All India Aakash Test Series for Medical-2018

TEST - 4 (Code-C)

Test Date : 08-01-2017

ANSWERS

1.	(3)	37.	(4)	73.	(1)	109.	(3)	145.	(3)
2.	(3)	38.	(3)	74.	(1)	110.	(3)	146.	(3)
3.	(1)	39.	(1)	75.	(1)	111.	(2)	147.	(4)
4.	(3)	40.	(2)	76.	(3)	112.	(2)	148.	(2)
5.	(2)	41.	(2)	77.	(1)	113.	(1)	149.	(4)
6.	(3)	42.	(1)	78.	(2)	114.	(3)	150.	(4)
7.	(2)	43.	(3)	79.	(3)	115.	(2)	151.	(3)
8.	(1)	44.	(1)	80.	(4)	116.	(3)	152.	(4)
9.	(3)	45.	(2)	81.	(3)	117.	(3)	153.	(2)
10.	(1)	46.	(4)	82.	(2)	118.	(2)	154.	(3)
11.	(2)	47.	(4)	83.	(1)	119.	(3)	155.	(3)
12.	(2)	48.	(4)	84.	(4)	120.	(4)	156.	(2)
13.	(2)	49.	(2)	85.	(2)	121.	(3)	157.	(4)
14.	(3)	50.	(1)	86.	(3)	122.	(3)	158.	(2)
15.	(1)	51.	(3)	87.	(3)	123.	(4)	159.	(1)
16.	(2)	52.	(3)	88.	(1)	124.	(2)	160.	(1)
17.	(3)	53.	(4)	89.	(2)	125.	(3)	161.	(2)
18.	(3)	54.	(1)	90.	(4)	126.	(1)	162.	(4)
19.	(1)	55.	(3)	91.	(3)	127.	(3)	163.	(3)
20.	(3)	56.	(2)	92.	(3)	128.	(1)	164.	(4)
21.	(2)	57.	(4)	93.	(4)	129.	(2)	165.	(2)
22.	(2)	58.	(4)	94.	(1)	130.	(3)	166.	(3)
23.	(4)	59.	(2)	95.	(3)	131.	(4)	167.	(2)
24.	(2)	60.	(1)	96.	(4)	132.	(2)	168.	(3)
25.	(1)	61.	(2)	97.	(4)	133.	(4)	169.	(3)
26.	(4)	62.	(2)	98.	(4)	134.	(4)	170.	(2)
27.	(2)	63.	(2)	99.	(2)	135.	(3)	171.	(2)
28.	(1)	64.	(4)	100.	(2)	136.	(2)	172.	(4)
29.	(3)	65.	(4)	101.	(3)	137.	(3)	173.	(4)
30.	(3)	66.	(4)	102.	(4)	138.	(4)	174.	(1)
31.	(2)	67.	(3)	103.	(1)	139.	(3)	175.	(2)
32.	(1)	68.	(4)	104.	(2)	140.	(4)	176.	(3)
33.	(1)	69.	(1)	105.	(4)	141.	(4)	177.	(2)
34.	(3)	70.	(4)	106.	(3)	142.	(1)	178.	(4)
35.	(1)	71.	(1)	107.	(1)	143.	(4)	179.	(3)
36.	(3)	72.	(2)	108.	(2)	144.	(3)	180.	(3)

Hints to Selected Questions

[PHYSICS]

1. Answer (3)

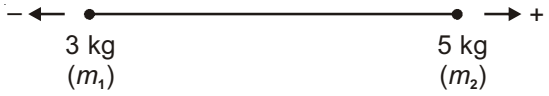
$I = I_{CM} + Md^2$

$\therefore$ MI is minimum about an axis passing through centre of mass of a rigid body.

Now, since linear mass density is increasing from *A* to *B*.

Hence, centre of mass should lie somewhere between *C* and *B*.

2. Answer (3)

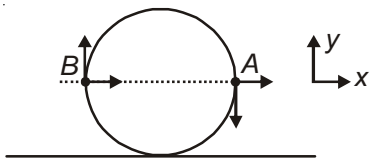


$$\Delta x_{CM} = \frac{m_1\Delta x_1 + m_2\Delta x_2}{m_1 + m_2}$$

$$\Rightarrow \quad \frac{-1}{4} = \frac{3\Delta x_1 + 5(3)}{8}$$

$$\Rightarrow \quad \Delta x_1 = -\frac{17}{3}\text{m}$$

3. Answer (1)



$\vec{v}_A = v_0\hat{i} - v_0\hat{j}$

$\vec{v}_B = v_0\hat{i} + v_0\hat{j}$

$|\overrightarrow{\Delta v}| = |\vec{v}_A - \vec{v}_B| = 2v_0$

4. Answer (3)

$$\frac{M}{12}\left(a^2 + b^2\right)$$

5. Answer (2)

$$\tau = \frac{dL}{dt}$$

$\Rightarrow$ Area under τ–t graph = ΔL

$$\therefore \quad \Delta L = \frac{1}{2}\times 2\times 2 + 2\times 2 = 6 \text{ kg m}^2/\text{s}$$

$\therefore$ $\Delta L = I\omega$

$\Rightarrow$ ω = 0.6 rad/s

6. Answer (3)

Unifrom circular motion about axis *AB*, so torque about *AB* = 0

7. Answer (2)

$$I = \frac{MR^2}{2}$$

Now, $\frac{dR}{dt} = 0.02$ m/s

$$\Rightarrow \quad \frac{dI}{dt} = MR\frac{dR}{dt}$$

$= 4 \times 1 \times 0.02$

$= 0.08$ kg m^2/s

8. Answer (1)

9. Answer (3)

$$\vec{v} = \vec{\omega}\times\vec{r}$$

$$\therefore \quad \vec{v} = (3\hat{i} + \hat{j} + \hat{k})\times(2\hat{i} - \hat{j} - \hat{k})$$

$$\Rightarrow \quad \vec{v} = 5\hat{j} - 5\hat{k}$$

10. Answer (1)

$$\alpha = \theta^{\frac{1}{2}}$$

$$\omega\frac{d\omega}{d\theta} = \theta^{\frac{1}{2}}$$

$$\Rightarrow \quad \int_0^{\omega}\omega\, d\omega = \int_0^{\theta}\theta^{\frac{1}{2}}\, d\theta$$

$$\Rightarrow \quad \frac{\omega^2}{2} = \frac{2}{3}\theta^{\frac{3}{2}}$$

11. Answer (2)

12. Answer (2)

$a_1 = a_2 = g$

$$a_{cm} = \frac{m_1a_1 + m_2a_2}{m_1 + m_2} = g$$

13. Answer (2)

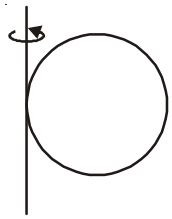
For equilibrium, torque of weight about hinge should be balanced by that of external force.

$$mg\frac{L}{2} = \text{FL}$$

$\Rightarrow \quad F = \frac{mg}{2}$

$= \frac{\lambda Lg}{2}$

14. Answer (3)



$I = \frac{2}{5}MR^2 + MR^2 = \frac{7}{5}MR^2$

$\Rightarrow \quad \frac{7}{5}MR^2 = Mk^2$

$\Rightarrow \quad k = \sqrt{\frac{7}{5}}R$

15. Answer (1)

Only statement (1) is true.

