

FIITJEE

JUNIOR SCIENCE TALENT SEARCH EXAMINATION (JSTSE) 2019 – 20

(For Class – IX)

Held on December 15, 2020

ANSWER KEYS

GENERAL KNOWLEDGE

1.	2	2.	2	3.	3	4.	2
5.	1	6.	3	7.	2	8.	2
9.	2	10.	4	11.	1	12.	2
13.	2	14.	4	15.	1	16.	4
17.	1	18.	3	19.	1	20.	4
21.	3	22.	1	23.	2	24.	3
25.	1	26.	4	27.	4	28.	1
29.	4	30.	4	31.	2	32.	1
33.	2	34.	3	35.	4	36.	3
37.	1	38.	3	39.	2	40.	4
41.	2	42.	3	43.	3	44.	3
45.	4	46.	3	47.	1	48.	2
49.	3	50.	3				

PHYSICS

51.	2	52.	4	53.	2	54.	1
55.	3	56.	2	57.	1	58.	2
59.	4	60.	1	61.	1	62.	2
63.	1	64.	2	65.	2	66.	3
67.	4	68.	4	69.	2	70.	1
71.	3	72.	1	73.	3	74.	2
75.	3	76.	4	77.	4	78.	3
79.	2	80.	2	81.	4	82.	1
83.	2	84.	3	85.	3	86.	2
87.	3	88.	1	89.	1	90.	2

CHEMISTRY

91.	3	92.	2	93.	3	94.	1
95.	2	96.	3	97.	1	98.	2
99.	2	100.	4	101.	1	102.	2
103.	4	104.	1	105.	2	106.	2
107.	1	108.	1	109.	3	110.	3
111.	2	112.	4	113.	1	114.	3
115.	4	116.	2	117.	1	118.	2
119.	3	120.	4	121.	2	122.	2
123.	2	124.	4	125.	1	126.	3
127.	1	128.	2	129.	4	130.	3

BIOLOGY

131.	4	132.	1	133.	4	134.	2
135.	2	136.	2	137.	3	138.	1
139.	2	140.	1	141.	3	142.	2
143.	4	144.	1	145.	1	146.	1
147.	1	148.	1	149.	2	150.	3
151.	3	152.	4	153.	2	154.	2
155.	1	156.	1	157.	1	158.	1
159.	1	160.	3	161.	3	162.	3
163.	3	164.	1	165.	1	166.	3
167.	4	168.	1	169.	2	170.	1

MATHEMATICS

171.	2	172.	1	173.	3	174.	No option correct $\left(\frac{17}{2}\right)$
175.	1	176.	3	177.	3	178.	2
179.	3	180.	1	181.	4	182.	1
183.	4	184.	1	185.	4	186.	4
187.	3	188.	4	189.	3	190.	1
191.	2	192.	4	193.	2	194.	4
195.	4	196.	1	197.	2	198.	1
199.	3	200.	1				

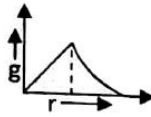
HINTS AND SOLUTIONS

51. 2
Sol. The instrument used to conduct electrolysis is voltameter.

52. 4
Sol. Distance between two consecutive crest or trough is wavelength.

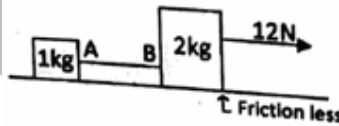
53. 2
Sol. Acceleration = $\frac{P}{m}$
Velocity $v = u + at \Rightarrow v = \frac{P}{m} \times t$
Kinetic energy $K = \frac{1}{2}mv^2 = \frac{P^2 t^2}{2m}$

54. 1
Sol. $g \propto r$ ($r < \text{Radius of Earth}$)
 $g \propto \frac{1}{r^2}$ ($r > \text{Radius of Earth}$)



55. 3
Sol. By conservation of momentum
 $mv + 2m \times 0 = (m + 2m)V$
 $\Rightarrow V = \frac{v}{3}$

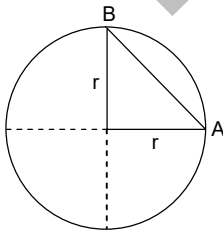
56. 2
Sol. Acceleration $a = \frac{12}{3} = 4 \text{ m/s}^2$
FBD of 1 kg $\Rightarrow T = ma = 4 \text{ N}$.



