

Physics

1. Which of the following option is true of

$\vec{A} = 3\hat{i} + 4\hat{j}$ and $\vec{B} = 6\hat{i} + 8\hat{j}$, where A and B are the magnitudes of $\vec{A}$ and $\vec{B}$

- A) $\vec{A} \times \vec{B} = 0$ B) $\frac{A}{B} = \frac{1}{2}$
C) $\vec{A} \cdot \vec{B} = 50$ D) $A=5$

2. The angle between the two vectors

$\vec{A} = 3\hat{i} + 4\hat{j} + 5\hat{k}$ and $\vec{B} = 3\hat{i} + 4\hat{j} - 5\hat{k}$ will be

- A) 90° B) 0°
C) 60° D) 45°

3. The unit vector along $\hat{i} + \hat{j}$ is

- A) $\hat{k}$ B) $\hat{i} + \hat{j}$
C) $\frac{\hat{i} + \hat{j}}{\sqrt{2}}$ D) $\frac{\hat{i} + \hat{j}}{2}$

4. Two forces $\vec{F}_1 = 5\hat{i} + 10\hat{j} - 20\hat{k}$ and

$\vec{F}_2 = 10\hat{i} - 5\hat{j} - 15\hat{k}$ act on a single point. The angle between $\vec{F}_1$ and $\vec{F}_2$ is nearly

- A) 30° B) 45°
C) 60° D) 90°

5. Let the angle between two nonzero vectors $\vec{A}$ and $\vec{B}$ be 120° and resultant be $\vec{C}$

- A) $\vec{C}$ must be equal to $|\vec{A} - \vec{B}|$ B) $\vec{C}$ must be less than $|\vec{A} - \vec{B}|$
C) $\vec{C}$ must be greater than $|\vec{A} - \vec{B}|$ D) $\vec{C}$ may be equal to $|\vec{A} - \vec{B}|$

6. If $|\vec{A} + \vec{B}| = |\vec{A}| + |\vec{B}|$, then angle between $\vec{A}$ and $\vec{B}$ will be

- A) 90° B) 120°
C) 0° D) 60°

7. If a vector $2\hat{i} + 3\hat{j} + 8\hat{k}$ is perpendicular to the vector $4\hat{j} - 4\hat{i} + \alpha\hat{k}$. Then the value of α is

- A) -1 B) $\frac{1}{2}$
C) $-\frac{1}{2}$ D) 1

8. If $|\vec{V}_1 + \vec{V}_2| = |\vec{V}_1 - \vec{V}_2|$ and V_2 is finite, then

- A) V_1 is parallel to V_2 B) $\vec{V}_1 = \vec{V}_2$
C) V_1 and V_2 are mutually perpendicular D) $|\vec{V}_1| = |\vec{V}_2|$

9. The angle between two vectors given by

$6\hat{i} + 6\hat{j} - 3\hat{k}$ and $7\hat{i} + 4\hat{j} + 4\hat{k}$ is

- A) $\cos^{-1}\left(\frac{1}{\sqrt{3}}\right)$ B) $\cos^{-1}\left(\frac{5}{\sqrt{3}}\right)$
C) $\sin^{-1}\left(\frac{2}{\sqrt{3}}\right)$ D) $\sin^{-1}\left(\frac{\sqrt{5}}{3}\right)$

10. The magnitudes of two vectors are A and B ($A > B$). If the maximum resultant magnitude of these two vectors is 3 times their minimum resultant magnitude, what is the ratio of A to B?

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

11. The maximum and minimum resultants of two forces acting at a point are 10 N and 6 N respectively. What is the ratio of the magnitudes of the larger force to the smaller force?

- A) 5:3 B) 3:1
C) 4:1 D) 2:1

12. The resultant of two vectors $\vec{P}$ and $\vec{Q}$ is perpendicular to the vector $\vec{P}$. If the magnitude of the resultant vector $\vec{R}$ is equal to the magnitude of $\vec{P}$, what is the angle between the vectors $\vec{P}$ and $\vec{Q}$?

- A) 120° B) 135°
C) 150° D) 90°

13. If two unit vectors $\vec{a}$ and $\vec{b}$ are inclined at an angle θ such that $|\vec{a} + \vec{b}| = \sqrt{3}|\vec{a} - \vec{b}|$, then the value of θ is:

- A) 30° B) 45°
C) 60° D) 90°

14. Two vectors $\vec{A}$ and $\vec{B}$ of equal magnitude R are inclined at an angle θ . If the magnitude of their resultant sum vector is also equal to R , then what is the angle θ between them?

A) 60° B) 90°
C) 120° D) 150°

15. Two forces having magnitudes $2F$ and F are acting perpendicularly to each other at a point. The magnitude of their resultant force is:

A) $\sqrt{3}F$ B) $\sqrt{5}F$
C) $3F$ D) $\sqrt{2}F$

16. Two perpendicular velocity vectors have magnitudes v and $\sqrt{3}v$. What is the magnitude of the net resultant velocity?

A) $2v$ B) $4v$
C) $\sqrt{2}v$ D) $\sqrt{10}v$

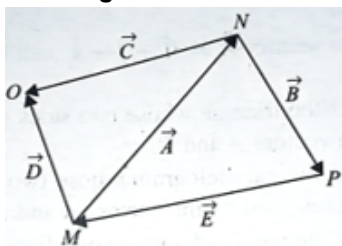
17. The resultant of two mutually perpendicular forces is 10 N. If one of the forces has a magnitude of 6 N, what is the magnitude of the other force?

A) 4 N B) 16 N
C) 8 N D) $\sqrt{136}$ N

18. Two vectors $\vec{A}$ and $\vec{B}$ have equal magnitudes. If the magnitude of their sum vector $|\vec{A} + \vec{B}|$ is equal to $\sqrt{3}$ times the magnitude of their difference vector $|\vec{A} - \vec{B}|$, then the angle θ between $\vec{A}$ and $\vec{B}$ is:

A) $\cos^{-1}\left(\frac{1}{2}\right)$ B) $\cos^{-1}\left(\frac{1}{3}\right)$
C) $\cos^{-1}\left(\frac{1}{4}\right)$ D) $\cos^{-1}\left(\frac{2}{3}\right)$

19. From Fig. the correct relation is



A) $\vec{A} + \vec{B} + \vec{E} = \vec{0}$ B) $\vec{C} - \vec{D} = -\vec{A}$
C) $\vec{B} + \vec{E} - \vec{C} = -\vec{D}$ D) All of the above

20. Out of the following set of forces, the resultant of which cannot be zero

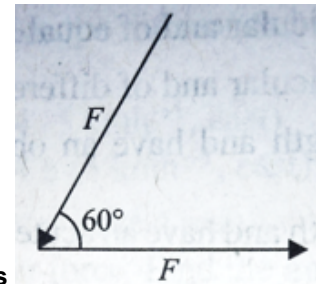
A) 10, 10, 10 B) 10, 10, 20
C) 10, 20, 20 D) 10, 20, 40

21. The ratio of maximum and minimum magnitudes of the resultant of two vectors $\vec{a}$ and $\vec{b}$ is 3 : 1.

Now, $|\vec{a}|$ is equal to

A) $|\vec{b}|$ B) $2|\vec{b}|$
C) $3|\vec{b}|$ D) $4|\vec{b}|$

22. Two forces, each equal to F , act as shown in Fig.



Their resultant is

A) $F/2$ B) F
C) $\sqrt{3}F$ D) $\sqrt{5}F$

23. Out of the following forces, the resultant of which cannot be 10 N?

A) 15 N and 20 N B) 10 N and 10 N
C) 5 N and 12 N D) 12 N and 1 N

24. The vector sum of two forces is perpendicular to their vector difference. The forces are

A) equal to each other B) equal to each other in magnitude
C) not equal to each other D) cannot be predicted in magnitude

25. The resultant

$\vec{C}$ of $\vec{A}$ and $\vec{B}$ is perpendicular to $\vec{A}$. Also, $|\vec{A}| = |\vec{C}|$. The angle between $\vec{A}$ and $\vec{B}$ is

A) $\frac{\pi}{4}$ rad B) $\frac{3\pi}{4}$ rad
C) $\frac{5\pi}{4}$ rad D) $\frac{7\pi}{4}$ rad

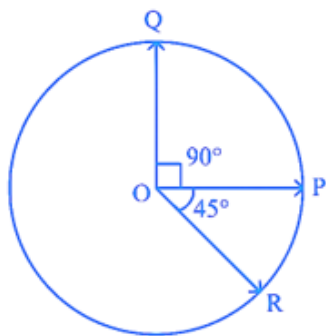
26. The resultant of two vectors $\vec{A}$ and $\vec{B}$ is perpendicular to $\vec{A}$ and its magnitude is half that of $\vec{B}$. The angle between vectors $\vec{A}$ and $\vec{B}$ is _____°.

A) 150 B) 897
C) 134 D) 120

27. If $\vec{a}$ and $\vec{b}$ makes an angle $\cos^{-1}\left(\frac{5}{9}\right)$ with each other, then $|\vec{a} + \vec{b}| = \sqrt{2}|\vec{a} - \vec{b}|$ for $|\vec{a}| = n|\vec{b}|$. The integer value of n is _____.

