All India Aakash Test Series for Medical - 2021

TEST - 2 (Code-C)

Test Date : 10/11/2019

ANSWERS

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

HINTS & SOLUTIONS

[PHYSICS]

1. Answer (1)

Hint: $v_x = u_x, v_y = -gt$

Sol.: At any time t, the horizontal and vertical components of velocity can be written as

v_x = 10 m/s and $v_y = -gt = -10t$

if velocity is directed at angle 45° with the horizontal, then

$|v_x| = |v_y|$

$10 = 10t \quad \Rightarrow t = 1$ s

2. Answer (2)

Hint: Uniformly accelerated motion in two dimensions.

Sol.: Time of flight (T) $= \sqrt{\frac{2h}{g}} = \sqrt{\frac{2\times 20}{g}} = 2$ s

Horizontal Displacement $= \frac{1}{2}at^2$

$= \frac{1}{2}\times 10 \times 4 = 20$ m

Displacement $= (20^2 + 20^2)^{1/2} = (2\times 20^2)^{1/2}$

$= 20\sqrt{2}$ m

3. Answer (4)

Hint: Use vector addition.

Sol.: $\vec{P} = 3\hat{i} + 4\hat{j}$

$\vec{P} + \vec{Q} = 8\hat{i} + 7\hat{j}$

$\vec{Q} = 8\hat{i} + 7\hat{j} - \vec{P} = 8\hat{i} + 7\hat{j} - 3\hat{i} - 4\hat{j} = 5\hat{i} + 3\hat{j}$

$|\vec{Q}| = \sqrt{25+9} = \sqrt{34}$

4. Answer (1)

Hint: River-swimmer problem with minimum time of crossing.

Sol.: $T_{\min} = \frac{d}{v_{m/R}} = \frac{200}{10} = 20$ s

5. Answer (1)

Hint & Sol.: Greater the vertical component of velocity of projection greater would be the time of flight and the maximum height.

6. Answer (1)

Hint: In uniform circular motion, speed $(|\vec{v}|)$ is constant, but velocity $(\vec{v})$ is variable due to change in its direction.

Sol.: Speed is constant $\therefore \frac{d|\vec{v}|}{dt} = 0$

Velocity is variable $\therefore \frac{dv}{dt} \neq 0$

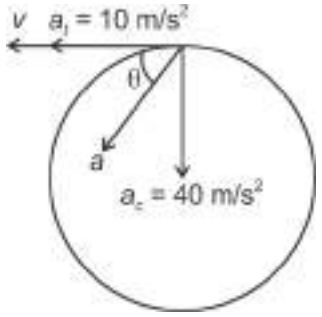
Acceleration vector is also variable $\therefore \frac{d^2\vec{v}}{dt^2} \neq 0$

7. Answer (1)

Hint: Velocity in circular motion is tangential. Thus, angle between acceleration and tangential direction would be angle between acceleration and velocity.

Sol.: $a_c = \frac{v^2}{R} = \frac{20^2}{10} = \frac{400}{10} = 40$ m/s^2

$a_t = \frac{d|\vec{v}|}{dt} = 10$ m/s^2 given



$\tan(\theta) = \frac{a_c}{a_t} = \frac{40}{10} = 4$

$\theta = \tan^{-1}(4)$

8. Answer (2)

Hint: Use concept of velocity of approach.

Sol.: Velocity along line OP = 10 cos60° = 5 m/s.

Time taken $= \frac{20}{5} = 4$ s

9. Answer (1)

Hint: Relative acceleration between free falling particles is zero.

Sol.: Since relative acceleration = 0

$\therefore$ relative velocity = 5 + 3 = 8 m/s is constant.

Separation = relative velocity × time

= 8 × 4 = 32 m

10. Answer (4)

Hint: $v^2 = u^2 + 2a_t s$

Sol.: $v^2 = 2\ a_t s$

$v^2 = 2 \times 2 \times 4$

$= 4$ m/s

11. Answer (2)

Hint: $a_c = \dfrac{v^2}{R}$

Sol.: From graph, $a_c = \tan(37°)t$

$a_c = \dfrac{3}{4}t$

$\dfrac{v^2}{R} = \dfrac{3}{4}t$

$\Rightarrow \quad v = \sqrt{\dfrac{3}{4}Rt} = \sqrt{\dfrac{3}{4} \times 12 \times 1} = 3$ m/s

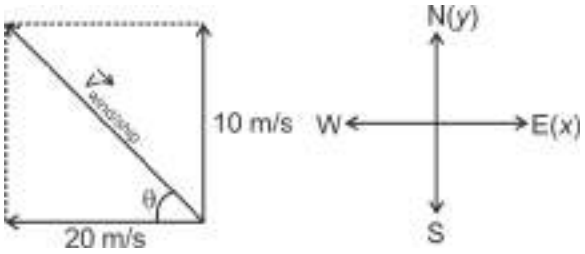
12. Answer (4)

Hint: Flag flutters in the direction of velocity of wind with respect to the ship.

Sol.: $\vec{v}_{\text{ship}} = 20\hat{i}$ m/s

$\vec{v}_{\text{wind}} = 10\,\hat{j}$ m/s

$\vec{v}_{\text{wind/ship}} = \left(10\hat{j} - 20\hat{i}\right)$ m/s



$\tan\theta = \dfrac{10}{20}$

$\theta = \tan^{-1}\left(\dfrac{1}{2}\right)$, north of west

13. Answer (1)

Hint: 2-D motion under uniform acceleration.

Sol.: $\vec{v} = \vec{u} + \vec{a}t$

$\vec{v} = (3i + 8j) + \left(2i + 2\hat{j}\right)t$

at $t = 3$ s

$\vec{v} = \left(9\hat{i} + 14\hat{j}\right)$ m/s

14. Answer (1)

Hint & Sol.: As, for freely falling bodies, relative acceleration is zero, the monkey will get hit by the bullet.

15. Answer (3)

Hint: The relative velocity of *A* must be directed towards *B* from *A*.

Sol.: $\vec{r}_A + \vec{v}_A t = \vec{r}_B + \vec{v}_B t$

$\Rightarrow \quad \left(\vec{v}_A - \vec{v}_B\right)t = \vec{r}_B - \vec{v}_A$

$\Rightarrow$ Therefore $\vec{v}_{AB} = \vec{r}_{BA}$

16. Answer (1)

Hint & Sol.: Instantaneous speed is magnitude of instantaneous velocity.

17. Answer (4)

Hint: Time of flight = $t_1 + t_2$

Sol.: Time of flight = 3 + 5 = 8 s

$\dfrac{2u\sin(\theta)}{g} = 8$

$\dfrac{2 \times u \times \sin(30°)}{10} = 8$

$U = 80$ m/s

18. Answer (4)

Hint: $\vec{v}_{(\text{rain/man})} = \vec{v}_{(\text{rain})} - \vec{v}_{(\text{man})}$

Sol.: As man starts walking with 6 m/s.

Let velocity of rain = $v(-\hat{j})$

Velocity of man = $6\hat{i}$ m/s

$\vec{v}_{(\text{rain/man})} = v(-\hat{j}) - 6\hat{i}$

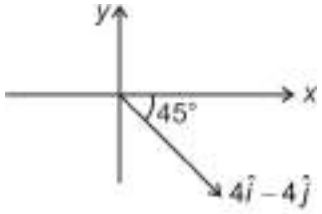
For this to be at angle 45°

$v = 6$ m/s

19. Answer (3)

Hint: $(\vec{A} + \vec{B})$ is in fourth quadrant.

Sol.: $\vec{A} + \vec{B} = (4\hat{i} - 2\hat{j} + 6\hat{k}) + (-2\hat{j} - 6\hat{k}) = 4\hat{i} - 4\hat{j}$

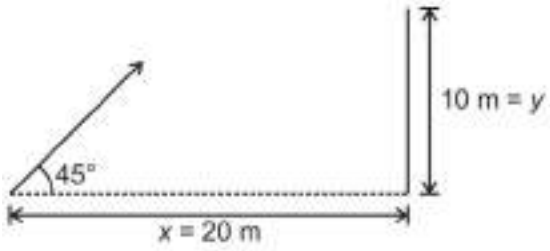


$\Rightarrow$ Angle with *y*-axis = 135°

20. Answer (2)

Hint: Equation of trajectory of a projectile.

Sol.:



$y = x\tan\theta - \frac{1}{2}g\frac{x^2}{u^2}\left(1+\tan^2\theta\right)$

$\theta = 45° \Rightarrow \tan(\theta) = 1$

y = 10 m

x = 20 m

$\Rightarrow u = 20$ m/s

21. Answer (1)

Hint: $\vec{a} = \frac{d^2\vec{r}}{dt^2}$

Sol.: $\vec{v} = \frac{d\vec{r}}{dt} = \left(10t\hat{i} + 3\hat{j}\right)$ m/s

$\vec{a} = \frac{d\vec{v}}{dt} = \left(10\hat{i}\right)$ m/s^2

22. Answer (1)

Hint: $\vec{v}_{B/E} = \vec{v}_B - \vec{v}_E$

Sol.: $\vec{v}_{B/E} = 10\hat{i} - 20\hat{j}$

$\left|\vec{v}_{B/E}\right| = \sqrt{(10)^2 + (20)^2} = 10\sqrt{5}$ m/s

23. Answer (4)

Hint & Sol.: A particle under action of constant force follows either a rectilinear path or a parabolic path.

24. Answer (4)

Hint & Sol.: The angle is 90° for uniform circular motion only. For circular motions with increasing and decreasing speeds, the angle is acute and obtuse respectively.

25. Answer (4)

Hint: $\vec{v} = \frac{d\vec{r}}{dt}$; $\vec{a} = \frac{d\vec{v}}{dt}$

Sol.: $\vec{r} = \cos(3t)\hat{i} + \sin(3t)\hat{j}$

$\vec{v} = \frac{d\vec{r}}{dt} = 3\sin(3t)\hat{t} + 3\cos(3t)\hat{j}$

$\vec{a} = \frac{d\vec{v}}{dt} = -9\cos(3t)\hat{i} - 9\sin(3t)\hat{j} = -9\vec{r}$

$\therefore$ acceleration is antiparallel $\vec{r}$

26. Answer (3)

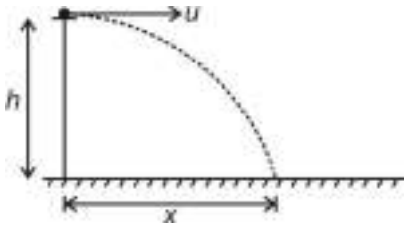
Hint & Sol.: From triangle law of vector addition,

$\vec{a} + \vec{b} = \vec{c}$

27. Answer (2)

Hint: Horizontal projection of projectile

Sol.:



Time of flight $= T = \sqrt{\frac{2h}{g}}$

$x = uT = u\sqrt{\frac{2h}{g}}$

$\Rightarrow u = x\sqrt{\frac{g}{2h}}$

28. Answer (3)

Hint: Speed at top most point $u\cos(\theta)$

Sol.: $\frac{1}{4}\left(\frac{1}{2}mu^2\right) = \frac{1}{2}m\left(u\cos(\theta)\right)^2$

$\cos(\theta) = \frac{1}{2}$

θ = 60°

29. Answer (1)

Hint: $\left|\overrightarrow{OA},\overrightarrow{OB},\overrightarrow{OC},\overrightarrow{OD},\overrightarrow{OE}\right.$ and $\left.\overrightarrow{OF}\right|$ all are unit vectors.

