All India Aakash Test Series for NEET - 2025

TEST - 2 (Code-E)

For Code-F Sol. Click here

Test Date : 24/11/2024

ANSWERS

1.	(2)	41.	(2)	81.	(4)	121.	(3)	161.	(1)
2.	(1)	42.	(4)	82.	(2)	122.	(3)	162.	(2)
3.	(2)	43.	(3)	83.	(3)	123.	(4)	163.	(1)
4.	(3)	44.	(1)	84.	(1)	124.	(1)	164.	(2)
5.	(4)	45.	(4)	85.	(4)	125.	(1)	165.	(3)
6.	(2)	46.	(1)	86.	(2)	126.	(4)	166.	(4)
7.	(4)	47.	(3)	87.	(2)	127.	(4)	167.	(2)
8.	(3)	48.	(2)	88.	(3)	128.	(1)	168.	(2)
9.	(3)	49.	(2)	89.	(1)	129.	(4)	169.	(3)
10.	(4)	50.	(2)	90.	(3)	130.	(3)	170.	(2)
11.	(3)	51.	(4)	91.	(2)	131.	(3)	171.	(2)
12.	(2)	52.	(1)	92.	(3)	132.	(1)	172.	(2)
13.	(4)	53.	(3)	93.	(2)	133.	(3)	173.	(4)
14.	(4)	54.	(1)	94.	(2)	134.	(4)	174.	(3)
15.	(4)	55.	(2)	95.	(2)	135.	(3)	175.	(3)
16.	(3)	56.	(1)	96.	(1)	136.	(3)	176.	(3)
17.	(3)	57.	(4)	97.	(1)	137.	(4)	177.	(2)
18.	(1)	58.	(2)	98.	(4)	138.	(1)	178.	(4)
19.	(3)	59.	(1)	99.	(4)	139.	(4)	179.	(2)
20.	(4)	60.	(2)	100.	(4)	140.	(1)	180.	(4)
21.	(3)	61.	(1)	101.	(2)	141.	(3)	181.	(1)
22.	(4)	62.	(2)	102.	(3)	142.	(2)	182.	(1)
23.	(4)	63.	(3)	103.	(3)	143.	(1)	183.	(3)
24.	(2)	64.	(4)	104.	(3)	144.	(4)	184.	(3)
25.	(4)	65.	(4)	105.	(4)	145.	(4)	185.	(2)
26.	(1)	66.	(1)	106.	(4)	146.	(3)	186.	(1)
27.	(4)	67.	(1)	107.	(2)	147.	(3)	187.	(1)
28.	(4)	68.	(3)	108.	(1)	148.	(1)	188.	(3)
29.	(4)	69.	(3)	109.	(1)	149.	(1)	189.	(3)
30.	(2)	70.	(3)	110.	(4)	150.	(3)	190.	(2)
31.	(1)	71.	(2)	111.	(4)	151.	(3)	191.	(3)
32.	(1)	72.	(2)	112.	(1)	152.	(1)	192.	(4)
33.	(4)	73.	(1)	113.	(1)	153.	(4)	193.	(1)
34.	(1)	74.	(2)	114.	(3)	154.	(1)	194.	(1)
35.	(2)	75.	(1)	115.	(2)	155.	(4)	195.	(2)
36.	(3)	76.	(1)	116.	(3)	156.	(4)	196.	(3)
37.	(1)	77.	(3)	117.	(2)	157.	(3)	197.	(2)
38.	(2)	78.	(4)	118.	(3)	158.	(2)	198.	(3)
39.	(1)	79.	(3)	119.	(3)	159.	(3)	199.	(4)
40.	(3)	80.	(1)	120.	(3)	160.	(4)	200.	(4)

HINTS & SOLUTIONS

[PHYSICS]

SECTION - A

1. Answer (2)

Hint: Use Newton's second law of motion.

Sol.: If the net external force on a body is zero, its acceleration is zero.

Acceleration can be non-zero only if there is a net external force on the body.

2. Answer (1)

Hint and Sol.: $\vec{F} = \frac{\Delta \vec{P}}{\Delta t}$

Since time is fixed, hence $\vec{F} \propto \Delta \vec{P}$

3. Answer (2)

Hint: $W = \vec{F} \cdot \vec{s}$

Sol.: $W = \vec{F} \cdot \vec{s}$

$= Fs\cos\theta$

Work done is positive as $\theta = 0°$

4. Answer (3)

Hint and Sol.: $F_{ext} = ma$

Acceleration of a particle depends only on the force that is acting at that instant.

5. Answer (4)

Hint: Use, $F_{net} = ma$

Sol.: As net force acting on object is zero,

$\therefore \quad \vec{a} = \vec{0}, \; s = ut + \frac{1}{2}at^2$

$= 5 \times 5 = 25$ m

6. Answer (2)

Hint: $\left|\vec{F}_{avg}\right| = \frac{|\Delta \vec{P}|}{\Delta t}$

Sol.: $v = \sqrt{2gh}$

$\Delta P = m\sqrt{2gh}$

$t = \sqrt{\frac{2h}{g}}$

$\vec{F}_{avg} = \frac{m\sqrt{2gh}}{\sqrt{\frac{2h}{g}}}$

$= mg$

7. Answer (4)

Hint: $\vec{A} \cdot \vec{B} = A \cdot B\cos\theta$

Sol.: $A\cos\theta = \frac{\vec{A} \cdot \vec{B}}{|\vec{B}|}$

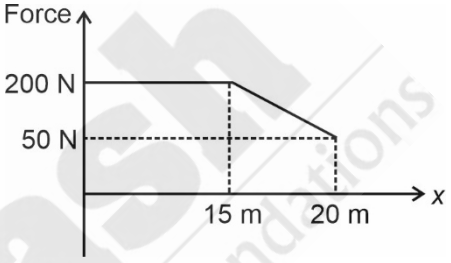
$A\cos\theta = \frac{1+2+3}{\sqrt{3}}$

$= 2\sqrt{3}$

8. Answer (3)

Hint: Work = Area under force-displacement curve.

Sol.:



W.D = Area under F-x curve

$= 15 \times 200 + \frac{1}{2} \times (200 + 50) \times 5$

$= 3000 + \frac{1}{2} \times 250 \times 5$

$= 3000 + 625 = 3625$ J

9. Answer (3)

Hint: Use, $v_n = e^n\sqrt{2gh}$

Sol.: $20 = e^3\sqrt{2 \times 10 \times 20}$

$20 = e^3 \times 20$

$e^3 = 1$

$e = 1$

10. Answer (4)

Hint: $E_K = \frac{P^2}{2m}$

Sol.: $\sqrt{E_K} \propto P$

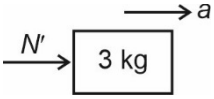
$\sqrt{E_K} \times \frac{1}{P} =$ constant

$\therefore$ Curve between $\sqrt{E_K}$ and $\frac{1}{P}$ is a rectangular hyperbola.

11. Answer (3)

Hint: Use $a = \dfrac{F_{net}}{\text{Total mass}}$

Sol.: $a = \dfrac{F}{m_1 + m_2} = \dfrac{30}{5} = 6 \text{ m/s}^2$



$N' = 3 \times 6 = 18$ N

12. Answer (2)

Hint: $P = \vec{F} \cdot \vec{v}$

Sol.: $x = 5t - 12$

$v = \dfrac{dx}{dt} = 5$ m/s

$\Rightarrow P = 10 \times 5$

$= 50$ W

13. Answer (4)

Hint: $T = \dfrac{M}{L}(L - y)g$ (for distance y from ceiling)

Sol.: $T = Mg\left[1 - \dfrac{y}{L}\right]$

$= 10 \times 10\left[1 - \dfrac{1}{2 \times 2}\right]$

$= 100\left[\dfrac{3}{4}\right]$

$= 75$ N

14. Answer (4)

Hint and Sol.: If a body is in equilibrium under the action of three forces, then their resultant is zero and they form a closed triangle, so they are coplanar.

15. Answer (4)

Hint: $W = \vec{F} \cdot \vec{r}$

Sol.: $W = \left(2\hat{i} + 3\hat{j}\right) \cdot (2\hat{k})$

$= 0$

16. Answer (3)

Hint: Use conservation of mechanical energy.

Sol.: $K_{max} = mgh$

$= mg[L - L\cos\theta]$

$= 2 \times 10 \times 1 \times \left[1 - \dfrac{1}{2}\right]$

$= 10$ J

17. Answer (3)

Hint and Sol.: The S.I. unit of power is watt.

18. Answer (1)

Hint and Sol.: Inertial frame is unaccelerated frame where Newton's laws of motion can be applied.

19. Answer (3)

Hint: $f_{s, max} = \mu N$

Sol.: $F = f_{s, max}$

$= \mu mg$

$= 0.4 \times 6 \times 10$

$= 24$ N

20. Answer (4)

Hint: Properties of dot product.

Sol.:

(i) Dot product is commutative $\vec{A} \cdot \vec{B} = \vec{B} \cdot \vec{A}$

(ii) Dot product is distributive

$\vec{A} \cdot (\vec{B} + \vec{C}) = \vec{A} \cdot \vec{B} + \vec{A} \cdot \vec{C}$

(iii) $\vec{A} \cdot \vec{A} = A^2$

21. Answer (3)

Hint: WD = $\Delta K.E.$

Sol.: $\text{W.D.} = \dfrac{1}{2}mv^2$

$mg(h_1 - h_2) = \dfrac{1}{2}mv^2$

$m \times 10 \times 80 = \dfrac{1}{2}mv^2$

$v = \sqrt{2gh}$

$v = \sqrt{2gh} = \sqrt{2 \times 10 \times 80} = \sqrt{1600} = 40$ m/s

22. Answer (4)

Hint: Use work energy theorem

Sol.: $W_g + W_f = \dfrac{1}{2}m(v_f^2 - v_i^2)$

$mg(h + x) - Fx = 0$

$1 \times 10\ (10 + 2) = F \times 2$

$120 = F \times 2$

$\boxed{F = 60 \text{ N}}$

23. Answer (4)

Hint: Use, $F = -\dfrac{dU}{dx}$

Sol.: $F = -2x + 5$

$F_{(x = 1 \text{ m})} = -2 + 5 = 3$ N

24. Answer (2)

Hint: Scalar product, $\vec{A} \cdot \vec{B} = AB\cos\theta$

Sol.: Since scalar product is zero

$\Rightarrow \theta = 90°$

25. Answer (4)

Hint and Sol: 1 J = 10^7 erg

1 eV = 1.6×10^{-19}J

1 kWh = 3.6×10^6J

1 H.P = 746 watt

26. Answer (1)

Hint and Sol.: Static friction is a self-adjusting force and not kinetic friction.

27. Answer (4)

Hint and Sol: When two particles of equal masses perform head on elastic collision, then after collision their velocities get exchanged.

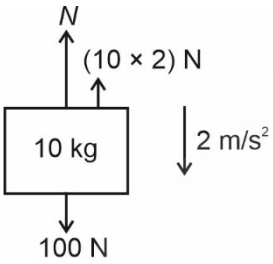
$v_A = 0$

$v_B = 10$ m/s

28. Answer (4)

Hint : The pseudo force acts in direction opposite to the acceleration of the frame and magnitude is equal to mass of object multiplied by acceleration of frame.

Sol. : With respect to elevator frame, $F_{net} = 0$



$N + ma_0 = mg$

$N = mg - ma_0 = 10 \times (10 - 2) = 80$ N

29. Answer (4)

Hint and Sol.: Action and reaction act on different bodies and they cannot be cancelled out.

30. Answer (2)

Hint and Sol: Impulse = Force × time

= Change in momentum

31. Answer (1)

Hint: Use work energy theorem

Sol.: $\frac{1}{2}Mv^2 = F \times \delta_1 \Rightarrow \frac{M_1}{\delta_1} = \frac{M_2}{\delta_2} \Rightarrow \frac{\delta_1}{\delta_2} = \frac{M_1}{M_2}$

32. Answer (1)

Hint and Sol.: In equilibrium position, $F_{net} = 0$

$\Rightarrow F = K \cdot x_0$

$\Rightarrow x_0 = \frac{F}{K}$

33. Answer (4)

Hint: $F_{net} = ma$, $f_{max} = \mu N$, $F_{applied} - f_{max} = ma$

Sol.: $a = 0$, when $F_{applied} = 5$ N

$F_{net} = ma$	$a = 1$ m/s^2
$F_{net} = 0$	$F_{applied} = 6$ N
$5 - f_{max} = 0$	$F_{net} = ma$
$f_{max} = 5$ N	$6 - 5 = m \times 1$
	$m = 1$ kg

34. Answer (1)

Hint and Sol.: In this explosion, total linear momentum of the system must be conserved.

35. Answer (2)

Hint: Use, $v_{max} = \sqrt{\mu rg}$

Sol.: $v_{max} = \sqrt{0.5 \times 5 \times 10} = 5$ m/s

SECTION - B

36. Answer (3)

Hint: Area under $F - t$ curve equals change in momentum

Sol.: Area under curve = Zero

Change in momentum = Zero

Final velocity = Zero

37. Answer (1)

Hint: Momentum, $P = mv$

Sol.: $\vec{P_i} = mv\hat{i}$ and $\vec{P_f} = mv\hat{j}$

$\Delta\vec{P} = mv\hat{j} - mv\hat{i} \Rightarrow |\Delta\vec{P}| = \sqrt{2}mv$

38. Answer (2)

Hint and Sol.: For perfectly inelastic collision $e = 0$

39. Answer (1)

Hint and Sol.: Potential energy decreases and kinetic energy increases when height of particle decreases.

40. Answer (3)

Hint and Sol.: K.E of 1 bullet = k

$\therefore$ For n bullets K.E = nk.

Change in K.E. of bullets = W.D. by machine gun.

41. Answer (2)

Hint and Sol.: $A(B\cos\theta) = \vec{A} \cdot \vec{B}$

Scalar product obey commutativity and distributivity.

42. Answer (4)

Hint and Sol.: In elastic collision loss in kinetic energy will be zero.

43. Answer (3)

Hint: Use, $\tan\alpha = \frac{\tan\theta}{e}$

Sol.: $\tan\alpha = \frac{\tan 30^\circ}{\frac{1}{2}}$

$\tan\alpha = \frac{2}{\sqrt{3}}$

$\alpha = \tan^{-1}\left(\frac{2}{\sqrt{3}}\right)$

44. Answer (1)

Hint and Sol.: When a horse starts suddenly, the rider falls backwards due to inertia of rest.

45. Answer (4)

Hint and Sol.: Coefficient of friction is independent of normal reaction.

46. Answer (1)

Hint: Use work energy theorem.