A) 8 B) 1
C) 6 D) 3

28. Three vectors $\vec{OP}$, $\vec{OQ}$ and $\vec{OR}$ each of magnitude A are acting as shown in figure. The resultant of the three vectors is $A\sqrt{x}$. The value



- of x is _____.
- A) 3 B) 9
C) 10 D) 14
29. The angle between vector $\vec{Q}$ and the resultant of $(2\vec{Q} + 2\vec{P})$ and $(2\vec{Q} - 2\vec{P})$ is :
- A) $\tan^{-1}(P/Q)$ B) 0°
C) $\tan^{-1}\left(\frac{2\vec{Q}-2\vec{P}}{2\vec{Q}+2\vec{P}}\right)$ D) $\tan^{-1}(2Q/P)$
30. When vector $\vec{A} = 2\hat{i} + 3\hat{j} + 2\hat{k}$ is subtracted from vector $\vec{B}$, it gives a vector equal to $2\hat{j}$. Then the magnitude of vector $\vec{B}$ will be :
- A) 3 B) $\sqrt{33}$
C) $\sqrt{6}$ D) $\sqrt{5}$
31. Two forces having magnitude A and $\frac{A}{2}$ are perpendicular to each other. The magnitude of their resultant is:
- A) $\frac{5A}{2}$ B) $\frac{\sqrt{5}A}{4}$
C) $\frac{\sqrt{5}A}{2}$ D) $\frac{\sqrt{5}A^2}{2}$
32. If two vectors $\vec{P} = \hat{i} + 2m\hat{j} + m\hat{k}$ and $\vec{Q} = 4\hat{i} - 2\hat{j} + m\hat{k}$ are perpendicular to each other. Then, the value of m will be :
- A) -1 B) 3
C) 1 D) 2
33. If the projection of $2\hat{i} + 4\hat{j} - 2\hat{k}$ on $\hat{i} + 2\hat{j} + \alpha\hat{k}$ is zero. Then, the value of α will be _____.
- A) 4 B) 1
C) 9 D) 5
34. If $\vec{A} = (2\hat{i} + 3\hat{j} - \hat{k})$ m and $\vec{B} = (\hat{i} + 2\hat{j} + 2\hat{k})$ m. The magnitude of component of vector $\vec{A}$ along vector $\vec{B}$ will be _____ m.
- A) 2 B) 6
C) 8 D) 10

35. Two vectors $\vec{A}$ and $\vec{B}$ have equal magnitudes. If magnitude of $\vec{A} + \vec{B}$ is equal to two times the magnitude of $\vec{A} - \vec{B}$, then the angle between $\vec{A}$ and $\vec{B}$ will be :

- A) $\sin^{-1}\left(\frac{3}{5}\right)$ B) $\sin^{-1}\left(\frac{1}{3}\right)$
C) $\cos^{-1}\left(\frac{3}{5}\right)$ D) $\cos^{-1}\left(\frac{1}{3}\right)$

36. What is the projection of the vector $A = 2\hat{i} + 3\hat{j} + 5\hat{k}$ on the x-axis?

- A) 2 B) 3
C) 5 D) 0

37. What is the angle between the vectors $A = \hat{i} + \hat{j}$ and $B = \hat{j} + \hat{k}$?

- A) 30° B) 45°
C) 60° D) 90°

38. If a vector $\vec{A} = 3\hat{i} + 4\hat{j}$ is perpendicular to a vector $\vec{B} = 2\hat{i} - k\hat{j}$, what is the value of k ?

- A) 1.5 B) 2.5
C) 3.5 D) 4.5

39. If a vector $\vec{A} = 2\hat{i} + 3\hat{j} + 8\hat{k}$ is perpendicular to the vector $\vec{B} = 4\hat{i} - 4\alpha\hat{j} + \alpha\hat{k}$, then what is the value of α ?

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

40. A force of 10 N acts on a particle along the vector $4\hat{i} + 3\hat{j}$. If the particle is displaced from the origin $(0, 0, 0)$ to the point $(1, 2, 0)$, what is the work done by the force on the particle?

- A) 2 J B) 10 J
C) 20 J D) 5 J

41. If two vectors $\vec{A} = 2\hat{i} - 3\hat{j} + 4\hat{k}$ and $\vec{B} = \hat{i} + 2\hat{j} + n\hat{k}$ are perpendicular to each other, what is the value of n ?

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

42. If two vectors A and B have magnitudes of 6 N and 8 N, and their resultant has a magnitude of 10 N, find the angle between the two vectors:

- A) 0° B) 60°
C) 90° D) 180°

43. Two vectors of magnitude 3 N and 4 N are acting at an angle of 90 degrees. Find the magnitude of their resultant vector.

- A) 5 N B) 7 N
C) 1 N D) 25 N

44. Two vectors of magnitude 6 N and 8 N are acting at an angle of 90 degrees. Find the magnitude of their resultant vector.

- A) 10 N B) 14 N
C) 2 N D) 100 N

45. If a unit vector is represented by $0.6i + 0.8j + ck$, then find the positive value of c:

- A) 0 B) 1
C) 0.5 D) 0.75

Chemistry

46. Which of the following is the most basic oxide?

- A) SeO_2 B) Al_2O_3
C) Sb_2O_3 D) Bi_2O_3

47. Identify the correct order of the size of the following:

- A) $Ca^{2+} < K^+ < Ar < Cl^-$ B) $Ar < Ca^{2+} < K^+ < Cl^-$
C) $Ca^{2+} < Ar < K^+ < Cl^-$ D) $Ar < S^{2-} < K^+ < Ar < S^{2-} < Cl^-$

48. The correct order of decreasing second ionisation enthalpy of $Ti(22)$, $V(23)$, $Cr(24)$ and $Mn(25)$ is:

- A) $Mn > Cr > Ti > V$ B) $Ti > V > Cr > Mn$
C) $Cr > Mn > V > Ti$ D) $V > Mn > Cr > Ti$

49. Amongst the elements with following electronic configurations, which one of them may have the highest ionization energy?

- A) $[Ne]3s^23p^1$ B) $[Ne]3s^23p^3$
C) $[Ne]3s^23p^2$ D) $[Ar]3d^{10}4s^24p^3$

50. The correct order of the decreasing ionic radii among the following isoelectronic species is:

- A) $K^+ > Ca^{2+} > Cl^- > S^{2-}$ B) $Ca^{2+} > K^+ > S^{2-} > Cl^-$
C) $Cl^- > S^{2-} > Ca^{2+} > K^+$ D) $S^{2-} > Cl^- > K^+ > Ca^{2+}$

51. Which of the following represents the correct order of increasing electron gain enthalpy with negative sign for the elements O, S, F and Cl?

- A) $S < O < Cl < F$ B) $Cl < F < O < S$
C) $O < S < F < Cl$ D) $F < S < O < Cl$

52. What is the value of electron gain enthalpy of Na^+ if IE_1 of $Na = 5.1eV$:

- A) $+0.2eV$ B) $-5.1eV$
C) $-10.2eV$ D) $+2.55eV$

53. Which of the following orders of ionic radii is correctly represented?

- A) $H^- > H^+ > H$ B) $Na^+ < F^- < O^{2-}$
C) $F^- > O^{2-} > Na^+$ D) $Al^{3+} > Mg^{2+} > N^{3-}$

54. Be^{2+} is isoelectronic with which of the following ions?

- A) H^+ B) Li^+
C) Na^+ D) Mg^{2+}

55. The species Ar , K^+ and Ca^{2+} contain the same number of electrons. In which order do their radii increase?

- A) $Ca^{2+} < Ar < K^+$ B) $Ca^{2+} < K^+ < Ar$
C) $K^+ < Ar < Ca^{2+}$ D) $Ar < K^+ < Ca^{2+}$

56. The number of d-electrons in $Fe^{2+}(Z = 26)$ is not equal to the number of electrons in which one of the following?

- A) p-electrons in $Cl(Z = 17)$ B) d-electrons in $Fe(Z = 26)$
C) p-electrons in $Ne(Z = 10)$ D) s-electrons in $Mg(Z = 12)$

57. The formation of the oxide ion, $O^{2-}(g)$, from oxygen atom requires first an exothermic and then an endothermic step as shown below:
 $O(g) + e^- \rightarrow O^-(g) \quad \Delta H = -141kJ/mol$
 $O^-(g) + e^- \rightarrow O^{2-}(g) \quad \Delta H = +780kJ/mol$
Thus process of formation of O^{2-} in gas phase is unfavourable even though O^{2-} is isoelectronic with neon. It is due to the fact that:

- A) Oxygen is more electronegative B) Addition of electron in oxygen results in larger size of the ion
C) Electron repulsion outweighs the stability gained by achieving noble gas configuration D) O^- ion has comparatively smaller size than oxygen atom

58. In which of the following options the order of arrangement does not agree with the variation of property indicated against it?

- A) $Al^{3+} < Mg^{2+} < Na^+ < K^+$ (increasing ionic size) B) $B < C < N < O$ (increasing first ionisation enthalpy)
C) $I < Br < Cl < F$ (increasing electron gain enthalpy) D) $Li < Na < K < Rb$ (increasing metallic radius)

59. The correct order of atomic radii in group 13 elements is:

- A) $B < Al < In < Ga < Tl$ B) $B < Al < Ga < In < Tl$
C) $B < Ga < Al < Tl < In$ D) $B < Ga < Al < In < Tl$

60. Which of the following is an amphoteric hydroxide?

- A) $Sr(OH)_2$ B) $Ca(OH)_2$
C) $Mg(OH)_2$ D) $Be(OH)_2$

61. For the second period elements the correct increasing order of first ionisation enthalpy is:

- A) $Li < Be < B < C < N < O < F < Ne$ B) $Li < Be < B < C < O < N < F < Ne$
C) $Li < B < Be < C < N < O < F < Ne$ D) $Li < Be < B < C < O < N < F < Ne$

62. 4d, 5p, 5f and 6p orbitals are arranged in the order of decreasing energy. The correct option is:

- A) $5f > 6p > 5p > 4d$ B) $6p > 5f > 5p > 4d$
C) $6p > 5f > 4d > 5p$ D) $5f > 6p > 4d > 5p$

63. Match the oxide given in column A with its property given in column B

Column-A	Column-B
(i) Na_2O	(a) Neutral
(ii) Al_2O_3	(b) Basic
(iii) N_2O	(c) Acidic
(iv) Cl_2O_7	(d) Amphoteric

Which of the following options has all correct pairs?

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

64. Which of the following is correct match?

	Atomic number	Group number	Period number
(A)	46	10	6
(B)	58	3	6
(C)	56	2	6
(D)	42	6	5

- A) Only B, C, D B) Only A, B, C
C) Only B, C D) Only A, C, D

65. Atomic number of Ag is 47. In the same group the atomic number of elements placed above and below Ag will be:

- A) 37, 67 B) 29, 79
C) 39, 69 D) 29, 65

66. Which of the following statements is wrong?

- A) van der Waal's radius of iodine is more than its covalent radius B) All isoelectronic ions belong to same period of the periodic table
C) IE_1 of N is higher than that of O while IE_2 of O is higher than that of N D) The electron affinity of N is less than that of P

67. $M(g) \rightarrow M^+(g) + e^-, \Delta H = 100 \text{ eV}$ and $M(g) \rightarrow M^{2+}(g) + 2e^-, \Delta H = 250 \text{ eV}$. Which is incorrect statement?