Sol.: $\left|\overrightarrow{OA} + \overrightarrow{OB} + \overrightarrow{OC} + \overrightarrow{OD} + \overrightarrow{OE} + \overrightarrow{OF}\right|$

$= \left|\left(\overrightarrow{OA} + \overrightarrow{OD}\right) + \left(\overrightarrow{OB} + \overrightarrow{OE}\right) + \overrightarrow{OC}\right|$

$= \left|\vec{0} + \vec{0} + \overrightarrow{OC}\right|$

$= \left|\overrightarrow{OC}\right| = 1$ m

30. Answer (4)

Hint: $a = v^2/R$

Sol.: $\left|\Delta\vec{a}\right| = \sqrt{2}\frac{v^2}{R}$

31. Answer (2)

Hint: Horizontal component of velocity remains constant in projectile motion, i.e. $u\cos\theta = v\cos\alpha$

Sol.: 30cos60° = $v$cos45°

$v = 15\sqrt{2}$ m/s

32. Answer (4)

Hint: $\vec{r} = u\cos(\theta)t\hat{i} + \left(u\sin(\theta)t - \frac{1}{2}gt^2\right)\hat{j}$

Sol.: $u\cos\theta = 20\cos(30) = 10\sqrt{3}$ m/s

$\vec{r} = 10\sqrt{3}x(10)\hat{i} + \left(10\times10 - \frac{1}{2}\times(10)(10)^2\right)\hat{j}$

$= 100\sqrt{3}\hat{i} + (-400)\hat{j}$

$|\vec{r}| = \sqrt{(100\sqrt{3})^2 + (400)^2}$

$\sqrt{30000 + 160000} = 100\sqrt{19}$ m

33. Answer (3)

Hint: $y = x\tan\theta\left(1 - \frac{x}{R}\right)$

Sol.: $y = x\tan\theta\left(1 - \frac{x}{R}\right)$

$m = \frac{dy}{dx} = \tan(\theta) - \frac{2x\tan(\theta)}{R}$

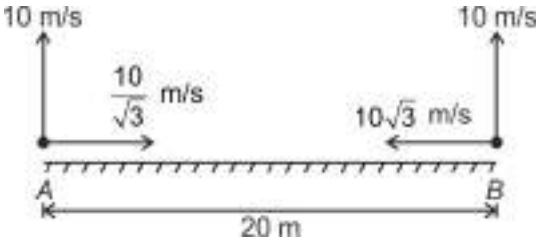
$\frac{dm}{dt} = 0 - \frac{2\tan(\theta)}{R}\frac{dx}{dt} = -\frac{2u_x\tan(\theta)}{R}$

$\therefore \frac{dm}{dt} = a$ negative constant

34. Answer (4)

Hint: Relative motion in 2-D

Sol.: Resolving:

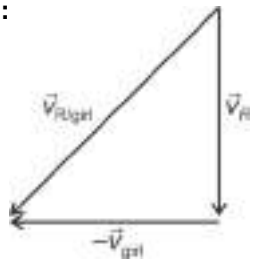


Both particles will collide $\Rightarrow$ minimum separation = 0

35. Answer (2)

Hint: Rain-man problem.

Sol.:



$10^2 = 6^2 + v_{girl}^2$

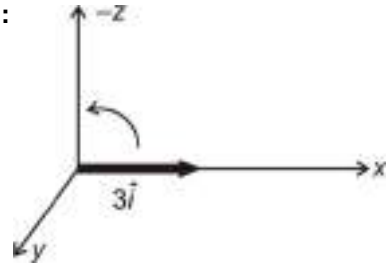
$v_{girl} = 8$ m/s

36. Answer (3)

Hint & Sol.: At maximum height, the speed is minimum and not equal to zero.

37. Answer (4)

Hint & Sol.:



New vector will be along (negative z)

$= -3\hat{k}$

38. Answer (2)

Hint: Horizontal Range (R) $= \frac{u^2\sin(2\theta)}{g}$

Sol.: $20 = \frac{(20)^2\sin(2\theta)}{(10)}$

$200 = (400)\sin(2\theta)$

$\sin(2\theta) = \frac{1}{2}$

$2\theta = 30°$

$\theta = 15°$ (with the horizontal)

$\Rightarrow$ 75° (with the vertical)

39. Answer (3)

Hint & Sol.: Both particles have zero initial vertical velocity and therefore, would reach the ground simultaneously.

40. Answer (1)

Hint: Equation of trajectory of a projectile

$y = x\tan\theta - \frac{gx^2}{2u^2}(1 + \tan^2\theta)$

Sol.: Comparing with equation of trajectory

$b = \tan(\theta)$

$\theta = \tan^{-1}(b)$

41. Answer (2)

Hint: $\vec{B} \parallel n\vec{B}$ if $n > 0$

Sol.: $8\vec{B}$ has magnitude 8 times the magnitude of $\vec{B}$ and has same direction as that of $\vec{B}$.

$\therefore$ Magnitude of $8\vec{B} = 8 \times 5 = 40$ unit

42. Answer (2)

Hint & Sol.: In uniform circular motion, the magnitude of acceleration (centripetal acceleration) is constant but its direction is variable. Thus statement (a) is wrong. For a moving body, distance can never be zero but displacement can be zero.

43. Answer (2)

Hint: Relative motion in 2-D.

Sol.: As the ball is dropped, the horizontal velocity of ball and plane will be same. Thus relative velocity in horizontal direction would be zero and ball would appear to fall vertically downwards.

44. Answer (1)

Hint & Sol.: $x = 3t$, $y = 4t + 4$

$$t = \frac{x}{3}$$

$$y = \frac{4x}{3} + 4$$

45. Answer (3)

Hint & Sol.: If $\theta_1 + \theta_2 = 90°$, the range of projectiles is same.

[CHEMISTRY]

46. Answer (3)

Hint: Anions are larger than cations, in case of isoelectronic species

Sol.: Size decreases with increase in effective nuclear charge.

The correct order of ionic radii is

So, $P^{3-} > S^{2-} > Cl^- > K^+$

47. Answer (4)

Hint: F has lower negative electron gain enthalpy than Cl.

Sol.:

	$\Delta_{eg}H$ (kJ mol^{-1})
F	–328
Cl	–349
S	–200
O	–141

48. Answer (1)

Hint: Al^{3+} has 10 electrons

Sol.: Both Al^{3+} ion and O^{2-} ion have 10 electrons each, hence, these are isoelectronic.

49. Answer (2)

Hint: Fully filled and half filled subshells are found to be extraordinarily stable.

Sol.: Be ····· $2s^2$ fully filled

N ····· $2p^3$ half filled

Above electronic configurations are associated with extra stability. Hence, their electron gain enthalpies are positive.

50. Answer (3)

Hint: Ionisation energy increases with increase in effective nuclear charge

Sol.: [Ne]$3s^1$ = Na

[Ne]$3s^2$ = Mg

[Ne]$3s^2 3p^1$ = Al

[Ar]$4s^2$ = Ca

Order of $(IE)_1$

Mg > Ca > Al > Na

51. Answer (3)

Hint: Transition metals have incomplete *d*-subshell either in neutral atom or in their ions.

Sol.: $(n - 1)d^5ns^2$ is a typical transition element while ns^1 is an *s*-block (group 1) element $(n - 1)d^{10}ns^2np^5$ and ns^2np^5 are *p*-block (group 17) elements.

52. Answer (2)

Hint: AB_2 type molecules with no lone pair of electrons on central atom are linear.

Sol.: H_2O, SO_2 are bent, SO_3 is trigonal planar. Be in BeF_2 is *sp* hybridised with no lone pair, hence, linear.

53. Answer (3)

Hint: Bond order $= \frac{1}{2}(N_b - N_a)$

Where N_b = Number of electrons in bonding orbitals and N_a = Number of electrons in antibonding orbitals.

Sol.: NO^+ and CO both have 14 electrons each hence will have the same bond order i.e. 3.

54. Answer (2)

Hint: H atom bonded with F, O and N generally gets involved in H-bonding.

55. Answer (2)

Hint: Hybridisation depends upon the value of n. n = number of bond pair + number of lone pair.

Sol.: NH_3; n = 3bp + 1 lp = 4 $\therefore$ sp^3 hybridisation

SO_3; n = 3bp + 0 lp = 3 $\therefore$ sp^2 hybridisation

CO_2; n = 2bp + 0 lp = 2 $\therefore$ *sp* hybridisation

56. Answer (3)

Hint: Chemical species having unpaired electron(s) are called paramagnetic while species having all the electrons paired are called diamagnetic.

Sol.: O_2, O_2^+ & O_2^- have unpaired electrons hence, paramagnetic but O_2^{2-} has all electrons paired. Therefore, it is diamagnetic.

57. Answer (2)

Hint: Dipole moment is a vector quantity.

Sol.: 

58. Answer (1)

Hint: $CH_3 - CH = \underset{sp}{C} = \underset{sp^2}{C}H - CH_2 - OCH_3$

59. Answer (4)

Hint: *sp* hybridized central atom acquires linear structure

Sol.: $O = \overset{+}{N} = O$ is linear.

60. Answer (3)

Hint: In PCl_5, there are 10 electrons around P atom, So, it is an example of expanded octet.

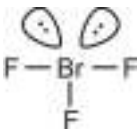
61. Answer (4)

Hint: $K^+ O^- - H$, $Ba^{2+} O^- - \underset{\underset{O}{\|}}{\overset{\overset{O}{\|}}{S}} - O^-$, $Na^+ \bar{C} \equiv N$.

In all the above structures both ionic and covalent bonds are present.

62. Answer (3)

Hint: Br has 7 electrons in outermost shell.

Sol.:  has 3 bp + 2 lp.

63. Answer (2)

Hint: MO configuration of C_2 is

$$\sigma 1s^2 \sigma^* 1s^2 \sigma 2s^2 \sigma^* 2s^2 \begin{cases} \pi 2p_x^2 \\ \pi 2p_y^2 \end{cases}$$

Sol.: C_2 has two π bonds only.

64. Answer (1)

Hint: Molecule having an unpaired electron is called an odd electron species.

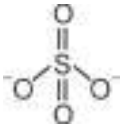
Sol.: NO_2 has one unpaired electron so, it is an odd electron species. In CO_2, SO_2 and CO molecules, all the electrons are paired.

65. Answer (2)

Hint: Bond order in SO_4^{2-} ion

$$= \frac{\text{number of } \sigma \text{ bonds} + \pi \text{ bonds}}{\text{number of } \sigma \text{ bonds}}$$

Sol.: Bond order of S – O in SO_4^{2-} ion $= \frac{6}{4} = 1.5$



66. Answer (4)

Hint: Hybridisation of S in SF_4 is sp^3d.

Sol.: 

67. Answer (3)

Hint: With increase of charge on anion, polarisability will increase.

Sol.: $C^{4-} > N^{3-} > O^{2-} > F^-$: Polarizability.

68. Answer (1)

Hint: In trigonal bipyramidal molecule two axial bonds are longer than three equatorial bonds.

Sol.: In ammonia all three N – H bond lengths are equal.

69. Answer (4)

Hint: $N_2\left(14e^-\right) = \sigma 1s^2, \sigma^* 1s^2, \sigma 2s^2, \sigma^* 2s^2$

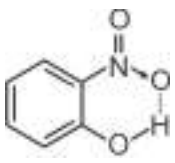
$$\begin{cases} \pi 2p_x^{\ 2} \\ \pi 2p_y^{\ 2}, \sigma 2p_z^{\ 2} \end{cases}$$

Sol.: Bond order of N_2 molecule $= \frac{10-4}{2} = 3$

Bond order of N_2^+ ion $= \frac{9-4}{2} = 2.5$

Bond order of N_2^- ion $= \frac{10-5}{2} = 2.5$

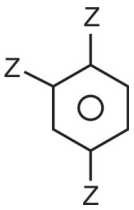
70. Answer (1)

Hint: 

Intramolecular H-bonding

71. Answer (3)

Hint: Dipole moment of  molecule is zero.

