {}^nC_2\, a^2x^2 + \ldots = 1 + 8x + 24x^2 + \ldots$

$\Rightarrow\ na = 8,\ \ {}^nC_2 a^2 = 24$

$\Rightarrow\ \frac{n(n-1)}{1\times 2}a^2 = 24$

$\Rightarrow\ na(na - a) = 48$

$\Rightarrow\ 8(8 - a) = 48$

$\Rightarrow\ 8 - a = 6$

$\Rightarrow\ a = 2$

$\therefore\ n = 4$

$\therefore$ (A) is true

(R) : $(1+x)^n = 1 + nx + \frac{n(n-1)}{2!}x^2 + \ldots \forall n \in Z^+$

(R) is correct explanation of (A) :

59. Ⓐ

(A) : Third term = $ar^2 = 4$

$\therefore$ product of first five terms

$= a(ar)(ar^2)(ar^3)(ar^4)$

$= a^5r^{10} = (ar^2)^5 = (4)^5$

$\therefore$ (A) is true

(R) : Product of first five terms of a G.P. = $a(ar)(ar^2)(ar^3)(ar^4)$ which is true.

(R) is correct explanation of (A).

60. Ⓒ

Rani (2, – 2), Sneha (–1, 0)

$\therefore$ Slope of equation of line formed by Rani and Sneha $= \frac{0+2}{-1-2} = \frac{2}{-3} = -\frac{2}{3}$

61. Ⓐ

Equation of median through Rani is $y-(-2) = \frac{\frac{1}{2}+2}{0-2}(x-2)$

$\Rightarrow y+2 = \frac{5}{-4}(x-2)$

$\Rightarrow -4y - 8 = 5x - 10$

$\Rightarrow 5x + 4y = 2$

62. Ⓒ

Slope of line formed by Mansi and Sneha is $\frac{0-1}{-1-1} = \frac{1}{2}$

$\therefore$ equation of line passing through Rani and parallel to line having slope $\frac{1}{2}$ is

$y+2 = \frac{1}{2}(x-2)$

$\Rightarrow 2y + 4 = x - 2$

$\Rightarrow x - 2y = 6$

63. Ⓒ

When n is odd then two middle terms exist which are $t_{\frac{n-1}{2}+1}$ and $t_{\frac{n+1}{2}+1}$

When n is even then one middle term exists which is $t_{\frac{n}{2}+1}$

$\therefore \frac{n}{2}+1=5 \Rightarrow \frac{n}{2}=4 \Rightarrow n=8$

$\frac{n-1}{2}+1=5 \Rightarrow \frac{n-1}{2}=4 \Rightarrow n=9$

$\frac{n+1}{2}+1=5 \Rightarrow \frac{n+1}{2}=4 \Rightarrow n=7$

64. ©

$a_n = ar^{n-1}$

$\Rightarrow 25(5)^{n-1} = 390625$

$\Rightarrow (5)^{n-1} = 15625 = (5)^6$

$\Rightarrow n - 1 = 6 \Rightarrow n = 7$

65. Ⓐ

Distance between parallel lines $2x + y + 4 = 0$ and $2x + y + 8 = 0$ is $\left|\frac{8}{\sqrt{5}}-\frac{4}{\sqrt{5}}\right|=\frac{4}{\sqrt{5}}$ units.

66. Ⓐ

$a\cos 2x + b\sin 2x$

$=a\left(\frac{1-\tan^2 x}{1+\tan^2 x}\right)+b\left(\frac{2\tan x}{1+\tan^2 x}\right)$

$=\frac{a\left(1-\frac{b^2}{a^2}\right)}{\left(1+\frac{b^2}{a^2}\right)}+\frac{b\left(2\times\frac{b}{a}\right)}{1+\frac{b^2}{a^2}}$

