Max Marks: 300 **JR_WEEK-5 (13-07-2026)** **Time: 180 mins**

Chemistry

1. The IUPAC nomenclature of an element with electronic configuration $[Rn]5f^{14}6d^{1}7s^{2}$ is:

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

2. The first ionization enthalpies of Be, B, N and O follow the order:

A) $O < N < B < Be$ **B)** $Be < B < N < O$
C) $B < Be < N < O$ **D)** $B < Be < O < N$

3. Outermost electronic configurations of four elements A, B, C, D are given: (A)$3s^2$ (B)$3s^2 3p^1$ (C) $3s^2 3p^3$ (D)$3s^2 3p^4$. The correct order of first ionization enthalpy for them is:

A) (A) < (B) < (C) < (D) **B)** (B) < (A) < (D) < (C)
C) (B) < (D) < (A) < (C) **D)** (B) < (A) < (C) < (D)

4. The correct decreasing order for metallic character is:

A) $Na > Mg > Be > Si > P$ **B)** $P > Si > Be > Mg > Na$
C) $Si > P > Be > Na > Mg$ **D)** $Be > Na > Mg > Si > P$

5. The first ionization enthalpy of Na, Mg and Si, respectively, are: 496, 737 and $786 kJ mol^{-1}$. The first ionization enthalpy $\left(kJ\,mol^{-1}\right)$ of Al is:

A) 487 **B)** 768
C) 577 **D)** 856

6. Match List-I with List-II

List-I(Electronicconfiguration ofelements)	List-II (Δ_i in $kJ\,mol^{-1}$)
A. $1s^2 2s^2$	(i) 801
B. $1s^2 2s^2 2p^4$	(ii) 899
C. $1s^2 2s^2 2p^3$	(iii) 1314
D. $1s^2 2s^2 2p^1$	(iv) 1402

Choose the most appropriate answer from the options given below.

A) (A-ii), (B-iii), (C-iv), (D-i) **B)** (A-i), (B-iv), (C-iii), (D-ii)
C) (A-i), (B-iii), (C-iv), (D-ii) **D)** (A-iv), (B-i), (C-ii), (D-iii)

7. Consider the elements Mg, Al, S, P and Si, the correct increasing order of their first ionization enthalpy is:

A) $Mg < Al < Si < S < P$ **B)** $Al < Mg < Si < S < P$
C) $Mg < Al < Si < P < S$ **D)** $Al < Mg < S < Si < P$

8. The set of elements that differ in mutual relationship from those of the other sets is:

A) $Li - Mg$ **B)** $B - Si$
C) $Be - Al$ **D)** $Li - Na$

9. Identify the elements X and Y using the ionisation energy values given below.

	Ionisation energy (Ist)	kJ/mol (IInd)
X	495	4563
Y	71	1450

A) $X = Na, Y = Mg$ **B)** $X = Mg, Y = F$
C) $X = Mg, Y = Na$ **D)** $X = F, Y = Mg$

10. The first ionisation energy of magnesium is smaller as compared to that of elements X and Y, but higher than that of Z. The elements X, Y and Z, respectively, are

A) chlorine, lithium and sodium **B)** argon, lithium and sodium
C) argon, chlorine and sodium **D)** neon, sodium and chlorine

11. Outermost configuration of a Group 13 element E is $4s^2 4p^1$. The electronic configuration of an element of p-block period five placed diagonally to element, E is :

A) $[Kr]3d^{10}4s^2 4p^2$ **B)** $[Ar]3d^{10}4s^2 4p^2$
C) $[Xe]5d^{10}6s^2 6p^2$ **D)** $[Kr]4d^{10}5s^2 5p^2$

12. The ionic radii ofF^- and O^{2-} respectively are 1.33A and $1.4\ \text{A}$,while the covalent radius of N is $0.74A$. The correct statement for the ionic radius of N^{3-} from the following is:

A) It is smaller than F^- and N **B)** It is bigger than O^{2-} and F^-
C) It is bigger than $F^-$and N, but smaller than of O^{2-} **D)** It is smaller than O^{2-} and F^-, but bigger than of N

13. **The correct order of ionic radii for $P^{3-}, S^{2-}, Ca^{2+}, K^{+}, Cl^{-}$ is:**

A) $P^{3-} > S^{2-} > Cl^{-} > K^{+} > Ca^{2+}$ **B)** $Ca^{2+} > S^{2-} > P^{3-} > Ca^{2+} > K^{+}$

C) $\mathrm{P^{3-} > S^{2-} > Cl^{-} > Ca^{2+} > K^{+}}$ **D)** $\mathrm{K^{+} > Ca^{2+} > P^{3-} > S^{2-} > Cl^{-}}$

