

Physics

1. A man is walking along the east direction with a speed of 5 m/s and rain is falling vertically downwards with a speed of $5\sqrt{3} \text{ m/s}$. At what angle with the vertical and in which direction should he hold his umbrella?

- | | |
|--|--|
| A) 30° with vertical towards east | B) 60° with vertical towards east |
| C) 30° with horizontal towards east | D) 45° with vertical towards east |

2. A man runs towards the east with a velocity of 10 m/s while rain falls vertically downwards. If he holds his umbrella at an angle of 60° with the vertical to protect himself, what is the speed of the falling rain?

- | | |
|--------------------------------------|-----------------------------|
| A) $\frac{10}{\sqrt{3}} \text{ m/s}$ | B) $10\sqrt{3} \text{ m/s}$ |
| C) 20 m/s | D) $5\sqrt{3} \text{ m/s}$ |

3. A car is moving towards the north with a speed of 15 m/s , and a person walking on the ground observes a bus moving towards the east with a speed of 20 m/s . Find the magnitude and direction of the velocity of the bus as observed by a passenger in the car.

- | | |
|---|---|
| A) 25 m/s (53° south of east) | B) 25 m/s (37° south of east) |
| C) 25 m/s (53° east of south) | D) 35 m/s (37° east of south) |

4. A train is moving along a straight track towards the east with a speed of 30 m/s . A bicyclist is riding towards the north with a speed of $30\sqrt{3} \text{ m/s}$. What is the velocity of the bicyclist as observed from the train?

- | | |
|---|---|
| A) 60 m/s (30° north of west) | B) 60 m/s (60° north of west) |
| C) 60 m/s (30° west of north) | D) 30 m/s (60° north of west) |

5. An airplane is flying due west with a velocity of 100 m/s , and a strong wind is blowing due south with a velocity of 100 m/s . Find the velocity of the airplane as observed by an air traffic controller stationed on the ground.

- | | |
|--|--|
| A) $100\sqrt{2} \text{ m/s}$ (45° south of west) | B) 200 m/s (45° south of west) |
| C) $100\sqrt{2} \text{ m/s}$ (45° west of north) | D) 100 m/s (30° south of west) |

6. A man is moving along the $+x$ -axis (east) with a speed of 15 m/s , and rain is falling vertically downward with a speed of $15\sqrt{3} \text{ m/s}$. In which direction should the man hold his umbrella to protect himself?

- | | |
|--|--|
| A) 30° with vertical towards east | B) 60° with vertical towards east |
| C) 30° with horizontal towards east | D) 45° with vertical towards east |

7. A person is walking towards the east with a speed of 5 m/s , and rain appears to fall vertically downward to him. If the actual speed of the rain is 10 m/s , at what angle with the vertical is the rain actually falling?

- | | |
|--|--|
| A) 30° with vertical towards west | B) 60° with vertical towards east |
| C) 30° with vertical towards east | D) 45° with vertical towards west |

8. A car is moving towards the east with a speed of 20 m/s , and rain is falling vertically downwards. A person inside the car observes that the rain falls at an angle of 45° to the vertical. What is the speed of the rain?

- A) $10\sqrt{2} \text{ m/s}$ B) 20 m/s
C) $20\sqrt{2} \text{ m/s}$ D) 40 m/s

9. Rain is falling vertically downwards with a speed of 20 m/s . A person is running due east with a speed of 20 m/s . In which direction should the person hold their umbrella to protect themselves from the rain?

- A) 30° with vertical towards east B) 45° with vertical towards east
C) 60° with vertical towards east D) 90° with vertical towards east

10. To a stationary man, rain appears to fall vertically downwards with a certain speed. When the man starts running towards the west with a speed of 8 m/s , the rain appears to hit him at an angle of 30° with the vertical. Find the actual speed of the rain.

- A) $8\sqrt{3} \text{ m/s}$ B) $\frac{8}{\sqrt{3}} \text{ m/s}$
C) 16 m/s D) $4\sqrt{3} \text{ m/s}$

11. Rain is falling at an angle of 30° with the vertical (towards the west) with a speed of 40 m/s . A car is moving along the east direction with a speed of 20 m/s . Find the angle with the vertical at which the person inside the car should hold the umbrella.

- A) 30° with vertical towards east B) 45° with vertical towards east
C) 60° with vertical towards east D) 30° with vertical towards west

12. To a stationary observer, rain appears to be falling vertically downwards. When the observer starts running horizontally with a speed of $15\sqrt{3} \text{ m/s}$, the rain appears to fall at an angle of 60° with the vertical. What is the actual speed of the rain?

- A) 15 m/s B) 30 m/s
C) 45 m/s D) $15\sqrt{3} \text{ m/s}$

13. Rain is falling with a speed of 20 m/s at an angle of 37° with the vertical, and a man is moving along the east direction. What should be the velocity of the man so that the rain appears to be falling vertically downward to him?

- A) 10 m/s B) 12 m/s
C) 16 m/s D) 20 m/s

14. Rain is falling with a speed of 15 m/s at an angle of 30° with the vertical. A man runs along the east direction with a speed of 5 m/s . Find the horizontal component of the relative velocity of rain with respect to the man.

- A) 2.5 m/s B) 5.0 m/s
C) 7.5 m/s D) 10.0 m/s

15. A man is moving along the east direction with a speed of 4 m/s , and rain appears to him to fall vertically downwards. If the actual vertical component of the rain's velocity is 3 m/s , what is the actual speed of the rain?

- A) 3 m/s B) 4 m/s
C) 5 m/s D) 7 m/s

16. To a stationary man, rain appears to be falling at an angle of 30° with the vertical. As he starts moving with a speed of 10 m/s , he feels that the rain is falling at an angle of 30° with the vertical in the opposite direction. Find the speed of the rain.

- A) 10 m/s B) $10\sqrt{3} \text{ m/s}$
C) 20 m/s D) 5 m/s

17. To a stationary man, rain appears to be falling vertically downwards with a speed of 6 m/s . When the man starts running with a speed of 8 m/s due east, the rain appears to fall at an angle of 45° with the vertical. Find the actual speed of the rain.

- A) 10 m/s B) $6\sqrt{2} \text{ m/s}$
C) $8\sqrt{2} \text{ m/s}$ D) 14 m/s

18. A man is running along the east direction with a speed of 5 m/s , and the rain appears to fall towards him at an angle of 45° with the vertical. If the actual speed of the rain is $5\sqrt{2} \text{ m/s}$, find the angle that the rain actually makes with the vertical.

- A) 30° B) 45°
C) 60° D) 0° (vertical)

19. A boy carrying a flag is running with a speed of 5 m/s along the north direction. If the wind is blowing with a speed of $5\sqrt{3} \text{ m/s}$ along the east direction, in which direction will the flag flutter?

- A) 60° north of west B) 30° north of west
C) 45° north of west D) 60° south of east

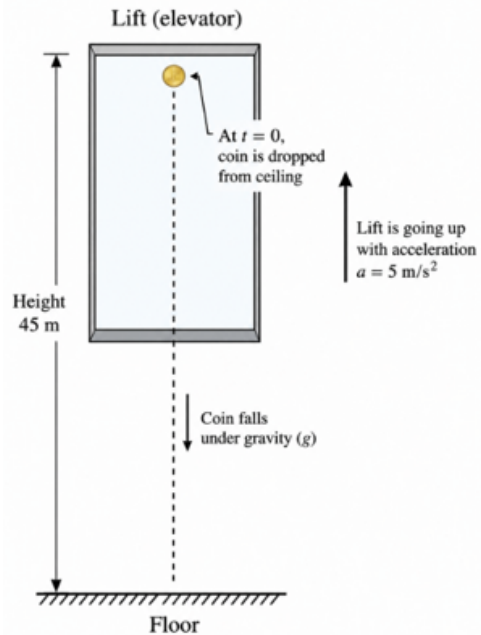
20. A person is driving a car towards the west with a velocity of 20 m/s and observes that a flag on a pole flutters towards the north-west direction at an angle of 45° . What is the actual velocity of the wind?

- A) $20\sqrt{2} \text{ m/s}$ towards north-east B) 20 m/s towards north
C) 20 m/s towards south D) $20\sqrt{2} \text{ m/s}$ towards south-west

21. A cyclist is moving due east with a speed of 12 m/s . To him, the wind appears to blow from the south with a speed of 12 m/s . Find the actual speed and direction of the wind.

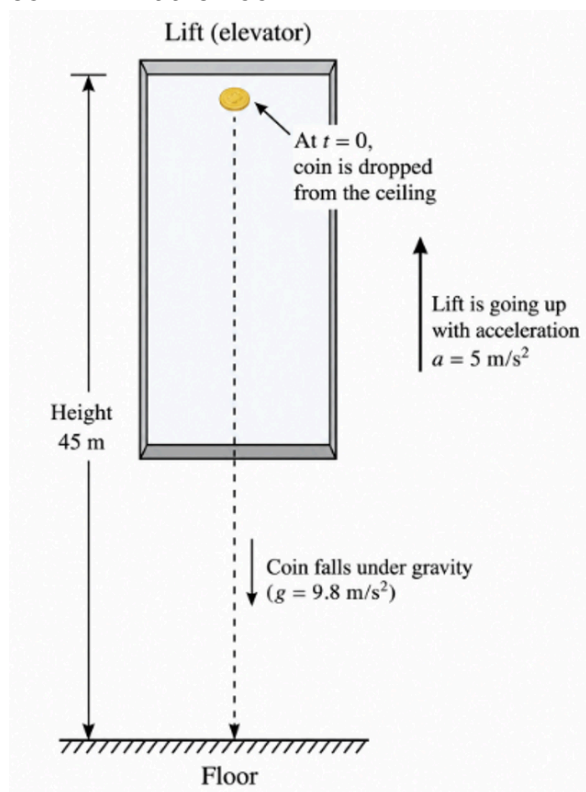
- A) $12\sqrt{2} \text{ m/s}$ directed 45° east of north B) 12 m/s directed due north
C) $12\sqrt{2} \text{ m/s}$ directed 45° west of south D) 24 m/s directed due east

22. From the image given below, a lift of height 45 m is going up with acceleration $a = 5 \text{ m/s}^2$. When the velocity of the lift is 10 m/s upward, a coin is dropped from the ceiling at $t = 0$. Find the time when the coin will hit the floor.



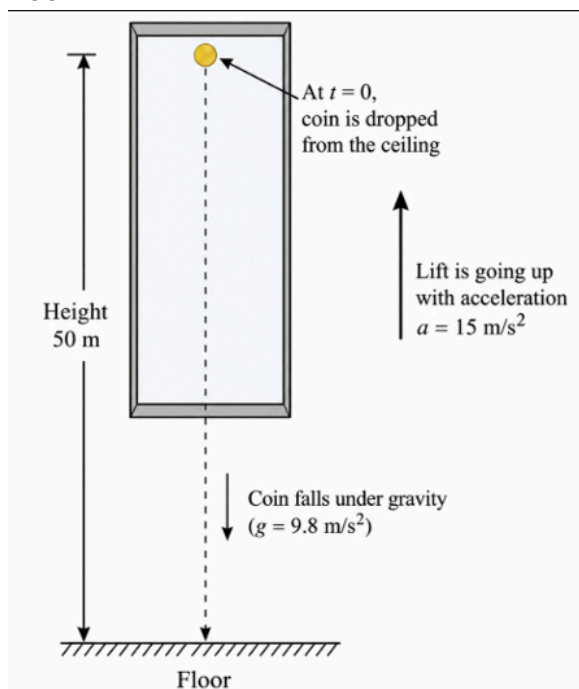
- A) 3 sec B) 2 sec
C) 4 sec D) 5 sec

23. From the image given below, a lift of height 20 m is going up with acceleration $a = 10 \text{ m/s}^2$. When the velocity of the lift is 5 m/s upward, a coin is dropped from the ceiling at $t = 0$. Find the time when the coin will hit the floor.



