FIITJEE

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PART – II
SCHOLOASTIC APTITUDE TEST (SAT)
Held on: January 22, 2023
ANSWER KEYS

101.	**1**	102.	**4**	103.	**3**	104.	**2**
105.	**4**	106.	**3**	107.	**2**	108.	**3**
109.	**1**	110.	**4**	111.	**2**	112.	**4**
113.	**1**	114.	**2**	115.	**2**	116.	**2**
117.	**4**	118.	**1**	119.	**1**	120.	**1**
121.	**1**	122.	**1**	123.	**3**	124.	**2**
125.	**4**	126.	**3**	127.	**4**	128.	**1**
129.	**1**	130.	**3**	131.	**2**	132.	**3**
133.	**3**	134.	**4**	135.	**3**	136.	**4**
137.	**2**	138.	**1**	139.	**4**	140.	**2**
141.	**2**	142.	**3**	143.	**2**	144.	**1**
145.	**3**	146.	**1**	147.	**4**	148.	**1**
149.	**4**	150.	**3**	151.	**3**	152.	**2**
153.	**2**	154.	**1**	155.	**4**	156.	**1**
157.	**4**	158.	**2**	159.	**2**	160.	**1**
161.	**4**	162.	**3**	163.	**2**	164.	**1**
165.	**4**	166.	**3**	167.	**4**	168.	**1**
169.	**1**	170.	**3**	171.	**2**	172.	**2**
173.	**2**	174.	**2**	175.	**2**	176.	**2**
177.	**1**	178.	**2**	179.	**3**	180.	**2**
181.	**2**	182.	**4**	183.	**2**	184.	**2**
185.	**4**	186.	**2**	187.	**4**	188.	**3**
189.	**2**	190.	**2**	191.	**2**	192.	**1**
193.	**1**	194.	**1**	195.	**3**	196.	**2**
197.	**2**	198.	**3**	199.	**4**	200.	**1**

HINTS & SOLUTIONS

101. 1

Sol. Gravitational force (F) = $\frac{Gm_1m_2}{R^2}$

$$F = \frac{K}{R^2} \Rightarrow F' = \frac{K}{\left(R + \frac{4R}{100}\right)^2} = \frac{K}{R^2} \times \left(\frac{100}{104}\right)^2 = F(0.92)$$

$\therefore$ % decrease = $\frac{F - F'}{F} \times 100\% = \frac{F - 0.92F}{F} \times 100\%$

= 8%

102. 4

Sol. $F = \frac{\Delta p}{\Delta t} = \frac{10}{0.01} = 1000\ N$

103. 3

Sol. $t = \sqrt{\frac{2h}{g}}$ $\quad \therefore \frac{t_1}{t_2} = \sqrt{\frac{h_1}{h_2}}$

104. 2

Sol. Momentum is a vector quantity

105. 4

Sol. As, $s = ut + \frac{1}{2}at^2$

$s \propto t^2$

Acceleration is constant.

106. 3

Sol. Mass is the measure of inertia of a body.

$\frac{M_{father}}{M_{son}} = \frac{60}{30} = \frac{2}{1}$

107. 2

Sol. $s = ut + \frac{1}{2}at^2$

$s \propto t^2$

Acceleration is constant.

108. 3

Sol. $\left(\frac{9}{10}v\right)^2 - v^2 = 2ax$ …(I)

$o^2 - v^2 = 2a.(nx)$ …(II)

$\frac{-v^2}{n} = \left(\frac{9v}{10}\right)^2 - v^2$

$\Rightarrow \frac{-v^2}{n} = \frac{81v^2 - 100v^2}{100} = \frac{-19v^2}{100}$

$n = \frac{100}{19}$

Thus number of block needed to stop the bullet = 6

109. 1

Sol. $G = \frac{Fr^2}{m_1 m_2}$

Unit : $\frac{Nm^2}{Kg^2} = \frac{Kg\frac{m}{s^2} \times m^2}{Kg^2} = \frac{m^3}{Kgs^2}$

or $kg^{-1}\ m^3\ s^{-2}$

110. 4

Sol. Fluid pressure (P) = ρgh

As 'ρ' and 'h' are same in all cases. So, pressure will be same.

