PACE-IIT & MEDICAL

MUMBAI / AKOLA / DELHI / KOLKATA / GHAZIABAD / NASHIK / GOA / BOKARO / PUNE

IIT – JEE: 2022-24 TWT DATE: 03/06/22

TIME: 2hrs and 30mini TOPIC :Vector& Mole Concept , Quadratic Equation MARKS:180

Total 45 Single Choice Question (+4-1)

1 What is the maximum number of components into which a vector can be split ?

(1) 2 (2) 3 (3) 4 (4) Infinite

2 What is the maximum number of rectangular components into which a vector can be split in space ?

(1) 2 (2) 3 (3) 4 (4) Infinite

3 Two vectors, both equal in magnitude, have their resultant equal in magnitude of the either vector. The angle between the vectors is :-

(1) 90° (2) 120° (3) 180° (4) zero

4 Maximum and minimum values of the resultant of two forces acting at a point are 7 N and 3 N respectively. The smaller force will be equal to

(a) 5 N (b) 4 N (c) 2 N (d) 1 N

5 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 :

(1) –1 (2) 1/2 (3) –1/2 (4) 1

6 If a unit vector is represented by $0.5\,\hat{i} + 0.8\,\hat{j} + c\hat{k}$ the value of c is

(a) 1 (b) $\sqrt{0.11}$ (c) $\sqrt{0.01}$ (d) 0.39

7 The direction cosines of a vector $\hat{i} + \hat{j} + \sqrt{2}\hat{k}$ are :-

(1) $\frac{1}{2}, \frac{1}{2}, 1$ (2) $\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}, \frac{1}{2}$

(3) $\frac{1}{2}, \frac{1}{2}, \frac{1}{\sqrt{2}}$ (4) $\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}$

8 The vector that is added to $(\hat{i}-5\hat{j}+2\hat{k})$ and $(3\hat{i}+6\hat{j}-7\hat{k})$ to give a unit vector along the x-axis is:-

(1) $3\hat{i}+\hat{j}+5\hat{k}$ (2) $\hat{i}+3\hat{j}+5\hat{k}$

(3) $-3\hat{i}-\hat{j}-5\hat{k}$ (4) $3\hat{i}+\hat{j}-5\hat{k}$

$F=\sqrt{3^2+4^2}=5N$

$S=\sqrt{3^2+4^2}=5M$

$W=FS$

$=25NM$

9 A force $(3\hat{i}+4\hat{j})$ newton acts on a body and displaces it by $(3\hat{i}+4\hat{j})$ metre. The work done by the force is

(a) 5 J (b) 25 J (c) 10 J (d) 30 J

10 The (x, y, z) co-ordinates of two points A and B are given respectively as $(0, 3, -1)$ and $(-2, 6, 4)$. The displacement vector from A to B is given by

(a) $-2\hat{i}+6\hat{j}+4\hat{k}$ (b) $-2\hat{i}+3\hat{j}+3\hat{k}$

(c) $-2\hat{i}+3\hat{j}+5\hat{k}$ (d) $2\hat{i}-3\hat{j}-5\hat{k}$

$-2i+3j+5k$

11 What is the dot product of two vectors of magnitudes 3 and 5, if angle between them is 60°?

(a) 5.2 (b) 7.5 (c) 8.4 (d) 8.6

12 The angle between the two vectors $A=3\hat{i}+4\hat{j}+5\hat{k}$ and $B=3\hat{i}+4\hat{j}-5\hat{k}$ is

(a) 60° (b) 45° (c) 90° (d) 30°

$\sqrt{9+16+2}$

$\sqrt{9+16+}$

13 The resultant of A and B makes an angle α with A and β with B, then

(a) α is always less than β (b) $\alpha<\beta$ if $A<B$

(c) $\alpha<\beta$ if $A>B$ (d) $\alpha<\beta$ if $A=B$

$\sqrt{13}$ $\sqrt{30}$ $\sqrt{50}$

14 The component of vector $A=2\hat{i}+3\hat{j}$ along the vector $\hat{i}+\hat{j}$ is

(a) $\frac{5}{\sqrt{2}}$ (b) $10\sqrt{2}$ (c) $5\sqrt{2}$ (d) 5

15 The angles which the vector $A=3\hat{i}+6\hat{j}+2\hat{k}$ makes with the co-ordinate axes are

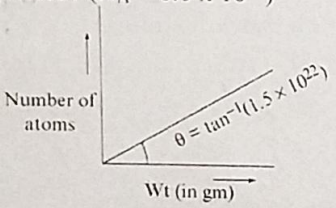
(a) $\cos^{-1}\frac{3}{7}, \cos^{-1}\frac{6}{7}$ and $\cos^{-1}\frac{2}{7}$ (b) $\cos^{-1}\frac{4}{7}, \cos^{-1}\frac{5}{7}$ and $\cos^{-1}\frac{3}{7}$

