

NTSE STAGE – I
(2016- 17)
SCHOLASTIC APTITUDE TEST
SOLUTIONS

PHYSICS

101. $S_{nth} = u + \frac{1}{2}a(2n - 1)$
 $n = 2, n = 3, n = 5$
 ratio = 3 : 5 : 9

102. $a = \frac{v^2 - u^2}{2\ell}$; ℓ = length of the train.
 $v^2 = u^2 + 2\left(\frac{v^2 - u^2}{2\ell}\right) \times \frac{\ell}{2}$
 $V = \sqrt{\frac{u^2 + V^2}{2}}$

103. Ratio = $\frac{2\pi r + \frac{2\pi r}{4}}{2r} = \frac{3}{2}\pi$

104. Resistance = $\frac{4x}{7} = 3$.
 $x = \frac{21}{4}\Omega$

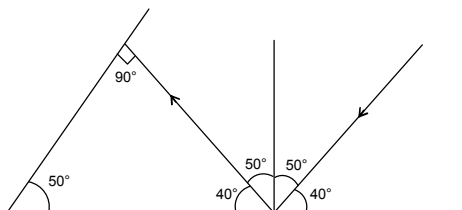
105. Using conservation of momentum
 $M_1V_1 = M_2V_2$
 $3 \times V_1 = 6 \times V_2 \dots(i)$
 $\frac{1}{2} \times 3 \times V_1^2 = 216$
 $\Rightarrow V_1 = 12 \text{ m/s} ; V_2 = 6 \text{ m/s}$

106. Electrons are transferred from glass rod to silk.

107. $\frac{V_s}{V} = \frac{\text{Density of body}}{\text{Density of liquid}}$

108. $T = 2\pi\sqrt{\frac{\ell}{g}}$
 $\Rightarrow T^2 = 4\pi^2 \frac{\ell}{g} \Rightarrow T^2 \times \ell$
 Hence straight line.

109.



110. $V = at$
Hence straight line graph with +ve slope.

111. $V = \text{constant}$, $a = 0$, $m = 80 \text{ kg}$
 $T = mg = 800 \text{ N}$

112. $P = \frac{V^2}{R} = \frac{110 \times 110}{220 \times 220} \times 40 = 10 \text{ W}$

113. Using right hand thumb rule.

114. Density of glass is more than water.

CHEMISTRY

115. $2\text{C}_4\text{H}_{10} + 13\text{O}_2 \longrightarrow 8\text{CO}_2 + 10\text{H}_2\text{O}$

2 moles required 13 mole O_2

1 mole required $\frac{13}{2}$ mole O_2

3 mole required $\frac{13}{2} \times 3 = \frac{39}{2} = 19.5$ mole

Wt of O_2 required = $19.5 \times 32 = 624 \text{ g}$

116.
$$\begin{array}{c} \text{O} \quad \text{O} \\ || \quad || \\ \text{H} - \text{C} - \text{C} - \text{H} \\ \quad 1 \quad 2 \end{array}$$

Ethanedial

117. $2\text{CH}_3\text{COOH} + \text{Ca}(\text{OH})_2 \longrightarrow \text{Ca}(\text{CH}_3\text{COO})_2 + 2\text{H}_2\text{O}$

280 mL, $0.5 = 140 \times 10^{-3}$ moles

1 mole required 2 moles CH_3COOH

140×10^{-3} required $140 \times 10^{-3} \times 2$ moles $\text{CH}_3\text{COOH} = 0.280$ mole

i.e $0.280 \times 60 = 16.8 \text{ g}$

118. MSO_4
 $\text{M}^{2+} \text{SO}_4^{2-}$
i.e., $\text{M}^{2+} \text{PO}_4^{3-}$
 $\text{M}_3(\text{PO}_4)_2$

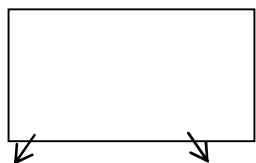
119. $\text{Na}_2\text{CO}_3 + 2\text{HCl} \longrightarrow 2\text{NaCl} + \text{H}_2\text{O} + \text{CO}_2$

$$\frac{5.3 \text{ g}}{106} = 0.05 = 5 \times 10^{-2}$$

$$250 \times \frac{1}{2} = 125 \times 10^{-3} \text{ moles} = 12.5 \times 10^{-2}$$

Limiting reagent
 $2 \times 5 \times 10^{-2} = 10^{-1} \text{ moles} = 0.1 \text{ moles}$
 i.e., 5.85 g

120.