- A) I_1 of $M(g)$ is 100 eV B) I_2 of $M(g)$ is 150 eV
C) I_2 of $M(g)$ is 250 eV D) None

68. Successive ionisation energies of an element A are 100 eV, 150 eV, 181 eV, 2000 eV, 2200 eV.

Correct statement regarding A is:

- A) Element 'A' may be metal B) Formula of oxide of A may be A_2O_3
C) Oxide of element A may be amphoteric D) All are correct

69. Elements of which group form anions most readily?

- A) Oxygen family B) Nitrogen group
C) Halogens D) Alkali metals

70. The inter nuclear distance in H_2 and Cl_2 molecules are 74 and 198 . respectively. The bond length of HCl may be (EN of $H = 2.1, Cl = 3.0$):

- A) 136 B) 272
C) 135.919 D) 271.919

71. Which is the weakest base among

$NaOH, Ca(OH)_2, KOH$ and $Zn(OH)_2$?

- A) NaOH B) KOH
C) $Ca(OH)_2$ D) $Zn(OH)_2$

72. Identify the incorrect statement:

- A) Shielding constant (σ): $Li < Na < K < Rb$ B) $Z_{eff} : Li > Na > K > Rb$
C) Ionic radius: $O^{2-} > F^- > Na^+ > Mg^{2+}$ D) Atomic size: $Li < Na < K < Rb$

73. The order of ionisation potential between He^+ ion and H-atom (both species are in gaseous state) is:

- A) $I.P. (He^+) = I.P. (H)$ B) $I.P. (He^+) < I.P. (H)$
C) $I.P. (He^+) > I.P. (H)$ D) Cannot be compared

74. Given electronic configurations: A - $1s^2 2s^2 2p^1$ B - $1s^2 2s^2 2p^6 3s^1 3p^2$ C - $1s^2 2s^1 2p^1$ D - $1s^2 2s^2 2p^5 3s^1$. Then which among these will belong to the same group in the periodic table?

- A) A & B B) A, B, C
C) A, B, D D) A, B, C, D

75. The IE_1 & IE_2 of three elements A, B & C are given (in KJ/mol):

	A	B	C
IE_1	400	550	1150
IE_2	2650	1070	2090

Identify the element which represents a non-metal:

- A) A B) B
C) Both A & B D) C

76. In which arrangement the order is NOT according to the property indicated against it?

- A) $Al^{3+} < Mg^{2+} < Na^+ < K^+$ (increasing ionic size)
B) $B < C < N < O$ (increasing first ionization energy)
C) $I < Br < F < Cl$ (increasing electron gain enthalpy with negative sign)
D) $Li < Na < K < Rb$ (increasing metallic radius)

77. Which one of the following orders represents the correct sequence of the increasing basic nature of the given oxides?

- A) $Na_2O < K_2O < MgO < Al_2O_3$
B) $Al_2O_3 < Na_2O < Al_2O_3 < MgO$
C) $Al_2O_3 < MgO < Na_2O < K_2O$
D) $MgO < K_2O < Al_2O_3 < Na_2O$

78. The outer electron configuration of Gd (Atomic No.: 64) is:

- A) $4f^4 5d^4 6s^2$ B) $4f^7 5d^1 6s^2$
C) $4f^3 5d^5 6s^2$ D) $4f^8 5d^0 6s^2$

79. The correct order of electron gain enthalpy with negative sign of F, Cl, Br and I having atomic number 9, 17, 35 and 53 respectively, is:-

- A) $I > Br > Cl > F$ B) $F > Cl > Br > I$
C) $Cl > F > Br > I$ D) $Br > Cl > I > F$

80. The first ionisation potential of Na is 5.1 eV. The value of electron gain enthalpy of Na^+ will be:

- A) $-2.55eV$ B) $-5.1eV$
C) $-10.2eV$ D) $+2.55eV$

81. For electron affinity of halogens which of the following is correct:

- A) $Br > F$ B) $F > Cl$
C) $Br > Cl$ D) $F > I$

82. The pair of amphoteric hydroxide is:

- A) $Al(OH)_3, LiOH$ B) $Be(OH)_2, Mg(OH)_2$
C) $B(OH)_3, Be(OH)_2$ D) $Be(OH)_2, Zn(OH)_2$

83. Electronegativity is the measurement of capacity of an atom by which:

- A) Electrons get repelled B) Electrons get attracted
C) Gain of electron D) Loose of proton

84. The ions $O^{2-}, F^-, Na^+, Mg^{2+}$ and Al^{3+} are isoelectronic. Their ionic radii show:

- A) an increase from O^{2-} to Al^{3+}
B) a decrease from O^{2-} to Al^{3+}
C) a significant increase from O^{2-} to Al^{3+}
D) a significant decrease from O^{2-} to Al^{3+}

85. Ionic radii are:

- A) Directly proportional to square of effective nuclear charge
B) Inversely proportional to effective nuclear charge
C) Inversely proportional to square of effective nuclear charge
D) Directly proportional to effective nuclear charge

86. Which one of the following arrangements represents the correct order of electron gain enthalpy (with negative sign) of the given atomic species:-

- A) $F < Cl < O < S$ B) $S < O < Cl < F$
C) $O < S < F < Cl$ D) $Cl < F < S < O$

87. Which of the following E.A. order is not correct?

- A) $N < O < S$ B) $Cl > O > N > C$
C) $O < S < F < Cl$ D) $B < C < Si < S$

88. Which one of the following order of given properties is correct?

- A) Atomic radius - $Li < Be < B$
B) Ionisation potential - $Li < Be < B$
C) Electron affinity - $Li < Be < B$
D) Electronegativity - $Li < Be < B$

89. The IUPAC nomenclature of an element with electronic configuration $[Rn]5f^{14}6d^17s^2$ is:

- A) Unnilbium B) Unnilunium
C) Unnilquadium D) Unniltrium

90. One element is placed in 6th period and 15th group. Atomic number of this element is

- A) 83 B) 98
C) 28 D) 87

Botany

91. In a protein molecule, various amino acids are linked together by:

- A) α -glycosidic bond B) β -glycosidic bond
C) Peptide bond D) Dative bond

92. The helical structure (α -helix) of proteins is stabilized by:

- A) Dipeptide bonds B) Hydrogen bonds
C) Ether bonds D) Peptide bonds

93. If a protein is imagined as a line, the left end represents the _____ and the right end represents the _____.

- A) First amino acid (C-terminal), Last amino acid (N-terminal) B) First amino acid (N-terminal), Last amino acid (C-terminal)
C) Variable amino acid, Constant amino acid D) Non-essential amino acid, Essential amino acid

94. Which structural level of a protein provides positional information about its amino acids?

- A) Primary structure B) Secondary structure
C) Tertiary structure D) Quaternary structure

95. Which level of protein structure is absolutely necessary for the biological activities of most proteins and enzymes?

- A) Primary structure only B) Secondary structure only
C) Tertiary structure D) Linear structure

96. Adult human hemoglobin consists of 4 subunits —2 α and 2 β . This arrangement represents its:

- A) Secondary structure B) Tertiary structure
C) Quaternary structure D) Primary structure

97. Which of the following sets of bonds stabilizes the tertiary structure of proteins?

- A) Only peptide bonds B) Hydrogen bonds, covalent bonds, and ionic bonds only
C) Hydrogen bonds, disulfide linkages, ionic bonds, and hydrophobic interactions D) Peptide bonds and glycosidic bonds only

98. Consider the following two statements regarding protein structure: Statement I: The first amino acid in a polypeptide chain is called the C-terminal amino acid. Statement II: A protein is imagined as a line where the left end represents the first amino acid and the right end represents the last amino acid.

- A) Both Statement I and Statement II are correct. B) Both Statement I and Statement II are incorrect.
C) Statement I is correct but Statement II is incorrect. D) Statement I is incorrect but Statement II is correct.

99. Which of the following statements is INCORRECT regarding protein structures?

- A) In a protein, only right-handed helices are observed. B) The tertiary structure gives a 3-dimensional view of a protein.
C) Quaternary structure is present in all proteins. D) Peptide bonds are formed by a dehydration (condensation) reaction.

100.

Collagen is an abundant fibrous protein in animals. Its structural arrangement is uniquely characterized by:

- A) A single right-handed α -helix. B) A triple helix composed of three polypeptide chains.
C) Broad, flat parallel β -pleated sheets. D) A spherical quaternary structure with a heme prosthetic group.

101.

Which statement accurately describes the components of starch?

- A) Amylose is branched and water-soluble; Amylopectin is linear and water-insoluble. B) Amylose is linear and water-soluble; Amylopectin is branched and water-insoluble.
C) Both components are highly branched. D) Both components are completely linear.

102.

In a polysaccharide chain (like glycogen), the right end is called the _____ end, and the left end is called the _____ end.

- A) Non-reducing, Reducing B) Reducing, Non-reducing
C) Amino, Carboxyl D) Oxidised, Neutral

103.

Chitin is the second most abundant organic substance on Earth and forms the exoskeleton of arthropods. Chemically, it is a polymer of:

- A) Lipopolysaccharides B) N-acetylglucosamine (NAG)
C) D-fructose D) Glucose-6-phosphate

104.

Inulin is a polymer of which monosaccharide unit?

- A) Glucose B) Fructose
C) Galactose D) Mannose

105.

Which of the following is a heteropolysaccharide?

- A) Chitin B) Inulin
C) Hyaluronic acid D) Glycogen

106.

Cellulose, starch, and glycogen are all polymers of:

- A) Fructose B) Glucose
C) Galactose D) Amino acids

107.

Read the following two statements regarding protein functions: Statement I: Collagen is the most abundant protein in the whole of the biosphere. Statement II: RuBisCO (Ribulose biphosphate carboxylase-oxygenase) is the most abundant protein in the animal world.

- A) Both statements are correct. B) Both statements are incorrect.
C) Statement I is correct, Statement II is incorrect. D) Statement I is incorrect, Statement II is correct.

108.

Match the following proteins with their correct biological functions:

Column I (Protein)	Column II (Function)
(p) GLUT-4	(i) Interacellular ground substance
(q) Collagen	(ii) Sensory reception (smell, taste)
(r) Receptor	(iii) Enables glucose transport into cells
(s) Antibody	(iv) Fights infectious agents

Choose the correct matching option:

- A) p-(iii), q-(i), r-(ii), s-(iv) B) p-(i), q-(iii), r-(iv), s-(ii)
C) p-(iii), q-(iv), r-(ii), s-(i) D) p-(iv), q-(i), r-(ii), s-(iii)

109.

Assertion (A): The alpha-helix (α -helix) secondary structure of a protein is stabilized by intermolecular hydrogen bonding. Reason (R): Hydrogen bonds form between the carbonyl oxygen of one amino acid and the amide hydrogen of another amino acid four residues further down the same chain.