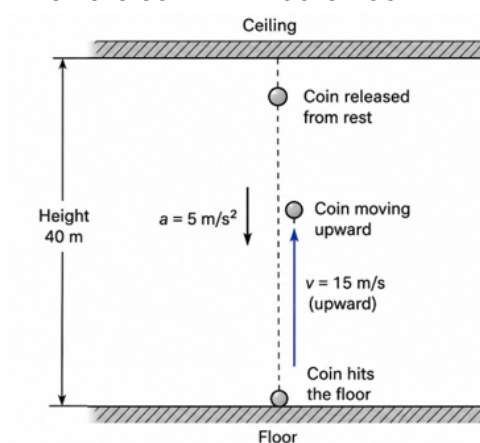
- A) 2 sec
B) 1 sec
C) 3 sec
D) 4 sec

24. From the image given below, a lift of height 50 m is going up with acceleration $a = 15 \text{ m/s}^2$. When the lift is moving, a coin is dropped from the ceiling at $t = 0$. Find the time when the coin will hit the floor.



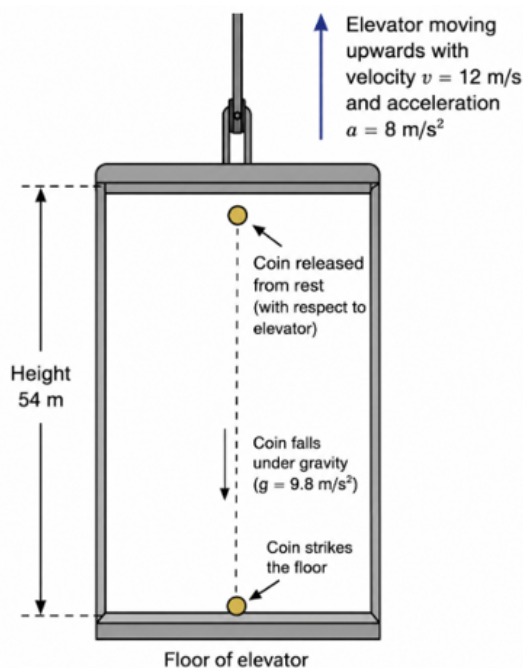
- A) 1 sec
B) $\sqrt{2}$ sec
C) $\sqrt{5}$ sec
D) 2 sec

25. A coin is dropped from the ceiling of a lift of height 40 m which is moving upwards with an acceleration $a = 5 \text{ m/s}^2$ and an upward velocity $v = 15 \text{ m/s}$. Find the time when the coin will hit the floor.



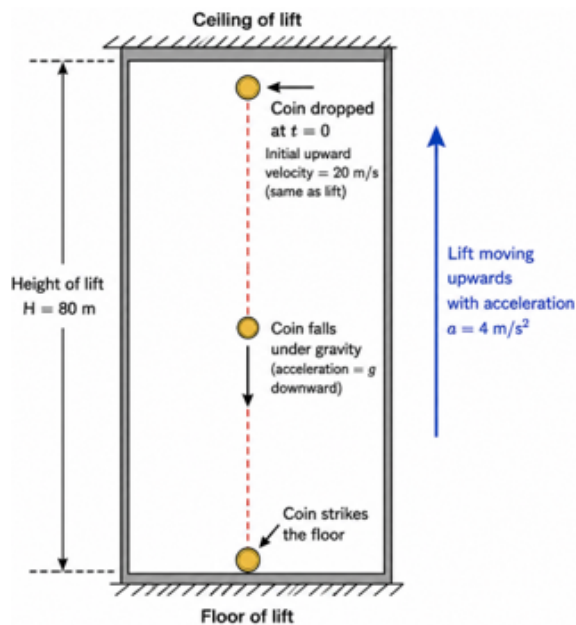
- A) 2 sec
B) 4 sec
C) 3 sec
D) 5 sec

26. A coin is dropped from the ceiling of an elevator of height 54 m which is moving upwards with an acceleration $a = 8 \text{ m/s}^2$ and velocity $v = 12 \text{ m/s}$. Find the time when the coin will strike the floor.



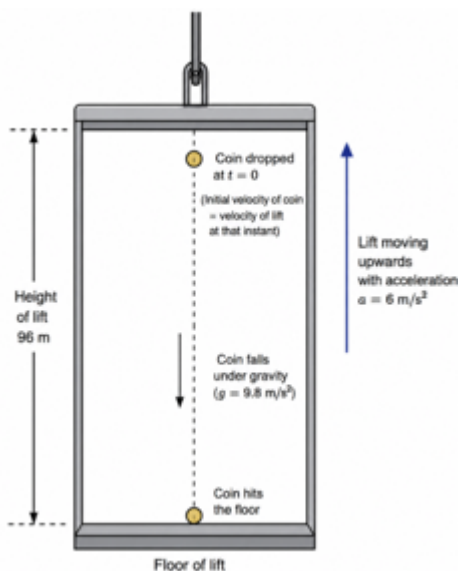
- A) 2 sec B) 4 sec
C) 3 sec D) 6 sec

28. Question: From the ceiling of a lift of height 80 m, which is moving upwards with an acceleration $a = 4 \text{ m/s}^2$ and an initial upward velocity $v = 20 \text{ m/s}$, a coin is dropped at $t = 0$. When will the coin strike the floor?



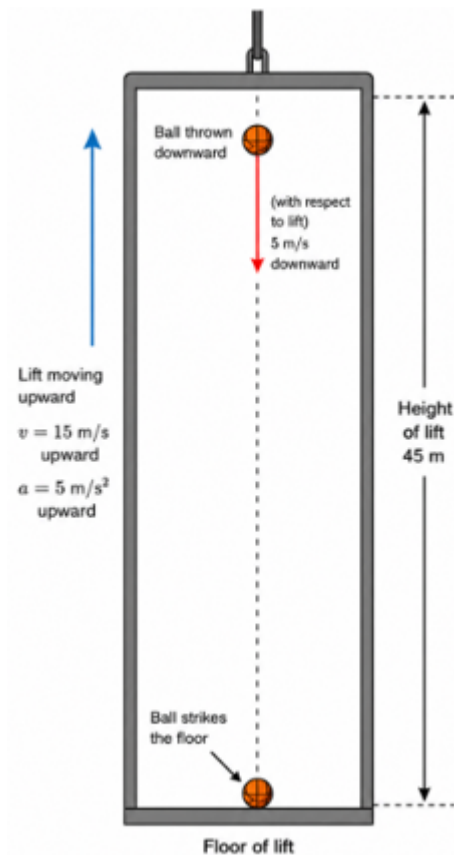
- A) 2 sec B) 3 sec
C) 5 sec D) 8 sec

27. From the ceiling of a lift of height 96 m moving upwards with an acceleration $a = 6 \text{ m/s}^2$, a coin is dropped at $t = 0$. Calculate the time taken by the coin to hit the floor.



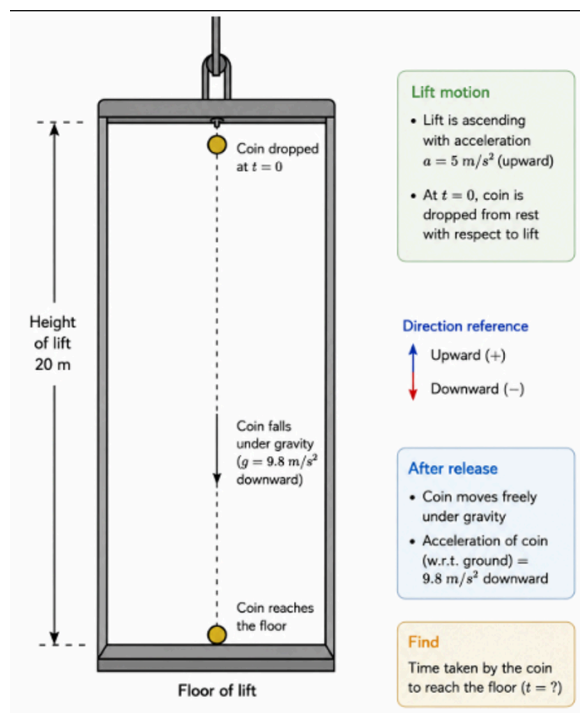
- A) 2 sec B) 4 sec
C) 3 sec D) 5 sec

29. Question: A ball is thrown downward at a speed of 5 m/s with respect to a lift of height 45 m which is moving upward with a velocity of 15 m/s and an upward acceleration of $a = 5 \text{ m/s}^2$. When will the ball strike the floor?



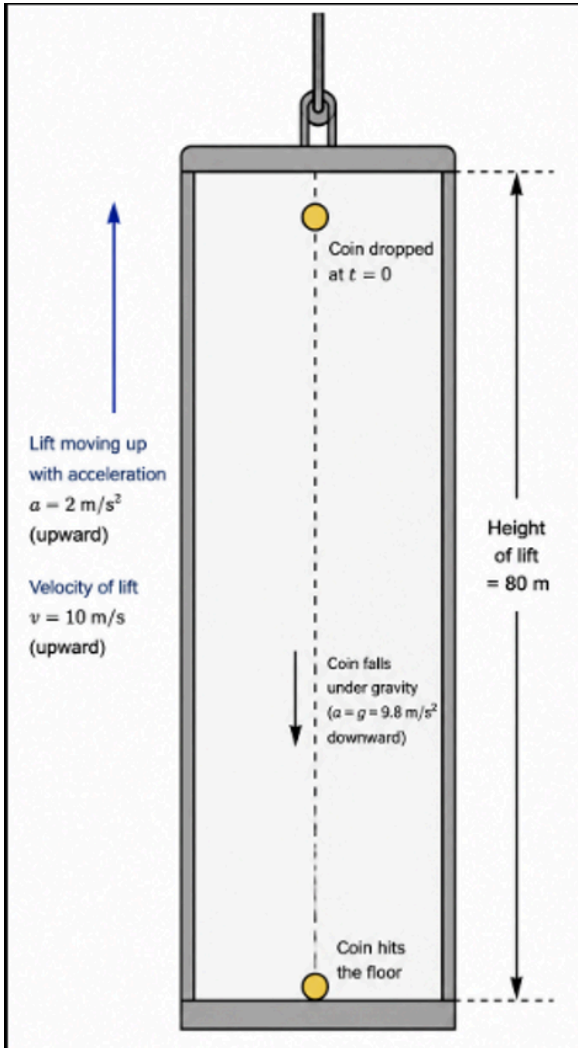
- A) 2 sec B) 3 sec
C) 4 sec D) 5 sec

30. From the ceiling of a lift of height 20 m , which is ascending with an acceleration $a = 5 \text{ m/s}^2$, a coin is dropped at $t = 0$. Find the time taken by the coin to reach the floor.



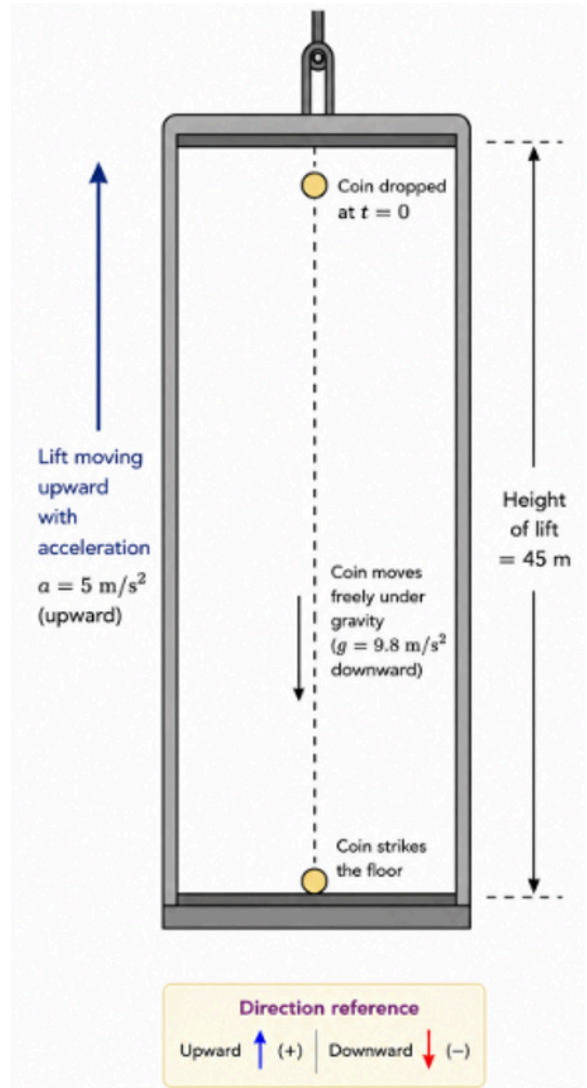
- A) 1 sec B) 4 sec
C) 2 sec D) 3 sec

31. From the image given below, a lift of height 80 m is going up with an acceleration $a = 2 \text{ m/s}^2$. When the velocity of the lift is 10 m/s upward, a coin is dropped from the ceiling at $t = 0$. Find the time when the coin will hit the floor.