50 % He 50 % CH₄
 Suppose 22.4 L volume is present
 i.e. 11.2 L He i.e. ½ mole He i.e. 2 g He
 11.2 L He i.e. ½ mole CH₄ i.e. 8 g CH₄
 $\% \text{CH}_4 = \frac{8}{10} \times 100 = 80 \%$

121. 60% Copper
 20% Nickel
 20% Zinc

122. The protective power of lyophilic colloids is measured in terms of gold number

123. Non reacting gases

$$\text{H}_2 : \text{O}_2$$

$$1 : 4$$

$$\frac{W_{\text{H}_2}}{W_{\text{O}_2}} = \frac{1}{4}$$

$$\frac{W_{\text{H}_2} M_{\text{O}_2}}{M_{\text{H}_2} W_{\text{O}_2}}$$

$$\frac{n_{\text{H}_2}}{n_{\text{O}_2}} = \frac{1 \times 32}{4 \times 2} = \frac{4}{1}$$

124. X should be calcium (Ca – 2, 8, 8, 2)
 CaO, Basic

125. Alitame used as sweetener

126. (a)	0.5 mole SO ₂ gas	(Q)	11.2 L at S.T.P
(b)	1 mole H ₂ O	(P)	10 moles of proton
(c)	96g of O ₂ gas	(S)	6 moles of atoms
(d)	88g of CO ₂ gas	(R)	2 moles

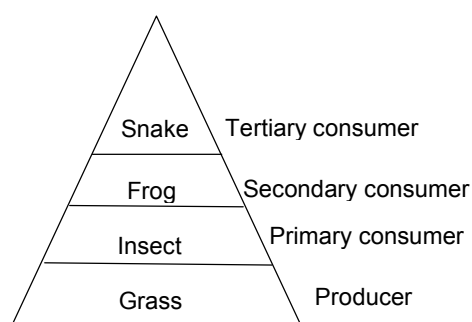
127. Rancidity is the phenomenon of oxidation of oils and fat which lead to their foul smell and unpleasant odour.

128. Iodine is essential for the formation of thyroxine hormone. It is present in iodised salt.

129. Medulla oblongata helps to control blood pressure, salivation, vomiting whereas body posture is controlled by cerebellum.

130. Glycolysis takes place in cytoplasm of the cell.
131. Oxygen rich blood carried out by pulmonary vein from lungs to left atrium of the heart.
132. Growth of pollen tube in the style towards the ovule in plants is an example of chemotropism
133. Urethra is the common passage of urine and sperm in human males.
134. Pepsin is protein digesting enzyme which activated in acidic medium secreted by chief cells of stomach.
135. Bowman's capsule is apart of nephron in kidney.
136. 'Khadins' are used in Rajasthan for Rain Water Harvesting.
137. Sweating is not a reflex action.

138.



Therefore 'frog' is the secondary consumer.

139. Colour of seed of garden pea is an inherited trait.
140. Cholera is caused by vibrio cholerae and it is transmitted through contaminated food and water.

141.
$$\frac{\frac{y^4 - x^4}{x(x+y)} - \frac{y^3}{x}}{y^2 - xy + x^2}$$

$$= \frac{(y^2 + x^2)(y - x) - y^3}{x(y^2 - xy + x^2)}$$

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

$$= -1$$

142.
$$a = \frac{4xy}{x+y}$$

$$\Rightarrow \frac{a}{2x} = \frac{2y}{x+y}, \frac{a}{2y} = \frac{2x}{x+y}$$

By applying Componendo Dividendo

$$\frac{a+2x}{a-2x} = \frac{3y+x}{y-x} \text{ and } \frac{a+2y}{a-2y} = \frac{3x+y}{x-y}$$

So,
$$\frac{a+2x}{a-2x} + \frac{a+2y}{a-2y} = \frac{3y+x}{y-x} + \frac{3x+y}{x-y} = 2$$

$$143. \quad \frac{x^2 - bx}{ax - c} = \frac{m-1}{m+1}$$

In standard form, given equation is $(m+1)x^2 - x(bm + b + ma - a) + cm - c = 0$

Since roots are equal in magnitude but opposite in signs

\Rightarrow Sum of zeros = 0

or $bm + b + ma - a = 0$

$$\Rightarrow m = \frac{a-b}{a+b}$$

$$144. \quad \text{By going through options}$$

$$x = 4, y = 3, z = 9$$

$$145. \quad \text{Let area of triangle ECG} = x \text{ sq. units}$$

$$\Rightarrow \text{ar}(\triangle AGE) = 2x \text{ sq. units}$$

Now, $\text{ar}(\triangle AEC) = 3x \text{ sq. units}$

Since, $BD = DE = EC$

$$\Rightarrow \text{ar}(\triangle ABD) = \text{ar}(\triangle ADE) = \text{ar}(\triangle AEC)$$