111. 2

Sol. Slope of displacement-time graph gives velocity

Slope of B > slope of A

112. 4

Sol. $F_{net} = \frac{\Delta P}{\Delta t} = \frac{m(v-u)}{t}$

$\Rightarrow \quad 20 = \frac{10(100-0)}{t}$

$\Rightarrow \quad t = \frac{1000}{20} = 50 \text{ sec}$

113. 1

Sol. Pressure (P) = $\frac{F}{A}$

For minimum pressure area of contact should be maximum.

114. 2

Sol. Tincture of iodine is a solution of iodine in alcohol.

115. 2

Sol. Colloidal solutions(Milk, Starch Solution & Blood) show Tyndall effect.

116. 2

Sol. Atomicity is known as number of atoms constituting a molecule

117. 4

Sol. The valency of phosphorus is 3 & 5

118. 1

Sol. $^2_1D \rightarrow$ No. of electron = 1

No. of proton = 1

No. of neutron = 1

119. 1

Sol. This statement "There is a positively charged centre in an atom called the nucleus" was conclusion not an observation of Rutherford's model of atom.

120. 1
Sol. The symbol of nitride ion is N^{3-}.

121. 1
Sol. Mass of 10^{22} atoms = 930×10^{-3} g
Mass of 6.022×10^{23} atoms = $\frac{930 \times 10^{-3} \times 6.022 \times 10^{23}}{10^{22}} = 56$ g

122. 1
Sol. 1.5×10^{20} molecule of methane
6.022×10^{23} molecules of CH_4 = 1 mol
1.5×10^{20} molecules of CH_4 = $\frac{1 \times 1.5 \times 10^{20}}{6.022 \times 10^{23}} = 2.49 \times 10^{-4}$ mole
Mass of CH_4 = $1.6 \times 2.49 \times 10^{-4} = 3.984 \times 10^{-3}$ g (same as ethane)
M.Wt of C_2H_6 = 30
30 g of C_2H_6 contains 6.022×10^{23} molecules
3.984×10^{-3} of C_2H_6 contains = $\frac{6.022 \times 10^{23} \times 3.984 \times 10^{-3}}{30} = 8 \times 10^{19}$ molecule

123. 3
Sol. Dry ice(Solid CO_2) is a compound.

124. 2
Sol. The mixture of NH_4Cl & NaCl is separated by sublimation.

125. 4
Sol. Av. atomic mass = $\frac{35 \times 3 + 37 \times 1}{3 + 1} = 35.5$

126. 3
Sol. $\text{Moles} = \frac{\text{Mass}}{\text{Mol.Mass}}$
$CO_2 = \frac{1}{44}, H_2 = \frac{1}{2}, N_2 = \frac{1}{28}, CH_4 = \frac{1}{16}$

127. 4
Sol. Lysosomes are the waste disposal systems of the cell.

128. 1
Sol. The correct order of taxonomic hierarchy is
$\text{Kingdom} \xrightarrow{\text{Phylum}} \text{Class} \xrightarrow{\text{Order}} \text{Family} \xrightarrow{\text{Genus}} \text{Species}$

129. 1
Sol. Aerenchyma tissue is present in aquatic plants and it is made up of parenchyma tissue which helps in floating of aquatic plants.

130. 3
Sol. Mackerel, Tuna, Sardine & Bombay duck are marine fishes.

131. 2
Sol. Notochord is present in tail of Herdmania larva. Urochordates have notochord present only in the tail of free living talpole larva.

132. 3
Sol. Cutin is a waxy substance present on the epidermis of desert plants to prevent water loss.

133. 3
Sol. 'Omnis cellula e cellula' was proposed by Rudolf Virchow.

134. 4
Sol. Riccia is a bryophyte, which lacks vascular tissue (Xylem & phloem)

135. 3
Sol. Commercial cork is the derivative of the phellogen. It is obtained from the prime subset of bark tissue which is also called phellogen.

136. 4
Sol. Periplaneta (Cockroach) belongs to phylum Arthropoda.

137. 2
Sol. Carl Woese divided kingdom monera into Archaebacteria and Eubacteria.

138. 1
Sol. Red wood tree 'Sequoia' belongs to phylum 'Gymnosperms'.

139. 4
Sol. Influenza is a viral disease.