16. Answer (2)

$P = \tau\omega$

$\omega = \omega_0 + \alpha t \qquad \alpha = \frac{\tau}{I}$

$\omega = 0 + 10 \times 4$

$\omega = 40$ rad/s

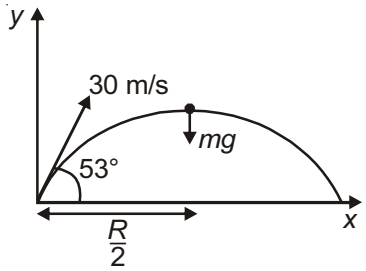
$P = 20 \times 40 = 800$ W

17. Answer (3)

18. Answer (3)

Only option (3) is correct.

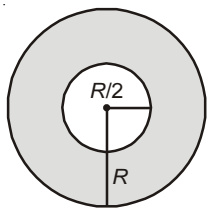
19. Answer (1)



$L = \frac{1}{2}mugt^2\cos\theta$

$\left(t = \frac{u\sin\theta}{g}\right)$ = 1037 Js

20. Answer (3)

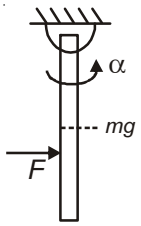


MI of annular disc

$I = \frac{1}{2}M\left(R_1^2 + R_2^2\right) = \frac{5}{8}MR^2$

21. Answer (2)

Free Body Diagram of Rod



$Fx = \frac{ML^2}{3}\alpha \qquad ...(1)$

$F = Ma_{CM} = \frac{ML\alpha}{2} \quad ...(2)$ (Since reaction = 0)

Equating (1) & (2),

$\frac{ML^2\alpha}{3x} = \frac{ML\alpha}{2}$

$\Rightarrow \quad x = \frac{2L}{3}$

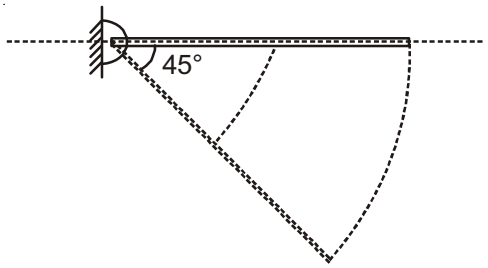
22. Answer (2)

$Mg\frac{L}{2} = \frac{ML^2}{3}\alpha \quad \Rightarrow \quad \alpha = \frac{3g}{2L}$

23. Answer (4)

$\begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 3 & -4 & 5 \\ 1 & 1 & 1 \end{vmatrix} = \hat{i}(-9) - \hat{j}(-2) + \hat{k}(7)$

24. Answer (2)



By mechanical energy conservation,

$$mg\frac{l}{2\sqrt{2}} = \frac{1}{2}\cdot I\omega^2$$

$$\frac{mg}{2}\frac{l}{\sqrt{2}} = \frac{1}{2}\frac{mL^2}{3}\omega^2$$

$$\omega = \sqrt{\frac{3g}{\sqrt{2}l}}$$

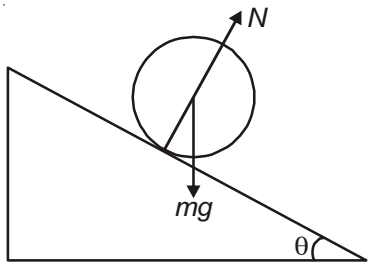
25. Answer (1)

By energy conservation,

$$\frac{1}{2}Mv_0^2 + \frac{1}{2}I\omega_0^2 = 0 + \frac{1}{2}I\omega_0^2 + Mgh$$

$$h = \frac{v_0^2}{2g}$$

26. Answer (4)



As there is no friction sphere will simply slide down without rolling with $a_{CM} = g\sin\theta$

Also, $N = mg\cos\theta$

Hence, net torque is zero about any point on line passing through its centre and parallel to the inclined plane.

27. Answer (2)

$$k = \frac{1}{2}I\omega_0^2$$

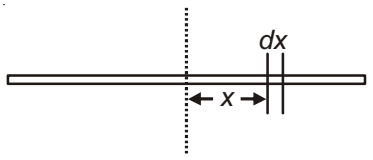
$$\Delta k = \frac{1}{2}I\left[\omega_0 + \frac{10}{100}\omega_0\right]^2 - \frac{1}{2}I\omega_0^2$$

$$\% \text{ change} = \frac{\Delta k}{k}\times 100 = 21\%$$

28. Answer (1)

Since the square is placed symmetrically, hence centre of mass will lie at origin hence its coordinates are (0, 0).

29. Answer (3)

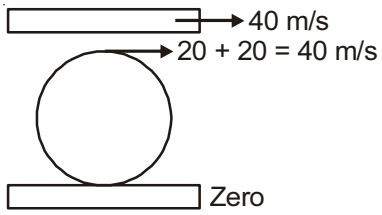


$$\int dI = \int_0^{L/2}\frac{M}{L}dx\cdot x = \frac{M}{2L}\frac{L^2}{4}$$

$$I_{rod} = 2\left[\frac{ML^2}{8L}\right] = \frac{ML}{4}$$

30. Answer (3)

For pure rolling



31. Answer (2)

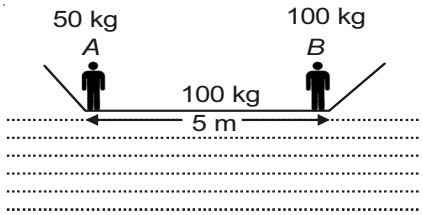
Power = $\vec{\tau}\cdot\vec{w}$

= 50 × 2 × 20

= 2000 W

= 2 kW

32. Answer (1)



Since there is no external force, hence centre of mass of system will not move. Let boat move to right a distance x w.r.t. ground.