So, Area of triangle ABC = $9x \text{ sq units}$

Shaded area = $7x \text{ sq. units}$

$$\text{Required ratio} = \frac{7x}{9x} = \frac{7}{9}$$

$$146. \quad \because A + B = 90^\circ$$

$$\therefore \frac{\tan A \cdot \tan B + \tan A \cdot \cot B}{\sin A \cdot \sec B} = \frac{\sin^2 B}{\cos^2 A}$$

$$= \frac{\cot B \cdot \tan B + \cot B \cot B}{\sin A \cdot \operatorname{cosec} A} = \frac{\cos^2 A}{\cos^2 A}$$

$$= \frac{1 + \cot^2 B}{1} - 1$$

$$= \cot^2 B$$

$$147. \quad \frac{1}{(2^2 - 1)} + \frac{1}{(4^2 - 1)} + \frac{1}{(6^2 - 1)} + \dots + \frac{1}{20^2 - 1}$$

$$= \frac{1}{1 \times 3} + \frac{1}{3 \times 5} + \frac{1}{5 \times 7} + \dots + \frac{1}{19 \times 21}$$

$$= \frac{1}{2} \left(\frac{1}{1} - \frac{1}{3} \right) + \frac{1}{2} \left(\frac{1}{3} - \frac{1}{5} \right) + \frac{1}{2} \left(\frac{1}{5} - \frac{1}{7} \right) + \dots + \frac{1}{2} \left(\frac{1}{19} - \frac{1}{21} \right)$$

$$= \frac{1}{2} \left[\frac{1}{1} - \frac{1}{3} + \frac{1}{3} - \frac{1}{5} + \frac{1}{5} - \frac{1}{7} + \dots + \frac{1}{19} - \frac{1}{21} \right]$$

$$= \frac{1}{2} \left(1 - \frac{1}{21} \right)$$

$$= \frac{1}{2} \times \frac{20}{21} = \frac{10}{21}$$

$$148. \quad 2^{\sin x + \cos y} = 1 = 2^0$$

$$\sin x + \cos y = 0$$

let $\sin x = a$, $\cos y = b$

$$\Rightarrow a + b = 0$$

$$\Rightarrow a^2 + b^2 + 2ab = 0$$

$$\Rightarrow ab = -\frac{1}{4}$$

$$16^{\sin^2 x + \cos^2 y} = 4 = 16^{1/2}$$

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

$$\Rightarrow a^2 + b^2 = \frac{1}{2}$$

$$\therefore a + b = 0$$

$$\Rightarrow a + \frac{-1}{4a} = 0$$

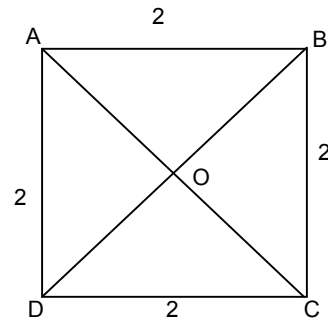
$$\Rightarrow 4a^2 - 1 = 0$$

$$a = \pm \frac{1}{2}$$

$$\Rightarrow b = -a$$

$$b = \pm \frac{1}{2}$$

149. $AB = BC = CD = DA = 2 \text{ cm}$
 $AC = BD = 2\sqrt{2}$
 $\therefore AO = BO = CO = DO = \sqrt{2}$
 $\therefore \text{Sum of perimeter} = (2 + \sqrt{2} + \sqrt{2}) \times 4$
 $= 8 + 8\sqrt{2}$
 $= 8(1 + \sqrt{2})$



150. $\therefore \text{Ar}(\text{CEF}) = \frac{1}{3} \text{Ar}(\text{ABC})$
 $= \frac{1}{6} \text{Ar}(\text{ABCD})$
 $\therefore \frac{\text{Ar}(\text{CEF})}{\text{Ar}(\text{ABCD})} = \frac{1}{6}$

