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. $a = \frac{v^2 - u^2}{2\ell}$; □ = 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

$M_1V_1 = M_2V_2$

$3 \times V_1 = 6 \times V_2$ …(i)

$\frac{1}{2} \times 3 \times V_1^2 = 216$

$\Rightarrow$ $V_1 = 12$ m/s ; $V_2 = 6$ m/s

106. Electrons are transferred from glass rod to silk.

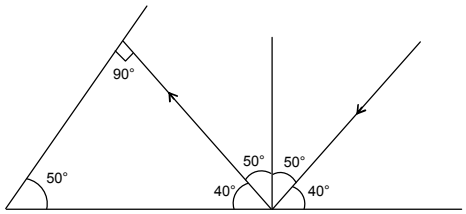
107. $\frac{V_s}{V} = \frac{\text{Density of body}}{\text{Density of liquid}}$

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 = constant, a = 0, m = 80 kg
T = mg = 800 N

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

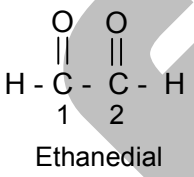
113. Using right hand thumb rule.

114. Density of glass is more than water.

CHEMISTRY

115. $2C_4H_{10} + 13O_2 \longrightarrow 8CO_2 + 10H_2O$
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 × 32 = 624 g

116.



Ethanedial

117. $2CH_3COOH + Ca(OH)_2 \longrightarrow Ca(CH_3COOH)_2 + 2H_2O$
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 CH_3COOH = 0.280 mole
i.e 0.280 × 60 = 16.8 g

118. MSO_4
M^{2+} SO_4^{2-}
i.e., M^{2+} PO_4^{3-}
$M_3(PO_4)_2$

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

$\frac{5.3\,g}{106}$ $250 \times \frac{1}{2}$

= 0.05 = 125×10^{-3} moles

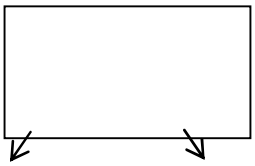
= 5×10^{-2} = 12.5×10^{-2}

Limiting reagent

$2 \times 5 \times 10^{-2} = 10^{-1}$ moles = 0.1 moles

i.e., 5.85 g

120.



50 % He 50 % CH_4

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 CH_4 i.e. 8 g CH_4

$\%\,CH_4 = \frac{8}{10} \times 100 = 80\%$

121. 60% Copper
20% Nickel
20% Zinc

122. The protective power of lyophillic collids is measure in term of gold number

123. Non reacting gases

$H_2 : O_2$

1 : 4

$\frac{W_{H_2}}{W_{O_2}} = \frac{1}{4}$

$\frac{W_{H_2}\, M_{O_2}}{M_{H_2} W_{O_2}}$

$\frac{n_{H_2}}{n_{O_2}} = \frac{1 \times 32}{4 \times 2} = \frac{4}{1}$

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

125. Alitame used as sweetner

126.

(a)	0.5 mole SO_2 gas	(Q)	11.2 L at S.T.P
(b)	1 mole H_2O	(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 where as 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.

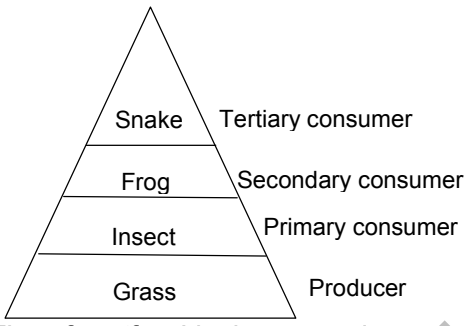
134. Pepsin is protein digesting enzyme which activated in acidic medium secreted by chief cells of stomach.

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. $$\frac{\frac{y^4-x^4}{x(x+y)}-\frac{y^3}{x}}{y^2-xy+x^2}$$
$$=\frac{\left(y^2+x^2\right)(y-x)-y^3}{x\left(y^2-xy+x^2\right)}$$
$$=\frac{-x\left(y^2-xy+x^2\right)}{x\left(y^2-xy+x^2\right)}$$
$$=-1$$

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

$\frac{a+2x}{a-2x}=\frac{3y+x}{y-x}$ 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. $\dfrac{x^2-bx}{ax-c}=\dfrac{m-1}{m+1}$