Sol.: $W = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$

$v = \frac{dx}{dt}$

$= t$

$W = \frac{1}{2} \times 4 \times (4^2 - 2^2)$

$= 2 \times 12$

$= 24$ J

47. Answer (3)

Hint: $F_{net} = ma$

Sol.: Since, there are no nearby stars to exert gravitational force on her and the small spaceship exerts negligible gravitational attraction on her, the net force acting on her is zero.

So, a = zero.

48. Answer (2)

Hint and Sol.: The condition for leaving the circle would be $\sqrt{2gR} < u < \sqrt{5gR}$

49. Answer (2)

Hint and Sol.:

$\Rightarrow \quad a = \frac{m_2 g - m_1 g}{m_1 + m_2}$

And $T - m_1 g = m_1 a$

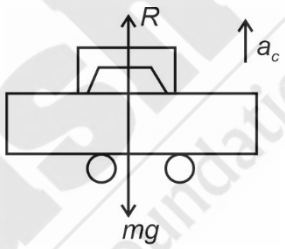
$\Rightarrow \quad T = m_1[a + g]$

$\Rightarrow \quad T = \frac{2m_1 m_2 g}{m_1 + m_2}$

50. Answer (2)

Hint: Use, $F_{centripetal} = \frac{mv^2}{r}$

Sol.:



$R - mg = \frac{mv^2}{r}$

$R = mg + \frac{mv^2}{r}$

Clearly $R > mg$

i.e. the weight of the moving car is greater than the weight of stationary car.

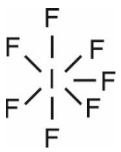
[CHEMISTRY]

SECTION - A

51. Answer (4)

Hint: IF_7 has seven bond pairs and no lone pair

Sol.:



- Central atom is sp^3d^3 hybridised.
- Shape of the molecule is pentagonal bipyramidal.

52. Answer (1)

Hint: Along the period, electronegativity increases while down the group it decreases.

Sol.:

Elements	Electronegativity (on Pauling scale)
C	2.5
B	2.0
Si	1.8
Al	1.5

53. Answer (3)

Hint: For alkali metals, down the group negative electron gain enthalpy decreases.

Sol.:

Elements	$\Delta_{eg}H$ (kJ mol^{-1})
Li	–60
Na	–53
O	–141
S	–200

54. Answer (1)

Hint: Acidic oxide on reaction with water forms acid.

Sol.:

- $Cl_2O_7 + H_2O \rightarrow 2HClO_4$
- Cl_2O_7 is an acidic oxide

55. Answer (2)

Hint: In octet rule, atoms combine by sharing of valence electrons in order to have an octet in their valence shells.

Sol.:

- NO_2 and NO are odd-electron molecules.
- Expanded octet is observed in PF_5, H_2SO_4 and SF_6
- CH_4, N_2 and CO_2 follow octet rule

56. Answer (1)

Hint: IUPAC official name of element with atomic number 103 is Lawrencium.

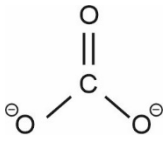
Sol.:

	Atomic number		IUPAC official name
a.	107	(i)	Bohrium
b.	103	(ii)	Lawrencium
c.	105	(iii)	Dubnium
d.	104	(iv)	Rutherfordium

57. Answer (4)

Hint: Bond order $= \dfrac{\text{Total number of bonds } (\sigma+\pi)}{\text{Number of } \sigma\text{-bonds}}$

Sol.:

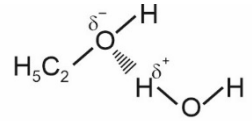


Bond order of C – O in $CO_3^{2-} = \dfrac{4}{3} = 1.33$

58. Answer (2)

Hint: Ethyl alcohol forms H–bond with water.

Sol.:



Intermolecular H-bond

Ethanol forms intermolecular H-bond with water hence it dissolves in water.

59. Answer (1)

Hint: Metalloids show properties which are characteristics of metals and non-metals.

Sol.:

- Group-16 elements are called chalcogens.
- Rubidium is *s*-block element while indium is *p*-block element.

60. Answer (2)

Hint: More is the effective nuclear charge, lesser is the size of atoms.

Sol.: Along a period, as the effective nuclear charge increases, the size of atom decreases.

61. Answer (1)

Hint and Sol.: The covalent radius is measured approximately as the radius of an atom's core which is in contact with the core of an adjacent atom in a bonded situation.

62. Answer (2)

Hint: The bond formed, as a result of the electrostatic attraction between the positive and negative ions is called as ionic bond.

Sol.: Covalent bonds are formed by the sharing of electron pairs between the two atoms.

- NaBr contains only ionic bond
- CCl_4 and SO_3 contain only covalent bonds
- Na_2SO_4 contains both ionic and covalent bonds.

63. Answer (3)

Hint: If the bond order is zero, the species will not exist.

Bond order $= \dfrac{1}{2}(N_b - N_a)$

Sol.: In He_2 and Be_2 molecules the bond order is zero. The total number of bonding electrons are equal to the total number of anti-bonding electrons.

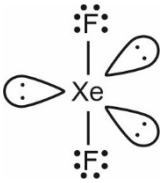
He_2 : $(\sigma 1s)^2(\sigma^* 1s)^2$

Be_2 : $(\sigma 1s)^2(\sigma^* 1s)^2(\sigma 2s)^2(\sigma^* 2s)^2$

64. Answer (4)

Hint: Hybridisation of Xe in XeF_2 is sp^3d.

Sol.:

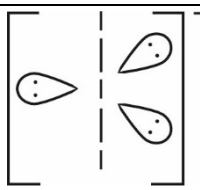
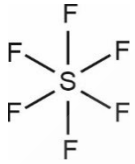
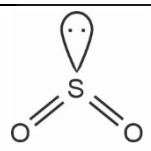


Total number of lone pairs = 9

65. Answer (4)

Hint: 180° bond angle is possible for sp, sp^3d^2 and sp^3d hybridisations.

Sol.:

Species	Hybridisation	Bond angle
I_3^-		180°
CO_2	O=C=O	180°
SF_6		90°, 180°
SO_2		119°

66. Answer (1)

Hint: Smaller is the size of atoms, smaller is the bond length

Sol.: Atomic size order: C > O > H

Correct order of bond length:

C–C > C–O > C–H > O–H

Bond type	Bond length (pm)
C–C	154
C–O	143
C–H	107
O–H	96

67. Answer (1)

Hint: The species which contains unpaired electron is paramagnetic in nature

Sol.: $O_2 : (\sigma 1s)^2(\sigma^*1s)^2(\sigma 2s)^2(\sigma^*2s)^2(\sigma 2p_z)^2(\pi 2p_x^2 = \pi 2p_y^2)(\pi^*2p_x^1\pi^*2p_y^1)$

$N_2 : (\sigma 1s)^2(\sigma^*1s)^2(\sigma 2s)^2(\sigma^*2s)^2(\pi 2p_x^2 = \pi 2p_y^2)(\sigma 2p_z)^2$

$C_2 : (\sigma 1s)^2(\sigma^*1s)^2(\sigma 2s)^2(\sigma^*2s)^2(\pi 2p_x^2 = \pi 2p_y^2)$

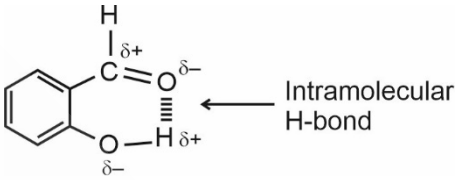
$H_2 : (\sigma 1s)^2$

O_2 contains two unpaired electrons.

68. Answer (3)

Hint: Intramolecular hydrogen bond is formed when hydrogen atom is in between the two highly electronegative (F, O, N) atoms

Sol.:



69. Answer (3)

Hint: *s* and *p*-block elements are called representative elements

Sol.: Zn, Cd, Ti and Cu are *d*-block elements

- Bi and Pb are *p*-block elements
- Nd is *f*-block element
- Ba is *s*-block element

70. Answer (3)

Hint: In ethyne, carbon-carbon triple bond is present

Sol.: H—C ≡ C—H

Ethyne consists of 3σ-bonds and 2 pi bonds.

71. Answer (2)

Hint: Electronic configuration of O_2

$O_2 : (\sigma 1s)^2(\sigma^*1s)^2(\sigma 2s)^2(\sigma^*2s)^2(\sigma 2p_z)^2$

$$\left(\pi 2p_x^2 = \pi 2p_y^2\right)\ \left(\pi^* 2p_x^1 = \pi^* 2p_y^1\right)$$

Sol.: $O_2^- : (\sigma 1s)^2(\sigma^*1s)^2(\sigma 2s)^2(\sigma^*2s)^2(\sigma 2p_2)^2$

$$\left(\pi 2p_x^2 = \pi 2p_y^2\right)\ \left(\pi^* 2p_x^2, \pi^* 2p_y^1\right)$$

Number of bonding electrons = 10

Number of antibonding electrons = 7

72. Answer (2)

Hint: For alkali metals, down the group the ionisation enthalpy decreases

Sol.:

Metal	Δ_iH (kJ mol^{-1})
Na	496
K	419
Rb	403
Cs	374

73. Answer (1)

Hint: The species in which the central atoms have same hybridisation having same number of bond pairs and lone pairs will be isostructural.

Sol.:

Species	Hybridisation	Shape
SO_4^{2-}	sp^3	Tetrahedral
PO_4^{3-}	sp^3	Tetrahedral
XeF_4	sp^3d^2	Square planar
SF_4	sp^3d	See – Saw
NO_3^-	sp^2	Trigonal planar
SO_3^{2-}	sp^3	Pyramidal
BF_3	sp^2	Trigonal planar
NF_3	sp^3	Pyramidal

74. Answer (2)

Hint: The dipole moment of molecules depend on bond dipoles as well as shape of the molecules.

Sol.:

Molecules	Shape	Dipole moment (μ)(D)
H_2O	Bent	1.85
NH_3	Pyramidal	1.47
H_2S	Bent	0.95
BF_3	Trigonal-planar	0

75. Answer (1)

Hint: Neptunium comes after uranium in periodic table

Sol.: Samarium is a lanthanoid element

76. Answer (1)

Hint: Ca, Sr, and Ba are a set of Dobereiner's triad

Sol.: Given set of elements belong to Dobereiner triad

- Li, Na, K
- Ca, Sr, Ba
- Cl, Br, I

77. Answer (3)

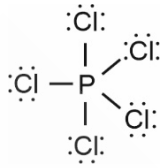
Hint: Element below silicon and aluminium are called Eka-silicon and Eka-aluminium respectively.

Sol.: Gallium (Ga) is Eka-aluminium while Germanium (Ge) is Eka-silicon.

78. Answer (4)

Hint: In PCl_5 molecule, axial bond pairs suffer more repulsive interaction from the equatorial bond pair.

Sol.:



- P in PCl_5 is sp^3d hybridised.
- As the axial bond pairs suffer more repulsive interaction from equatorial bond pairs, therefore axial bonds have been found to be slightly longer and hence slightly weaker than the equatorial bonds.

79. Answer (3)

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

Sol.: Species	**Bond order**
	$\frac{1}{2}(N_b - N_a)$
O_2	$\frac{1}{2}(10-6)=2$
O_2^+	$\frac{1}{2}(10-5)=2.5$
O_2^-	$\frac{1}{2}(10-7)=1.5$

80. Answer (1)

Hint: Down the group ionic radii increases.

Sol.: Ions	**Radii (pm)**
Li^+	76
Na^+	102
Be^{2+}	31
Mg^{2+}	72

81. Answer (4)

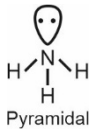
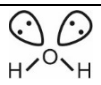
Hint: Al_2O_3 reacts both with acid and base.

Sol.: Compounds	**Chemical nature**
NO	Neutral
Al_2O_3	Amphoteric
Na_2O	Basic
SO_2	Acidic

82. Answer (2)

Hint: Bond angle depends on hybridisation of central atom and number of lone pairs on central atom.

Sol.:

Molecules	Shape	Hybridisation	Bond angle
CO_2	O = C = O Linear	*sp*	180°
BCl_3	 Trigonal planar	sp^2	120°
NH_3	 Pyramidal	sp^3	107°
H_2O		sp^3	104.5°

83. Answer (3)

Hint: σ-bond is formed using σ molecular orbital

Sol.:

Molecules	Nature of bond
B_2	1π bond
C_2	2π bond
H_2	1σ bond
N_2	1σ and 2π bonds

N_2 (electronic configuration): $(\sigma 1s)^2\ (\sigma^* 1s)^2\ (\sigma 2s)^2\ (\sigma^* 2s)^2\ (\pi 2p_x^2 = \pi 2p_y^2)\ (\sigma 2p_z^2)$

84. Answer (1)

Hint: (σ1s) orbital does not contain any node.

Sol.: (σ*1s) orbital has one node.

85. Answer (4)

Hint: $N_2 : (\sigma 1s)^2\ (\sigma^* 1s)^2\ (\sigma 2s)^2\ (\sigma^* 2s)^2\ (\pi 2p_x^2 = \pi 2p_y^2)\ (\sigma 2p_z^2)$

Sol.: In N_2^- the added electron will go to $\pi^* 2p_x$ or $\pi^* 2p_y$ molecular orbital.

SECTION - B

86. Answer (2)

Hint: Number of π-electrons is equal to twice the number of π-bonds

Sol.: Number of π bonds = 5

Number of π electron = 5 × 2 = 10

87. Answer (2)

Hint: Oxidation state of fluorine in its compound is –1

Sol.:

- In OF_2 the oxidation state of oxygen is +2
- p_π-p_π bond is present in $N_2(N \equiv N)$ molecule.

88. Answer (3)

Hint: Intermolecular hydrogen bond is formed between two different molecules of the same or different compounds. In these compounds hydrogen should be bonded to electronegative elements F, N or O.

Sol.: H – S bond polarity in H_2S is not pronounced hence intermolecular H-bond is absent in H_2S.

89. Answer (1)

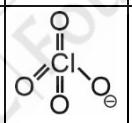
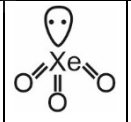
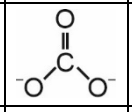
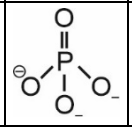
Hint: Few elements of second and third period present diagonally show similarity in their properties and are said to be diagonally related.

Sol.: Li and Mg; Be and Al; show diagonal relationship with each other.

90. Answer (3)

Hint: For the formation of pπ-dπ bond one of the atom should contain electron in d-orbital.