151. $10a + b = (a + b)4 + 3$
 $10a + b = 3ab + 5$
 $6a = 3b + 3 \quad 5 \times (b + 1) + b = 3 \times \left(\frac{b + 1}{2}\right) \times b + 5$
 $5b + 5 + b = \frac{3}{2}b^2 + \frac{3}{2}b + 5$
 $\frac{3}{2}b^2 - \frac{9}{2}b = 0$
 $\frac{3b}{2}(b - 3) = 0 \quad b \neq 0 \text{ as } a \neq \frac{1}{s}$
 $b = 3$
 $a = 2$
 Number is 23. Odd prime,

152. $\text{avg wt} = \text{total students} = n$

$$\frac{n^2 + 21}{n + 1} - n = n - \frac{n^2 + 18}{n + 1}$$

$$\frac{n^2 + 21 + n^2 + 19}{n + 1} = 2n$$

$$2n^2 + 40 = 2n^2 + 2n$$

$$n = 20$$

153. $a + b + c + d = 125 \quad a + 4 = b - 4 = 4c = \frac{d}{4} = t$

$$t - 4 + t + 4 + t / 4 + 4t = 125$$

$$\frac{25t}{4} = 125 \quad t = 20$$

$$a = 24, b = 16$$

$$c = 5, d = 80$$

154. $1^2 + 2^2 + 3^2 + 4^2 + 5^2 + 6^2 + 7^2 + 8^2$
 $\frac{8(8+1)(2 \times 8 + 1)}{6} = \frac{8 \times 9 \times 17}{6} \Rightarrow 12 \times 17 \Rightarrow 204$

155. $\text{ar } \triangle ADE = \text{ar } \triangle BEC = 1$

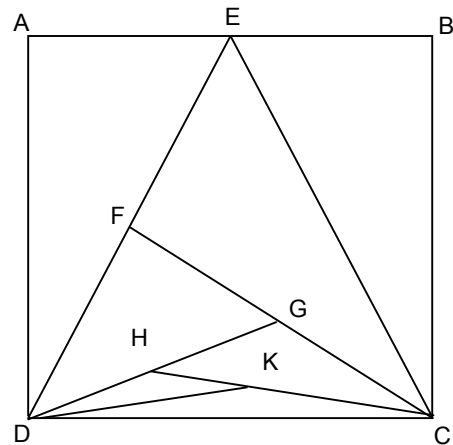
$$\text{ar } \triangle DEC = \frac{4}{2} = 2$$

$$\text{ar } \triangle DFC = \frac{2}{2} = 1$$

$$\text{ar } \triangle DGC = \frac{1}{2}$$

$$\text{ar } \triangle DHC = \frac{1}{4}$$

$$\text{ar } \triangle DKC = \frac{1}{4 \times 2} = \frac{1}{8}$$



156. $xy = z, yz = x, xz = y \Rightarrow x^2 y^2 z^2 = xyz$

$$xyz = 1$$

$$z^2 = 1 \Rightarrow z = \pm 1$$

$$x = \pm 1, y = \pm 1$$

$$xy + zy + zx = 3$$

157. $V = \pi r^2 h$

$$S = 2\pi r h + 2\pi r^2$$

$$\frac{V}{S} = \frac{\pi r^2}{2\pi r + 2\pi r^2}$$

$$= \frac{1}{2} \left(\frac{r}{1+r} \right) = \frac{1}{2} \left[1 - \frac{1}{r+1} \right]$$

158. $h = 1.1h$

$$r = .9h$$

$$\text{Area} = 2\pi r h = 2\pi 1.1 \times .9h$$

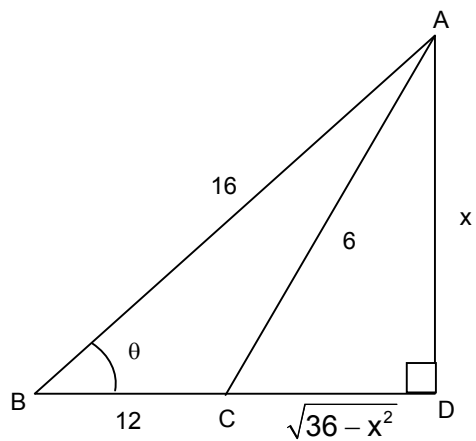
$$.99(2\pi r h)$$

Decreases by 1%

$$159. \quad 256 = x^2 + 144 + 36 - x^2 + 24\sqrt{36 - x^2}$$

$$\sqrt{36 - x^2} = \frac{76}{24} = \frac{19}{6}$$

$$CD = \frac{19}{6}$$



$$160. \quad x - 1 = 0$$

$$y - 2 = 0$$

$$z - 3 = 0$$

$$x = 1, y = 2, z = 3$$