Sol.:  dipole moment = x D

72. Answer (2)

Hint: If in a molecule or ion, bond order is 0, then, the molecule or ion will not exist.

Sol.: B.O. in $He_2 = \frac{2-2}{2} = 0$

73. Answer (3)

Hint: In KO_2, O_2^- ion is present which is paramagnetic.

Sol.: BaO_2 has O_2^{2-} ion which is diamagnetic.

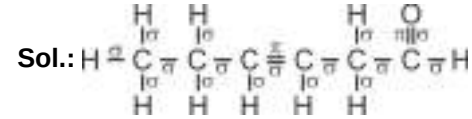
AlO_2^- has O^{2-} ion which is diamagnetic. NO_2^+ ion has all the electrons paired, hence it is also diamagnetic

74. Answer (4)

Hint: CO_2 is linear, $HgCl_2$ is also linear. On the other hand SO_2, NO_2, I_3^+ are bent.

75. Answer (4)

Hint: Double bond has 1σ and 1π bond.

Sol.: 

Number of σ bonds = 16

Number of π bonds = 2

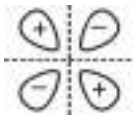
76. Answer (3)

Hint: NO is paramagnetic while NO^+ is diamagnetic

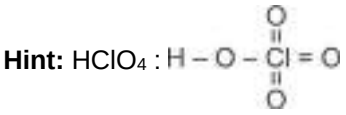
Sol.: Bond order in NO = 2.5

Bond order in NO^+ = 3

77. Answer (2)

Hint:  represents π-antibonding molecular orbital.

78. Answer (3)

Hint: $HClO_4$: 

There are three Cl = O bonds in $HClO_4$.

79. Answer (3)

Hint: On increasing bond order, bond length decreases.

Sol.: B.O. in CO = 3

B.O. in CO_2 = 2

B.O. in CO_3^{2-} ion $= \frac{4}{3} = 1.33$

∴ Longest C – O bond length will be found in CO_3^{2-} ion.

80. Answer (2)

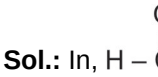
Hint: $O^{\delta-} - H^{\delta+} \cdots F^-$ will be strongest.

Sol.: Strength of H-bond follows the order

F ··· H > O ··· H > N ··· H

81. Answer (4)

Hint: In H – C ≡ N there are 2σ and 2π bonds.

Sol.: In,  4σ, 1π bonds

In,  4σ, 2π bonds

In, O = N – N = O 3σ, 2π bonds

82. Answer (3)

Hint:

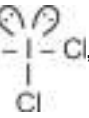
Bond type	Bond length (pm)
C – H	107
C – C	154
C – N	143

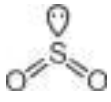
83. Answer (2)

Hint: C – N bond in CN^- ion is polar.

While N – N bond in N_2 is non polar.

84. Answer (3)

Hint: In  , there is no π bond.

Sol.:  has 2π bonds

O = C = O has 2π bonds

N ≡ N has 2π bonds

85. Answer (1)

Hint: F.C. = total number of valence electrons – total number of nonbonding electrons $-\frac{1}{2}$ (total number of bonding electrons)

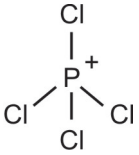
Sol.: F.C. on central oxygen atom of O_3

$= 6 - 2 - \frac{1}{2}(6)$

$= +1$

86. Answer (2)

Hint:



P is sp^3 hybridized and it acquires tetrahedral shape.

87. Answer (2)

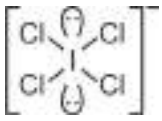
Hint: NO_2^+ has linear geometry.

Sol.:

Molecule/ion	Bond angle
NO_2^+	180°
NO_2	134°
NO_2^-	115°

88. Answer (3)

Hint:



has 2 l.p. on central atom.

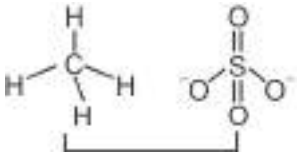
Sol.: Xe in XeF_6 has 1 lone pair

S in SO_3 has 0 lone pair

P in PO_4^{3-} has 0 lone pair

89. Answer (4)

Hint:



Both are sp^3 hybridized.

90. Answer (3)

Hint: A metal ion having pseudo inert gas like configuration i.e. having complete *d* subshell is found to have greater covalent character.

Sol.: AgCl has the highest degree of covalent character.

[BIOLOGY]

91. Answer (3)

Hint: Metabolic reactions that occur *in vitro* are living reactions.

Sol.: Metabolism is defining feature of all living organisms because non living objects do not show metabolism.

92. Answer (3)

Hint: First word in the biological name of an organism is generic name.

Sol.: Author citation is written after the specific epithet of the organism.

93. Answer (3)

Hint: Herbaria and botanical gardens are concerned with plants only.

Sol.: Museum is a place used for storing, preservation and exhibition of both plants and animals. Catalogue includes the alphabetical arrangement of species of a particular place describing their feature.

94. Answer (1)

Hint: Wheat and mango, both are angiosperms.

Sol.: Mango belongs to the class Dicotyledonae and wheat belongs to the class Monocotyledonae. Both belong to the division Angiospermae.

95. Answer (2)

Hint: ICBN - International Code of Botanical Nomenclature

Sol.: The set of rules and recommendations dealing with the formal names of plants is given in ICBN. Plant cells have cellulosic cell wall.

96. Answer (1)

Hint: Linnaeus proposed 'two kingdom system' of classification.

Sol.: Kingdom Plantae and Kingdom Animalia were the two kingdoms proposed by Linnaeus.

97. Answer (4)

Hint: Some members in Protista and Monera are autotrophs.

Sol.: All the members of Fungi and Animalia are heterotrophic.

98. Answer (1)

Hint: Three-domain system divides the kingdom Monera into two domains.

Sol.: Three domains are Bacteria, Archaea and Eukarya. All the eukaryotes are grouped in Eukarya.

99. Answer (4)

Hint: Lichens cannot tolerate air pollution.

Sol.: Lichens can grow in most inhospitable and uninhabited place but cannot tolerate air pollution especially due to SO_2, therefore these are considered as pollution indicators.

100. Answer (2)

Hint: Kingdom Protista includes only unicellular eukaryotic organisms.

Sol.: *Spirogyra* - Kingdom Plantae

Nostoc, Anabaena, Mycoplasma - Kingdom Monera

Amoeba, Chlamydomonas, Paramoecium, Chlorella, Euglena, Gonyaulax - Kingdom Protista

101. Answer (3)

Hint: Cellulosic cell wall is found in plants.

Sol.: Cell wall in monerans (except Archaebacteria and *Mycoplasma*) is made up of peptidoglycan and cell wall in fungi is made up of chitin.

102. Answer (4)

Hint: Bovine spongiform encephalopathy is caused by a prion.

Sol.: Prions are abnormally folded infectious protein particles. They lack nucleic acid.

103. Answer (3)

Hint: Both algae and fungi are eukaryotic.

Sol.: Algae are photosynthetic and fungi are non-photosynthetic.

104. Answer (2)

Hint: Sole members of kingdom Monera are bacteria.

Sol.: Bacteria are structurally simple but very complex in behaviour.

105. Answer (1)

Hint: Vibrium is comma-shaped.

Sol.: Coccus - Spherical

Bacillus - Rod-shaped

Spirillum - Spiral

106. Answer (4)

Hint: Methanogens produce methane from the dung of ruminants.

Sol.: Methanogens are Archaebacteria. They have a different cell wall structure than other bacteria.

107. Answer (2)

Hint: Phycobiont is algal partner in lichen.

Sol.: Algal partner in lichens picks up water and mineral salts from the fungus and prepare food by the process of photosynthesis.

108. Answer (1)

Hint: Cyanobacteria are blue-green algae.

Sol.: Cyanobacteria are photosynthetic prokaryotes. They are mainly fresh-water forms, though few are marine.

109. Answer (4)

Hint: Heterocysts contain nitrogenase enzyme.

Sol.: Heterocysts lack PS II activities and CO_2 fixation is done only by vegetative cells. PS I in heterocyst generates ATP required to fix nitrogen.

110. Answer (3)

Hint: Potato spindle tuber disease is caused by a viroid.

Sol.: Viroids are infectious RNA particles which were discovered by T.O. Diener.

111. Answer (3)

Sol.: Heterotrophic bacteria are most abundant in nature. The majority are important decomposers.

112. Answer (2)

Hint: The bacteria exhibit a primitive form of sexual reproduction.

Sol.: In bacteria, there is no gamete formation and fusion. Exchange of genetic material, i.e., genetic recombination occurs by transformation, conjugation and transduction methods.

113. Answer (1)

Hint: Diatoms are photosynthetic protists and are called Chrysophytes.

Sol.: Diatoms are found in fresh water as well as in marine water. They float passively in water current. Their silica embedded cell wall forms diatomaceous earth.

114. Answer (2)

Hint: Chemosynthetic autotrophic bacteria do not utilise light as energy source.

Sol.: Chemosynthetic autotrophic bacteria obtain energy for the synthesis of food by oxidising ceratin inorganic substances.

115. Answer (4)

Hint: Bacteria play a great role in recycling of nutrients like nitrogen, phosphorous, iron and sulphur.

Sol.: Mumps is a viral disease and viruses do not play a role in recycling of nutrients.

116. Answer (1)

Hint: Viroids are infectious RNA particles which are devoid of protein coat.

Sol.: Both viruses and viroids are obligate parasites. Both of them cause disease in plants.

117. Answer (3)

Hint: *Mycoplasma* lack cell wall.

Sol.: *Mycoplasma* infects both animals and plants and have both RNA and DNA.

118. Answer (1)

Hint: Kingdom Protista has only unicellular eukaryotic organisms.

Sol.: Boundaries of Kingdom Protista are not well defined. They have the features of fungi, plants and animals.

119. Answer (4)

Hint: Protista reproduce sexually by a process involving cell fusion and zygote formation.

Sol.: Crysophytes are mostly photosynthetic. All the major groups of protozoans have parasitic individuals.

120. Answer (1)

Sol.: In diatoms the cell wall has two thin overlapping shells which fit together like a soap box.

121. Answer (2)

Hint: Diatoms are the chief producers in the ocean.

Sol.: Walls in diatoms are embedded with silica. Large amount of their cell wall deposits in their habitat forms diatomaceous earth over billion of years.

122. Answer (3)

Hint: M.W. Beijerinck used the extract of the infected plants of tobacco to which he called *'Contagium vivum fluidum*'.

Sol.: The extract of infected tobacco plant contained tobacco mosaic virus (TMV).

123. Answer (3)

Hint: Viruses cannot synthesise proteins by self.

Sol.: No virus contains both RNA and DNA. They have either RNA or DNA.

124. Answer (2)

Hint: Cilia and cell wall are not found in euglenoids.

Sol.: Euglenoids have a covering of pellicle which is proteinaceous. This covering provides flexibility to the organisms.

125. Answer (2)

Hint: *Paramoecium* is a ciliated protozoan.

Sol.: *Trypanosoma* is a flagellated protozoan. Marine forms of amoeboid protozoans have silica shells on their surface. *Plasmodium* causes malaria.

126. Answer (1)

Hint: Spores of slime moulds are extremely resistant and survive for many years.

Sol.: During unfavourable conditions entire plasmodium forms sporocarp which contains a stalk having a sporangium at its tip. In sporangia spores are produced. Spores have cell wall

127. Answer (3)

Hint: Chlamydospores are formed under unfavourable conditions.

Sol.: Chlamydospores are thick walled resting resistant spores.

128. Answer (4)

Hint: Zoospores are formed in the members of Phycomycetes.

Sol.: In Phycomycetes, the mycelia are aseptate and coenocytic. Their spores are produced endogenously. They also reproduce sexually.