57. 1
Sol. Acceleration = $\frac{\text{Net force}}{\text{Total mass}} = \frac{40 - 20}{2 + 4} = \frac{10}{3} \text{ m/s}^2$

58. 2
Sol. $V = \varepsilon - Ir$ (Straight line equation with -ve slope & +ve intercept)

59. 4
Sol.



$$AB = \sqrt{r^2 + r^2} = \sqrt{2} r$$

60. 1
Sol. Factual

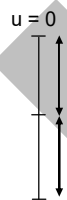
61. 1
 Sol. $h_{\text{Hg}} 13.6 \times g = 20 \times 1 \times g$
 $h_{\text{Hg}} = 1.48 \text{ cm}$

62. 2
 Sol. $\frac{V_i}{V} = \frac{2}{3} = \frac{\rho_{\text{wood}}}{\rho_{\text{H}_2\text{O}}} = \text{Relative density of wood.}$

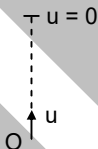
63. 1
 Sol. Gravitational intensity = $\frac{GM}{R^2} = g.$

64. 2
 Sol. $F = \frac{GM^2}{(2r)^2} = \frac{G\left(\frac{4}{3}\pi r^3 \times \rho\right)^2}{4r^2} = \frac{G\pi^2 r^4 \rho^2}{9}$
 $F \propto r^4$

65. 2
 Sol. Half height
 $h = \frac{1}{2} \times g \times 9$
 Say time taken to reach ground is t.
 $2h = \frac{1}{2} \times g \times t^2$
 $t = \sqrt{18} = 4.242$



66. 3
 Sol. Time of ascent $t_A = 5 \text{ sec.}$
 $v = u - gt$
 $0 = u - 9.8 \times 5 \quad (t = \text{sec})$
 $\Rightarrow u = 49 \text{ m/s}$



67. 4
 Sol. An object while moving may not have non-zero acceleration but constant velocity.

68. 4
 Sol. Average speed \geq average velocity.

69. 2
 Sol. The graph represents constant -ve acceleration with +ve initial velocity.

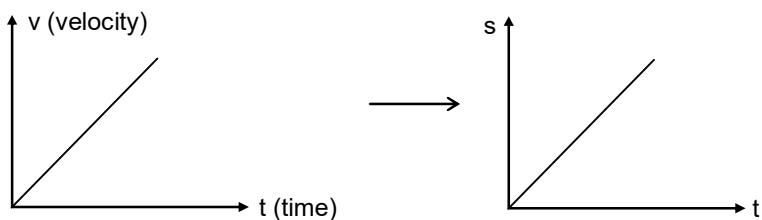
70. 1
 Sol. Option 1 is correct. Though if we take downward direction as positive direction then option 3 can also be correct.

71. 3
 Sol. Area under acceleration time graph is equal to change in velocity.

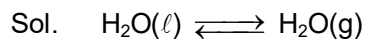
72. 1
 Sol. $s = \frac{1}{2}at^2 \quad (a = \text{constant})$

73. 3

Sol.



74. 2



According to Le Chatelier principle, if we increase the pressure at equilibrium then the reaction will move towards that side, where the gaseous moles are less. So, the reaction will shift backward it means boiling point increases.

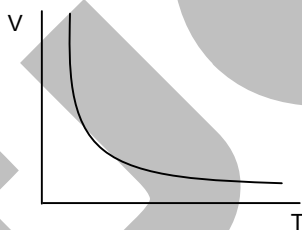
75. 3

Sol. By Wien's displacement law.

$$\lambda \propto \frac{1}{T}$$

76. 4

Sol. Time period = $\frac{1}{\text{Frequency}}$



77. 4

Sol. $P = \frac{mgh}{t}$

$$2 \times 10^3 = \frac{m \times 9.8 \times 10}{60}$$

$$\Rightarrow m \cong 1225 \text{ kg}$$

78. 3

Sol. Unit of intensity of sound = $\frac{W}{m^2}$
 $= \text{Jm}^{-2} \text{s}^{-1}$ (1 W = 1 J/s)

79. 2

Sol. $F = \frac{150}{1000} \times \frac{(20-0)}{0.1} = 30 \text{ N}$

80. 2

Sol. Static friction is self-adjusting force.

81. 4

Sol. When milk is churned cream separates out because of the centrifugal force.

82. 1

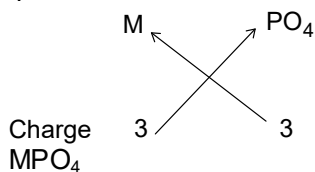
Sol. Work done by a simple pendulum in one complete oscillation is zero.

