FIITJEE VIZAG CENTRE

NTSE 2017 SOLUTIONS – Stage I (Andhra Pradesh State)
(For class X Students)

MENTAL ABILITY TEST

1. 13, 74, 290, 650

   $2^2 + 3^2 = 13$

   $5^2 + 7^2 = 74$

   $11^2 + 13^2 = 290$

   $17^2 + 19^2 = 650$

   $23^2 + 29^2 = 1370$

2. 1, 11, 35, 79

   General term = $n^3 + n^2 - 1$

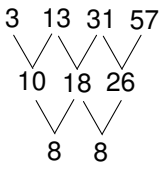
   $5^3 + 5^2 - 1 = 125 + 24 = 149$

3. 1, 5, 15, 34

   General term = $\frac{n(n^2+1)}{2}$

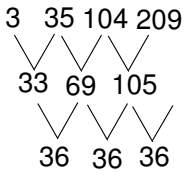
   $\frac{5(26)}{2} = 65$

4. 3, 13, 31, 57

   Next term = 57 + 34 = 91

5. 3, 35, 104, 209

   Next term = 209 + 141 = 350

6. A – BBC – AAB – CCA – BBCC

   ACBA

7. BC – BBC – B – CCB

   = BCCB / BCCB / BCCB

   = CBCD

8. C – BBB – ABBBB – ABBB –

   CA / BBBB / CA / BBBB / CA / BBBB

   = ABCCB

9. C – BCCD – CCDB – CDBCC – BC
CD / BCCD / BCCD / BCCD / BCCD / BC
= DBCD

10. BAAB / BAAB / BAAB
= ABBA

11. If the order is
$\times + =$
Then $6 \times 3 + 4 = 22$ is true

12. $+ - =$
as $12 + 3 - 4 = 11$

13. $\div + =$
as $16 \div 4 + 3 = 7$

14. $+ - =$
as $7 \times 3 - 8 = 13$

15. $\div + =$
as $15 \div 3 + 4 = 9$

16. $32 + 31 + 30 + 28 = 121 = (11)^2$
$70 + 72 + 73 + 74 = 289 = (17)^2$
$112 + 108 + 100 + 175 = 441 = (21)^2$

17. $1^3 + 2^3 + 3^3 + 4^3 = 100$
$1^2 + 2^3 + 3^3 + 6^3 = 289$
$1^3 + 5^3 + 6^3 + 7^3 = 685$

18. HCF of (12, 36, 42, 48) = 6
HCF of (14, 35, 49, 63) = 7
HCF of (30, 45, 60, 75) = 15

19. 7 – 5 + 11 = 9
13 – 9 + 6 = 10
11 – 14 + 7 = 4

20. 5 + 12 + 13 = 30 = | 3 – 0 | = 3
13 + 9 + 4 = 26 = | 2 – 6 | = 4
7 + 5 + 16 = 28 = | 2 – 8 | = 6

21-25.
$A \rightarrow 2$ (as 2 is common number in code for ATRNP & ABLMS)
$M \rightarrow 4$ (as 48 is common number in code for MSPTQ & ABLMS)
$S \rightarrow 8$ (as 48 is common number in code for MSPTQ & ABLMS)
$N \rightarrow 7$ (as 1 is common number in code for PTQAB & ATRNP)
$P \rightarrow 1$ (as 1 is common number in code for PTQAB & ATRNP)

26-30.

D is father of A and grandfather of F

So, A is father of F then D, A are two fathers

C is sister of F. So, C is daughter of A.

Only one mother O, it is evident that E is wife of A and hence the mother of C and F.

