22/03/2026

Code_C

***Corporate Office :*** AESL, 3rd Floor, Incuspaze Campus-2, Plot No. 13, Sector-18, Udyog Vihar, Gurugram, Haryana - 122015, ***Ph.***+91-1244168300

**MM : 180**

AIATS For Two Year JEE(Advanced)-2027 (XI Studying-P1)_Test-4A_Paper-1_Online

**Time : 180 Min.**

## PHYSICS

### Section-I

**1.** (D)

**2.** (C)

**3.** (B)

**4.** (D)

### Section-II

**5.** (A,C,D)

**6.** (A,C)

**7.** (B,C)

### Section-III

**8.** (04.00)

**9.** (75.00)

**10.** (02.00)

**11.** (00.40)

**12.** (00.20)

**13.** (31.00)

### Section-IV

**14.** (B)

**15.** (D)

**16.** (C)

## CHEMISTRY

### Section-I

**17.** (B)

**18.** (C)

**19.** (C)

**20.** (C)

### Section-II

**21.** (A,B)

**22.** (A,B,C)

**23.** (A,D)

### Section-III

**24.** (30.60)

**25.** (04.00)

**26.** (08.62)

**27.** (02.00)

**28.** (36.80)

**29.** (05.10)

### Section-IV

**30.** (B)

**31.** (A)

**32.** (D)

## MATHEMATICS

### Section-I

**33.** (A)

**34.** (A)

**35.** (C)

**36.** (D)



### Section-II

**37.** (B,C)

**38.** (A,C)

**39.** (A,C,D)

### Section-III

**40.** (05.88)

**41.** (06.00)

**42.** (08.00)

**43.** (03.00)

**44.** (10.00)

**45.** (04.00)

### Section-IV

**46.** (D)

**47.** (A)

**48.** (B)

## Hints and Solutions

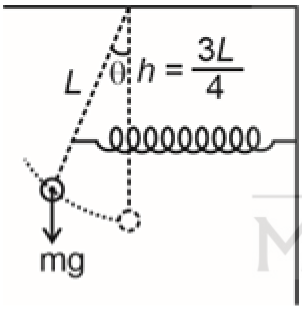
## PHYSICS

### Section-I

**(1)** **Answer :** (D)
**Hint:**
$v^2 = u^2 + 2ab$
**Solution:**
$a = \frac{2S}{t^2} = 1.5\ \mathrm{m/s^2} \quad V_{avg} = \frac{3}{2} = 1.5\ \ \mathrm{m/s^2}$
$V_{max} = (1.5)2 = 3\ \mathrm{m/s}$ in $2\,\mathrm{sec.}$
So absolute value of acceleration is at most $1.5\ \mathrm{m/s^2}$ i.e $\frac{3}{20}$times of gravitational acceleration. so co-efficient of friction
$\mu \leq \frac{3}{20}$

**(2)** **Answer :** (C)
**Hint:**
$\frac{dx}{dt} = v$
**Solution:**
$v = \alpha\mathrm{x} + \beta\,,\ \ \beta \leq \frac{\alpha}{2}$
$\frac{dx}{dt} = \alpha\mathrm{x} + \beta\,,\ \int \frac{dx}{\alpha\mathrm{x}+\beta} = \int dt$
$x = \frac{\beta}{\alpha}\left(e^{\alpha t} - 1\right)$

**(3)** **Answer :** (B)
**Hint:**
$\tau = I\alpha$
**Solution:**

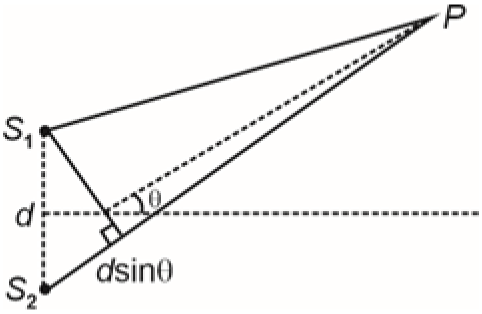



$\tau = -[\mathrm{mg}(\mathrm{L}\sin\theta) + K(\mathrm{h}\tan\theta)h]$
for small angle $\sin\theta \approx \theta$
$\tau = -\left(\mathrm{mgL} + \mathrm{Kh}^2\right)\theta = \left(\mathrm{mL}^2\right)\alpha$
$\omega^2 = \frac{g}{L} + \frac{9K}{16m}$
$\omega = \sqrt{\frac{g}{L} + \frac{9K}{16m}}$

**(4)** **Answer :** (D)
**Hint:**
$B = -\frac{\Delta P}{\left(\frac{\Delta V}{V}\right)}$
**Solution:**
$\Delta V = V_0(3\alpha)\,\Delta T$
$\Delta P = B\left(\frac{\Delta V}{V}\right) = 3\alpha B\,\Delta T$
$= 5.28 \times 10^8\ \mathrm{Pa}\,.$