83. 2
 Sol. Acceleration $a = \frac{v_1}{t_1}$
 Force = m.a.
 Velocity $v = a \cdot t$
 Power = F. v. = $ma^2t = \frac{m \times v_1^2}{t_1^2} \times t$
84. 3
 Sol. $KE = \frac{p^2}{2m}$
 $p \propto \sqrt{m}$ (KE – constant)
85. 3
 Sol. On temperature scales upper fixed point is boiling point of water.
86. 2
 Sol. A body is just floating in a liquid. If the body is slightly pressed downwards and released it will sink to bottom.
87. 3
 Sol. $P = \rho gh$
88. 1
 Sol. The loudness and pitch of sound depends on intensity and frequency.
89. 1
 Sol. $\frac{-40^\circ f - 32^\circ f}{180} = \frac{x^\circ C - 0}{100}$
 $x = -40^\circ C$
90. 2
 Sol. $E = mc^2$
 Since water release energy, some mass must get converted into energy.
91. 3
 Sol. Latent heat of vapourisation overcome the force of attraction between molecules in liquid state.
92. 2
 Sol. Crushing of crystal does not change state of matter.
93. 3
 Sol. Because 'R' melts at $-166^\circ C$ and boils at $-103^\circ C$.
94. 1
 Sol. $H_2O > C_2H_5OH > CS_2$. Higher is the value of heat of vaporization more is intermolecular force of attraction.
95. 2
 Sol. Water (liquid) \rightarrow Layers can slide over each other
 Sugar (Solid) \rightarrow Particles are not free to move
 Nitrogen (gas) \rightarrow Particles move randomly
 Ammonium chloride (sublime) \rightarrow Changes directly to gaseous phase

96. 3
Sol. Emulsion – Milk
Foam – Shaving cream
Aerosol – Smoke
Solid sol – Coloured gem stone
97. 1
Sol. Chromatography, distillation & fractional distillation method are used for purification of liquids.
98. 2
Sol. Stainless steel pins are used for holding broken bones together.
99. 2
Sol. Coal is a mixture.
100. 4
Sol. True solution does not show tyndall effect
101. 1
Sol. $w / w\% = \frac{\text{mass of solute}}{\text{mass of solution}} \times 100 = \frac{30}{250} \times 100 = 12\%$
102. 3
Sol. Mass of 1 mol molecule of $\text{H}_2\text{O} = 18 \text{ g}$
Mass of 1 molecule $\text{H}_2\text{O} = \frac{18}{6.02 \times 10^{23}} = 2.99 \times 10^{-23} = 3 \times 10^{-23} \text{ g}$
Density of water is 1 g/cm^3
 \therefore Volume of 1 molecule will be $3 \times 10^{-23} \text{ cm}^3$
103. 4
Sol. 1 mol of CO_2 contains $= 3 \times N_A$ atom
 \therefore 0.1 mol of CO_2 contains $= 0.3 \times 6.022 \times 10^{23} = 1.8 \times 10^{23}$
104. 1
Sol. Mass of nitrogen present in alkaloid $= \frac{17.28}{100} \times 162 = 27.99$
 \therefore Number of nitrogen atoms present per molecule $= \frac{28}{14} = 2$
105. 2
Sol. Number of moles of Fe $= \frac{558.6}{55.86} = 10$
Number of moles of C $= \frac{60}{12} = 5$
So, option (2) is correct.
106. 2
Sol. Atomic mass of He = 4.
Number of atom in 52u He $= \frac{52}{4} = 13$ atoms

107. 1

Sol.



108. 1

Sol.

$$\frac{\text{Charge}}{\text{Mass}} = n \quad \alpha \quad p \quad e$$

$$\frac{0}{1} \quad \frac{1}{2} \quad 1 \quad \frac{1}{1/1837} = 1837$$

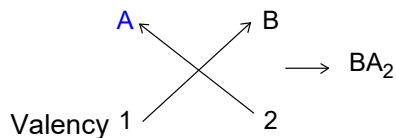
109. 3

Sol.

$^{12}_6\text{C}$ = no. of neutron = 6
 $^{14}_{28}\text{Si}$ = no. of neutron = 14
 Ratio of neutron = 3 : 7

110. 3

Sol.



111. 2

Sol.

Let ratio of $^{16}_8\text{A}$ isotope be 'x'
 $16 \times x + 18 \times (1 - x) = 16.2$
 $1.8 = 2x$
 $x = 0.9$
 \therefore Percentage abundance of $^{16}_8\text{A} = 90\%$ & $^{18}_8\text{A} = 10\%$

112. 4

Sol.

Alum helps to purify muddy water by coagulation.

113. 1

Sol.

Teflon is used for making non-stick utensils.

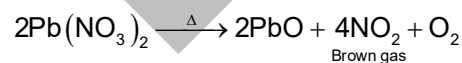
114. 3

Sol.

Solder = Pb & Sn

115. 4

Sol.



116. 2

Sol.

Calcium hydroxide reacts slowly with CO_2 in air to form CaCO_3 , which gives a shiny finish to walls.

117. 1

Sol.



118. 2

Sol.

Antirust solution are alkaline.

119. 3
Sol. Na – 24 used to detect blood clot.

