SRIGAYATRI EDUCATIONAL INSTITUTIONS

INDIA

SR EAMCET | **DPP - 2** | **Date : 07-04-2020**

Time: 3 Hours | **Max. Marks: 360**

MATHS-A

SYLLABUS : Multiple & sub multiple angles, Transformations, Peroidicity, Graphs, Maximum & minimum values

1. **If a and b are such that** $a\sin\theta = b\cos\theta$ **for** $0 \le \theta < \frac{\pi}{4}$ **then** $\sqrt{\frac{a-b}{a+b}} + \sqrt{\frac{a+b}{a-b}} =$

1) $\frac{2}{\sqrt{\cos 2\theta}}$ 2) $2\cos\theta$ 3) $\frac{2\cos\theta}{\sqrt{\cos 2\theta}}$ 4) $\frac{\sin\theta}{\sqrt{\cos 2\theta}}$

2. $\tan 9^0 - \tan 27^0 - \tan 63^0 + \tan 81^0 =$

1) 2 2) 3 3) 4 4) 1

3. $\sqrt{2+\sqrt{2+\sqrt{2+\sqrt{2+\sqrt{2+\sqrt{2}}}}}} =$

1) $2\cos\frac{\pi}{128}$ 2) $2\cos\frac{\pi}{16}$ 3) $2\cos\frac{\pi}{256}$ 4) $2\cos\frac{\pi}{32}$

4. $\cos^3 10^o + \cos^3 110^o + \cos^3 130^o =$

1) $\frac{3}{8}$ 2) $\frac{3\sqrt{3}}{8}$ 3) $\frac{3}{4}$ 4) $\frac{3\sqrt{3}}{4}$

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

1) $8\cos\left(\frac{x}{8}\right)\sin\left(\frac{x}{4}\right)\cos\left(\frac{x}{2}\right)$ 2) $8\sin\left(\frac{x}{8}\right)\sin\left(\frac{x}{4}\right)\sin\left(\frac{x}{2}\right)$

3) $8\cos\left(\frac{x}{8}\right)\cos\left(\frac{x}{4}\right)\sin\left(\frac{x}{2}\right)$ 4) $8\cos\left(\frac{x}{8}\right)\cos\left(\frac{x}{4}\right)\cos\left(\frac{x}{2}\right)$

6. **If** $\cos 2B = \frac{\cos(A+C)}{\cos(A-C)}$ **then tan A, tan B, tan Care in**

1) A.P 2) A.G.P 3) H.P 4) G.P

7. **A quadratic equation whose roots are** $\tan 22\frac{1}{2}^0$ *and* $\cot 22\frac{1}{2}^0$ **is**

1) $x^2 - 2\sqrt{2}x + 1 = 0$ 2) $2x^2 - \sqrt{2}x + 1 = 0$ 3) $x^2 + 2\sqrt{2}x - 1 = 0$ 4) $x^2 - 2\sqrt{2}x - 1 = 0$

8. $\left(1+\cos\frac{\pi}{8}\right)\left(1+\cos\frac{2\pi}{8}\right)\left(1+\cos\frac{3\pi}{8}\right)\left(1+\cos\frac{4\pi}{8}\right)\left(1+\cos\frac{5\pi}{8}\right)\left(1+\cos\frac{6\pi}{8}\right)\left(1+\cos\frac{7\pi}{8}\right) =$

1) $\frac{1}{32}$ 2) $\frac{1}{128}$ 3) $\frac{1}{16}$ 4) $\frac{1}{64}$

9. **If** α, β, γ **are any three angles then** $\cos\alpha + \cos\beta - \cos\gamma - \cos(\alpha+\beta+\gamma) =$

1) $4\cos\left(\frac{\alpha+\beta}{2}\right)\cos\left(\frac{\beta+\gamma}{2}\right)\cos\left(\frac{\gamma+\alpha}{2}\right)$ 2) $4\cos\left(\frac{\alpha+\beta}{2}\right)\sin\left(\frac{\beta+\gamma}{2}\right)\sin\left(\frac{\gamma+\alpha}{2}\right)$

3) $4\sin\left(\frac{\alpha+\beta}{2}\right)\cos\left(\frac{\beta+\gamma}{2}\right)\cos\left(\frac{\gamma+\alpha}{2}\right)$ 4) $4\cos\left(\frac{\alpha+\beta}{2}\right)\sin\left(\frac{\beta+\gamma}{2}\right)\sin\left(\frac{\gamma+\alpha}{2}\right)$

10. **If** $\cos x + \cos y + \cos z = \sin x + \sin y + \sin z$ **then** $\cos^2\left(\frac{x-y}{2}\right) =$

1) $\frac{1}{2}$ 2) $\frac{1}{4}$ 3) $\frac{3}{4}$ 4) 1

11. $\left(\frac{\cos A+\cos B}{\sin A-\sin B}\right)^{2020}+\left(\frac{\sin A+\sin B}{\cos A-\cos B}\right)^{2020}=$

1) $2\cot^{2020}\left(\frac{A-B}{2}\right)$ 2) $2\tan^{2020}\left(\frac{A+B}{2}\right)$ 3) $2\cot^{2020}\left(\frac{A+B}{2}\right)$ 4) $2\tan^{2020}\left(\frac{A-B}{2}\right)$

12. **If x and y are acute angles such that** $\cos x+\cos y=\frac{3}{2}$ **and** $\sin x+\sin y=\frac{3}{4}$ **then** $\sin(x+y)=$