### Section-II

**(5)** **Answer :** (A,C,D)
**Hint:**
$\Delta x = d\sin\theta$
**Solution:**




For 1st
$\Delta x=\lambda=d\sin\theta_1$
For 2nd
$\Delta x=2\lambda=d\sin\theta_2$
$\lambda=d(\sin\theta_2-\sin\theta_1)$
$=2(0.05)=0.1\text{ m}$
$f=\frac{340}{0.1}=3400\text{ m}$
For smallest angle, destructive interference
$\Delta x=d\ \sin\ \theta=\frac{\lambda}{2}$
$\theta=\sin^{-1}\left(\frac{\lambda}{2d}\right)$
$\theta=\sin^{-1}\left(\frac{1}{40}\right)$

**(6)** **Answer :** (A,C)
**Hint:**
$PV^r$ = const.
$W=\frac{P_1V_1-P_2V_2}{r-1}$
**Solution:**
$W_{AB}=\frac{P_1V_1-P_i\left(\frac{V_1}{V_2}\right)^{\gamma}V_2}{\left(\frac{2}{3}\right)}$
$W_{BC}=0$
$W_{net}=-\frac{3}{2}P_0V_0\left[\left(\frac{V_0}{V}\right)^{\frac{2}{3}}-1\right]$
$\Delta Q_{AB}=0$
$U_{AB}=-W_{AB}=\frac{3}{2}P_0V_0\left[\left(\frac{V_0}{V}\right)^{\frac{2}{3}}-1\right]$
$\Delta W_{BC}=0$
$\Delta U_{BC}=Q_{BC}=Q$
$U=\frac{3}{2}P_0V_0\left[\left(\frac{V_0}{V}\right)^{\frac{2}{3}}-1\right]+Q$
$\Delta U=nC_V\,\Delta T$
$\Delta U=nC_V\Delta T=2\left(\frac{R}{p-1}\right)\left(T_e-T_A\right)$
$T_e=\frac{Q}{3R}+\frac{P_0V_0}{2R}\left(\frac{V_0}{V}\right)^{\frac{2}{3}}$

**(7)** **Answer :** (B,C)
**Hint:**
$T_{max}$ at θ = 45°
**Solution:**
$\lambda Rg\int_0^{\pi/2}\cos\theta\cdot d\theta=\mu\lambda Rg\int_0^{\pi/2}\sin\theta\cdot d\theta$
$\mu=1$
At the position of maximum tension in the rope
$(\lambda Rd\theta)\cos\theta=\mu\left(\lambda Rd\theta\cdot\sin\theta\right)$
$\theta=45^\circ$
At any angle $\theta$
$dT=\lambda Rd\theta\cos\theta-(\mu\lambda R\cdot d\theta)g\sin\theta$

$\int_0^{T_{\max}} dT = \lambda Rg \int_0^{\pi/4} \left(\cos\theta - \sin\theta\right) d\theta$

$T_{\max} = \lambda Rg\left(\sqrt{2} - 1\right) = 4.1\ N$

## Section-III

**(8)** **Answer :** 04.00
**Hint:**
Equivalent thermal conductivity
**Solution:**

$H = -K\left(2\pi rl\right)\frac{dT}{dr}$

$\int_{R_1}^{R_2} \frac{H.dr}{2\pi rl} = -K\int_{T_1}^{T_2} dT$

$H_1 = H_2$

$n = 4$

**(9)** **Answer :** 75.00
**Hint:**
$W = \int F dy$
**Solution:**
Work done by all forces $= 0$

$\int_0^h mg\left(1 - 0.4y\right).dy = 0$

$mg\int_0^h \left(1 - 0.4y\right).dy = 0$

$mg\left(h - 0.2h^2\right) = 0$

$h = 5m$

work done by $F \Rightarrow W = \int_0^{\frac{h}{2}} F.dy = \frac{15mg}{4}$

= 75 J

**(10)** **Answer :** 02.00
**Hint:**
F. B. D.
**Solution:**

$N_2 \cos\theta_2 = mg$

$N_2 \sin\theta_2 = N_1$

$\tan\theta_2 = \frac{N_1}{mg}$

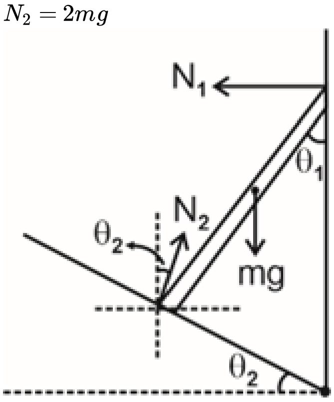
$l\ N_1 \cos\theta_1 = \frac{l}{2} mg \sin\theta_1$

$\tan\theta_1 = \frac{2N_1}{mg}$

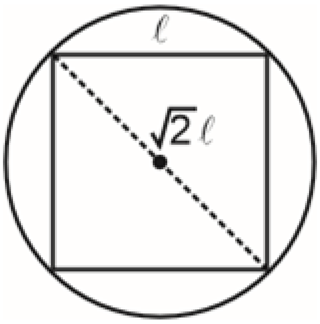
$\tan\theta_1 = 2\tan\theta_2 = 2\sqrt{3}$

$N_1 = \sqrt{3}mg$

$N_2 = 2mg$




**(11)** **Answer :** 00.40
**Hint:**
*I*α = *fR*
**Solution:**




M.I of each rod about centre of ring

$I=\frac{2mr^2}{3}$

$I_{net}=\frac{8mr^2}{3}$

Now, $4ma=4mg\ \sin\theta-f$ ...(i)