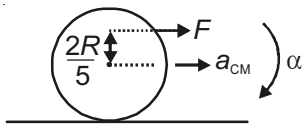
$\Delta X_{CM} = 0$

$\Rightarrow M_1\Delta X_1 + M_2\Delta X_2 + M_3\Delta X_3 = 0$

$\Rightarrow 50[5 + x] - 100[5 - x] + 100x = 0$

$\Rightarrow x = 1$ m

33. Answer (1)



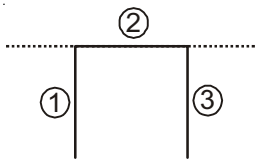
$F = Ma_{CM}$

$$F\frac{2R}{5} = \frac{2}{5}MR^2\alpha$$

$a_{CM} = R\alpha$

Hence, sphere rolls without slipping.

34. Answer (3)



Moment of inertia of rod

1 $\Rightarrow$ $\frac{mL^2}{3}$

2 $\Rightarrow$ 0

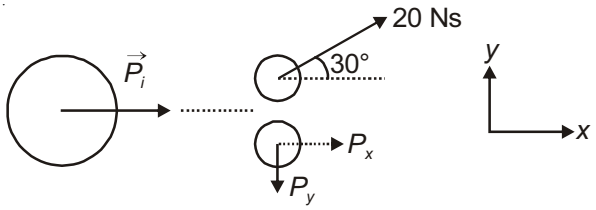
3 $\Rightarrow$ $\frac{mL^2}{3}$

Hence, moment of inertia of system = $\frac{2mL^2}{3}$

35. Answer (1)

$$a = \frac{(m_2 - m_1)g}{m_1 + m_2 + \frac{I}{r^2}} = \frac{10}{3}\ \text{m/s}^2$$

36. Answer (3)



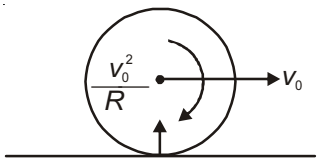
By momentum conservation total momentum along *y* direction after bursting of shell should be *O*.

$\therefore$ 20 sin 30 = P_y = 10 Ns

P_x may be zero or non-zero.

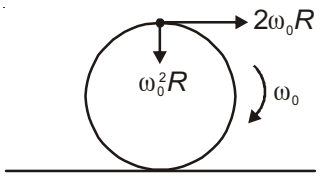
Hence, minimum momentum will be 10 Ns when P_x = 0.

37. Answer (4)



Acceleration is non-zero = $\frac{v_0^2}{R}$ while velocity = 0

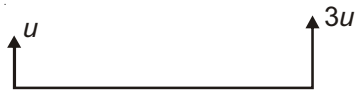
38. Answer (3)



$$\frac{[2\omega_0 R]^2}{R_C} = \omega_0^2 R$$

$R_C = 4R$

39. Answer (1)



$$\omega = \frac{3u - u}{I} = \frac{2u}{I}$$

40. Answer (2)

By angular momentum conservation

$I_1\omega_1 = I_2\omega_2$

$\Rightarrow \frac{2}{5}MR^2\omega = \frac{2}{5}M\left[\frac{R}{2}\right]^2\omega_2$

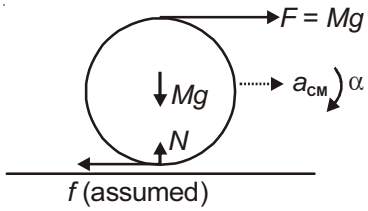
$\Rightarrow \omega_2 = 4\omega$

41. Answer (2)

$\int dI = \int dMR^2$

$I = MR^2$

42. Answer (1)



$F - f = Ma_{CM}$

$(F + f)R = \frac{2}{3}MR^2\alpha$

$a_{CM} = R\alpha$

$\Rightarrow a_{CM} = \frac{6F}{5M} = \frac{6g}{5}$

$\Rightarrow f = -\frac{Mg}{5}$

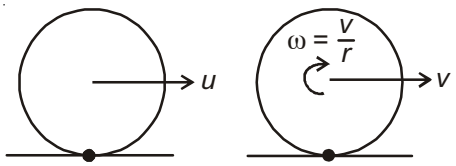
(–ve sign shows opposite to assumed direction)

$|f| \le \mu N$

$\Rightarrow \frac{Mg}{5} \le \mu Mg$

$\Rightarrow \mu \ge \frac{1}{5},\ \mu_{min} = 0.2$

43. Answer (3)



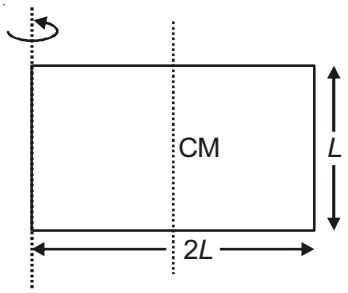
Applying conservation of angular momentum about point of contact

$$mur = mvr + \frac{2}{5}mr^2\omega$$

$$\Rightarrow \quad v = \frac{5u}{7} \qquad \because \ \omega = \frac{v}{r}$$

44. Answer (1)

45. Answer (2)



$$I = I_{CM} + Md^2$$

$$I = \frac{M(2L)^2}{12} + ML^2$$

$$= \frac{ML^2}{3} + ML^2 = \frac{4}{3}ML^2$$

[CHEMISTRY]

46. Answer (4)

47. Answer (4)

$\Delta G = \Delta H - T\Delta S$ and for spontaneous ΔG should be negative.

48. Answer (4)

49. Answer (2)

50. Answer (1)

During strong acid-base, neutralization per mole H_2O release 57.1 kJ heat.

51. Answer (3)

52. Answer (3)

Internal energy is state function.

53. Answer (4)

54. Answer (1)

55. Answer (3)

During free expansion $P_{ex} = 0$.

56. Answer (2)

57. Answer (4)

K_c only depends upon temperature.

58. Answer (4)

59. Answer (2)

Active mass = $\frac{7/28}{2}$ = 0.125

60. Answer (1)

61. Answer (2)

62. Answer (2)

$$\alpha = \frac{104.16 - 62}{62(2-1)} = 0.68$$

63. Answer (2)

64. Answer (4)

Phenolphthalein is used as an indicator for weak acid and strong base titration.

65. Answer (4)

66. Answer (4)

67. Answer (3)

$$H_2PO_4^- \rightleftharpoons H^+ + HPO_4^{2-}$$

68. Answer (4)

HOCl is the weakest acid among the given options.

69. Answer (1)

70. Answer (4)

71. Answer (1)

72. Answer (2)

$\Delta H - \Delta E = \Delta n(g)RT = -RT$

73. Answer (1)

H_2O has 2 O – H bonds.

74. Answer (1)

For best fuel, ΔH per gram should be maximum.

75. Answer (1)

76. Answer (3)

$\Delta H = (-110.5) + (-283.2) = -393.7$ kJ

77. Answer (1)

78. Answer (2)

79. Answer (3)

BF_3 cannot lose proton.