120. 4
Sol. Latent heat of vaporization of water = 22.5×10^5 J/Kg

121. 2
Sol. Moles = $\frac{4.25}{17}$ g = 0.25
1 mole of NH_3 = $4 \times N_A$ atom
0.25 mole of NH_3 = $0.25 \times 4 \times 6.022 \times 10^{23}$ atm = 6.0×10^{23}

122. 2
Sol. Fe^{2+} ion present in oxygenated heamoglobin.

123. 2
Sol. $\text{Fe}_2\text{O}_3 + 3\text{CO} \longrightarrow 2\text{Fe} + 3\text{CO}_2$
3 mol CO \rightarrow 2 mole Fe
16 mol CO $\rightarrow \frac{2}{3} \times 16 = 10.67$ mol

124. 4
Sol.

$\begin{array}{ccccccc} & & \text{Oxidation} & & & & \\ & & \downarrow & & & & \\ +3 & 0 & & +2 & & 0 & \\ \text{Al}_2\text{O}_3 & + & 3\text{Mg} & \longrightarrow & 3\text{MgO} & + & 2\text{Al} \\ \text{(Oxidant)} & & \text{(Reductant)} & & & & \\ & & & & & & \\ & & & & & & \uparrow \\ & & & & & & \text{Reduction} \end{array}$

125. 1
Sol. Mass of one litre of vapour = $V \times d$
= $1000 \times 0.0006 = 0.6$ g
 \therefore Volume of liquid water = $\frac{\text{mass}}{\text{density}} = \frac{0.6}{1} = 0.6$ cm³
 \therefore density of water = 1 g/cc

126. 3
Sol. 1. ${}^{19}_9\text{F}^-$ = 10 electron, 10 neutron
2. ${}^{26}_{13}\text{Al}^{3+}$ = 10 electron, 13 neutron
3. ${}^{16}_8\text{O}^{2-}$ = 10 electron, 8 neutron
4. ${}^{23}_{11}\text{Na}^+$ = 10 electron, 12 neutron
 ${}^{16}_8\text{O}^{2-}$ has more electron than neutron

127. 1
Sol. Dry ice is a molecular crystal.

128. 2
Sol. Atomicity of S is 8

129. 4
Sol. Metal placed above hydrogen displaces H_2 from acid.

130. 3
Sol. Dissolution of NH_4Cl in water is an endothermic reaction.
131. 4
Sol. Self fertilization is observed in Liver fluke.
132. 1
Sol. Flame cells are excretory organism in flat worms.
133. 4
Sol. The husk of coconut is made up of Sclerenchyma.
134. 2
Sol. Round worm has pseudocoelom.
135. 2
Sol. BHC is an insecticide
136. 2
Sol. Vacuolar membrane is called tonoplast.
137. 3
Sol. Murrah is a high yielding breed of Buffalo.
138. 1
Sol. Secretion of enzymes, mucous and hormones is done by golgi apparatus.
139. 2
Sol. Both B & T cells of immune system are produced in bone marrow.
140. 1
Sol. The third kingdom added in Haeckel's system of classification was protista.
141. 3
Sol. Entamoeba gingivalis lives in pus pocket of pyorrhea.
142. 2
Sol. Lichen sensitive to pollutants like SO_2 .
143. 4
Sol. Red blood cell will burst when placed in hypotonic media.
144. 1
Sol. Haemoglobin is dissolved in plasma in earthworm.
145. 1
Sol. A river with high BOD value is highly polluted.
146. 1
Sol. Skeletal cells get tired soon.
147. 1
Sol. Prokaryotic cells do not have lysosomes.
148. 1
Sol. On adding iodine solution in test tubes, test tube A colour changed because it contain carbohydrate (rice).

149. 2
Sol. Protoplasm includes nucleus and cytoplasm.

150. 3
Sol. The postulates of cell theory are all cells rise from pre-existing cells, cell is the basic unit of life and all organisms are composed of cells.

151. 3

Sol.

Column – A			Column – B
	Tendon	→	White fibre
	Ligament	→	Yellow fibre
	Cartilage	→	Chondriocytes
	Bone	→	Osteocytes

152. 4
Sol. Rice is the cereal crop of India.

153. 2
Sol. Animal husbandry is the scientific management of animal breeding, animal livestock and rearing of animals.

154. 2
Sol. Dr. V. Kurien is known as the father of white revolution in India.

155. 1
Sol. Ozone is poisonous.

156. 1
Sol. Ipomoea is a dicot plant.

157. 1
Sol. Cotton chemically consists of cellulose.

158. 1
Sol. Chara belongs to Thallophyta.

159. 1
Sol. Exocoetus is a flying fish.