$fR=I\alpha$

$f=\frac{Ia}{R^2},\ f=\frac{8ma}{3}$ ...(ii)

From (i) and (ii)

$a=\frac{12g}{20\sqrt{2}},\ f=\frac{8mg}{5\sqrt{2}}$

$f\le\mu N$

$\mu\ge\frac{2}{5}$

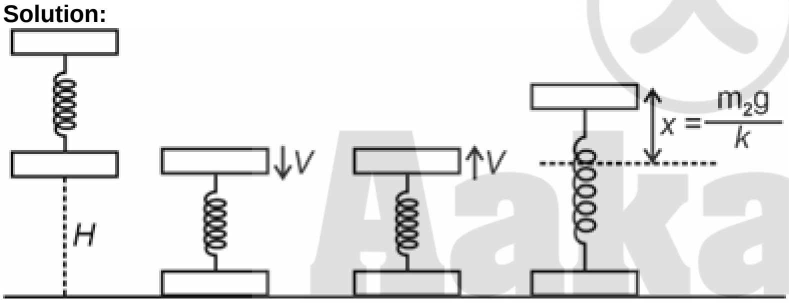
$\mu_{\min}=0.4$

**(12)** **Answer :** 00.20

**Hint:**

Conservation of energy

**Solution:**




$\frac{1}{2}m_1V^2=m_1gx+\frac{1}{2}Kx^2\ ,\ V^2=2gH$

and for the block $M_2$ to just lift off

$x=\frac{m_2g}{K}$

$m_1gH=m_1g\left(\frac{m_2g}{K}\right)+\frac{1}{2}K\left(\frac{m_2g}{K}\right)^2$

$H=\frac{m_2g}{K}\left(\frac{2m_1+m_2}{2m_1}\right)$

*H* = 0.20 m

**(13)** **Answer :** 31.00

**Hint:**

$W=\int Fdx$

**Solution:**

$\pi r^2l\rho g=\pi r^2l_{in}\rho_\omega g$

$l_{in}=\left(\frac{\rho}{\rho_\omega}\right)l=\frac{225}{1000}\times40=9$ cm

net displacement = 40 – 9 = 31 cm

$F_{net}=kx+\pi r^2\rho gx$

$W=\int f_{net}dx=\int_0^{.31}\left(kx+\pi r^2\rho gx\right)dx$

$W=\left(\frac{\pi+5}{200}\right)(31)^2$

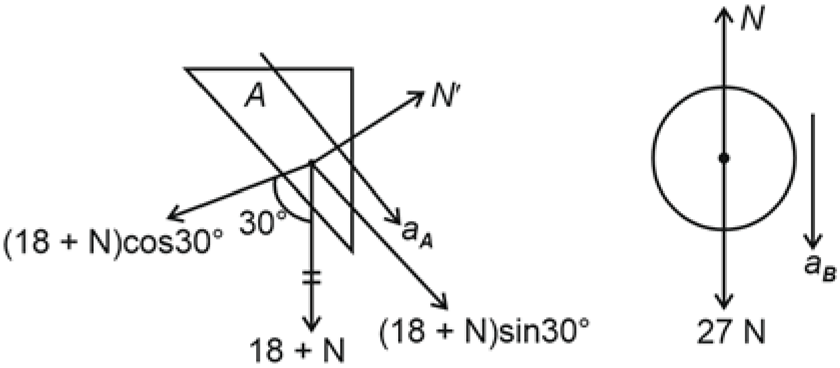
**Section-IV**

**(14)** **Answer :** (B)

**Hint:**

Draw F. B. D and analysis the motion

**Solution:**




$(18+N)\times\frac{1}{2}=1.8\ a_A$

$18+N=3.6\ a_A$ ...(i)

$27-N=2.7\ a_B$ ...(ii)

From constraint relation $a_A = 2a_B$ ...(iii)

From equation (i), (ii) & (iii)

$a_B = 4.545$ m/s$^2$

$a_A = 9.09$ m/s$^2$

$N = 14.72$ N

**(15) Answer :** (D)

**Hint:**

Apply conservation of volume and work energy theorem

**Solution:**

Let cross sectional area of cube $=A=a^2$

then cross sectional area of vessel $=2A=2a^2$

height of a cube $=a=h$

$k.\frac{h}{4}=mg,\ K=4\rho gA$

when liquid is filled and spring is relaxed

$2\rho gxA=\rho ghA,\ x=\frac{h}{2}$(inside liquid)

As external force pushes the block in the liquid, liquid also rises from remaining area

Remaining area $=2A-A=A$

$A_1x_1=A_2x_2,\ x_1=x_2$

$x_1+x_2=\frac{h}{2},\ x_1=x_2=\frac{h}{4}$

displacement of block $x_1=\frac{h}{4}$

$W_{mg}=\rho ghA\left(\frac{h}{4}\right)=\frac{\rho gh^2A}{4}=\frac{\rho ga^4}{4}$

$W_{spring}=-\frac{1}{2}kx^2=-\frac{\rho gAh^2}{8}=-\frac{\rho ga^4}{8}$

When block displaced by $x$, it gets submerged by 2x in liquid

$W_{upthrust}=-\int_0^{\frac{h}{4}}2\rho A\left(\frac{h}{2}+2x\right)g.dx=-\frac{3}{8}\rho gAh^2=-\frac{3\rho ga^4}{8}$