E is mother

F is the son of A

A made, B is brother → male of D, E → male

F male (as he is brother) Total 4

31. KMF → LLH

Jump → 1st letter → 1

2nd letter ← 1

3rd letter → 2

∴ RMS → SLU

32. GFH → EGG

1st letter ← 2

2nd letter → 1

3rd letter ← 1

∴ HRT → FSS

33. UVST → WTUR

1st letter → 2

2nd letter ← 2

3rd letter → 2

4th letter ← 2

34. News paper → editor

Film → Director

35. Smoke → Pollution

War → Death

36. -1

37. 4

38. 4

39. 5

40. 2

41. 5

42. 5

43. 4

44. 4

45. 4

46. 1

47. 5

48. 3

49. 1

50. 3

PHYSICS

101. (4)

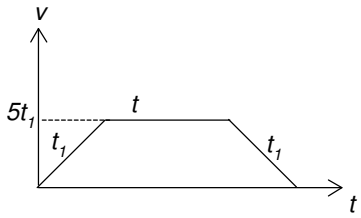
$t + 2t_1 = 25.....(1)$

$2 \times \frac{1}{2} \times 5t_1^2 + 5t_1.t = \frac{72 \times 1000}{60 \times 60} \times 25$

$t_1^2 + t.t_1 = 100.....(2)$

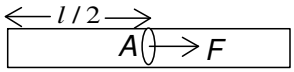
From eq. (1) and (2)

$t_1^2 - 25t_1 + 100 = 0 \qquad \Rightarrow t_1 = 5s \qquad t = 15s$



102. (4)

$F = \rho A.\frac{l}{2}\alpha \qquad \frac{F}{A} = \frac{1}{2}\rho l\alpha$



103. (1)

Refraction surface (1)

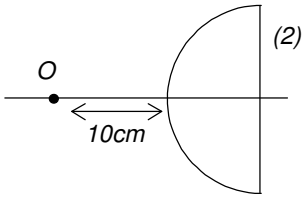
$\frac{\mu_2}{v} - \frac{\mu_1}{u} = \frac{\mu_2 - \mu_1}{R} \qquad v = -30\,\text{cm}$

At surface (2)

$u = -40\,\text{cm}$ Apparent shift $= \frac{40}{3}\,\text{cm}$

Distance of image from surface (2)

$= 40 - \frac{40}{3} = 26.67\,\text{cm}$



104. (2)

In centre of mass frame, equal and opposite force acts m both blocks.

In centre of mass frame, if the force on the block is F, then maximum expansion = $\frac{2F}{k}$

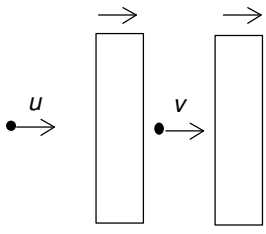
105. (2)

$0.02u = 1.v_1 + 0.02v.....(1)$

$0.02v = (2.98 + 0.02)v_1.....(2)$

Solving eq (1) and (2), $\qquad v = \frac{3}{4}u$

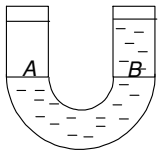
Percentage loss in velocity = $\frac{u - v}{u} \times 100 = 25\%$



106. (1)

Pressure at point A = pressure at point B

$\rho_1 g h_1 = \rho_2 g h_2 \Rightarrow \rho_1 = \rho_2$

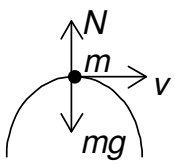


107. (3)

$mg - N = \frac{mv^2}{R}$

For maximum speed $N = 0$.

$\Rightarrow \frac{mv^2}{R} = mg \Rightarrow v^2 = Rg \qquad v = \sqrt{Rg} = 14m/s$



108. (3)

$r = \frac{mv}{qB}$

The particle enters region–3 if $r > l$

thus $v > \frac{qlB}{m}$

Path length in region–2 is maximum if $r = l$

Time spend in region–2 if the particle returns back to region–1,

$t = \frac{\pi r}{v} = \frac{\pi m}{qB}$

109. (4)

$R_{eq} = 10\Omega$

$i = 1A$

$v_{12\Omega} = 10 - 1\times 6 = 4v$

110. (2)