129. Answer (1)

Sol.: Venus flytrap is partially heterotrophic plant.

130. Answer (4)

Hint: In wheat, rust is caused by *Puccinia* and smut is caused by *Ustilago.*

Sol.: Both *Puccinia* and *Ustilago* are the members of Basidiomycetes.

131. Answer (2)

Hint: The given figure is of *Aspergillus.*

Sol.: *Aspergillus* belong to the class Ascomycetes (sac-fungi). It produces conidia exogenously.

132. Answer (2)

Hint: *Agaricus* is a member of Basidiomycetes.

Sol.: In *Agarcius*, the dikaryotic structure ultimately gives rise to basidium in which karyogamy and meiosis take place.

133. Answer (1)

Hint: Deuteromycetes are commonly known as imperfect fungi.

Sol.: *Alternaria, Colletotrichum* and *Trichoderma* are the members of Deuteromycetes.

134. Answer (4)

Hint: Early blight of potato is caused by *Alternaria* and late blight of potato is caused by *Phytophthora.*

Sol.: *Alternaria* is the member of Deuteromycetes and *Phytophthora* is the member of phycomycetes.

135. Answer (3)

Hint: The fungus which is used extensively in biochemical and genetic work belongs to Ascomycetes

Sol.: *Neurospora* is used extensively in biochemical and genetic work. They produce asexual spores exogenously and ascospores endogenously.

136. Answer (3)

Hint: These are involved in grinding of food.

Sol.: Premolars and last molar are a part of permanent dentition.

137. Answer (2)

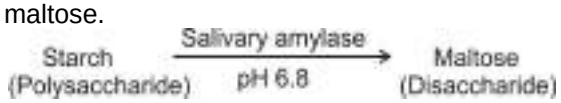
Hint: Product of mastication that passes from oral cavity to stomach.

Sol.: In stomach, food mixes with acidic gastric juice by the churning movements producing chyme.

138. Answer (2)

Hint: 70% starch is hydrolysed in small intestine

Sol.: Salivary amylase converts starch into maltose.



139. Answer (4)

Hint: Enzyme which acts on nucleic acid

Sol.: The enzymes in succus entericus are a part of intestinal juice. It includes dipeptidases, maltase, lactase, sucrase, nucleotidase, nucleosidase and intestinal lipases.

140. Answer (1)

Hint: Layer which is located outer to mucosa

Sol.: The submucosal layer is formed of loose connective tissue containing nerves, blood and lymph vessels. In duodenum, Brunner's glands are present in sub mucosal layer.

141. Answer (1)

Hint: Digested food gets absorbed in small intestine.

Sol.: Bio-macromolecules (protein, nucleic acids, polysaccharides and lipids) have to be broken down and converted into simple substances in the digestive system.

142. Answer (2)

Hint: Identify a part of large intestine.

Sol.: Caecum is a small blind sac which hosts some symbiotic micro-organisms. Vermiform appendix (a finger-like tubular projection) which arises from the caecum, is vestigial in human beings. Caecum opens into the colon.

143. Answer (4)

Hint: Disorder that is preceded by nausea.

Sol.: Vomiting is the ejection of stomach contents through mouth.

Indigestion is caused due to inadequate enzyme secretion, anxiety, food poisoning, overeating and spicy food.

144. Answer (4)

Hint: Identify the characteristic feature of kwashiorkor disease.

Sol.: Marasmus is produced by a simultaneous deficiency of proteins and calories. It is found in infants less than one year of age. In Marasmus, both growth rate and body weight decline considerably.

145. Answer (1)

Hint: Structure that has a cystic duct.

Sol.: Gall bladder stores bile composed of bile pigments, bile salts, cholesterol and phospholipids but no enzymes.

146 Answer (4)

Hint: Ileum is the last part of the small intestine.

Sol.: Ileo-caecal valve prevents the backward flow of the faecal matter. The faecal matter is temporarily stored in the rectum till defecation. Sphincter of Boyden controls opening of common bile duct into hepatopancreatic duct.

147. Answer (2)

Hint: Enzyme secreted by accessory digestive gland.

Sol.: Carbohydrates in the chyme are hydrolysed by pancreatic amylase into disaccharides.

148. Answer (2)

Hint: Lymph turns white upon absorption of lipids.

Sol.: B-Lacteals, A-Villi,
C-Artery, D-Vein

149. Answer (2)

Hint: Largest gland of the body.

Sol.: Hepatic lobule is the structural and functional unit of liver. Glisson's capsule is a mammalian feature.

150. Answer (4)

Hint: Assimilation occurs after digestion and absorption.

Sol.: Although absorption in human digestive system occurs chiefly in small intestine, some amount of absorption also occurs in the stomach.

151. Answer (1)

Hint: Frenulum means a small fold.

Sol.: Tongue is a voluntary muscular and glandular structure which occupies the floor of the mouth. It is attached to the floor of the mouth by a fold called the lingual frenulum.

152. Answer (3)

Hint: Dentition that has well-developed roots.

Sol.: When a set of temporary milk teeth are replaced by a set of permanent teeth, the type of dentition is called diphyodont.

153. Answer (1)

Hint: Structure into which the buccal cavity opens.

Sol.: A cartilaginous flap called epiglottis prevents the entry of food into the glottis *i.e.* opening of the wind pipe, during swallowing.

154. Answer (4)

Hint: Cells which are wine glass shaped in structure.

Sol.: Parietal cells secrete HCl and goblet cells secrete mucus.

155. Answer (4)

Hint: Structure related to tonsils.

Sol.: Lymphoid tissue of pharynx is called tonsil. Tonsils are arranged in a ring like-manner called - Waldeyer's ring.

156. Answer (4)

Hint: Structure that has maximum surface area.

Sol.: In small intestine, the cells forming the villi produce numerous microscopic projections called microvilli which give a brush border appearance. These modifications increase the surface area enormously.

157. Answer (4)

Hint: Identify water insoluble substances.

Sol.: Fatty acids and glycerol are first incorporated into small droplets called micelles which move into the intestinal mucosa. They are rearranged into very small protein coated fat globules called the chylomicrons which are transported into lacteals in villi. Lacteals ultimately release the absorbed substances into the blood stream.

158. Answer (4)

Hint: Present in beverages like wine.

Sol.: Absorption of water, simple sugars and alcohol takes place in stomach. No significant digestive activity occurs in the large intestine.

159. Answer (1)

Hint: Action of amylase

Sol.: Salivary amylase acts optimally at pH 6.8.

160. Answer (1)

Hint: Source and target organ of this hormone is stomach.

Sol.: Secretin promotes release of bicarbonates in the pancreatic juice. It increases secretion of bile and decreases gastric secretion and motility.

Somatostatin suppresses the release of hormones from digestive tract.

161. Answer (3)

Hint: Wheezing occurs due to constriction of bronchioles.

Sol.: Asthma occurs due to allergic reaction to foreign substances that affect the respiratory tract.

162. Answer (4)

Hint: Residual volume remains same in lungs even after a forceful exhalation.

Sol.: Expiratory capacity is a sum of tidal volume and expiratory reserve volume.

EC = TV + ERV

= 500 + 1000

= 1500 ml.

163. Answer (2)

Hint: Largest class in the animal kingdom.

Sol.: Lower invertebrates like sponges, coelenterates, flatworms, etc, exchange O_2 with CO_2 by simple diffusion over their entire body surface.

164. Answer (2)

Hint: Spinal cord is dorsal in humans.

Sol.: The thoracic chamber is formed dorsally by the vertebral column, ventrally by the sternum, laterally by the ribs and on the lower side by dome-shaped diaphragm.

165. Answer (4)

Hint: Bronchioles of conducting part have cartilaginous rings.

Sol.: The trachea, primary, secondary and tertiary bronchi and initial bronchioles are supported by incomplete cartilaginous rings.

166. Answer (1)

Hint: Reflex related to stretch receptors.

Sol.: In the walls of bronchi and bronchioles, stretch receptors are located and are stimulated by overstretching of lungs. Nerve impulses are sent along the vagus nerve to inhibit the inspiratory area. This results in cessation of inhalation and start of exhalation. Therefore, it is mainly a protective mechanism for preventing excessive inflation of lungs.

167. Answer (4)

Hint: Forced exhalation is an active process.

Sol.: Forceful exhalation is due to contraction of internal intercostals and abdominal muscles.

168. Answer (3)

Hint: Expulsion of air from lungs to atmosphere.

Sol.: Expiration is the moving of air out of lungs when the pressure within the lungs is more than the atmospheric pressure.

169. Answer (2)

Hint: Rate of breathing is higher in newborns than adults.

Sol.: Breathing rate is nearly 40 times per minute in newly born.

170. Answer (4)

Hint: Tidal volume is the air breathed in or out in a normal breath.

Sol.:

Respiratory Volumes	Values
Tidal Volume (TV)	500 mL
Inspiratory Reserve Volume (IRV)	2500-3000 mL
Expiratory Reserve Volume (ERV)	1000-1100 mL
Residual Volume (RV)	1100-1200 mL

171. Answer (2)

Hint: VC = ERV + TV + IRV.

Sol.: Total lung capacity includes residual volume, expiratory reserve volume, tidal volume and inspiratory reserve volume.

172. Answer (4)

Hint: Spirometer can only measure air being breathed in or out.

Sol.: With exception of FRC, RV and TLC, all other lung volumes and capacities can be measured with the help of a simple spirometer.

173. Answer (1)

Hint: In systemic arteries, pCO_2 is lower and pO_2 is higher.

Sol.:

Partial Pressures (in mm Hg) of Oxygen and Carbon dioxide at Different Parts Involved in Diffusion in Comparison to those in Atmosphere

Respiratory Gas	Atmospheric Air	Alveoli	Blood (Deoxygenated)	Blood (Oxygenated)	Tissues
O_2	159	104	40	95	40
CO_2	0.3	40	45	40	45

174. Answer (3)

Hint: Diffusion membrane is the respiratory membrane.

Sol.: Diffusion / respiratory / alveolar-capillary membrane is made up of three layers:

(i) Thin squamous epithelium of alveoli.

(ii) Endothelial lining of alveolar capillaries.

(iii) Between the above two layers acellular basement substance is present.

175. Answer (3)

Hint: About 7% of CO_2 is carried in dissolved state through plasma.

Sol.: About 97% of O_2 is transported by RBCs in the blood. The remaining 3% of O_2 is carried in dissolved state through plasma.

176. Answer (3)

Hint: 'S' shaped curve is obtained.

Sol.: Sigmoid curve is called the oxygen dissociation curve, is highly useful in studying the effect of factors like pCO_2, H^+ concentration, etc, on binding of O_2 with haemoglobin.

177. Answer (3)

Hint: High pCO_2 shifts oxygen dissociation curve to right.

Sol.: A rise in pCO_2 or fall in pH decreases oxygen affinity of haemoglobin, raising the P_{50} value. Conversely, a fall in pCO_2 and rise in pH increases oxygen affinity of haemoglobin.

178. Answer (1)

Hint: Central chemoreceptors are located in medulla.

Sol.: Increase in CO_2 and H^+ ions can activate the rhythm centre, which in turn can signal the rhythm centre to make necessary adjustments in the respiratory process by which these substances can be eliminated. Central chemo receptors can recognize changes in CO_2 and H^+ concentration and send necessary signals to the rhythm centre for remedial actions.

179. Answer (2)

Hint: Both centres are located within hindbrain.

Sol.: The respiratory centre is composed of a group of neurons located in the medulla oblongata. The pneumotaxic centre regulates the rate of breathing.

Respiratory rhythm centre and pneumotaxic centre are located in medulla oblongata and pons region of hindbrain respectively.