Sol.:

Species	Shape	Number of pπ-dπ bonds
ClO_4^-		3
XeO_3		3
CO_3^{2-}		0
PO_4^{3-}		1

91. Answer (2)

Hint: 17 group elements are called halogens

Sol.:

Vanadium ⟶ Transition metal

Iodine ⟶ Halogen

Cerium ⟶ Lanthanoid

Thorium ⟶ Actinoid

92. Answer (3)

Hint: In a period the electronegativity generally increases as we move from left to right

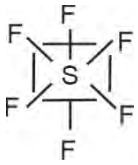
Sol.: Correct order of electronegativity value of the third period elements

Cl > S > P > Si > Al > Mg > Na

93. Answer (2)

Hint: Central atom in SF_6 is sp^3d^2 hybridised

Sol.:



Maximum atoms lie in a plane are 5.

94. Answer (2)

Hint: For the given elements, the nearest inert gas is neon (Ne). Total electrons in Ne is 10

Sol.: For isoelectronic species more is the negative charge on ion larger is its ionic size. Correct order of ionic size : $O^{2-} > F^- > Na^+ > Mg^{2+}$

95. Answer (2)

Hint:

- Percentage ionic character = $\frac{\mu_{observed}}{\mu_{calculated}} \times 100$
- 1D = 3.33×10^{-30} Cm

Sol.: $\mu_{observed} = 0.8 \times 3.33 \times 10^{-30}$ Cm

$\mu_{calculated} = 1.602. \times 10^{-19} \times 100 \times 10^{-12}$ Cm

$= 1.6 \times 10^{-29}$ Cm

Percentage ionic character

$$= \frac{0.8 \times 3.33 \times 10^{-30} \times 100}{1.6 \times 10^{-29}}$$

$= 1.665 \times 10 = 16.65\%$

96. Answer (1)

Hint: The occupied molecular orbital which has highest energy is called highest occupied molecular orbital

Sol.: O_2^- electronic configuration

$$(\sigma 1s)^2(\sigma^* 1s)^2(\sigma 2s)^2(\sigma^* 2s)^2(\sigma 2p_z)^2(\pi 2p_x^2 = \pi 2p_y^2)$$

$$(\pi^* 2p_x^2 = \pi^* 2p_y^1)$$

97. Answer (1)

Hint: In endothermic process, the energy is absorbed.

Sol.:

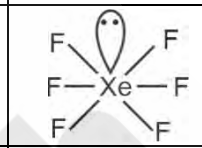
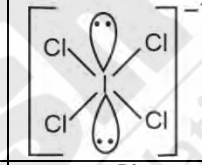
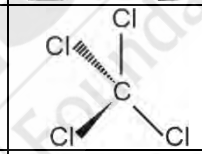
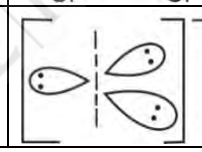
Process	$\Delta_{eg}H$(kJ mol^{-1})
$Ne \longrightarrow Ne^-$	116
$Br \longrightarrow Br^-$	–325
$Rb \longrightarrow Rb^-$	–47
$Te \longrightarrow Te^-$	–190

Electron gain enthalpy of inert gases is positive.

98. Answer (4)

Hint: In CCl_4 , all the valence electrons of carbon are involved in bond formation.

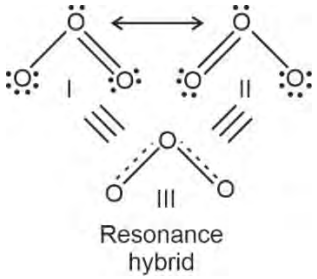
Sol.:

Species	Shape	Number of lone pair(s) on central atom
XeF_6		1
$[ICl_4]^-$		2
CCl_4		0
I_3^-		3

99. Answer (4)

Hint: Energy of O_3 resonance hybrid is lower than either of the two canonical forms

Sol.: O_3 is a resonance hybrid of two canonical structure



Resonance hybrid

100. Answer (4)

Hint and Sol: For cations of same size and charge, the one with electronic configuration $(n-1)d^{10}ns^2$ is more polarising than the one with noble gas configuration, $ns^2\ np^6$.

[BOTANY]

SECTION-A

101. Answer (2)

Hint: The prominent vein present in the middle of the leaf blade is called midrib.

Sol.: Leaf base bears two lateral small leaf like structures called stipules. In some leguminous plants, the leaf base swells and is called pulvinus.

102. Answer (3)

Hint: Bacteria are the sole members of this kingdom and they are prokaryotes.

Sol.: Some of the bacteria are autotrophic but vast majority are heterotrophic.

103. Answer (3)

Hint: Cocci are spherical bacteria

Sol.: Bacillus – Rod shaped
Vibrium – Comma shaped
Spirillum – Spiral

104. Answer (3)

Hint: Penicillin interferes in the synthesis of peptidoglycan, a component of cell wall of bacteria.

Sol.: Mycoplasma are facultative anaerobes and lack cell wall. They can survive without oxygen.

105. Answer (4)

Hint: Mango develops from monocarpellary ovary.

Sol.: In mango, epicarp forms skin, mesocarp is fleshy, juicy and edible, and endocarp is hard and stony.

106. Answer (4)

Hint: Typhoid is caused by *Salmonella typhi*.

Sol.: Sleeping sickness is caused by *Trypanosoma* which is a flagellated protozoan.

107. Answer (2)

Hint: Archaebacteria differ from other bacteria in having a different cell wall structure.

Sol.: Cell membrane of Archaebacteria contains branched chain lipids.

108. Answer (1)

Hint: *Rhizopus* – Bread mould

Sol.: *Ustilago* – Smut fungus
Agaricus – Mushroom
Puccinia – Rust fungus

109. Answer (1)

Hint: Methanogens are responsible for the production of methane and they are present in the gut of ruminant animals.

Sol.: Thermoacidophiles are found in hot water springs having low pH.

110. Answer (4)

Hint: Bacterial viruses are also called bacteriophages.

Sol.: Bacterial viruses have protein coat and usually have double stranded DNA.

111. Answer (4)

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

Sol.: Majority of slime moulds are saprophytic protists.

112. Answer (1)

Hint: Deuteromycetes are commonly known as imperfect fungi.

Sol.: Cyanobacteria are characterised by the absence of flagellum throughout the life cycle. Kingdom fungi is classified on the basis of morphology of the mycelium, mode of spore formation and fruiting bodies into various classes.

113. Answer (1)

Sol.: Cell wall of fungi is composed of chitin and other polysaccharides.

114. Answer (3)

Hint: Sporozoans include *Plasmodium* that causes malaria.

Sol.:
Flagellated protozoan – *Trypanosoma*
Ciliated protozoan – *Paramoecium*
Amoeboid protozoan – *Amoeba*, *Entamoeba*

115. Answer (2)

Hint: There are organisms which can fix atmospheric nitrogen in specialised cells called heterocysts.

Sol.: Heterocysts are present in Cyanobacteria or BGA.

116. Answer (3)

Hint: Fungi can also live as symbionts in association with algae as in lichens.

Sol.: Mycorrhiza is a symbiotic association between roots of higher plants and fungi.

117. Answer (2)

Hint: Euglenoids show mixotrophic mode of nutrition.

Sol.: Euglenoids can perform photosynthesis in the presence of sunlight as they have pigments identical to higher plants.

118. Answer (3)

Hint: The causative agent of Cr-Jacob disease is similar in size to viruses.

Sol.: Cr-Jacob disease in humans is caused by prions.

119. Answer (3)

Hint: Lichens do not grow in polluted areas.

Sol.: Lichens are mutually useful association between algae and fungi. Algae prepare food for fungi and fungi provide shelter and absorb mineral nutrients and water for its partner.

120. Answer (3)

Hint: *Claviceps* causes ergot disease.

Sol.: Late blight of potato is caused by *Phytophthora infestans*.

Early blight of potato is caused by *Alternaria solani*.

121. Answer (3)

Hint: Calyx is the outermost whorl of the flower and its members are called sepals.

Sol.: Corolla is the second whorl of the flower which is generally brightly coloured, have fragrance and makes the flower more attractive.

122. Answer (3)

Hint: In hypogynous flower, ovary occupies the highest position while the other parts are situated below it.

Sol.: In flowers of mustard and china rose, ovary is superior.

123. Answer (4)

Hint: In radial symmetry, flower can be divided into two equal radial halves in any radial plane passing through the centre.

Sol.: Mustard, *Datura* and chilli are examples of plants having flowers with radial symmetry.

Bean flower shows bilateral symmetry.

124. Answer (1)

Hint: *Calotropis* shows valvate aestivation in corolla.

Sol.: Twisted aestivation – Cotton

Imbricate aestivation – *Cassia*

Vexillary aestivation – Pea

125. Answer (1)

Hint: In cymose inflorescence, the flowers are borne in a basipetal order.

Sol.: In cymose inflorescence, the main axis terminates into a flower hence is limited in growth.

126. Answer (4)

Hint: Root synthesises plant growth regulators.

Sol.: The food manufactured in leaves is transported to roots, fruits and organs of storage through stem.

127. Answer (4)

Hint: In acropetal succession, younger flowers are present towards the apex and the older flowers are present at the base.

Sol.: Radish, lupin and mustard show acropetal succession of flowers.

Dianthus shows basipetal succession of flowers.

128. Answer (1)

Hint: Inflorescence is the arrangement of flowers on the floral axis.

Sol.: Ovary bears ovules on a cushion-like structure called placenta.

The arrangement of ovules on placenta within the ovary is known as placentation.

129. Answer (4)

Hint: In apocarpous condition, carpels are free.

Sol.: Lotus and rose are example of flowers having apocarpous gynoecium.

130. Answer (3)

Hint: China rose shows axile placentation.

Sol.: Marginal placentation – Pea

Parietal placentation – *Argemone*, mustard

131. Answer (3)

Sol.: In maturation zone, some of the epidermal cells form very fine and delicate, thread like structures called root hairs.

132. Answer (1)

Hint: Epiphyllous condition of androecium is found in lily.

Sol.: When stamen is attached to the petal, it is called epipetalous.

133. Answer (3)

Hint: The hilum is a scar on the seed coat through which the developing seeds were attached to the fruit.

Sol.: Nucellus remains persistent in some seeds called perisperm.

134. Answer (4)

Hint: When stamens are united into more than two bundles, it is called polyadelphous, e.g., *Citrus*.

Sol.: Monoadelphous condition is found in China rose and diadelphous condition is found in pea.

135. Answer (3)

Hint: Floral formula of Solanaceae family is $\oplus \male K_{(5)} \overset{\frown}{C_{(5)}} A_5 \underline{G}_{(2)}$

Sol.: Potato, *Petunia* and belladonna belongs to Solanaceae family. Sugarcane, wheat and maize belong to Poaceae family. Mustard belongs to Brassicaceae family.

SECTION - B

136. Answer (3)

Hint: In alternate phyllotaxy, single leaf is present at each node in an alternate fashion.

Sol.: China rose, mustard and sunflower show alternate phyllotaxy.

Guava shows opposite phyllotaxy.

137. Answer (4)

Hint: Floral formula of Malvaceae family is $Epi_{5-7} \oplus \male K_{(5)} \overset{\frown}{C_5 A_{(\infty)}} \underline{G}_{(5)}$

Sol.:

Gramineae	$\% \male P_{0 \text{ or } 2 \text{ or } 3(\text{Lodicules})} A_{3 \text{ or } 6} \underline{G}_1$
Cruciferae	$Ebr \oplus or \% \male K_{2+2} C_{\times 4} A_{2+4} \underline{G}_{(2)}$
Compositae	$Br \% \female K_{\text{pappus or } 0} C_{(5)} A_0 \overline{G}_{(2)}$

138. Answer (1)

Hint: Symbols C_n and $C_{(n)}$ are used for polypetalous and gamopetalous condition respectively.

Sol.: K_n and $K_{(n)}$ are used for polysepalous and gamosepalous condition respectively.

139. Answer (4)

Hint: In basidiomycetes, karyogamy and meiosis occurs in club-shaped structures known as basidium.

Sol.: In basidiomycetes, the secondary mycelium is long lived and dominant phase of life cycle.

140. Answer (1)

Hint: R.H. Whittaker (1969) proposed the five kingdom classification system.

Sol.: Carl Woese proposed three domains of life-Bacteria, Archaea, and Eukarya. This system divides the kingdom Monera into two domains.

141. Answer (3)

Hint: M.W. Beijerinck demonstrated that the extract of the infected plants of tobacco could cause infection in healthy plants and called this fluid as '*Contagium vivum fluidum*'.

Sol.: Viruses could be crystallised, was shown by W.M. Stanley.

D.J. Ivanowsky recognised certain microbes as causal organisms of the mosaic disease of tobacco.

T.O. Diener discovered viroids.

142. Answer (2)

Hint: It is a multicellular member of Ascomycetes.

Sol.: *Neurospora* belongs to Ascomycetes and it is used extensively in biochemical and genetic work.

143. Answer (1)

Hint: Dinoflagellates have stiff cellulosic plates on the outer surface.

Sol.: Dinoflagellates are mostly marine and photosynthetic. They appear yellow, green, brown, blue or red depending on the main pigments present in their cells.

144. Answer (4)

Hint: Viruses consist of nucleic acid and proteins only.

Sol.: Viruses are smaller than bacteria. Therefore, they pass through bacteria-proof filters. Viruses are infectious agents with simple, acellular organisation and they are exception to cell theory.

145. Answer (4)

Hint: Reticulate venation generally occurs in dicot plants.

Sol.: Peepal, *Hibiscus*, *Luffa* show reticulate venation. Parallel venation is found in banana.

146. Answer (3)

Hint: These belong to the class ascomycetes.

Sol.: Morels and truffles are edible and are considered delicacies.

147. Answer (3)

Hint: In palmately compound leaves, the leaflets are attached at a common point.

Sol.: In a pinnately compound leaf, a number of leaflets are present on a common axis, the rachis, which represents the midrib of the leaf.

148. Answer (1)

Hint: In Malvaceae family, sepals and petals are five in number with valvate and twisted aestivation respectively.

Sol.: In members of Brassicaceae, following characters are found:

(i) Racemose type of inflorescence.

(ii) Siliqua or silicula type of fruit are seen.

(iii) Sepals and petals are four in number with imbricate and valvate aestivation respectively.

149. Answer (1)

Hint: Root hairs are present in maturation zone.

Sol.: The apex of the root is covered by a thimble-like structure called root cap. It protects the tender apex of the root as it makes its way through the soil.

150. Answer (3)

Hint: In mango and coconut, the fruit is known as a drupe.

Sol.: In mango, the pericarp is well differentiated into an outer thin epicarp, a middle fleshy edible mesocarp and inner hard stony endocarp.

[ZOOLOGY]

SECTION-A

151. Answer (3)

Hint: Facilitates diffusion

Sol.: The primary site for exchange of gases in the human respiratory tract is alveoli. Alveoli are lined by a single thin layer of flattened cells with irregular boundaries *i.e.*, simple squamous epithelium, which helps in exchange of gases.

Secretion and absorption are the main functions of simple cuboidal and simple columnar epithelium. The function of compound epithelium is to provide protection against chemical and mechanical stresses.