1) $\frac{3}{4}$ 2) $\frac{2}{5}$ 3) $\frac{4}{5}$ 4) $\frac{3}{5}$

13. **If** $A+B+C=270^0$ **then** $\cos 2A+\cos 2B+\cos 2C+4\sin A\sin B\sin C=$

1) 0 2) 3 3) 2 4) 1

14. **If** $\cos\alpha+\cos\beta=a,\ \sin\alpha+\sin\beta=b$ **and** $\alpha-\beta=2\theta$ **then** $\frac{\cos 3\theta}{\cos\theta}=$

1) a^2+b^2-3 2) $3-a^2+b^2$ 3) a^2+b^2-2 4) $\frac{a^2+b^2}{4}$

15. **Period of** $\cos ec\left(x+\frac{x}{2}+\frac{x}{4}+...+\infty\right)$ **is**

1) π 2) 2π 3) $\frac{\pi}{4}$ 4) $\frac{\pi}{2}$

16. **If** $f(x)=\sin^2\left(\frac{\pi}{8}+\frac{x}{2}\right)+\sin^2\left(\frac{\pi}{8}-\frac{x}{2}\right)$ **then the period of** $f(x)$ **is**

1) π 2) $\frac{\pi}{2}$ 3) $\frac{\pi}{3}$ 4) 2π

17. **The minimum value of** $27\tan^2\theta+3\cot^2\theta$ **is**

1) 15 2) 18 3) 36 4) 9

18. **If** $A=\sin^2\theta+\cos^4\theta$ **then for all values of** θ**, A lies in the interval**

1) $[1,2]$ 2) $\left[\frac{1}{2},\frac{3}{4}\right]$ 3) $\left[\frac{3}{4},1\right]$ 4) $\left[\frac{3}{4},\frac{19}{16}\right]$

19. **In a triangle ABC,** $C=90^0$ **then the maximum value of** $\sin A\sin B$ **is**

1) $\frac{1}{4}$ 2) $\frac{1}{2}$ 3) 1 4) 0

20. **Period of** $\sin^4 x+\cos^4 x$ **is**

1) $\frac{\pi}{4}$ 2) $\frac{3\pi}{2}$ 3) 2π 4) $\frac{\pi}{2}$

MATHS-B

SYLLABUS : Change of axis

1. **If** $(\cos\alpha,\cos\beta)$ **are the new coordinates of a point P when the axes are translated to the point** $(1,1)$ **then the original coordinates of P are**

1) $\left(2\cos^2\frac{\alpha}{2},2\cos^2\frac{\beta}{2}\right)$ 2) $\left(2\sin^2\frac{\alpha}{2},2\sin^2\frac{\beta}{2}\right)$

3) $\left(2\cos\frac{\alpha}{2},2\cos\frac{\beta}{2}\right)$ 4) $\left(2\sin\frac{\alpha}{2},2\sin\frac{\beta}{2}\right)$

2. **The point to which the origin should be shifted in order to eliminate x and y terms in the equation** $4x^2+9y^2-8x+36y+4=0$ **is**

1) $(1,3)$ 2) $(-4,3)$ 3) $(-1,2)$ 4) $(1,-2)$

3. **The point to which the axes are translated to eliminate y term and constant term in the equation $y^2+8x+4y-2=0$ is**

1) $(3,-2)$ 2) $\left(3,\frac{-2}{3}\right)$ 3) $\left(\frac{3}{4},-2\right)$ 4) $\left(\frac{2}{3},-4\right)$

4. **If the axes are translated to the circumcentre of the triangle formed by $(9,3),(-1,7),(-1,3)$ then the centroid of the triangle in the new system is**

1) $\left(5,\frac{5}{3}\right)$ 2) $(4,3)$ 3) $\left(\frac{-5}{3},\frac{-2}{3}\right)$ 4) $(0,0)$

5. **The transformed equation of $xy+2x-5y-11=0$ when the origin is shifted to the point $(5,-2)$ is**

1) $XY=1$ 2) $6X^2+5XY-6Y^2=0$

3) $2X^2+4XY+5Y^2=22$ 4) $5X^2+4XY+8Y^2=9$

6. **The origin is shifted to $(1,2)$. The equation $y^2-8x-4y+12=0$ changes to $Y^2=4aX$ then a=**

1) 1 2) 2 3) -2 4) -1

7. **If the transformed equation of a curve is $3X^2+XY-Y^2-7X+Y+7=0$ when the axes are translated to the point $(1,2)$ then the original equation of the curve is**

1) $3x^2+xy-y^2+15x+4y+13=0$ 2) $3x^2+xy-y^2-15x+4y+13=0$

3) $3x^2+xy+y^2-15x+4y+13=0$ 4) $3x^2+xy-y^2+15x-4y+13=0$

8. **By translating the axes the equation $xy-x+2y=6$ has changed to $xy=c$ then c=**

1) 4 2) 2 3) -2 4) -1

9. **If the axes are rotated through an angle of 45^0 in the positive direction without changing the origin then the coordinates of the point $\left(\sqrt{2},4\right)$ in the old system are**

1) $\left(1-2\sqrt{2},1+2\sqrt{2}\right)$ 2) $\left(1+2\sqrt{2},1-2\sqrt{2}\right)$ 3) $\left(2\sqrt{2},\sqrt{2}\right)$ 4) $\left(\sqrt{2},2\right)$

10. **The angle of rotation of axes to remove xy term in the equation $x^2+4xy+y^2-2x+2y-6=0$ is**