180. Answer (2)

Hint: In emphysema, lungs remain inflated as exhalation becomes difficult.

Sol.: In emphysema, alveolar sacs remain filled with air even after expiration.

❑ ❑ ❑

All India Aakash Test Series for Medical - 2021

TEST - 2 (Code-D)

Test Date : 10/11/2019

ANSWERS

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

HINTS & SOLUTIONS

[PHYSICS]

1. Answer (3)

Hint & Sol.: If $\theta_1 + \theta_2 = 90°$, the range of projectiles is same.

2. Answer (1)

Hint & Sol.: $x = 3t$, $y = 4t + 4$

$$t = \frac{x}{3}$$

$$y = \frac{4x}{3} + 4$$

3. Answer (2)

Hint: Relative motion in 2-D.

Sol.: As the ball is dropped, the horizontal velocity of ball and plane will be same. Thus relative velocity in horizontal direction would be zero and ball would appear to fall vertically downwards.

4. Answer (2)

Hint & Sol.: In uniform circular motion, the magnitude of acceleration (centripetal acceleration) is constant but its direction is variable. Thus statement (a) is wrong. For a moving body, distance can never be zero but displacement can be zero.

5. Answer (2)

Hint: $\vec{B} \parallel n\vec{B}$ if $n > 0$

Sol.: $8\vec{B}$ has magnitude 8 times the magnitude of $\vec{B}$ and has same direction as that of $\vec{B}$.

$\therefore$ Magnitude of $8\vec{B} = 8 \times 5 = 40$ unit

6. Answer (1)

Hint: Equation of trajectory of a projectile

$$y = x\tan\theta - \frac{gx^2}{2u^2}\left(1 + \tan^2\theta\right)$$

Sol.: Comparing with equation of trajectory

$b = \tan(\theta)$

$\theta = \tan^{-1}(b)$

7. Answer (3)

Hint & Sol.: Both particles have zero initial vertical velocity and therefore, would reach the ground simultaneously.

8. Answer (2)

Hint: Horizontal Range $(R) = \dfrac{u^2\sin(2\theta)}{g}$

Sol.: $20 = \dfrac{(20)^2\sin(2\theta)}{(10)}$

$200 = (400)\sin(2\theta)$

$\sin(2\theta) = \dfrac{1}{2}$

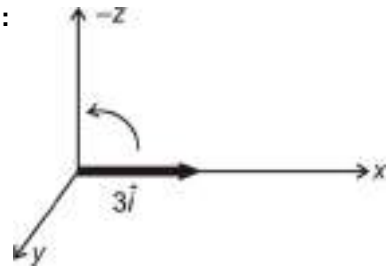
$2\theta = 30°$

$\theta = 15°$ (with the horizontal)

$\Rightarrow$ 75° (with the vertical)

9. Answer (4)

Hint & Sol.:



New vector will be along (negative z)

$= -3\hat{k}$

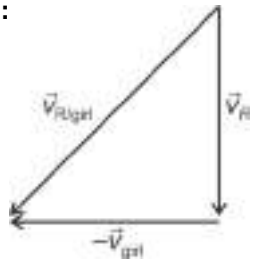
10. Answer (3)

Hint & Sol.: At maximum height, the speed is minimum and not equal to zero.

11. Answer (2)

Hint: Rain-man problem.

Sol.:



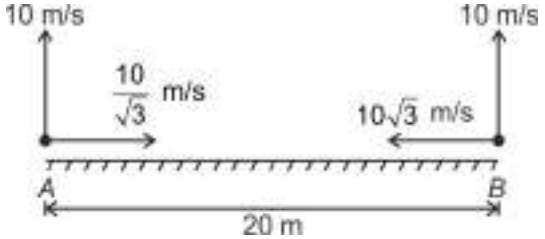
$10^2 = 6^2 + v_{girl}^2$

$v_{girl} = 8$ m/s

12. Answer (4)

Hint: Relative motion in 2-D

Sol.: Resolving:



Both particles will collide $\Rightarrow$ minimum separation = 0

13. Answer (3)

Hint: $y = x\tan\theta\left(1-\frac{x}{R}\right)$

Sol.: $y = x\tan\theta\left(1-\frac{x}{R}\right)$

$m = \frac{dy}{dx} = \tan(\theta) - \frac{2x\tan(\theta)}{R}$

$\frac{dm}{dt} = 0 - \frac{2\tan(\theta)}{R}\frac{dx}{dt} = -\frac{2u_x\tan(\theta)}{R}$

$\therefore \ \frac{dm}{dt} = a$ negative constant

14. Answer (4)

Hint: $\vec{r} = u\cos(\theta)t\,\hat{i} + \left(u\sin(\theta)t - \frac{1}{2}gt^2\right)\hat{j}$

Sol.: $u\cos\theta = 20\cos(30) = 10\sqrt{3}$ m/s

$\vec{r} = 10\sqrt{3}x(10)\hat{i} + \left(10\times10 - \frac{1}{2}\times(10)(10)^2\right)\hat{j}$

$= 100\sqrt{3}\hat{i} + (-400)\hat{j}$

$|\vec{r}| = \sqrt{\left(100\sqrt{3}\right)^2 + (400)^2}$

$\sqrt{30000+160000} = 100\sqrt{19}$ m

15. Answer (2)

Hint: Horizontal component of velocity remains constant in projectile motion, i.e. $u\cos\theta = v\cos\alpha$

Sol.: 30cos60° = $v$cos45°

$v = 15\sqrt{2}$ m/s

16. Answer (4)

Hint: $a = v^2/R$

Sol.: $|\Delta\vec{a}| = \sqrt{2}\frac{v^2}{R}$

17. Answer (1)

Hint: $|\overrightarrow{OA},\overrightarrow{OB},\overrightarrow{OC},\overrightarrow{OD},\overrightarrow{OE}$ and $\overrightarrow{OF}|$ all are unit vectors.

Sol.: $|\overrightarrow{OA}+\overrightarrow{OB}+\overrightarrow{OC}+\overrightarrow{OD}+\overrightarrow{OE}+\overrightarrow{OF}|$

$= |(\overrightarrow{OA}+\overrightarrow{OD})+(\overrightarrow{OB}+\overrightarrow{OE})+\overrightarrow{OC}|$

$= |\vec{0}+\vec{0}+\overrightarrow{OC}|$

$= |\overrightarrow{OC}| = 1$ m

18. Answer (3)

Hint: Speed at top most point $u\cos(\theta)$

Sol.: $\frac{1}{4}\left(\frac{1}{2}mu^2\right) = \frac{1}{2}m\left(u\cos(\theta)\right)^2$

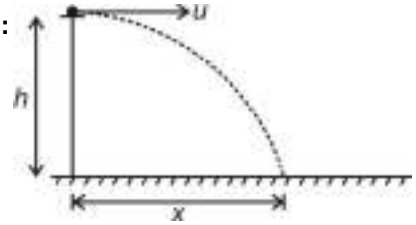
$\cos(\theta) = \frac{1}{2}$

$\theta = 60°$

19. Answer (2)

Hint: Horizontal projection of projectile

Sol.:



Time of flight $= T = \sqrt{\frac{2h}{g}}$

$x = uT = u\sqrt{\frac{2h}{g}}$

$\Rightarrow u = x\sqrt{\frac{g}{2h}}$

20. Answer (3)

Hint & Sol.: From triangle law of vector addition, $\vec{a}+\vec{b} = \vec{c}$

21. Answer (4)

Hint: $\vec{v} = \frac{d\vec{r}}{dt}$; $\vec{a} = \frac{d\vec{v}}{dt}$

Sol.: $\vec{r} = \cos(3t)\hat{i} + \sin(3t)\hat{j}$

$\vec{v} = \frac{d\vec{r}}{dt} = 3\sin(3t)\hat{t} + 3\cos(3t)\hat{j}$

$\vec{a} = \frac{d\vec{v}}{dt} = -9\cos(3t)\hat{i} - 9\sin(3t)\hat{j} = -9\vec{r}$

$\therefore$ acceleration is antiparallel $\vec{r}$

22. Answer (4)

Hint & Sol.: The angle is 90° for uniform circular motion only. For circular motions with increasing and decreasing speeds, the angle is acute and obtuse respectively.

23. Answer (4)

Hint & Sol.: A particle under action of constant force follows either a rectilinear path or a parabolic path.

24. Answer (1)

Hint: $\vec{v}_{B/E} = \vec{v}_B - \vec{v}_E$

Sol.: $\vec{v}_{B/E} = 10\hat{i} - 20\hat{j}$

$|\vec{v}_{B/E}| = \sqrt{(10)^2 + (20)^2} = 10\sqrt{5}$ m/s

25. Answer (1)

Hint: $\vec{a} = \frac{d^2\vec{r}}{dt^2}$

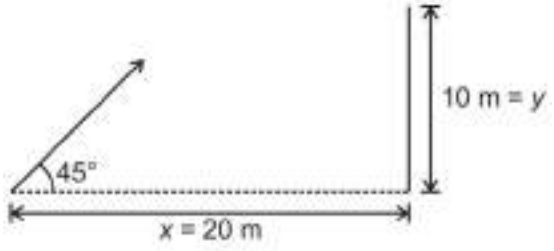
Sol.: $\vec{v} = \frac{d\vec{r}}{dt} = \left(10t\hat{i} + 3\hat{j}\right)$ m/s

$\vec{a} = \frac{d\vec{v}}{dt} = \left(10\hat{i}\right)$ m/s^2

26. Answer (2)

Hint: Equation of trajectory of a projectile.

Sol.:



$y = x\tan\theta - \frac{1}{2}g\frac{x^2}{u^2}\left(1+\tan^2\theta\right)$

$\theta = 45° \Rightarrow \tan(\theta) = 1$

y = 10 m

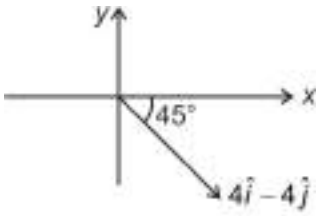
x = 20 m

$\Rightarrow u = 20$ m/s

27. Answer (3)

Hint: $(\vec{A}+\vec{B})$ is in fourth quadrant.

Sol.: $\vec{A}+\vec{B} = (4\hat{i}-2\hat{j}+6\hat{k})+(-2\hat{j}-6\hat{k}) = 4\hat{i}-4\hat{j}$



$\Rightarrow$ Angle with y-axis = 135°

28. Answer (4)

Hint: $\vec{v}_{(\text{rain/man})} = \vec{v}_{(\text{rain})} - \vec{v}_{(\text{man})}$

Sol.: As man starts walking with 6 m/s.

Let velocity of rain = $v(-\hat{j})$

Velocity of man = $6\hat{i}$ m/s

$\vec{v}_{(\text{rain/man})} = v(-\hat{j}) - 6\hat{i}$

For this to be at angle 45°

v = 6 m/s

29. Answer (4)

Hint: Time of flight = $t_1 + t_2$

Sol.: Time of flight = 3 + 5 = 8 s

$\frac{2u\sin(\theta)}{g} = 8$

$\frac{2\times u\times\sin(30°)}{10} = 8$

u = 80 m/s

30. Answer (1)

Hint & Sol.: Instantaneous speed is magnitude of instantaneous velocity.

31. Answer (3)

Hint: The relative velocity of *A* must be directed towards *B* from *A*.

Sol.: $\vec{r}_A + \vec{v}_A t = \vec{r}_B + \vec{v}_B t$

$\Rightarrow \left(\vec{v}_A - \vec{v}_B\right)t = \vec{r}_B - \vec{v}_A$

$\Rightarrow$ Therefore $\vec{v}_{AB} = \vec{r}_{BA}$

32. Answer (1)

Hint & Sol.: As, for freely falling bodies, relative acceleration is zero, the monkey will get hit by the bullet.