80. Answer (4)

Na_3PO_4 will form basic solution.

81. Answer (3)

$$pH = pK_a + \log \frac{[Salt]}{[Acid]}$$

$$= 4.74 + \log\left(\frac{3}{2}\right)$$

$$= 4.9$$

82. Answer (2)

$$\frac{K_p}{K_c} = (RT)^{\Delta n(g)} = (RT)$$

83. Answer (1)

84. Answer (4)

85. Answer (2)

$3P = 9 \Rightarrow P = 3$ atm

$K_p = (2P)^2P = 4P^3 = 4 \times 27 = 108$

86. Answer (3)

$$pH = 7 - \frac{1}{2}pK_b - \frac{1}{2}\log C$$

$$= 7 - \frac{1}{2}(4.74) - \frac{1}{2}\log(0.2)$$

$$= 4.28$$

87. Answer (3)

88. Answer (1)

For $Ga(OH)_3$,

$$K_{sp} = 27(s)^4 = 27\left(\frac{10^{-3}}{3}\right)^4 = 3.3\times10^{-13}$$

89. Answer (2)

Minimum concentration of common ion will show maximum solubility.

90. Answer (4)

[BIOLOGY]

91. Answer (3)

Tap root

92. Answer (3)

Primary root is long lived in mustard.

93. Answer (4)

Rhizophora

94. Answer (1)

Stolon and sucker as sub-aerial stem.

95. Answer (3)

Generally in monocots and few dicots like *Calophylum*, *Eryngium*.

96. Answer (4)

97. Answer (4)

Tendril in pea, spines.

98. Answer (4)

Cymose type

99. Answer (2)

100. Answer (2)

Racemose in fabaceae.

101. Answer (3)

For vegetative reproduction only.

102. Answer (4)

Superior ovary

103. Answer (1)

104. Answer (2)

105. Answer (4)

Unilocular ovary in free central and multilocular in axile.

106. Answer (3)

Asteraceae

107. Answer (1)

108. Answer (2)

109. Answer (3)

110. Answer (3)

Mango and coconut

111. Answer (2)

Hilum is present on seed coat.

112. Answer (2)

Lily family

113. Answer (1)

Liliaceae, solanaceae, fabaceae, brassicaceae.

114. Answer (3)

Non-endospermous seeds in fabaceae family

115. Answer (2)

Brassicaceae

116. Answer (3)

Primary meristems give rise primary permanent tissue.

117. Answer (3)

Axillary bud

118. Answer (2)

Epidermis, endodermis and pericycle are parenchymatous without intercellular space.

119. Answer (3)

Collenchyma

120. Answer (4)

Non-perforated end wall in tracheids.

121. Answer (3)

Pear, guava, sapota etc.

122. Answer (3)

Protoxylem

123. Answer (4)

Parenchyma – Fundamental tissue

124. Answer (2)

Pericyclic fibres or perivascular fibres in dicot stem.

125. Answer (3)

Phloem parenchyma is absent in monocots.

126. Answer (1)

Simple tissues both living and dead.

127. Answer (3)

Closed vascular bundles in monocot stem and leaves.

128. Answer (1)

Undifferentiated ground tissue.

129. Answer (2)

Starch sheath

130. Answer (3)

Intrafascicular cambium is ontogenetically primary and functionally secondary meristem.

131. Answer (4)

132. Answer (2)

Phellogen is couple of layers thick.

133. Answer (4)

Secondary phloem and periderm.

134. Answer (4)

Generally cortical in origin

135. Answer (3)

Help in rolling and unrolling of leaves in dry and moist conditions respectively.

136. Answer (2)

Nerve gas inhibits acetylcholinesterase.

137. Answer (3)

Nucleotides are the monomers of nucleic acid.

138. Answer (4)

Cellulose is most abundant organic substance of the biosphere.

139. Answer (3)

140. Answer (4)

Ribozyme is RNA acting as an enzyme.

141. Answer (4)

Haem in catalase is prosthetic group which is responsible for catalase activity.

142. Answer (1)

On increasing substrate concentration, rate of reaction increases upto maximum velocity.

143. Answer (4)

144. Answer (3)

Increase in the product concentration decreases the enzyme activity.

145. Answer (3)

Fe^{2+} is cofactor for catalase.

146. Answer (3)

$NADP^{+}$ is nicotinamide adenosine dinucleotide phosphate.

147. Answer (4)

Guanine is a purine having double ring structure.

148. Answer (2)

One turn of 360° of DNA spiral has about 10 nitrogen bases on each strand of DNA.

149. Answer (4)

Tryptophan synthesizes nicotinamide, melatonin and IAA.

150. Answer (4)

Glycine is simplest amino acid and is optically inactive.

151. Answer (3)

Carbohydrate – 3%

152. Answer (4)

Furanose ring is pentagonal ring.

153. Answer (2)

Maltose and sucrose are disaccharides.

154. Answer (3)

Glycogen has α-1,4 and α-1,6 linkage.

155. Answer (3)

Nucleotides are monomers of DNA.

156. Answer (2)

Cotton fibre is cellulose.

157. Answer (4)

158. Answer (2)

Glycine is simplest amino acid in which 'R' group is replaced by hydrogen.

159. Answer (1)

Conacanavalin-A is a secondary metabolite.

160. Answer (1)

Ascorbic acid is sugar acid.

161. Answer (2)

162. Answer (4)

163. Answer (3)

Enzyme suppresses the activation energy, so increases the rate of reaction.

164. Answer (4)

165. Answer (2)

Given organic compound is ribose.

166. Answer (3)

In human, reserved food is stored in the form of glycogen.

167. Answer (2)

Galactose is a monosaccharide.

168. Answer (3)

Maltose, lactose, sucrose, trehalose and cellobiose are disaccharides.

169. Answer (3)

Enzyme A is lyase belonging to class-IV.

170. Answer (2)

Cysteine, tyrosine and alanine are non-essential amino acids.

171. Answer (2)

Adenine – 28%

Thymine – 28%

Cytosine – 22%

Guanine – 22%

172. Answer (4)

Nicotine is an alkaloid present in tobacco.

173. Answer (4)

Albumin is a plasma protein.

174. Answer (1)

In glycogen, α-1,4 linkage is present in straight chain.

175. Answer (2)

Enzyme 'X' is carbonic anhydrase.

176. Answer (3)

177. Answer (2)

End product is an inhibitor in feedback or allosteric inhibition.

178. Answer (4)

Two hydrogen bonds are formed between adenine and thymine.

179. Answer (3)

Starch and glycogen are homopolymer and branched polymer of glucose.