160. 3
Sol. **Musculoskeletal system** helps the body parts together and helps the body move.

161. 3
Sol. **Humus** is major factor in deciding the soil structure.

162. 3
Sol. Lichens are very sensitive to **SO₂** in the air.

163. 3
Sol. When a cell divides by meiosis it produces **four** new cells.

164. 1
Sol. Peptic ulcers is related to Helicobacter pylori.
165. 1
Sol. Leghorn is related to poultry farming.
166. 3
Sol. Cambium is responsible for the increase of the stem in growth.

167. 4
Sol. In succulent plant Stomata open at night.

168. 1
Sol. Haversian canal occurs in humerus.

169. 2
Sol. Hardness and stiffness in plants because of the **Sclerenchyma** tissue.

170. 1
Sol. Viruses are **Nucleoprotein** particles

171. 2

Sol.
$$\left(\frac{x+1}{x+3}\right)^3 = \frac{x-1}{x+5}$$

$$\Rightarrow \frac{(x+1)^3}{(x+3)^3} = \frac{x-1}{x+5}$$

$$\Rightarrow \frac{x^3+1+3x(x+1)}{x^3+27+9x(x+3)} = \frac{x-1}{x+5}$$

$$\Rightarrow (x^3+3x^2+3x+1)(x+5) = (x^3+9x^2+27x+27)(x-1)$$

$$\Rightarrow x^4+5x^3+3x^3+15x^2+3x^2+15x+x+5 = x^4-x^3+9x^3-9x^2+27x^2-27x+27x-27$$

$$\Rightarrow 16x = -32$$

$$x = -2$$

172. 1

Sol.
$$\frac{1}{2+\sqrt{3}-2\sqrt{2}} + \frac{3}{2+\sqrt{3}+2\sqrt{2}}$$

$$\frac{1}{(2+\sqrt{3})-2\sqrt{2}} \times \frac{(2+\sqrt{3})+2\sqrt{2}}{(2+\sqrt{3})+2\sqrt{2}} + \frac{3}{(2+\sqrt{3})+2\sqrt{2}} \times \frac{(2+\sqrt{3})-2\sqrt{2}}{(2+\sqrt{3})-2\sqrt{2}}$$

$$\Rightarrow \frac{2+\sqrt{3}+2\sqrt{2}}{7+4\sqrt{3}-8} + \frac{3(2+\sqrt{3}-2\sqrt{2})}{7+4\sqrt{3}-8}$$

$$\Rightarrow \frac{2+\sqrt{3}+2\sqrt{2}}{4\sqrt{3}-1} + \frac{6+3\sqrt{3}-6\sqrt{2}}{4\sqrt{3}-1}$$

$$\Rightarrow \frac{2+\sqrt{3}+2\sqrt{2}+6+3\sqrt{3}-6\sqrt{2}}{4\sqrt{3}-1}$$

$$\begin{aligned} &\Rightarrow \frac{8+4\sqrt{3}-4\sqrt{2}}{4\sqrt{3}-1} = \frac{4(2+\sqrt{3}-\sqrt{2})}{4\sqrt{3}-1} \times \frac{(4\sqrt{3}+1)}{(4\sqrt{3}+1)} \\ &\Rightarrow \frac{4(8\sqrt{3}+2+12+\sqrt{3}-4\sqrt{6}-\sqrt{2})}{47} \\ &\Rightarrow \frac{4}{47}(9\sqrt{3}+14-\sqrt{2}-4\sqrt{6}) \end{aligned}$$

173. 3

Sol.

$$x = \frac{5\sqrt{21}}{\sqrt{3}+\sqrt{7}}$$

$$\frac{x}{5\sqrt{7}} = \frac{\sqrt{3}}{\sqrt{3}+\sqrt{7}}$$

Applying C - D

$$\frac{x+5\sqrt{7}}{x-5\sqrt{7}} = \frac{\sqrt{3}+\sqrt{3}+\sqrt{7}}{\sqrt{3}-\sqrt{3}-\sqrt{7}} = \frac{2\sqrt{3}+\sqrt{7}}{-\sqrt{7}} \quad \dots\dots\dots(i)$$

$$\text{and } \frac{x}{5\sqrt{3}} = \frac{\sqrt{7}}{\sqrt{3}+\sqrt{7}}$$

Applying C - D

$$\frac{x+5\sqrt{3}}{x-5\sqrt{3}} = \frac{\sqrt{7}+\sqrt{3}+\sqrt{7}}{\sqrt{7}-\sqrt{3}-\sqrt{7}} = \frac{\sqrt{3}+2\sqrt{7}}{-\sqrt{3}} \quad \dots\dots\dots(ii)$$

$$\text{Now, } \frac{x+5\sqrt{7}}{x-5\sqrt{7}} - \frac{x+5\sqrt{3}}{x-5\sqrt{3}} = \frac{2\sqrt{3}+\sqrt{7}}{-\sqrt{7}} - \frac{\sqrt{3}+2\sqrt{7}}{-\sqrt{3}}$$

$$= \frac{-(6+\sqrt{21})+\sqrt{21}+14}{\sqrt{21}}$$

$$\Rightarrow \frac{-6-\sqrt{21}+\sqrt{21}+14}{\sqrt{21}}$$

$$\Rightarrow \frac{8}{\sqrt{21}}$$

174. **No option correct**

Sol.