1) $\frac{\pi}{12}$ 2) $\frac{\pi}{6}$ 3) $\frac{\pi}{3}$ 4) $\frac{5\pi}{12}$

11. **The transformed equation of $x\sin\alpha-y\cos\alpha=p$ when the axes are rotated through an angle of α is**

1) $X=p$ 2) $Y=p$ 3) $X+p=0$ 4) $Y+p=0$

12. **If the axes are rotated in anti clock wise through an angle 90^0 then the equation $x^2=4ay$ is changed to the equation**

1) $Y^2=4aX$ 2) $X^2=4aY$ 3) $Y^2=-4aX$ 4) $X^2=-4aY$

13. **The transformed equation of $4xy-3x^2=a^2$ when the axes are rotated through an angle $Tan^{-1}(2)$ is**

1) $2XY+a^2=0$ 2) $XY=a^2$ 3) $X^2-4Y^2=a^2$ 4) $2Y^2-X^2+a^2=0$

14. **The transformed equation of $x^2+y^2=r^2$ when the axes are rotated through an angle 360^0 is**

1) $\sqrt{5}X^2-4XY+Y^2=r^2$ 2) $X^2+2XY-\sqrt{5}Y^2=r^2$

3) $X^2-Y^2=r^2$ 4) $X^2+Y^2=r^2$

15. **If the transformed equation of a curve is $X^2-2XY\tan\alpha-Y^2=a^2$ when the axes are rotated through an angle of α then the original equation of the curve is**

1) $x^2+y^2=a^2\cos 2\alpha$ 2) $x^2-y^2=a^2\cos 2\alpha$ 3) $x^2+a^2=y^2\cos 2\alpha$ 4) $x^2-a^2=y^2\cos 2\alpha$

16. **The angle of rotation of axes so that the equation $\sqrt{3}x-y+5=0$ may be reduced to the form Y = constant is**

1) $\frac{\pi}{6}$ 2) $\frac{\pi}{4}$ 3) $\frac{\pi}{3}$ 4) $\frac{\pi}{2}$

17. If the distance between the two given points is 2 units and the points are transformed by shifting the origin to $(2,2)$ then the distance between the points in their new position is

1) 2 2) 5 3) 6 4) 7

18. The coordinate axes are rotated through an angle 22^0 about the origin. If the equation $4x^2+12xy+9y^2+6x+9y+2=0$ changes to $ax^2+2hxy+by^2+2gx+2fy+c=0$ then

1) $\frac{h}{a}=\frac{3}{2}$ 2) $\frac{h}{b}=3$ 3) $\frac{g}{c}=\frac{1}{2}$ 4) $\frac{g}{c}=\frac{1}{3}$

19. When the axes are rotated through an angle of 90^0 then the equation $5x-2y+7=0$ transforms to

1) $2X-5Y+7=0$ 2) $2X+5Y-7=0$ 3) $2X-5Y-7=0$ 4) $2X+5Y+7=0$

20. On shifting the origin to a particular point the equation $x^2+y^2-4x-6y-12=0$ transforms to $X^2+Y^2=k$ then k=

1) 12 2) 25 3) 24 4) 5

PHYSICS

SYLLABUS : Motion in a Plane : Upto motion of a boat in a river

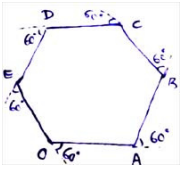
1. If $2\hat{i}-3\hat{j}+4\hat{k}$ and $3\hat{i}+\lambda\hat{j}+\mu\hat{k}$ be collinear vectors, then the values of λ and μ are

1) 6, 6 2) 6, $\frac{9}{2}$ 3) $\frac{-9}{2}$, 6 4) $\frac{1}{2}$, $\frac{-2}{9}$

2. The plane which can be formed with the vectors $\overline{a}=3\hat{i}-4\hat{j}+2\hat{k}$, $\overline{b}=2\hat{i}-\hat{j}-6\hat{k}$, $\overline{c}=5\hat{i}-5\hat{j}-4\hat{k}$ is

1) Quadrilateral 2) Triangle 3) Circle 4) Hyperbola

3. A person moving on a motor cycle in a grand takes a turn through 60^o on his left after every 50m. Then the magnitude of displacement suffered by him after 9th turn



1) 100m 2) 50 m 3) $50\sqrt{3}$ m 4) 20 m

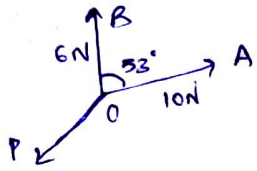
4. The rectangular components of a vector lying in XY plane are (n + 1) and 1. If coordinate system is turned by 60^o they are n and 3 respectively the value of 'n' is

1) 2 2) 3 3) 2.5 4) 3.5

5. If $\vec{A},\vec{B},\vec{C}$ represents the three sides of an equilateral triangle taken in the same order then the angle between $\vec{A}$ and $\vec{C}$ is

1) 180^o 2) 60^o 3) 120^o 4) 90^o

6. If the system is in equilibrium, then the value of 'p' is



1) 16N 2) 4N 3) $\sqrt{208}$ N 4) $\sqrt{232}$ N

7. The resultant of two vectors of magnitudes 3 units and 5 units is perpendicular to 3 units. The angle between the vectors is

1) 127^o 2) 120^O 3) 75^o 4) 150^o

8. A particle is moving eastwards with a velocity 5m/s changes its direction northwards in 10 seconds and moves with same magnitude of velocity. The average acceleration is

1) zero 2) $\frac{1}{\sqrt{2}} m/s^2$ towards N-E

3) $\frac{1}{\sqrt{2}} m/s^2$ towards S-E 4) $\frac{1}{\sqrt{2}} m/s^2$ towards N-W