140. 2
Sol. Smog is a combination of smoke and fog.

141. 2
Sol. $\sqrt[3]{x}-\sqrt[3]{x-36}=3$

Cubing

$$\left[(x)^{1/3}\right]^3-\left[(x-36)^{1/3}\right]^3-3\times(x)^{1/3}(x-36)^{1/3}\left\{(x)^{1/3}-(x-36)^{1/3}\right\}=27$$

$$\Rightarrow x-x+36-3\times(x)^{1/3}(x-36)^{1/3}\times 3=27$$

$$\Rightarrow 9=9(x)^{1/3}(x-36)^{1/3}.$$

$$\Rightarrow (x)^{1/3}(x-36)^{1/3}=1$$

$$\Rightarrow x(x-36)=1$$

$$\Rightarrow x-36=\frac{1}{x}$$

$$\Rightarrow x-\frac{1}{x}=36$$

142. 3

Sol. $$\frac{1}{(a-b)}+\left(\frac{1}{b-c}\right)+\left(\frac{1}{c-a}\right)=3\sqrt{10} \qquad \text{.....(i)}$$

$$\frac{1}{(a-b)^2}+\frac{1}{(b-c)^2}+\frac{1}{(c-a)^2}+10=??$$

Squaring equation (i)

$$\frac{1}{(a-b)^2}+\frac{1}{(b-c)^2}+\frac{1}{(c-a)^2}+2\left[\frac{1}{(a-b)(b-c)}+\frac{1}{(b-c)(c-a)}+\frac{1}{(c-a)(a-b)}\right]$$

$= 90$

$$\Rightarrow \frac{1}{(a-b)^2}+\frac{1}{(b-c)^2}+\frac{1}{(c-a)^2}+2\left[\frac{c-a+a-b+b-c}{(a-b)(b-c)(c-a)}\right]=90$$

$$\Rightarrow \frac{1}{(a-b)^2}+\frac{1}{(b-c)^2}+\frac{1}{(c-a)^2}+0=90$$

$$\Rightarrow \frac{1}{(a-b)^2}+\frac{1}{(b-c)^2}+\frac{1}{(c-a)^2}+10=90+10=100$$

143. 2

Sol. $x=2+\sqrt{3}$

$x-2=\sqrt{3}$

Squaring

$x^2+4-4x=3$

$\Rightarrow x^2-4x+1=0 \quad \Rightarrow \quad x^2+1=4x \qquad \ldots\ldots(i)$

squaring equation (i)

$\Rightarrow x^4+1+2x^2=16x^2$

$\Rightarrow x^4+1=14x^2$

Now, $x^4-8x^3+18x^2-8x+2$

$=\left(x^4+1\right)+18x^2-8x\left(x^2+1\right)+1$

$\Rightarrow 14x^2+18x^2-8x(4x)+1$

$= 1$

144. 1

Sol. $l=2021, m=2022, n=2023,$

$$l^2+m^3+n^3-3lm=\frac{(l+m+n)}{2}\left[(l-m)^2+(m-n)^2+(n-l)^2\right]$$

$$=\frac{(2021+2022+2023)}{2}\left[(1)^2+(1)^2+(2)^2\right]$$

$$\Rightarrow \frac{6066}{2}\times 6=18198$$

145. 3

Sol. $a+b=10,$ (i)

$a^3+b^3=370$

Cubing equation (i)

$a^3+b^3+3ab(a+b)=1000$

$\Rightarrow 370+3ab\times 10=1000$

$\Rightarrow 30ab=630$

$\Rightarrow ab=21$

$\therefore a^2+b^2=(a+b)^2-2ab$

$=100-2\times 21$

$=58$

146. 1

Sol. $A=2^{1/3}+2^{-1/3}$

Cubing

$A^3=\left(2^{1/3}\right)^3+\left(2^{-1/3}\right)^3+3\times\left(2^{1/3}\right)\left(2^{-1/3}\right)\left(2^{1/3}+2^{-1/3}\right)$

