

**NTSE STAGE – I (DELHI STATE)**  
**(2020 – 21)**  
**(For Class – X)**  
**SCHOLASTIC APTITUDE TEST**  
**ANSWER KEYS**

**PHYSICS**

101.	3	102.	1	103.	1	104.	2
105.	4	106.	4	107.	2	108.	4
109.	1	110.	2	111.	3	112.	1
113.	2						

**CHEMISTRY**

114.	2	115.	3	116.	3	117.	1
118.	1	119.	3	120.	4	121.	2
122.	2	123.	4	124.	4	125.	4
126.	1						

**BIOLOGY**

127.	3	128.	1	129.	2	130.	4
131.	4	132.	3	133.	2	134.	3
135.	3	136.	2	137.	2	138.	1
139.	1	140.	2				

**MATHEMATICS**

141.	3	142.	2	143.	2	144.	3
145.	3	146.	4	147.	4	148.	1
149.	1	150.	3	151.	4	152.	2
153.	2	154.	2	155.	2	156.	4
157.	3	158.	4	159.	3	160.	1

**SOCIAL SCIENCE**

161.	1	162.	4	163.	2	164.	2
165.	3	166.	4	167.	3	168.	2
169.	1	170.	3	171.	4	172.	4
173.	1	174.	2	175.	2	176.	3
177.	4	178.	2	179.	3	180.	2
181.	2	182.	1	183.	4	184.	2
185.	1	186.	3	187.	3	188.	3
189.	3	190.	3	191.	4	192.	4
193.	1	194.	1	195.	3	196.	4
197.	2	198.	2	199.	2	200.	4

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**HINTS & SOLUTIONS**

**PHYSICS**

101. 3  
101. Quality of sound helps to distinguish between two sounds.
102. 1  
102.  $\text{Power (p)} = \frac{W}{t} = \frac{mgh}{t} = \frac{30 \times 9.8 \times 10}{60} = 49 \text{ J/s}$
103. 1  
103.  $R_{AB} = \frac{5R}{11}$   
 $R_{BC} = \frac{3R}{11}$   
 $R_{AC} = \frac{4R}{11}$
104. 2  
104.  $F = kx = 15 \times 0.2 = 3 \text{ N}$   
 $a = \frac{F}{m} = \frac{3}{0.3} = 10 \text{ m/s}^2$
105. 4  
105. As slope of v–t graph is decreasing between points A and B. So acceleration is decreasing.
106. 4  
106. A retarding force of any magnitude can stop the moving body.
107. 2  
107. As,  $W = VQ$   
 $\therefore Q = \frac{18}{90} = 0.2 \text{ C}$
108. 4  
108. Magnetic field lines are closed curve because magnetic monopoles do not exist.
109. 1  
109.  $\text{Average speed} = \frac{S}{\frac{S}{5V_1} + \frac{4S}{5V_2}}$   
 $\Rightarrow \frac{5V_1V_2}{V_2 + 4V_1}$

110. 2

110. Refractive index =  $\frac{C}{V}$

$$n = \frac{C}{V} \Rightarrow V = \frac{C}{n}$$

Distance = speed  $\times$  time

$$t = \frac{C}{n} (\text{time})$$

$$\text{Time} \Rightarrow \frac{nt}{C}$$

111. 3

111.  $R_{\text{eq}} = \frac{20}{3} \Omega$  ;  $I_{\text{max}} = \frac{2.2}{\left(\frac{20}{3}\right)} \Rightarrow 0.33 \text{ A}$

$$R_{\text{eq}} = \frac{20}{3} + 30 \Rightarrow \frac{110}{3} \Omega$$

$$I_{\text{min}} = \frac{2.2}{\left(\frac{110}{3}\right)} ; I_{\text{min}} = 0.06 \text{ A}$$