$$p(x) = 4x^3 - ax^2 + 2x - 1$$

$$q(x) = 3x^3 - 7x^2 - 8x + a$$

∴ p(x) and q(x) leave the same remainder

When divided by x - 1 then

$$\therefore p(1) = q(1)$$

$$\Rightarrow 4(1) - a + 2 - 1 = 3(1) - 7 - 8 + a$$

$$\Rightarrow 5 - a = -12 + a$$

$$\Rightarrow 17 = 2a$$

$$\Rightarrow a = \frac{17}{2}$$

175. 1

Sol. $6x^2 - 5xy - 4y^2 + x + 17y - 15$
 $\Rightarrow 6x^2 + x(1-5y) - [4y^2 - 17y + 15]$
 $\Rightarrow 6x^2 + x(1-5y) - [4y^2 - 12y - 5y + 15]$
 $\Rightarrow 6x^2 + x(1-5y) - [4y(y-3) - 5(y-3)]$
 $\Rightarrow 6x^2 + x(1-5y) - (y-3)(4y-5)$
 $\Rightarrow 6x^2 + (x-5xy) - (y-3)(4y-5)$
 $\Rightarrow 6x^2 + (3xy - 8xy + 10x - 9x) - (y-3)(4y-5)$
 $6x^2 + \{3x(y-3) - 2x(4y-5)\} - (y-3)(4y-5)$
 $\Rightarrow \{6x^2 + 3x(y-3)\} - \{2x(4y-5) + (y-3)(4y-5)\}$
 $\Rightarrow 3x(2x+y-3) - (4y-5)(2x+y-3)$
 $\Rightarrow (2x+y-3)(3x-4y+5)$

176. 3

Sol. $x = 28^{1/3}, y = 27^{1/3}$

$$\Rightarrow x^3 = 28, y^3 = 27$$

Then $x^3 - y^3 = 1$

$$x + y - \frac{1}{x^2 + xy + y^2} = ?$$

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

$$\Rightarrow x + y - \frac{x-y}{x^3 - y^3}$$

$$\Rightarrow x + y - x + y$$

$$= 2y$$

$$= 2 \times 3 = 6$$

177. 3

Sol. $0.\overline{2} + 0.\overline{23} = ?$

$$\Rightarrow \frac{2}{9} + \frac{23-2}{90}$$

$$\Rightarrow \frac{2}{9} + \frac{21}{90}$$

$$\Rightarrow \frac{20+21}{90} = \frac{41}{90} = 0.4\overline{5}$$

178. 2

Sol. $(x-2)^2 + (y-3)^2 + (z-4)^2 = 0$ then $xy + yz + zx = ?$

\therefore Sum of three square terms is equal to zero

\therefore each term should be equal to zero

$$\therefore x-2=0 \Rightarrow x=2$$

$$y-3=0 \Rightarrow y=3$$

$$z - 4 = 0 \Rightarrow z = 4$$

$$xy + yz + zx = 6 + 12 + 8 = 26$$

179. 3

Sol. $p^2 - 3p - 1 = 0$

$$\Rightarrow p(p - 3) = 1$$

$$p - 3 = \frac{1}{p}$$

$$\Rightarrow p - \frac{1}{p} = 3$$

\therefore square both sides

$$p^2 + \frac{1}{p^2} - 2 = 9$$

$$p^2 + \frac{1}{p^2} = 11$$

180. 1

Sol. $m + n = 7$

$$m^3 + n^3 = 133$$

$$\Rightarrow (m + n)^3 - 3mn(m + n) = 133$$

$$\Rightarrow 7^3 - 3mn \times 7 = 133$$

$$\Rightarrow mn = 10$$

$$\therefore m^2 + n^2 = (m + n)^2 - 2mn$$

$$= 7^2 - 2 \times 10 = 29$$

181. 4

Sol. $x + y = \sqrt{3}$ (i)

$$x - y = \sqrt{2}$$
(ii)

$$8xy(x^2 + y^2) = ?$$

$$(i)^2 + (ii)^2 = 2(x^2 + y^2) = 5$$

$$x^2 + y^2 = \frac{5}{2}$$

$$\Rightarrow (x + y)^2 - 2xy = \frac{5}{2}$$

$$\Rightarrow 3 - \frac{5}{2} = 2xy$$

$$\Rightarrow \frac{1}{2} = 2xy$$

$$\Rightarrow xy = \frac{1}{4}$$

$$\therefore 8xy(x^2 + y^2) = 8 \times \frac{1}{4} \left(\frac{5}{2} \right) = 5$$