180. Answer (3)

❑ ❑ ❑

All India Aakash Test Series for Medical-2018

TEST - 4 (Code-D)

Test Date : 08-01-2017

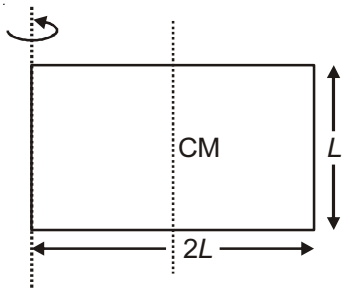
ANSWERS

1.	(4)	37.	(1)	73.	(4)	109.	(1)	145.	(4)
2.	(3)	38.	(3)	74.	(4)	110.	(1)	146.	(4)
3.	(1)	39.	(4)	75.	(4)	111.	(4)	147.	(1)
4.	(3)	40.	(1)	76.	(3)	112.	(1)	148.	(1)
5.	(4)	41.	(4)	77.	(4)	113.	(3)	149.	(4)
6.	(4)	42.	(1)	78.	(2)	114.	(4)	150.	(1)
7.	(3)	43.	(3)	79.	(2)	115.	(4)	151.	(2)
8.	(1)	44.	(1)	80.	(4)	116.	(1)	152.	(2)
9.	(2)	45.	(1)	81.	(1)	117.	(1)	153.	(1)
10.	(1)	46.	(4)	82.	(3)	118.	(4)	154.	(2)
11.	(3)	47.	(4)	83.	(2)	119.	(3)	155.	(4)
12.	(1)	48.	(3)	84.	(3)	120.	(1)	156.	(3)
13.	(3)	49.	(1)	85.	(3)	121.	(2)	157.	(3)
14.	(3)	50.	(1)	86.	(3)	122.	(4)	158.	(4)
15.	(4)	51.	(4)	87.	(4)	123.	(3)	159.	(4)
16.	(1)	52.	(4)	88.	(4)	124.	(2)	160.	(4)
17.	(1)	53.	(3)	89.	(4)	125.	(1)	161.	(1)
18.	(3)	54.	(4)	90.	(4)	126.	(4)	162.	(1)
19.	(4)	55.	(1)	91.	(1)	127.	(4)	163.	(4)
20.	(2)	56.	(2)	92.	(2)	128.	(2)	164.	(2)
21.	(3)	57.	(1)	93.	(2)	129.	(2)	165.	(1)
22.	(4)	58.	(4)	94.	(4)	130.	(2)	166.	(2)
23.	(2)	59.	(3)	95.	(2)	131.	(3)	167.	(2)
24.	(4)	60.	(1)	96.	(3)	132.	(3)	168.	(4)
25.	(4)	61.	(1)	97.	(4)	133.	(2)	169.	(2)
26.	(1)	62.	(3)	98.	(3)	134.	(1)	170.	(1)
27.	(3)	63.	(3)	99.	(1)	135.	(1)	171.	(1)
28.	(1)	64.	(4)	100.	(3)	136.	(1)	172.	(1)
29.	(1)	65.	(3)	101.	(1)	137.	(1)	173.	(2)
30.	(4)	66.	(2)	102.	(4)	138.	(2)	174.	(3)
31.	(3)	67.	(3)	103.	(2)	139.	(2)	175.	(2)
32.	(1)	68.	(2)	104.	(3)	140.	(1)	176.	(2)
33.	(4)	69.	(1)	105.	(1)	141.	(4)	177.	(1)
34.	(4)	70.	(2)	106.	(2)	142.	(1)	178.	(2)
35.	(4)	71.	(2)	107.	(1)	143.	(2)	179.	(1)
36.	(3)	72.	(2)	108.	(4)	144.	(2)	180.	(4)

Hints to Selected Questions

[PHYSICS]

1. Answer (4)



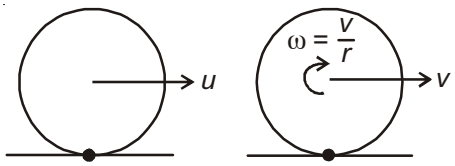
$I = I_{CM} + Md^2$

$I = \frac{M(2L)^2}{12} + ML^2$

$= \frac{ML^2}{3} + ML^2 = \frac{4}{3}ML^2$

2. Answer (3)

3. Answer (1)

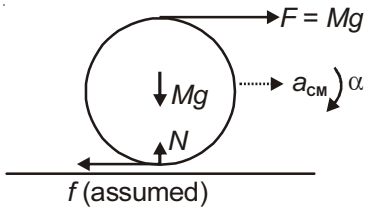


Applying conservation of angular momentum about point of contact

$mur = mvr + \frac{2}{5}mr^2\omega$

$\Rightarrow \quad v = \frac{5u}{7} \qquad \because \ \omega = \frac{v}{r}$

4. Answer (3)



$F - f = Ma_{CM}$

$(F + f)R = \frac{2}{3}MR^2\alpha$

$a_{CM} = R\alpha$

$\Rightarrow \quad a_{CM} = \frac{6F}{5M} = \frac{6g}{5}$

$\Rightarrow \quad f = -\frac{Mg}{5}$

(–ve sign shows opposite to assumed direction)

$|f| \le \mu N$

$\Rightarrow \quad \frac{Mg}{5} \le \mu Mg$

$\Rightarrow \quad \mu \ge \frac{1}{5}, \ \mu_{min} = 0.2$

5. Answer (4)

$\int dI = \int dMR^2$

$I = MR^2$

6. Answer (4)

By angular momentum conservation

$I_1\omega_1 = I_2\omega_2$

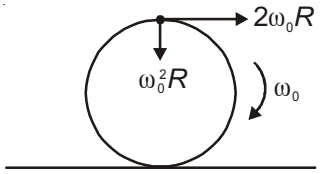
$\Rightarrow \quad \frac{2}{5}MR^2\omega = \frac{2}{5}M\left[\frac{R}{2}\right]^2\omega_2$

$\Rightarrow \quad \omega_2 = 4\omega$

7. Answer (3)

$\omega = \frac{3u - u}{l} = \frac{2u}{l}$

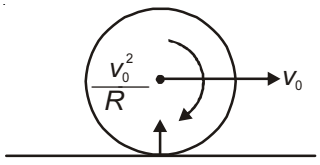
8. Answer (1)



$\frac{[2\omega_0 R]^2}{R_C} = \omega_0^2 R$

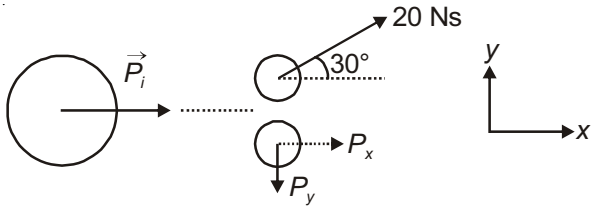
$R_C = 4R$

9. Answer (2)



Acceleration is non-zero = $\frac{v_0^2}{R}$ while velocity = 0

10. Answer (1)



By momentum conservation total momentum along *y* direction after bursting of shell should be *O*.