152. Answer (1)

Hint: Depolarisation of the upper chambers of heart

Sol.: In a standard ECG, the P-wave represents the electrical excitation (or depolarisation) of the atria, which leads to the contraction of both the atria. The QRS complex represents the depolarisation of the ventricles, which initiates the ventricular contraction.

The T-wave represents the return of the ventricles from excited to normal state (repolarisation). The end of the T-wave marks the end of ventricular systole.

153. Answer (4)

Hint: Hepatic cells absorb nutrients

Sol.: The hepatic portal vein carries blood from intestine to the liver before it is delivered to the systemic circulation.

154. Answer (1)

Hint: It is an important factor that affects exchange of gases.

Sol.: Partial pressure of a gas is the pressure contributed by an individual gas in a mixture of gases.

Exchange of gases by simple diffusion is mainly based on the pressure/concentration gradient of gases.

155. Answer (4)

Hint: Factors for blood clotting are present in the blood plasma

Sol.: Plasma contains small amounts of minerals like Na^+, Ca^{++}, Mg^{++}, HCO_3^-, Cl^-, *etc.*

Factors for coagulation of blood are present in the plasma in an inactive form.

Plasma without the clotting factors is called serum.

156. Answer (4)

Hint: Feature of amphibian RBCs

Sol.: A healthy adult man has, on an average, 5 millions to 5.5 millions of RBCs mm^{-3} of blood. RBCs are formed in the red bone marrow in the adults. RBCs are devoid of nucleus and are biconcave in shape.

157. Answer (3)

Hint: Cardiac cycle takes place 72 times per minute in a healthy adult man.

Sol.: By counting the number of QRS complexes that occur in a given time period, one can determine the heart beat rate of an individual.

Adult human RBCs have an average life span of 120 days after which they are destroyed in the spleen.

158. Answer (2)

Hint: Myogenic heart

Sol.: Purkinje fibres are modified cardiac muscle fibres. Cardiac muscles are exclusively present in the heart.

159. Answer (3)

Hint: Eject out blood to lungs

Sol.: Heart is a mesodermally derived organ, has the size of a clenched fist and is protected by a double walled membranous bag, pericardium. The left ventricle ejects out blood to aorta and from aorta, blood is pumped out to the whole body, so it has the thickest wall as compared to any other chambers of the heart.

160. Answer (4)

Hint: Affects the kidneys and is higher than the normal.

Sol.: Normal blood pressure is 120/80 mm Hg, where 120 mm Hg is systolic or pumping pressure and 80 mm Hg is the diastolic or resting pressure. If repeated checks of blood pressure of an individual result in pressure values around 140/90 mm Hg or higher, it indicates hypertension.

161. Answer (1)

Hint: Eliminate angina pectoris

Sol.:

Heart attack	–	Heart muscles are suddenly damaged by an inadequate blood supply
Cardiac arrest	–	Heart stops beating
Heart failure	–	Heart is not pumping blood effectively enough to meet the body's demand

162. Answer (2)

Hint: Half moon-shaped

Sol.: The openings of the right and the left ventricles into the pulmonary artery and the aorta respectively are provided with the semilunar valves. The opening of the right and left atria into the ventricles is guarded by the tricuspid and bicuspid valves respectively. Bicuspid valve is also known as mitral valve.

163. Answer (1)

Hint: Last wave of ECG from P to T

Sol.: P-wave – Depolarisation of the atria

QRS complex – Depolarisation of the ventricles

T-wave – Repolarisation of the ventricles

164. Answer (2)

Hint: More than ten times the number of fingers in your hands.

Sol.: RBCs are the most abundant of all the cells in blood.

In adult humans, RBCs have an average life span of 120 days.

165. Answer (3)

Hint: Catecholamines increase the heart rate.

Sol.: If the parasympathetic influence on heart is removed, heart will beat at a faster rate.

Adrenal medullary hormones *i.e.*, catecholamines (adrenaline and noradrenaline) increase the cardiac output.

166. Answer (4)

Hint: Diffusion of a gas depends upon its partial pressure.

Sol.: Exchange of gases at the diffusion membrane in human respiratory system is mainly based on

a. Concentration gradient/partial pressure gradient of the gases
b. Thickness of the membrane
c. Solubility of the gases

167. Answer (2)

Hint: Pumping pressure is the systolic pressure.

Sol.: In humans, 120 mm Hg is the systolic or pumping pressure and 80 mm Hg is the diastolic or resting pressure.

168. Answer (2)

Hint: Lumen of arteries is narrower than veins.

Sol.: Each artery and vein consists of three layers: an inner lining of squamous endothelium, the tunica intima, a middle layer of smooth muscle and elastic fibres, the tunica media, and an external layer of fibrous connective tissue with collagen fibres, the tunica externa. The tunica media is comparatively thin in the veins than arteries.

169. Answer (3)

Hint: Medulla oblongata contains respiratory rhythm centre

Sol.: Pneumotaxic centre present in the pons region of the brain can moderate the functions of the respiratory rhythm centre. Neural signals from this centre can reduce the duration of inspiration and thereby alter the respiratory rate.

170. Answer (2)

Hint: Release of CO_2 is the last step.

Sol.: Respiration involves the following steps:

- Atmospheric air is drawn in and CO_2 rich alveolar air is released out. (Pulmonary ventilation)
- Diffusion of gases across alveolar membrane.
- Transport of gases by the blood.
- Diffusion of gases between blood and tissues.
- Utilisation of O_2 by the cells for catabolic reactions and resultant release of CO_2. (Cellular respiration)

171. Answer (2)

Hint: Ventricular diastole decreases ventricular pressure.

Sol.: During the ventricular diastole, the ventricles relax and the ventricular pressure falls, causing the closure of the semilunar valves which prevents the backflow of blood into the ventricles. Atrial diastole coincides with the ventricular systole.

172. Answer (2)

Hint: Functional residual capacity

Sol.: Volume of air that will remain in the lungs after a normal expiration is Functional Residual Capacity (FRC). This includes ERV + RV.

IC + EC – TV = VC

TLC – IC = FRC

TLC – FRC = IC

IC + FRC = TLC

173. Answer (4)

Hint: Equal to the pO_2 in blood of pulmonary vein

Sol.:

Respiratory gas	pO_2 (in mm Hg)	pCO_2 (in mm Hg)
Atmospheric Air	159	0.3
Alveoli	104	40
Blood (Deoxygenated)	40	45
Blood (Oxygenated)	95	40
Tissues	40	45

174. Answer (3)

Hint: Its co-factor is zinc.

Sol.: The RBCs contain a very high concentration of the enzyme, carbonic anhydrase and minute quantities of the same is present in the plasma too.

175. Answer (3)

Hint: Tidal volume

Sol.: Tidal volume is the volume of air inspired or expired during a normal respiration. It is approximately 500 mL.

176. Answer (3)

Hint: Located in medulla oblongata

Sol.: A chemosensitive area is situated adjacent to the respiratory rhythm centre which is highly sensitive to pCO_2 and hydrogen ions. Increase in these substances can activate this centre, which in turn can signal the rhythm centre to make necessary adjustments in the respiratory process by which these substances can be eliminated. Role of O_2 in the regulation of respiratory rhythm is quite insignificant.

177. Answer (2)

Hint: S-shaped curve

Sol.: A sigmoid curve is obtained when percentage saturation of haemoglobin with oxygen is plotted against the pO_2. This curve is called oxygen dissociation curve.

178. Answer (4)

Hint: Feather-like gills

Sol.: Pulmonary respiration is breathing through lungs. Aquatic molluscs respire through specialised feather like gills. Respiration through gills is known as branchial respiration.

179. Answer (2)

Hint: Rh antigen is absent in mother.

Sol.: A special case of Rh incompatibility has been observed between the Rh –ve blood of a pregnant mother with Rh +ve blood of the foetus. Rh antigens of the foetus do not get exposed to the Rh –ve blood of the mother in the first pregnancy as the two bloods are well separated by the placenta.

If the mother is Rh –ve and the first baby is Rh +ve, erythroblastosis foetalis can occur in her subsequent pregnancies.

180. Answer (4)

Hint: Can be measured by a spirometer

Sol.:

- Vital capacity is the maximum volume of air a person can breathe in after a forced expiration.
- Functional residual capacity is the volume of air that will remain in the lungs after a normal expiration.
- Total lung capacity is the total volume of air accommodated in the lungs at the end of a forced inspiration.

181. Answer (1)

Hint: Include structures supported by incomplete cartilaginous rings

Sol.: The part starting with the external nostrils up to the terminal bronchioles constitutes the conducting part whereas the alveoli and their ducts form the respiratory or exchange part of the respiratory system.

The conducting part transports the atmospheric air to the alveoli, clears it from foreign particles, humidifies and also brings the air to body temperature.

182. Answer (1)

Hint: AV valves

Sol.: The first heart sound (lub) is associated with the closure of the tricuspid and bicuspid valves whereas the second heart sound (dub) is associated with the closure of the semilunar valves.

Tricuspid and bicuspid valves prevent the back flow of blood into atria from ventricles.

Semilunar valves prevent the backflow of blood into left ventricle from aorta and into right ventricle from pulmonary artery.

183. Answer (3)

Hint: Blood group 'O' is the universal donor.

Sol.:

Blood Group	A	B	AB	O
Antigens on RBCs	A	B	A, B	Nil
Antibodies in Plasma	Anti-B	Anti-A	Nil	Anti-A, B
Donor's Group	A, O	B, O	AB, A, B, O	O

184. Answer (3)

Hint: Amphibians and reptiles have 3-chambered heart.

Sol.: In reptiles, the left atrium receives oxygenated blood from the lungs.

During a cardiac cycle, the blood pumped out by each ventricle is approximately 70 mL, known as the stroke volume.

Neural signals through the sympathetic nerves can increase the rate of heart beat, the strength of ventricular contraction and thereby the cardiac output.

185. Answer (2)

Hint: A respiratory pigment.

Sol.: A healthy human breathes 12-16 times/ minute.

Proteins contribute about 6-8 per cent in blood plasma.

12-16 gms of haemoglobin is present in every 100 mL of blood a healthy adult human.

Monocytes form 6-8% of the total WBCs.

Our heart normally beats 70-75 times in a minute.

SECTION - B

186. Answer (1)

Hint: Bicephalic structure

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

187. Answer (1)

Hint: 4-chambered heart

Sol.: Two separate pathways *i.e.*, pulmonary and systemic circulation are present in mammals and birds. Mixing of oxygenated and deoxygenated blood does not occur in double circulation. In fishes, single circulation is present while in amphibians and reptiles (except crocodile), incomplete double circulation is present.

188. Answer (3)

Hint: Includes RV

Sol.: Residual volume cannot be measured by a simple spirometer.

FRC = ERV + RV

TLC = TV + IRV + ERV + RV

So, RV, FRC and TLC cannot be measured by a simple spirometer.

189. Answer (3)

Hint: SA node

Sol.: SAN is present in the right upper corner of the right atrium. It has the ability to generate action potentials without any external stimulus.

190. Answer (2)

Hint: Phagocytic granulocytes constitute 60-65% of total WBCs.

Sol.: Neutrophils (60-65%) and monocytes (6-8%) are phagocytic cells which destroy the foreign organisms entering the human body. Monocytes are agranulocytes.

Lymphocytes (20-25%) are responsible for immune responses of the body.

Eosinophils (2-3%) resist infections and are also associated with allergic reactions.

191. Answer (3)

Hint: We cannot directly alter the pulmonary volume.

Sol.: The anatomical set up of lungs in thorax is such that any change in the volume of the thoracic cavity will be reflected in the pulmonary cavity. We have two lungs which are covered by a double layered pleura. The outer pleural membrane is in close contact with the thoracic lining whereas the inner pleural membrane is in contact with the lung surface.

192. Answer (4)

Hint: Decrease in intrapulmonary pressure

Sol.: During inspiration, the contraction of diaphragm increases the volume of thoracic chamber in the antero-posterior axis and the contraction of external inter-costal muscles lifts up the ribs and sternum causing an increase in the volume of the thoracic chamber in the dorso-ventral axis.

193. Answer (1)

Hint: The diffusion membrane is composed of 2 cellular and a single acellular layer.

Sol.: The diffusion membrane is made up of three layers namely, the thin squamous epithelium of alveoli, the endothelium of alveolar capillaries and the basement substance (composed of thin basement membrane supporting the squamous epithelium and the basement membrane surrounding the single layer endothelial cells of capillaries) in between them.

194. Answer (1)

Hint: Platelets are involved in the coagulation of blood.

Sol.: Calcium ions, prothrombin, thrombocytes, fibrinogens, tissue factors and platelet factors are involved in the coagulation of blood.

195. Answer (2)

Hint: Devoid of oxygen carrying molecule.

Sol.: As the blood passes through the capillaries in tissues, some water along with many small water soluble substances move out into the spaces between the cells of tissues leaving the larger proteins and most of the formed elements in the blood vessels. This fluid released out is called the interstitial fluid or tissue fluid.

Lymph is a colourless fluid containing specialised lymphocytes which are responsible for the immune responses of the body.

196. Answer (3)

Hint: Prawns perform branchial respiration.

Sol.: Specialised vascularised structures called gills (branchial respiration) are used by most of the aquatic arthropods and molluscs whereas vascularised bags called lungs (pulmonary respiration) are used by the terrestrial vertebrates for the exchange of gases.

197. Answer (2)

Hint: Specifically for heart muscles.

Sol.: A special neural centre in the medulla oblongata can moderate the cardiac functions through autonomic nervous system (ANS). The systemic circulation provides nutrients, O_2 and other essential substances to the tissues and takes CO_2 and other harmful substances away for elimination.

Silicosis is an occupational respiratory disorder.

198. Answer (3)

Hint: Binding of oxygen with haemoglobin is primarily related to pO_2.

Sol.: In the alveoli, high pO_2 low pCO_2, lesser H^+ concentration and lower temperature, are all favourable for the formation of oxyhaemoglobin whereas in tissues, low pO_2, high pCO_2, high H^+ concentration and higher temperature exist, which favour the dissociation of oxygen from the oxyhaemoglobin.

199. Answer (4)

Hint: Additional volume of air a person can inspire

Sol.:

1. Total volume of air a person can inspire after a normal expiration is inspiratory capacity (3000-3500 mL).
2. The maximum volume of air a person can breathe in after a forced expiration is vital capacity (4000-4600 mL).
3. Volume of air remaining in the lungs even after a forcible expiration is residual volume (1100-1200 mL).

200. Answer (4)

Hint: Oxygenated blood is present in pulmonary vein.

Sol.: Every 100 mL of oxygenated blood can deliver around 5 mL of O_2 to the tissues under normal physiological conditions.