14. **The first ionization energy (kJ/mol) of Na, Mg, Al and Si respectively, are:**

A) 496, 737, 577, 786 **B)** 496, 577, 737, 786

C) 786, 737, 577, 496 **D)** 496, 577, 786, 737

15. **The electron gain enthalpy (kJ/mol) of fluorine, chlorine, bromine and iodine, respectively, are:**

A) −296, −325, −333 and −349 **B)** −349, −333, −325 and −296

C) $-333, -349, -325$ and -296 **D)** $-333, -325, -349$ and -296

16. **Within pairs $F\&Cl$, $S\&Se$, and $Li\&Na$, respectively, the elements that release more energy upon an electron gain are:**

A) Cl, Se and Na **B)** Cl, S and Li

C) F, S and Li **D)** F, Se and Na

17. **The correct order of the ionic radii of $O^{2-}, N^{3-}, F^{-}, Mg^{2+}, Na^{+}$ and Al^{3+} is:**

A) $\mathrm{N^{3-} < O^{2-} < F^{-} < Na^{+} < Al^{3+} < Mg^{2+}}$ **B)** $\mathrm{Al^{3+} < Mg^{2+} < Na^{+} < O^{2-} < F^{-} < N^{3-}}$

C) $Al^{3+} < Mg^{2+} < Na^{+} < F < O^{2-} < N^{3-}$ **D)** $N^{3-} < O^{2-} < F^{-} < Mg^{2+} < Na^{+} < Al^{3+}$

18. **The process that is NOT endothermic in nature is:**

A) $Ar(g) + e^{-} \rightarrow Ar^{-}(g)$ **B)** $H(g) + e^{-} \rightarrow H^{-}(g)$

C) $\mathrm{O^{-}(g) + e^{-} \rightarrow O^{2-}(g)}$ **D)** $\mathrm{Na(g) \rightarrow Na^{+}(g) + e^{-}}$

19. **The formation of the oxide ion $O^{2-}(g)$ requires first an exothermic and then an endothermic step as shown below**

$\mathrm{O(g) + e^{-} = O^{-}(g)}\ \Delta H^{\circ} = -142\ \mathrm{kJmol^{-1}}$

$\mathrm{O^{-}(g) + e^{-} = O^{2-}(g)}\ \Delta H^{\circ} = 844\ \mathrm{kJmol^{-1}}$ **This is because**

A) O^{-} ion will tend to resist the addition of another electron **B)** Oxygen has high electron affinity

C) Oxygen is more electronegative **D)** O^{-} ion has comparativelylarger size than oxygen atom

20. **The 71st electron of an element X with an atomic number of 71 enters into the orbital:**

A) 6p **B)** 4f

C) 5d **D)** 6s

21. **The atomic number of Unnilunium is:**

22. **The $1^{st}, 2^{nd}$, and 3^{rd} ionization enthalpies, I_1, I_2, and I_3, of four atoms with atomic numbers $n, n+1, n+2$, and $n+3$, where $n < 10$, are tabulated below. What is the value of n?**

Atomic number	Ionization Enthalpy (kJ/mol)		
	I_1	I_2	I_3
n	1681	3374	6050
$n+1$	2081	3952	6122
$n+2$	496	4562	6910
$n+3$	738	1451	7733

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

24. **John-New land, theory octaves is true up li the element of atomic mass**

25. **At present, the known elements are**

Maths

26. **If $\tan 22^{\circ} + \tan 38^{\circ} - \sqrt{3} = k \tan 22^{\circ} \tan 38^{\circ}$, then $k =$**

A) -1 **B)** $-\sqrt{3}$

C) 0 **D)** 1

27. **If $B = \frac{1}{5}.\sin(2A + B)$, then $\frac{\tan(A+B)}{\tan A} =$**

A) $5/3$ **B)** $2/3$

C) $3/2$ **D)** $3/5$

28. **If $2\cos\frac{A}{2} = \sqrt{1+\sin A} + \sqrt{1-\sin A}$, then $\frac{A}{2}$ lies between:**

A) $2n\pi + \frac{\pi}{4}$ and $2n\pi + \frac{3\pi}{4}$ **B)** $2n\pi - \frac{\pi}{4}$ and $2n\pi + \frac{\pi}{4}$

C) $2n\pi - \frac{3\pi}{4}$ and $2n\pi - \frac{\pi}{4}$ **D)** $2n\pi - \frac{5\pi}{4}$ and $2n\pi - \frac{\pi}{4}$

29. $4\sin 27^{\circ} =$

A) $\sqrt{5+\sqrt{5}} + \sqrt{3-\sqrt{5}}$ **B)** $\sqrt{5-\sqrt{5}} + \sqrt{3+\sqrt{5}}$