$3K.\frac{100-T}{l} = 2K\frac{T-50}{l} + K\frac{T-0}{l}$

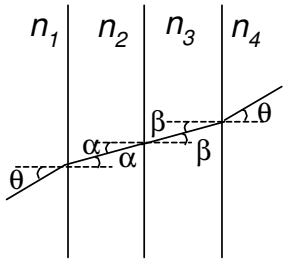
$\Rightarrow T = \frac{200}{3}°C$

111. (4)

$\frac{\sin\theta}{\sin\alpha} = \frac{n_2}{n_1}$

$\frac{\sin\alpha}{\sin\beta} = \frac{n_3}{n_2}$

$\frac{\sin\beta}{\sin\theta} = \frac{n_4}{n_3}$



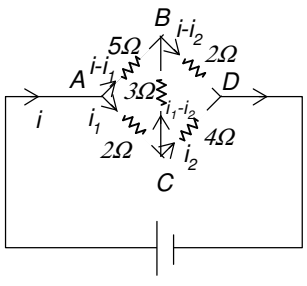
Multiplying these equations,

$\frac{n_4}{n_1} = 1$

112. (3)

Density of mixture = $\frac{2\times\rho + 1\times 16\rho}{2+1} = 6\rho$

113. (3)



In loop ABC,

$-2i_2 - 3(i_1 - i_2) + 5(i - i_1) = 0.....(1)$

In loop BCD,

$-3(i_1 - i_2) - 2(i - i_2) + 4i_2 = 0.....(2)$

In loop ACD,

$V - 2i_1 - 4i_2 = 0.....(3)$

Solving we get

$R_{eq} = \frac{V}{i} = 3\Omega$

CHEMISTRY

114. (1)

$$\underset{1mole}{N_2H_{4(l)}} + \underset{2\ moles}{2H_2O_{(l)}} \rightarrow N_{2(g)} + 4H_2O_{(g)}$$

$\Rightarrow$ 1 mole N_2H_4 can react with 2 moles of H_2O_2

$\Rightarrow$ 1 mole $N_2H_4 \rightarrow 2\times 34\ g\ of\ H_2O_2$

$\frac{1}{4}$ moles $N_2H_4 \rightarrow 17\ g\ of\ H_2O_2$

$\Rightarrow$ 0.25 moles of N_2H_4 is reacted

The amount of unreacted N_2H_4 = 0.75 – 0.25 = 0.5 moles N_2H_4

= 0.5 x 32 = 16 g N_2H_4

115. (3)

Collidal solution = $10^{-5} - 10^{-7}\ cm$

True solutions = less than $10^{-7}\ cm$

Suspensions = greater than $10^{-5}\ cm$

116. (3)

$Fe_2O_3 + 2Al \rightarrow Al_2O_3 + 2Fe$ (or) $Cr_2O_3 + 2Al \rightarrow Al_2O_3 + 2Cr$

It is a reduction of oxide ore to metal

117. (2)

$2C_2H_2 + 5O_2 \rightarrow 4CO_2 + 2H_2O$ is a balanced chemical reaction

118. (3)

	x-rays	UV – rays	IR – rays	Ratio
λ	$1\times10^{-10}\ m$	$1\times10^{-8}\ m$	$1\times10^{-6}\ m$	
$v=\frac{c}{\lambda}$	$c\times10^{10}\ m$	$c\times10^{8}\ m$	$c\times10^{6}\ m$	$10^4:10^2:1$
$E=hv$	$h\times c\times10^{10}$	$h\times c\times10^{8}$	$h\times c\times10^{6}$	$1:10^{-2}:10^{-4}$

All electromagnetic radiations have some velocity

119. (4)

Electronic configuration (X) = $K^2L^8M^5$ (Z = 15)

$\Rightarrow X^{+3} = K^2L^8M^2 = 1s^2 2s^2 2p^6 3s^2$

Number of p electrons = 6

$\Rightarrow$ one of the allotropic forms of phosphorous is P_4

120. (1)