Thus, 500 mL of oxygenated blood will deliver 25 mL of O_2 to the tissues.

❑ ❑ ❑

All India Aakash Test Series for NEET - 2025

TEST - 2 (Code-F)

For Code-E Sol. Click here

Test Date : 24/11/2024

ANSWERS

1.	(2)	41.	(4)	81.	(2)	121.	(2)	161.	(1)
2.	(1)	42.	(1)	82.	(1)	122.	(3)	162.	(2)
3.	(4)	43.	(3)	83.	(3)	123.	(1)	163.	(1)
4.	(1)	44.	(4)	84.	(1)	124.	(1)	164.	(2)
5.	(1)	45.	(2)	85.	(4)	125.	(4)	165.	(3)
6.	(2)	46.	(3)	86.	(4)	126.	(4)	166.	(4)
7.	(4)	47.	(1)	87.	(4)	127.	(1)	167.	(2)
8.	(4)	48.	(2)	88.	(4)	128.	(1)	168.	(2)
9.	(4)	49.	(1)	89.	(1)	129.	(2)	169.	(3)
10.	(1)	50.	(3)	90.	(1)	130.	(4)	170.	(2)
11.	(4)	51.	(4)	91.	(2)	131.	(4)	171.	(2)
12.	(2)	52.	(1)	92.	(2)	132.	(3)	172.	(3)
13.	(4)	53.	(3)	93.	(2)	133.	(3)	173.	(3)
14.	(4)	54.	(2)	94.	(3)	134.	(3)	174.	(1)
15.	(3)	55.	(4)	95.	(2)	135.	(2)	175.	(1)
16.	(4)	56.	(1)	96.	(3)	136.	(3)	176.	(4)
17.	(3)	57.	(3)	97.	(1)	137.	(1)	177.	(2)
18.	(1)	58.	(4)	98.	(3)	138.	(1)	178.	(4)
19.	(3)	59.	(3)	99.	(2)	139.	(3)	179.	(2)
20.	(3)	60.	(1)	100.	(2)	140.	(3)	180.	(3)
21.	(4)	61.	(1)	101.	(3)	141.	(4)	181.	(3)
22.	(4)	62.	(2)	102.	(4)	142.	(4)	182.	(3)
23.	(4)	63.	(1)	103.	(3)	143.	(1)	183.	(4)
24.	(2)	64.	(2)	104.	(1)	144.	(2)	184.	(2)
25.	(3)	65.	(2)	105.	(3)	145.	(3)	185.	(2)
26.	(4)	66.	(3)	106.	(3)	146.	(1)	186.	(4)
27.	(3)	67.	(3)	107.	(4)	147.	(4)	187.	(4)
28.	(3)	68.	(3)	108.	(1)	148.	(1)	188.	(3)
29.	(4)	69.	(1)	109.	(4)	149.	(4)	189.	(2)
30.	(2)	70.	(1)	110.	(4)	150.	(3)	190.	(3)
31.	(4)	71.	(4)	111.	(1)	151.	(3)	191.	(2)
32.	(3)	72.	(4)	112.	(1)	152.	(1)	192.	(1)
33.	(2)	73.	(3)	113.	(4)	153.	(4)	193.	(1)
34.	(1)	74.	(2)	114.	(3)	154.	(1)	194.	(4)
35.	(2)	75.	(1)	115.	(3)	155.	(4)	195.	(3)
36.	(2)	76.	(2)	116.	(3)	156.	(4)	196.	(2)
37.	(2)	77.	(1)	117.	(3)	157.	(3)	197.	(3)
38.	(2)	78.	(2)	118.	(3)	158.	(2)	198.	(3)
39.	(3)	79.	(4)	119.	(2)	159.	(3)	199.	(1)
40.	(1)	80.	(1)	120.	(3)	160.	(4)	200.	(1)

HINTS & SOLUTIONS

[PHYSICS]

SECTION - A

1. Answer (2)

Hint: Use, $v_{max} = \sqrt{\mu rg}$

Sol.: $v_{max} = \sqrt{0.5 \times 5 \times 10} = 5$ m/s

2. Answer (1)

Hint and Sol.: In this explosion, total linear momentum of the system must be conserved.

3. Answer (4)

Hint: $F_{net} = ma$, $f_{max} = \mu N$, $F_{applied} - f_{max} = ma$

Sol.: $a = 0$, when $F_{applied} = 5$ N

$F_{net} = ma$	$a = 1$ m/s^2
$F_{net} = 0$	$F_{applied} = 6$ N
$5 - f_{max} = 0$	$F_{net} = ma$
$f_{max} = 5$ N	$6 - 5 = m \times 1$
	$m = 1$ kg

4. Answer (1)

Hint and Sol.: In equilibrium position, $F_{net} = 0$

$\Rightarrow \quad F = K \cdot x_0$

$\Rightarrow \quad x_0 = \dfrac{F}{K}$

5. Answer (1)

Hint: Use work energy theorem

Sol.: $\dfrac{1}{2}Mv^2 = F \times \delta_1 \Rightarrow \dfrac{M_1}{\delta_1} = \dfrac{M_2}{\delta_2} \Rightarrow \dfrac{\delta_1}{\delta_2} = \dfrac{M_1}{M_2}$

6. Answer (2)

Hint and Sol: Impulse = Force × time

= Change in momentum

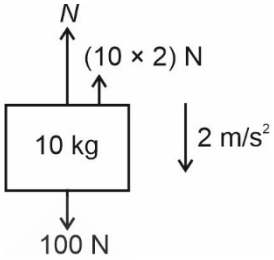
7. Answer (4)

Hint and Sol.: Action and reaction act on different bodies and they cannot be cancelled out.

8. Answer (4)

Hint : The pseudo force acts in direction opposite to the acceleration of the frame and magnitude is equal to mass of object multiplied by acceleration of frame.

Sol. : With respect to elevator frame, $F_{net} = 0$



$N + ma_0 = mg$

$N = mg - ma_0 = 10 \times (10 - 2) = 80$ N

9. Answer (4)

Hint and Sol: When two particles of equal masses perform head on elastic collision, then after collision their velocities get exchanged.

$v_A = 0$

$v_B = 10$ m/s

10. Answer (1)

Hint and Sol.: Static friction is a self-adjusting force and not kinetic friction.

11. Answer (4)

Hint and Sol: 1 J = 10^7 erg

1 eV = 1.6×10^{-19}J

1 kWh = 3.6×10^6J

1 H.P = 746 watt

12. Answer (2)

Hint: Scalar product, $\vec{A} \cdot \vec{B} = AB\cos\theta$

Sol.: Since scalar product is zero

$\Rightarrow \theta = 90°$

13. Answer (4)

Hint: Use, $F = -\dfrac{dU}{dx}$

Sol.: $F = -2x + 5$

$F_{(x = 1\text{ m})} = -2 + 5 = 3$ N

14. Answer (4)

Hint: Use work energy theorem

Sol.: $W_g + W_f = \dfrac{1}{2}m(v_f^2 - v_i^2)$

$mg(h + x) - Fx = 0$

$1 \times 10\ (10 + 2) = F \times 2$

$120 = F \times 2$

$\boxed{F = 60\text{ N}}$

15. Answer (3)

Hint: WD = $\Delta K.E.$

Sol.: $\text{W.D.} = \frac{1}{2}mv^2$

$mg(h_1 - h_2) = \frac{1}{2}mv^2$

$m \times 10 \times 80 = \frac{1}{2}mv^2$

$v = \sqrt{2gh}$

$v = \sqrt{2gh} = \sqrt{2 \times 10 \times 80} = \sqrt{1600} = 40$ m/s

16. Answer (4)

Hint: Properties of dot product.

Sol.:

(i) Dot product is commutative $\vec{A} \cdot \vec{B} = \vec{B} \cdot \vec{A}$

(ii) Dot product is distributive
$\vec{A} \cdot (\vec{B} + \vec{C}) = \vec{A} \cdot \vec{B} + \vec{A} \cdot \vec{C}$

(iii) $\vec{A} \cdot \vec{A} = A^2$

17. Answer (3)

Hint: $f_{s,\max} = \mu N$

Sol.: $F = f_{s,\max}$

$= \mu mg$

$= 0.4 \times 6 \times 10$

$= 24$ N

18. Answer (1)

Hint and Sol.: Inertial frame is unaccelerated frame where Newton's laws of motion can be applied.

19. Answer (3)

Hint and Sol.: The S.I. unit of power is watt.

20. Answer (3)

Hint: Use conservation of mechanical energy.

Sol.: $K_{max} = mgh$

$= mg[L - L\cos\theta]$

$= 2 \times 10 \times 1 \times \left[1 - \frac{1}{2}\right]$

$= 10$ J

21. Answer (4)

Hint: $W = \vec{F} \cdot \vec{r}$

Sol.: $W = \left(2\hat{i} + 3\hat{j}\right) \cdot (2\hat{k})$

$= 0$

22. Answer (4)

Hint and Sol.: If a body is in equilibrium under the action of three forces, then their resultant is zero and they form a closed triangle, so they are coplanar.

23. Answer (4)

Hint: $T = \frac{M}{L}(L - y)g$ (for distance y from ceiling)

Sol.: $T = Mg\left[1 - \frac{y}{L}\right]$

$= 10 \times 10\left[1 - \frac{1}{2 \times 2}\right]$

$= 100\left[\frac{3}{4}\right]$

$= 75$ N

24. Answer (2)

Hint: $P = \vec{F} \cdot \vec{v}$

Sol.: $x = 5t - 12$

$v = \frac{dx}{dt} = 5$ m/s

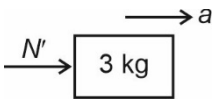
$\Rightarrow P = 10 \times 5$

$= 50$ W

25. Answer (3)

Hint: Use $a = \frac{F_{\text{net}}}{\text{Total mass}}$

Sol.: $a = \frac{F}{m_1 + m_2} = \frac{30}{5} = 6$ m/s^2



$N' = 3 \times 6 = 18$ N

26. Answer (4)

Hint: $E_K = \frac{P^2}{2m}$

Sol.: $\sqrt{E_K} \propto P$

$\sqrt{E_K} \times \frac{1}{P} =$ constant

$\therefore$ Curve between $\sqrt{E_K}$ and $\frac{1}{P}$ is a rectangular hyperbola.

27. Answer (3)

Hint: Use, $v_n = e^n\sqrt{2gh}$

Sol.: $20 = e^3\sqrt{2\times10\times20}$

$20 = e^3 \times 20$

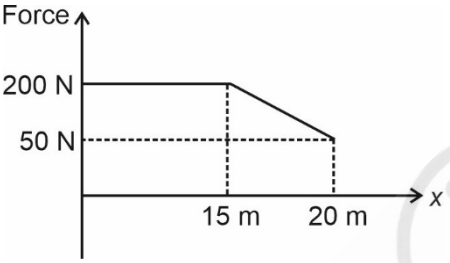
$e^3 = 1$

$e = 1$

28. Answer (3)

Hint: Work = Area under force-displacement curve.

Sol.:



W.D = Area under *F*-*x* curve

$= 15\times200 + \frac{1}{2}\times(200+50)\times5$

$= 3000 + \frac{1}{2}\times250\times5$

= 3000 + 625 = 3625 J

29. Answer (4)

Hint: $\vec{A}\cdot\vec{B} = A\cdot B\cos\theta$

Sol.: $A\cos\theta = \frac{\vec{A}\cdot\vec{B}}{|\vec{B}|}$

$A\cos\theta = \frac{1+2+3}{\sqrt{3}}$

$= 2\sqrt{3}$

30. Answer (2)

Hint: $|\vec{F}_{avg}| = \frac{|\Delta\vec{P}|}{\Delta t}$

Sol.: $v = \sqrt{2gh}$

$\Delta P = m\sqrt{2gh}$

$t = \sqrt{\frac{2h}{g}}$

$\vec{F}_{avg} = \frac{m\sqrt{2gh}}{\sqrt{\frac{2h}{g}}}$

$= mg$

31. Answer (4)

Hint: Use, $F_{net} = ma$

Sol.: As net force acting on object is zero,

$\therefore \quad \vec{a} = \vec{0},\ s = ut + \frac{1}{2}at^2$

$= 5 \times 5 = 25$ m

32. Answer (3)

Hint and Sol.: $F_{ext} = ma$

Acceleration of a particle depends only on the force that is acting at that instant.

33. Answer (2)

Hint: $W = \vec{F}\cdot\vec{s}$

Sol.: $W = \vec{F}\cdot\vec{s}$

$= Fs\cos\theta$

Work done is positive as $\theta = 0°$

34. Answer (1)

Hint and Sol.: $\vec{F} = \frac{\Delta\vec{P}}{\Delta t}$

Since time is fixed, hence $\vec{F} \propto \Delta\vec{P}$

35. Answer (2)

Hint: Use Newton's second law of motion.

Sol.: If the net external force on a body is zero, its acceleration is zero.

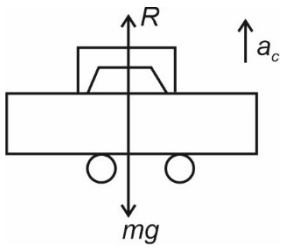
Acceleration can be non-zero only if there is a net external force on the body.

SECTION - B

36. Answer (2)

Hint: Use, $F_{centripetal} = \frac{mv^2}{r}$

Sol.:



$R - mg = \frac{mv^2}{r}$

$$R = mg + \frac{mv^2}{r}$$

Clearly $R > mg$

i.e. the weight of the moving car is greater than the weight of stationary car.

37. Answer (2)

Hint and Sol.:

$$\Rightarrow \quad a = \frac{m_2 g - m_1 g}{m_1 + m_2}$$

And $T - m_1 g = m_1 a$

$\Rightarrow \quad T = m_1[a + g]$

$$\Rightarrow \quad T = \frac{2m_1 m_2 g}{m_1 + m_2}$$

38. Answer (2)

Hint and Sol.: The condition for leaving the circle would be $\sqrt{2gR} < u < \sqrt{5gR}$

39. Answer (3)

Hint: $F_{net} = ma$

Sol.: Since, there are no nearby stars to exert gravitational force on her and the small spaceship exerts negligible gravitational attraction on her, the net force acting on her is zero.

So, a = zero.

40. Answer (1)

Hint: Use work energy theorem.

Sol.: $W = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$

$$v = \frac{dx}{dt}$$

$= t$

$$W = \frac{1}{2} \times 4 \times (4^2 - 2^2)$$

$= 2 \times 12$

$= 24$ J

41. Answer (4)

Hint and Sol.: Coefficient of friction is independent of normal reaction.

42. Answer (1)

Hint and Sol.: When a horse starts suddenly, the rider falls backwards due to inertia of rest.