112. 1

112.  $V_A = \sqrt{u^2 + 2gh}$

$$V_B = \sqrt{u^2 + 2gh}$$

For C: Vertical velocity  $V_y = \sqrt{2gh}$

Horizontal velocity =  $u$

$$V_C = \sqrt{V_x^2 + V_y^2}$$

$$\Rightarrow \sqrt{u^2 + 2gh}$$

$$V_A = V_B = V_C$$

113. 2

113.  $u = -12$

$$m = \frac{-v}{u} = \frac{-5}{2}$$

$$\Rightarrow \frac{-V}{-12} = \frac{-5}{2}$$

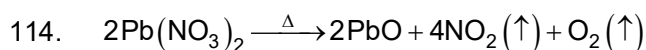
$$V = -30 \text{ cm}$$

$$\frac{1}{v} + \frac{1}{u} = \frac{1}{f} ; \frac{1}{-30} + \frac{1}{-12} = \frac{1}{f}$$

$$\Rightarrow f = -8.6 \text{ cm}$$

## CHEMISTRY

114. 2

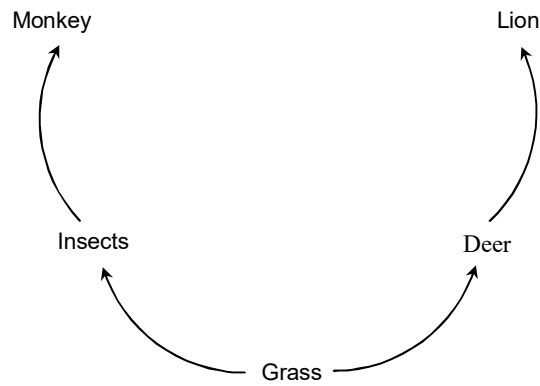


115. 3  
 115.  $\text{Pb}(\text{NO}_3)_2 + 2\text{KI} \longrightarrow \text{PbI}_2 (\downarrow) + 2\text{KNO}_3$   
 Yellow ppt.
116. 3  
 116.  $\text{NaHCO}_3$  + Tartaric acid
117. 1  
 117. 3 mole conc. HCl + 1 mole conc.  $\text{HNO}_3$
118. 1  
 118.  $\text{CH}_3\text{CH}_2\text{OH} \xrightarrow[443\text{K}]{\text{Conc. H}_2\text{SO}_4} \text{H}_2\text{C} = \text{CH}_2 (\text{Ethene}) + \text{H}_2\text{O}$
119. 3  
 119. Denatured alcohol is a mixture of  $\text{C}_2\text{H}_5\text{OH}$  and  $\text{CH}_3\text{OH}$ .
120. 4  
 120. For welding a mixture of oxygen and ethyne is burnt.
121. 2  
 121.  $\text{Si} < \text{Be} < \text{Al} < \text{K}$
122. 2  
 122. CuO is insoluble in water.
123. 4  
 123.  $\text{KO}_2$  turns red litmus into blue.
124. 4  
 124.  $\text{SO}_2$  is not a green house gas.
125. 4  
 125. Aluminium does not show allotropy.
126. 1  
 126. (1) 100 g of He =  $\frac{100}{4} = 25 N_A$   
 (2) 100 g of Na =  $4.3 N_A$   
 (3) 100 g of Li =  $14.28 N_A$   
 (4) 100 g of Al =  $3.70 N_A$

## BIOLOGY

127. 3  
 127. → Absorption of light energy by chlorophyll.  
 → Breakdown of  $\text{H}_2\text{O}$  into Hydrogen and Oxygen and Conversion of light energy into chemical energy  
 → Reduction of carbon dioxide to carbohydrates.

128. 1  
128.



129. 2

129. In stratosphere the ozone is formed naturally through the interaction of solar ultraviolet radiation with molecular O<sub>2</sub>.

130. 4

130.