Compound A = $Cl_2O \Rightarrow 71g\ of\ Cl \rightarrow 16\,g\ of\ O$

$$1\,g\ of\ Cl \rightarrow \frac{16}{71} = 0.225$$

Compound B = $1\,g\ of\ Cl \rightarrow 0.903g\ of\ O$

$71\,g\ of\ Cl \rightarrow 71\times 0.903g\ of\ O$

= 64 g of O $\Rightarrow 4\ O-atoms$

$\therefore B = Cl_2O_4$ or Cl_4O_8 or Cl_6O_{16}

Compound C $\Rightarrow$ 1 g of Cl $\rightarrow$ 1.354 g of O

71 g of Cl $\rightarrow$ 71 x 1.354 g of O

= 96.134g of O

= 6 O – atoms

$\therefore$ C = Cl_2O_6 or ClO_3 or Cl_3O_4

Compound D = 1 g of Cl $\rightarrow$ 1.579g of O

= 71 g of Cl $\rightarrow$ 71 x 1.579 g of O

= 112 g of O

= 7 O-atoms

$\therefore$ D = Cl_2O_7 or Cl_4O_{14} This data shows law of multiple proportions

121. (3)

$$3Al_{(s)} + 3NH_4ClO_{4(s)} \rightarrow Al_2O_{3(s)} + AlCl_{3(s)} + 3NO_{(g)} + 6H_2O_{(g)}$$

3 moles of Al $\rightarrow$ 3 moles of NH_4ClO_4

3 x 27 g of Al $\rightarrow$ 3 x 117.5 g of NH_4ClO_4

1000 g of Al $\rightarrow \dfrac{3\times 117.5\times 1000}{3\times 27} = 4351.85\ g = 4.351kg$

122. (3)

123. (3)

SO_2 : 32 g of S $\rightarrow$ 32 g of O

9.02 g of S $\rightarrow$ 9.02 g of O

SO_3 : 32 g of S $\rightarrow$ 48 g of O

9.02 g of S $\rightarrow \dfrac{48\times 9.02}{32} = 13.53g$

124. (2)

$$NH_3 + NH_3 \rightleftharpoons NH_4^+ + NH_2^-$$

$$\Rightarrow NaNH_2 + NH_4Cl \rightarrow NaCl + 2NH_3$$

125. (4)

126. (1)

MATHEMATICS

141. $31513 = x \pmod a$

$34369 = x \pmod a$

$\Rightarrow 2856 = 0 \pmod a$

$2856 = 3\times 8\times 7\times 17$

Let us consider the factor 102.

Then remainder = 97.

142. Let number = x

$\Rightarrow x = 3a+1, x = 5b+3, x = 7c+5, x = 9c+7$

Let $a = b = c = d$

We observe first term = - 2

For sequence, the common difference = LCM (3, 5, 7, 9) = 315

n^{th} term = (-2) + (n – 1)315

Largest number = 9763

143. $\dfrac{1000e+100f+10g+h}{100} = \dfrac{10e+f+10g+h}{2}$

$10e+f+\dfrac{g}{10}+\dfrac{h}{100} = 5e+\dfrac{f}{2}+5g+\dfrac{h}{2}$

$5e+\dfrac{f}{2} = \dfrac{49h}{100}+\dfrac{49g}{10}$

$\Rightarrow e = 4, f = 9, h = 0, g = 5$

144. $x(x+y+1) = 12 \qquad \dfrac{x}{y} = \dfrac{2}{3} \Rightarrow x = \dfrac{2y}{3}$

$y(x+y+1) = 18$

$\Rightarrow \dfrac{3x}{2}\left(\dfrac{5x}{2}+1\right) = 18$

$\Rightarrow x\left(\dfrac{5x}{2}+1\right) = 12$

$\Rightarrow x = 2, \Rightarrow y = 3$

$\Rightarrow x+y = 5$

(or)