33. Answer (1)

Hint: 2-D motion under uniform acceleration.

Sol.: $\vec{v} = \vec{u} + \vec{a}t$

$\vec{v} = (3i+8j) + \left(2i+2\hat{j}\right)t$

at t = 3 s

$\vec{v} = \left(9\hat{i}+14\hat{j}\right)$ m/s

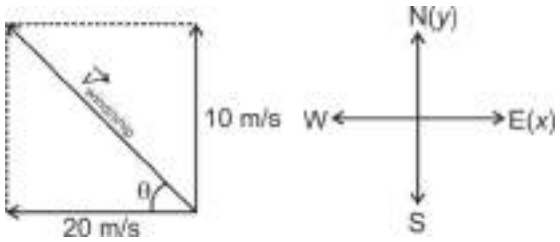
34. Answer (4)

Hint: Flag flutters in the direction of velocity of wind with respect to the ship.

Sol.: $\vec{v}_{\text{ship}} = 20\hat{i}$ m/s

$\vec{v}_{\text{wind}} = 10\,\hat{j}$ m/s

$\vec{v}_{\text{wind/ship}} = \left(10\hat{j}-20\hat{i}\right)$ m/s



$\tan\theta = \frac{10}{20}$

$\theta = \tan^{-1}\left(\frac{1}{2}\right)$, north of west

35. Answer (2)

Hint: $a_c = \frac{v^2}{R}$

Sol.: From graph, $a_c = \tan(37°)t$

$a_c = \frac{3}{4}t$

$\frac{v^2}{R} = \frac{3}{4}t$

$\Rightarrow v = \sqrt{\frac{3}{4}Rt} = \sqrt{\frac{3}{4}\times 12\times 1} = 3$ m/s

36. Answer (4)

Hint: $v^2 = u^2 + 2a_t s$

Sol.: $v^2 = 2\ a_t s$

$v^2 = 2 \times 2 \times 4$

$= 4$ m/s

37. Answer (1)

Hint: Relative acceleration between free falling particles is zero.

Sol.: Since relative acceleration = 0

$\therefore$ relative velocity = 5 + 3 = 8 m/s is constant.

Separation = relative velocity × time

$= 8 \times 4 = 32$ m

38. Answer (2)

Hint: Use concept of velocity of approach.

Sol.: Velocity along line *OP* = 10 cos60° = 5 m/s.

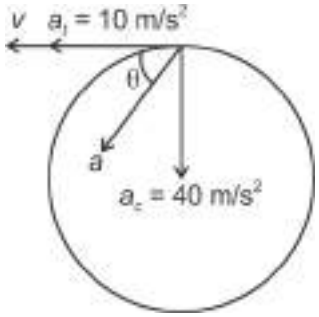
$$\text{Time taken} = \frac{20}{5} = 4 \text{ s}$$

39. Answer (1)

Hint: Velocity in circular motion is tangential. Thus, angle between acceleration and tangential direction would be angle between acceleration and velocity.

Sol.: $a_c = \frac{v^2}{R} = \frac{20^2}{10} = \frac{400}{10} = 40 \text{ m/s}^2$

$a_t = \frac{d|\vec{v}|}{dt} = 10 \text{ m/s}^2$ given



$$\tan(\theta) = \frac{a_c}{a_t} = \frac{40}{10} = 4$$

$\theta = \tan^{-1}(4)$

40. Answer (1)

Hint: In uniform circular motion, speed $(|\vec{v}|)$ is constant, but velocity $(\vec{v})$ is variable due to change in its direction.

Sol.: Speed is constant $\therefore \frac{d|\vec{v}|}{dt} = 0$

Velocity is variable $\therefore \frac{dv}{dt} \neq 0$

Acceleration vector is also variable $\therefore \frac{d^2\vec{v}}{dt^2} \neq 0$

41. Answer (1)

Hint & Sol.: Greater the vertical component of velocity of projection greater would be the time of flight and the maximum height.

42. Answer (1)

Hint: River-swimmer problem with minimum time of crossing.

Sol.: $T_{\min} = \frac{d}{v_{m/R}} = \frac{200}{10} = 20$ s

43. Answer (4)

Hint: Use vector addition.

Sol.: $\vec{P} = 3\hat{i} + 4\hat{j}$

$\vec{P} + \vec{Q} = 8\hat{i} + 7\hat{j}$

$\vec{Q} = 8\hat{i} + 7\hat{j} - \vec{P} = 8\hat{i} + 7\hat{j} - 3\hat{i} - 4\hat{j} = 5\hat{i} + 3\hat{j}$

$|\vec{Q}| = \sqrt{25 + 9} = \sqrt{34}$

44. Answer (2)

Hint: Uniformly accelerated motion in two dimensions.

Sol.: Time of flight (T) $= \sqrt{\frac{2h}{g}} = \sqrt{\frac{2 \times 20}{g}} = 2$ s

Horizontal Displacement $= \frac{1}{2}at^2$

$= \frac{1}{2} \times 10 \times 4 = 20$ m

Displacement $= (20^2 + 20^2)^{1/2} = (2 \times 20^2)^{1/2}$

$= 20\sqrt{2}$ m

45. Answer (1)

Hint: $v_x = u_x, v_y = -gt$

Sol.: At any time *t*, the horizontal and vertical components of velocity can be written as

$v_x = 10$ m/s and $v_y = -gt = -10t$

if velocity is directed at angle 45° with the horizontal, then

$|v_x| = |v_y|$

$10 = 10t \quad \Rightarrow t = 1$ s

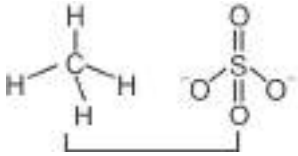
[CHEMISTRY]

46. Answer (3)

Hint: A metal ion having pseudo inert gas like configuration i.e. having complete *d* subshell is found to have greater covalent character.

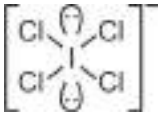
Sol.: AgCl has the highest degree of covalent character.

47. Answer (4)

Hint: 

Both are sp^3 hybridized.

48. Answer (3)

Hint:  has 2 l.p. on central atom.

Sol.: Xe in XeF_6 has 1 lone pair

S in SO_3 has 0 lone pair

P in PO_4^{3-} has 0 lone pair

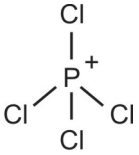
49. Answer (2)

Hint: NO_2^+ has linear geometry.

Sol.:

Molecule/ion	Bond angle
NO_2^+	180°
NO_2	134°
NO_2^-	115°

50. Answer (2)

Hint: 

P is sp^3 hybridized and it acquires tetrahedral shape.

51. Answer (1)

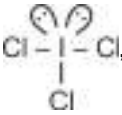
Hint: F.C. = total number of valence electrons – total number of nonbonding electrons $-\frac{1}{2}$ (total number of bonding electrons)

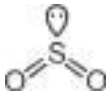
Sol.: F.C. on central oxygen atom of O_3

$= 6 - 2 - \frac{1}{2}(6)$

$= +1$

52. Answer (3)

Hint: In  , there is no π bond.

Sol.:  has 2π bonds

O = C = O has 2π bonds

N ≡ N has 2π bonds

53. Answer (2)

Hint: C – N bond in CN^- ion is polar.

While N – N bond in N_2 is non polar.

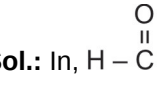
54. Answer (3)

Hint:

Bond type	Bond length (pm)
C – H	107
C – C	154
C – N	143

55. Answer (4)

Hint: In H – C ≡ N there are 2σ and 2π bonds.

Sol.: In,  4σ, 1π bonds

In,  4σ, 2π bonds

In, O = N – N = O 3σ, 2π bonds

56. Answer (2)

Hint: $O^{\delta-} - H^{\delta+} \cdots F^-$ will be strongest.

Sol.: Strength of H-bond follows the order

F ··· H > O ··· H > N ··· H

57. Answer (3)

Hint: On increasing bond order, bond length decreases.

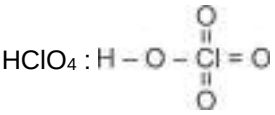
Sol.: B.O. in CO = 3

B.O. in CO_2 = 2

B.O. in CO_3^{2-} ion $= \frac{4}{3} = 1.33$

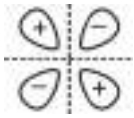
∴ Longest C – O bond length will be found in CO_3^{2-} ion.

58. Answer (3)

Hint: $HClO_4$: 

There are three Cl = O bonds in $HClO_4$.

59. Answer (2)

Hint:  represents π-antibonding molecular orbital.

60. Answer (3)

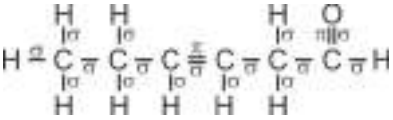
Hint: NO is paramagnetic while NO^+ is diamagnetic

Sol.: Bond order in NO = 2.5

Bond order in NO^+ = 3

61. Answer (4)

Hint: Double bond has 1σ and 1π bond.

Sol.: 

Number of σ bonds = 16

Number of π bonds = 2

62. Answer (4)

Hint: CO_2 is linear, $HgCl_2$ is also linear. On the other hand SO_2, NO_2, I_3^+ are bent.

63. Answer (3)

Hint: In KO_2, O_2^- ion is present which is paramagnetic.

Sol.: BaO_2 has O_2^{2-} ion which is diamagnetic.

AlO_2^- has O^{2-} ion which is diamagnetic. NO_2^+ ion has all the electrons paired, hence it is also diamagnetic

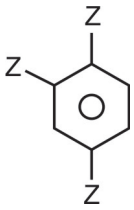
64. Answer (2)

Hint: If in a molecule or ion, bond order is 0, then, the molecule or ion will not exist.

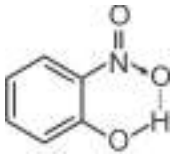
Sol.: B.O. in $He_2 = \frac{2-2}{2} = 0$

65. Answer (3)

Hint: Dipole moment of  molecule is zero.

Sol.:  dipole moment = x D

66. Answer (1)

Hint: 

Intramolecular H-bonding

67. Answer (4)

Hint: $N_2\left(14e^-\right) = \sigma 1s^2, \sigma * 1s^2, \sigma 2s^2, \sigma * 2s^2$

$\begin{cases} \pi 2p_x^{\,2} \\ \pi 2p_y^{\,2}, \sigma 2p_z^{\,2} \end{cases}$

Sol.: Bond order of N_2 molecule $= \frac{10-4}{2} = 3$

Bond order of N_2^+ ion $= \frac{9-4}{2} = 2.5$

Bond order of N_2^- ion $= \frac{10-5}{2} = 2.5$

68. Answer (1)

Hint: In trigonal bipyramidal molecule two axial bonds are longer than three equatorial bonds.

Sol.: In ammonia all three N – H bond lengths are equal.

69. Answer (3)

Hint: With increase of charge on anion, polarisability will increase.

Sol.: $C^{4-} > N^{3-} > O^{2-} > F^-$: Polarizability.

70. Answer (4)

Hint: Hybridisation of S in SF_4 is sp^3d.

Sol.: 

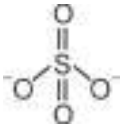
see-saw shape

71. Answer (2)

Hint: Bond order in SO_4^{2-} ion

$= \frac{\text{number of } \sigma \text{ bonds} + \pi \text{ bonds}}{\text{number of } \sigma \text{ bonds}}$

Sol.: Bond order of S – O in SO_4^{2-} ion $= \frac{6}{4} = 1.5$



72. Answer (1)

Hint: Molecule having an unpaired electron is called an odd electron species.

Sol.: NO_2 has one unpaired electron so, it is an odd electron species. In CO_2, SO_2 and CO molecules, all the electrons are paired.