9. Rain drops are falling downward vertically at 4kmph. for a person moving forward at 3 kmph feels the rain falling at

1) 7 kmph 2) 1 kmph 3) 5 kmph 4) 25 kmph

10. A ship is moving due east with a velocity of 12 m/s, a truck is moving across on the ship with velocity 4 m/s. A monkey is climbing the vertical pole mounted on the truck with a velocity of 3 m/s. The velocity of the monkey as observed by the man on the shore

1) 10 2) 15 3) 13 4) 20

11. A man is walking due east at the rate of 2 kmph. The rain appears to him to come down vertically at the rate of 2 kmph. The actual velocity and direction of rainfall with the vertical respectively are

1) $2\sqrt{2}$ kmph, 45^o 2) $\frac{1}{\sqrt{2}}$ kmph, 30^o 3) 2 kmph, 0^o 4) 1 kmph, 90^o

12. A motor car A is travelling with a velocity of 20 m/s in the north-west direction and another motor car B is travelling with a velocity of 15 m/s i the north east direction. The magnitude of relative velocity of B with respect to A is

1) 25 m/s 2) 15 m/s 3) 20 m/s 4) 35 m/s

13. A man can swim in still water at a speed of 4 kmph. He desires to cross a river flowing at a speed of 3 kmph in the shortest time interval. If the width of the river is 3km time taken to cross the river (in hours) and the horizontal distance travelled (in km) are respectively.

1) $\frac{3}{4}, \frac{9}{4}$ 2) $\frac{3}{5}, 3$ 3) $\frac{1}{4}, \frac{15}{4}$ 4) $\frac{3}{\sqrt{7}}, 7$

14. A person can swim in still water at 5 m/s. He moves in a river of velocity 3 m/s, first down the stream and next same distance up the stream. The ratio of times taken is

1) 1:1 2) 1:2 3) 1:4 4) 4:1

15. A boat takes 4 hrs to travel certain distance in a river in down stream and it takes 6 hrs to travel the same distance in up stream. Then the time taken by the boat to travel same distance in still water is

1) 4.8 hrs 2) 9.8 hrs 3) 24 hrs 4) 10 hrs

16. A boats man finds that he can save 6 sec in crossing a river by quicker path, then by shortest path if the velocity of boat and river be respectively 17 m/s and 8 m/s, then river width is

1) 675 m 2) 765 m 3) 567 m 4) 657 m

17. A river is of width 120m which flows at a speed of 8 m/s. If a man swims with a speed of 5 m/s at an angle of 127^o with the stream, his drift on reaching other bank is

1) 50 m 2) 150 m 3) 200 m 4) 300 m

18. The square of the resultant of two forces 4N and 3N exceeds the square of the resultant of the two forces by 12 when they are mutually perpendicular. The angle between the vectors is

1) 30^o 2) 60^o 3) 90^o 4) 120^o

19. Two vectors of equal magnitude p are inclined at some angle such that the difference in magnitude of resultant and magnitude of either of the vectors is 0.732 times either of the magnitude of vectors. If the angle between them is increased by half of initial value then the magnitude of difference of the vectors is

1) 2p 2) $\sqrt{2}$ p 3) 3p 4) $\sqrt{3}$ p

20. It is raining at a speed of 5 m/s at an angle 37^o to vertical, towards east. A man is moving to west with a velocity of 5 m/s. The angle with the vertical at which he has to hold the umbrella to protect himself from rain is

1) $T\text{an}^{-1}(2)$ to west 2) $T\text{an}^{-1}(2)$ to east 3) $T\text{an}^{-1}\left(\frac{1}{2}\right)$ to south 4) $T\text{an}^{-1}\left(\frac{1}{2}\right)$ to east

CHEMISTRY

SYLLABUS : Atomic Structure : Upto Quantum numbers

1. The isoelectronic species with CO is

1) CN^- 2) OH^- 3) N_2^+ 4) O_2^-

2. An increasing order for the values of e/m for electron (e), proton (p), neutron (n) and $\propto$ -particle is

1) e, p, n, α 2) n, p, e, α 3) n, p, α, e 4) n, α, p, e

3. Electro magnetic radiation associated with highest amount of energy is

1) x-rays 2) γ-rays 3) cosmic rays 4) Radio waves

4. The longest wavelength for balmer series is

1) 6563 A^o 2) 4861 A^o 3) 4341 A^o 4) 4102 A^o

5. The ratio of the radii of the first three orbits in an atom of hydrogen is

1) 1:4:9 2) 9:4:1 3) 1:2:3 4) 3:2:1

6. For the d_z^2 orbital, the value of 'm' may be

1) -3 2) -2 3) 0 4) none

7. The $(n+l)$ value for 4f subshell is

1) 4 2) 5 3) 6 4) 7

8. Number of radial nodes in '3p' orbital is

1) 0 2) 1 3) 2 4) 3

9. Which one of the following constitutes a group of the isoelectronic species?

1) C_2^{2-}, O_2^-, CO, NO 2) $NO^+, C_2^{2-}, CN^-, N_2$ 3) $CN^-, N_2, O_2^-, C_2^{2-}$ 4) N_2, O_2^{2-}, NO^+, CO

10. A wave has a frequency of $3\times10^{15}\ \text{sec}^{-1}$. The energy of that photon is

1) $1.6\times10^{-12}\ erg$ 2) $3.2\times10^{-11}\ erg$ 3) $2.0\times10^{-11}\ erg$ 4) none