$W_{mg}+W_{spring}+W_{upthrust}\neq W_{ext}=\Delta K=0$

$W_{ext}=\frac{\rho gA^2}{4}=\frac{\rho ga^4}{4}$

**(16) Answer :** (C)

**Hint:**

$v=\sqrt{\frac{T}{u}}$

**Solution:**

$4\left(\frac{\lambda}{2}\right)=2$

$\lambda=1\ m$

$v=\sqrt{\frac{T}{\mu}}=\sqrt{\frac{T}{\rho s}}$

$\frac{T}{s}=y\left(\frac{\Delta l}{l}\right)$

V = 400 m/s

$f = \frac{v}{\lambda} = 400$ Hz

$y = A\sin(Kx)\cos(\omega t)$

$A = 3\ mm,\ K = \frac{2\pi}{\lambda}$ and $\omega = 2\pi f$

$y = (3\,mm)\sin(2\pi x)\cos(800\ \pi t)$

$x = \frac{\partial y}{\partial t} = -\omega A\sin\left(Kx\right)\sin\left(\omega t\right)$

$dK = \frac{1}{2}\left(\mu dx\right)v^2 = \frac{1}{2}\left(\frac{m}{l}\right)v^2 - dx$

$K.E. = K = \frac{1}{2}\left(\frac{m}{l}\right)(\omega A)^2\int_0^l \sin^2 Kx \cdot dx$

$K = \frac{1}{4}m\omega^2 A^2$

= 1.44 J

= 1440 mJ

## CHEMISTRY

### Section-I

**(17) Answer :** (B)

**Solution:**

Since Beaker $X$ contains temporary hardness, it will get removed on heating & white precipitate of $CaCO_3$ will be observed

$Ca(HCO_3)_2 \xrightarrow{\Delta} CaCO_3\downarrow + CO_2 + H_2O$

Beaker $y$ has permanent hardness

**(18) Answer :** (C)

**Solution:**

| | $NH_3$ | + | $HCl$ | $\rightleftharpoons$ | $NH_4^+$ | + | $H_2O$ |
|---|---|---|---|---|---|---|---|
| $(moles)_i$ | 0.01 | | 0.01 | | | | |
| $(moles)_f$ | 0 | | 0 | | 0.01 | | |

After adding NaOH

| | $NH_4^+$ | + | $OH^-$ | $\rightleftharpoons$ | $NH_3$ | + | $H_2O$ |
|---|---|---|---|---|---|---|---|
| $(moles)_i$ | 0.01 | | 0.01 | | | | |
| $(moles)_f$ | 0 | | 0 | | 0.01 | | |

$[NH_3]_f = \frac{0.01}{0.2} = 5\times10^{-2}$

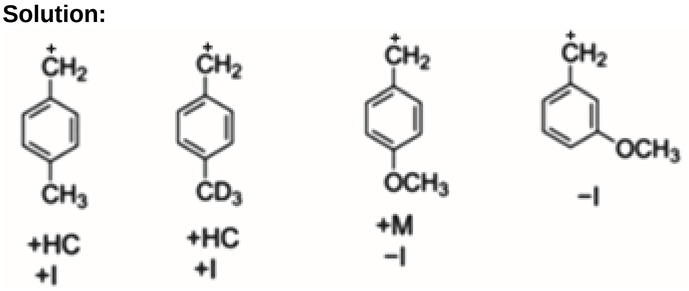
$pOH = -\log\sqrt{5\times10^{-2}\times1.8\times10^{-5}} = -\frac{1}{2}\log 9\times10^{-7}$

pOH ≈ 3

pH ≈ 11

**(19) Answer :** (C)

**Solution:**




$(+HC)_H > (+HC)_D$

Stability order III > I > II > IV

**(20) Answer :** (C)

**Solution:**

$Fe^{2+} + Mn\,O_4^- \rightarrow Fe^{3+} + Mn^{2+}$

Meq of $Fe^{2+}$ = meq $KMnO_4$

$\frac{0.25}{152+18x} \times 1000 \times 1 = 0.02 \times 9 \times 5$

x ≈ 7

**Section-II**

**(21)** **Answer :** (A,B)

**Solution:**

Chemical smog is a mixture of smog, fog and sulphur dioxide

Ozone, nitric oxide and acrolein are components of photochemical smog

**(22)** **Answer :** (A,B,C)

**Solution:**

For $D_2O$ melting point, Boiling point & magnitude of $\Delta H_f$ is higher compared to $H_2O$

**(23)** **Answer :** (A,D)

**Solution:**

$\Delta \mathrm{H}_{\mathrm{T}_2} = (\Delta \mathrm{C_P})_{\mathrm{r}}(\mathrm{T}_2 - \mathrm{T}_1) + \Delta \mathrm{H}_{\mathrm{T}_1}$