$=\frac{a(a^2-b^2)}{a^2+b^2}+\frac{2ab^2}{a^2+b^2}$

$=\frac{a(a^2-b^2+2b^2)}{a^2+b^2}$

$=\frac{a(a^2+b^2)}{a^2+b^2}=a$

67. Ⓐ

$$y = \frac{x}{1+x^2}$$

$\Rightarrow yx^2 + y = x$

$\Rightarrow yx^2 - x + y = 0$

$\forall x \in R,\ 1 - 4y^2 \geq 0$

$\Rightarrow y^2 - \frac{1}{4} \leq 0$

$\Rightarrow (y+\frac{1}{2})(y-\frac{1}{2}) \leq 0$

$\therefore -\frac{1}{2} \leq y \leq \frac{1}{2}$

68. ⓑ

$x = \sin 1^\circ$

$$\frac{1}{\cos 0^\circ \cos 1^\circ} + \frac{1}{\cos 1^\circ \cos 2^\circ} + \frac{1}{\cos 2^\circ \cos 3^\circ} + \ldots + \frac{1}{\cos 44^\circ \cos 45^\circ}$$

$$= \frac{1}{x}\left[\frac{\sin 1^\circ}{\cos 0^\circ \cos 1^\circ} + \frac{\sin 1^\circ}{\cos 1^\circ \cos 2^\circ} + \frac{\sin 1^\circ}{\cos 2^\circ \cos 3^\circ} + \ldots + \frac{\sin 1^\circ}{\cos 44^\circ \cos 45^\circ}\right]$$

$$= \frac{1}{x}\left[\frac{\sin(1^\circ - 0^\circ)}{\cos 0^\circ \cos 1^\circ} + \frac{\sin(2^\circ - 1^\circ)}{\cos 1^\circ \cos 2^\circ} + \frac{\sin(3^\circ - 2^\circ)}{\cos 2^\circ \cos 3^\circ} + \ldots + \frac{\sin(45^\circ - 44^\circ)}{\cos 44^\circ \cos 45^\circ}\right]$$

$$= \frac{1}{x}\left[\frac{\sin 1^\circ \cos 0^\circ - \cos 1^\circ \sin 0^\circ}{\cos 0^\circ \cos 1^\circ} + \frac{\sin 2^\circ \cos 1^\circ - \cos 2^\circ \sin 1^\circ}{\cos 1^\circ \cos 2^\circ} + \frac{\sin 3^\circ \cos 2^\circ - \cos 3^\circ \sin 2^\circ}{\cos 2^\circ \cos 3^\circ} + \ldots + \frac{\sin 45^\circ \cos 44^\circ - \cos 45^\circ \sin 44^\circ}{\cos 44^\circ \cos 45^\circ}\right]$$

$$= \frac{1}{x}[\tan 1^\circ - \tan 0^\circ + \tan 2^\circ - \tan 1^\circ + \tan 3^\circ - \tan 2^\circ + \ldots + \tan 45^\circ - \tan 44^\circ]$$

$$= \frac{1}{x}[\tan 45^\circ - \tan 0^\circ] = \frac{1}{x}[1] = \frac{1}{x}$$

69. ⓒ

$n(\cup) = 700,\ n(\mathrm{A}) = 200,\ n(\mathrm{B}) = 300$

$n(\mathrm{A} \cap \mathrm{B}) = 100$

$n(\mathrm{A}^C \cap \mathrm{B}^C) = n[(\mathrm{A} \cup \mathrm{B})^C] = n(\cup) - n(\mathrm{A} \cup \mathrm{B})$

$= 700 - 400 = 300$

$n(A \cup B) = n(A) + n(B) - n(A \cap B)$

$= 200 + 300 - 100$

$= 400$

70. Ⓓ

$$\frac{\sin 13^\circ \cos 47^\circ + \cos 13^\circ \sin 47^\circ}{\cos 72^\circ \cos 12^\circ + \sin 72^\circ \sin 12^\circ}$$

$$= \frac{\sin 60^\circ}{\cos 60^\circ} = \tan 60^\circ = \sqrt{3}$$

71. Ⓑ

$$\left(3x - \frac{1}{x^2}\right)^{10}$$

5th term from the end

= 7th term from the beginning

$$= {}^{10}C_6 (3x)^4 \left(-\frac{1}{x^2}\right)^6$$

$$= \frac{10 \times 9 \times 8 \times 7}{1 \times 2 \times 3 \times 4} \times 3^4 \times x^4 \times \frac{1}{x^{12}}$$

$$= \frac{17010}{x^8}$$

72. Ⓐ

Let two numbers be a and b.