43. Answer (3)

Hint: Use, $\tan\alpha = \frac{\tan\theta}{e}$

Sol.: $\tan\alpha = \frac{\tan 30^\circ}{\frac{1}{2}}$

$$\tan\alpha = \frac{2}{\sqrt{3}}$$

$$\alpha = \tan^{-1}\left(\frac{2}{\sqrt{3}}\right)$$

44. Answer (4)

Hint and Sol.: In elastic collision loss in kinetic energy will be zero.

45. Answer (2)

Hint and Sol.: $A(B\cos\theta) = \vec{A} \cdot \vec{B}$

Scalar product obey commutativity and distributivity.

46. Answer (3)

Hint and Sol.: K.E of 1 bullet = k

$\therefore$ For n bullets K.E = nk.

Change in K.E. of bullets = W.D. by machine gun.

47. Answer (1)

Hint and Sol.: Potential energy decreases and kinetic energy increases when height of particle decreases.

48. Answer (2)

Hint and Sol.: For perfectly inelastic collision $e = 0$

49. Answer (1)

Hint: Momentum, $P = mv$

Sol.: $\vec{P_i} = mv\hat{i}$ and $\vec{P_f} = mv\hat{j}$

$$\Delta\vec{P} = mv\hat{j} - mv\hat{i} \Rightarrow \left|\Delta\vec{P}\right| = \sqrt{2}mv$$

50. Answer (3)

Hint: Area under $F - t$ curve equals change in momentum

Sol.: Area under curve = Zero

Change in momentum = Zero

Final velocity = Zero

[CHEMISTRY]

SECTION - A

51. Answer (4)

Hint: $N_2 : (\sigma 1s)^2 \ (\sigma^* 1s)^2 \ (\sigma 2s)^2 \ (\sigma^* 2s)^2$

$(\pi 2p_x^2 = \pi 2p_y^2)(\sigma 2p_z^2)$

Sol.: In N_2^- the added electron will go to π^*2p_x or π^*2p_y molecular orbital.

52. Answer (1)

Hint: (σ1s) orbital does not contain any node.

Sol.: (σ^*1s) orbital has one node.

53. Answer (3)

Hint: σ-bond is formed using σ molecular orbital

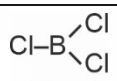
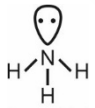
Sol.: **Molecules**	**Nature of bond**
B_2	1π bond
C_2	2π bond
H_2	1σ bond
N_2	1σ and 2π bonds

N_2 (electronic configuration): $(\sigma 1s)^2$ $(\sigma^*1s)^2$ $(\sigma 2s)^2$ $(\sigma^*2s)^2$ $(\pi 2p_x^2 = \pi 2p_y^2)(\sigma 2p_z^2)$

54. Answer (2)

Hint: Bond angle depends on hybridisation of central atom and number of lone pairs on central atom.

Sol.:

Molecules	**Shape**	**Hybridisation**	**Bond angle**
CO_2	O = C = O Linear	*sp*	180°
BCl_3	 Trigonal planar	sp^2	120°
NH_3	 Pyramidal	sp^3	107°
H_2O		sp^3	104.5°

55. Answer (4)

Hint: Al_2O_3 reacts both with acid and base.

Sol.: **Compounds**	**Chemical nature**
NO	Neutral
Al_2O_3	Amphoteric
Na_2O	Basic
SO_2	Acidic

56. Answer (1)

Hint: Down the group ionic radii increases.

Sol.: **Ions**	**Radii (pm)**
Li^+	76
Na^+	102
Be^{2+}	31
Mg^{2+}	72

57. Answer (3)

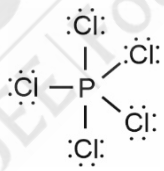
Hint: Bond order = $\frac{1}{2}(N_b - N_a)$

Sol.: **Species**	**Bond order** $\frac{1}{2}(N_b - N_a)$
O_2	$\frac{1}{2}(10-6) = 2$
O_2^+	$\frac{1}{2}(10-5) = 2.5$
O_2^-	$\frac{1}{2}(10-7) = 1.5$

58. Answer (4)

Hint: In PCl_5 molecule, axial bond pairs suffer more repulsive interaction from the equatorial bond pair.

Sol.:



- P in PCl_5 is sp^3d hybridised.
- As the axial bond pairs suffer more repulsive interaction from equatorial bond pairs, therefore axial bonds have been found to be slightly longer and hence slightly weaker than the equatorial bonds.

59. Answer (3)

Hint: Element below silicon and aluminium are called Eka-silicon and Eka-aluminium respectively.

Sol.: Gallium (Ga) is Eka-aluminium while Germanium (Ge) is Eka-silicon.

60. Answer (1)

Hint: Ca, Sr, and Ba are a set of Dobereiner's triad

Sol.: Given set of elements belong to Dobereiner triad

- Li, Na, K
- Ca, Sr, Ba
- Cl, Br, I

61. Answer (1)

Hint: Neptunium comes after uranium in periodic table

Sol.: Samarium is a lanthanoid element

62. Answer (2)

Hint: The dipole moment of molecules depend on bond dipoles as well as shape of the molecules.

Sol.:

Molecules	Shape	Dipole moment (μ)(D)
H_2O	Bent	1.85
NH_3	Pyramidal	1.47
H_2S	Bent	0.95
BF_3	Trigonal-planar	0

63. Answer (1)

Hint: The species in which the central atoms have same hybridisation having same number of bond pairs and lone pairs will be isostructural.

Sol.:

Species	Hybridisation	Shape
SO_4^{2-}	sp^3	Tetrahedral
PO_4^{3-}	sp^3	Tetrahedral
XeF_4	sp^3d^2	Square planar
SF_4	sp^3d	See – Saw
NO_3^-	sp^2	Trigonal planar
SO_3^{2-}	sp^3	Pyramidal
BF_3	sp^2	Trigonal planar
NF_3	sp^3	Pyramidal

64. Answer (2)

Hint: For alkali metals, down the group the ionisation enthalpy decreases

Sol.:

Metal	Δ_iH (kJ mol^{-1})
Na	496
K	419
Rb	403
Cs	374

65. Answer (2)

Hint: Electronic configuration of O_2

$O_2 : (\sigma 1s)^2(\sigma^*1s)^2(\sigma 2s)^2(\sigma^*2s)^2(\sigma 2p_z)^2$

$\left(\pi 2p_x^2 = \pi 2p_y^2\right)\ \left(\pi^* 2p_x^1 = \pi^* 2p_y^1\right)$

Sol.: $O_2^- : (\sigma 1s)^2(\sigma^*1s)^2(\sigma 2s)^2(\sigma^*2s)^2(\sigma 2p_z)^2$

$\left(\pi 2p_x^2 = \pi 2p_y^2\right)\ \left(\pi^* 2p_x^2, \pi^* 2p_y^1\right)$

Number of bonding electrons = 10

Number of antibonding electrons = 7

66. Answer (3)

Hint: In ethyne, carbon-carbon triple bond is present

Sol.: H—C ≡ C—H

Ethyne consists of 3σ-bonds and 2 pi bonds.

67. Answer (3)

Hint: *s* and *p*-block elements are called representative elements

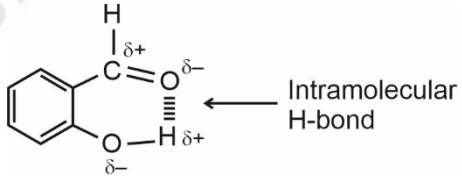
Sol.: Zn, Cd, Ti and Cu are *d*-block elements

- Bi and Pb are *p*-block elements
- Nd is *f*-block element
- Ba is *s*-block element

68. Answer (3)

Hint: Intramolecular hydrogen bond is formed when hydrogen atom is in between the two highly electronegative (F, O, N) atoms

Sol.:



69. Answer (1)

Hint: The species which contains unpaired electron is paramagnetic in nature

Sol.: $O_2 : (\sigma 1s)^2(\sigma^*1s)^2(\sigma 2s)^2(\sigma^*2s)^2(\sigma 2p_z)^2(\pi 2p_x^2 = \pi 2p_y^2)\ (\pi^*2p_x^1\pi^*2p_y^1)$

$N_2 : (\sigma 1s)^2(\sigma^*1s)^2(\sigma 2s)^2(\sigma^*2s)^2(\pi 2p_x^2 = \pi 2p_y^2)(\sigma 2p_z)^2$

$C_2 : (\sigma 1s)^2(\sigma^*1s)^2(\sigma 2s)^2(\sigma^*2s)^2(\pi 2p_x^2 = \pi 2p_y^2)$

$H_2 : (\sigma 1s)^2$

O_2 contains two unpaired electrons.

70. Answer (1)

Hint: Smaller is the size of atoms, smaller is the bond length

Sol.: Atomic size order: C > O > H

Correct order of bond length:

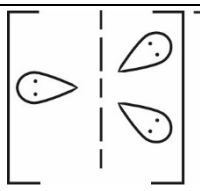
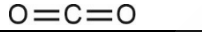
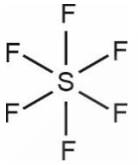
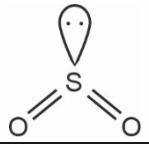
C–C > C–O > C–H > O–H

Bond type	Bond length (pm)
C–C	154
C–O	143
C–H	107
O–H	96

71. Answer (4)

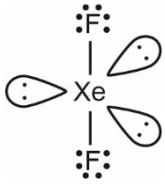
Hint: 180° bond angle is possible for *sp*, sp^3d^2 and sp^3d hybridisations.

Sol.:

Species	Hybridisation	Bond angle
I_3^-		180°
CO_2		180°
SF_6		90°, 180°
SO_2		119°

72. Answer (4)

Hint: Hybridisation of Xe in XeF_2 is sp^3d.

Sol.: 

Total number of lone pairs = 9

73. Answer (3)

Hint: If the bond order is zero, the species will not exist.

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

Sol.: In He_2 and Be_2 molecules the bond order is zero. The total number of bonding electrons are equal to the total number of anti-bonding electrons.

He_2 : $(\sigma 1s)^2(\sigma^* 1s)^2$

Be_2 : $(\sigma 1s)^2(\sigma^* 1s)^2(\sigma 2s)^2(\sigma^* 2s)^2$

74. Answer (2)

Hint: The bond formed, as a result of the electrostatic attraction between the positive and negative ions is called as ionic bond.

Sol.: Covalent bonds are formed by the sharing of electron pairs between the two atoms.

- NaBr contains only ionic bond
- CCl_4 and SO_3 contain only covalent bonds
- Na_2SO_4 contains both ionic and covalent bonds.

75. Answer (1)

Hint and Sol.: The covalent radius is measured approximately as the radius of an atom's core which is in contact with the core of an adjacent atom in a bonded situation.

76. Answer (2)

Hint: More is the effective nuclear charge, lesser is the size of atoms.

Sol.: Along a period, as the effective nuclear charge increases, the size of atom decreases.

77. Answer (1)

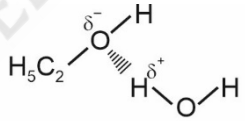
Hint: Metalloids show properties which are characteristics of metals and non-metals.

Sol.:

- Group-16 elements are called chalcogens.
- Rubidium is *s*-block element while indium is *p*-block element.

78. Answer (2)

Hint: Ethyl alcohol forms H–bond with water.

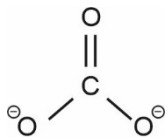
Sol.: 

Intermolecular H-bond

Ethanol forms intermolecular H-bond with water hence it dissolves in water.

79. Answer (4)

Hint: Bond order = $\frac{\text{Total number of bonds } (\sigma+\pi)}{\text{Number of } \sigma\text{-bonds}}$

Sol.: 

Bond order of C – O in $CO_3^{2-} = \frac{4}{3} = 1.33$

80. Answer (1)

Hint: IUPAC official name of element with atomic number 103 is Lawrencium.

Sol.:

	Atomic number		IUPAC official name
a.	107	(i)	Bohrium
b.	103	(ii)	Lawrencium
c.	105	(iii)	Dubnium
d.	104	(iv)	Rutherfordium

81. Answer (2)

Hint: In octet rule, atoms combine by sharing of valence electrons in order to have an octet in their valence shells.

Sol.:

- NO_2 and NO are odd-electron molecules.
- Expanded octet is observed in PF_5, H_2SO_4 and SF_6
- CH_4, N_2 and CO_2 follow octet rule

82. Answer (1)

Hint: Acidic oxide on reaction with water forms acid.

Sol.:

- $Cl_2O_7 + H_2O \rightarrow 2HClO_4$
- Cl_2O_7 is an acidic oxide

83. Answer (3)

Hint: For alkali metals, down the group negative electron gain enthalpy decreases.

Sol.:

Elements	$\Delta_{eg}H$ (kJ mol^{-1})
Li	–60
Na	–53
O	–141
S	–200

84. Answer (1)

Hint: Along the period, electronegativity increases while down the group it decreases.

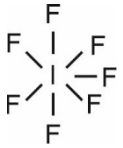
Sol.:

Elements	Electronegativity (on Pauling scale)
C	2.5
B	2.0
Si	1.8
Al	1.5

85. Answer (4)

Hint: IF_7 has seven bond pairs and no lone pair

Sol.:



- Central atom is sp^3d^3 hybridised.
- Shape of the molecule is pentagonal bipyramidal.

SECTION - B

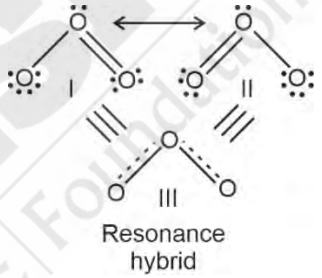
86. Answer (4)

Hint and Sol: For cations of same size and charge, the one with electronic configuration $(n-1)d^{10}ns^2$ is more polarising than the one with noble gas configuration, $ns^2\ np^6$.

87. Answer (4)

Hint: Energy of O_3 resonance hybrid is lower than either of the two canonical forms

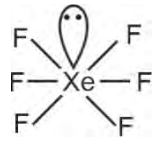
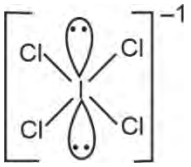
Sol.: O_3 is a resonance hybrid of two canonical structure

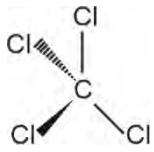
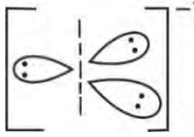


88. Answer (4)

Hint: In CCl_4 , all the valence electrons of carbon are involved in bond formation.

Sol.:

Species	Shape	Number of lone pair(s) on central atom
XeF_6		1
$[ICl_4]^-$		2

CCl_4		0
I_3^-		3

89. Answer (1)

Hint: In endothermic process, the energy is absorbed.