- 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.

110.

Assertion (A): Adult human hemoglobin is classified as a quaternary protein structure. Reason (R): It is composed of four independent polypeptide chains—two alpha subunits and two beta subunits—arranged architecturally with respect to each other.

- 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.

111.

Branching points in amylopectin and glycogen molecules are formed by which type of linkage?

- A) α -1,4-glycosidic bond B) β -1,4-glycosidic bond
C) α -1,6-glycosidic bond D) β -1,6-glycosidic bond

112.

Assertion (A): Cellulose cannot be digested by human beings. Reason (R): The human digestive tract lacks the specific enzyme cellulase required to hydrolyse β -1,4-glycosidic linkages.

- 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.

113.

Read the following statements and identify the correct option: Statement I: Inulin is a clinical diagnostic marker used to filter and assess human kidney function (Glomerular Filtration Rate). Statement II: Inulin is an unbranched polymer of fructose units.

- A) Both Statement I and Statement II are correct. B) Both Statement I and Statement II are incorrect.
C) Statement I is correct but Statement II is incorrect. D) Statement I is incorrect but Statement II is correct.

114.

Identify the INCORRECT statement regarding polysaccharides from the following

- A) Cotton fibers are composed entirely of cellulose. B) Paper made from plant pulp is rich in cellulose.
C) Chitin contains nitrogen atoms in its monomeric building blocks. D) Starch changes into a blue-black color upon exposure to iodine because it contains long, completely linear chains.

115.

In a polysaccharide like glycogen, the two ends of the chain are called:

- A) N-terminal and C-terminal
- B) C-terminal and N-terminal
- C) Reducing end and non-reducing end
- D) Phosphorylated end and hydroxyl end

116.

Which type of bond is solely responsible for maintaining the primary structure of a protein?

- A) Hydrogen bond
- B) Peptide bond
- C) Disulfide bond
- D) Ionic bond

117.

During the formation of a peptide bond in a primary protein chain, what molecule is eliminated?

- A) Carbon dioxide
- B) Ammonia
- C) Water
- D) Hydrogen gas

118.

The secondary structure of a protein is primarily stabilized by which type of chemical bond?

- A) Covalent peptide bonds
- B) Intramolecular hydrogen bonds
- C) Hydrophobic interactions
- D) Disulfide bridges

119.

In an alpha-helix secondary structure, the polypeptide chain is folded into a:

- A) Left-handed helix with hydrogen bonds between parallel chains
- B) Right-handed helix with intermolecular hydrogen bonds
- C) Right-handed helix with intramolecular hydrogen bonds
- D) Loose random coil without fixed bonding

120.

Which of the following statements is TRUE regarding beta-pleated sheets?

- A) They are exclusively formed by a single polypeptide chain looping back on itself
- B) Hydrogen bonds are formed perpendicular to the direction of the polypeptide chain
- C) Adjacent strands can only run in a parallel orientation
- D) The structure is highly elastic and stretchable compared to an alpha-helix

121.

Purines found both in DNA and RNA are:

- A) Cytosine and thymine
- B) Adenine and thymine
- C) Adenine and guanine
- D) Guanine and cytosine

122.

In RNA, an additional -OH group is present at which position of the ribose sugar?

- A) 5' position
- B) 2' position
- C) 3' position
- D) 1' position

123.

The correct statement regarding RNA and DNA, respectively is:

- A) The sugar component in RNA is arabinose and the sugar component in DNA is 2'-deoxyribose.
- B) The sugar component in RNA is ribose and the sugar component in DNA is 2'-deoxyribose.
- C) The sugar component in RNA is arabinose and the sugar component in DNA is ribose.
- D) The sugar component in RNA is 2'-deoxyribose and the sugar component in DNA is arabinose.

124.

A nucleotide is structurally composed of:

- A) Purine + Pyrimidine + Phosphate
- B) Nitrogenous base + Pentose sugar
- C) Nitrogenous base + Pentose sugar + Phosphate group
- D) Pentose sugar + Phosphate group

125.

Adenosine differs from Adenylic acid because Adenosine lacks a/an:

- A) Nitrogenous base
- B) Phosphate group
- C) Pentose sugar
- D) Hydroxyl group

126.

Match the chemical names correctly:

- A) Guanosine — Nucleotide; Guanylic acid — Nucleoside
- B) Guanosine — Nucleoside; Guanylic acid — Nucleotide
- C) Cytosine — Nucleoside; Cytidine — Base
- D) Thymine — Nucleotide; Thymidine — Base

127.

Starch gives a characteristic blue-black colour with iodine solution, whereas cellulose does not. What is the structural reason behind this difference?

- A) Cellulose is a heteropolymer, while starch is a homopolymer.
- B) Starch forms a helical secondary structure that can hold iodine molecules, while cellulose lacks these helices.
- C) Cellulose contains ionic bonds that repel the iodine ions.
- D) Starch is a reducing sugar, while cellulose is non-reducing.

128.

Glycogen and the amylopectin component of starch are highly branched polysaccharides.

Which of the following glycosidic linkages is responsible for the branching points?

- A) α -1,4-glycosidic bond B) β -1,4-glycosidic bond
C) α -1,6-glycosidic bond D) β -1,6-glycosidic bond

129.

Plant cell walls are made of cellulose. Paper made from plant pulp and cotton fibres are chemically composed of:

- A) Chitin B) Cellulose
C) Starch D) Glycogen

130.

When a tissue is ground in trichloroacetic acid and filtered, polysaccharides are recovered in which fraction?

- A) Acid-soluble pool (Filtrate) B) Acid-insoluble fraction (Retentate)
C) Liquid supernatant D) Inorganic fraction

131.

Which of the following polysaccharides is filtered by the human kidney glomerulus but is neither reabsorbed nor secreted by the renal tubules, making it ideal for measuring the Glomerular Filtration Rate (GFR)?

- A) Glycogen B) Inulin
C) Insulin D) Dextrin

132.

Match the items in Column-I with their appropriate descriptions in Column-II:

Column-I	Column-II
P. Amylose	1. Highly branched component of starch with α -1,4 and α -1,6 bonds
Q. Amylopectin	2. Unbranched, linear component of starch with α -1,4 bonds
R. Chitin	3. Structural heteropolysaccharide of animal joints
S. Hyaluronic Acid	4. Structural homopolymer containing nitrogen

Correct combination option:

- A) P-1, Q-2, R-4, S-3 B) P-2, Q-1, R-4, S-3
C) P-2, Q-1, R-3, S-4 D) P-1, Q-2, R-3, S-4

133.

The structural level of a protein that provides a complete, overall three-dimensional view of a single polypeptide chain is the:

- A) Primary structure B) Alpha helix
C) Beta-pleated sheet D) Tertiary structure

134.

The primary structure of a linear protein molecule always features:

- A) One end B) Two ends
C) Three ends D) No ends

135.

When a functional protein complex assembles from more than one polypeptide chain, this structural arrangement is known as the:

- A) Secondary structure B) Tertiary structure
C) Quaternary structure D) Polysaccharide structure

Zoology.

136.

Chordates possess

- A) Dorsal nerve cord placed below gut B) Single hollow nerve cord placed dorsal to gut
C) Double ventral nerve cord D) Single solid & ventral nerve cord

137.

The distinguishing feature of all chordates is

- A) A ventrally placed nerve cord B) A water vascular system
C) A chitinous exoskeleton D) Notochord

138.

Salpa & Doliolum belong to : -

- A) Hemichordata B) Cephalochordata
C) Urochordata D) Protochordata

139.

Chordates are distinguished from non chordates by the presence of : -

- A) Brain B) Dorsal tubular hollow nerve cord
C) Ventral nerve cord D) Dorsal solid nerve cord

140.

Which of the following animal belongs to Urochordata : -

- A) Herdmania B) Balanoglossus
C) Amphioxus D) Petromyzon

141.

Which of the following character is shared by all chordates at some stage of life -

- A) Notochord B) Dorsal tubular nerve cord
C) Pharyngeal gill slits D) All of the above

142.

Protochordates lack : -

- | | |
|-------------------------------|----------------------------|
| A) Cranium & vertebral column | B) Jaws & vertebral column |
| C) Paired appendages | D) All of the above |

143.

Gnathosomian with notochord persistent throughout the life in : -

- | | |
|------------------|--------------|
| A) Scoliodon | B) Herdmania |
| C) Balanoglossus | D) Frog |

144.

The adult tunicates show : -

- | | |
|------------------------------------|---------------------------|
| A) All the chordate characters | B) No chordate characters |
| C) Some of the chordate characters | D) Only dorsal nerve cord |

145.

Which of the following is not an essential chordate character : -

- | | |
|--------------------------|-----------------------------|
| A) Notochord | B) Vertebral column |
| C) Pharyngeal gill slits | D) Dorsal hollow nerve cord |

146.

The cephalochordates : -

- | | |
|--------------------------------------|---|
| A) Are exclusively marine in habitat | B) Retain the three primary chordate characters throughout the life |
| C) Ciliary feeders | D) All of the above |

147.

The gill – slits of chordates occur in : -

- | | |
|---|--|
| A) Buccal cavity of aquatic animals | B) Pharynx of all land vertebrates |
| C) Pharynx of all chordate embryos and pharynx of aquatic adult chordates | D) Pharynx of all aquatic and land vertebrates in adults as well as in their embryos |

148.

Protochordates are not vertebrates as : -

- | | |
|----------------------|----------------------------|
| A) Notochord absent | B) Vertebral column absent |
| C) Nerve cord absent | D) None of the above |

149.

Branchiostoma is : -

- | | |
|--------------|------------------|
| A) Amphioxus | B) Balanoglossus |
| C) Herdmania | D) Salpa |

150.

Notochord is restricted in tail of : -

- | | |
|------------------|---------------------|
| A) All chordates | B) Hemichordates |
| C) Urochordates | D) Cephalochordates |

151.

Fishes found mainly in marine water are

- | | |
|---------------|-------------------|
| A) Placodermi | B) Chondrichthyes |
| C) Dipnoi | D) Osteichthyes |

152.

A reptile which has completely 4- chambered heart-

- | | |
|--------------|---------------------|
| A) Crocodile | B) Snakes & lizards |
| C) Sphenodon | D) Turtle |

153.

Wings of birds are modified from

- | | |
|--------------|---------------------|
| A) Fore limb | B) Hind limb |
| C) Skin | D) Pectoral muscles |

154.