$\Rightarrow A^3=2+2^{-1}+3A$

$\Rightarrow A^3=\frac{5}{2}+3A$

$\Rightarrow 2A^3=5+6A$

$\therefore 2A^3-6A+3=(6A+5)-6A+3$

$=8$

147. 4

Sol. $x+y+z=3,\ x^2+y^2+z^2=6$

$\frac{1}{x}+\frac{1}{y}+\frac{1}{z}=1,$

$\because x+y+z=3$

squaring both sides

$x^2+y^2+z^2+2(xy+yz+zx)=9$

$\Rightarrow 6+2(xy+yz+zx)=9$

$\Rightarrow xy+yz+zx=\frac{3}{2}$

Now $\frac{1}{x}+\frac{1}{y}+\frac{1}{z}=1$

$\frac{xy+yz+zx}{xyz}=1$

$\Rightarrow xyz=xy+yz+zx$

$=\frac{3}{2}$

148. 1

Sol. $\because$ diagonal of a polygon = 54

$\Rightarrow \frac{n(n-3)}{2}=54$

$\Rightarrow n^2-3n-108=0$

$\Rightarrow n^2-12n+9n-108=0$

$\Rightarrow n(n-12)+9(n-12)=0$

$\Rightarrow (n-12)(n+9)=0$

$\because n\neq -9$

$\Rightarrow n=12$

149. 4

Sol. $a=0.\bar{2}, b=0.2\bar{3}$

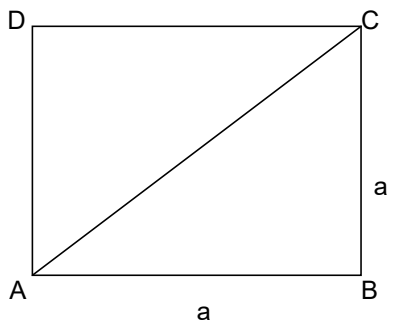
$\Rightarrow a=0.\bar{2}=\frac{2}{9}$

$b=0.2\bar{3}=\frac{23-2}{90}=\frac{21}{90}$

$\therefore a+b=\frac{2}{9}+\frac{21}{90}=\frac{20+21}{90}=\frac{41}{90}=0.45\bar{}$

150. 3

Sol. $\because ABCD$ is a square with side 'a'



$\therefore$ Diagonal AC $=a\sqrt{2}$

$\because$ Diagonals are equal in square

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

Now, ATQ, $AC+BD=100$

$\Rightarrow a\sqrt{2}+a\sqrt{2}=100$

$\Rightarrow 2a\sqrt{2} = 100$

$\Rightarrow a = \frac{50}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}} = 25\sqrt{2}$,

$\therefore$ Area $= a^2 = \left(25\sqrt{2}\right)^2 = 625 \times 2 = 1250$ sq cm

151. 3

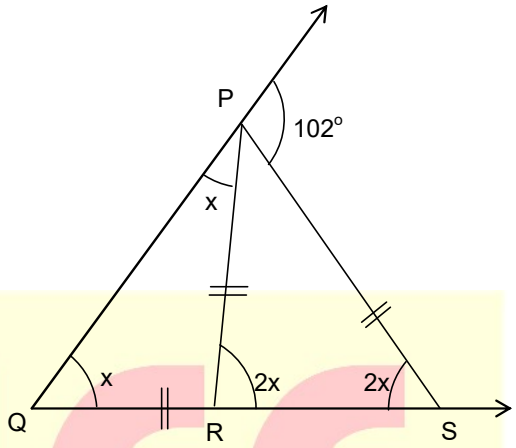
Sol. Since $PR = QR \Rightarrow \angle QPR = \angle RQP = x$

$\Rightarrow \angle PRS = 2x$ (exterior angle)

Since PR = PS

$\Rightarrow \angle PSR = 2x$

Now, from figure, $102 = x + 2x \Rightarrow x = 34$



152. 2

Sol. Let edge of cube = x units

Then $V = x^3, S = 6x^2, D = \sqrt{3}\,x$

Then $DS = \left(\sqrt{3}x\right)\left(6x^2\right) = 6\sqrt{3}x^3 = 6\sqrt{3}V$

153. 2

Sol. Side of hexagon = radius = R

$\Rightarrow$ Perimeter of hexagon = 6R

154. 1

Sol. unit digit of $(12)^{222} = 4$

Unit digit of $(23)^{333} = 3$

Unit digit of $(34)^{444} = 6$

Unit digit of $(12)^{222} + (23)^{333} + (34)^{444}$ = unit digit of 13 = 3

155. 4

Sol. Let $x^4 + 4x^3 + nx^2 + 4x + 1 = \left(x^2 + bx + c\right)^2$

$\Rightarrow x^4 + 4x^3 + nx^2 + 4x + 1 = x^4 + 2bx^3 + \left(b^2 + 2c\right)x^2 + 2bcx + c^2$