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 $bm+b+ma-a=0$

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

144. By going through options

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

145. Let area of triangle ECG = x sq. units

$\Rightarrow ar(\Delta AGE)=2x$ sq. units

Now, $ar(\Delta AEC)=3x$ sq. units

Since, BD = DE = EC

$\Rightarrow ar(ABD)=ar(ADE)=ar(AEC)$

So, Area of triangle ABC = 9x sq units

Shaded area = 7x sq. units

Required ratio = $\dfrac{7x}{9x}=\dfrac{7}{9}$

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

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

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

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

$$=\cot^2 B$$

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

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

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

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

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

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

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

$\sin x+\cos y=0$

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

$\Rightarrow a+b=0$

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

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

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

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

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

$\because a + b = 0$

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

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

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

$\Rightarrow b = -a$

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

149. $AB = BC = CD = DA = 2\,cm$

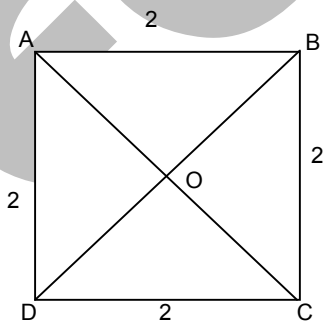
$AC = BD = 2\sqrt{2}$

$\therefore AO = BO = CO = DO = \sqrt{2}$

$\therefore$ Sum of perimeter $= \left(2 + \sqrt{2} + \sqrt{2}\right) \times 4$

$= 8 + 8\sqrt{2}$

$= 8\left(1 + \sqrt{2}\right)$



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

$= \frac{1}{6}Ar(ABCD)$

$\therefore \frac{Ar(CEF)}{Ar(ABCD)} = \frac{1}{6}$

151. $10a + b = (a + b)4 + 3$

$10a + b = 3ab + 5$

$6a = 3b + 3 \qquad 5 \times (b + 1) + b = 3 \times \left(\frac{b + 1}{2}\right) \times b + 5$

$5b + 5 + b = \frac{3}{2}b^2 + \frac{3}{2}b + 5$

$\frac{3}{2}b^2 - \frac{9}{2}b = 0$

$\frac{3b}{2}(b - 3) = 0 \quad b \neq 0$ as $a \neq \frac{1}{s}$

b = 3

a = 2

Number is 23. Odd prime,

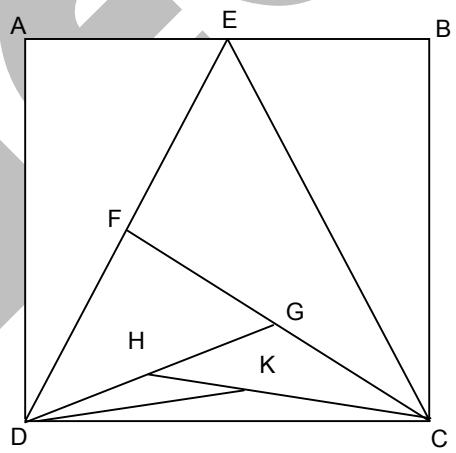
152. avg wt = total students = n

$$\frac{n^2+21}{n+1}-n=n-\frac{n^2+18}{n+1}$$
$$\frac{n^2+21+n^2+19}{n+1}=2n$$
$$2n^2+40=2n^2+2n$$
$$n=20$$

153. $a+b+c+d=125 \qquad a+4=b-4=4c=\frac{d}{4}=t$
$$t-4+t+4+t/4+4t=125$$
$$\frac{25t}{4}=125 \qquad t=20$$
$$a=24,\ b=16$$
$$c=5,\ d=80$$

154. $1^2+2^2+3^2+4^2+5^2+6^2+7^2+8^2$
$$\frac{8(8+1)(2\times8+1)}{6}=\frac{8\times9\times17}{6}\Rightarrow12\times17\Rightarrow204$$

155. $ar\,\Delta ADE=ar\,\Delta BEC=1$
$$ar\Delta DEC=\frac{4}{2}=2$$
$$ar\,\Delta DFC=\frac{2}{2}=1$$
$$ar\,\Delta DGC=\frac{1}{2}$$
$$ar\Delta DHC=\frac{1}{4}$$
$$ar\Delta DKC=\frac{1}{4\times2}=\frac{1}{8}$$



156. $xy=z,\ yz=x,xz=y\Rightarrow x^2y^2z^2=xyz$
$$xyz=1$$
$$z^2=1\Rightarrow z+1$$
$$x=\pm1,\ y=\pm1$$
$$xy+zy+zx=3$$

157. $V=\pi r^2h$
$$S=2\pi rh+2\pi r^2$$
$$\frac{V}{S}=\frac{\pi r^2}{2\pi r+2\pi r^2}$$
$$=\frac{1}{2}\left(\frac{r}{1+r}\right)=\frac{1}{2}\left[1-\frac{1}{r+1}\right]$$

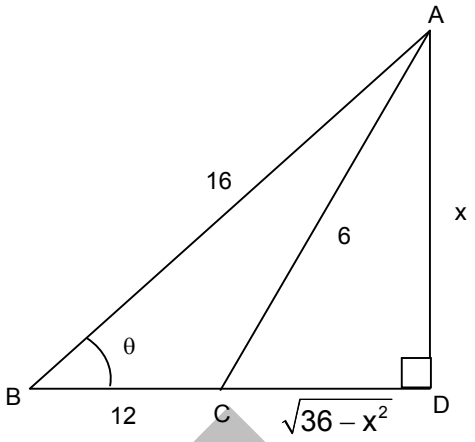
158. $h=1.1h$
$$r=.9h$$
$$\text{Area}=2\pi rh=2\pi1.1\times9rh$$
$$.99(2\pi rh)$$

Decreases by 1%

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

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

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



160. $x - 1 = 0$

$y - 2 = 0$

$z - 3 = 0$

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