11. If the energy of an electron in first Bohr orbit of H-atom is -13.6eV, then which of the following is a possible excited state of electron in H-atom

1) -5.1 eV 2) -3.4 eV 3) -6.8 eV 4) -1.7 eV

12. The momentum of a particle of wavelength 1A^o is

1) $6.625\times10^{-27}\ g.cm.s^{-1}$ 2) $6.625\times10^{-19}\ g.cm.s^{-1}$ 3) $6.625\times10^{-16}\ g.cm.s^{-1}$ 4) $6.625\times10^{-23}\ g.cm.s^{-1}$

13. The impossible set of quantum number is

1) $n=2,\ l=0,\ m=0,\ s=\frac{+1}{2}$ 2) $n=2,\ l=1,\ m=0,\ s=\frac{+1}{2}$

3) $n=2,\ l=0,\ m=1,\ s=-\frac{1}{2}$ 4) $n=3,\ l=1,\ m=-1,\ s=-\frac{1}{2}$

14. To provide 1.0 Joule energy of light associated with wavelength 6000A^o, the number of photons required are

1) 3.0×10^{20} 2) 3.0×10^{18} 3) 2×10^{23} 4) 3.0×10^{10}

15. The electron in the hydrogen atom is excited to the 5th orbit, the no. of spectral lines is expected to emit is

1) 6 2) 10 3) 12 4) 20

16. Velocity of the electron in the 1st Bohr orbit

1) 2.18×10^8 cm/sec 2) 2.18×10^8 m/sec 3) 2.18×10^{16} cm/sec 4) 36559×10^8 cm/sec

17. The number of nucleons in the isotope of an atom $_zX^m$ are

1) m 2) z 3) m + z 4) m - z

18. Charge of 1 mole of alpha particle is

1) 0.5 Faraday 2) 2 Faraday 3) 4 Faraday 4) 1 Faraday

19. When electron Jumbs from 5th energy level to 1st energy level to which series the spectral line belongs?

1) Balmer 2) Lyman 3) Paschen 4) Pfund

20. The ratio of energies of two photons with wave length 2000A^o and 4000 A^o is

1) 1:2 2) 2:1 3) 4:1 4) 1:4

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SR EAMCET | **DPP-2** | **Date : 07-04-2020**

Time: | **Max. Marks: 360**

KEY SHEET

MATHS-A

1) **3**	2) **3**	3) **1**	4) **2**	5) **4**	6) **4**	7) **1**	8) **3**	9) **2**	10) **2**
11) **1**	12) **3**	13) **4**	14) **1**	15) **1**	16) **4**	17) **2**	18) **3**	19) **2**	20) **4**

MATHS-B

1) **1**	2) **4**	3) **3**	4) **3**	5) **1**	6) **2**	7) **2**	8) **1**	9) **1**	10) **4**
11) **4**	12) **1**	13) **3**	14) **4**	15) **2**	16) **3**	17) **1**	18) **1**	19) **2**	20) **2**

PHYSICS

1) **3**	2) **2**	3) **1**	4) **4**	5) **3**	6) **3**	7) **1**	8) **4**	9) **3**	10) **3**
11) **1**	12) **1**	13) **1**	14) **3**	15) **1**	16) **2**	17) **2**	18) **2**	19) **2**	20) **1**

CHEMISTRY

1) **1**	2) **4**	3) **3**	4) **1**	5) **1**	6) **3**	7) **4**	8) **2**	9) **2**	10) **3**
11) **2**	12) **2**	13) **3**	14) **2**	15) **2**	16) **1**	17) **1**	18) **2**	19) **2**	20) **2**

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INDIA

EAMCET | **DPP-2** | **DATE: 07-04-2020**

TIME: 3 hrs.

HINTS & SOLUTIONS
MATHS-A

1. $\tan\theta=\frac{b}{a}$

$$\therefore\sqrt{\frac{a-b}{a+b}}+\sqrt{\frac{a+b}{a-b}}=\sqrt{\frac{1-\frac{b}{a}}{1+\frac{b}{a}}}+\sqrt{\frac{1+\frac{b}{a}}{1-\frac{b}{a}}}=\sqrt{\frac{1-\tan\theta}{1+\tan\theta}}+\sqrt{\frac{1+\tan\theta}{1-\tan\theta}}=\frac{2}{\sqrt{1-\tan^2\theta}}=\frac{2\cos\theta}{\sqrt{\cos 2\theta}}$$

2. $\tan 9^0-\tan 27^0-\cot 27^0+\cot 9^0=\tan 9^0-\tan 27^0-\frac{1}{\tan 27^0}+\frac{1}{\tan 9^0}$

$$=\frac{1+\tan^2 9^0}{\tan 9^0}-\frac{1+\tan^2 27^0}{\tan 27^0}=\frac{2}{\sin 18^0}-\frac{2}{\sin 54^0}$$

3. $\sqrt{2+\sqrt{2+\sqrt{2+\sqrt{2+\sqrt{2+2\cos\frac{\pi}{4}}}}}}=\sqrt{2+\sqrt{2+\sqrt{2+\sqrt{2\left(2\cos^2\frac{\pi}{8}\right)}}}}$

$$=2\cos\frac{\pi}{128}$$

4. $\cos^3\theta=\frac{1}{4}\left(\cos 3\theta+3\cos\theta\right)$

5. $=\frac{2\sin\left(\frac{x}{2}\right)\cos\left(\frac{x}{2}\right)}{\sin\left(\frac{x}{8}\right)}=\frac{4\sin\left(\frac{x}{4}\right)\cos\left(\frac{x}{4}\right)\cos\left(\frac{x}{2}\right)}{\sin\left(\frac{x}{8}\right)}=8\cos\left(\frac{x}{8}\right)\cos\left(\frac{x}{4}\right)\cos\left(\frac{x}{2}\right)$