(c) $\cos^{-1}\frac{3}{7}, \cos^{-1}\frac{4}{7}$ and $\cos^{-1}\frac{1}{7}$ (d) None of these

16 The mass of 3.2×10^5 atoms of an element is 8.0×10^{-18} g. The atomic mass of the element is about $(N_A = 6 \times 10^{23})$

(a) 2.5×10^{-22} (b) 15 (c) 8.0×10^{-18} (d) 30

17 A graph is plotted for an element by putting its mass on X-axis and the corresponding number of atoms on Y-axis. What is the atomic mass of the element for which the graph is plotted? $(N_A = 6.0 \times 10^{23})$



no. of atom = 1

weight = 1.5×10^{22}

no of atoms = moles × N_A

$1 = \frac{1.5 \times 10^{22}}{x} \times N_A$

(a) 80 (b) 40 (c) 0.025 (d) 20

18 A mixture of 2×10^{21} molecules of P and 3×10^{21} molecules of Q weighs 0.60 g. If the molecular mass of P is 45, then the molecular mass of Q wili be $(N_A = 6 \times 10^{23})$

(a) 45 (b) 180 (c) 90 (d) 270

$\frac{2 \times 10^{21}}{6 \times 10^{23}} \times \frac{1}{1} = \frac{45}{x}$

$0.33 \times 10^{-2} = \frac{45}{x}$

$0.1485 = x$

$\frac{3 \times 10^{21}}{6 \times 10^{23}} \times \frac{1}{1} = \frac{0.46}{x}$

$0.5 \times 10^{-2} = \frac{0.46}{x}$

$x = \frac{0.5 \times 10^{-2}}{0.46}$

$\frac{0.60 - 0.1485}{0.46}$

19 The density of a DNA sample is 1.1g/ml and its molar mass determined by cryoscopic method was found to be 6×10^8 g/mole. What is the volume occupied by one DNA molecule? ($N_A = 6 \times 10^{23}$)

(a) 5.45×10^8 ml (b) 1.83×10^{-9} ml

(c) 9.09×10^{-16} ml (d) 1.09×10^{-13} ml

20 A compound contains 7 carbon atoms, 2 oxygen atoms and 9.96×10^{-24} g of other elements. The molecular mass of compound is ($N_A = 6 \times 10^{23}$)

(a) 122 (b) 116 (c) 148 (d) 154

21 Total number of valence electrons present in 6.4 g peroxides ion (O_2^{2-}) is

(a) $0.2N_A$ (b) $3.2N_A$ (c) $3.6N_A$ (d) $2.8N_A$

22 A gaseous mixture contains 40% H_2 and 60% He by volume. What is the total number of moles of gases present in 10 g of such mixture?

(a) 5 (b) 2.5 (c) 4.33 (d) 3.125

23 An organic compound contains 40% carbon and 6.67% hydrogen by mass. Which of the following represents the empirical formula of the compound?

(a) CH_2 (b) CH_2O (c) $2H_4O$ (d) CH_3O

24 How many grams of solute should be added in 100 g water to get a solution of density 1.2 g/ml and strength 5% (w/v)?

(a) 5g (b) 6 g (c) 4.17 g (d) 4.35 g

25 An aqueous solution of glucose is 10% (w/v). The volume in which 1 mole of glucose is dissolved will be

(a) 18 L (b) 9L (c) 0.9 L (d) 1.8 L

26 What volume of 0.8 M-$AlCl_3$ solution should be mixed with 50 ml of 0.2 M-$CaCl_2$ solution to get a solution of chloride ion concentration equal to 0.6 M?

(a) 5.56 ml (b) 100 ml (c) 50 ml (d) 4.89 ml

27 In 1200 g solution, 12 g urea (molar mass = 60) is present. If density of the solution is 1.2 g/ml, then the molarity of the solution is

(a) 0.2 M (b) 10 M (c) 0.167 M (d) 12 M

28 Mole fraction of solute in an aqueous solution of NaOH is 0.1. If the specific gravity (density) of the solution is 1.4, then the molarity of the solution is

(a) 6.93 (b) 0.1 (c) 71.4 (d) 0.14

29 What should be the density of an aqueous solution of urea (molar mass = 60 g/mol) such that the molality as well as molarity of the solution becomes equal to 1.0 unit?