C) $\sqrt{5+\sqrt{5}} - \sqrt{3-\sqrt{5}}$ **D)** $\sqrt{5+\sqrt{5}} + \sqrt{3+\sqrt{5}}$

30. $\sin^2 160^{\circ} + \sin^2 140^{\circ} + \sin^2 100^{\circ} =$

A) $1/2$ **B)** $3/2$

C) $5/2$ **D)** $7/2$

31. **The value of $\sin^2 46^{\circ} + \sin^2 14^{\circ} + \sin 46^{\circ} \sin 14^{\circ} =$**

A) $1/4$ **B)** $3/4$

C) $5/4$ **D)** $1/2$

32. $\frac{1-\tan^2 7\frac{1}{2}^\circ}{2\tan 7\frac{1}{2}^\circ} =$

A) $2-\sqrt{3}$ **B)** $2+\sqrt{3}$
C) $\sqrt{2}-1$ **D)** $\sqrt{2}+1$

33. $4\sin^3 75^\circ - 3\cos 15^\circ =$

A) $1/2$ **B)** $1/\sqrt{2}$
C) $1/3$ **D)** $\sqrt{3}$

34. If $\theta \in Q_3$**, then**
$\sqrt{4\sin^4\theta + \sin^2 2\theta} + 4\cos^2(\frac{\pi}{4} - \frac{\theta}{2}) =$

A) 2 **B)** -2
C) 0 **D)** 1

35. $\sin^4\frac{\pi}{8} + \sin^4\frac{3\pi}{8} + \sin^4\frac{5\pi}{8} + \sin^4\frac{7\pi}{8} =$

A) $1/2$ **B)** $1/4$
C) $3/2$ **D)** $3/4$

36. $\sqrt{3}\csc 20^\circ - \sec 20^\circ =$

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

37. $\cos\frac{2\pi}{15}\cos\frac{4\pi}{15}\cos\frac{8\pi}{15}\cos\frac{14\pi}{15} =$

A) $1/16$ **B)** $1/8$
C) $3/4$ **D)** $1/4$

38. $\frac{\sin 3\alpha}{\cos 2\alpha} < 0$ **if** α **lies in:**

A) $(\frac{13\pi}{48}, \frac{14\pi}{48})$ **B)** $(\frac{14\pi}{48}, \frac{18\pi}{48})$
C) $(\frac{18\pi}{48}, \frac{23\pi}{48})$ **D)** $(0, \frac{\pi}{2})$

39. Evaluate
$\cos\left\{\frac{2\pi}{2^{64}-1}\right\}\cos\left\{\frac{2^2\pi}{2^{64}-1}\right\}\cdots\cos\left\{\frac{2^{64}\pi}{2^{64}-1}\right\}.$

A) $\frac{1}{16^{16}}$ **B)** $\frac{1}{8^8}$
C) $\frac{1}{32^{32}}$ **D)** $\frac{1}{64^{64}}$

40. If
$f_n(x) = \left(\frac{\sin x}{\cos 3x} + \frac{\sin 3x}{\cos 3^2x} + \frac{\sin 3^2x}{\cos 3^3x} \cdots + \frac{\sin 3^{n-1}x}{\cos 3^n x}\right)$,
then $f_2(\pi/4) + f_3(\pi/4) =$

A) 0 **B)** 1
C) -1 **D)** 2

41. Let
$f_n(\theta) = \tan\frac{\theta}{2}(1+\sec\theta)(1+\sec 2\theta)\,(1+\sec 2\theta)\ldots(1+\sec 2^{n-1}\theta)$
. Evaluate
$f_2(\pi/16) + f_3(\pi/32) + f_4(\pi/64) + f_5(\pi/128).$

A) 0 **B)** 2
C) 4 **D)** 8

42. $\cos 9^\circ - \sin 9^\circ =$

A) $\sqrt{5-\sqrt{5}}$ **B)** $\frac{1}{2}\sqrt{5+\sqrt{5}}$
C) $\frac{1}{2}\sqrt{5-\sqrt{5}}$ **D)** $\frac{1}{4}\sqrt{5-\sqrt{5}}$

43. Evaluate $4\cos 36^\circ + \cot 7\frac{1}{2}^\circ$.

A) $1+\sqrt{2}+\sqrt{3}+\sqrt{4}+\sqrt{5}+\sqrt{6}$ **B)** $1+\sqrt{2}-\sqrt{3}+\sqrt{4}-\sqrt{5}+\sqrt{6}$
C) $1-\sqrt{2}+\sqrt{3}-\sqrt{4}+\sqrt{5}+\sqrt{6}$ **D)** $1+\sqrt{2}-\sqrt{3}+\sqrt{4}+\sqrt{5}-\sqrt{6}$