Air sacs of birds

- | | |
|---------------------------------|------------------------------|
| A) Keep body warm | B) Reduce body weight |
| C) Facilitate blood circulation | D) Maintain body temperature |

155.

Which group of characters of whale justify its inclusion in the class mammalia

- | | |
|---|--|
| A) Lungs, 4-chambered heart & kidneys | B) Vertebral column, lungs and 4-chambered heart |
| C) Hair skin, mammary glands and viviparity | D) Gills, fins and viviparity |

156.

Whale is a mammal because-

- | | |
|-------------------------------------|---|
| A) Lungs, four chambered heart | B) Vertebral column, lungs four chambered heart |
| C) Hair, mammary glands, viviparous | D) Viviparous, gills, fins |

157.

External ear pinna is found in-

- | | |
|---------------|------------|
| A) Reptiles | B) Mammals |
| C) Amphibians | D) Fishes |

158.

Body organization in Chordates-

- | | |
|-----------------|-----------------|
| A) Tissue organ | B) organ system |
| C) Cell tissue | D) Cellular |

159.

Other than mammals which group is also warm blooded-

- | | |
|-------------|---------------|
| A) Fishes | B) Amphibians |
| C) Reptiles | D) Birds |

160.

Ventral nerve cord is found in-

- | | |
|--------------|-----------|
| A) Cockroach | B) Hydra |
| C) Frog | D) Amoeba |

161.

In which of the following groups the members are exclusively marine

- | | |
|------------------------|------------------|
| A) Aquatic vertebrates | B) Tetrapoda |
| C) Pisces | D) Protochordata |

162.

One character is given wrongly for phylum chordata mark it

- | | |
|--|---|
| A) Presence of notochord | B) Presence of vertebral column |
| C) Paired gill slits connected with the exterior | D) A central nervous system dorsal to digestive canal |

163.

Gnathostomata is divided into 2 super classes, these are

- | | |
|-------------------------|--------------------------------|
| A) Acrania and craniata | B) Pisces and tetrapoda |
| C) Amniota and bipedal | D) Tetrapoda and Gnathostomata |

164.

Which one of the following sets of animals belongs to the same class of a phylum (1) Hydra, jelly fish, sea anemone (2) Rat, pigeon, whale (3) Locust, Limulus, cockroach (4) Whale, Pteropus, kangaroo

- | | |
|---------------------|-------------------|
| A) Homoiothermic | B) Poikilothermic |
| C) Both (1) and (2) | D) None of these |

165.

Amphibians breed

- | | |
|----------------|-------------|
| A) In crevices | B) In water |
| C) On trees | D) In soil |

166.

Which is the smallest taxonomic group having cranium, vertebral column, ventral heart, pulmonary respiration and two pairs of legs

- | | |
|---------------|------------------|
| A) Chordata | B) Gnathostomata |
| C) Vertebrata | D) Tetrapoda |

167.

Which one of the following groups of animals is correctly matched with its one characteristic feature without even a single exception?

- | | |
|--|---|
| A) Mammalia : give birth to young ones. | B) Reptilia : possess 3-chambered heart with one incompletely divided ventricle |
| C) Chordata : possess a mouth provided with an upper and a lower jaw | D) Chondrichthyes : possess cartilaginous endoskeleton |

168.

Development is direct in A. Chondrichthyes B. Osteichthyes C. Amphibia D. Reptilia E. Aves F. Mammalia G. cyclostomata

- | | |
|------------|-----------|
| A) ABCDEFH | B) ABDEFG |
| C) ABDEF | D) CG |

169.

In which of the following fish electric organs are present which are modified musculature between eye and nostrils?

- | | |
|---------------------------|-------------------------|
| A) Torpedo (electric ray) | B) Scoliodon (dog fish) |
| C) Trygon (sting ray) | D) Pristis (saw fish) |

170.

Gill slits in chondrichthyes are

- | | |
|--------------|---------------------------|
| A) Uncovered | B) Covered by operculum |
| C) Absent | D) Only sometimes covered |

171.

Scales in cartilaginous fishes are

- | | |
|------------|------------|
| A) Cycloid | B) Ctenoid |
| C) Placoid | D) Leptoid |

172.

Air bladder is present in

- | | |
|-------------------------|-----------------|
| A) Cartilaginous fishes | B) Bony fishes |
| C) Star fish | D) Electric Ray |

173.

One of the following fish does not belong to class osteichthyes

- | | |
|----------------|--------------|
| A) Hippocampus | B) Labeo |
| C) Torpedo | D) Exocoetus |

174.

Which one of the following is a true fish?

- | | |
|----------------|----------------|
| A) Cray fish | B) Cuttle fish |
| C) Flying fish | D) Jelly fish |

175.

One of the following is a limbless amphibian

- A) Salamandra (Urodela) B) Ichthyophis (Apoda)
C) Necturus (Urodela) D) Hyla (Anura)

176.

Crocodile, fish and frog, on one hand and Kangaroo and crows on the other differ in the following

- A) The former have four appendages, the latter have only two B) The body temperature of the former changes with environmental temperature, the temperature of the latter remains more or less constant
C) The former undergo metamorphosis, the latter do not D) The former are oviparous the latter are viviparous

177.

Which of the following represents the correct combination without any exception ?

	Characteristics	Class
(a)	Sucking and circular mouth; jaws absent, integument without scales; paired appendages.	Cyclostomata
(b)	Body covered with feathers; skin moist and glandular, fore-limbs form wings; lungs with air sacs.	Aves
(c)	Mammary gland; hair on body; pinnae; two pairs of limbs.	Mammalia
(d)	Mouth ventral; gills without operculum; skin with placoid scales; persistent notochord.	Chondrichthyes

- A) a B) b
C) c D) d

178.

Which of the following are correctly matched with respect to their taxonomic classification?

- A) Spiny anteater, sea urchin, sea cucumber- Echinodermata B) Flying fish, cuttlefish, silverfish-Pisces.
C) Centipede, millipede, spider, scorpion-Insecta D) House fly, butterfly, tsetsefly, silverfish- Insecta

179.

Choose the number of incorrect statements from the given

1. All chordates are vertebrates except	Urochordata and cephalochordata
2. All vertebrates are chordates except	Cyclostomata
3. Anadromous migration	Petromyzon
4. Air bladder is absent	Chondrichthyes
5. Air bladder is present	Osteichthyes
6. Air sacs connected lungs	Aves

- A) six B) Five
C) One D) Four

180.

Choose the incorrect statement

1. Skin of amphibians	Moist and useful for cutaneous respiration - Rana
2. Sucking and circular mouth with jaws	Cyclostomata - Petromyzon
3. Skin with hair	Mammalia - Macropus
4. Skin is cornified with epidermal scales or scutes	Reptilia - snakes/crocodiles

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

ANSWER KEY

Physics

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

Chemistry

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

Botany

91.	3	103.	2	115.	3	127.	2
92.	2	104.	2	116.	2	128.	3
93.	2	105.	3	117.	3	129.	2
94.	1	106.	2	118.	2	130.	2
95.	3	107.	2	119.	3	131.	2
96.	3	108.	1	120.	2	132.	2
97.	3	109.	4	121.	3	133.	4
98.	4	110.	1	122.	2	134.	2
99.	3	111.	3	123.	2	135.	3
100.	2	112.	1	124.	3		
101.	2	113.	1	125.	2		
102.	2	114.	4	126.	2		

Zoology

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

SOLUTIONS

Q1.

Answer: C

Explanation:

$$\vec{A} \cdot \vec{B} = 18 + 32 = 50$$

Q2.

Answer: A

Explanation:

$$\cos\theta = \frac{\vec{A} \cdot \vec{B}}{|\vec{A}||\vec{B}|} = \frac{(3\hat{i}+4\hat{j}+5\hat{k}) \cdot (3\hat{i}+4\hat{j}-5\hat{k})}{\sqrt{9+16+25}\sqrt{9+16+25}} = \frac{9+16-25}{50} = 0$$

$$\Rightarrow \cos\theta = 0, \therefore \theta = 90^\circ$$

Q3.

Answer: C

Explanation:

$$\hat{R} = \frac{\vec{R}}{|\vec{R}|} = \frac{\hat{i}+\hat{j}}{\sqrt{1^2+1^2}} = \frac{1}{\sqrt{2}}\hat{i} + \frac{1}{\sqrt{2}}\hat{j}$$

Q4.

Answer: B

Explanation:

$$\cos\theta = \frac{\vec{F}_1 \cdot \vec{F}_2}{|\vec{F}_1||\vec{F}_2|} = \frac{(5\hat{i}+10\hat{j}-20\hat{k}) \cdot (10\hat{i}-5\hat{j}-15\hat{k})}{\sqrt{25+100+400}\sqrt{100+25+225}} = \frac{50-50+300}{\sqrt{525}\sqrt{350}}$$

$$\Rightarrow \cos\theta = \frac{1}{\sqrt{2}} \therefore \theta = 45^\circ$$

Q5.

Answer: C

Explanation:

When the angle θ between two nonzero vectors $\vec{A}$ and $\vec{B}$ is 120° , the magnitude of their resultant $\vec{C}$ is calculated using the law of cosines. Because $\cos 120^\circ = -0.5$, the resulting value for C is mathematically larger than the magnitude of the vector difference $|\vec{A} - \vec{B}|$.

Q6.

Answer: C

Explanation:

Resultant of two vectors $\vec{A}$ and $\vec{B}$ can be given by $\vec{R} = \vec{A} + \vec{B}$ $|\vec{R}| = |\vec{A} + \vec{B}| = \sqrt{A^2 + B^2 + 2AB\cos\theta}$ If $\theta = 0^\circ$ then $|\vec{R}| = A + B = |\vec{A}| + |\vec{B}|$

Q7.

Answer: C

Explanation:

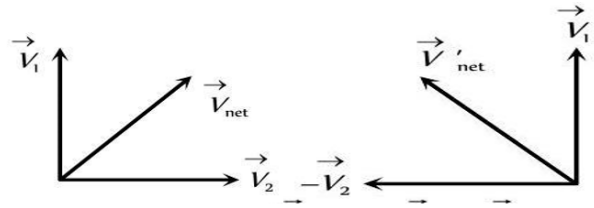
Given vectors can be rewritten as $\vec{A} = 2\hat{i} + 3\hat{j} + 8\hat{k}$ and $\vec{B} = -4\hat{i} + 4\hat{j} + \alpha\hat{k}$ Dot product of these vectors should be equal to zero because they are perpendicular

$$\therefore \vec{A} \cdot \vec{B} = -8 + 12 + 8\alpha = 0 \Rightarrow 8\alpha = -4 \Rightarrow \alpha = -1/2.$$

Q8.