Sol.:

Process	$\Delta_{eg}H$(kJ mol^{-1})
$Ne \longrightarrow Ne^-$	116
$Br \longrightarrow Br^-$	–325
$Rb \longrightarrow Rb^-$	–47
$Te \longrightarrow Te^-$	–190

Electron gain enthalpy of inert gases is positive.

90. Answer (1)

Hint: The occupied molecular orbital which has highest energy is called highest occupied molecular orbital

Sol.: O_2^- electronic configuration

$$(\sigma 1s)^2(\sigma^* 1s)^2(\sigma 2s)^2(\sigma^* 2s)^2(\sigma 2p_z)^2(\pi 2p_x^2 = \pi 2p_y^2)$$

$$(\pi^* 2p_x^2 = \pi^* 2p_y^1)$$

91. Answer (2)

Hint:

- Percentage ionic character = $\frac{\mu_{observed}}{\mu_{calculated}} \times 100$
- 1D = 3.33×10^{-30} Cm

Sol.: $\mu_{observed} = 0.8 \times 3.33 \times 10^{-30}$ Cm

$\mu_{calculated} = 1.602. \times 10^{-19} \times 100 \times 10^{-12}$ Cm

$= 1.6 \times 10^{-29}$ Cm

Percentage ionic character

$$= \frac{0.8 \times 3.33 \times 10^{-30} \times 100}{1.6 \times 10^{-29}}$$

$= 1.665 \times 10 = 16.65\%$

92. Answer (2)

Hint: For the given elements, the nearest inert gas is neon (Ne). Total electrons in Ne is 10

Sol.: For isoelectronic species more is the negative charge on ion larger is its ionic size. Correct order of ionic size : $O^{2-} > F^- > Na^+ > Mg^{2+}$

93. Answer (2)

Hint: Central atom in SF_6 is sp^3d^2 hybridised

Sol.: 

Maximum atoms lie in a plane are 5.

94. Answer (3)

Hint: In a period the electronegativity generally increases as we move from left to right

Sol.: Correct order of electronegativity value of the third period elements

Cl > S > P > Si > Al > Mg > Na

95. Answer (2)

Hint: 17 group elements are called halogens

Sol.:

Vanadium $\longrightarrow$ Transition metal

Iodine $\longrightarrow$ Halogen

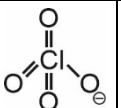
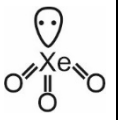
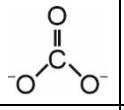
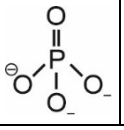
Cerium $\longrightarrow$ Lanthanoid

Thorium $\longrightarrow$ Actinoid

96. Answer (3)

Hint: For the formation of pπ-dπ bond one of the atom should contain electron in d-orbital.

Sol.:

Species	Shape	Number of pπ-dπ bonds
ClO_4^-		3
XeO_3		3
CO_3^{2-}		0
PO_4^{3-}		1

97. Answer (1)

Hint: Few elements of second and third period present diagonally show similarity in their properties and are said to be diagonally related.

Sol.: Li and Mg; Be and Al; show diagonal relationship with each other.

98. Answer (3)

Hint: Intermolecular hydrogen bond is formed between two different molecules of the same or different compounds. In these compounds hydrogen should be bonded to electronegative elements F, N or O.

Sol.: H – S bond polarity in H_2S is not pronounced hence intermolecular H-bond is absent in H_2S.

99. Answer (2)

Hint: Oxidation state of fluorine in its compound is –1

Sol.:

- In OF_2 the oxidation state of oxygen is +2
- p_π-p_π bond is present in $N_2(N \equiv N)$ molecule.

100. Answer (2)

Hint: Number of π-electrons is equal to twice the number of π-bonds

Sol.: Number of π bonds = 5

Number of π electron = 5 × 2 = 10

[BOTANY]

SECTION-A

101. Answer (3)

Hint: Floral formula of Solanaceae family is $\oplus ♀ ♂ K_{(5)} \overset{\frown}{C_{(5)}} A_5 \underline{G}_{(2)}$

Sol.: Potato, *Petunia* and belladonna belongs to Solanaceae family. Sugarcane, wheat and maize belong to Poaceae family. Mustard belongs to Brassicaceae family.

102. Answer (4)

Hint: When stamens are united into more than two bundles, it is called polyadelphous, e.g., *Citrus*.

Sol.: Monoadelphous condition is found in China rose and diadelphous condition is found in pea.

103. Answer (3)

Hint: The hilum is a scar on the seed coat through which the developing seeds were attached to the fruit.

Sol.: Nucellus remains persistent in some seeds called perisperm.

104. Answer (1)

Hint: Epiphyllous condition of androecium is found in lily.

Sol.: When stamen is attached to the petal, it is called epipetalous.

105. Answer (3)

Sol.: In maturation zone, some of the epidermal cells form very fine and delicate, thread like structures called root hairs.

106. Answer (3)

Hint: China rose shows axile placentation.

Sol.: Marginal placentation – Pea

Parietal placentation – *Argemone*, mustard

107. Answer (4)

Hint: In apocarpous condition, carpels are free.

Sol.: Lotus and rose are example of flowers having apocarpous gynoecium.

108. Answer (1)

Hint: Inflorescence is the arrangement of flowers on the floral axis.

Sol.: Ovary bears ovules on a cushion-like structure called placenta.

The arrangement of ovules on placenta within the ovary is known as placentation.

109. Answer (4)

Hint: In acropetal succession, younger flowers are present towards the apex and the older flowers are present at the base.

Sol.: Radish, lupin and mustard show acropetal succession of flowers.

Dianthus shows basipetal succession of flowers.

110. Answer (4)

Hint: Root synthesises plant growth regulators.

Sol.: The food manufactured in leaves is transported to roots, fruits and organs of storage through stem.

111. Answer (1)

Hint: In cymose inflorescence, the flowers are borne in a basipetal order.

Sol.: In cymose inflorescence, the main axis terminates into a flower hence is limited in growth.

112. Answer (1)

Hint: *Calotropis* shows valvate aestivation in corolla.

Sol.: Twisted aestivation – Cotton

Imbricate aestivation – *Cassia*

Vexillary aestivation – Pea

113. Answer (4)

Hint: In radial symmetry, flower can be divided into two equal radial halves in any radial plane passing through the centre.

Sol.: Mustard, *Datura* and chilli are examples of plants having flowers with radial symmetry.

Bean flower shows bilateral symmetry.

114. Answer (3)

Hint: In hypogynous flower, ovary occupies the highest position while the other parts are situated below it.

Sol.: In flowers of mustard and china rose, ovary is superior.

115. Answer (3)

Hint: Calyx is the outermost whorl of the flower and its members are called sepals.

Sol.: Corolla is the second whorl of the flower which is generally brightly coloured, have fragrance and makes the flower more attractive.

116. Answer (3)

Hint: *Claviceps* causes ergot disease.

Sol.: Late blight of potato is caused by *Phytophthora infestans*.

Early blight of potato is caused by *Alternaria solani*.

117. Answer (3)

Hint: Lichens do not grow in polluted areas.

Sol.: Lichens are mutually useful association between algae and fungi. Algae prepare food for fungi and fungi provide shelter and absorb mineral nutrients and water for its partner.

118. Answer (3)

Hint: The causative agent of Cr-Jacob disease is similar in size to viruses.

Sol.: Cr-Jacob disease in humans is caused by prions.

119. Answer (2)

Hint: Euglenoids show mixotrophic mode of nutrition.

Sol.: Euglenoids can perform photosynthesis in the presence of sunlight as they have pigments identical to higher plants.

120. Answer (3)

Hint: Fungi can also live as symbionts in association with algae as in lichens.

Sol.: Mycorrhiza is a symbiotic association between roots of higher plants and fungi.

121. Answer (2)

Hint: There are organisms which can fix atmospheric nitrogen in specialised cells called heterocysts.

Sol.: Heterocysts are present in Cyanobacteria or BGA.

122. Answer (3)

Hint: Sporozoans include *Plasmodium* that causes malaria.

Sol.:

Flagellated protozoan – *Trypanosoma*

Ciliated protozoan – *Paramoecium*

Amoeboid protozoan – *Amoeba*, *Entamoeba*

123. Answer (1)

Sol.: Cell wall of fungi is composed of chitin and other polysaccharides.

124. Answer (1)

Hint: Deuteromycetes are commonly known as imperfect fungi.

Sol.: Cyanobacteria are characterised by the absence of flagellum throughout the life cycle. Kingdom fungi is classified on the basis of morphology of the mycelium, mode of spore formation and fruiting bodies into various classes.

125. Answer (4)

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

Sol.: Majority of slime moulds are saprophytic protists.

126. Answer (4)

Hint: Bacterial viruses are also called bacteriophages.

Sol.: Bacterial viruses have protein coat and usually have double stranded DNA.

127. Answer (1)

Hint: Methanogens are responsible for the production of methane and they are present in the gut of ruminant animals.

Sol.: Thermoacidophiles are found in hot water springs having low pH.

128. Answer (1)

Hint: *Rhizopus* – Bread mould

Sol.: *Ustilago* – Smut fungus
Agaricus – Mushroom
Puccinia – Rust fungus

129. Answer (2)

Hint: Archaebacteria differ from other bacteria in having a different cell wall structure.

Sol.: Cell membrane of Archaebacteria contains branched chain lipids.

130. Answer (4)

Hint: Typhoid is caused by *Salmonella typhi*.

Sol.: Sleeping sickness is caused by *Trypanosoma* which is a flagellated protozoan.

131. Answer (4)

Hint: Mango develops from monocarpellary ovary.

Sol.: In mango, epicarp forms skin, mesocarp is fleshy, juicy and edible, and endocarp is hard and stony.

132. Answer (3)

Hint: Penicillin interferes in the synthesis of peptidoglycan, a component of cell wall of bacteria.

Sol.: Mycoplasma are facultative anaerobes and lack cell wall. They can survive without oxygen.

133. Answer (3)

Hint: Cocci are spherical bacteria

Sol.: Bacillus – Rod shaped
Vibrium – Comma shaped
Spirillum – Spiral

134. Answer (3)

Hint: Bacteria are the sole members of this kingdom and they are prokaryotes.

Sol.: Some of the bacteria are autotrophic but vast majority are heterotrophic.

135. Answer (2)

Hint: The prominent vein present in the middle of the leaf blade is called midrib.

Sol.: Leaf base bears two lateral small leaf like structures called stipules. In some leguminous plants, the leaf base swells and is called pulvinus.

SECTION - B

136. Answer (3)

Hint: In mango and coconut, the fruit is known as a drupe.

Sol.: In mango, the pericarp is well differentiated into an outer thin epicarp, a middle fleshy edible mesocarp and inner hard stony endocarp.

137. Answer (1)

Hint: Root hairs are present in maturation zone.

Sol.: The apex of the root is covered by a thimble-like structure called root cap. It protects the tender apex of the root as it makes its way through the soil.

138. Answer (1)

Hint: In Malvaceae family, sepals and petals are five in number with valvate and twisted aestivation respectively.

Sol.: In members of Brassicaceae, following characters are found:

(i) Racemose type of inflorescence.
(ii) Siliqua or silicula type of fruit are seen.
(iii) Sepals and petals are four in number with imbricate and valvate aestivation respectively.

139. Answer (3)

Hint: In palmately compound leaves, the leaflets are attached at a common point.

Sol.: In a pinnately compound leaf, a number of leaflets are present on a common axis, the rachis, which represents the midrib of the leaf.

140. Answer (3)

Hint: These belong to the class ascomycetes.

Sol.: Morels and truffles are edible and are considered delicacies.

141. Answer (4)

Hint: Reticulate venation generally occurs in dicot plants.

Sol.: Peepal, *Hibiscus*, *Luffa* show reticulate venation. Parallel venation is found in banana.

142. Answer (4)

Hint: Viruses consist of nucleic acid and proteins only.

Sol.: Viruses are smaller than bacteria. Therefore, they pass through bacteria-proof filters. Viruses are infectious agents with simple, acellular organisation and they are exception to cell theory.

143. Answer (1)

Hint: Dinoflagellates have stiff cellulosic plates on the outer surface.

Sol.: Dinoflagellates are mostly marine and photosynthetic. They appear yellow, green, brown, blue or red depending on the main pigments present in their cells.

144. Answer (2)

Hint: It is a multicellular member of Ascomycetes.

Sol.: *Neurospora* belongs to Ascomycetes and it is used extensively in biochemical and genetic work.

145. Answer (3)

Hint: M.W. Beijerinck demonstrated that the extract of the infected plants of tobacco could cause infection in healthy plants and called this fluid as '*Contagium vivum fluidum*'.

Sol.: Viruses could be crystallised, was shown by W.M. Stanley.

D.J. Ivanowsky recognised certain microbes as causal organisms of the mosaic disease of tobacco.

T.O. Diener discovered viroids.

146. Answer (1)

Hint: R.H. Whittaker (1969) proposed the five kingdom classification system.

Sol.: Carl Woese proposed three domains of life- Bacteria, Archaea, and Eukarya. This system divides the kingdom Monera into two domains.

147. Answer (4)

Hint: In basidiomycetes, karyogamy and meiosis occurs in club-shaped structures known as basidium.

Sol.: In basidiomycetes, the secondary mycelium is long lived and dominant phase of life cycle.

148. Answer (1)

Hint: Symbols C_n and $C_{(n)}$ are used for polypetalous and gamopetalous condition respectively.

Sol.: K_n and $K_{(n)}$ are used for polysepalous and gamosepalous condition respectively.

149. Answer (4)

Hint: Floral formula of Malvaceae family is $Epi_{5-7}\oplus\male K_{(5)}\overset{\frown}{C_5A_{(\infty)}}\underline{G}_{(5)}$

Sol.:

Gramineae	$\%\male P_{0 \text{ or } 2 \text{ or } 3(\text{Lodicules})}A_{3 \text{ or } 6}\underline{G}_1$
Cruciferae	$Ebr\oplus or\%\male K_{2+2}C_{\times 4}A_{2+4}\underline{G}_{(2)}$
Compositae	$Br\%\female K_{\text{pappus or } 0}C_{(5)}A_0\overline{G}_{(2)}$

150. Answer (3)

Hint: In alternate phyllotaxy, single leaf is present at each node in an alternate fashion.

Sol.: China rose, mustard and sunflower show alternate phyllotaxy.

Guava shows opposite phyllotaxy.

[ZOOLOGY]

SECTION-A

151. Answer (3)

Hint: Facilitates diffusion

Sol.: The primary site for exchange of gases in the human respiratory tract is alveoli. Alveoli are lined by a single thin layer of flattened cells with irregular boundaries *i.e.*, simple squamous epithelium, which helps in exchange of gases.

Secretion and absorption are the main functions of simple cuboidal and simple columnar epithelium. The function of compound epithelium is to provide protection against chemical and mechanical stresses.