$\Delta \mathrm{H}_{500} = \frac{10(500-300)}{1000} - 40$

= – 38 kJ/mole

$\Delta \mathrm{H}_{400} = \frac{10(400-300)}{1000} - 40$

= – 39 kJ/mole

**Section-III**

**(24)** **Answer :** 30.60

**Solution:**

$v_n = 2.2 \times 10^6 \times \frac{Z}{n}$

$1.65 \times 10^6 = 2.2 \times 10^6 \times \frac{Z}{4}$

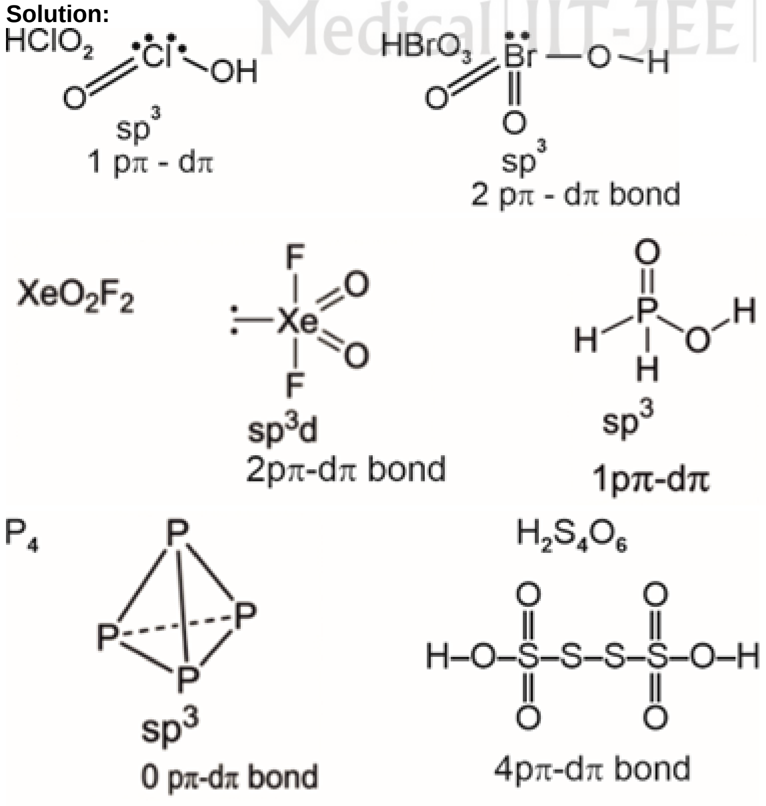
$3 = Z$

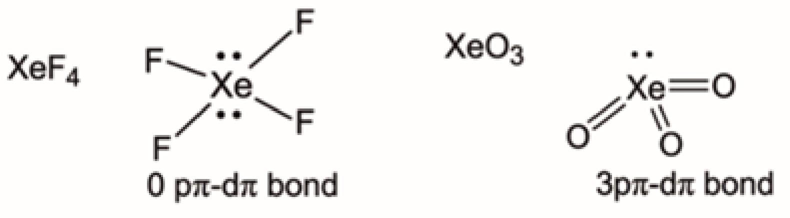
$E_n = 13.6 \frac{Z^2}{n^2} = 13.6 \times \frac{3^2}{2^2}$

$= 30.6\ eV$

**(25)** **Answer :** 04.00

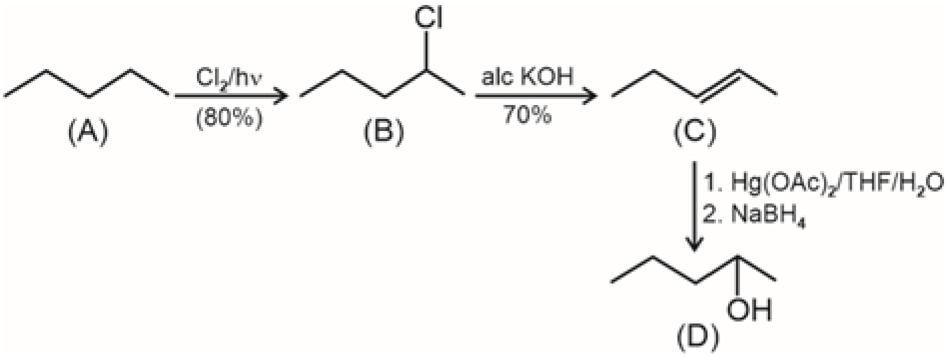
**Solution:**






**(26) Answer :** 08.62

**Solution:**




moles of pentane = $\frac{25.2}{72}$= $0.35$

mass of 3-pentanol formed = $0.35 \times 0.8 \times 0.7 \times 0.5 \times 88$

= $8.624$ g

**(27) Answer :** 02.00

**Solution:**

$\Delta G^{\circ} = -\mathrm{RTlnKeq}$

$-3.5 \times 10^{3} = 8.3 \times 300\ \mathrm{lnKeq}$

$1.4 = \mathrm{lnKeq}$

$4 = \mathrm{Keq}$

| | $2\,\mathrm{HI(g)}$ | $\rightleftharpoons$ | $\mathrm{I_2(g)}$ | + | $\mathrm{H_2(g)}$ |
|---|---|---|---|---|---|
| $\mathrm{t = 0}$ | 5 | | | | |
| $\mathrm{t = t_{eq}}$ | $5 - 2\mathrm{x}$ | | x | | x |