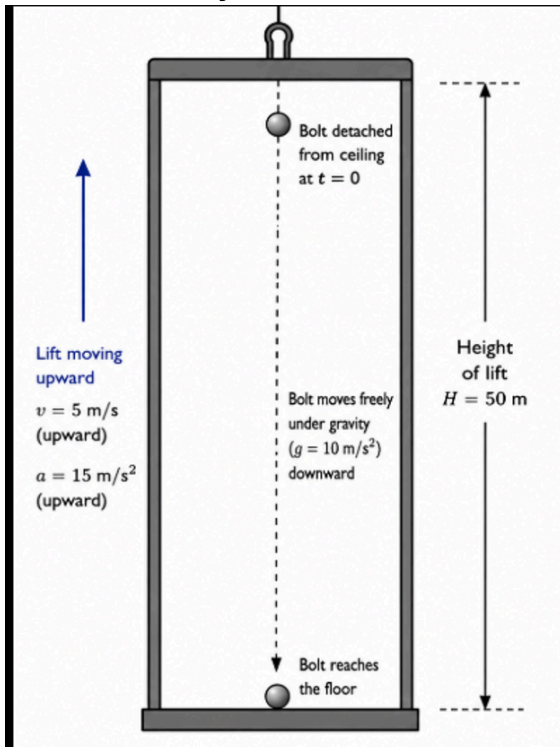
- A) 4 sec
B) 5 sec
C) 6 sec
D) 8 sec

32. A lift of height 45 m is moving upwards with an acceleration $a = 5 \text{ m/s}^2$ and an upward velocity of 15 m/s . At $t = 0$, a coin is dropped from its ceiling. Determine the time taken by the coin to strike the floor of the lift.



- A) 2 sec
B) 3 sec
C) 4 sec
D) 5 sec

33. A coin is dropped from the ceiling of a lift of height 20 m which is accelerating upwards at $a = 10 \text{ m/s}^2$. Taking the acceleration due to gravity as 10 m/s^2 , find the time taken by the coin to hit the floor.



- A) 1 sec
B) 4 sec
C) 2 sec
D) 3 sec

34. A boat is sent across a river with a velocity of 12 km/hr. If the resultant velocity of the boat is 15 km/hr, then what is the velocity of the river?

- A) 3 km/hr
B) 6 km/hr
C) 9 km/hr
D) 12 km/hr

35. A motorboat is driven across a river with a speed of 9 km/hr pointing directly across the stream. If the actual resultant velocity of the motorboat is 41 km/hr, find the speed of the river current.

- A) 20 km/hr
B) 30 km/hr
C) 40 km/hr
D) 50 km/hr

36. A steamer is moving with a velocity of 16 km/hr perpendicular to the river flow. If the river water is flowing such that the resultant velocity of the steamer becomes 20 km/hr, calculate the speed of the river.

- A) 8 km/hr
B) 10 km/hr
C) 12 km/hr
D) 14 km/hr

37. Question: A particle is moving with a velocity of $3\hat{i} + 4\hat{j} \text{ m/s}$ in a reference frame, and another object is moving with a velocity of $1\hat{i} - 2\hat{j} \text{ m/s}$ in the same reference frame. Find the relative velocity of the first object with respect to the second object.

- A) $2\hat{i} + 6\hat{j}$
B) $-2\hat{i} - 6\hat{j}$
C) $4\hat{i} + 2\hat{j}$
D) $-4\hat{i} - 2\hat{j}$

38. Question: A motorboat is traveling with a velocity of $5\hat{i} + 12\hat{j} \text{ km/hr}$ with respect to the ground, and a water current flows with a velocity of $2\hat{i} - 3\hat{j} \text{ km/hr}$ with respect to the ground. Determine the relative velocity of the boat with respect to the water current.

- A) $7\hat{i} + 9\hat{j}$
B) $3\hat{i} + 15\hat{j}$
C) $-3\hat{i} - 15\hat{j}$
D) $7\hat{i} - 9\hat{j}$

39. Question: A swimmer can swim in still water with a speed of $2\sqrt{2} \text{ m/s}$. While crossing a river in the shortest possible time, his average speed is 4 m/s. What is the speed of flow of water?

- A) 2 m/s
B) 3 m/s
C) 4 m/s
D) 5 m/s

40. Question: A swimmer can swim in still water with a speed of 3 m/s. While crossing a river in the shortest possible time, his average speed is 2.5 m/s. What is the speed of flow of water?

- A) 2 m/s
B) 3 m/s
C) 4 m/s
D) 5 m/s

41. A river is flowing from West to East with a speed of 3 m/min. A man can swim in still water with a velocity of 6 m/min. In which direction should the man swim so as to take the shortest possible path to go to the south?

- A) 30° with downstream
B) 60° with downstream
C) 120° with downstream
D) South

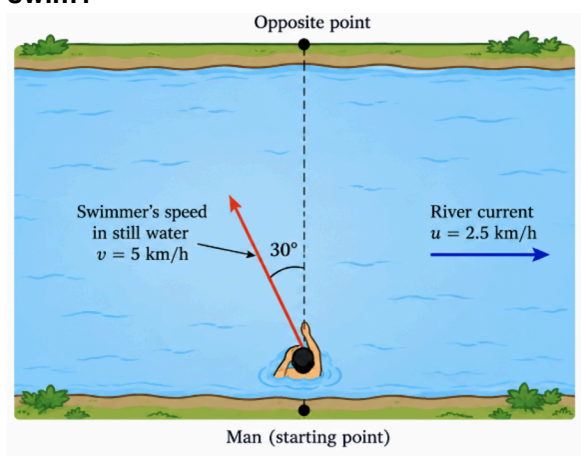
42. A river is flowing from West to East with a speed of 4 m/min. A man can swim in still water with a velocity of 8 m/min. In which direction should the man swim to reach the opposite bank along the shortest path?

- A) 30° with downstream
 B) 120° with downstream
 C) 150° with downstream
 D) 60° with downstream

43. A river flows from West to East with a speed of 5 m/min. A swimmer has a speed of 10 m/min in still water. Find the angle with the downstream direction the swimmer must choose to cross the river along the shortest possible path.

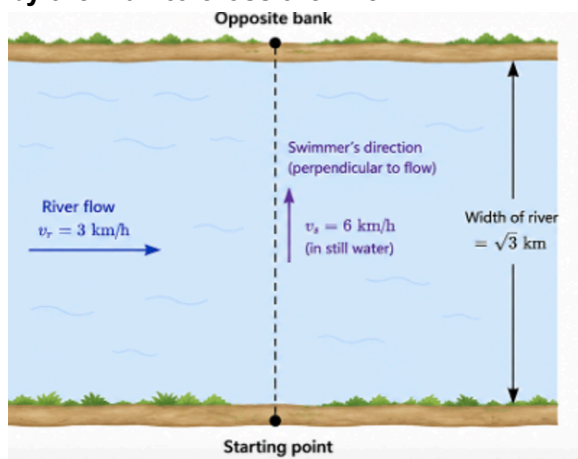
- A) 60° with downstream
 B) 90° with downstream
 C) 120° with downstream
 D) 135° with downstream

44. A man can swim in still water at 5 km/h. He wants to reach a point just opposite his starting point across a river flowing at 2.5 km/h. In which direction should he swim?



- A) 30° against the current from normal to the direction of flow
 B) 45° against the current from normal to the direction of flow
 C) 60° against the current from normal to the direction of flow
 D) 90° against the current from normal to the direction of flow

45. A man can swim in still water at a speed of 6 km/h. He wants to cross a river of width $\sqrt{3}$ km flowing at a speed of 3 km/h in the shortest possible time. Find the time taken by the man to cross the river.



- A) 10 minutes
 B) 20 minutes
 C) 30 minutes
 D) 40 minutes

Chemistry

46. In the structure of ClF_3 , the number of lone pair of electrons on central atom 'Cl' is

- A) One
 B) Two
 C) Three
 D) Four

47. Which of the following molecules represents the order of hybridisation sp^2 , sp^2 , sp , sp from left to right atoms?

- A) $HC \equiv C - C \equiv CH$
 B) $CH_2 = CH - C \equiv CH$
 C) $CH_3 - CH = CH - CH_2$
 D) $CH_2 = CH - CH = CH_2$

48. Consider the following species: CN^+ , CN^- , NO and CN. Which one of these will have the highest bond order?

- A) NO
 B) CN^-
 C) CN
 D) CN^+

49. The species, having bond angles of 120° is:

- A) ClF_3
 B) NCl_3
 C) BCl_3
 D) PH_3

50. Which of the following pairs of species have the same bond order?

- A) O_2 , NO^+
 B) CN^- , CO
 C) N_2 , O_2^-
 D) CO, NO

51. Consider the molecules CH_4 , NH_3 and H_2O . Which of the given statements is false?

- A) The $H - C - H$ bond angle in CH_4 , the $H - N - H$ bond angle in NH_3 , and the $H - O - H$ bond angle in H_2O are all greater than 90°
- B) The $H - O - H$ bond angle in H_2O is larger than the $H - C - H$ bond angle in CH_4 .
- C) The $H - O - H$ bond angle in H_2O is smaller than the $H - N - H$ bond angle in NH_3 .
- D) The $H - C - H$ bond angle in CH_4 is larger than the $H - N - H$ bond angle in NH_3 .

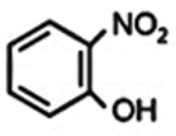
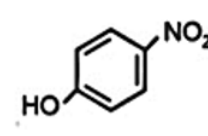
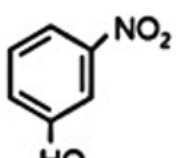
52. Predict the correct order among the following:

- A) lone pair - lone pair > lone pair - bond pair > bond pair - bond pair
- B) lone pair - lone pair > bond pair - bond pair > lone pair - bond pair
- C) bond pair - bond pair > lone pair - bond pair > lone pair - lone pair
- D) lone pair - bond pair > bond pair - bond pair > lone pair - lone pair

53. Decreasing order of stability of O_2 , O_2^- , O_2^+ and O_2^{2-} is:

- A) $O_2^+ > O_2 > O_2^- > O_2^{2-}$
- B) $O_2^{2-} > O_2^- > O_2 > O_2^+$
- C) $O_2 > O_2^+ > O_2^- > O_2^{2-}$
- D) $O_2^{2-} > O_2^- > O_2^+ > O_2$

54. Intramolecular hydrogen bonding is present in:

- A) 
- B) 
- C) 
- D) HF

55. Which of the following pairs of ions are isoelectronic and isostructural?

- A) ClO_3^- , CO_3^{2-}
- B) SO_3^{2-} , NO_3^-
- C) ClO_3^- , SO_3^{2-}
- D) CO_3^{2-} , SO_3^{2-}

56. Maximum bond angle at nitrogen is present in which of the following?

- A) NO_2^-
- B) NO_2^+
- C) NO_3^-
- D) NO_2

57. Which of the following species contains equal number of σ and π bonds?

- A) XeO_4
- B) $(CN)_2$
- C) $CH_2(CN)_2$
- D) HCO_3^-

58. Which of the following molecules has the maximum dipole moment?

- A) CO_2
- B) CH_4
- C) NH_3
- D) NF_3

59. Which one of the following species has planar triangular shape?

- A) N_3^-
- B) NO_3^-
- C) NO_2^-
- D) CO_2

60. Amongst the following the total number of species NOT having eight electrons around central atom in its outermost shell, is NH_3 , $AlCl_3$, $BeCl_2$, CCl_4 , PCl_5 :