44. $\theta < \frac{\pi}{16}$, $\sqrt{2+\sqrt{2+\sqrt{2+2\cos 8\theta}}} = k\cos\theta$**. Then** $k =$

A) 2 **B)** 4
C) 8 **D)** 16

45. $\frac{\sin x}{\sin(x/8)} =$

A) $8\cos\frac{x}{8}\cos\frac{x}{4}\cos\frac{x}{2}$ **B)** $8\cos\frac{x}{8}\sin\frac{x}{4}\sin\frac{x}{2}$
C) $8\sin\frac{x}{8}\sin\frac{x}{4}\sin\frac{x}{2}$ **D)** $8\sin\frac{x}{8}\sin\frac{x}{4}\cos\frac{x}{2}$

46. $\frac{\tan 80^\circ - \tan 10^\circ}{\tan 70^\circ} =$

47. $\tan 27^\circ\tan 32^\circ + \tan 32^\circ\tan 31^\circ + \tan 31^\circ\tan 27^\circ =$

48. $\frac{(1+\tan 33^\circ)(1+\tan 12^\circ)}{(1+\tan 18^\circ)(1+\tan 27^\circ)} =$

49. $\tan 9^\circ - \tan 27^\circ - \tan 63^\circ + \tan 81^\circ =$

50. The value of the expression
$\tan^6 20^\circ - 33\tan^4 20^\circ + 27\tan^2 20^\circ$ **is:**

Physics

51. 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

52. 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°

53. 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)** $\frac{\hat{i}+\hat{j}}{2}$

54. 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°

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

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

A) 90°
B) 120°
C) 0°
D) 60°

57. 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

58. If $\left|\vec{V}_1+\vec{V}_2\right|=\left|\vec{V}_1-\vec{V}_2\right|$ 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) $\left|\vec{V}_1\right|=\left|\vec{V}_2\right|$

59. 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

60. 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°

61. The resultant of two forces $\vec{F}_1$ and $\vec{F}_2$ is perpendicular to $\vec{F}_1$. If the magnitude of the resultant force is $4\ \mathrm{N}$ and the magnitude of $\vec{F}_1$ is $3\ \mathrm{N}$, what is the magnitude of the force $\vec{F}_2$?

A) $5\ \mathrm{N}$
B) $7\ \mathrm{N}$
C) $1\ \mathrm{N}$
D) $\sqrt{7}\ \mathrm{N}$

62. If two vectors $\vec{A}$ and $\vec{B}$ have equal magnitude R and are inclined at an angle θ to each other, then the magnitude of their difference vector $|\vec{A}-\vec{B}|$ is given by:

A) $2R\cos\left(\frac{\theta}{2}\right)$
B) $2R\sin\left(\frac{\theta}{2}\right)$
C) $\sqrt{2}R\sin\left(\frac{\theta}{2}\right)$
D) $2R\sin\theta$

63. 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) $\sqrt{2}F$

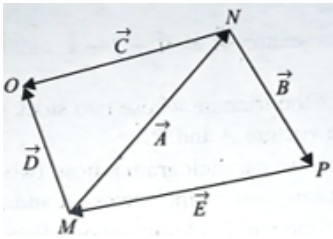
64. Two vectors $\vec{P}$ and $\vec{Q}$ have equal magnitudes. If the magnitude of $(\vec{P}+\vec{Q})$ is n times the magnitude of $(\vec{P}-\vec{Q})$, then the angle θ between the two vectors is given by:

A) $\cos^{-1}\left(\frac{n^2-1}{n^2+1}\right)$
B) $\cos^{-1}\left(\frac{n^2+1}{n^2-1}\right)$
C) $\sin^{-1}\left(\frac{n^2-1}{n^2+1}\right)$
D) $\tan^{-1}\left(\frac{n-1}{n+1}\right)$

65. Two forces of equal magnitude act at a point. If the angle between them is 90°, what is the ratio of the magnitude of their sum vector to the magnitude of their difference vector?

A) 2:1
B) 1:1
C) $\sqrt{2}:1$
D) $1:\sqrt{2}$

66. 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

67. 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) $4|\vec{b}|$

68. Out of the following forces, the resultant of which cannot be $10\ \mathrm{N}$?

A) $15\ \mathrm{N}$ and $20\ \mathrm{N}$
B) $10\ \mathrm{N}$ and $10\ \mathrm{N}$
C) $5\ \mathrm{N}$ and $12\ \mathrm{N}$
D) $12\ \mathrm{N}$ and $1\ \mathrm{N}$

69. 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 in magnitude
D) cannot be predicted

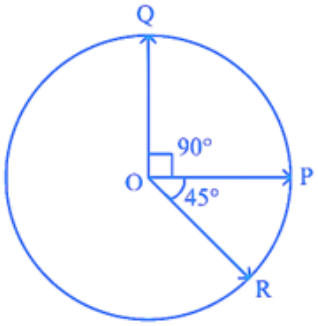
70. The angle between vector $\vec{Q}$ and the resultant of $(2\vec{Q}+2\vec{P})$ and $(2\vec{Q}-2\vec{P})$ is :

A) $\tan^{-1}(\mathrm{P/Q})$
B) 0°
C) $\tan^{-1}\frac{\left(2\vec{Q}-2\vec{P}\right)}{2\vec{Q}+2\vec{P}}$
D) $\tan^{-1}(2Q/\mathrm{P})$

71. 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 _____$^{\circ}$.