$\mathrm{K_P} = \frac{\mathrm{P_{H_2} P_{I_2}}}{(\mathrm{P_{HI}})^2}$

$4 = \frac{\mathrm{x}^2}{(5-2\mathrm{x})^2}$

$2 = \frac{x}{5-2x}$

$10 - 4x = x$

$2 = x$

**(28) Answer :** 36.80

**Solution:**

Each molecule of orthoboric acid will require

2 molecule of glycerol.

mass of glycerol required for $12.36$ g $\mathrm{H_3BO_3}$

$= 2 \times \frac{12.36}{61.8} \times 92$

$= 36.8$ g

**(29) Answer :** 05.10

**Solution:**

$\mathrm{Al_2O_3}$ in original sample $= \frac{6.12}{102} \times \frac{100}{75} \times \frac{100}{80} \times \frac{2}{2} \times 102$

= 10.2 g

% purity $= \frac{10.2 \times 100}{200}$

$= 5.1\%$

**Section-IV**

**(30) Answer :** (B)

**Solution:**
(P) Electron density on Benzene ring ∝ + HC > + I
(Q) Stability of enol decreases as extent of cross conjugation increases
(R) Stability of carbocation ∝ +HC > + z
(S) Stability of carbanion increases due to back bonding followed by extent of – I

**(31)** **Answer :** (A)
**Solution:**

| | | % | Moles | Moles ratio |
|---|---|---|---|---|
| (P) | C | 73 | 6.08 | 6 |
| | H | 11.5 | 11.5 | 12 |
| | O | 15.5 | 0.96 | 1 |

| | | % | Moles | Moles ratio |
|---|---|---|---|---|
| (Q) | C | 39% | 3.25 | 3 |
| | H | 8.6% | 8.6 | 8 |
| | O | 52.4% | 3.27 | 3 |

| | | % | Moles | Moles ratio |
|---|---|---|---|---|
| (R) | C | 54.5% | 4.54 | 4 |
| | H | 9% | 9 | 8 |
| | O | 36.5 | 2.28 | 2 |

| | | % | Moles | Moles ratio |
|---|---|---|---|---|
| (S) | C | 58.8 | 4.9 | 5 |
| | H | 9.8 | 9.8 | 10 |
| | O | 31.4 | 1.96 | 2 |

**(32)** **Answer :** (D)
**Solution:**
Charles law, $\frac{V}{T}$ = constant
Boyle's Law, PV = constant
Gay-Lussac's Law, $\frac{P}{T}=\frac{nR}{V}$
$PT=\frac{nRT^2}{V}$
$y = x^2$
Avogadro's Law, $\frac{V}{n}$= constant



**MATHEMATICS**

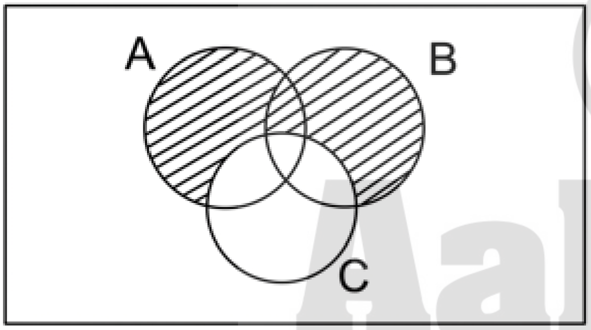
**Section-I**

**(33)** **Answer :** (A)
**Solution:**
$y^2=12x+2y+23$
$y^2-2y+1=12(x+2)$
$(y-1)^2=12(x+2)$
Vertex: $(-2,1)$
$a=3$
Focus: $(1,1)$
Let equation of focal chord of the Parabola is $\frac{x}{p}+\frac{y}{q}=1$
$\Rightarrow \frac{x}{p}+\frac{y}{2}=1$
It passes through focus.
$\frac{1}{p}+\frac{1}{2}=1$
$\Rightarrow p=2$
Equation of focal chord is:
$x+y=2\,,\ m=-1\Rightarrow\theta=\frac{3\pi}{4}$

Length of focal chord : $4a\text{cosec}^2\theta$
$= 4 \times 3 \times \cos ec^2 \left(\frac{3\pi}{4}\right)$
= 12 × 2
= 24

**(34) Answer :** (A)
**Solution:**
$3x - 2y = 6\alpha$
$3\alpha x + 2\alpha y = 6$
$3x + 2y = \frac{6}{\alpha}$
$9x^2 - 4y^2 = 36$
$\frac{x^2}{4} - \frac{y^2}{9} = 1$
Tangent to S,
$y = mx \pm \sqrt{4m^2 - 9}$
$m = \frac{5}{2}$
$\Rightarrow y = \frac{5x}{2} \pm \sqrt{16} = \frac{5x}{2} + 4$

**(35) Answer :** (C)
**Solution:**
Let $n(A)$= number of $3$-digit numbers that are divisible by $3$.
$n(B)$= number of $3$-digit numbers that are divisible by $5$.
$n(C)$= number of $3$-digit numbers that are divisible by $11$.