Column-I		Column-II	
(i)	Regeneration	(d)	Planaria
(ii)	Rhizopus	(e)	Spores
(iii)	Plumule	(a)	Shoot
(iv)	Rose	(c)	Vegetative Propagation
(v)	Stigma	(b)	Pollen grain

131. 4

131. The opening and closing of stomata regulated by water in guard cells.

132. 3

132. Total = 2432 seeds

$$\frac{2432}{16} = 152$$

Dihybrid cross ratio = 9 : 3 : 3 : 1

$$152 \times 9 = 1368$$

Yellow round – 9

Yellow wrinkled – 3

Green round – 3

Green wrinkled – 1

133. 2

133. The stakeholders of various forest products are:

→ People living near forests

→ Government only

→ Nature lovers

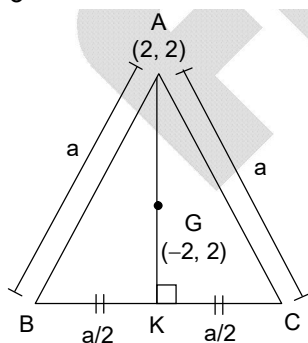
134. 3  
 134. Right auricle → Pulmonary artery → Pulmonary vein → Left ventricle
135. 3  
 135. Both statements A and R are false.
136. 2  
 136. Glass bottle, Perfume spray bottle, Thermocol, Ball pen refill are non biodegradable substances
137. 2  
 137.

Column-I			Column-II
(A)	Ribosome	(3)	Protein synthesis
(B)	Mitochondria	(1)	ATP formation
(C)	Centriole	(4)	Cell division
(D)	Chloroplast	(2)	Photosynthesis

138. 1  
 138. **Diaphragm** is a barrier method of contraception.
139. 1  
 139. Sperms are produced in the **seminiferous tubules**.
140. 2  
 140. Blood pressure is measured by **Sphygmomanometer**.

### MATHEMATICS

141. 3  
 141.



$$AG = \sqrt{(2+2)^2} = 4$$

$$\therefore AG = \frac{2}{3} \times AK$$

$$\therefore 4 = \frac{2}{3} \times AK$$

$$\Rightarrow AK = 6$$

$$\therefore AK = \frac{\sqrt{3}}{2} \times a$$

$$6 = \frac{\sqrt{3}}{2} \times a$$

$$\Rightarrow \frac{12}{\sqrt{3}} = a \Rightarrow \frac{12 \times \sqrt{3}}{\sqrt{3} \times \sqrt{3}} \Rightarrow a = 4\sqrt{3}$$

142. 2

142.  $5 + 7 + 9 + \dots +$  upto  $n$  terms  $= 60$

$\therefore$  sum of  $n$  terms of AP

$$= \frac{n}{2} [2a + (n-1)d]$$

ATQ,

$$\text{sum} = \frac{n}{2} [2 \times 5 + (n-1)2] = 60$$

$$\Rightarrow n[5 + n - 1] = 60$$

$$\Rightarrow n(4 + n) = 60$$

$$\Rightarrow n^2 + 10n - 6n - 60 = 0$$

$$\Rightarrow n(n + 10) - 6(n + 10) = 0$$

$$\Rightarrow (n + 10)(n - 6) = 0$$

$$\Rightarrow n = 6$$

$$\therefore n^2 - n = n(n - 1)$$

$$= 6 \times 5 = 30$$

143. 2

143. Sum of  $n$  odd natural number  $= n^2$

$$\therefore \text{sum of } p \text{ odd natural number} = p^2 = 100 \Rightarrow p = 10$$