72. 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 _____.

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



_____.

74. 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 _____.

75. If $\vec{A}=(2\hat{i}+3\hat{j}-\hat{k})\,\mathrm{m}$ and $\vec{B}=(\hat{i}+2\hat{j}+2\hat{k})\,\mathrm{m}$. The magnitude of component of vector $\vec{A}$ along vector $\vec{B}$ will be _____ m.

ANSWER KEY

Chemistry

1.	**4**	8.	**4**	15.	**3**	22.	**9**
2.	**4**	9.	**1**	16.	**2**	23.	**83**
3.	**2**	10.	**3**	17.	**3**	24.	**40**
4.	**1**	11.	**4**	18.	**2**	25.	**118**
5.	**3**	12.	**2**	19.	**1**		
6.	**1**	13.	**1**	20.	**3**		
7.	**2**	14.	**1**	21.	**101**		

Maths

26.	**2**	33.	**2**	40.	**3**	47.	**1**
27.	**3**	34.	**1**	41.	**3**	48.	**1**
28.	**2**	35.	**3**	42.	**3**	49.	**4**
29.	**3**	36.	**4**	43.	**1**	50.	**3**
30.	**2**	37.	**1**	44.	**1**		
31.	**2**	38.	**1**	45.	**1**		
32.	**2**	39.	**1**	46.	**2**		

Physics

51.	**3**	58.	**3**	65.	**2**	72.	**3**
52.	**1**	59.	**2**	66.	**4**	73.	**3**
53.	**3**	60.	**2**	67.	**2**	74.	**5**
54.	**2**	61.	**1**	68.	**4**	75.	**2**
55.	**3**	62.	**2**	69.	**2**		
56.	**3**	63.	**2**	70.	**2**		
57.	**3**	64.	**1**	71.	**150**		

SOLUTIONS

Q1.

Answer: D

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

Q2.

Answer: D

Explanation:
Stable fully-filled ($2s^2$) and half-filled ($2p^3$) configurations cause Be and N to have higher IE than expected.

Q3.

Answer: B

Explanation:

Orbitals with fully-filled and half-filled configurations are stable and require more energy for ionization.

Q4.

Answer: A

Explanation:
Metallic character increases from top to bottom in a group and decreases from left to right in a period.

Q5.

Answer: C

Explanation:
Al has a lower IE than Mg but higher than Na$\left(496 < IE(Al) < 737\right)$.

Q6.

Answer: A

Explanation:

Stability increasesIE: Half-filled N (C) >O (B) > fully-filled Be (A) >B(D).

Q7.

Answer: B

Explanation:
Mg(s^2) and P(p^3) have extra stability, breaking the general periodic trend.

Q8.

Answer: D

Explanation:
$Li - Na$ belong to the same group; the other pairs show a diagonal relationship.

Q9.

Answer: A

Explanation:

X is Na because of its extremely high IE_2 after losing its only valence electron.

Q10.

Answer: C

Explanation:
IE is highest for noble gases (Ar) and halogens (Cl) and lowest for alkali metals (Na).

Q11.

Answer: D

Explanation:
Element E is Ga; its diagonal neighbor in Period 5 is Tin (Sn).

Q12.

Answer: B

Explanation:

In isoelectronic species, size increases as negative charge increases (lower nuclear attraction).

Q13.

Answer: A

Explanation:
For isoelectronic species, radius decreases as effective nuclear charge (Z) increases.

Q14.

Answer: A

Explanation:
Mg has a higher IE than Al because of its stable $3s^2$ configuration.

Q15.

Answer: C

Explanation:
Chlorine has the most negative EGE; fluorine is less negative due to electron-electron repulsion.

Q16.

Answer: B

Explanation:
Cl and S have higher EGE magnitudes than their Group partners F and Se.

Q17.

Answer: C

Explanation:
For isoelectronic species, size increases with increasing negative charge and decreasing nuclear charge.

Q18.

Answer: B

Explanation:
Adding an electron to Hydrogen is an exothermic process; the others require energy.

Q19.