6. By componendo & dividend

$$\frac{1+\cos 2B}{1-\cos 2B}=\frac{\cos(A+C)+\cos(A-C)}{\cos(A+C)-\cos(A-C)}$$

7. $x^2-\left(\tan 22\frac{1}{2}^0+\cot 22\frac{1}{2}^0\right)x+\tan 22\frac{1}{2}^0\cot 22\frac{1}{2}^0=0$

$$x^2-\left(\frac{2}{\sin 45^0}\right)x+=0$$

8. $\left(1+\cos\frac{\pi}{8}\right)\left(1+\cos\frac{2\pi}{8}\right)\left(1+\cos\frac{3\pi}{8}\right)(1+0)\left(1-\cos\frac{3\pi}{8}\right)\left(1-\cos\frac{2\pi}{8}\right)\left(1-\cos\frac{\pi}{8}\right)$

$$\sin^2\frac{\pi}{8}\sin^2\frac{2\pi}{8}\sin^2\frac{3\pi}{8}=\sin^2\frac{\pi}{8}\cos^2\frac{\pi}{8}=\frac{1}{4}\sin^2\frac{\pi}{4}$$

9. Using transformation $\cos\alpha+\cos\beta-\left(\cos\gamma+\cos(\alpha+\beta+\gamma)\right)$

10. $\alpha=\cos x+i\sin x,\beta=\cos y+i\sin y,\gamma=\cos z+i\sin z$

11. $\left(\frac{2\cos\left(\frac{A+B}{2}\right)\cos\left(\frac{A-B}{2}\right)}{2\cos\left(\frac{A+B}{2}\right)\sin\left(\frac{A-B}{2}\right)}\right)^{2020}+\left(\frac{2\sin\left(\frac{A+B}{2}\right)\cos\left(\frac{A-B}{2}\right)}{-2\sin\left(\frac{A+B}{2}\right)\sin\left(\frac{A-B}{2}\right)}\right)^{2020}$

12. Squaring and adding

13. Using transformation

14. Squaring and adding we get $a^2+b^2=4\cos^2\theta$

$\frac{\cos 3\theta}{\cos\theta}=4\cos^2\theta-3$

15. $\cos ec\left(x\left(1+\frac{1}{2}+\frac{1}{4}+...+\infty\right)\right)=\cos ec\left(2x\right)$

16. $f\left(x\right)=\sin^2\left(\frac{\pi}{8}+\frac{x}{2}\right)+1-\cos^2\left(\frac{\pi}{8}-\frac{x}{2}\right)=1+\cos\left(\frac{\pi}{4}\right)\cos x$

17. Max of $a^2\tan^2\theta+b^2\cot^2\theta=2ab$

18. $A=\sin^2\theta+\left(1-\sin^2\theta\right)^2$

19. $A+B=90^0$

$\sin A\sin B=\sin A\cos A=\frac{1}{2}\sin 2A$

20. Verify

MATHS-B

1. $x=\cos\alpha+1, y=\cos\beta+1$

$x=2\cos^2\frac{\alpha}{2}, y=2\cos^2\frac{\beta}{2}$

2. $a=4, b=9, g=-4, f=18$

$P=\left(\frac{-g}{a},\frac{-f}{b}\right)=\left(1,-2\right)$

3. $\left(y+2\right)^2+8\left(x-\frac{3}{4}\right)=0$

$\Rightarrow$ Point of translation $=\left(\frac{3}{4},-2\right)$

4. Given points form right angled triangle at $\left(-1,3\right)$.

$\therefore$ Circumcentre = mid point of $\left(9,3\right),\left(-1,7\right)$

$=\left(4,5\right)$

Centroid of triangle $=\left(\frac{7}{3},\frac{13}{3}\right)$

Centroid in new system $=\left(\frac{7}{3}-4,\frac{13}{3}-5\right)$

$=\left(\frac{-5}{3},\frac{-2}{3}\right)$

5. $x=X+5, y=Y-2$

$\therefore$ Transformed equation is

$\left(X+5\right)\left(Y-2\right)+2\left(X+5\right)-5\left(Y-2\right)-11=0$

$\Rightarrow XY=1$

6. $x=X+1, y=Y+2$

Transformed equation is $(Y+2)^2-8(X+1)-4(Y+2)+12=0$

$\Rightarrow Y^2=8X$

$\therefore a=2$

7. $x=x-1, y=y-2$

Original equation is

$3(x-1)^2+(x-1)(y-2)-(y-2)^2-7(x-1)+(y-2)+7=0$

$\Rightarrow 3x^2+xy-y^2-15x+4y+13=0$

8. Transformed equation is

$(x+h)(y+k)-(x+h)+2(y+k)-6=0$

Compare with $xy=c$

$K-1=0, h+2=0$

And $c=-(hk-h+2k-6)$

Put k=1, $h=-2$

Then c=4.