- A) 2
- B) 4
- C) 1
- D) 3

61. Which of the following diatomic molecular species has only π bonds according to Molecular Orbital Theory?

- A) O_2
- B) N_2
- C) C_2
- D) Be_2

62. Which of the following is paramagnetic?

- A) N_2
- B) H_2
- C) Li_2
- D) O_2

63. Which of the following is the correct order of dipole moment?

- A) $NH_3 < BF_3 < NF_3 < H_2O$
- B) $H_2O < NF_3 < NH_3 < H_2O$
- C) $BF_3 < NH_3 < NF_3 < H_2O$
- D) $H_2O < NF_3 < NH_3 < BF_3$

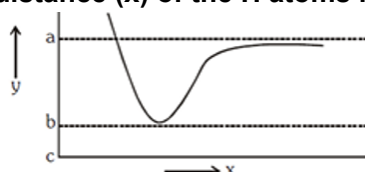
64. The correct boiling point order is:

- A) $H_2O > HF > NH_3$
- B) $H_2O > NH_3 > HF$
- C) $HF > H_2O > NH_3$
- D) $NH_3 > HF > H_2O$

65. Among the compounds shown below which one revealed a linear structure?

- A) NO_2 B) HOCl
C) O_3 D) N_2O

66. The potential energy (y) curve for H_2 formation as a function of internuclear distance (x) of the H atoms is shown.



The bond energy of H_2 is:

- A) $(a - b)$ B) $\frac{c-a}{2}$
C) $\frac{b-a}{2}$ D) $(c - a)$

67. Identify a molecule which does not exist?

- A) O_2 B) He_2
C) Li_2 D) C_2

68. Match List-I with List-II.

List I

- a) PCl_5
b) SF_6
c) BrF_5
d) BF_3

List II

- i) Square pyramidal
ii) Trigonal planar
iii) Octahedral
iv) Trigonal bipyramidal

- A) a-(i), b-(iii), c-(iv), d-(ii) B) a-(iii), b-(i), c-(iv), d-(ii)
C) a-(iv), b-(iii), c-(ii), d-(i) D) a-(iv), b-(iii), c-(i), d-(ii)

69. BF_3 is planar and electron deficient compound. Hybridization and number of electrons around the central atom, respectively are:

- A) sp^3 and 6 B) sp^2 and 6
C) sp^2 and 8 D) sp^3 and 4

70. From the following pairs of ions which one is not an iso-electronic pair?

- A) Na^+ , Mg^{2+} B) Mn^{2+} , Fe^{3+}
C) Fe^{2+} , Mn^{2+} D) O^{2-} , F^-

71. Which of the following molecules is non-polar in nature?

- A) CH_2O B) SbCl_5
C) NO_2 D) POCl_3

72. Amongst the following which one will have maximum 'lone pair-lone pair' electron repulsions?

- A) ClF_3 B) IF_5
C) SF_4 D) XeF_2

73. Which one of the following statements is incorrect related to Molecular Orbital Theory?

- A) The π^* antibonding molecular orbital has a node between the nuclei.
B) In the formation of bonding molecular orbital, the two electron waves of the bonding atoms reinforce each other.
C) Molecular orbitals obtained from $2p_x$ and $2p_y$ orbitals are symmetrical around the bond axis.
D) A π -bonding molecular orbital has larger electron density above and below the internuclear axis.

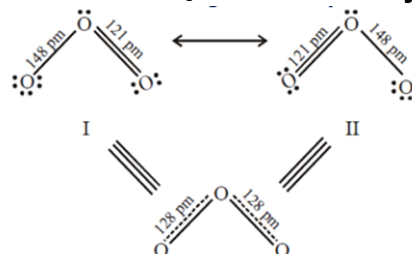
74. Which of the following statements is not true about covalent compounds?

- A) They may exhibit space isomerism B) They have low melting and boiling points
C) They show ionic reactions D) They show molecular reactions

75. Among the following which compound will show the highest lattice energy?

- A) KF B) NaF
C) CsF D) RbF

76. Which of the following structure represents structure of O_3 more accurately?



- A) I and III only B) II and III only
C) I and II only D) All

77. A pair of compounds which has odd electrons in the group NO , CO , ClO_2 , N_2O_5 , SO_2 and O_3 are:

- A) NO and ClO_2 B) CO and SO_2
C) ClO_2 and CO D) SO_2 and O_3

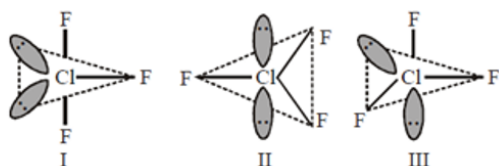
78. Polarisability of halide ions increases in the order:

- A) $F^{-}, I^{-}, Br^{-}, Cl^{-}$ B) $Cl^{-}, Br^{-}, I^{-}, F^{-}$
 C) $I^{-}, Br^{-}, Cl^{-}, F^{-}$ D) $F^{-}, Cl^{-}, Br^{-}, I^{-}$

79. The number of lone pair and bond pair of electrons on the sulphur atom in sulphur dioxide molecule are respectively:

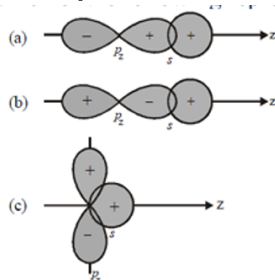
- A) 1 and 3 B) 4 and 1
 C) 3 and 1 D) 1 and 2

80. Which of the following structure is most stable?



- A) Only I B) Only II
 C) Only III D) All three have same stability

81. Which of the following represents zero overlap of atomic orbitals.



- A) (a) B) (b)
 C) (c) D) All of these

82. The strength of bonds formed by s-s, p-p and s-p overlap is in the order of:

- A) $s-p > s-s > p-p$ B) $p-p > s-s > s-p$
 C) $s-s > p-p > s-p$ D) $s-s > s-p > p-p$

83. Which one of the following is the correct order of interactions?

- A) covalent < hydrogen bonding < van der Waals < dipole-dipole
 B) van der Waals < hydrogen bonding < dipole-dipole < covalent
 C) van der Waals < dipole-dipole < hydrogen bonding < covalent
 D) dipole-dipole < van der Waals < hydrogen bonding < covalent

84. Hydrogen bonding is maximum in:

- A) C_2H_5OH B) CH_3OCH_3
 C) $(CH_3)_2C=O$ D) CH_3CHO

85. If N_x is the number of bonding orbitals of an atom and N_y is the number of antibonding orbitals, then the molecule/atom will be stable if

- A) $N_x > N_y$ B) $N_x = N_y$
 C) $N_x < N_y$ D) $N_x \leq N_y$

86. In the change of NO^{+} to NO, the electron is added to

- A) σ -orbital B) π -orbital
 C) σ^* -orbital D) π^* -orbital

87. Of the following hydrides which one has the lowest boiling point?

- A) AsH_3 B) SbH_3
 C) PH_3 D) NH_3

88. What is the dominant intermolecular force or bond that must be overcome in converting liquid CH_3OH to a gas?

- A) Dipole-dipole interaction B) Covalent bonds
 C) London dispersion force D) Hydrogen bonding

89. Which of the following two are isostructural?

- A) NH_3, BF_3 B) PCl_5, ICl_5
 C) XeF_2, ICl_2^{-} D) CO_3^{2-}, SO_3^{2-}

90. Which of the following salt shows maximum covalent character?

- A) $AlCl_3$ B) $MgCl_2$
 C) $CsCl$ D) $LaCl_3$

Botany

91. Pyrenoids, the storage bodies found inside the chloroplasts of green algae, contain:

- A) Only starch B) Only protein
 C) Protein inside and starch outside D) Starch inside and protein outside

92. Hydrocolloids like algin and carrageen are extracted from which of the following groups respectively?

- A) Brown algae and Red algae B) Red algae and Brown algae
C) Green algae and Brown algae D) Red algae and Green algae

93. Which of the following is a unicellular, protein-rich alga utilized as a food supplement by space travelers?

- A) Spirogyra B) Chlorella
C) Volvox D) Fucus

94. Mannitol and laminarin are the characteristic stored food materials found in:

- A) Ectocarpus and Dictyota B) Chlamydomonas and Volvox
C) Polysiphonia and Porphyra D) Ulothrix and Spirogyra

95. Non-motile, structurally identical gametes (isogamy with non-flagellated gametes) are characteristic of:

- A) Chlamydomonas B) Spirogyra
C) Volvox D) Fucus

96. Read the following statements regarding Algae and choose the correct option: I. Volvox forms colonial structures. II. Ulothrix and Spirogyra are unbranched filamentous forms. III. Kelps form massive plant bodies that can reach up to 100 meters.

- A) Only I and II are correct B) Only II and III are correct
C) Only I and III are correct D) All I, II, and III are correct

97. Identify the incorrect statement regarding Rhodophyceae (Red Algae):

- A) The major pigments are chlorophyll a, d, and phycoerythrin. B) The stored food is floridean starch, which is structurally similar to amylopectin and glycogen.
C) They produce motile asexual spores and flagellated gametes. D) Most of the red algae are marine and occur in greater depths of oceans.

98. The structural organization and asexual reproductive pattern of the green alga Ulothrix is best characterized as:

- A) Non-motile, colonial, and lacking any spore structures B) Filamentous and completely lacking flagellated phases
C) Filamentous with motile, flagellated reproductive stages D) Thalloid, unbranched, and generating non-motile conidia

99. Match Column I (Algal Class) with Column II (Flagellar Number and Position of Insertions):

Column I	Column II
A. Chlorophyceae	1. 2, Unequal, Lateral
B. Phaeophyceae	2. Absent
C. Rhodophyceae	3. 2-8, Equal, Apical

- A) A-3, B-1, C-2 B) A-1, B-3, C-2
C) A-3, B-2, C-1 D) A-2, B-1, C-3

100.

Match the algal genus with its corresponding economic or structural trait:

Column I	Column II
A. Gelidium	1. Global carbon fixation
B. Porphyra	2. Agar-Agar production
C. Sargassum	3. Edible marine alga

- A) A-2, B-3, C-1 B) A-1, B-2, C-3
C) A-2, B-1, C-3 D) A-3, B-2, C-1

101.

Assertion (A): Organisms belonging to Rhodophyceae can thrive at deep ocean beds where little light penetrates. Reason (R): Red algae possess the accessory pigment r-phycoerythrin, which can efficiently absorb short-wavelength blue-green light.

- A) Both A and R are true, and R is the correct explanation of A. B) Both A and R are true, but R is not the correct explanation of A.
C) A is true but R is false. D) A is false but R is true.

102.

Assertion (A): Spirogyra exhibits a haplontic life cycle. **Reason (R):** Meiosis occurs directly inside the diploid zygote, resulting in haploid vegetative filaments.

- A) Both A and R are true, and R is the correct explanation of A. B) Both A and R are true, but R is not the correct explanation of A.
C) A is true but R is false. D) A is false but R is true.

103.

In which of the following groups of algae do you find an asymmetric, pear-shaped (pyriform) zoospore with two laterally attached flagella?

- A) Polysiphonia, Gracilaria B) Ectocarpus, Dictyota
C) Volvox, Ulothrix D) Chara, Spirogyra

104.

The plant body of a typical complex brown alga (like Laminaria) is anchored to the substratum by a structure called the ____, and features a stalk called the ____ and a leaf-like photosynthetic organ called the ____.

- A) Rhizoid, Stem, Blade B) Holdfast, Stipe, Frond
C) Root, Petiole, Lamina D) Capsule, Seta, Foot

105.

Vegetative reproduction in chlorophyceae occurs predominantly through:

- A) Akinetes formation B) Fragmentation
C) Binary fission D) Zoospore production

106.

Why are Bryophytes widely known as the 'amphibians of the plant kingdom'?

- A) They can live both in fresh water and deep marine ecosystems. B) They live on land but strictly depend on external water for sexual fertilization.
C) They alternate morphologically between an aquatic sporophyte and a terrestrial gametophyte. D) They completely lack mechanical and protective tissues.

107.

The primary function of the specialized 'gemmae' found in liverworts like Marchantia is:

- A) Water and nutrient absorption B) Protection against dry climates
C) Asexual reproduction through detached green buds D) Direct formation of the diploid sporophyte capsule

108.

Which plant provides a dense, fibrous peat used widely as fuel and as packing material for shipping living plants due to its immense water-holding capacity?

- A) Funaria B) Polytrichum
C) Sphagnum D) Marchantia

109.