Answer: C

Explanation:



According to problem $|\vec{V}_1 + \vec{V}_2| = |\vec{V}_1 - \vec{V}_2|$
 $\Rightarrow |\vec{V}_{\text{net}}| = |\vec{V}'_{\text{net}}|$ So V_1 and V_2 will be mutually perpendicular.

Q9.

Answer: D

Explanation:

The angle θ between two vectors is determined by first calculating their dot product and their magnitudes. After finding that $\cos\theta = \frac{2}{3}$, the value is converted to a sine function to match the format of the correct option.

Q10.

Answer: B

Explanation:

The maximum resultant of two vectors is given by $A + B$ and the minimum resultant is given by $A - B$. According to the problem statement, the maximum resultant is 3 times the minimum resultant, leading to the algebraic relation $A + B = 3(A - B)$, which can be solved to find the ratio $\frac{A}{B}$.

Q11.

Answer: C

Explanation:

Let the two forces be F_1 and F_2 ($F_1 > F_2$). The maximum possible resultant occurs when the forces are in the same direction ($F_1 + F_2 = 10$), and the minimum occurs when they are in opposite directions ($F_1 - F_2 = 6$). Solving this system of simultaneous linear equations gives the individual values of the forces.

Q12.

Answer: B

Explanation:

Since the resultant $\vec{R} = \vec{P} + \vec{Q}$ is perpendicular to $\vec{P}$, their dot product is zero: $\vec{R} \cdot \vec{P} = 0$, which gives $P + Q \cos\theta = 0 \Rightarrow \cos\theta = -\frac{P}{Q}$. Also, by the Pythagorean theorem in the vector triangle, $P^2 + R^2 = Q^2$. Given $R = P$, we can substitute to find the relationship between P and Q , and subsequently determine θ .

Q13.

Answer: C

Explanation:

Since $\vec{a}$ and $\vec{b}$ are unit vectors, their magnitudes are $|\vec{a}| = |\vec{b}| = 1$. Squaring the relation $|\vec{a} + \vec{b}| = \sqrt{3}|\vec{a} - \vec{b}|$ eliminates the vector magnitudes and allows direct calculation of $\cos \theta$.

Q14.

Answer: C

Explanation:

Using the identity solved in the original exam question, the sum of two equal vectors is $|\vec{A} + \vec{B}| = 2R \cos\left(\frac{\theta}{2}\right)$. Since the problem states that this resultant magnitude is itself equal to R , we set up the identity $R = 2R \cos\left(\frac{\theta}{2}\right)$ to evaluate the underlying angle.

Q15.

Answer: B

Explanation:

The magnitude of the resultant vector of two vectors $\vec{P}$ and $\vec{Q}$ inclined at an angle θ is given by

$R = \sqrt{P^2 + Q^2 + 2PQ \cos \theta}$. Since the forces are perpendicular, $\theta = 90^\circ$ and $\cos 90^\circ = 0$. The formula simplifies to the Pythagorean theorem: $R = \sqrt{P^2 + Q^2}$. Substituting $2F$ and F gives the result.

Q16.

Answer: A

Explanation:

When two vectors are perpendicular to each other, their resultant is calculated using the square root of the sum of their squares ($R = \sqrt{v_1^2 + v_2^2}$). Substituting the given values provides a perfect square inside the radical.

Q17.

Answer: C

Explanation:

Given that the forces are perpendicular, their relationship with the resultant follows $F_1^2 + F_2^2 = R^2$. By substituting the known resultant (10 N) and one known force component (6 N), we can isolate and solve for the remaining unknown force component.

Q18.

Answer: A

Explanation:

Let the magnitudes of both vectors be equal ($|\vec{A}| = |\vec{B}| = R$). The given condition is $|\vec{A} + \vec{B}| = \sqrt{3}|\vec{A} - \vec{B}|$. Squaring both sides of this relationship allows us to use standard vector expansion formulas ($\sqrt{A^2 + B^2 + 2AB \cos \theta}$) to group variables and cleanly extract the value of $\cos \theta$.

Q19.

Answer: D

Explanation:

In $\triangle MNO$: $\vec{A} + \vec{C} - \vec{D} = 0 \Rightarrow \vec{C} - \vec{D} = -\vec{A}$. Hence B is correct
In $\triangle MNP$: $\vec{A} + \vec{B} + \vec{E} = 0$. Hence A is correct
In $\triangle MPNO$: $-\vec{E} - \vec{B} + \vec{C} - \vec{D} = 0$.
 $\Rightarrow \vec{B} + \vec{E} - \vec{C} = -\vec{D}$. Hence, C is correct

Q20.

Answer: D

Explanation:

For the resultant of some vectors to be zero, they should form a closed figure taken in same order.

Q21.

Answer: B

Explanation:

$$\frac{a+b}{a-b} = \frac{3}{1} \text{ or } 3a - 3b = a + b \text{ or } 2a = 4b \text{ or } a = 2b$$

Q22.

Answer: B

Explanation:

Note that the angle between two forces is 120° and not 60° .
 $R^2 = F^2 + F^2 + 2F^2 \cos 120^\circ$
or $R^2 = 2F^2 + 2F^2 \left(-\frac{1}{2}\right) = F^2$ or $R = F$

Q23.

Answer: D

Explanation:

The resultant of two forces can lie between $A - B$ and $A + B$, i.e., $12 - 1 = 11$ N and $12 + 1 = 13$ N.

Q24.

Answer: B

Explanation:

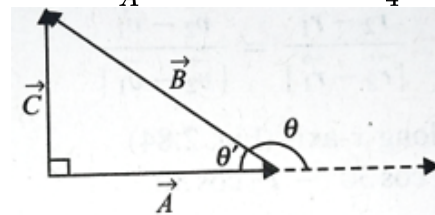
$$(\vec{A} + \vec{B}) \cdot (\vec{A} - \vec{B}) = 0 \quad A^2 - B^2 = 0 \Rightarrow A^2 = B^2 \Rightarrow A = B$$

Q25.

Answer: B

Explanation:

$$\tan \theta' = \frac{C}{A} = 1 \Rightarrow \theta' = 45^\circ = \frac{\pi}{4} \quad \theta = \pi - \frac{\pi}{4} = \frac{3\pi}{4}$$



Q26.

Answer: A

Explanation:

To solve this problem, we'll analyze the conditions given about the vectors $\vec{A}$ and $\vec{B}$, and their resultant $\vec{R}$. Given:

$\vec{R} = \vec{A} + \vec{B}$ is perpendicular to $\vec{A}$. The magnitude of $\vec{R}$ is half that of $\vec{B}$: $|\vec{R}| = \frac{1}{2}|\vec{B}|$. Approach: We know that if $\vec{R}$ is

perpendicular to $\vec{A}$, then their dot product is zero: $\vec{R} \cdot \vec{A} = 0$

Substitute $\vec{R} = \vec{A} + \vec{B}$: $(\vec{A} + \vec{B}) \cdot \vec{A} = 0 \Rightarrow$

$\vec{A} \cdot \vec{A} + \vec{B} \cdot \vec{A} = 0 \Rightarrow |\vec{A}|^2 + |\vec{A}||\vec{B}| \cos \theta = 0 \Rightarrow$

$\cos \theta = -\frac{|\vec{A}|^2}{|\vec{A}||\vec{B}|} \Rightarrow \cos \theta = -\frac{|\vec{A}|}{|\vec{B}|}$ Next, we use the second

condition involving magnitudes: $|\vec{R}| = |\vec{A} + \vec{B}| = \frac{1}{2}|\vec{B}| \Rightarrow$

$\sqrt{|\vec{A}|^2 + |\vec{B}|^2 + 2|\vec{A}||\vec{B}| \cos \theta} = \frac{1}{2}|\vec{B}| \Rightarrow$

$|\vec{A}|^2 + |\vec{B}|^2 - 2|\vec{A}||\vec{B}| \frac{|\vec{A}|}{|\vec{B}|} = \frac{1}{4}|\vec{B}|^2 \Rightarrow$

$|\vec{A}|^2 + |\vec{B}|^2 - 2|\vec{A}|^2 = \frac{1}{4}|\vec{B}|^2 \Rightarrow |\vec{B}|^2 - |\vec{A}|^2 = \frac{1}{4}|\vec{B}|^2 \Rightarrow$

$\frac{3}{4}|\vec{B}|^2 = |\vec{A}|^2 \Rightarrow |\vec{A}| = \frac{\sqrt{3}}{2}|\vec{B}|$ Finally, substitute this back

into the cosine formula: $\cos \theta = -\frac{\frac{\sqrt{3}}{2}|\vec{B}|}{|\vec{B}|} \cos \theta = -\frac{\sqrt{3}}{2}$ This

value of $\cos \theta$ corresponds to an angle of 150° because

$\cos 150^\circ = -\frac{\sqrt{3}}{2}$. Answer: The angle between $\vec{A}$ and $\vec{B}$ is 150° .

Q27.