9. $x=\sqrt{2}\cos 45^0-4\sin 45^0$

$=1-2\sqrt{2}$ & $y=\sqrt{2}\sin 45^0+4\cos 45^0$

$=1+2\sqrt{2}$

$\therefore P=\left(1-2\sqrt{2},1+2\sqrt{2}\right)$

10. Coefficient of $x^2=1=$ coefficient of y^2

$\Rightarrow$ Angle of rotation is $\frac{\pi}{4}$

11. $y=-x\sin\alpha+y\cos\alpha$

$\Rightarrow$ from given equation

$-(x\sin\alpha-y\cos\alpha)=p$

$\Rightarrow -y=p$

$\Rightarrow y+p=0$

12. $x=x\cos 90^0-y\sin 90^0$,

$y=x\sin 90^0+y\cos 90^0$

$\Rightarrow x=-y$ and y=x

& Transformed equation is

$y^2=4ax$.

13. Let $\theta=\tan^{-1}(2)$

$\tan\theta=2$

$\Rightarrow \sin\theta=\frac{2}{\sqrt{5}}, \cos\theta=\frac{1}{\sqrt{5}}$

$x=x\cos\theta-y\sin\theta=\frac{x-2y}{\sqrt{5}}$

$y=x\sin\theta+y\cos\theta=\frac{2x+y}{\sqrt{5}}$

Transformed equation is

$4\left(\frac{x-2y}{\sqrt{5}}\right)\left(\frac{2x+y}{\sqrt{5}}\right)-3\left(\frac{x-2y}{\sqrt{5}}\right)^2=a^2$

$\Rightarrow x^2-4y^2=a^2$

14. By rotation of axes

Centre of circle does not change and radius also

$\therefore$ Transformed equation is

$x^2 + y^2 = r^2$

15. Original equation of curve is

$(x\cos\alpha + y\sin\alpha)^2 - 2(x\cos\alpha + y\sin\alpha)$

$(-x\sin\alpha + y\cos\alpha)\tan 2\alpha - (-x\sin\alpha + y\cos\alpha)^2 = a^2$

$\Rightarrow (x^2 - y^2)\left(\cos 2\alpha + \frac{\sin^2 2\alpha}{\cos 2\alpha}\right) = a^2$

$\Rightarrow x^2 - y^2 = a^2\cos 2\alpha$.

16. Angle of rotation $= \tan^{-1}\left(\frac{-a}{b}\right)$

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

$= \frac{\pi}{3}$

17. Distance remains same.

18. $\theta = 22^0$

$\Rightarrow 4x^2 + 12xy + 9y^2 + 6x + 9y + 2 = 0$

Changes $ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$

$\Rightarrow a = 4, h = 12, b = 9, 2g = 6, 2f = 9$

$c = 2$

Given equation represent a pair of parallel lines, in rotation of axes the parallel lines are not change

$\therefore \frac{h}{a} = \frac{6}{4} = \frac{3}{2}$

19. $x = -y, y = x$

Transformed equation is

$5(-y) - 2(x) + 7 = 0$

$\Rightarrow 2x + 5y - 7 = 0$

20. New origin $= \left(\frac{-g}{a}, \frac{-f}{b}\right) = (2,3)$

Transformed equation is

$(x+2)^2 + (y+3)^2 - 4(x+2) - 6(y+3) - 12 = 0$

Compare with $x^2 + y^2 = k$

We get k = 25.

PHYSICS

1. If $\bar{a}$ & $\bar{b}$ are collinear than $\bar{a} \times \bar{b} = 0$

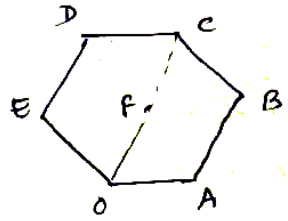
$$\begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 2 & -3 & 4 \\ 3 & \lambda & \mu \end{vmatrix} = 0$$

$\therefore \lambda = \frac{-9}{2}$ and $\mu = 6$

2. $\bar{a} + \bar{b} - \bar{c} = \bar{0}$ ($\because$ triangle law)

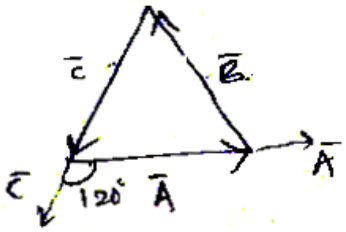
$\bar{a} + \bar{b} = \bar{c}$

3. Let starting point
"O". Then 9th turn becomes at 'c'
$\therefore$ displacement $= OC = OF + FC$
$= 50 + 50 = 100m$



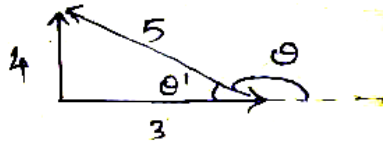
4. By rotation of coordinate system, there is no changes with magnitude of vector.
$|\text{Vector}| = \text{constant}$
$\sqrt{(n+1)^2 + 1^2} = \sqrt{n^2 + 3^2}$
$n = 3.5$

5.



6. At equilibrium net force is zero and P is
$P = \sqrt{A^2 + B^2 + 2AB\cos\theta}$
$P = \sqrt{100 + 36 + 2(10)6\cos 53^0}$
$P = \sqrt{208}$

7.



$\theta^1 = 53^0$
$\theta = 180^0 - \theta^1$
$\theta = 127^0$

8.