The dominant, independent, and photosynthetic phase in the life cycle of a bryophyte is the:

- A) Haploid Gametophyte B) Diploid Sporophyte
C) Multicellular Protonema only D) Diploid Prothallus

110.

Along with cellulose and pectin, the cell walls of members of Rhodophyceae uniquely contain which of the following chemical components?

- A) Algin and fucoxanthin B) Polysulphate esters
C) Hemicellulose and silica D) Peptidoglycan complexes

111.

Read the statements below carefully regarding mosses: I. The protonema stage develops directly from the germination of a haploid spore. II. The leafy stage arises as a lateral bud from the secondary protonema. III. Rhizoids in mosses are unicellular and unbranched structures.

- A) I and II only B) II and III only
C) I and III only D) I, II, and III are correct

112.

Which of the following statements about the bryophyte sporophyte is false?

- A) It is not free-living and remains structurally attached to the gametophyte. B) It derives structural support and nutrition entirely or partially from the gametophyte.
- C) It undergoes immediate mitotic divisions to produce haploid spores. D) It is structurally differentiated into a foot, seta, and capsule.

113.

Identify the true statement concerning bryophyte reproduction:

- A) Male organs are called archegonia and female organs are called antherozia. B) The antherozoids produced are uniquely multi-flagellated.
- C) The zygote does not undergo a reduction division immediately after fertilization. D) Fertilization takes place openly in the surrounding soil medium.

114.

Match the categories in Column I with their distinct representative example in Column

Column I	Column II
A. Liverwort	1. Polytrichum
B. Leafy Moss	2. Marchantia
C. Peat Moss	3. Sphagnum

II:

- A) A-2, B-1, C-3 B) A-1, B-2, C-3
- C) A-2, B-3, C-1 D) A-3, B-1, C-2

115.

Match the following anatomical structures of bryophytes with their description:

Column I	Column II
A. Protonema	1. Flask-shaped female sex organ
B. Archegonium	2. Creeping, green, filamentous juvenile stage
C. Calyptra	3. Protective hood covering the sporophyte capsule

- A) A-2, B-1, C-3 B) A-1, B-2, C-3
- C) A-3, B-1, C-2 D) A-2, B-3, C-1

116.

Assertion (A): Mosses along with lichens are of great ecological significance during primary biological succession. **Reason (R):** They decompose hard rocky substrates, building up organic soil layers suitable for higher vascular plants.

- A) Both A and R are true, and R is the correct explanation of A. B) Both A and R are true, but R is not the correct explanation of A.
- C) A is true but R is false. D) A is false but R is true.

117.

Assertion (A): The sporophyte of mosses is morphologically more elaborate than that of liverworts. **Reason (R):** Mosses possess highly developed spore dispersal mechanism involving peristome teeth.

- A) Both A and R are true, and R is the correct explanation of A. B) Both A and R are true, but R is not the correct explanation of A.
- C) A is true but R is false. D) A is false but R is true.

118.

A unique structural feature of bryophytes that clearly differentiates them from all other green plant divisions is that:

- A) They lack true root systems B) They completely lack vascular plumbing
- C) They multiply via unicellular spores D) Their sporophytes are physically attached to the gametophyte

119.

In bryophytes, the multicellular, sterile-jacketed female sex organ is termed the ____ and is morphologically ____:

- A) Antheridium, round-shaped B) Archegonium, flask-shaped
- C) Prothallus, heart-shaped D) Protonema, kidney-shaped

120.

In mosses, sexual reproduction occurs via the fusion of gametes. These gametes are produced directly by mitosis in:

- A) Spore mother cells
- B) Antheridia and Archegonia
- C) Protonema
- D) Capsule elaters structures

121.

Which of the following groups represents the first terrestrial vascular plants to develop true xylem and phloem tissues?

- A) Bryophytes
- B) Pteridophytes
- C) Gymnosperms
- D) Algae

122.

In pteridophytes, the dominant independent plant body is a:

- A) Gametophyte (n) differentiated into true roots and leaves
- B) Sporophyte (2n) differentiated into true roots, stem, and leaves
- C) Thalloid protonema phase
- D) Highly reduced parasitic capsule

123.

Macrophyllous (large-sized) leaves are a distinguishing morphological feature of which pteridophyte?

- A) Selaginella
- B) Equisetum
- C) Ferns
- D) Lycopodium

124.

Distinct, compact reproductive structures called strobili or cones are naturally found in:

- A) Pteris and Adiantum
- B) Selaginella and Equisetum
- C) Dryopteris and Salvinia
- D) Marsilea and Azolla

125.

The event that serves as an evolutionary precursor to the seed habit in vascular plants is:

- A) Development of a highly visible homosporous lifestyle
- B) Retention of the female gametophyte within the parent sporophyte body
- C) Development of a completely water-independent archegonium
- D) Production of flagellated male gametes

126.

Evaluate the following statements regarding the pteridophyte prothallus: I. It is a small, inconspicuous, multicellular, thalloid gametophyte. II. It requires cool, damp, and shady places to grow successfully. III. It lacks vascular tissue and absorbs water via rhizoids.

- A) I and II only
- B) II and III only
- C) I and III only
- D) I, II, and III are correct

127.

Choose the incorrect statement regarding heterosporous pteridophytes:

- A) They produce two morphologically distinct types of spores (megaspores and microspores).
- B) Genera like Selaginella and Salvinia are heterosporous.
- C) Megaspores germinate to give rise to male gametophytes.
- D) The development of zygotes into young embryos takes place within the female gametophytes.

128.

Which statement is correct regarding vascular distribution within pteridophytes?

- A) Xylem possesses highly functional vessels.
- B) Phloem lacks sieve tubes and companion cells.
- C) Secondary growth is highly prominent across all standard homosporous forms.
- D) Sieve tubes are escorted by highly specialized companion cells.

129.

Match the Pteridophyte Classes listed in Column I with their correct corresponding examples in Column II:

Column I	Column II
A. Psilopsida	1. Equisetum
B. Lycopsidea	2. Psilotum
C. Sphenopsida	3. Selaginella
D. Pteropsida	4. Pteris

- A) A-2, B-3, C-1, D-4 B) A-1, B-2, C-3, D-4
C) A-2, B-1, C-3, D-4 D) A-4, B-3, C-2, D-1

130.

Match Column I with Column II regarding

Column I	Column II
A. Aquatic Fern	1. Equisetum
B. Horsetail	2. Salvinia
C. Club Moss	3. Lycopodium

traits:

- A) A-2, B-1, C-3 B) A-1, B-2, C-3
C) A-3, B-1, C-2 D) A-2, B-3, C-1

131.

Assertion (A): The geographical distribution of living pteridophytes is narrow and restricted to specific zones.
Reason (R): Their gametophytes require water for fertilization and thrive only in cool, damp, and shady environments.

- A) Both A and R are true, and R is the correct explanation of A. B) Both A and R are true, but R is not the correct explanation of A.
C) A is true but R is false. D) A is false but R is true.

132.

Assertion (A): Selaginella is characterized as a heterosporous plant. **Reason (R):** It generates two distinct types of spores called microspores and megaspores.

- A) Both A and R are true, and R is the correct explanation of A. B) Both A and R are true, but R is not the correct explanation of A.
C) A is true but R is false. D) A is false but R is true.

133.

What is the ploidy level of the following structures in a standard fern plant?
[Prothallus cell, Leaf cell, Spore, Rhizoid cell, Spore mother cell]

- A) n, 2n, n, n, 2n B) 2n, 2n, n, n, 2n
C) n, n, n, 2n, 2n D) 2n, n, 2n, n, 2n

134.

A student discovers a vascular land plant that lacks seeds, produces homosporous spores, and has jointed stems with silica ridges. The plant is most likely:

- A) Marsilea B) Equisetum
C) Selaginella D) Azolla

135.

The gametophyte of a pteridophyte, typically referred to as a prothallus, is best described as:

- A) Large, vascular, and highly dependent on the parent sporophyte B) Microscopic, non-photosynthetic, and parasitic
C) Small, inconspicuous, multicellular, and free-living D) A highly advanced, flowering stage that produces seeds

Zoology

136.

Read the following statements regarding AIDS: 1. AIDS is caused by Human Immunodeficiency Virus. 2. HIV belongs to the group of retroviruses. 3. HIV contains RNA as its genetic material. 4. HIV can multiply independently outside a living host cell. Which of the above statements are correct?

- A) 1, 2 and 3 only B) 1 and 4 only
C) 2, 3 and 4 only D) 1, 2, 3 and 4

137.

A student makes the following statements about HIV infection: 1. HIV enters the body mainly through sexual contact, contaminated blood and infected mother-to-child transmission. 2. HIV infection immediately produces complete destruction of the immune system. 3. The virus attacks cells of the immune system. 4. The progressive reduction of immunity makes the infected individual susceptible to opportunistic infections. Which combination is correct?

- A) 1, 3 and 4 only B) 1 and 2 only
C) 2, 3 and 4 only D) All four

138.

Consider the following statements concerning HIV replication: 1. HIV has an RNA genome. 2. After entering the host cell, viral RNA can be used to produce DNA) 3. Reverse transcriptase is involved in this process. 4. The viral DNA can become integrated into the host cell's genetic material. Which option is correct?

- A) 1, 2, 3 and 4 B) 1 and 3 only
C) 2 and 4 only D) 1, 2 and 4 only

139.

Which of the following statements correctly explains why AIDS is primarily regarded as a disease of the immune system?

- A) HIV directly destroys all erythrocytes, resulting in severe anaemia) B) HIV progressively reduces the population/function of immune cells, weakening the body's defence against infections.
C) HIV specifically infects only cancer cells and converts them into malignant cells. D) HIV prevents oxygen transport by destroying haemoglobin.

140.

A person infected with HIV may remain apparently healthy for several years before developing serious manifestations. Which explanation best agrees with the NCERT description?

- A) HIV remains permanently outside the body and becomes active only after many years. B) Progressive damage to the immune system eventually allows opportunistic infections and other manifestations to occur.
C) HIV is eliminated completely during the asymptomatic period and later reappears. D) The virus remains restricted to red blood cells during the asymptomatic phase.

141.

Which of the following combinations concerning AIDS transmission is incorrect?

- A) Sexual contact — possible route B) Transfusion of infected blood — possible route
C) Sharing infected needles — possible route D) Sharing food and water with an infected person — established route

142.

Consider the following statements regarding prevention of AIDS: 1. Avoiding multiple sexual partners reduces the risk of HIV transmission. 2. Screening of blood before transfusion is important. 3. Using disposable or properly sterilised needles helps prevent transmission. 4. HIV transmission can be prevented by avoiding all physical contact with infected individuals. Choose the correct answer.

- A) 1, 2 and 3 only B) 1 and 4 only
C) 2, 3 and 4 only D) All four

143.

Which statement most appropriately distinguishes cancer cells from normal cells?

- | | |
|--|---|
| A) Cancer cells always stop dividing when they come in contact with neighbouring cells. | B) Cancer cells lose normal regulatory mechanisms controlling cell division and may continue proliferating abnormally. |
| C) Cancer cells are unable to divide by mitosis. | D) Cancer cells can never invade neighbouring tissues. |

144.

A tumour remains confined to its original location and does not invade neighbouring tissues or spread to distant organs. Such a tumour is generally described as:

- | | |
|---------------------|----------------------|
| A) Malignant | B) Metastatic |
| C) Benign | D) Infectious |

145.

Which one of the following best describes metastasis?

- | | |
|---|--|
| A) Conversion of a normal cell into an immune cell | B) Spread of cancer cells from their original site to distant parts of the body |
| C) Destruction of cancer cells by antibodies | D) Formation of a blood clot around a tumour |

146.

Regarding carcinogens, consider: 1. Physical agents can act as carcinogens. 2. Chemical substances may induce cancer. 3. Oncogenic viruses can contribute to cancer development. 4. Tobacco smoke contains carcinogenic substances. Which statements are correct?

- | | |
|-------------------------|---------------------------|
| A) 1 and 2 only | B) 2 and 3 only |
| C) 1, 2, 3 and 4 | D) 1, 3 and 4 only |

147.

Which of the following is correctly associated with cancer?