152. Answer (1)

Hint: Depolarisation of the upper chambers of heart

Sol.: In a standard ECG, the P-wave represents the electrical excitation (or depolarisation) of the atria, which leads to the contraction of both the atria. The QRS complex represents the depolarisation of the ventricles, which initiates the ventricular contraction.

The T-wave represents the return of the ventricles from excited to normal state (repolarisation). The end of the T-wave marks the end of ventricular systole.

153. Answer (4)

Hint: Hepatic cells absorb nutrients

Sol.: The hepatic portal vein carries blood from intestine to the liver before it is delivered to the systemic circulation.

154. Answer (1)

Hint: It is an important factor that affects exchange of gases.

Sol.: Partial pressure of a gas is the pressure contributed by an individual gas in a mixture of gases.

Exchange of gases by simple diffusion is mainly based on the pressure/concentration gradient of gases.

155. Answer (4)

Hint: Factors for blood clotting are present in the blood plasma

Sol.: Plasma contains small amounts of minerals like Na^+, Ca^{++}, Mg^{++}, HCO_3^-, Cl^-, *etc*.

Factors for coagulation of blood are present in the plasma in an inactive form.

Plasma without the clotting factors is called serum.

156. Answer (4)

Hint: Feature of amphibian RBCs

Sol.: A healthy adult man has, on an average, 5 millions to 5.5 millions of RBCs mm^{-3} of blood. RBCs are formed in the red bone marrow in the adults. RBCs are devoid of nucleus and are biconcave in shape.

157. Answer (3)

Hint: Cardiac cycle takes place 72 times per minute in a healthy adult man.

Sol.: By counting the number of QRS complexes that occur in a given time period, one can determine the heart beat rate of an individual.

Adult human RBCs have an average life span of 120 days after which they are destroyed in the spleen.

158. Answer (2)

Hint: Myogenic heart

Sol.: Purkinje fibres are modified cardiac muscle fibres. Cardiac muscles are exclusively present in the heart.

159. Answer (3)

Hint: Eject out blood to lungs

Sol.: Heart is a mesodermally derived organ, has the size of a clenched fist and is protected by a double walled membranous bag, pericardium. The left ventricle ejects out blood to aorta and from aorta, blood is pumped out to the whole body, so it has the thickest wall as compared to any other chambers of the heart.

160. Answer (4)

Hint: Affects the kidneys and is higher than the normal.

Sol.: Normal blood pressure is 120/80 mm Hg, where 120 mm Hg is systolic or pumping pressure and 80 mm Hg is the diastolic or resting pressure. If repeated checks of blood pressure of an individual result in pressure values around 140/90 mm Hg or higher, it indicates hypertension.

161. Answer (1)

Hint: Eliminate angina pectoris

Sol.:

Heart attack	–	Heart muscles are suddenly damaged by an inadequate blood supply
Cardiac arrest	–	Heart stops beating
Heart failure	–	Heart is not pumping blood effectively enough to meet the body's demand

162. Answer (2)

Hint: Half moon-shaped

Sol.: The openings of the right and the left ventricles into the pulmonary artery and the aorta respectively are provided with the semilunar valves. The opening of the right and left atria into the ventricles is guarded by the tricuspid and bicuspid valves respectively. Bicuspid valve is also known as mitral valve.

163. Answer (1)

Hint: Last wave of ECG from P to T

Sol.: P-wave – Depolarisation of the atria

QRS complex – Depolarisation of the ventricles

T-wave – Repolarisation of the ventricles

164. Answer (2)

Hint: More than ten times the number of fingers in your hands.

Sol.: RBCs are the most abundant of all the cells in blood.

In adult humans, RBCs have an average life span of 120 days.

165. Answer (3)

Hint: Catecholamines increase the heart rate.

Sol.: If the parasympathetic influence on heart is removed, heart will beat at a faster rate.

Adrenal medullary hormones *i.e.*, catecholamines (adrenaline and noradrenaline) increase the cardiac output.

166. Answer (4)

Hint: Diffusion of a gas depends upon its partial pressure.

Sol.: Exchange of gases at the diffusion membrane in human respiratory system is mainly based on

a. Concentration gradient/partial pressure gradient of the gases

b. Thickness of the membrane

c. Solubility of the gases

167. Answer (2)

Hint: Pumping pressure is the systolic pressure.

Sol.: In humans, 120 mm Hg is the systolic or pumping pressure and 80 mm Hg is the diastolic or resting pressure.

168. Answer (2)

Hint: Lumen of arteries is narrower than veins.

Sol.: Each artery and vein consists of three layers: an inner lining of squamous endothelium, the tunica intima, a middle layer of smooth muscle and elastic fibres, the tunica media, and an external layer of fibrous connective tissue with collagen fibres, the tunica externa. The tunica media is comparatively thin in the veins than arteries.

169. Answer (3)

Hint: Medulla oblongata contains respiratory rhythm centre

Sol.: Pneumotaxic centre present in the pons region of the brain can moderate the functions of the respiratory rhythm centre. Neural signals from this centre can reduce the duration of inspiration and thereby alter the respiratory rate.

170. Answer (2)

Hint: Release of CO_2 is the last step.

Sol.: Respiration involves the following steps:

- Atmospheric air is drawn in and CO_2 rich alveolar air is released out. (Pulmonary ventilation)
- Diffusion of gases across alveolar membrane.
- Transport of gases by the blood.
- Diffusion of gases between blood and tissues.
- Utilisation of O_2 by the cells for catabolic reactions and resultant release of CO_2. (Cellular respiration)

171. Answer (2)

Hint: A respiratory pigment.

Sol.: A healthy human breathes 12-16 times/ minute.

Proteins contribute about 6-8 per cent in blood plasma.

12-16 gms of haemoglobin is present in every 100 mL of blood a healthy adult human.

Monocytes form 6-8% of the total WBCs.

Our heart normally beats 70-75 times in a minute.

172. Answer (3)

Hint: Amphibians and reptiles have 3-chambered heart.

Sol.: In reptiles, the left atrium receives oxygenated blood from the lungs.

During a cardiac cycle, the blood pumped out by each ventricle is approximately 70 mL, known as the stroke volume.

Neural signals through the sympathetic nerves can increase the rate of heart beat, the strength of ventricular contraction and thereby the cardiac output.

173. Answer (3)

Hint: Blood group 'O' is the universal donor.

Sol.:

Blood Group	A	B	AB	O
Antigens on RBCs	A	B	A, B	Nil
Antibodies in Plasma	Anti-B	Anti-A	Nil	Anti-A, B
Donor's Group	A, O	B, O	AB, A, B, O	O

174. Answer (1)

Hint: AV valves

Sol.: The first heart sound (lub) is associated with the closure of the tricuspid and bicuspid valves whereas the second heart sound (dub) is associated with the closure of the semilunar valves.

Tricuspid and bicuspid valves prevent the back flow of blood into atria from ventricles.

Semilunar valves prevent the backflow of blood into left ventricle from aorta and into right ventricle from pulmonary artery.

175. Answer (1)

Hint: Include structures supported by incomplete cartilaginous rings

Sol.: The part starting with the external nostrils up to the terminal bronchioles constitutes the conducting part whereas the alveoli and their ducts form the respiratory or exchange part of the respiratory system.

The conducting part transports the atmospheric air to the alveoli, clears it from foreign particles,

humidifies and also brings the air to body temperature.

176. Answer (4)

Hint: Can be measured by a spirometer

Sol.:

- Vital capacity is the maximum volume of air a person can breathe in after a forced expiration.
- Functional residual capacity is the volume of air that will remain in the lungs after a normal expiration.
- Total lung capacity is the total volume of air accommodated in the lungs at the end of a forced inspiration.

177. Answer (2)

Hint: Rh antigen is absent in mother.

Sol.: A special case of Rh incompatibility has been observed between the Rh –ve blood of a pregnant mother with Rh +ve blood of the foetus. Rh antigens of the foetus do not get exposed to the Rh –ve blood of the mother in the first pregnancy as the two bloods are well separated by the placenta.

If the mother is Rh –ve and the first baby is Rh +ve, erythroblastosis foetalis can occur in her subsequent pregnancies.

178. Answer (4)

Hint: Feather-like gills

Sol.: Pulmonary respiration is breathing through lungs. Aquatic molluscs respire through specialised feather like gills. Respiration through gills is known as branchial respiration.

179. Answer (2)

Hint: S-shaped curve

Sol.: A sigmoid curve is obtained when percentage saturation of haemoglobin with oxygen is plotted against the pO_2. This curve is called oxygen dissociation curve.

180. Answer (3)

Hint: Located in medulla oblongata

Sol.: A chemosensitive area is situated adjacent to the respiratory rhythm centre which is highly sensitive to pCO_2 and hydrogen ions. Increase in these substances can activate this centre, which in turn can signal the rhythm centre to make necessary adjustments in the respiratory process by which these substances can be eliminated. Role of O_2 in the regulation of respiratory rhythm is quite insignificant.

181. Answer (3)

Hint: Tidal volume

Sol.: Tidal volume is the volume of air inspired or expired during a normal respiration. It is approximately 500 mL.

182. Answer (3)

Hint: Its co-factor is zinc.

Sol.: The RBCs contain a very high concentration of the enzyme, carbonic anhydrase and minute quantities of the same is present in the plasma too.

183. Answer (4)

Hint: Equal to the pO_2 in blood of pulmonary vein

Sol.:

Respiratory gas	pO_2 (in mm Hg)	pCO_2 (in mm Hg)
Atmospheric Air	159	0.3
Alveoli	104	40
Blood (Deoxygenated)	40	45
Blood (Oxygenated)	95	40
Tissues	40	45

184. Answer (2)

Hint: Functional residual capacity

Sol.: Volume of air that will remain in the lungs after a normal expiration is Functional Residual Capacity (FRC). This includes ERV + RV.

IC + EC – TV = VC

TLC – IC = FRC

TLC – FRC = IC

IC + FRC = TLC

185. Answer (2)

Hint: Ventricular diastole decreases ventricular pressure.

Sol.: During the ventricular diastole, the ventricles relax and the ventricular pressure falls, causing the closure of the semilunar valves which prevents the backflow of blood into the ventricles. Atrial diastole coincides with the ventricular systole.

SECTION - B

186. Answer (4)

Hint: Oxygenated blood is present in pulmonary vein.

Sol.: Every 100 mL of oxygenated blood can deliver around 5 mL of O_2 to the tissues under normal physiological conditions.

Thus, 500 mL of oxygenated blood will deliver 25 mL of O_2 to the tissues.

187. Answer (4)

Hint: Additional volume of air a person can inspire

Sol.:

1. Total volume of air a person can inspire after a normal expiration is inspiratory capacity (3000-3500 mL).
2. The maximum volume of air a person can breathe in after a forced expiration is vital capacity (4000-4600 mL).
3. Volume of air remaining in the lungs even after a forcible expiration is residual volume (1100-1200 mL).

188. Answer (3)

Hint: Binding of oxygen with haemoglobin is primarily related to pO_2.

Sol.: In the alveoli, high pO_2 low pCO_2, lesser H^+ concentration and lower temperature, are all favourable for the formation of oxyhaemoglobin whereas in tissues, low pO_2, high pCO_2, high H^+ concentration and higher temperature exist, which favour the dissociation of oxygen from the oxyhaemoglobin.

189. Answer (2)

Hint: Specifically for heart muscles.

Sol.: A special neural centre in the medulla oblongata can moderate the cardiac functions through autonomic nervous system (ANS). The systemic circulation provides nutrients, O_2 and other essential substances to the tissues and takes CO_2 and other harmful substances away for elimination.

Silicosis is an occupational respiratory disorder.

190. Answer (3)

Hint: Prawns perform branchial respiration.

Sol.: Specialised vascularised structures called gills (branchial respiration) are used by most of the aquatic arthropods and molluscs whereas vascularised bags called lungs (pulmonary respiration) are used by the terrestrial vertebrates for the exchange of gases.

191. Answer (2)

Hint: Devoid of oxygen carrying molecule.

Sol.: As the blood passes through the capillaries in tissues, some water along with many small water soluble substances move out into the spaces between the cells of tissues leaving the larger proteins and most of the formed elements in the blood vessels. This fluid released out is called the interstitial fluid or tissue fluid.

Lymph is a colourless fluid containing specialised lymphocytes which are responsible for the immune responses of the body.

192. Answer (1)

Hint: Platelets are involved in the coagulation of blood.

Sol.: Calcium ions, prothrombin, thrombocytes, fibrinogens, tissue factors and platelet factors are involved in the coagulation of blood.

193. Answer (1)

Hint: The diffusion membrane is composed of 2 cellular and a single acellular layer.

Sol.: The diffusion membrane is made up of three layers namely, the thin squamous epithelium of alveoli, the endothelium of alveolar capillaries and the basement substance (composed of thin basement membrane supporting the squamous epithelium and the basement membrane surrounding the single layer endothelial cells of capillaries) in between them.

194. Answer (4)

Hint: Decrease in intrapulmonary pressure

Sol.: During inspiration, the contraction of diaphragm increases the volume of thoracic chamber in the antero-posterior axis and the contraction of external inter-costal muscles lifts up the ribs and sternum causing an increase in the volume of the thoracic chamber in the dorso-ventral axis.

195. Answer (3)

Hint: We cannot directly alter the pulmonary volume.

Sol.: The anatomical set up of lungs in thorax is such that any change in the volume of the thoracic cavity will be reflected in the pulmonary cavity. We have two lungs which are covered by a double layered pleura. The outer pleural membrane is in close contact with the thoracic lining whereas the inner pleural membrane is in contact with the lung surface.

196. Answer (2)

Hint: Phagocytic granulocytes constitute 60-65% of total WBCs.

Sol.: Neutrophils (60-65%) and monocytes (6-8%) are phagocytic cells which destroy the foreign organisms entering the human body. Monocytes are agranulocytes.

Lymphocytes (20-25%) are responsible for immune responses of the body.

Eosinophils (2-3%) resist infections and are also associated with allergic reactions.

197. Answer (3)

Hint: SA node

Sol.: SAN is present in the right upper corner of the right atrium. It has the ability to generate action potentials without any external stimulus.

198. Answer (3)

Hint: Includes RV

Sol.: Residual volume cannot be measured by a simple spirometer.

FRC = ERV + RV

TLC = TV + IRV + ERV + RV

So, RV, FRC and TLC cannot be measured by a simple spirometer.

199. Answer (1)

Hint: 4-chambered heart

Sol.: Two separate pathways *i.e.*, pulmonary and systemic circulation are present in mammals and birds. Mixing of oxygenated and deoxygenated blood does not occur in double circulation. In fishes, single circulation is present while in amphibians and reptiles (except crocodile), incomplete double circulation is present.

200. Answer (1)

Hint: Bicephalic structure

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

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