182. 1

Sol. $(3x^2 - 2x)(6 - 3x^2 + 2x) - 5$
 $\Rightarrow (3x^2 - 2x)\{6 - (3x^2 - 2x)\} - 5$
Let's say $3x^2 - 2x = k$
 $\Rightarrow k(6 - k) - 5$
 $\Rightarrow 6k - k^2 - 5$
 $\Rightarrow -(k^2 - 6k + 5)$
 $\Rightarrow -(k - 5)(k - 1)$
 $\Rightarrow -(3x^2 - 2x - 5)(3x^2 - 2x - 1)$
 $\Rightarrow -\{3x^2 - 5x + 3x - 5\}\{3x^2 - 3x + x - 1\}$
 $\Rightarrow -\{x(3x - 5) + 1(3x - 5)\}\{3x(x - 1) + (x - 1)\}$
 $\Rightarrow -(3x - 5)(x + 1)(x - 1)(3x + 1)$
 $\Rightarrow (x - 1)(x + 1)(1 + 3x)(5 - 3x)$

183. 4

Sol. $m = 2p + \sqrt{p^2 + k}$
 $m - 2p = \sqrt{p^2 + k}$
Squaring both sides
 $m^2 + 4p^2 - 4mp = p^2 + k$
 $\Rightarrow m^2 - p^2 + 4p^2 - 4mp = k$
 $\Rightarrow (m + p)(m - p) + 4p(p - m) = k$
 $\Rightarrow (m - p)(m + p - 4p) = k$
 $\Rightarrow k = (m - p)(m - 3p)$

184. 1

Sol. $p - x = 1$
 $\frac{3x + 2}{5} + \frac{3}{2} = \frac{4p - 3}{2}$
 $\Rightarrow \frac{3x + 2}{5} + \frac{3}{2} = \frac{4(x + 1) - 3}{2}$
 $\Rightarrow \frac{3x + 2}{5} + \frac{3}{2} = \frac{4x + 1}{2}$
 $\Rightarrow \frac{6x + 4 + 15}{10} = \frac{4x + 1}{2}$
 $\Rightarrow \frac{6x + 19}{5} = 4x + 1$
 $\Rightarrow 6x + 19 = 20x + 5$
 $\Rightarrow 14x = 14$
 $x = 1$

185. 4

Sol. $5^{2m-1} = 25^{m-1} + 100$
 $\Rightarrow 5^{2m-1} = 5^{2m-2} + 100$
 $\Rightarrow 5^{2m-1} - 5^{2m-2} = 100$
 $\Rightarrow \frac{5^{2m}}{5} - \frac{5^{2m}}{25} = 100$
 $\Rightarrow \frac{5^{2m}}{5} \left(1 - \frac{1}{5}\right) = 100$
 $\Rightarrow \frac{5^{2m}}{5} \times \frac{4}{5} = 100$
 $\Rightarrow 5^{2m} = 5^4$
 $\Rightarrow 2m = 4 \Rightarrow m = 2$
 $\therefore 6^{-m} = 6^{-2} = \frac{1}{36}$

186. 4

Sol. $x = 3 + 3^{1/3} + 3^{2/3} \Rightarrow x - 3 = 3^{1/3} + 3^{2/3}$
 $\Rightarrow (x - 3)^3 = (3^{1/3} + 3^{2/3})^3$
 $\Rightarrow x^3 - 27 - 9x^2 + 27x = 3 + 3^2 + 3(3)(x - 3)$
 $\Rightarrow x^3 - 9x^2 + 18x - 10 = 2$

187. 3

Sol. $(a + b + c)^2 = a^2 + b^2 + c^2 + 2(ab + bc + ca)$
 $\Rightarrow a^2 + b^2 + c^2 = 6$
Now $a^3 + b^3 + c^3 - 3abc = (a + b + c) [a^2 + b^2 + c^2 - (ab + bc + ca)]$
 $\Rightarrow a^3 + b^3 + c^3 = (2)[6 + 1] + 3(-2)$
 $= 8$