73. Answer (2)

Hint: MO configuration of C_2 is

$$\sigma 1s^2 \sigma^* 1s^2 \sigma 2s^2 \sigma^* 2s^2 \begin{cases} \pi 2p_x^2 \\ \pi 2p_y^2 \end{cases}$$

Sol.: C_2 has two π bonds only.

74. Answer (3)

Hint: Br has 7 electrons in outermost shell.

Sol.:  has 3 bp + 2 lp.

75. Answer (4)

Hint: $K^+ O^- - H$, $Ba^{2+} O^- - \overset{\overset{O}{\|}}{\underset{\underset{O}{\|}}{S}} - O^-$, $Na^+ \bar{C} \equiv N$.

In all the above structures both ionic and covalent bonds are present.

76. Answer (3)

Hint: In PCl_5, there are 10 electrons around P atom, So, it is an example of expanded octet.

77. Answer (4)

Hint: *sp* hybridized central atom acquires linear structure

Sol.: $O = \overset{+}{N} = O$ is linear.

78. Answer (1)

Hint: $CH_3 - CH = \underset{sp}{C} = \underset{sp^2}{C}H - CH_2 - OCH_3$

79. Answer (2)

Hint: Dipole moment is a vector quantity.

Sol.: 

80. Answer (3)

Hint: Chemical species having unpaired electron(s) are called paramagnetic while species having all the electrons paired are called diamagnetic.

Sol.: O_2, O_2^+ & O_2^- have unpaired electrons hence, paramagnetic but O_2^{2-} has all electrons paired. Therefore, it is diamagnetic.

81. Answer (2)

Hint: Hybridisation depends upon the value of n. n = number of bond pair + number of lone pair.

Sol.: NH_3; n = 3bp + 1 lp = 4 $\therefore$ sp^3 hybridisation

SO_3; n = 3bp + 0 lp = 3 $\therefore$ sp^2 hybridisation

CO_2; n = 2bp + 0 lp = 2 $\therefore$ *sp* hybridisation

82. Answer (2)

Hint: H atom bonded with F, O and N generally gets involved in H-bonding.

83. Answer (3)

Hint: Bond order $= \frac{1}{2}(N_b - N_a)$

Where N_b = Number of electrons in bonding orbitals and N_a = Number of electrons in antibonding orbitals.

Sol.: NO^+ and CO both have 14 electrons each hence will have the same bond order i.e. 3.

84. Answer (2)

Hint: AB_2 type molecules with no lone pair of electrons on central atom are linear.

Sol.: H_2O, SO_2 are bent, SO_3 is trigonal planar. Be in BeF_2 is *sp* hybridised with no lone pair, hence, linear.

85. Answer (3)

Hint: Transition metals have incomplete *d*-subshell either in neutral atom or in their ions.

Sol.: $(n-1)d^5ns^2$ is a typical transition element while ns^1 is an *s*-block (group 1) element $(n-1)d^{10}ns^2np^5$ and ns^2np^5 are *p*-block (group 17) elements.

86. Answer (3)

Hint: Ionisation energy increases with increase in effective nuclear charge

Sol.: [Ne]$3s^1$ = Na

[Ne]$3s^2$ = Mg

[Ne]$3s^23p^1$ = Al

[Ar]$4s^2$ = Ca

Order of $(IE)_1$

Mg > Ca > Al > Na

87. Answer (2)

Hint: Fully filled and half filled subshells are found to be extraordinarily stable.

Sol.: Be ····· $2s^2$ fully filled

N ····· $2p^3$ half filled

Above electronic configurations are associated with extra stability. Hence, their electron gain enthalpies are positive.

88. Answer (1)

Hint: Al^{3+} has 10 electrons

Sol.: Both Al^{3+} ion and O^{2-} ion have 10 electrons each, hence, these are isoelectronic.

89. Answer (4)

Hint: F has lower negative electron gain enthalpy than Cl.

Sol.:

	$\Delta_{eg}H$ (kJ mol^{-1})
F	–328
Cl	–349
S	–200
O	–141

90. Answer (3)

Hint: Anions are larger than cations, in case of isoelectronic species

Sol.: Size decreases with increase in effective nuclear charge.

The correct order of ionic radii is

So, $P^{3-} > S^{2-} > Cl^- > K^+$

[BIOLOGY]

91. Answer (3)

Hint: The fungus which is used extensively in biochemical and genetic work belongs to Ascomycetes

Sol.: *Neurospora* is used extensively in biochemical and genetic work. They produce asexual spores exogenously and ascospores endogenously.

92. Answer (4)

Hint: Early blight of potato is caused by *Alternaria* and late blight of potato is caused by *Phytophthora.*

Sol.: *Alternaria* is the member of Deuteromycetes and *Phytophthora* is the member of phycomycetes.

93. Answer (1)

Hint: Deuteromycetes are commonly known as imperfect fungi.

Sol.: *Alternaria, Colletotrichum* and *Trichoderma* are the members of Deuteromycetes.

94. Answer (2)

Hint: *Agaricus* is a member of Basidiomycetes.

Sol.: In *Agarcius*, the dikaryotic structure ultimately gives rise to basidium in which karyogamy and meiosis take place.

95. Answer (2)

Hint: The given figure is of *Aspergillus.*

Sol.: *Aspergillus* belong to the class Ascomycetes (sac-fungi). It produces conidia exogenously.

96. Answer (4)

Hint: In wheat, rust is caused by *Puccinia* and smut is caused by *Ustilago.*

Sol.: Both *Puccinia* and *Ustilago* are the members of Basidiomycetes.

97. Answer (1)

Sol.: Venus flytrap is partially heterotrophic plant.

98. Answer (4)

Hint: Zoospores are formed in the members of Phycomycetes.

Sol.: In Phycomycetes, the mycelia are aseptate and coenocytic. Their spores are produced endogenously. They also reproduce sexually.

99. Answer (3)

Hint: Chlamydospores are formed under unfavourable conditions.

Sol.: Chlamydospores are thick walled resting resistant spores.

100. Answer (1)

Hint: Spores of slime moulds are extremely resistant and survive for many years.

Sol.: During unfavourable conditions entire plasmodium forms sporocarp which contains a stalk having a sporangium at its tip. In sporangia spores are produced. Spores have cell wall

101. Answer (2)

Hint: *Paramoecium* is a ciliated protozoan.

Sol.: *Trypanosoma* is a flagellated protozoan. Marine forms of amoeboid protozoans have silica shells on their surface. *Plasmodium* causes malaria.

102. Answer (2)

Hint: Cilia and cell wall are not found in euglenoids.

Sol.: Euglenoids have a covering of pellicle which is proteinaceous. This covering provides flexibility to the organisms.

103. Answer (3)

Hint: Viruses cannot synthesise proteins by self.

Sol.: No virus contains both RNA and DNA. They have either RNA or DNA.

104. Answer (3)

Hint: M.W. Beijerinck used the extract of the infected plants of tobacco to which he called '*Contagium vivum fluidum*'.

Sol.: The extract of infected tobacco plant contained tobacco mosaic virus (TMV).

105. Answer (2)

Hint: Diatoms are the chief producers in the ocean.

Sol.: Walls in diatoms are embedded with silica. Large amount of their cell wall deposits in their habitat forms diatomaceous earth over billion of years.

106. Answer (1)

Sol.: In diatoms the cell wall has two thin overlapping shells which fit together like a soap box.

107. Answer (4)

Hint: Protista reproduce sexually by a process involving cell fusion and zygote formation.

Sol.: Crysophytes are mostly photosynthetic. All the major groups of protozoans have parasitic individuals.

108. Answer (1)

Hint: Kingdom Protista has only unicellular eukaryotic organisms.

Sol.: Boundaries of Kingdom Protista are not well defined. They have the features of fungi, plants and animals.

109. Answer (3)

Hint: *Mycoplasma* lack cell wall.

Sol.: *Mycoplasma* infects both animals and plants and have both RNA and DNA.

110. Answer (1)

Hint: Viroids are infectious RNA particles which are devoid of protein coat.

Sol.: Both viruses and viroids are obligate parasites. Both of them cause disease in plants.

111. Answer (4)

Hint: Bacteria play a great role in recycling of nutrients like nitrogen, phosphorous, iron and sulphur.

Sol.: Mumps is a viral disease and viruses do not play a role in recycling of nutrients.

112. Answer (2)

Hint: Chemosynthetic autotrophic bacteria do not utilise light as energy source.

Sol.: Chemosynthetic autotrophic bacteria obtain energy for the synthesis of food by oxidising ceratin inorganic substances.

113. Answer (1)

Hint: Diatoms are photosynthetic protists and are called Chrysophytes.

Sol.: Diatoms are found in fresh water as well as in marine water. They float passively in water current. Their silica embedded cell wall forms diatomaceous earth.

114. Answer (2)

Hint: The bacteria exhibit a primitive form of sexual reproduction.

Sol.: In bacteria, there is no gamete formation and fusion. Exchange of genetic material, i.e., genetic recombination occurs by transformation, conjugation and transduction methods.

115. Answer (3)

Sol.: Heterotrophic bacteria are most abundant in nature. The majority are important decomposers.

116. Answer (3)

Hint: Potato spindle tuber disease is caused by a viroid.

Sol.: Viroids are infectious RNA particles which were discovered by T.O. Diener.

117. Answer (4)

Hint: Heterocysts contain nitrogenase enzyme.

Sol.: Heterocysts lack PS II activities and CO_2 fixation is done only by vegetative cells. PS I in heterocyst generates ATP required to fix nitrogen.

118. Answer (1)

Hint: Cyanobacteria are blue-green algae.

Sol.: Cyanobacteria are photosynthetic prokaryotes. They are mainly fresh-water forms, though few are marine.

119. Answer (2)

Hint: Phycobiont is algal partner in lichen.

Sol.: Algal partner in lichens picks up water and mineral salts from the fungus and prepare food by the process of photosynthesis.

120. Answer (4)

Hint: Methanogens produce methane from the dung of ruminants.

Sol.: Methanogens are Archaebacteria. They have a different cell wall structure than other bacteria.

121. Answer (1)

Hint: Vibrium is comma-shaped.

Sol.: Coccus - Spherical
Bacillus - Rod-shaped
Spirillum - Spiral

122. Answer (2)

Hint: Sole members of kingdom Monera are bacteria.

Sol.: Bacteria are structurally simple but very complex in behaviour.

123. Answer (3)

Hint: Both algae and fungi are eukaryotic.

Sol.: Algae are photosynthetic and fungi are non-photosynthetic.

124. Answer (4)

Hint: Bovine spongiform encephalopathy is caused by a prion.

Sol.: Prions are abnormally folded infectious protein particles. They lack nucleic acid.

125. Answer (3)

Hint: Cellulosic cell wall is found in plants.

Sol.: Cell wall in monerans (except Archaebacteria and *Mycoplasma*) is made up of peptidoglycan and cell wall in fungi is made up of chitin.

126. Answer (2)

Hint: Kingdom Protista includes only unicellular eukaryotic organisms.

Sol.: *Spirogyra* - Kingdom Plantae

Nostoc, Anabaena, Mycoplasma - Kingdom Monera

Amoeba, Chlamydomonas, Paramoecium, Chlorella, Euglena, Gonyaulax - Kingdom Protista

127. Answer (4)

Hint: Lichens cannot tolerate air pollution.

Sol.: Lichens can grow in most inhospitable and uninhabited place but cannot tolerate air pollution especially due to SO_2, therefore these are considered as pollution indicators.

128. Answer (1)

Hint: Three-domain system divides the kingdom Monera into two domains.

Sol.: Three domains are Bacteria, Archaea and Eukarya. All the eukaryotes are grouped in Eukarya.