$\therefore$ 20 sin 30 = P_y = 10 Ns

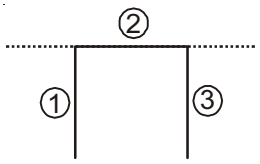
P_x may be zero or non-zero.

Hence, minimum momentum will be 10 Ns when $P_x = 0$.

11. Answer (3)

$$a = \frac{(m_2 - m_1)g}{m_1 + m_2 + \frac{I}{r^2}} = \frac{10}{3}\ \text{m/s}^2$$

12. Answer (1)



Moment of inertia of rod

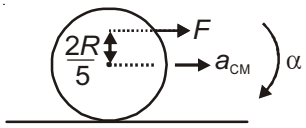
1 $\Rightarrow$ $\frac{mL^2}{3}$

2 $\Rightarrow$ 0

3 $\Rightarrow$ $\frac{mL^2}{3}$

Hence, moment of inertia of system = $\frac{2mL^2}{3}$

13. Answer (3)



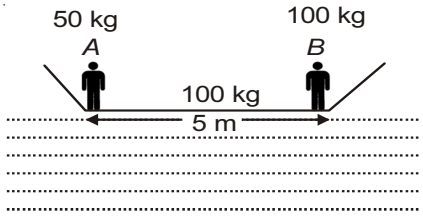
$F = Ma_{CM}$

$$F\frac{2R}{5} = \frac{2}{5}MR^2\alpha$$

$a_{CM} = R\alpha$

Hence, sphere rolls without slipping.

14. Answer (3)



Since there is no external force, hence centre of mass of system will not move. Let boat move to right a distance *x* w.r.t. ground.

$\Delta X_{CM} = 0$

$\Rightarrow$ $M_1\Delta X_1 + M_2\Delta X_2 + M_3\Delta X_3 = 0$

$\Rightarrow$ $50[5 + x] - 100[5 - x] + 100x = 0$

$\Rightarrow$ $x = 1$ m

15. Answer (4)

Power = $\vec{\tau}\cdot\vec{w}$

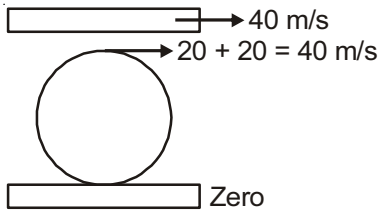
= 50 × 2 × 20

= 2000 W

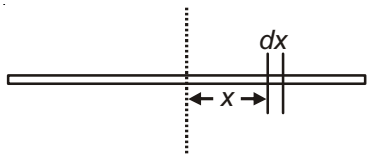
= 2 kW

16. Answer (1)

For pure rolling



17. Answer (1)



$$\int dI = \int_0^{L/2} \frac{M}{L}dx \cdot x = \frac{M}{2L}\frac{L^2}{4}$$

$$I_{rod} = 2\left[\frac{ML^2}{8L}\right] = \frac{ML}{4}$$

18. Answer (3)

Since the square is placed symmetrically, hence centre of mass will lie at origin hence its coordinates are (0, 0).

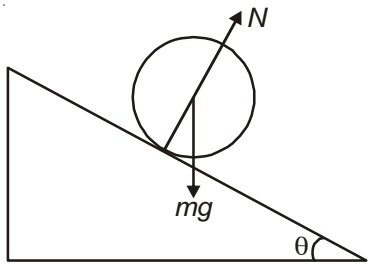
19. Answer (4)

$$k = \frac{1}{2} I\omega_0^2$$

$$\Delta k = \frac{1}{2} I\left[\omega_0 + \frac{10}{100}\omega_0\right]^2 - \frac{1}{2} I\omega_0^2$$

$$\% \text{ change} = \frac{\Delta k}{k} \times 100 = 21\%$$

20. Answer (2)



As there is no friction sphere will simply slide down without rolling with $a_{CM} = g \sin\theta$

Also, $N = mg\cos\theta$

Hence, net torque is zero about any point on line passing through its centre and parallel to the inclined plane.

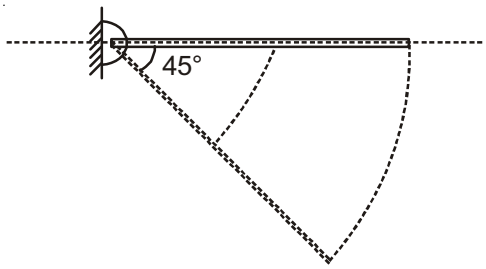
21. Answer (3)

By energy conservation,

$$\frac{1}{2}Mv_0^2 + \frac{1}{2}I\omega_0^2 = 0 + \frac{1}{2}I\omega_0^2 + Mgh$$

$$h = \frac{v_0^2}{2g}$$

22. Answer (4)



By mechanical energy conservation,

$$mg\frac{I}{2\sqrt{2}} = \frac{1}{2}\cdot I\omega^2$$

$$\frac{mg}{2}\frac{I}{\sqrt{2}} = \frac{1}{2}\frac{mL^2}{3}\omega^2$$

$$\omega = \sqrt{\frac{3g}{\sqrt{2}\,I}}$$

23. Answer (2)

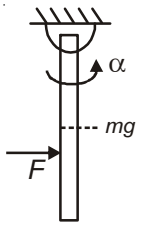
$$\begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 3 & -4 & 5 \\ 1 & 1 & 1 \end{vmatrix} = \hat{i}(-9) - \hat{j}(-2) + \hat{k}(7)$$

24. Answer (4)

$$Mg\frac{L}{2} = \frac{ML^2}{3}\alpha \quad \Rightarrow \quad \alpha = \frac{3g}{2L}$$

25. Answer (4)

Free Body Diagram of Rod



$$Fx = \frac{ML^2}{3}\alpha \qquad ...(1)$$

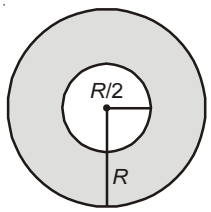
$$F = Ma_{CM} = \frac{ML\alpha}{2} \quad ...(2) \quad \text{(Since reaction = 0)}$$

Equating (1) & (2),

$$\frac{ML^2\alpha}{3x} = \frac{ML\alpha}{2}$$

$$\Rightarrow \quad x = \frac{2L}{3}$$

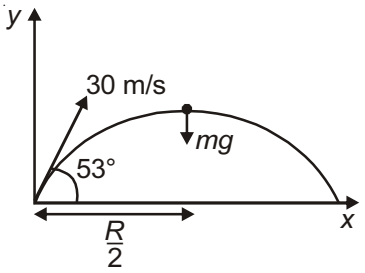
26. Answer (1)



MI of annular disc

$$I = \frac{1}{2}M\left(R_1^2 + R_2^2\right) = \frac{5}{8}MR^2$$

27. Answer (3)



$$L = \frac{1}{2} mugt^2 \cos\theta$$

$$\left(t = \frac{u \sin\theta}{g} \right) = 1037 \text{ Js}$$

28. Answer (1)

Only option (1) is correct.