188. 4

Sol. $(x + 3)(x - 5)(x + 7) = x^3 + 5x^2 - 29x - 105$
Coefficient of $x^2 = 5$

189. 3

Sol. In $\triangle ABC$, $\angle CAB = \angle CBA = x^\circ$
 $\Rightarrow \angle ACD = 2x^\circ$
In $\triangle ACD$, $\angle ADC = \angle ACD = 2x^\circ$
Now In $\triangle ABD$, $\angle ABD + \angle ADB = 102^\circ$
 $\Rightarrow x + 2x = 102$
 $\Rightarrow x = 34^\circ$

190. 1

Sol. $\frac{(\sqrt{32})^m}{2^{n+1}} = 1 \Rightarrow \frac{2^{\frac{5m}{2}}}{2^{n+1}} = 1$

$$\Rightarrow \frac{5m}{2} - n - 1 = 0$$

$$\Rightarrow 5m - 2n = 2$$

Also, $16^{4-\frac{m}{2}} - 8^n = 0$

$$\Rightarrow 2^{16-2m} - 2^{3n} = 0$$

$$\Rightarrow 16 - 2m = 3n \Rightarrow 2m + 3n = 16$$

On solving both equation we get $m = 2, n = 4$

191. 2

Sol. In $\triangle OAB, \angle OBA = \angle OAB = 32^\circ$

$$\Rightarrow \angle AOB = 116^\circ$$

$$\angle ACB = \frac{1}{2} \angle AOB = 58^\circ$$

Now In $\triangle CPB, x = 180^\circ - (90^\circ + 58^\circ)$
 $= 32^\circ$

192. 4

Sol. Since $OS \parallel TR \Rightarrow \angle SOR = \angle ORT = 30^\circ$

$$\text{Now } b = \angle SQR = \frac{1}{2} \angle SOR = 15^\circ$$

$$\text{Also, } \angle PQS = \frac{1}{2} \angle POS = 45^\circ$$

Now, in $\triangle PTQ, a = \angle QPT = 30^\circ$

193. 2

Sol. If side of cube is x units then $L = x^3, M = 6x^2, N = \sqrt{3}x$ then $MN = 6\sqrt{3}x^3 = 6\sqrt{3}L$

194. 4

Sol. Given: $\frac{a+b}{2} = \frac{c}{2} + 6 \Rightarrow a + b - c = 12$

$$\frac{b+c}{2} = \frac{a}{2} + 6 \Rightarrow b + c - a = 12 \text{ and } \frac{c+a}{2} = \frac{b}{2} + 6 \Rightarrow c + a - b = 12$$

On solving these equation we get $a = b = c = 12$ cm

$$\text{So, area} = 36\sqrt{3} \text{ cm}^2$$

195. 4

Sol. Let R and r be radii of outer and inner circle then $R - r = 7$ and $\pi[R^2 - r^2] = 286$

$$\Rightarrow R + r = 13$$

On solving both equations we get $R = 10$ and $r = 3$

196. 1

Sol. $49^x - 49^{x-1} = 16464$

$$\Rightarrow 49^x - \frac{49^x}{49} = 16464$$

$$\Rightarrow 49^x = 7^5 \Rightarrow x = \frac{5}{2}$$

So, $(2x)^x = 5^{\frac{5}{2}}$

197. 2

Sol. Let side of cube = x

Then diameter of sphere = diagonal of cube = $\sqrt{3}x$

So, radius of sphere = $\frac{\sqrt{3}x}{2}$

$$\text{Ratio of volumes} = \frac{x^3}{\frac{4}{3}\pi\left(\frac{\sqrt{3}x}{2}\right)^3} = \frac{2}{\sqrt{3}\pi}$$

198. 1

Sol. Let $\sqrt[3]{20+14\sqrt{2}} + \sqrt[3]{20-14\sqrt{2}} = x$

Cubing both sides we get

$$40 + 3\left(\sqrt[3]{(20+14\sqrt{2})(20-14\sqrt{2})}\right)(x) = x^3$$

$$\Rightarrow x^3 - 6x - 40 = 0$$

$$\Rightarrow (x-4)(x^2 + 4x - 10) = 0$$

$$\Rightarrow x = 4$$

199. 3

Sol. $m + \frac{1}{m} = 5 \Rightarrow m^2 + \frac{1}{m^2} = 23$

Now, $\frac{m^4 + 3m^3 + 5m^2 + 3m + 1}{m^4 + 1}$

$$= \frac{\left(m^2 + \frac{1}{m^2}\right) + 3\left(m + \frac{1}{m}\right) + 5}{m^2 + \frac{1}{m^2}}$$

$$= \frac{43}{23}$$

200. 1

Sol. Let $x = 4K$, $y = 3K$ and $z = 2K$

then $x^2 + y^2 + z^2 = 29K^2 = 11600$

$$\Rightarrow K = 20$$

So, $\sqrt{x+y-z} = \sqrt{5K} = \sqrt{100} = 10$