129. Answer (4)

Hint: Some members in Protista and Monera are autotrophs.

Sol.: All the members of Fungi and Animalia are heterotrophic.

130. Answer (1)

Hint: Linnaeus proposed 'two kingdom system' of classification.

Sol.: Kingdom Plantae and Kingdom Animalia were the two kingdoms proposed by Linnaeus.

131. Answer (2)

Hint: ICBN - International Code of Botanical Nomenclature

Sol.: The set of rules and recommendations dealing with the formal names of plants is given in ICBN. Plant cells have cellulosic cell wall.

132. Answer (1)

Hint: Wheat and mango, both are angiosperms.

Sol.: Mango belongs to the class Dicotyledonae and wheat belongs to the class Monocotyledonae. Both belong to the division Angiospermae.

133. Answer (3)

Hint: Herbaria and botanical gardens are concerned with plants only.

Sol.: Museum is a place used for storing, preservation and exhibition of both plants and animals. Catalogue includes the alphabetical arrangement of species of a particular place describing their feature.

134. Answer (3)

Hint: First word in the biological name of an organism is generic name.

Sol.: Author citation is written after the specific epithet of the organism.

135. Answer (3)

Hint: Metabolic reactions that occur *in vitro* are living reactions.

Sol.: Metabolism is defining feature of all living organisms because non living objects do not show metabolism.

136. Answer (2)

Hint: In emphysema, lungs remain inflated as exhalation becomes difficult.

Sol.: In emphysema, alveolar sacs remain filled with air even after expiration.

137. Answer (2)

Hint: Both centres are located within hindbrain.

Sol.: The respiratory centre is composed of a group of neurons located in the medulla oblongata. The pneumotaxic centre regulates the rate of breathing.

Respiratory rhythm centre and pneumotaxic centre are located in medulla oblongata and pons region of hindbrain respectively.

138. Answer (1)

Hint: Central chemoreceptors are located in medulla.

Sol.: Increase in CO_2 and H^+ ions can activate the rhythm centre, which in turn can signal the rhythm centre to make necessary adjustments in the respiratory process by which these substances can be eliminated. Central chemo receptors can recognize changes in CO_2 and H^+ concentration and send necessary signals to the rhythm centre for remedial actions.

139. Answer (3)

Hint: High pCO_2 shifts oxygen dissociation curve to right.

Sol.: A rise in pCO_2 or fall in pH decreases oxygen affinity of haemoglobin, raising the P_{50} value. Conversely, a fall in pCO_2 and rise in pH increases oxygen affinity of haemoglobin.

140. Answer (3)

Hint: 'S' shaped curve is obtained.

Sol.: Sigmoid curve is called the oxygen dissociation curve, is highly useful in studying the effect of factors like pCO_2, H^+ concentration, etc, on binding of O_2 with haemoglobin.

141. Answer (3)

Hint: About 7% of CO_2 is carried in dissolved state through plasma.

Sol.: About 97% of O_2 is transported by RBCs in the blood. The remaining 3% of O_2 is carried in dissolved state through plasma.

142. Answer (3)

Hint: Diffusion membrane is the respiratory membrane.

Sol.: Diffusion / respiratory / alveolar-capillary membrane is made up of three layers:

(i) Thin squamous epithelium of alveoli.

(ii) Endothelial lining of alveolar capillaries.

(iii) Between the above two layers acellular basement substance is present.

143. Answer (1)

Hint: In systemic arteries, pCO_2 is lower and pO_2 is higher.

Sol.:

Partial Pressures (in mm Hg) of Oxygen and Carbon dioxide at Different Parts Involved in Diffusion in Comparison to those in Atmosphere

Respiratory Gas	Atmospheric Air	Alveoli	Blood (Deoxygenated)	Blood (Oxygenated)	Tissues
O_2	159	104	40	95	40
CO_2	0.3	40	45	40	45

144. Answer (4)

Hint: Spirometer can only measure air being breathed in or out.

Sol.: With exception of FRC, RV and TLC, all other lung volumes and capacities can be measured with the help of a simple spirometer.

145. Answer (2)

Hint: VC = ERV + TV + IRV.

Sol.: Total lung capacity includes residual volume, expiratory reserve volume, tidal volume and inspiratory reserve volume.

146. Answer (4)

Hint: Tidal volume is the air breathed in or out in a normal breath.

Sol.:

Respiratory Volumes	Values
Tidal Volume (TV)	500 mL
Inspiratory Reserve Volume (IRV)	2500-3000 mL
Expiratory Reserve Volume (ERV)	1000-1100 mL
Residual Volume (RV)	1100-1200 mL

147. Answer (2)

Hint: Rate of breathing is higher in newborns than adults.

Sol.: Breathing rate is nearly 40 times per minute in newly born.

148. Answer (3)

Hint: Expulsion of air from lungs to atmosphere.

Sol.: Expiration is the moving of air out of lungs when the pressure within the lungs is more than the atmospheric pressure.

149. Answer (4)

Hint: Forced exhalation is an active process.

Sol.: Forceful exhalation is due to contraction of internal intercostals and abdominal muscles.

150. Answer (1)

Hint: Reflex related to stretch receptors.

Sol.: In the walls of bronchi and bronchioles, stretch receptors are located and are stimulated by overstretching of lungs. Nerve impulses are sent along the vagus nerve to inhibit the inspiratory area. This results in cessation of inhalation and start of exhalation. Therefore, it is mainly a protective mechanism for preventing excessive inflation of lungs.

151. Answer (4)

Hint: Bronchioles of conducting part have cartilaginous rings.

Sol.: The trachea, primary, secondary and tertiary bronchi and initial bronchioles are supported by incomplete cartilaginous rings.

152. Answer (2)

Hint: Spinal cord is dorsal in humans.

Sol.: The thoracic chamber is formed dorsally by the vertebral column, ventrally by the sternum, laterally by the ribs and on the lower side by dome-shaped diaphragm.

153. Answer (2)

Hint: Largest class in the animal kingdom.

Sol.: Lower invertebrates like sponges, coelenterates, flatworms, etc, exchange O_2 with CO_2 by simple diffusion over their entire body surface.

154. Answer (4)

Hint: Residual volume remains same in lungs even after a forceful exhalation.

Sol.: Expiratory capacity is a sum of tidal volume and expiratory reserve volume.

EC = TV + ERV

= 500 + 1000

= 1500 ml.

155. Answer (3)

Hint: Wheezing occurs due to constriction of bronchioles.

Sol.: Asthma occurs due to allergic reaction to foreign substances that affect the respiratory tract.

156. Answer (1)

Hint: Source and target organ of this hormone is stomach.

Sol.: Secretin promotes release of bicarbonates in the pancreatic juice. It increases secretion of bile and decreases gastric secretion and motility.

Somatostatin suppresses the release of hormones from digestive tract.

157. Answer (1)

Hint: Action of amylase

Sol.: Salivary amylase acts optimally at pH 6.8.

158. Answer (4)

Hint: Present in beverages like wine.

Sol.: Absorption of water, simple sugars and alcohol takes place in stomach. No significant digestive activity occurs in the large intestine.

159. Answer (4)

Hint: Identify water insoluble substances.

Sol.: Fatty acids and glycerol are first incorporated into small droplets called micelles which move into the intestinal mucosa. They are rearranged into very small protein coated fat globules called the chylomicrons which are transported into lacteals in villi. Lacteals ultimately release the absorbed substances into the blood stream.

160. Answer (4)

Hint: Structure that has maximum surface area.

Sol.: In small intestine, the cells forming the villi produce numerous microscopic projections called microvilli which give a brush border appearance. These modifications increase the surface area enormously.

161. Answer (4)

Hint: Structure related to tonsils.

Sol.: Lymphoid tissue of pharynx is called tonsil. Tonsils are arranged in a ring like-manner called - Waldeyer's ring.

162. Answer (4)

Hint: Cells which are wine glass shaped in structure.

Sol.: Parietal cells secrete HCl and goblet cells secrete mucus.

163. Answer (1)

Hint: Structure into which the buccal cavity opens.

Sol.: A cartilaginous flap called epiglottis prevents the entry of food into the glottis *i.e.* opening of the wind pipe, during swallowing.

164. Answer (3)

Hint: Dentition that has well-developed roots.

Sol.: When a set of temporary milk teeth are replaced by a set of permanent teeth, the type of dentition is called diphyodont.

165. Answer (1)

Hint: Frenulum means a small fold.

Sol.: Tongue is a voluntary muscular and glandular structure which occupies the floor of the mouth. It is attached to the floor of the mouth by a fold called the lingual frenulum.

166. Answer (4)

Hint: Assimilation occurs after digestion and absorption.

Sol.: Although absorption in human digestive system occurs chiefly in small intestine, some amount of absorption also occurs in the stomach.

167. Answer (2)

Hint: Largest gland of the body.

Sol.: Hepatic lobule is the structural and functional unit of liver. Glisson's capsule is a mammalian feature.

168. Answer (2)

Hint: Lymph turns white upon absorption of lipids.

Sol.: B-Lacteals, A-Villi,
C-Artery, D-Vein

169. Answer (2)

Hint: Enzyme secreted by accessory digestive gland.

Sol.: Carbohydrates in the chyme are hydrolysed by pancreatic amylase into disaccharides.

170 Answer (4)

Hint: Ileum is the last part of the small intestine.

Sol.: Ileo-caecal valve prevents the backward flow of the faecal matter. The faecal matter is temporarily stored in the rectum till defecation. Sphincter of Boyden controls opening of common bile duct into hepatopancreatic duct.

171. Answer (1)

Hint: Structure that has a cystic duct.

Sol.: Gall bladder stores bile composed of bile pigments, bile salts, cholesterol and phospholipids but no enzymes.

172. Answer (4)

Hint: Identify the characteristic feature of kwashiorkor disease.

Sol.: Marasmus is produced by a simultaneous deficiency of proteins and calories. It is found in infants less than one year of age. In Marasmus, both growth rate and body weight decline considerably.

173. Answer (4)

Hint: Disorder that is preceded by nausea.

Sol.: Vomiting is the ejection of stomach contents through mouth.

Indigestion is caused due to inadequate enzyme secretion, anxiety, food poisoning, overeating and spicy food.

174. Answer (2)

Hint: Identify a part of large intestine.

Sol.: Caecum is a small blind sac which hosts some symbiotic micro-organisms. Vermiform appendix (a finger-like tubular projection) which arises from the caecum, is vestigial in human beings. Caecum opens into the colon.

175. Answer (1)

Hint: Digested food gets absorbed in small intestine.

Sol.: Bio-macromolecules (protein, nucleic acids, polysaccharides and lipids) have to be broken down and converted into simple substances in the digestive system.

176. Answer (1)

Hint: Layer which is located outer to mucosa

Sol.: The submucosal layer is formed of loose connective tissue containing nerves, blood and lymph vessels. In duodenum, Brunner's glands are present in sub mucosal layer.

177. Answer (4)

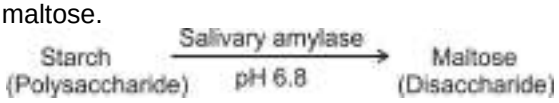
Hint: Enzyme which acts on nucleic acid

Sol.: The enzymes in succus entericus are a part of intestinal juice. It includes dipeptidases, maltase, lactase, sucrase, nucleotidase, nucleosidase and intestinal lipases.

178. Answer (2)

Hint: 70% starch is hydrolysed in small intestine

Sol.: Salivary amylase converts starch into maltose.



179. Answer (2)

Hint: Product of mastication that passes from oral cavity to stomach.

Sol.: In stomach, food mixes with acidic gastric juice by the churning movements producing chyme.

180. Answer (3)

Hint: These are involved in grinding of food.

Sol.: Premolars and last molar are a part of permanent dentition.