Answer: A

Explanation:
The negative O^- ion repels the second incoming electron, requiring energy to overcome it.

Q20.

Answer: C

Explanation:
The element with atomic number 71 is lutetium (Lu). Its electronic configuration is $[\mathrm{Xe}], 4f^{14}5d^{1}6s^{2}$. Hence, the 71st (last) electron enters the 5d orbital.

Q21.

Answer: 101

Explanation:
According to IUPAC roots, un (1), nil (0), and un (1) form the number 101.

Q22.

Answer: 9

Explanation:

By analyzing the ionization enthalpies, we observe a massive jump between I_1 and I_2 for the element with atomic number $n+2$ (496 to $4562kJ/mol$). This indicates that $n+2$ is an alkali metal (Group 1), as the second electron is removed from a stable noble gas configuration. Given $n<10$, the element $n+2$ must be Sodium ($Z=11$), making $n=9$ (Fluorine).

Q23.

Answer: 83

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

Q24.

Answer: 40

Explanation:
According to Newlands' Law of Octaves, the properties of elements repeat after every eighth element when they are arranged in the increasing order of atomic masses. This law is valid only up to elements with an atomic mass of about 40 (approximately calcium).

Q25.

Answer: 118

Explanation:
At present, 118 elements are officially recognized and included in the modern periodic table. These elements have been discovered or synthesized and approved by the International Union of Pure and Applied Chemistry (IUPAC).

Q26.

Answer: B

Explanation:
Use the tangent addition formula with $22^\circ+38^\circ=60^\circ$.

Q27.

Answer: C

Explanation:
By applying the Componendo and Dividendo rule to the given sine ratio and using sum-to-product identities, the expression simplifies to the ratio of the tangents of the specified angles.

Q28.

Answer: B

Explanation:
For the sum of the magnitudes of $(\cos\frac{A}{2}+\sin\frac{A}{2})$ and $(\cos\frac{A}{2}-\sin\frac{A}{2})$ to equal $2\cos\frac{A}{2}$, both expressions inside the absolute values must be positive, which occurs when $\cos\frac{A}{2}>|\sin\frac{A}{2}|$.

Q29.

Answer: C

Explanation:
By using the submultiple angle identity $2\sin\frac{A}{2}=\sqrt{1+\sin A}-\sqrt{1-\sin A}$ and substituting $A=54^\circ$, we can evaluate $4\sin 27^\circ$ using the known value of $\sin 54^\circ$.

Q30.

Answer: B

Explanation:
The expression simplifies to $\sin^2 20^\circ+\sin^2 40^\circ+\sin^2 80^\circ$, which is a standard trigonometric sum equal to $3/2$.

Q31.

Answer: B

Explanation:
For any two angles A and B such that $A+B=60^\circ$, the identity $\sin^2 A+\sin^2 B+\sin A\sin B=3/4$ holds.

Q32.

Answer: B

Explanation:
This expression is the reciprocal of the double angle formula for tangent. It simplifies to $\cot(15^\circ)$, which is equal to $2+\sqrt{3}$.

Q33.

Answer: B

Explanation:
Using the identity $\sin 75^\circ=\cos 15^\circ$, the expression resembles the triple angle formula $4\cos^3 A-3\cos A=\cos 3A$. While the printed angles yield $1/\sqrt{2}$

Q34.

Answer: A

Explanation:
The radical term simplifies to $|2\sin\theta|$, which is $-2\sin\theta$ in the third quadrant. The second term simplifies to $2+2\sin\theta$, making the sum equal to 2.

Q35.

Answer: C

Explanation:
Using symmetry and the identity $\sin\frac{3\pi}{8}=\cos\frac{\pi}{8}$, the sum reduces to $2(\sin^4\frac{\pi}{8}+\cos^4\frac{\pi}{8})$, which evaluates to $3/2$.

Q36.

Answer: D

Explanation:
By converting the expression to sine and cosine and applying the sine addition formula, the ratio simplifies to 4.

Q37.

Answer: A

Explanation:
By using the property $\cos A = -\cos(\pi - A)$ for the last term and the product formula for cosines in geometric progression, the value is found to be $1/16$.

Q38.

Answer: A

Explanation:
For the ratio to be negative, the numerator and denominator must have opposite signs; this occurs in the interval $(\pi/4, \pi/3)$, which contains option A.

Q39.

Answer: A

Explanation:
Use the identity $\prod_{k=0}^{n-1} \cos(2^k x) = \frac{\sin(2^n x)}{2^n \sin x}$. After substituting $x = \frac{2\pi}{2^{64}-1}$, the numerator and denominator contain the same sine term, leaving only $\frac{1}{2^{64}} = \frac{1}{16^{16}}$.

Q40.