$\vec{a} = \frac{v_f - v_i}{t} = \frac{5\hat{j} - 5\hat{i}}{10}$
$|\vec{a}| = \frac{1}{\sqrt{2}} N - W$

9. $\vec{V}_{RM} = \vec{V}_R - \vec{V}_M$
$|\vec{V}_{RM}| = \sqrt{4^2 + 3^2} = 5\ kmgh$

10. $V = \sqrt{V_x^2 + V_y^2 + V_z^2}$

11. $V_R = \sqrt{V^2 + V_m^2}, \tan\theta = \frac{V_m}{V}$

12. $V_A = -20\hat{i}\cos 45^0 + 20\hat{j}\sin 45^0$

$V_B = 15\hat{i}\cos 45^0 + 15\hat{j}\sin 45^0$

$V_B - V_A = 25m/s$

13. $t = \dfrac{d}{V_B}$ and $x = V_W\left(\dfrac{d}{V_B}\right)$

14. $\dfrac{t_1}{t_2} = \dfrac{d/V_B + V_R}{d/V_B - V_R}$

$\dfrac{t_1}{t_2} = \dfrac{5-3}{5+3} = \dfrac{1}{4}$

15. $t_1 = \dfrac{d}{V_B + V_W} = 4$ and $t_2 = \dfrac{d}{V_B - V_W} = 6$

$d = 4V_B + 4V_W$ $\qquad$ $d = 6V_B - 6V_W$

$6d = 24V_B + 24V_W$ ……(1) $\quad 4d = 24V_B - 24V_W$ ……(2)

(1) +(2) $\quad \dfrac{d}{V_B} = \dfrac{24}{5}$

$t_3 = 4.8m/s$

16. $t_1 - t_2 = 6$

$\dfrac{d}{\sqrt{V_B^2 - V_W^2}} - \dfrac{d}{V_B} = 6$

$d = 765\ m$

17. $\theta = 37^0$

$\sin 37^0 = \dfrac{3}{5}, \cos 37^0 = \dfrac{4}{5}$

$x = \left(V_W - V_B\sin\theta\right)\dfrac{d}{V_B\cos\theta}$

18. $R_0^2 = R_{90^0}^2 + 12$

$P^2 + Q^2 + 2PQ\cos\theta = P^2 + Q^2 + 12$

$\theta = 60^0$

19. $R - P = 0.732P$

$R = \sqrt{3}P$

$2P\cos\left(\dfrac{\theta}{2}\right) = \sqrt{3}P$

$\theta = 60^0$

$\theta^1 = \theta + \dfrac{\theta}{2}$

$\theta^1 = 90^0$

$\therefore R = \sqrt{2}P$

20. $\overline{V}_{RM} = \overline{V}_R - \overline{V}_M$

$\overline{V}_{RM} = \overline{V}_R - \left(-5\hat{i}\right)$

$\overline{V}_{RM} = \overline{V}_R + 5\hat{i}$

$\tan\alpha = \dfrac{5+3}{4} = \dfrac{8}{4} = 2$

$\alpha = \tan^{-1}(2)$ to west.

CHEMISTRY

1. Isoelectronic species have
   Same no. of electrons
   CO =6+8 = 14 & $CN^- = 6+7+1 = 14$
2.

Particle	Mass	e/m
Electron	1/1837	$\frac{1}{1/1837} = 1837$
Proton	1	$\frac{1}{1} = 1$
Neutron	1	$\frac{0}{1} = 0$
$\alpha\left[He^{+2}\right]$	4	$\frac{2}{4} = 0.5$

3. Conceptual
4. Blamer series $\left[H_\alpha line\right] = 6563A^0$
5. $r_n = 0.529\frac{n^2}{z}A^0$
   n= principle quantum no= orbit
   $r_1 : r_2 : r_3 = 1^2 : 2^2 : 3^2$
   $= 1:4:9$
6. Conceptual
7. f f orbital l value = 3
   $n+l = 4+3 = 7$
8. No. of nodal regions $= n-l-1$
   $P : e = 1$ $= 3-1-1$
   $= 1$
9. Isoelectronic species have
   Same no. of electrons
   $NO^+ = 7+8-1 = 14e^-$
   $C_2^{2-} = 6+5+2 = 14e^-$
   $CN^- = 6+7+1 = 14e^-$
   $N_2 = 7+7 = 14e^-$
10. $E = hv$
    $= 6+62\times10^{-27}\times3\times10^{15} = 2\times10^{-11} ergs$
11. $E_n = -13.6\times\frac{z^2}{n^2}eV$
    $= -13.6\times\frac{1^2}{2^2} = -3.4\,eV$ ($\because$ excited to 2nd orbital)
12. $\lambda = \frac{h}{p}$
    $P = \frac{h}{\lambda} = \frac{6.625\times10^{-27}}{1\times10^{-8}} = 6.625\times10^{-19} cms^{-1}$
13. Conceptual
14. $E = \frac{nhc}{\lambda}, n = \frac{E\lambda}{hc}$
    $= \frac{1\times6000\times10^{10}}{6.6\times10^{-34}\times3\times10^8} = \frac{1}{3.3\times10^{-19}} = 3\times10^{18}$

15. No. of spectral lines $= \frac{n(n-1)}{2}$

$= \frac{5(5-1)}{2}$

$= 10$

16. $V_n = \frac{2.18 \times 10^8}{n} cm/\sec$

$= 2.18 \times 10^8 cm/\sec$

17. Nucleons = P + neutrons

$= Z + M - Z$

$= m$

18. Charge possessed by 1 mole of
+Ve charge = 1 faraday
One mole $\alpha-$ particle $\left(He^{+2}\right)$ contains
Two moles of +Ve charge
One mole of $\alpha-$ particle = 2 faraday

19. Conceptual

20. $E\alpha\frac{1}{\lambda}$

The ratio of energies

$\frac{E_1}{E_2} = \frac{\lambda_2}{\lambda_1} = \frac{4000}{2000} = \frac{2}{1}$