sum of first ' $q$ ' even natural number

$$\Rightarrow 2 + 4 + 6 + \dots \text{ upto } 'q' \text{ terms}$$

$$= 2(1 + 2 + 3 + \dots \text{ upto } q \text{ term})$$

$$= 2 \times \frac{q \times (q+1)}{2} = 90$$

$$q^2 + q - 90 = 0$$

$$(q + 10)(q - 9) = 0$$

$$\Rightarrow q = 9$$

$$p + q = 10 + 9 = 19$$

144. 3

$$144. \quad x + \frac{1}{y} = 1$$

$$\Rightarrow xy + 1 = y$$

$$\Rightarrow xy - y = -1 \Rightarrow y(x - 1) = -1$$

$$\Rightarrow y = \frac{1}{1-x}$$

$$y + \frac{1}{z} = 1 \Rightarrow yz + 1 = z = yz - z = -1$$

$$\Rightarrow z(y - 1) = -1 \Rightarrow z = \frac{1}{1-y}$$

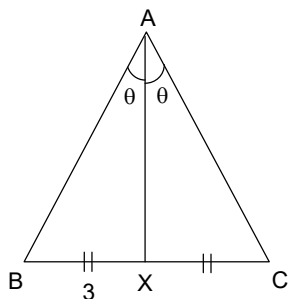
$$\therefore z = \frac{1}{1 - \frac{1}{1-x}} \Rightarrow z = \frac{1-x}{1-x-1}$$

$$\begin{aligned}
 -xz &= 1 - x \Rightarrow 1 + xz = x \\
 \Rightarrow \frac{1}{x} + z &= 1 \\
 \therefore \frac{1}{x} + z + 1 &= 1 + 1 = 2
 \end{aligned}$$

145. 3  
 145.  $p^{1/3} + q^{1/3} + r^{1/3} = 0$  ... (i)  
 If  $a + b + c = 0$  then  
 $a^3 + b^3 + c^3 = 3abc$   
 $\therefore$  by equation (i)  
 $(p^{1/3})^3 + (q^{1/3})^3 + (r^{1/3})^3 = 3 \times p^{1/3} \times q^{1/3} \times r^{1/3}$   
 $\Rightarrow p + q + r = 3(pqr)^{1/3}$   
 $\therefore (p + q + r)^3 = 27 pqr$

146. 4  
 146.  $a_1, a_2, a_3, \dots, a_n \rightarrow AP_1$   
 $b_1, b_2, b_3, \dots, b_n \rightarrow AP_2$   
 $a_1 b_1 = 120, a_2 b_2 = 143, a_3 b_3 = 154$  then  $a_8 b_8 = ?$   
 Let's say three terms of 1<sup>st</sup> AP are  
 $a - d, a, a + d,$   
 and first three terms of 2<sup>nd</sup> AP are  
 $B - D, B, B + D,$   
 Now,  $a_1 b_1 = 120$   
 $\Rightarrow (a - d)(B - D) = 120$   
 $\Rightarrow aB - aD - Bd + dD = 120$  ... (i)  
 $a_2 b_2 = 143$   
 $a \cdot B = 143$  ... (ii)  
 $a_3 b_3 = 154$   
 $\Rightarrow (a + d)(B + D) = 154$   
 $aB + aD + Bd + dD = 154$  ... (iii)  
 by equation (i) and (ii)  
 $23 = aD + Bd - dD$  ... (iv)  
 By equation (iii) and (ii)  
 $11 = aD + Bd + dD$  ... (v)  
 By equation (iv) and (v)  
 $12 = -2 dD \Rightarrow dD = -6$   
 and  $aD + Bd = 17$   
 Now,  $a_8 b_8 = (a + 6d)(B + 6D)$   
 $= aB + 6aD + 6Bd + 36 dD$   
 $= 143 + 6(17) + 36(-6)$   
 $= 143 + 102 - 216$   
 $= 29$

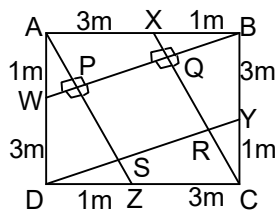
147. 4  
 147.





$AB = 12$   
 $BX = 3 \text{ cm}$   
 $\therefore \angle BAX = \angle CAX$   
 and  
 $AX$  bisects  $BC$ .  
 $\therefore \triangle ABC$  is isosceles  
 $\therefore AX \perp BC$   
 $\therefore AB = AC = 12$   
 $AC = \sqrt{12^2 - 3^2} = \sqrt{135} = 3\sqrt{15}$   
 $\therefore \text{Area of } \triangle ABC = \frac{1}{2} \times 6 \times 3\sqrt{15} = 9\sqrt{15} \text{ cm}^2$

148. 1  
148.