- | | |
|---|--|
| A) Transformation of normal cells into cancerous cells — oncogenic transformation | B) Spread of malignant cells to distant organs — metastasis |
| C) Detection of cancer at an early stage — improved chance of successful treatment | D) All of the above |

148.

Cancer may arise due to: 1. Activation of cellular oncogenes/proto-oncogenes. 2. Genetic changes affecting regulation of cell division. 3. Exposure to carcinogenic agents. 4. Certain viral infections. Which combination is most appropriate?

- | | |
|---------------------------|---------------------------|
| A) 1 and 2 only | B) 1, 2 and 3 only |
| C) 2, 3 and 4 only | D) 1, 2, 3 and 4 |

149.

A physician suspects cancer in a patient. Which combination of methods may be useful for cancer detection/diagnosis?

- | | |
|--|---|
| A) Biopsy and histopathological examination | B) Imaging techniques such as radiography/CT/MRI depending on the suspected tumour |
| C) Certain biochemical or molecular tests where appropriate | D) All of the above |

150.

Which statement regarding cancer treatment is most appropriate?

- | | |
|--|---|
| A) Cancer treatment is always based exclusively on antibiotics. | B) Surgery, radiotherapy and chemotherapy are among the important approaches used depending on the type and stage of cancer. |
| C) Vaccination immediately eliminates every malignant tumour. | D) Cancer can never be treated successfully if detected early. |

151.

The immune system has a role in recognising and eliminating abnormal cells. Therefore, cancer immunotherapy aims to:

- | | |
|--|--|
| A) Completely stop formation of all normal body cells | B) Enhance or utilise immune responses against tumour cells |
| C) Increase HIV replication inside lymphocytes | D) Replace all cancer cells with erythrocytes |

152.

Which of the following pairs is incorrectly matched?

- | | |
|--|---|
| A) Tobacco smoke — carcinogenic exposure | B) UV radiation — physical carcinogenic agent |
| C) Oncogenic viruses — biological cause associated with certain cancers | D) Metastasis — conversion of cancer cell into a normal cell |

153.

A patient develops a tumour due to uncontrolled proliferation of cells. Which sequence best represents the conceptual progression?

- | | |
|--|--|
| A) Normal cell → genetic alteration → uncontrolled proliferation → tumour formation | B) Tumour → normal cell → genetic alteration → controlled proliferation |
| C) Normal cell → antibody → erythrocyte → tumour | D) Virus → platelet → tumour → normal cell |

154.

Why is early detection of cancer particularly important?

- | | |
|--|---|
| A) It prevents every possible genetic mutation. | B) It can permit treatment before extensive invasion and metastasis occur, improving the possibility of successful management. |
| C) It guarantees that the tumour is benign. | D) It makes chemotherapy unnecessary in every case. |

155.

Which of the following statements about AIDS is most logically correct?

- | | |
|---|--|
| A) The severity of AIDS is related to progressive weakening of immune defence. | B) Opportunistic infections become important because immune surveillance/defence is compromised |
| C) HIV infection can ultimately lead to severe immunodeficiency. | D) All of the above |

156.

Assertion: AIDS patients become susceptible to opportunistic infections.

Reason: HIV progressively damages the immune system, reducing the body's ability to defend itself against infections.

- | | |
|---|---|
| A) Both Assertion and Reason are true, and Reason is the correct explanation of Assertion. | B) Both Assertion and Reason are true, but Reason is not the correct explanation of Assertion. |
| C) Assertion is true, but Reason is false. | D) Both Assertion and Reason are false. |

157.

Assertion: HIV is called a retrovirus.

Reason: Its genetic material is RNA and it uses reverse transcriptase to form DNA from an RNA template.

- | | |
|---|---|
| A) Both Assertion and Reason are true, and Reason is the correct explanation of Assertion. | B) Both Assertion and Reason are true, but Reason is not the correct explanation of Assertion. |
| C) Assertion is true, but Reason is false. | D) Both Assertion and Reason are false. |

158.

Assertion: Sharing food with an HIV-infected person is considered a major route of HIV transmission. Reason: HIV is transmitted through infected body fluids under specific routes such as sexual contact, contaminated blood and infected needles.

- | | |
|---|---|
| A) Both Assertion and Reason are true, and Reason is the correct explanation of Assertion. | B) Both Assertion and Reason are true, but Reason is not the correct explanation of Assertion. |
| C) Assertion is true, but Reason is false. | D) Both Assertion and Reason are false. |

159.

Assertion: Metastasis is an important feature of malignant tumours. Reason: Malignant cancer cells can invade surrounding tissues and spread to distant sites through body systems such as blood and lymph.

- | | |
|---|---|
| A) Both Assertion and Reason are true, and Reason is the correct explanation of Assertion. | B) Both Assertion and Reason are true, but Reason is not the correct explanation of Assertion. |
| C) Assertion is true, but Reason is false. | D) Both Assertion and Reason are false. |

160.

Assertion: Benign tumours are generally less dangerous than malignant tumours. Reason: Benign tumours usually remain localised and do not show the extensive invasive and metastatic behaviour characteristic of malignant tumours.

- | | |
|---|---|
| A) Both Assertion and Reason are true, and Reason is the correct explanation of Assertion. | B) Both Assertion and Reason are true, but Reason is not the correct explanation of Assertion. |
| C) Assertion is true, but Reason is false. | D) Both Assertion and Reason are false. |

161.

Assertion: Tobacco consumption can increase the risk of cancer. Reason: Tobacco smoke contains carcinogenic substances capable of contributing to cellular genetic damage and malignant transformation.

- | | |
|---|---|
| A) Both Assertion and Reason are true, and Reason is the correct explanation of Assertion. | B) Both Assertion and Reason are true, but Reason is not the correct explanation of Assertion. |
| C) Assertion is true, but Reason is false. | D) Both Assertion and Reason are false. |

162.

Assertion: All tumours are cancerous. Reason: Every tumour necessarily invades surrounding tissues and undergoes metastasis.

- | | |
|---|---|
| A) Both Assertion and Reason are true, and Reason is the correct explanation of Assertion. | B) Both Assertion and Reason are true, but Reason is not the correct explanation of Assertion. |
| C) Assertion is true, but Reason is false. | D) Both Assertion and Reason are false. |

163.

Assertion: Cancer cells may continue dividing even when normal regulatory mechanisms would restrict cell proliferation. Reason: Genetic alterations can disturb the normal control of cell division and growth.

- | | |
|---|---|
| A) Both Assertion and Reason are true, and Reason is the correct explanation of Assertion. | B) Both Assertion and Reason are true, but Reason is not the correct explanation of Assertion. |
| C) Assertion is true, but Reason is false. | D) Both Assertion and Reason are false. |

164.

Assertion: Early diagnosis is important in cancer management. Reason: Cancer cells can invade surrounding tissues and may eventually metastasise to distant organs.

- A) Both Assertion and Reason are true, and Reason is the correct explanation of Assertion. B) Both Assertion and Reason are true, but Reason is not the correct explanation of Assertion.
C) Assertion is true, but Reason is false. D) Both Assertion and Reason are false.

165.

Assertion: AIDS can be prevented by completely isolating every HIV-infected individual from society. Reason: HIV transmission occurs through specific routes and does not occur through ordinary social contact such as sharing food

- A) Both Assertion and Reason are true, and Reason is the correct explanation of Assertion. B) Both Assertion and Reason are true, but Reason is not the correct explanation of Assertion.
C) Assertion is true, but Reason is false. D) Both Assertion and Reason are false.

166.

Match Column I with Column II.

Column I	Column II
A) HIV	1. Cancer spread to distant sites
B) Reverse transcriptase	2. Retrovirus
C) Metastasis	3. RNA-dependent DNA synthesis
D) Benign tumour	4. Usually localised

- A) A-2, B-3, C-1, D-4 B) A-3, B-2, C-4, D-1
C) A-2, B-1, C-3, D-4 D) A-4, B-3, C-1, D-2

167.

Match the following:

Column I	Column II
A) Sexual contact	1. Possible HIV transmission route
B) Contaminated blood	2. Possible HIV transmission route in anemia patients
C) Infected needles	3. Possible HIV transmission route in intravenous drug abusers
D) Sharing food	4. Not a usual HIV transmission route

- A) A-1, B-2, C-3, D-4 B) A-2, B-3, C-4, D-1
C) A-1, B-3, C-2, D-4 D) A-4, B-2, C-1, D-3

168.

Match:

Column I	Column II
A) Carcinogenic chemicals	1. Chemical agents
B) UV radiation	2. Physical agent
C) Oncogenic viruses	3. Biological agent
D) Tobacco smoke	4. Important source of carcinogens

- A) A-1, B-2, C-3, D-4 B) A-2, B-1, C-4, D-3
C) A-3, B-2, C-1, D-4 D) A-4, B-3, C-2, D-1

169.

Match the following terms with their most appropriate descriptions:

Column I	Column II
A) Benign tumour	1. Invasion/metastatic potential
B) Malignant tumour	2. Usually localised
C) Metastasis	3. Spread of malignant cells
D) Biopsy	4. Tissue examination for diagnosis

- A) A-2, B-1, C-3, D-4 B) A-1, B-2, C-4, D-3
C) A-2, B-3, C-1, D-4 D) A-4, B-1, C-3, D-2

170.

Match:

Column I	Column II
A) HIV	1. Causes immunodeficiency
B) Cancer	2. Uncontrolled proliferation
C) Opportunistic infection	3. Takes advantage of weakened immunity
D) Immunotherapy	4. Utilisation of immune response in cancer treatment

- A) A-1, B-2, C-3, D-4 B) A-2, B-1, C-4, D-3
C) A-3, B-2, C-1, D-4 D) A-1, B-3, C-2, D-4

171.

A person has HIV infection but does not show severe symptoms initially. After several years, the individual develops recurrent infections. Which inference is most appropriate?

- A) HIV infection necessarily disappears during the asymptomatic period B) The absence of severe initial symptoms proves that the immune system is unaffected
C) Progressive impairment of immune function can eventually allow opportunistic infections to develop. D) HIV initially infects only cancer cells and later changes into a bacterium.

172.

Two patients have tumours of similar size. Tumour X is confined to its original tissue, whereas tumour Y has established secondary growths in distant organs.

Which conclusion is most appropriate?

- | | |
|---|---|
| A) X is necessarily malignant and Y necessarily benign. | B) X is more consistent with a localised tumour, whereas Y demonstrates metastatic behaviour. |
| C) Both must be benign because their primary tumours have similar sizes. | D) Metastasis depends only on tumour size and not on the biological behaviour of tumour cells. |

173.

A researcher observes that a population of cells continues dividing despite signals that normally inhibit proliferation. Which event is most likely involved?

- | | |
|--|---|
| A) Loss of normal regulatory control over cell division | B) Complete conversion of DNA into RNA in every cell |
| C) Destruction of all cellular proteins | D) Permanent arrest of the cell cycle |

174.

A doctor advises an individual to avoid tobacco exposure as part of cancer prevention. Which reasoning best supports this advice?

- | | |
|--|---|
| A) Tobacco smoke can contain carcinogenic substances that contribute to malignant transformation. | B) Tobacco directly infects every person with HIV. |
| C) Tobacco prevents immune cells from being formed by bone marrow in every individual. | D) Tobacco consumption guarantees development of cancer. |

175.

An HIV-infected individual is asked about transmission risk. Which situation represents the least appropriate concern for ordinary HIV transmission?

- | | |
|--|--|
| A) Receiving unscreened infected blood | B) Sharing contaminated needles |
| C) Unprotected sexual contact with an infected person | D) Sharing food with an infected person |

176.

A malignant tumour is detected before significant spread to distant organs. Why can this situation be clinically more favourable than detection after widespread metastasis?

- | | |
|--|---|
| A) Malignant cells become harmless before metastasis. | B) Localised disease may be more amenable to effective treatment before extensive dissemination. |
| C) Metastatic cells are always easier to destroy than primary tumour cells. | D) Early detection converts malignant cells automatically into benign cells. |

177.

Which one of the following represents the most appropriate chain of reasoning regarding cancer?