Answer: D

Explanation:

To solve this problem, we will use the concepts of vector addition and magnitudes involving the dot product. Given the angle between $\vec{a}$ and $\vec{b}$ is $\cos^{-1}(\frac{5}{9})$, we can use the properties of dot products and magnitudes to find the required integer value of n . First, let's use the condition

$|\vec{a} + \vec{b}| = \sqrt{2}|\vec{a} - \vec{b}|$. Square both sides to remove the

square roots: $|\vec{a} + \vec{b}|^2 = 2|\vec{a} - \vec{b}|^2$ Now we will expand both sides using the formula for the magnitude of the sum and difference of vectors:

$|\vec{a} + \vec{b}|^2 = (\vec{a} + \vec{b}) \cdot (\vec{a} + \vec{b}) = \vec{a} \cdot \vec{a} + 2\vec{a} \cdot \vec{b} + \vec{b} \cdot \vec{b}$ And

$|\vec{a} - \vec{b}|^2 = (\vec{a} - \vec{b}) \cdot (\vec{a} - \vec{b}) = \vec{a} \cdot \vec{a} - 2\vec{a} \cdot \vec{b} + \vec{b} \cdot \vec{b}$

Substitute these back into the original equation:

$\vec{a} \cdot \vec{a} + 2\vec{a} \cdot \vec{b} + \vec{b} \cdot \vec{b} = 2(\vec{a} \cdot \vec{a} - 2\vec{a} \cdot \vec{b} + \vec{b} \cdot \vec{b})$ Expand the right-hand side:

$\vec{a} \cdot \vec{a} + 2\vec{a} \cdot \vec{b} + \vec{b} \cdot \vec{b} = 2\vec{a} \cdot \vec{a} - 4\vec{a} \cdot \vec{b} + 2\vec{b} \cdot \vec{b}$ Rearrange

all terms to one side to combine like terms:

$\vec{a} \cdot \vec{a} + 2\vec{a} \cdot \vec{b} + \vec{b} \cdot \vec{b} - 2\vec{a} \cdot \vec{a} + 4\vec{a} \cdot \vec{b} - 2\vec{b} \cdot \vec{b} = 0$

Combine like terms: $-\vec{a} \cdot \vec{a} + 6\vec{a} \cdot \vec{b} - \vec{b} \cdot \vec{b} = 0$ We know that:

$\vec{a} \cdot \vec{a} = |\vec{a}|^2$ and $\vec{b} \cdot \vec{b} = |\vec{b}|^2$ and $\vec{a} \cdot \vec{b} = |\vec{a}||\vec{b}| \cos(\theta)$

Since the angle between $\vec{a}$ and $\vec{b}$ is $\cos^{-1}(\frac{5}{9})$, we have:

$\cos(\theta) = \frac{5}{9}$ Substitute these back into the equation:

$-|\vec{a}|^2 + 6|\vec{a}||\vec{b}|(\frac{5}{9}) - |\vec{b}|^2 = 0$ Simplify it further:

$-|\vec{a}|^2 + \frac{30}{9}|\vec{a}||\vec{b}| - |\vec{b}|^2 = 0 \Rightarrow -|\vec{a}|^2 + \frac{10}{3}|\vec{a}||\vec{b}| - |\vec{b}|^2 = 0$

We know that $|\vec{a}| = n|\vec{b}|$. Substitute this into the equation:

$-(n|\vec{b}|)^2 + \frac{10}{3}(n|\vec{b}|)|\vec{b}| - |\vec{b}|^2 = 0$ Simplify it:

$-n^2|\vec{b}|^2 + \frac{10}{3}n|\vec{b}|^2 - |\vec{b}|^2 = 0$ Factor out $|\vec{b}|^2$:

$|\vec{b}|^2(-n^2 + \frac{10}{3}n - 1) = 0$ Since $|\vec{b}|^2 \neq 0$, we can solve:

$-n^2 + \frac{10}{3}n - 1 = 0$ Multiply through by 3 to clear the

fraction: $-3n^2 + 10n - 3 = 0$ Rearrange it to match

standard quadratic form: $3n^2 - 10n + 3 = 0$ Solve this

quadratic equation using the quadratic formula:

$n = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ Here, $a = 3$, $b = -10$, and $c = 3$:

$n = \frac{10 \pm \sqrt{(-10)^2 - 4 \cdot 3 \cdot 3}}{2 \cdot 3} = \frac{10 \pm \sqrt{100 - 36}}{6} = \frac{10 \pm \sqrt{64}}{6} = \frac{10 \pm 8}{6}$

This results in two possible solutions for n :

$n = \frac{18}{6} = 3$ and $n = \frac{2}{6} = \frac{1}{3}$ However, since n is given to be an integer, we take: 3

Q28.

Answer: A

Explanation:

$(\vec{P} + \vec{Q}) = \sqrt{2}A$ $R = A$ $\theta = 90^\circ$ Resultant = $\sqrt{3}A$

Q29.

Answer: B

Explanation:

To find the angle between the vector $\vec{Q}$ and the resultant of $(2\vec{Q} + 2\vec{P})$ and $(2\vec{Q} - 2\vec{P})$, we first find the resultant vector of $(2\vec{Q} + 2\vec{P})$ and $(2\vec{Q} - 2\vec{P})$. The resultant vector of $(2\vec{Q} + 2\vec{P})$ and $(2\vec{Q} - 2\vec{P})$ can be simply found by adding these two vectors:

Resultant $= (2\vec{Q} + 2\vec{P}) + (2\vec{Q} - 2\vec{P}) = 4\vec{Q}$ Now, we need to find the angle between the vector $\vec{Q}$ and this resultant vector $4\vec{Q}$. Since the resultant vector is just a scaled version of $\vec{Q}$, they are in the same direction. The angle between any vector and another vector that is a scaled version of the first vector is always 0° , because they are parallel to each other.

Therefore, the angle between $\vec{Q}$ and the resultant of $(2\vec{Q} + 2\vec{P})$ and $(2\vec{Q} - 2\vec{P})$ is 0° . So, the correct option is: Option B: 0°

Q30.

Answer: B

Explanation:

Given that when vector $\vec{A} = 2\hat{i} + 3\hat{j} + 2\hat{k}$ is subtracted from vector $\vec{B}$, it gives a vector equal to $2\hat{j}$. We can write this as:

$\vec{B} - \vec{A} = 2\hat{j}$ Now, let's express the vector $\vec{B}$ in terms of its components: $\vec{B} = B_x\hat{i} + B_y\hat{j} + B_z\hat{k}$ Subtract vector $\vec{A}$ from vector $\vec{B}$: $(B_x\hat{i} + B_y\hat{j} + B_z\hat{k}) - (2\hat{i} + 3\hat{j} + 2\hat{k}) = 2\hat{j}$

Comparing the components, we get:

$$B_x - 2 = 0, B_y - 3 = 2, B_z - 2 = 0 \text{ Solving these}$$

equations, we find the components of vector $\vec{B}$:

$$B_x = 2, B_y = 5, B_z = 2 \text{ Now, we can find the magnitude of vector } \vec{B}:$$

$$|\vec{B}| = \sqrt{B_x^2 + B_y^2 + B_z^2} = \sqrt{2^2 + 5^2 + 2^2} = \sqrt{4 + 25 + 4} = \sqrt{33}$$

Therefore, the magnitude of vector $\vec{B}$ is $\sqrt{33}$

Q31.

Answer: C

Explanation:

The resultant of two perpendicular vectors is given by the Pythagorean theorem. If we have two vectors of magnitudes A and $\frac{A}{2}$, the resultant R is:

$$R = \sqrt{A^2 + \left(\frac{A}{2}\right)^2} = \sqrt{A^2 + \frac{A^2}{4}} = \sqrt{\frac{5A^2}{4}} = \frac{\sqrt{5}A}{2}$$

Q32.

Answer: D

Explanation:

$\vec{P}$ & $\vec{Q}$ are perpendicular $\vec{P} \cdot \vec{Q} = 0$

$$(\hat{i} + 2m\hat{j} + m\hat{k}) \cdot (4\hat{i} - 2\hat{j} + m\hat{k}) = 0$$

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

Q33.

Answer: D

Explanation:

$\vec{A} = 2\hat{i} + 4\hat{j} - 2\hat{k}$ $\vec{B} = \hat{i} + 2\hat{j} + \alpha\hat{k}$ $\vec{A} \cdot \vec{B} = 0$, as $\vec{A}$ should be perpendicular to $\vec{B} \Rightarrow 2 + 8 - 2\alpha = 0 \Rightarrow \alpha = 5$

Q34.

Answer: A

Explanation:

$$\vec{A} \cdot \vec{B} = (2\hat{i} + 3\hat{j} - \hat{k}) \cdot (\hat{i} + 2\hat{j} + 2\hat{k})$$

$$\Rightarrow \vec{A} \cdot \vec{B} = 2 \times 1 + 3 \times 2 - 1 \times 2 \Rightarrow \vec{A} \cdot \vec{B} = 6 \text{ And}$$

$$|\vec{B}| = \sqrt{1^2 + 2^2 + 2^2} = \sqrt{9} = 3 \text{ Magnitude of component of } \vec{A} \text{ along } \vec{B} = \frac{\vec{A} \cdot \vec{B}}{|\vec{B}|} = \frac{6}{3} = 2$$

Q35.

Answer: C

Explanation:

$$\sqrt{A^2 + A^2 + 2A^2 \cos \theta} = 2\sqrt{A^2 + A^2 + 2A^2(-\cos \theta)}$$

$$\Rightarrow 2A^2 + 2A^2 \cos \theta = 8A^2 + 8A^2(-\cos \theta)$$

$$\Rightarrow 5 \cos \theta = 3 \Rightarrow \theta = \cos^{-1} \left(\frac{3}{5} \right)$$

Q36.

Answer: A

Explanation:

The projection of any vector on an axis is equal to its corresponding scalar component along that axis. The x-axis is defined by the unit vector $\hat{i}$, so the projection of $\vec{A}$ on the x-axis is the dot product of $\vec{A}$ and $\hat{i}$.

Q37.

Answer: C

Explanation:

The angle θ between two vectors is found using the formula $\cos \theta = \frac{\vec{A} \cdot \vec{B}}{|\vec{A}||\vec{B}|}$. By calculating the dot product and the magnitudes of the individual vectors, we can determine the cosine of the angle and then the angle itself.

Q38.

Answer: A

Explanation:

Two vectors are perpendicular if and only if their dot product is zero. We compute the dot product of $\vec{A}$ and $\vec{B}$, set it to zero, and solve for k .

Q39.

Answer: A

Explanation:

For two vectors to be perpendicular, their dot product must be equal to zero. By calculating the dot product of $\vec{A}$ and $\vec{B}$ and equating it to zero, we can solve for the unknown variable α .

Q40.

Answer: C

Explanation:

The work done is the dot product of the force vector and the displacement vector. First, we find the unit vector of the direction to determine the force vector, then calculate the displacement, and finally compute the dot product.

Q41.

Answer: A

Explanation:

Two vectors are perpendicular if their dot product is zero. We calculate the dot product of $\vec{A}$ and $\vec{B}$, set the result to zero, and solve for the unknown constant n .

Q42.

Answer: C

Explanation:

The magnitude of the resultant of two vectors is given by the formula $R = \sqrt{A^2 + B^2 + 2AB \cos \theta}$. By substituting the given magnitudes and the resultant value, we can solve for the cosine of the angle θ . Since $6^2 + 8^2$ equals 10^2 , the term $2AB \cos \theta$ must be zero, implying the vectors are orthogonal.

Q43.

Answer: A

Explanation:

Since the two vectors are orthogonal (at 90 degrees), their resultant magnitude can be found using the Pythagorean theorem, where the resultant R is the hypotenuse of a right-angled triangle formed by the two vectors.