Answer: C

Explanation:
The telescoping sum reduces $f_n(x)$ to $\frac{1}{2}(\tan 3^n x - \tan x)$; evaluating this at $\pi/4$ for $n = 2$ and $n = 3$ gives a sum of -1.

Q41.

Answer: C

Explanation:
Each factor $(1 + \sec A)$ transforms the leading tangent into a tangent of twice the angle, making $f_n(\theta) = \tan 2^{n-1}\theta$. Each term in the sum then equals 1.

Q42.

Answer: C

Explanation:
Squaring the expression yields $1 - \sin 18^\circ$; substituting the standard value for $\sin 18^\circ$ results in the radical value.

Q43.

Answer: A

Explanation:
Use the exact values $4\cos 36^\circ = 1 + \sqrt{5}$and $\cot 7.5^\circ = 2 + \sqrt{2} + \sqrt{3} + \sqrt{6}$. Adding them gives the required expression.

Q44.

Answer: A

Explanation:

Repeated application of the identity $2 + 2\cos A = 4\cos^2(A/2)$ inside the nested radicals simplifies the expression to $2\cos\theta$.

Q45.

Answer: A

Explanation:
Using the sine double angle identity $\sin 2A = 2\sin A \cos A$ three times decomposes $\sin x$ into a product containing $\sin(x/8)$ and three cosines.

Q46.

Answer: 2

Explanation:
By using the tangent addition formula for the relationship $80^\circ = 70^\circ + 10^\circ$ and the fact that $\tan 10^\circ \tan 80^\circ = 1$, the numerator simplifies to $2\tan 70^\circ$.

Q47.

Answer: 1

Explanation:
For any three angles A, B, C that sum to 90°, the sum of the products of their tangents taken two at a time is always 1.

Q48.

Answer: 1

Explanation:
For any two angles A and B such that $A + B = 45^\circ$, the identity $(1 + \tan A)(1 + \tan B) = 2$ holds. Applying this to both the numerator and denominator results in the ratio $2/2$.

Q49.

Answer: 4

Explanation:
By grouping terms and using the identity $\tan\theta + \cot\theta = 2\csc 2\theta$, the expression simplifies to the difference between two cosecant terms which evaluates to 4.

Q50.

Answer: 3

Explanation:
By rearranging and squaring the triple angle formula $\tan 3\theta$ with $\theta = 20^\circ$, the given polynomial expression is found to be equal to 3.

Q51.

Answer: C

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

Q52.

Answer: A

Explanation:
$\cos\theta = \frac{\vec{A}\cdot\vec{B}}{|A||B|} = \frac{\left(3\hat{i}+4\hat{j}+5\hat{k}\right)\left(3\hat{i}+4\hat{j}-5\hat{k}\right)}{\sqrt{9+16+25}\sqrt{9+16+25}} = \frac{9+16-25}{50} = 0$
$\Rightarrow \cos\theta = 0, \therefore \theta = 90^\circ$

Q53.

Answer: C

Explanation:

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

Q54.

Answer: B

Explanation:
$\cos\theta = \frac{\vec{F_1}\cdot\vec{F_2}}{|F_1||F_2|} = \frac{\left(5\hat{i}+10\hat{j}-20\hat{k}\right)\cdot\left(10\hat{i}-5\hat{j}-15\hat{k}\right)}{\sqrt{25+100+400}\sqrt{100+25+225}} = \frac{50-50+300}{\sqrt{525}\sqrt{350}}$
$\Rightarrow \cos\theta = \frac{1}{\sqrt{2}} \therefore \theta = 45^\circ$

Q55.

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 $|\vec{A} - \vec{B}|$.

Q56.

Answer: C

Explanation:

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

Q57.

Answer: C

Explanation:

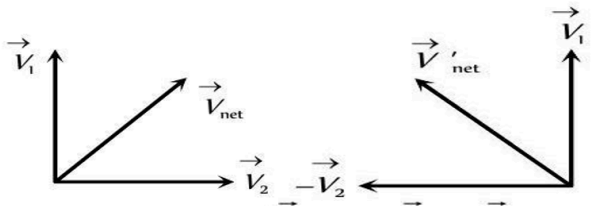
Given vectors can be rewritten as $\vec{A} = 2\hat{i} + 3\hat{j} + 8\hat{k}$ and $\vec{B} = -4\hat{i} + 4\hat{j} + \alpha\hat{k}$ Dot product of these vectors should be equal to zero because they are perpendicular

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

Q58.

Answer: C

Explanation:



According to problem $\left|\vec{V}_1 + \vec{V}_2\right| = \left|\vec{V}_1 - \vec{V}_2\right|$

$\Rightarrow \left|\vec{V}_{\text{net}}\right| = \left|\vec{V}'_{\text{net}}\right|$ So V_1 and V_2 will be mutually perpendicular.