29. Answer (1)

30. Answer (4)

$P = \tau\omega$

$\omega = \omega_0 + \alpha t \qquad \alpha = \frac{\tau}{I}$

$\omega = 0 + 10 \times 4$

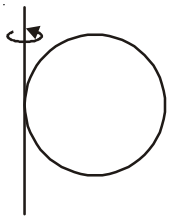
$\omega = 40$ rad/s

$P = 20 \times 40 = 800$ W

31. Answer (3)

Only statement (3) is true.

32. Answer (1)



$$I = \frac{2}{5} MR^2 + MR^2 = \frac{7}{5} MR^2$$

$$\Rightarrow \quad \frac{7}{5} MR^2 = Mk^2$$

$$\Rightarrow \quad k = \sqrt{\frac{7}{5}} R$$

33. Answer (4)

For equilibrium, torque of weight about hinge should be balanced by that of external force.

$$mg \frac{L}{2} = \text{FL}$$

$$\Rightarrow \quad F = \frac{mg}{2}$$

$$= \frac{\lambda L g}{2}$$

34. Answer (4)

$a_1 = a_2 = g$

$$a_{cm} = \frac{m_1 a_1 + m_2 a_2}{m_1 + m_2} = g$$

35. Answer (4)

36. Answer (3)

$\alpha = \theta^{\frac{1}{2}}$

$$\omega \frac{d\omega}{d\theta} = \theta^{\frac{1}{2}}$$

$$\Rightarrow \quad \int_0^{\omega} \omega \, d\omega = \int_0^{\theta} \theta^{\frac{1}{2}} \, d\theta$$

$$\Rightarrow \quad \frac{\omega^2}{2} = \frac{2}{3} \theta^{\frac{3}{2}}$$

37. Answer (1)

$$\vec{v} = \vec{\omega} \times \vec{r}$$

$$\therefore \quad \vec{v} = (3\hat{i} + \hat{j} + \hat{k}) \times (2\hat{i} - \hat{j} - \hat{k})$$

$$\Rightarrow \quad \vec{v} = 5\hat{j} - 5\hat{k}$$

38. Answer (3)

39. Answer (4)

$$I = \frac{MR^2}{2}$$

Now, $\frac{dR}{dt} = 0.02$ m/s

$$\Rightarrow \quad \frac{dI}{dt} = MR \frac{dR}{dt}$$

$= 4 \times 1 \times 0.02$

$= 0.08$ kg m^2/s

40. Answer (1)

Unifrom circular motion about axis *AB*, so torque about *AB* = 0

41. Answer (4)

$$\tau = \frac{dL}{dt}$$

$\Rightarrow$ Area under τ–*t* graph = ΔL

$$\therefore \quad \Delta L = \frac{1}{2} \times 2 \times 2 + 2 \times 2 = 6 \text{ kg m}^2/\text{s}$$

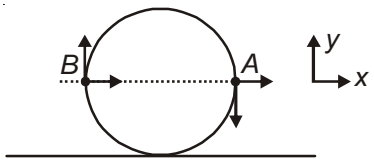
$\therefore \quad \Delta L = I\omega$

$\Rightarrow \quad \omega = 0.6$ rad/s

42. Answer (1)

$$\frac{M}{12}\left(a^2 + b^2\right)$$

43. Answer (3)

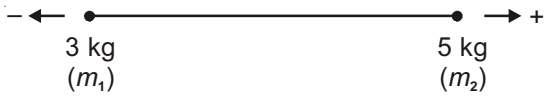


$\vec{v}_A = v_0\hat{i} - v_0\hat{j}$

$\vec{v}_B = v_0\hat{i} + v_0\hat{j}$

$|\overrightarrow{\Delta v}| = |\vec{v}_A - \vec{v}_B| = 2v_0$

44. Answer (1)



$$\Delta x_{CM} = \frac{m_1\Delta x_1 + m_2\Delta x_2}{m_1 + m_2}$$

$$\Rightarrow \quad \frac{-1}{4} = \frac{3\Delta x_1 + 5(3)}{8}$$

$$\Rightarrow \quad \Delta x_1 = -\frac{17}{3}\text{m}$$

45. Answer (1)

$I = I_{CM} + Md^2$

$\therefore$ MI is minimum about an axis passing through centre of mass of a rigid body.

Now, since linear mass density is increasing from *A* to *B*.

Hence, centre of mass should lie somewhere between *C* and *B*.

[CHEMISTRY]

46. Answer (4)

47. Answer (4)

Minimum concentration of common ion will show maximum solubility.

48. Answer (3)

For $Ga(OH)_3$,

$$K_{sp} = 27(s)^4 = 27\left(\frac{10^{-3}}{3}\right)^4 = 3.3\times10^{-13}$$

49. Answer (1)

50. Answer (1)

$$pH = 7 - \frac{1}{2}pK_b - \frac{1}{2}\log C$$

$$= 7 - \frac{1}{2}(4.74) - \frac{1}{2}\log(0.2)$$

= 4.28

51. Answer (4)

$3P = 9 \Rightarrow P = 3$ atm

$K_p = (2P)^2P = 4P^3 = 4 \times 27 = 108$

52. Answer (4)

53. Answer (3)

54. Answer (4)

$$\frac{K_p}{K_c} = (RT)^{\Delta n(g)} = (RT)$$

55. Answer (1)

$$pH = pK_a + \log\frac{[Salt]}{[Acid]}$$

$$= 4.74 + \log\left(\frac{3}{2}\right)$$

= 4.9

56. Answer (2)

Na_3PO_4 will form basic solution.

57. Answer (1)

BF_3 cannot lose proton.

58. Answer (4)

59. Answer (3)

60. Answer (1)

$\Delta H = (-110.5) + (-283.2) = -393.7$ kJ

61. Answer (1)

62. Answer (3)

For best fuel, ΔH per gram should be maximum.

63. Answer (3)

H_2O has 2 O – H bonds.