$CX = \sqrt{4^2 + 1^2} = 17 \text{ m}$   
 We have,  $BW = AZ = DY = CX$   
 $\text{ar}(\triangle BXC) = \frac{1}{2} \times 1 \times 4 = \frac{1}{2} \times (BQ) \times (XC)$   
 $\Rightarrow 4 = BQ \times \sqrt{17}$   
 $\Rightarrow BQ = \frac{4}{\sqrt{17}} \text{ m}$

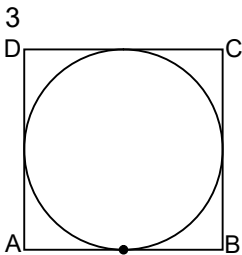
Also,  $BQ = CR = DS = AP = \frac{4}{\sqrt{17}}$   
 By Pythagoras theorem  
 $XQ = \sqrt{BX^2 - BQ^2} = \sqrt{1 - \frac{16}{17}} = \frac{1}{\sqrt{17}} \text{ m}$   
 $\Rightarrow XQ = WP = ZS = YR = \frac{1}{\sqrt{17}} \text{ m}$   
 Side of square =  $CX - CR - XQ$   
 $= \sqrt{17} - \frac{4}{\sqrt{17}} - \frac{1}{\sqrt{17}} = \frac{12}{\sqrt{17}} \text{ m}$   
 Area of square =  $\left(\frac{12}{\sqrt{17}}\right)^2 = \frac{144}{17} \text{ m}^2$   
 So,  $\sqrt{17A} = \sqrt{17 \times \frac{144}{17}} = 12$

149. 1  
149.  $(\cos^2\theta + 3 \cos^2\theta + 5 \cos^2\theta + \dots + 199 \cos^2\theta) + (2\sin^2\theta + 4\sin^2\theta + \dots + 200 \sin^2\theta) = 10050$   
 $\Rightarrow \cos^2\theta (1 + 3 + \dots + 199) + 2 \sin^2\theta (1 + 2 + 3 + \dots + 100) = 10050$   
 $\Rightarrow (100)^2 \cos^2\theta + 2 \sin^2\theta \times \frac{100 \times 101}{2} = 10050$   
 $\Rightarrow 10^4 \cos^2\theta + 10100 \sin^2\theta = 10050$   
 $\Rightarrow 10000 \cos^2\theta + 10000 \sin^2\theta + 100 \sin^2\theta = 10050$   
 $\Rightarrow 10000 (\cos^2\theta + \sin^2\theta) + 100 \sin^2\theta = 10050$   
 $\Rightarrow 100 \sin^2\theta = 50 (\because \sin^2\theta + \cos^2\theta = 1)$

$$\sin^2 \theta = \frac{1}{2} \Rightarrow \sin \theta = \frac{1}{\sqrt{2}} \Rightarrow \theta = 45^\circ$$

$$\therefore (\sin \theta + 3 \cos^2 \theta)^2 = (\sin 45 + 3 \cos 45)^2 = \left( \frac{1}{\sqrt{2}} + \frac{3}{\sqrt{2}} \right)^2 = \left( \frac{4}{\sqrt{2}} \right)^2 = 8$$

150.  
150.



$$p = x + y$$

Where  $x = 2\pi R$

$$y = 4a$$

Now  $2r = \text{side of square}$

$$\Rightarrow 2r = a$$

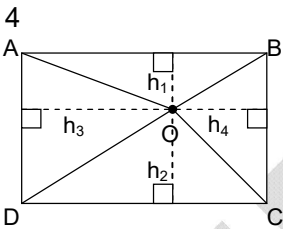
$$\Rightarrow p = 2\pi r + 4a$$

$$= 2\pi r + 8r$$

$$p = r(2\pi + 8)$$

$$\Rightarrow r = \frac{p}{2\pi + 8}$$

151.  
151.