- | | |
|---|---|
| A) Carcinogen → genetic/cellular alteration → abnormal proliferation → tumour → possible invasion/metastasis | B) Carcinogen → antibody formation → erythrocyte production → tumour |
| C) Cancer → normal cell formation → immune tolerance → complete recovery | D) Virus → platelet formation → benign tumour → HIV infection |

178.

Consider the following four statements: 1. HIV is a retrovirus. 2. Reverse transcriptase participates in the replication of HIV. 3. AIDS results from progressive weakening of the immune system. 4. Metastasis is a characteristic feature of benign tumours. Which statements are correct?

- | | |
|---------------------------|------------------------|
| A) 1, 2 and 3 only | B) 1 and 4 only |
| C) 2, 3 and 4 only | D) All four |

179.

A student claims: "Since HIV is transmitted through infected blood, any contact between the blood of an infected person and another person must inevitably cause AIDS." Which is the best evaluation?

A) Correct, because every blood contact inevitably causes HIV infection.

B) Incorrect, because HIV transmission requires appropriate exposure to infected material; ordinary contact does not automatically transmit HIV.

C) Correct, because HIV can multiply in blood outside the body indefinitely.

D) Incorrect, because HIV cannot occur in blood

180.

Consider the following statements about AIDS and cancer: 1. Both AIDS and cancer can involve serious impairment of normal immune function. 2. HIV is a retrovirus containing RNA as genetic material. 3. Metastasis refers to the spread of malignant cells to distant sites. 4. Benign tumours characteristically invade distant organs. 5. Tobacco smoke may contain carcinogenic substances. 6. Sharing food with an HIV-infected individual is an established route of HIV transmission. Which combination contains all and only the correct statements?

A) 1, 2, 3 and 5 only

B) 1, 2, 4 and 6 only

C) 2, 3, 4 and 5 only

D) 1, 3, 4, 5 and 6 only

ANSWER KEY

Physics

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

Chemistry

46.	2	58.	3	70.	3	82.	4
47.	2	59.	2	71.	2	83.	3
48.	2	60.	4	72.	4	84.	1
49.	3	61.	3	73.	3	85.	1
50.	2	62.	4	74.	3	86.	4
51.	2	63.	2	75.	2	87.	3
52.	1	64.	1	76.	1,2,3	88.	4
53.	1	65.	4	77.	1	89.	3
54.	1	66.	1	78.	4	90.	1
55.	3	67.	2	79.	4		
56.	2	68.	4	80.	1		
57.	1	69.	2	81.	3		

Botany

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

127.	3	130.	1	133.	1
128.	2	131.	1	134.	2
129.	1	132.	1	135.	3

Zoology

136.	1	148.	4	160.	1	172.	2
137.	1	149.	4	161.	1	173.	1
138.	1	150.	2	162.	4	174.	1
139.	2	151.	2	163.	1	175.	4
140.	2	152.	4	164.	1	176.	2
141.	4	153.	1	165.	4	177.	1
142.	1	154.	2	166.	1	178.	1
143.	2	155.	4	167.	1	179.	2
144.	3	156.	1	168.	1	180.	1
145.	2	157.	1	169.	1		
146.	3	158.	4	170.	1		
147.	4	159.	1	171.	3		

SOLUTIONS

Q1.

Answer: A

Explanation:

The man experiences the relative velocity of rain, which vectorially combines his reversed velocity with the velocity of the falling rain. The angle with the vertical is found using the ratio of the horizontal speed of the man to the vertical speed of the rain.

Q2.

Answer: A

Explanation:

By utilizing the relationship between the horizontal speed of the man and the vertical speed of the rain through the tangent of the umbrella holding angle, the speed of the rain can be isolated and computed.

Q3.

Answer: B

Explanation:

To find the relative velocity of the bus with respect to the car, we subtract the velocity vector of the car from the velocity vector of the bus. The magnitude is found using the Pythagorean theorem, and the direction is determined using trigonometric ratios with respect to the coordinate axes.

Q4.

Answer: B

Explanation:

The relative velocity of the bicyclist with respect to the train is obtained by vector subtraction of the train's velocity from the bicyclist's velocity, followed by calculating the resultant magnitude and angle.

Q5.

Answer: A

Explanation:

Since the air traffic controller is stationary on the ground, the observed velocity of the airplane is simply the vector sum of the airplane's velocity relative to the air and the wind velocity, or in this case, the direct combination of its orthogonal velocity components.

Q6.

Answer: A

Explanation:

To protect himself from the rain, the man must hold his umbrella in the direction of the relative velocity of the rain with respect to the man. By resolving the velocity vectors into components, the angle with the vertical can be found using trigonometry.

Q7.

Answer: A

Explanation:

Since the relative velocity of rain appears vertical to the moving man, the horizontal component of the actual rain's velocity must exactly cancel out the man's velocity. Using the hypotenuse (actual speed) and the horizontal side (man's speed), we can find the angle with the vertical.

Q8.

Answer: B

Explanation:

The apparent angle of the rain is given relative to the vertical, meaning the magnitude of the horizontal relative velocity component equals the vertical falling speed component.

Q9.

Answer: B

Explanation:

The umbrella must be held along the direction of the relative velocity of rain with respect to the man. The angle is determined by taking the inverse tangent of the ratio of the man's speed to the vertical speed of the rain.

Q10.

Answer: A

Explanation:

When the man moves, the apparent direction of the rain changes due to relative velocity. Using trigonometric ratios involving the man's running speed and the vertical velocity component of the rain yields the exact rain speed.

Q11.

Answer: C

Explanation:

By resolving the rain's velocity into horizontal and vertical components and subtracting the car's velocity, we find the net horizontal and vertical components of the relative velocity to determine the correct umbrella angle.

Q12.

Answer: A

Explanation:

Since the stationary rain has only a vertical component, the horizontal component of the relative velocity is entirely due to the observer's motion. Using the apparent angle of 60° , we apply trigonometry to find the vertical rain speed.

Q13.

Answer: B

Explanation:

For the rain to appear falling vertically downward to a moving observer, the man's horizontal velocity must exactly equal the horizontal component of the rain's velocity.

Q14.

Answer: A

Explanation:

The horizontal component of the relative velocity is found by subtracting the man's velocity from the horizontal component of the rain's velocity.

Q15.

Answer: C

Explanation:

The actual speed of the rain is the vector magnitude of its horizontal and vertical components, where the horizontal component equals the man's speed.

Q16.

Answer: B

Explanation:

When the man is stationary, the horizontal component of the rain's velocity balances the apparent horizontal velocity when he moves. By setting up simultaneous equations using the horizontal and vertical components of the rain's velocity in both cases, we can determine the actual speed of the rain.

Q17.

Answer: A

Explanation:

Since the rain appears to fall vertically to a stationary man, its horizontal velocity relative to the ground is zero (meaning there is no wind, and the rain falls straight down relative to the ground). Thus, the actual vertical speed of the rain is 6 m/s . When the man moves horizontally, the apparent velocity has both horizontal and vertical components.

Q18.

Answer: D

Explanation:

By resolving the actual velocity of the rain into horizontal and vertical components using its given magnitude and apparent behavior when the man is in motion, we can determine its true directional angle with the vertical.

Q19.

Answer: A

Explanation:

The flag flutters opposite to the direction of the relative velocity of the wind with respect to the running boy. By finding the vector difference between the wind velocity and the boy's velocity, we determine the angle made with the reference axis.

Q20.

Answer: B

Explanation:

The observed wind velocity is the relative velocity of the wind with respect to the car. Using vector addition of the car's velocity and the relative velocity, we find the absolute velocity of the wind.

Q21.

Answer: A

Explanation:

The true wind velocity is the vector sum of the cyclist's velocity and the apparent wind velocity observed by the cyclist.

Q22.

Answer: A

Explanation:

Working in the non-inertial reference frame of the accelerating lift, the initial relative velocity of the coin is zero, the relative acceleration accounts for both gravity and the lift's upward acceleration, and the relative displacement is equal to the negative of the lift's height.

Q23.

Answer: B

Explanation:

By transforming into the accelerated frame of the lift, the effective downward acceleration becomes the sum of gravitational acceleration and the lift's upward acceleration, allowing us to find the time taken to cover the height of 20 m starting from rest relative to the lift.

Q24.

Answer: C

Explanation:

Using the relative frame of the lift, the coin experiences a downward effective acceleration equal to the sum of gravity and the lift's upward acceleration, determining the exact time required to traverse the 50 m distance.

Q25.

Answer: A

Explanation:

In the frame of reference of the accelerating lift, the initial relative velocity of the coin is zero, and it experiences a downward relative acceleration equal to the sum of acceleration due to gravity and the lift's upward acceleration. Using the kinematic equation for relative motion, the time taken to cover the height of the lift is calculated.

Q26.

Answer: C

Explanation:

Working in the non-inertial frame of the accelerating elevator, the relative initial velocity is zero, and the effective downward acceleration is the sum of gravitational acceleration and the elevator's upward acceleration. The time is obtained by equating the relative displacement to the height of the elevator.

Q27.

Answer: B

Explanation:

By transforming into the accelerated frame of the lift, the initial relative velocity of the dropped coin is zero. The effective relative acceleration is the sum of the acceleration due to gravity and the lift's upward acceleration, allowing direct calculation of time using kinematic equations.

Q28.

Answer: B

Explanation:

We solve this by working in the non-inertial frame of the lift. The relative initial velocity of the coin is zero, and the relative acceleration is the difference between the acceleration due to gravity and the lift's upward acceleration. Using the kinematic equation for displacement gives the time of impact.

Q29.

Answer: A

Explanation:

Transform the motion into the accelerating reference frame of the lift. Find the relative initial velocity and the relative acceleration to apply the standard kinematic equation for distance covered.

Q30.

Answer: A

Explanation:

In the frame of the accelerating lift, the initial relative velocity of the dropped coin is zero. The effective downward acceleration is the sum of gravitational acceleration and the lift's upward acceleration.

Q31.

Answer: A

Explanation:

In the frame of reference of the accelerating lift, the initial relative velocity of the coin is zero, and the effective downward acceleration experienced by the coin is the sum of acceleration due to gravity and the lift's upward acceleration. Using the kinematic equation of motion under constant relative acceleration, we find the time taken to cover the height of the lift.

Q32.

Answer: B

Explanation:

By analyzing the motion from the non-inertial frame of the lift, the initial relative velocity of the dropped coin is zero. The effective relative acceleration is the sum of gravitational acceleration and the upward lift acceleration, allowing direct application of kinematic relations over the height of 45 meters.

Q33.

Answer: A

Explanation:

Transforming into the accelerating frame of the lift, the initial relative velocity is zero. The total downward acceleration relative to the lift is the sum of the gravitational deceleration and the upward acceleration of the lift, yielding a simple time calculation using standard kinematics.

Q34.

Answer: C

Explanation:

The velocity of the boat in still water and the velocity of the river flow act perpendicular to each other, forming a right-angled triangle where the resultant velocity is the hypotenuse. Using the Pythagorean theorem, the river velocity can be determined from the boat and resultant speeds.

Q35.

Answer: C

Explanation:

The resultant velocity represents the hypotenuse of a right-angled triangle formed by the boat's velocity across the river and the river's flow velocity. Subtracting the square of the boat's speed from the square of the resultant speed yields the square of the river speed.

Q36.

Answer: C

Explanation:

The steamer's velocity and the river's velocity act at a right angle to each other. By applying the Pythagorean theorem with the given steamer and resultant velocities, the unknown river velocity is calculated.

Q37.

Answer: A

Explanation:

The relative velocity of the first object with respect to the second object is calculated by subtracting the velocity vector of the second object from the velocity vector of the first object using vector subtraction component by component.

Q38.

Answer: B

Explanation:

The relative velocity of the boat with respect to the water is obtained by subtracting the velocity vector of the water from the velocity vector of the boat.

Q39.

Answer: B

Explanation:

When a swimmer crosses a river in the shortest possible time, the path is inclined due to the river flow. The average speed over the crossing is given by the root mean square of the swimmer's speed in still water and the river's flow speed divided by two. Using the given average speed, we can solve for the unknown river speed.

Q40.

Answer: C

Explanation:

Using the relation between the average speed in the shortest time path, the swimmer's speed in still water, and the river velocity, we set up the equation and solve for the river's flow speed.

Q41.