$\Rightarrow x = \dfrac{-12}{5}, y = \dfrac{-15}{5}$

$x+y = -6$

$\therefore 5 or -6$

145. $(217+131)(x+y) = 1740$

$x+y = \dfrac{1740}{348} = 5$

146. $x = \dfrac{1}{2-x} \Rightarrow 2x-x^2 = 1$

$\Rightarrow x = 1$

147. $a+a+6d+a+ad=-6$

$a+5d=-2$

$a+2d+a+7d+a+11d=-11$

$3a+20d=-11$

$\Rightarrow 3a+(-8-4a)=-11$

$\Rightarrow -a=-3 \qquad \Rightarrow a=3$

$a=-1$

$a+2d+a+7d+a+21d=9-30=-21$

148. $\dfrac{2\left(4+(n-1)3\right)}{n\left(14+(n-1)4\right)}=\dfrac{23}{35}$

$\dfrac{3n+1}{4n+10}=\dfrac{23}{35}$

$13n=195\Rightarrow n=15$

149. Centroid $=\dfrac{1+2+3}{3},\dfrac{1-3+4}{3}$

$=\left(2,\dfrac{2}{3}\right)$

150. $(0,\,0),\ (3,\sqrt{3})$

Third vertex $(0,2\sqrt{3})$

151. $\Rightarrow \dfrac{ar(\Delta CPA)}{ar(\Delta PCD)}=\dfrac{105}{35}=\dfrac{3}{1}$

Let BPD = a, APF = b (areas)

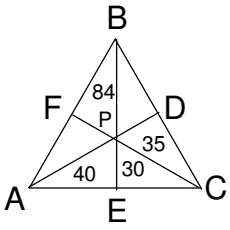
$\Rightarrow \dfrac{a+b+84}{a}=\dfrac{3}{1}\Rightarrow b+84=2a$

And

$\dfrac{\Delta ABF}{\Delta APF}=\dfrac{\Delta BEC}{\Delta PEC}$

$\Rightarrow \dfrac{124+b}{40}=\dfrac{64+a}{30}$

$\Rightarrow Area\ ABC=315$



152. $BD=\sqrt{117}$

$\dfrac{1}{2}\sqrt{117}\sqrt{x^2+(30-x)^2}=\dfrac{1}{2}(x)(30-x)$

$\Rightarrow 117\left(x^2+(30-x)^2\right)=\left(30x-x^2\right)^2$

$\Rightarrow x=12$

$\therefore Area=108$

153. A = 21, B = 21, C = 1

154. $ar(\Delta PHI)=36, PHI \sim PED \Rightarrow \left(\frac{PE}{PH}\right)^2=\frac{25}{36}$

$ar(\Delta PED)=25, \quad \Rightarrow \frac{PE}{PH}=\frac{5}{11}$

$ar(\Delta PFG)=16,$

So, $\frac{PH}{HE}=\frac{5}{11}\Rightarrow\frac{ar(\Delta PED)}{ar(\Delta EHC)}=\frac{25}{121}$

Area of PDIC = 60
Area of BHPG = 48
Area of PEAF = 40
$\therefore$ Area of ABC = 225

155. Let A(0, 0), B(2a, 0), C(a, $\sqrt{3}\,a$),

Then D$\left(\frac{4a}{3},\frac{2\sqrt{3}}{3}\right)$

$\Rightarrow 9AD^2=28a^2$

$=7AB^2$

156. $\angle ABT=29$ as $\angle AOT=58°$
$\Rightarrow \angle ATQ=180-90-29$
$=61$

157. $\frac{V_1}{V_2}=\frac{4}{9}\times\frac{5}{3}=\frac{20}{27}$

158. $lb=x, bh=y, lh=z$
$\Rightarrow volume=\sqrt{xyz}$

159. $\tan\theta+\cot\theta=2$
$\Rightarrow \tan\theta=1\Rightarrow \tan^2\theta+\cot^2\theta=2$

160. $I_1 \rightarrow$ when he draws red ball out of 15
$I_2 \rightarrow$ when he draws red ball out of 20
$P(I_1)=\frac{15-x}{15}, P(I_2)=\frac{20-x}{20}$
$\frac{20-x}{20}=2\left(\frac{15-x}{15}\right)$
$60-3x=120-8x$
$5x=60$
$\Rightarrow x=12$
$P(I_1)=\frac{1}{5}.$