$$\therefore A = \frac{a+b}{2}$$

$$S = \frac{n}{2}[(a+d)+(b-d)] = \frac{n}{2}(a+b) = nA$$

$$\therefore \frac{S}{A} = n$$

73. Ⓑ

$$9^{\frac{1}{3}} \times 9^{\frac{1}{9}} \times 9^{\frac{1}{27}} \times \ldots\ldots \propto$$

$$= 9^{\frac{1}{3}+(\frac{1}{3})^2+(\frac{1}{3})^3+\ldots\ldots\propto} = (9)^{\frac{\frac{1}{3}}{1-\frac{1}{3}}} = (9)^{\frac{1}{2}} = 3$$

74. Ⓓ

$2x+3=0 \Rightarrow x=-\frac{3}{2}$ which is parallel to y-axis

$3y=5 \Rightarrow y=\frac{5}{3}$ which is parallel to x-axis.

$\therefore$ Angle between them = 90°

75. Ⓒ

$\frac{x}{a}+\frac{y}{b}=1;\ \frac{x}{b}+\frac{y}{a}=1$

$= bx + ay = ab\ ;\ ax + by = ab$

$$\begin{array}{l} abx + a^2y = a^2b \\ abx + b^2y = ab^2 \\ (-)\quad (-)\quad (-) \\ \hline (a^2-b^2)y = ab(a-b) \end{array}$$

$\Rightarrow\ y = \frac{ab}{a+b}$

$\therefore\ bx = ab - a\times\frac{ab}{a+b} = ab\left(1-\frac{a}{a+b}\right)$

$= \frac{ab^2}{a+b}$

$\Rightarrow\ x = \frac{ab}{a+b}$

$\therefore$ Point of intersection $\left(\frac{ab}{a+b}, \frac{ab}{a+b}\right)$

Now, $\left(\frac{ab}{a+b}, \frac{ab}{a+b}\right)$ satisfy the equation $\frac{x}{c}+\frac{y}{d}=1$

$\Rightarrow\ \frac{ab}{c(a+b)}+\frac{ab}{d(a+b)}=1$

$\Rightarrow\ \frac{1}{c}+\frac{1}{d}=\frac{a+b}{ab}$

$\Rightarrow\ \frac{1}{c}+\frac{1}{d}=\frac{1}{b}+\frac{1}{a}$

Biology

76. Ⓓ

A lipid bilayer with proteins of two types, embedded (intrinsic) and superficial (extrinsic).

77. Ⓒ

Mature RBCs

Presence of mitrochondria would use up a part of oxygen carried for respiration. Hence lesser amount of oxygen would reach the cells.

78. Ⓑ

Cell division

To form the cell plate during cytokinesis

79. Ⓒ

Glycine

80. Ⓓ

Zymase

81. Ⓐ

No change

Only DNA doubles during S phase

82. Ⓑ

Leptotene, Zygotene, Pachytene, Dipotene, Diakinesis

83. Ⓐ

Both A and R are true and R is the correct explanation of A

The position of the centromere decides the length of the arms of the chromosomes

84. Ⓓ

A is false but R is true

Cellulose is a monomeric polysaccharide

85. Ⓓ

A is false but R is true

Nuclear membrane reappears during metaphase

86. Ⓑ

SER

87. Ⓑ

Golgi body

88. Ⓑ

Trans face of Golgi body

Releasing end of Golgi body

89. Ⓐ

Acidic pH

Hydrolytic enzymes

90. Ⓓ

Vacuoles

91. Ⓓ

All of the above

92. Ⓓ

Earthworm

Respiration occurs through skin

93. Ⓑ

Balanoglossus

94. Ⓒ

Ingestion

95. Ⓑ

Indigofera

96. Ⓓ

97. Ⓓ

A is false but R is true

Starch is a sugar

98. Ⓑ

S

99. Ⓑ

During cytokinesis

Cleavage furrow deepens to separate the two daughter cells

100. Ⓐ

Prophase I to Metaphase I