Answer: C

Explanation:

To cross the river via the shortest possible path (perpendicular to the flow), the man must swim upstream at an angle such that the horizontal component of his velocity cancels the river's flow velocity.

Q42.

Answer: B

Explanation:

The man aims upstream at a specific angle with the normal to counter the river current, ensuring his net motion is directly across the river.

Q43.

Answer: C

Explanation:

By vectorially balancing the eastward river velocity with the westward component of the swimmer's velocity, the swimmer achieves a straight-crossing path towards the south.

Q44.

Answer: A

Explanation:

To cross the river perpendicularly and reach the exact opposite point, the component of the swimmer's velocity opposing the river flow must exactly cancel the river's speed. Using the sine relation of the angle with the normal, we find the required direction.

Q45.

Answer: A

Explanation:

To cross the river in the shortest possible time, the man must swim perpendicular to the flow of the river. The effective velocity component across the river is his speed in still water.

Q46.

Answer: B

Explanation:

The central chlorine atom in ClF_3 has 7 valence electrons, forms 3 single bonds with fluorine, leaving 4 non-bonding electrons which constitute 2 lone pairs.

Q47.

Answer: B

Explanation:

In $CH_2 = CH - C \equiv CH$, the hybridization of carbons from left to right is sp^2 , sp^2 , sp , sp based on their number of σ bonds.

Q48.

Answer: B

Explanation:

Using Molecular Orbital Theory, CN^- has 14 electrons (isoelectronic with N_2), giving it a bond order of 3, which is the highest among the given species.

Q49.

Answer: C

Explanation:

BCl_3 is a symmetric trigonal planar molecule with sp^2 hybridization and zero lone pairs, giving it ideal bond angles of 120° .

Q50.

Answer: B

Explanation:

Isoelectronic species (species with the same number of electrons) share the same molecular orbital configuration and therefore have the same bond order. Both CN^- and CO have 14 electrons.

Q51.

Answer: B

Explanation:

The $H - O - H$ bond angle in H_2O is 104.5° due to repulsion from 2 lone pairs, whereas the $H - C - H$ bond angle in CH_4 is a tetrahedral 109.5° . Therefore, the statement in Option B is false.

Q52.

Answer: A

Explanation:

According to VSEPR theory, because lone pair electrons are localized only on the central nucleus, they occupy more space and cause stronger repulsion than bonded pairs.

Q53.

Answer: A

Explanation:

Stability is directly proportional to the bond order. The bond orders of O_2^+ , O_2 , O_2^- , and O_2^{2-} are 2.5, 2.0, 1.5, and 1.0 respectively.

Q54.

Answer: A

Explanation:

In o-nitrophenol, the $-OH$ and $-NO_2$ groups are on adjacent carbon atoms, allowing hydrogen bonding to occur within the same molecule.

Q55.

Answer: C

Explanation:

Both ClO_3^- and SO_3^{2-} contain 42 total electrons (isoelectronic) and have sp^3 hybridization with 3 bond pairs and 1 lone pair, resulting in a trigonal pyramidal shape (isostructural).

Q56.

Answer: B

Explanation:

NO_2^+ has sp hybridization with 2 bond pairs and 0 lone pairs on Nitrogen, resulting in a perfectly linear structure with a bond angle of 180° .

Q57.

Answer: A

Explanation:

In XeO_4 , the central Xenon atom forms 4 double bonds with 4 Oxygen atoms, containing 4 σ and 4 π bonds, which are equal in number.

Q58.

Answer: C

Explanation:

In NH_3 , the lone pair dipole and $N - H$ bond dipoles point in the same direction, reinforcing each other, resulting in a large net dipole moment.

Q59.

Answer: B

Explanation:

The Nitrate ion (NO_3^-) has sp^2 hybridization on the central Nitrogen atom with 3 bonding domains and no lone pairs, producing a trigonal planar geometry.

Q60.

Answer: D

Explanation:

The species $AlCl_3$ (6 electrons), $BeCl_2$ (4 electrons), and PCl_5 (10 electrons) do not obey the octet rule, giving a total of 3 species.

Q61.

Answer: C

Explanation:

According to Molecular Orbital Theory, the 12 electrons of C_2 fill the orbitals up to π_{2p} , meaning all bonding contribution comes from two π bonds.

Q62.

Answer: D

Explanation:

Molecular Orbital Theory reveals that O_2 has two unpaired electrons in its degenerate antibonding π^* orbitals, making it paramagnetic.

Q63.

Answer: B

Explanation:

BF_3 is non-polar ($\mu = 0$). In NF_3 , bond and lone pair dipoles oppose, making it less polar than NH_3 where they reinforce. H_2O has the highest dipole moment due to its highly polar $O-H$ bonds and geometry.

Q64.

Answer: A

Explanation:

H_2O forms an average of 4 hydrogen bonds per molecule in a 3D network, giving it a higher boiling point than HF (2 hydrogen bonds per molecule) and NH_3 (weaker H-bonding).

Q65.

Answer: D

Explanation:

N_2O is a linear molecule, represented by resonance structures like $N \equiv N^+ - O^-$, with sp hybridization on the central Nitrogen.

Q66.

Answer: A

Explanation:

Bond energy is the difference in potential energy between the completely separated atoms (energy level a) and the minimum energy state at equilibrium distance (energy level b).

Q67.

Answer: B

Explanation:

According to Molecular Orbital Theory, He_2 has a bond order of 0, meaning there is no net energetic stabilization to hold the atoms together.

Q68.

Answer: D

Explanation:

Matching geometries based on VSEPR: PCl_5 is trigonal bipyramidal, SF_6 is octahedral, BrF_5 is square pyramidal, and BF_3 is trigonal planar.

Q69.

Answer: B

Explanation:

Boron in BF_3 forms 3 single bonds using sp^2 hybridization, leaving it with 6 total valence electrons in its outer shell.

Q70.

Answer: C

Explanation:

Fe^{2+} has 24 electrons, while Mn^{2+} has 23 electrons, making them non-isoelectronic.

Q71.

Answer: B

Explanation:

$SbCl_5$ has a highly symmetric trigonal bipyramidal geometry (sp^3d), causing the individual bond dipoles to completely cancel out and giving a net dipole moment of zero.

Q72.

Answer: D

Explanation:

The central Xenon atom in XeF_2 has 3 lone pairs in equatorial positions, leading to the highest number of lone pair-lone pair repulsions.

Q73.

Answer: C

Explanation:

Molecular orbitals formed from the sideways overlap of $2p_x$ and $2p_y$ are π orbitals, which have a nodal plane passing through the bond axis and are thus not cylindrically symmetrical around it.

Q74.

Answer: C

Explanation:

Covalent compounds are made of molecules, so they undergo molecular/radical reactions which are slower, whereas ionic compounds participate in rapid ionic reactions.

Q75.

Answer: B

Explanation:

Lattice energy is inversely proportional to the interionic distance. Since Na^+ is the smallest cation among the options, NaF has the highest lattice energy.

Q76.

Answer: A,B,C

Explanation:

According to the source answer key, the structures representing ozone are the resonance forms I and II, which are standard Lewis representations.

Q77.

Answer: A

Explanation:

Both NO(11 valence electrons) and ClO_2 (19 valence electrons) contain an odd number of total valence electrons, making them stable odd-electron molecules.

Q78.

Answer: D

Explanation:

Polarizability of an anion is directly proportional to its ionic size. As size increases down Group 17, the valence electrons are held less tightly, making polarizability increase from F^- to I^- .

Q79.

Answer: D

Explanation:

In SO_2 , the central Sulfur atom has 1 lone pair and forms 2 double bonds (which are treated as 2 bonding domains or active σ bond pairs under VSEPR).

Q80.

Answer: A

Explanation:

In Structure I of ClF_3 , both lone pairs are placed in equatorial positions (120° apart), which minimizes the strong lone pair-lone pair repulsions at 90° .

Q81.

Answer: C

Explanation:

In (c), the positive lobe of the s-orbital overlaps equally with the positive and negative lobes of the perpendicular p-orbital, resulting in net zero overlap due to cancellation.

Q82.

Answer: D

Explanation:

Based on the answer key in the source file, Option D ($s - s > s - p > p - p$) is selected as the correct choice.

Q83.

Answer: C

Explanation:

The strength of forces increases from weak dispersion forces (van der Waals), to moderate dipole-dipole, to strong hydrogen bonds, up to chemical covalent bonds.

Q84.

Answer: A

Explanation:

Ethanol ($\text{C}_2\text{H}_5\text{OH}$) contains a hydrogen atom directly bonded to a highly electronegative oxygen atom ($-\text{OH}$ group), which is a prerequisite for forming intermolecular hydrogen bonds.

Q85.

Answer: A

Explanation:

A molecule is stable if its bond order is positive (greater than zero), which requires more electrons in bonding orbitals (N_x) than in antibonding orbitals (N_y).

Q86.

Answer: D

Explanation:

NO^+ has 14 electrons with a filled bonding shell. When it gains an electron to become NO(15 electrons), the extra electron enters the lowest unoccupied molecular orbital (LUMO), which is the antibonding π^* orbital.

Q87.

Answer: C

Explanation:

PH_3 has the lowest boiling point because it cannot form hydrogen bonds (unlike NH_3), and it has weaker London dispersion forces than the heavier hydrides (AsH_3 , SbH_3).

Q88.

Answer: D

Explanation:

Methanol (CH_3OH) molecules are held together in the liquid phase by strong intermolecular hydrogen bonds, which must be broken to transition into the gas phase.

Q89.

Answer: C

Explanation:

Both XeF_2 and ICl_2^- have sp^3d hybridization with 2 bond pairs and 3 lone pairs on the central atom, resulting in identical linear geometries.

Q90.

Answer: A

Explanation:

According to Fajan's rules, covalent character increases with a smaller cation size and a higher cation charge. Al^{3+} has the highest charge density among the options, making $AlCl_3$ the most covalent.

Q91.

Answer: C

Q92.

Answer: A

Q93.

Answer: B

Q94.

Answer: A

Q95.

Answer: B

Q96.

Answer: D

Q97.

Answer: C

Q98.

Answer: C

Q99.

Answer: A

Q100.

Answer: A

Q101.

Answer: A

Q102.

Answer: A

Q103.

Answer: B

Q104.

Answer: B

Q105.

Answer: B

Q106.

Answer: B

Q107.

Answer: C

Q108.

Answer: C

Q109.

Answer: A

Q110.

Answer: B

Q111.

Answer: A

Q112.

Answer: C

Q113.

Answer: C

Q114.

Answer: A

Q115.

Answer: A

Q116.

Answer: A

Q117.

Answer: A

Q118.

Answer: D

Q119.

Answer: B

Q120.

Answer: B

Q121.

Answer: B

Q122.

Answer: B

Q123.

Answer: C

Q124.

Answer: B

Q125.

Answer: B

Q126.

Answer: D

Q127.

Answer: C

Q128.

Answer: B

Q129.

Answer: A

Q130.

Answer: A

Q131.

Answer: A

Q132.

Answer: A

Q133.

Answer: A

Q134.

Answer: B

Q135.

Answer: C

Q136.

Answer: A

Q137.

Answer: A

Q138.

Answer: A

Q139.

Answer: B

Q140.

Answer: B

Q141.

Answer: D

Q142.

Answer: A

Q143.

Answer: B

Q144.

Answer: C

Q145.

Answer: B

Q146.

Answer: C

Q147.

Answer: D

Q148.

Answer: D

Q149.

Answer: D

Q150.

Answer: B

Q151.

Answer: B

Q152.

Answer: D

Q153.

Answer: A

Q154.

Answer: B

Q155.
Answer: D

Q156.
Answer: A

Q157.
Answer: A

Q158.
Answer: D

Q159.
Answer: A

Q160.
Answer: A

Q161.
Answer: A

Q162.
Answer: D

Q163.
Answer: A

Q164.
Answer: A

Q165.
Answer: D

Q166.
Answer: A

Q167.
Answer: A

Q168.
Answer: A

Q169.
Answer: A

Q170.
Answer: A

Q171.
Answer: C

Q172.
Answer: B

Q173.
Answer: A

Q174.
Answer: A

Q175.
Answer: D

Q176.
Answer: B

Q177.
Answer: A

Q178.
Answer: A

Q179.
Answer: B

Q180.
Answer: A