64. Answer (4)

$\Delta H - \Delta E = \Delta n(g)RT = -RT$

65. Answer (3)

66. Answer (2)

67. Answer (3)

68. Answer (2)

HOCl is the weakest acid among the given options.

69. Answer (1)

$H_2PO_4^- \rightleftharpoons H^+ + HPO_4^{2-}$

70. Answer (2)

71. Answer (2)

72. Answer (2)

Phenolphthalein is used as an indicator for weak acid and strong base titration.

73. Answer (4)

74. Answer (4)

$\alpha = \frac{104.16 - 62}{62(2-1)} = 0.68$

75. Answer (4)

76. Answer (3)

77. Answer (4)

Active mass = $\frac{7/28}{2}$ = 0.125

78. Answer (2)

79. Answer (2)

K_c only depends upon temperature.

80. Answer (4)

81. Answer (1)

During free expansion P_{ex} = 0.

82. Answer (3)

83. Answer (2)

84. Answer (3)

Internal energy is state function.

85. Answer (3)

86. Answer (3)

During strong acid-base, neutralization per mole H_2O release 57.1 kJ heat.

87. Answer (4)

88. Answer (4)

89. Answer (4)

$\Delta G = \Delta H - T\Delta S$ and for spontaneous ΔG should be negative.

90. Answer (4)

[BIOLOGY]

91. Answer (1)

Help in rolling and unrolling of leaves in dry and moist conditions respectively.

92. Answer (2)

Generally cortical in origin

93. Answer (2)

Secondary phloem and periderm.

94. Answer (4)

Phellogen is couple of layers thick.

95. Answer (2)

96. Answer (3)

Intrafascicular cambium is ontogenetically primary and functionally secondary meristem.

97. Answer (4)

Starch sheath

98. Answer (3)

Undifferentiated ground tissue.

99. Answer (1)

Closed vascular bundles in monocot stem and leaves.

100. Answer (3)

Simple tissues both living and dead.

101. Answer (1)

Phloem parenchyma is absent in monocots.

102. Answer (4)

Pericyclic fibres or perivascular fibres in dicot stem.

103. Answer (2)

Parenchyma – Fundamental tissue

104. Answer (3)

Protoxylem

105. Answer (1)

Pear, guava, sapota etc.

106. Answer (2)

Non-perforated end wall in tracheids.

107. Answer (1)

Collenchyma

108. Answer (4)

Epidermis, endodermis and pericycle are parenchymatous without intercellular space.

109. Answer (1)

Axillary bud

110. Answer (1)

Primary meristems give rise primary permanent tissue.

111. Answer (4)

Brassicaceae

112. Answer (1)

Non-endospermous seeds in fabaceae family

113. Answer (3)

Liliaceae, solanaceae, fabaceae, brassicaceae.

114. Answer (4)

Lily family

115. Answer (4)

Hilum is present on seed coat.

116. Answer (1)

Mango and coconut

117. Answer (1)

118. Answer (4)

119. Answer (3)

120. Answer (1)

Asteraceae

121. Answer (2)

Unilocular ovary in free central and multilocular in axile.

122. Answer (4)

123. Answer (3)

124. Answer (2)

Superior ovary

125. Answer (1)

For vegetative reproduction only.

126. Answer (4)

Racemose in fabaceae.

127. Answer (4)

128. Answer (2)

Cymose type

129. Answer (2)

Tendril in pea, spines.

130. Answer (2)

131. Answer (3)

Generally in monocots and few dicots like *Calophylum*, *Eryngium*.

132. Answer (3)

Stolon and sucker as sub-aerial stem.

133. Answer (2)

Rhizophora

134. Answer (1)

Primary root is long lived in mustard.

135. Answer (1)

Tap root

136. Answer (1)

137. Answer (1)

Starch and glycogen are homopolymer and branched polymer of glucose.

138. Answer (2)

Two hydrogen bonds are formed between adenine and thymine.

139. Answer (2)

End product is an inhibitor in feedback or allosteric inhibition.

140. Answer (1)

141. Answer (4)

Enzyme 'X' is carbonic anhydrase.

142. Answer (1)

In glycogen, α-1,4 linkage is present in straight chain.

143. Answer (2)

Albumin is a plasma protein.

144. Answer (2)

Nicotine is an alkaloid present in tobacco.

145. Answer (4)

Adenine – 28%

Thymine – 28%

Cytosine – 22%

Guanine – 22%

146. Answer (4)

Cysteine, tyrosine and alanine are non-essential amino acids.

147. Answer (1)

Enzyme A is lyase belonging to class-IV.

148. Answer (1)

Maltose, lactose, sucrose, trehalose and cellobiose are disaccharides.

149. Answer (4)

Galactose is a monosaccharide.

150. Answer (1)

In human, reserved food is stored in the form of glycogen.

151. Answer (2)

Given organic compound is ribose.

152. Answer (2)

153. Answer (1)

Enzyme suppresses the activation energy, so increases the rate of reaction.

154. Answer (2)

155. Answer (4)

156. Answer (3)

Ascorbic acid is sugar acid.

157. Answer (3)

Conacanavalin-A is a secondary metabolite.

158. Answer (4)

Glycine is simplest amino acid in which 'R' group is replaced by hydrogen.

159. Answer (4)

160. Answer (4)

Cotton fibre is cellulose.

161. Answer (1)

Nucleotides are monomers of DNA.

162. Answer (1)

Glycogen has α-1,4 and α-1,6 linkage.

163. Answer (4)

Maltose and sucrose are disaccharides.

164. Answer (2)

Furanose ring is pentagonal ring.

165. Answer (1)

Carbohydrate – 3%

166. Answer (2)

Glycine is simplest amino acid and is optically inactive.

167. Answer (2)

Tryptophan synthesizes nicotinamide, melatonin and IAA.

168. Answer (4)

One turn of 360° of DNA spiral has about 10 nitrogen bases on each strand of DNA.

169. Answer (2)

Guanine is a purine having double ring structure.

170. Answer (1)

$NADP^+$ is nicotinamide adenosine dinucleotide phosphate.

171. Answer (1)

Fe^{2+} is cofactor for catalase.

172. Answer (1)

Increase in the product concentration decreases the enzyme activity.

173. Answer (2)

174. Answer (3)

On increasing substrate concentration, rate of reaction increases upto maximum velocity.

175. Answer (2)

Haem in catalase is prosthetic group which is responsible for catalase activity.

176. Answer (2)

Ribozyme is RNA acting as an enzyme.

177. Answer (1)

178. Answer (2)

Cellulose is most abundant organic substance of the biosphere.

179. Answer (1)

Nucleotides are the monomers of nucleic acid.

180. Answer (4)

Nerve gas inhibits acetylcholinesterase.

❑ ❑ ❑