(a) 1.0 g/ml (b) 1.6 g/ml (c) 1.06 g/ml (d) 1.16 g/ml

30 An aqueous solution has urea and glucose in mass ratio 3: 1. If the mass ratio of water and glucose in the solution is 10:1, then the mole fraction of glucose in the solution is

(a) $\frac{1}{110}$ (b) $\frac{9}{110}$ (c) $\frac{3}{110}$ (d) $\frac{100}{110}$

31 The roots of the equation $(b-c)x^2+(c-a)x+(a-b)=0$ are

(A) $\frac{c-a}{b-c},1$ (B) $\frac{a-b}{b-c},1$ (C) $\frac{b-c}{a-b},1$ (D) $\frac{c-a}{a-b},1$

32 The real numbers α, β are such that $\alpha+\beta=3$, $\alpha-\beta=4$ then α, β are the roots of the quadrative equation:

(A) $4X^2-12X-7=0$ (B) $4X^2-12X+7=0$ (C) $4X^2-12X+25=0$ (D) None of these

33 Consider following statements:

S_1: If roots of $X^2-bX+C=0$ are two consecutive integers, then value of b^2-4C is equal to 1.

S_2: If α, β are roots of $X^2-X+3=0$ then value of $\alpha^4+\beta^4$ is equal to 7.

S_3: If α, β,γ are roots of $X^3-7X^2+16X-12=0$ then the value of $\alpha^2+\beta^2+\gamma^2$ is equal to 17.

(A) T T T (B) F T F (C) T F T (D) F T T

34 If two roots of the equation $X^3-PX^2+qX-r=0$ $(r\neq 0)$ are equal in magnitude but opposite in sign, then:

(A) pr = q (B) qr = P (C) Pq = r (D) None of these

35 If are α,β,γ are roots of equation $X^3-X-1=0$ then $\frac{1+\alpha}{1-\alpha}+\frac{1+\beta}{1-\beta}+\frac{1+\gamma}{1-\gamma}$ has value equal to:

(A) 0 (B) -1 (C) -7 (D) 1

36 Let α,β,γ are roots of $(X-a)(X-b)(X-c)=d$. $d\neq 0$ then roots of the equation $(x-\alpha)(x-\beta)(x-\gamma)+d=0$ are

(A) a + 1, b + 1, c + 1 (B) a, b, c (C) a - 1, b - 1, c - 1 (D) $\frac{a}{b},\frac{b}{c},\frac{c}{a}$

37 If are roots of the equation $X^2-\sqrt{3}x+\lambda=0$, $\lambda\in R$ is $\sqrt{3}+2$ then other roots is

(A) $\sqrt{3}-2$ (B) -2 (C) $2-\sqrt{3}$ (D) 2

38 If the equations $k(6X^2+3)+rx+2x^2-1=0$ and $6k(2x^2+1)+px+4x^2-2=0$ have both roots common, then value of 2r-p is

(A) 0 (B) $\frac{1}{2}$ (C) 1 (D) None of these

39 If $3x^2 - 17x + 10 = 0$ and $x^2 - 5x + \lambda = 0$ has a common roots, then sum of all possible real value of λ is

(A) 0 (B) $\frac{-29}{3}$ (C) $\frac{26}{9}$ (D) $\frac{29}{3}$

40 If α, $\alpha + 4$ are two roots of $x^2 - 8x + k = 0$, then possible value of k is

(A) 4 (B) 0 (C) 12 (D) 10

41 If α, β are two roots of $x^2 + 2x - 4 = 0$ and $\frac{1}{\alpha}, \frac{1}{\beta}$ are roots of $x^2 + qx + r = 0$ the value of $\frac{-3}{q+r}$ is

(A) 4 (B) 0 (C) 12 (D) 10

42 If a,b,c are integers, and $b^2 = 4(ac + 5d^2)$, $d \in N$ then roots of the quadratic equation $ax^2 + bx + c = 0$ are

(A) irrational (B) rational and different
(C) complex conjugate (D) Rational and equal

43 If α, β roots of quadratic equation $x^2 + px + q = 0$ and γ, δ are roots of $x^2 + px - r = 0$, then $(\alpha - \gamma)(\alpha - \delta)$ is equal to

(A) $q + r$ (B) $q - r$ (C) $-(q + r)$ (D) $-(p + q + r)$

44 If different between the roots of the equation $x^2 + ax + 1 = 0$ is less than $\sqrt{5}$, then set of possible value of a is

(A) (-3, 3) (B) $(-3, \infty)$ (C) $(3, \infty)$ (D) $(-\infty, -3)$

45 If the equations $x^2 + 2x + 3 = 0$ and $ax^2 + bx + c = 0$ a, b, c $\in R$ have a common root, then a : b : c is

(A) 1 : 2 : 3 (B) 3 : 2 : 1 (C) 1 : 3 : 2 (D) 3 : 2 : 1

Best of Luck