Q59.

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 $\frac{A}{B}$.

Q60.

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 $P + Q\cos\theta = 0 \implies \cos\theta = -\frac{P}{Q}$. 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.

Q61.

Answer: A

Explanation:

Because the resultant force $\vec{R}$ is at a right angle (90°) to the force $\vec{F}_1$, the vectors $\vec{F}_1$, $\vec{R}$, and $\vec{F}_2$ form a perfect right-angled triangle where $\vec{F}_2$ acts as the hypotenuse. We can directly apply the Pythagorean theorem to solve for the unknown magnitude.

Q62.

Answer: B

Explanation:

The magnitude of the difference between two vectors $\vec{A}$ and $\vec{B}$ is given by the general formula $R' = \sqrt{A^2 + B^2 - 2AB\cos\theta}$. Since both vectors have an equal magnitude equal to R, substituting $A = B = R$ simplifies the square root expression via trigonometric half-angle identities to determine the accurate relation.

Q63.

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.

Q64.

Answer: A

Explanation:

Given that $|\vec{P}| = |\vec{Q}|$ and $|\vec{P} + \vec{Q}| = n|\vec{P} - \vec{Q}|$, squaring both sides gives a general formula matching the structure of the source question. Grouping common terms containing the parameter n allows us to find a general algebraic identity for $\cos\theta$.

Q65.

Answer: B

Explanation:

When the angle between two component vectors is exactly 90°, the value of $\cos 90^\circ$ becomes zero. This causes the interaction cross-terms ($2AB\cos\theta$) to drop out completely from both the addition and subtraction formulas, leaving matching values under both radicals.

Q66.

Answer: D

Explanation:

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

$\Rightarrow\ \vec{B} + \vec{E} - \vec{C} = -\vec{D}$. Hence, C is correct

Q67.

Answer: B

Explanation:

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

Q68.

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.

Q69.

Answer: B

Explanation:

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

Q70.

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:
$\text{Resultant}=(2\vec{Q}+2\vec{P})+(2\vec{Q}-2\vec{P})=4\vec{Q}$ 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°

Q71.

Answer: 150

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°.

Q72.

Answer: 3

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 $\cos^{-1}\left(\frac{5}{9}\right)$, 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:
$\vec{a}\cdot\vec{a}=|\vec{a}|^2\quad\text{and}\quad\vec{b}\cdot\vec{b}=|\vec{b}|^2\quad\text{and}\quad\vec{a}\cdot\vec{b}=|\vec{a}||\vec{b}|\cos(\theta)$
Since the angle between $\vec{a}$ and $\vec{b}$ is $\cos^{-1}\left(\frac{5}{9}\right)$, we have:
$\cos(\theta)=\frac{5}{9}$ Substitute these back into the equation:
$-|\vec{a}|^2+6|\vec{a}||\vec{b}|\left(\frac{5}{9}\right)-|\vec{b}|^2=0$ Simplify it further:
$-|\vec{a}|^2+\frac{30}{9}|\vec{a}||\vec{b}|-|\vec{b}|^2=0-|\vec{a}|^2+\frac{10}{3}|\vec{a}||\vec{b}|-|\vec{b}|^2=0$ 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 $|\vec{b}|^2$:
$|\vec{b}|^2\left(-n^2+\frac{10}{3}n-1\right)=0$ Since $|\vec{b}|^2\neq0$, 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 $c=3$:
$n=\frac{10\pm\sqrt{(-10)^2-4\cdot3\cdot3}}{2\cdot3}=\frac{10\pm\sqrt{100-36}}{6}=\frac{10\pm\sqrt{64}}{6}=\frac{10\pm8}{6}$ This results in two possible solutions for n:
$n=\frac{18}{6}=3\quad\text{and}\quad n=\frac{2}{6}=\frac{1}{3}$ However, since n is given to be an integer, we take:3

Q73.

Answer: 3

Explanation:

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

Q74.

Answer: 5

Explanation:

$\overrightarrow{A}=2\hat{i}+4\hat{j}-2\hat{k}$ $\overrightarrow{B}=\hat{i}+2\hat{j}+\alpha\hat{k}$ $\overrightarrow{A}.\overrightarrow{B}=0$, as $\overrightarrow{A}$ should be perpendicular to $\overrightarrow{B}\Rightarrow2+8-2\alpha=0$ $\alpha=5$

Q75.

Answer: 2

Explanation:

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

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

$|\vec{B}| = \sqrt{1^2 + 2^2 + 2^2} = \sqrt{9} = 3$ Magnitude of component of

$\vec{A}$ along $\vec{B} = \frac{\vec{A} \cdot \vec{B}}{|B|} = \frac{6}{3} = 2$