$$[AOB] = a$$

$$[COD] = c$$

$$[AOD] = b$$

$$[AOB] + [COD] = \frac{1}{2} \times AB \times h_1 + \frac{1}{2} \times DC \times h_2$$

$$\Rightarrow \frac{1}{2} \times AB \times (h_1 + h_2) \quad \because AB = DC$$

$$a + c = \frac{1}{2} \times AB \times AD \quad \dots(i) \quad \because h_1 + h_2 = AD$$

Similarly,

$$[AOD] + [BOC] = \frac{1}{2} \times AD \times AB$$

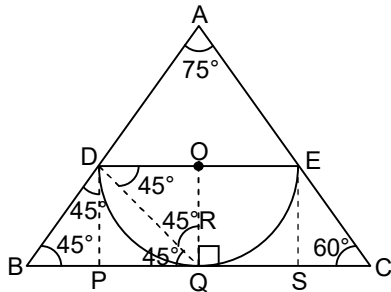
$$\Rightarrow b + [BOC] = \frac{1}{2} \times AB \times AD \quad \dots(ii)$$

by (i) and (ii)

$$\Rightarrow a + c = b + [BOC]$$

$$\Rightarrow [BOC] = a + c - b$$

152. 2  
152.



Draw  $DP \perp BC$ ,  $ES \perp BC$

Hence

$\square DOQP$ ,  $\square ESQO$  will be a square of side 'R' unit.

$\therefore PQ = R$

$\triangle BPD \rightarrow BP = R$  unit ( $\because \angle DBP = \angle BDP = 45^\circ$ )

Similarly,  $QS = R$  units

$\triangle ESC \rightarrow$

$$\tan 60^\circ = \frac{R}{SC} \Rightarrow \sqrt{3} = R/SC$$

$$SC = \frac{R}{\sqrt{3}}$$

$\therefore BC = BP + PQ + QS + SC$

$$26 = R + R + R + \frac{R}{\sqrt{3}}$$

$$\Rightarrow 26 = 3R + \frac{R}{\sqrt{3}}$$

$$\Rightarrow 26 = \frac{3\sqrt{3}R + R}{\sqrt{3}} \Rightarrow \frac{26\sqrt{3}}{3\sqrt{3} + 1} = R$$

$$R = \frac{26\sqrt{3}}{(3\sqrt{3} + 1)} \times \frac{(3\sqrt{3} - 1)}{(3\sqrt{3} - 1)}$$

$$R = \frac{26\sqrt{3}(3\sqrt{3} - 1)}{27 - 1}$$

$$= \sqrt{3}(3\sqrt{3} - 1)$$

$$R = 9 - \sqrt{3}$$

153. 2

153.  $p(\sin^2 x) + q(\sin x) + r = 0$

A/c to q

roots are  $\sin\theta$  and  $\sin(90 - \theta)$

$\therefore$  sum of roots

$$= \sin\theta + \sin(90 - \theta) = -\frac{q}{p}$$

$$\Rightarrow \sin\theta + \cos\theta = -\frac{q}{p} \quad \dots(i)$$

$$\text{Product of roots} = \sin\theta \cdot \cos\theta = \frac{r}{p} \quad \dots(ii)$$

$$(1)^2 = \sin^2\theta + \cos^2\theta + 2\sin\theta\cos\theta = \frac{q^2}{p^2}$$

$$\Rightarrow 1 + \frac{2r}{p} = \frac{q^2}{p^2}$$

$$\Rightarrow \frac{p+2r}{p} = \frac{q^2}{p^2} \Rightarrow p(p+2r) = q^2$$

154. 2

154. Female employee =  $\frac{2}{5}$  of 100 = 40

$\therefore$  Male employee = 60

$$\therefore \text{Avg} = 29 = \frac{\text{total weight}}{100}$$

$$\therefore 2900 = x + y \quad \dots(i)$$

where x = total weight of boys

y = total weight of girls

$$\Rightarrow \text{ATQ}, \frac{x/60}{y/40} = \frac{5}{7}$$

$$\Rightarrow 14x = 15y \quad \dots(ii)$$

by (i) & (ii)