Q44.

Answer: A

Explanation:

When two vectors act at an angle of 90 degrees, they form a right-angled triangle. The resultant magnitude is the hypotenuse, calculated using the Pythagorean theorem $R = \sqrt{A^2 + B^2}$.

Q45.

Answer: A

Explanation:

For a vector to be a unit vector, its magnitude must be equal to 1. By applying the definition of magnitude, we can solve for the unknown component c . Since 0.6^2 plus 0.8^2 already equals 1, the component c must be 0 for the vector to have a magnitude of 1.

Q46.

Answer: D

Explanation:

Metallic character increases as we move down a group in the periodic table, and metallic oxides are generally basic in nature.

Q47.

Answer: A

Explanation:

For isoelectronic species (species with the same number of electrons), the atomic/ionic radius increases as the nuclear charge (Z) decreases.

Q48.

Answer: C

Explanation:

Second ionization enthalpy (IE_2) involves removing an electron from a unipositive cation. Stability of half-filled or fully-filled configurations significantly increases ionization energy.

Q49.

Answer: B

Explanation:

Ionization energy depends on atomic size and the stability of the electronic configuration. Half-filled p^3 configurations are exceptionally stable and require more energy to remove an electron.

Q50.

Answer: D

Explanation:

For isoelectronic species, the size decreases as the atomic number (Z) increases because the electrons are pulled closer by a stronger nuclear charge.

Q51.

Answer: C

Explanation:

Electron gain enthalpy generally increases (becomes more negative) across a period. However, 3rd-period elements (S, Cl) have more negative values than 2nd-period elements (O, F) due to less inter-electronic repulsion in their larger valence shells.

Q52.

Answer: B

Explanation:

The ionization energy of a neutral atom is numerically equal to the electron affinity (or negative electron gain enthalpy) of its corresponding cation.

Q53.

Answer: B

Explanation:

Isoelectronic species (Na^+ , F^- , O^{2-}) follow the rule that size increases as nuclear charge (Z) decreases.

Q54.

Answer: B

Explanation:

Isoelectronic species have the same number of electrons.

Q55.

Answer: B

Explanation:

In an isoelectronic series, radius decreases as nuclear charge increases.

Q56.

Answer: A

Explanation:

Compare the count of electrons in specified subshells based on standard electronic configurations.

Q57.

Answer: C

Explanation:

The second electron gain enthalpy is always endothermic because the incoming electron faces strong electrostatic repulsion from the already negative ion.

Q58.

Answer: B

Explanation:

For option B, Nitrogen has a higher first ionization enthalpy than Oxygen due to its stable half-filled p^3 configuration. For option C, Chlorine has a more negative electron gain enthalpy than Fluorine.

Q59.

Answer: D

Explanation:

Gallium (Ga) is slightly smaller than Aluminium (Al) due to "transition contraction" caused by the poor shielding of 3d electrons.

Q60.

Answer: D

Explanation:

Hydroxides of elements with electronegativity near 1.7 can be amphoteric. BeO and $Be(OH)_2$ are well-known amphoteric compounds.

Q61.

Answer: B

Explanation:

IE generally increases across a period. Exceptions occur at Be vs B (fully filled $2s^2$ vs $2p^1$) and N vs O (half-filled $2p^3$ vs $2p^4$).

Q62.

Answer: A

Explanation:

Energy is determined by the $(n + l)$ rule. Higher $(n + l)$ means higher energy; if equal, higher n means higher energy.

Q63.

Answer: D

Explanation:

Metal oxides are basic, non-metal oxides with high oxidation states are acidic, certain non-metal oxides are neutral, and some transition/borderline metal oxides are amphoteric.

Q64.

Answer: A

Explanation:

The group and period numbers of elements are determined by their atomic number and electronic configuration. Matches B, C, and D are correct based on the long form of the periodic table.

Q65.

Answer: B

Explanation:

Silver (Ag) belongs to Group 11 (IB), the coinage metal group. The elements in this group are Copper (Cu), Silver (Ag), and Gold (Au).

Q66.

Answer: B

Explanation:

Isoelectronic species have the same number of electrons but can belong to different periods based on their nuclear charge.

Q67.

Answer: C

Explanation:

The first ionization energy (I_1) is the energy for the first step. The second ionization energy (I_2) is the energy required to remove an electron from the unipositive ion.

Q68.

Answer: D

Explanation:

A large jump in ionization energy occurs after removing valence electrons. Here, the jump is after the 3rd electron, indicating the element has 3 valence electrons.

Q69.

Answer: C

Explanation:

Halogens (Group 17) need only one electron to achieve a stable noble gas configuration and have the highest electronegativities and electron affinities.

Q70.

Answer: C

Explanation:

The bond length of a heteronuclear molecule can be calculated using the Schoemaker and Stevenson law.

Q71.

Answer: D

Explanation:

Basic strength of hydroxides increases with metallic character. Transition metal hydroxides like $Zn(OH)_2$ are often amphoteric and much weaker bases than alkali or alkaline earth metal hydroxides.

Q72.

Answer: B

Explanation:

In a group, the effective nuclear charge (Z_{eff}) experienced by the outermost electron remains approximately constant or increases very slightly; it does not decrease significantly down the group.

Q73.

Answer: C

Explanation:

Ionization potential depends on nuclear charge. He^+ and H are isoelectronic (1 electron), but He^+ has a higher nuclear charge ($Z = 2$ vs $Z = 1$).

Q74.

Answer: A

Explanation:

Elements in the same group have the same total number of valence electrons (considering ground and excited states correctly) or same valence shell configuration type.

Q75.

Answer: D

Explanation:

Non-metals generally have high ionization energies compared to metals.

Q76.

Answer: B

Explanation:

For first ionization energy in the 2nd period, Nitrogen is higher than Oxygen due to its half-filled p^3 configuration.

Q77.

Answer: C

Explanation:

Basic nature of oxides increases down a group and decreases across a period.

Q78.

Answer: B

Explanation:

Gadolinium (Gd) has an anomalous configuration to achieve a stable half-filled f^7 subshell.

Q79.

Answer: C

Explanation:

Chlorine has the highest electron affinity because the 2p shell of Fluorine is so small that inter-electronic repulsion reduces the net energy released when adding an electron.

Q80.

Answer: B

Explanation:

The energy released when an electron is added to a cation is equal to the energy required to remove an electron from the neutral atom.

Q81.

Answer: D

Explanation:

Despite the $Cl > F$ exception, Fluorine still has a much higher electron affinity than heavier halogens like Bromine and Iodine.

Q82.

Answer: D

Explanation:

Amphoteric hydroxides can react with both acids and bases. $Be(OH)_2$, $Al(OH)_3$, and $Zn(OH)_2$ are common examples.

Q83.

Answer: B

Explanation:

Electronegativity is specifically defined as the tendency of a bonded atom to attract a shared pair of electrons.

Q84.

Answer: D

Explanation:

In an isoelectronic series, as the atomic number increases, the nuclear charge pulls the electrons tighter, significantly decreasing the radius.

Q85.

Answer: B

Explanation:

Ionic radius is generally inversely related to effective nuclear charge (Z_{eff}) because a stronger pull from the nucleus shrinks the electron cloud.

Q86.

Answer: C

Explanation:

Halogens have higher electron affinity than chalcogens (O, S), and within these groups, 3rd period elements have higher affinity than 2nd period elements.

Q87.

Answer: B

Explanation:

Electron affinity generally increases across a period and decreases down a group (with some exceptions). Carbon has a higher electron affinity than Nitrogen because Nitrogen has a stable half-filled p^3 shell.

Q88.

Answer: D

Explanation:

Electronegativity increases regularly across a period as Z_{eff} increases and atomic size decreases.

Q89.

Answer: D

Explanation:

The electronic configuration corresponds to atomic number 103, which uses the roots un (1), nil (0), and tri (3).

Q90.

Answer: A

Explanation:

An element in the 6th period and 15th group is bismuth (Bi). From the modern periodic table, bismuth has the atomic number 83.

Q91.

Answer: C

Q92.

Answer: B

Q93.

Answer: B

Q94.

Answer: A

Q95.

Answer: C

Q96.

Answer: C

Q97.

Answer: C

Q98.

Answer: D

Q99.

Answer: C

Q100.

Answer: B

Q101.

Answer: B

Q102.

Answer: B

Q103.

Answer: B

Q104.

Answer: B

Q105.

Answer: C

Q106.

Answer: B

Q107.

Answer: B

Q108.

Answer: A

Q109.

Answer: D

Q110.

Answer: A

Q111.

Answer: C

Q112.

Answer: A

Q113.

Answer: A

Q114.

Answer: D

Q115.

Answer: C

Q116.

Answer: B

Q117.

Answer: C

Q118.

Answer: B

Q119.

Answer: C

Q120.

Answer: B

Q121.
Answer: C

Q122.
Answer: B

Q123.
Answer: B

Q124.
Answer: C

Q125.
Answer: B

Q126.
Answer: B

Q127.
Answer: B

Q128.
Answer: C

Q129.
Answer: B

Q130.
Answer: B

Q131.
Answer: B

Q132.
Answer: B

Q133.
Answer: D

Q134.
Answer: B

Q135.
Answer: C

Q136.
Answer: B

Q137.
Answer: D

Q138.
Answer: C

Q139.
Answer: B

Q140.
Answer: A

Q141.
Answer: D

Q142.
Answer: D

Q143.
Answer: A

Q144.
Answer: C

Q145.
Answer: B

Q146.
Answer: D

Q147.
Answer: C

Q148.
Answer: B

Q149.
Answer: A

Q150.
Answer: C

Q151.
Answer: B

Q152.
Answer: A

Q153.
Answer: A

Q154.
Answer: B

Q155.
Answer: C

Q156.
Answer: C

Q157.
Answer: B

Q158.
Answer: B

Q159.
Answer: D

Q160.
Answer: A

Q161.
Answer: D

Q162.
Answer: B

Q163.
Answer: B

Q164.
Answer: D

Q165.
Answer: B

Q166.
Answer: D

Q167.
Answer: D

Q168.
Answer: C

Q169.
Answer: A

Q170.
Answer: A

Q171.
Answer: C

Q172.
Answer: B

Q173.
Answer: C

Q174.
Answer: C

Q175.
Answer: B

Q176.
Answer: B

Q177.
Answer: D

Q178.
Answer: D

Q179.
Answer: C

Q180.
Answer: B