$n(A) = 300$, $n(B) = 180$, $n(C) = 81$,
$n(A \cap B) = 60$, $n(B \cap C) = 17$, $n(A \cap C) = 27$,
$n(A \cap B \cap C) = 6$ .
Required $\text{number} = 300 + 180 - 60 - 17 - 27 + 6 = 382$

**(36) Answer :** (D)
**Solution:**
$(2x+1)^2 + (3y+3)^2 = P + 10$
$\frac{\left(x+\frac{1}{2}\right)^2}{\frac{P+10}{4}} + \frac{(y+1)^2}{\frac{P+10}{9}} = 1$
$\frac{2B^2}{A^2} = 4$
$\Rightarrow 2\left(\frac{P+10}{9}\right) = \frac{4}{2}\sqrt{P+10}$
$\Rightarrow P = 71$
$\Rightarrow a = 2.\frac{9}{2} = 9$
$b = 6$
$\Rightarrow a + b = 15$

**Section-II**

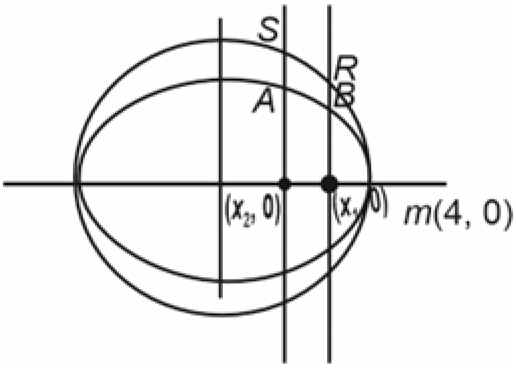
**(37) Answer :** (B,C)
**Hint:**
$\text{C.V.} = \frac{\sigma}{\bar{x}} \times 100$
**Solution:**
$\sum_{i=1}^{6} x_i = 36 \Rightarrow$ Mean $= 6 = \mu_A$

$\sigma_A = \sqrt{\frac{244}{6} - \left(6\right)^2} = 2.16$

$\sum_{j=1}^{5} x_j = 25 \Rightarrow$ Mean $= 5 = \bar{x}_B$

$\sigma_B = \sqrt{\frac{175}{5} - 25} = \sqrt{10}$

**(38) Answer :** (A,C)
**Solution:**




$R\ :\ \left(4\cos\frac{\pi}{6},\ 4\sin\frac{\pi}{6}\right):\ \left(\frac{4\sqrt{3}}{2},\ 2\right)$

$S\ :\ \left(4\cos\frac{\pi}{4},\ 4\sin\frac{\pi}{4}\right):\ \left(\frac{4}{\sqrt{2}},\ \frac{4}{\sqrt{2}}\right)$

B : $\left(\frac{4\sqrt{3}}{2},\ \frac{3}{2}\right)$, A : $\left(\frac{4}{\sqrt{2}},\ \frac{3}{\sqrt{2}}\right)$

Line joining $A$ & $B$ : $y - \frac{3}{2} = \frac{\frac{3}{\sqrt{2}} - \frac{3}{2}}{\frac{4}{\sqrt{2}} - \frac{4\sqrt{3}}{2}}\left(x - \frac{4\sqrt{3}}{2}\right)$

$\frac{|N_2B|}{|N_2S|} = \frac{\frac{3}{\sqrt{2}}}{\frac{4}{\sqrt{2}}} = \frac{3}{4}$

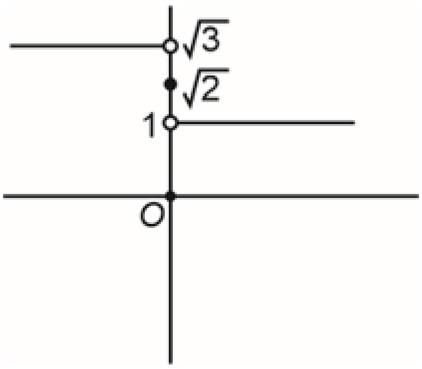
$\Rightarrow\ 4|N_2B| = 3|N_2S|$

$\frac{|N_1P|}{|N_1R|} = \frac{\frac{3}{2}}{2} = \frac{3}{4}$

$\Rightarrow\ 4\,|N_1P| = 3\,|N_1R|$

**(39) Answer :** (A,C,D)
**Solution:**

$\operatorname{sgn}\left(x\right) = \begin{cases} 1, & x > 0 \\ 0, & x = 0 \\ -1, & x < 0 \end{cases}$




$x > 0 \Rightarrow f(x) = \sqrt{2-1} = 1$

$x = 0 \Rightarrow f\left(x\right) = \sqrt{2-0} = \sqrt{2}$

$x < 0 \Rightarrow f\left(x\right) = \sqrt{2-(-1)} = \sqrt{3}$

## Section-III

**(40) Answer :** 05.88
**Solution:**

Multiply & divide by $7^x$

$\lim\limits_{x\to 2} \frac{7^{2x}-56\cdot 7^x+343}{7^{x/2}-7}$

$\lim\limits_{x\to 2} \frac{(7^x-49)(7^x-7)}{\left(7^{x/2}-7\right)}$

$\lim\limits_{x\to 2} \frac{\left(7^{x/2}-7\right)\left(7^{x/2}+7\right)\left(7^x-7\right)}{(7^{x/2}-7)}$