on comparing coefficients, we get $b = 2,\ c = 1,\ n = b^2 + 2c = 6$

156. 1

Sol. Let length of each train = x cm

Then distance covered by faster train to pass slower train = (2x) m

Relative speed = 46 – 36 = 10 km/hr $= \frac{25}{9}\text{m/sec}$

Time taken $= \frac{2x}{\frac{25}{9}} = 36 \Rightarrow x = 50\,\text{m}$

157. 4

Sol. Let original salary = Rs. 100

Then increased salary = Rs. 110

Now to make his salary back to original salary it must be reduced by Rs. 10

Reduction % $= \frac{10}{110} \times 100 = \frac{100}{11}\% = 9\frac{1}{11}\%$

158. 2

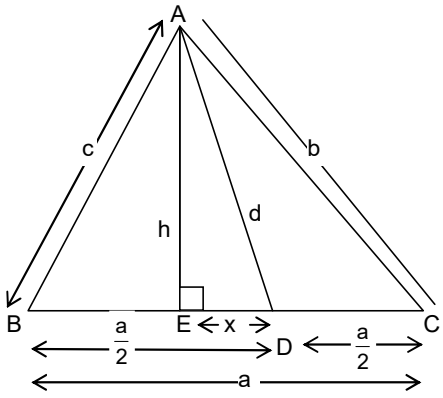
Sol. In $\Delta AED,\ d^2 = h^2 + x^2$ ….(i)

In $\Delta AEC,\ b^2 = h^2 + \left(x + \frac{a}{2}\right)^2$

$\Rightarrow b^2 = h^2 + x^2 + \frac{a^2}{4} + ax$

$\Rightarrow b^2 = d^2 + \frac{a^2}{4} + ax$

$\Rightarrow x = \frac{b^2 - d^2 - \frac{a^2}{4}}{a}$

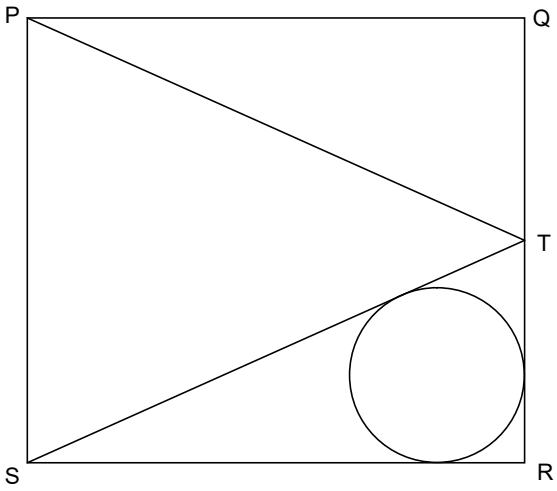


159. 2

Sol. $TS = 3\sqrt{5}$

TR = 3

SR = 6



$$r = \frac{\Delta}{s}$$

$$\Delta = \frac{1}{2} \times 6 \times 3 = 9$$

$$r = \frac{9}{\frac{9+3\sqrt{5}}{2}}$$

$$= \frac{18}{3\left(3+\sqrt{5}\right)}$$

$$= \frac{6}{3+\sqrt{5}}$$

160. 1

Sol. $2^x = 3^y = 6^{-z} = k$ (let)

then $k^{\frac{1}{x}} = 2, k^{\frac{1}{y}} = 3, k^{-\frac{1}{z}} = 6$

Now, $2 \times 3 = 6 \Rightarrow k^{\frac{1}{x}} \times k^{\frac{1}{y}} = k^{-\frac{1}{z}}$

$$\Rightarrow \frac{1}{x} + \frac{1}{y} = -\frac{1}{z} \Rightarrow \frac{1}{x} + \frac{1}{y} + \frac{1}{z} = 0$$