$$2900 = \frac{29y}{14} \Rightarrow y = 1400$$

$$\therefore \frac{y}{40} = \frac{1400}{40} = 35$$

155. 2

155.  $\frac{1}{a}, \frac{1}{b}, \frac{1}{c}$  are in AP

$$\Rightarrow \frac{2}{b} = \frac{1}{a} + \frac{1}{c} \Rightarrow 2ac = bc + ab$$

$$\text{Now, } \frac{b+a}{b-a} + \frac{b+c}{b-c}$$

$$= \frac{b^2 - bc + ab - ac + b^2 + bc - ab - ac}{b^2 - bc - ab + ac}$$

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

156. 4

$$156. x^2 + px + q = 0 \quad \dots(i)$$

$$x^2 + lx + m = 0 \quad \dots(ii)$$

$\therefore (x+k)$  is common factor of both

$\therefore x = -k$  will satisfy both

$$\Rightarrow k^2 - pk + q = 0 \quad \dots(iii)$$

$$k^2 - lk + m = 0 \quad \dots(iv)$$

(iii) - (iv)

$$(-p+l)k = m - q$$

$$K = \frac{m - q}{l - p}$$

157. 3

157. Let's say price of rice per kg = x

After 40% hike, new price = x + 40% of x = 1.4 x

Now, ATQ,

$$\frac{1400}{x} - \frac{1400}{1.4x} = 10$$

$$\Rightarrow \frac{1400}{x} \left[ 1 - \frac{10}{14} \right] = 10$$

$$\Rightarrow \frac{1400}{x} \times \frac{4}{14} = 10 \Rightarrow x = 40$$

158. 4

158. Let's say

Speed of boat =  $x$  km / hr

Speed of current =  $y$  km / hr

$\therefore$  downstream speed =  $x + y$

Upstream speed =  $x - y$

According to question

Time taken in downstream =  $\frac{1}{2}$  of time taken in upstream

$$\Rightarrow \frac{d}{x+y} = \frac{1}{2} \times \frac{d}{x-y}$$

$$\Rightarrow 2(x-y) = x+y$$

$$2x - 2y = x + y$$

$$x = 3y$$

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

159. 3

159. According to question  $M = \frac{n+(n+1)+(n+2)+\dots+(n+19)}{20}$

$$M = \frac{20n + (1+2+3+\dots+19)}{20}$$

$$M = \frac{20n + \frac{19 \times 20}{2}}{20}$$

$$M = \frac{20n + 190}{20} = n + \frac{19}{2}$$

Now, last six consecutive natural numbers are removed.

$\therefore$  New mean,  $\Rightarrow \frac{n+(n+1)+\dots+(n+13)}{14}$

$$N = \frac{14n + (1+2+\dots+13)}{14}$$

$$= 14n + \frac{13 \times 14}{2} = \frac{14n + 91}{14}$$

$$N = n + \frac{13}{2}$$

$$\% \text{ Change} = \frac{M-N}{M} \times 100$$

$$= \frac{\left(n + \frac{19}{2}\right) - \left(n + \frac{13}{2}\right)}{\left(n + \frac{19}{2}\right)} \times 100$$

$$= \frac{3}{M} \times 100$$
$$= \frac{300}{M} \%$$

160. 1

160. Fav. cases =  $\{(3 \times 6), (3 \times 8), (5 \times 4), (5 \times 6), (5 \times 8), (7 \times 4), (7 \times 6), (7 \times 8)\} = 8$   
Total cases =  $4 \times 4 = 16$

$$\therefore \text{Probability} = \frac{\text{Favorable}}{\text{total}} = \frac{8}{16} = \frac{1}{2}$$

FITJEE