$=(7+7)\left(7^2-7\right)$

$=14\cdot 42$

$=588$

**(41)** **Answer :** 06.00

**Solution:**

$n(X)=78$

$n(Y)=59$

$(AP)_x \to 3,6,9,12,\ldots$

Last term $=234$

$(AP)_y \to 5,9,13,17,\ldots$

Last term $=237$

$d=\gcd(d_x,d_y)=12$

Last term $\Rightarrow n<\frac{225}{12}+1$

$n=19$

So number of terms in $X\cup Y=78+59-19$

$=118$

$\Rightarrow \frac{K+2}{20}=6$

**(42)** **Answer :** 08.00

**Solution:**

$\left(1+x^3\right)^3=1+3x^3+3x^6+x^9$

$\left(1+x^3\right)^3(1+x)^n=\left(1+3x^3+3x^6+x^9\right)\left({}^nC_0+{}^nC_1x+{}^nC_2x^2+\ldots\right)$

$a_0=1$

$a_1=n$

$a_2={}^nC_2$

$a_3={}^nC_3+3\,.\,{}^nC_0$

$2+\left({}^nC_3+3\,.\,{}^nC_0\right)=n+{}^nC_2$

$\Rightarrow n=3,5$

**(43)** **Answer :** 03.00

**Solution:**

$\frac{-6}{\sqrt{21}\sqrt{54}}+\frac{4a}{\sqrt{21}\sqrt{54}}+\left(\frac{-6}{\sqrt{21}\sqrt{54}}\right)=0 \Rightarrow 4a=12\Rightarrow a=3$

**(44)** **Answer :** 10.00

**Solution:**

We have numbers as $7,6,4,11,7$

We write it in increasing order $4,6,7,7,11$

Clearly, Mean = Median = Mode = $7$

After adding $a,b,c,d,$

New mean, mode, median will be $9$.

We have old mode $7$ which repeats itself for 2 times.

If 9 is the new mode then it has to repeat at least for 3 times. Median is also $9$.

So we have 4, 6, 7, 7, 9, 9, 9, 11, *d*

Now mean is also 9, so

$\frac{4+6+7+7+9+9+9+11+d}{9}=9$

⇒ 62 + *d* = 81

⇒ *d* = 19

*a* = *b* = *c* = 9, *d* = 19

*d* – *c* = 19 – 9 = 10

**(45)** **Answer :** 04.00

**Solution:**

As we know, $z\bar{z}=|z|^2$

Equation can be written as:

$12z\bar{z}=2(z+2)(\bar{z}+2)+\left(z^2+1\right)\left(\bar{z}^2+1\right)+31$

$\Rightarrow -12z\bar{z}+2z\bar{z}+4(z+\bar{z})+8+z^2\bar{z}^2 \quad +(z^2+\bar{z}^2)+32=0$
$\Rightarrow (z^2+2z\bar{z}+\bar{z}^2)+4(z+\bar{z})+4 \quad +(z^2\bar{z}^2-12z\bar{z}+36)=0$
$\Rightarrow (z+\bar{z}+2)^2+(z\bar{z}-6)^2=0 \quad \Rightarrow z+\bar{z}+2=0 \Rightarrow z+\bar{z}=-2$
& $z\bar{z}-6=0$
$-2(z+\bar{z})=4$

## Section-IV

**(46) Answer :** (D)
**Solution:**
$\sin x-\cos x=1$
$\cos\left(\frac{\pi}{4}+x\right)=-\frac{1}{\sqrt{2}}$
$\Rightarrow x=-\frac{3\pi}{2},-\pi,\frac{\pi}{2},\pi$
II $\tan 3x=\sqrt{3}$
$3x=n\pi+\frac{\pi}{3}$
$x=\frac{-8\pi}{9},\ \frac{-5\pi}{9},\ \frac{-2\pi}{9},\ \frac{\pi}{9},\ \frac{4\pi}{9},\ \frac{7\pi}{9}$
III sin$x$ + cos$x$ = 1
$\cos\left(x-\frac{\pi}{4}\right)=\frac{1}{\sqrt{2}}$
$x-\frac{\pi}{4}=2n\pi\pm\frac{\pi}{4}$
$x=0,\ \frac{\pi}{2},\ 2\pi$
IV $\cos 2x=\frac{1}{2}$
$2x=2n\pi\pm\frac{\pi}{3}$
$x=\frac{\pi}{6},\ \frac{5\pi}{6}$

**(47) Answer :** (A)
**Solution:**
$2g_1g_2+2f_1f_2=2g_2g_3+2f_2f_3=2g_3g_1+2f_3f_1=0$
(centroid $(h,k)$
$h=-\frac{(g_1/2+g_2/2+g_3/2)}{3}$
$K=-\frac{(f_1/2+f_2/2+f_3/2)}{3}$
$(6h)^2+(6k)^2=m+n$
(1) $m+n=1\Rightarrow r=1/6$
(2) $m+n=4\Rightarrow r=1/3$
(3) $m+n=9\Rightarrow r=1/2$
(4) $m+n=36\Rightarrow r=1$

**(48) Answer :** (B)
**Solution:**
Number of diagonals of a polygon of $n$ sides
$=\frac{n(n-3)}{2}=\frac{11(11-3)}{2}=44$
Number of triangle by $n$ points out of which only $m$ are collinear = ${}^nC_3-{}^mC_3$
${}^{15}C_3-{}^7C_3=420$
Maximum number of points of intersection of $n$ circles : $2\cdot{}^nC_2=30$
Number of lines by $n$ points in which no three points are collinear is
${}^nC_2={}^7C_2=21$