

# MELUHA INTERNATIONAL SCHOOL

## HYDERABAD

SR MPC

Date: 24-04-2020

JEE MAINS MODEL UNIT TEST-II

Time: 3:00 Hrs.

Max. Marks: 300 M

### SECTION-I

#### (SINGLE CORRECT ANSWER TYPE)

This section contains 20 multiple choice questions. Each question has 4 options (1), (2), (3) and (4) for its answer, out of which **ONLY ONE** option can be correct.

**Marking Scheme: +4 for correct answer, 0 if not attempted and -1 if not correct**

### MATHEMATICS

#### SYLLABUS: TRIGONOMETRY, COMPLEX NUMBERS, DE MOIVERSES THEOREM

- In  $\Delta ABC$ , if  $\cot A \cot B \cot C = k$ , then \_\_\_\_\_  
1)  $k \leq \frac{1}{3\sqrt{3}}$       2)  $k \geq \frac{1}{3\sqrt{3}}$       3)  $k < \frac{1}{9}$       4)  $k > \frac{1}{3}$
- If  $\theta = 3\alpha$  and  $\sin \theta = \frac{3}{5}$ . Then the value of  $3\operatorname{cosec} \alpha - 4\sec \alpha$  is \_\_\_\_\_  
1) 0      2)  $\frac{9}{2}$       3) 10      4) 24
- If  $\cos^2 A + \cos^2 B + \cos^2 C = 1$ , then  $\Delta ABC$  is \_\_\_\_\_  
1) Equilateral      2) isosceles      3) right angled      4) right angled isosceles
- The ratio  $\frac{\sin \frac{2\pi}{7} + \sin \frac{4\pi}{7} - \sin \frac{6\pi}{7}}{\sin \frac{\pi}{7} \sin \frac{3\pi}{7} \sin \frac{5\pi}{7}} =$  \_\_\_\_\_  
1)  $\frac{1}{4}$       2) 1      3) 2      4) 4
- If the equation  $x^2 + 4x \sin \theta + \tan \theta = 0$  (where  $0 < \theta < \frac{\pi}{2}$ ) has repeated roots. Then  $\theta =$  \_\_\_\_\_  
1)  $\frac{\pi}{12}$       2)  $\frac{\pi}{6}$       3)  $\frac{\pi}{12}$  or  $\frac{5\pi}{12}$       4)  $\frac{\pi}{6}$  or  $\frac{\pi}{12}$
- $\sin^4 \theta - (k+2)\sin^2 \theta - (k+3) = 0$  admits a solution if  $k \in$  \_\_\_\_\_  
1)  $[0, \infty]$       2)  $[-3, -2]$       3)  $[-\infty, 0]$       4)  $[-\sqrt{3}, \sqrt{3}]$
- If  $[\sin \theta + 1] + [\cos \theta + 1] = 0$ . Then quadrant in which  $\theta$  lies is \_\_\_\_\_  
(where  $[ \ ]$  is greatest integer function).  
1) 1      2) 2      3) 3      4) 4
- The sum of all solutions of the equation  $\cot \theta = \sin 2\theta$  ( $\theta \in [0, \pi]$ ) is \_\_\_\_\_  
1)  $\frac{3\pi}{2}$       2)  $\pi$       3)  $\frac{3\pi}{4}$       4)  $2\pi$
- $\sin^{-1}(\sin 3) + \sin^{-1}(\sin 4) + \sin^{-1}(\sin 5) =$  \_\_\_\_\_  
1) -1      2) -2      3) 12      4)  $2 - \pi$
- $\sin^{-1}(\cos \sin^{-1} x) + \cos^{-1}(\sin x \cos^{-1} x) =$  \_\_\_\_\_

- 
- 1) 0                                      2)  $\frac{\pi}{4}$                                       3)  $\frac{\pi}{2}$                                       4)  $\frac{3\pi}{4}$
11. If  $\tan^{-1}(4^{\cos^2 \theta} + 1) + \cot^{-1}(6 + 2\cos \theta + \cos^2 \theta) = \frac{\pi}{2}$ . Then \_\_\_\_\_
- 1)  $\cos \theta = 1$                               2)  $\cos \theta = -1$                               3)  $\cos \theta = \frac{-1}{2}$                               4) all the above
12. In  $\Delta ABC$ , with usual notation, if  $2(2ab + ac - a^2) = 4b^2 + c^2$ , Then  $\sin B =$  \_\_\_\_\_
- 1)  $\frac{\sqrt{15}}{8}$                                       2)  $\frac{\sqrt{3}}{5}$                                       3)  $\frac{3}{8}$                                       4)  $\frac{7}{11}$
13. In  $\Delta ABC$ , with usual notation, if  $\cos A + \sin A = \frac{2}{\cos B + \sin B}$ , then  $\left(\frac{a+b}{c}\right)^2 = ?$
- 1) 2                                      2) 1                                      3) 3                                      4) 12
14. Two vertical poles 20 m and 60 m stands a part on a horizontal plane. The height of the point of intersection of the lines joining the top of each pole to the foot of the other is \_\_\_\_\_
- 1) 15 m                                      2) 16 m                                      3) 18 m                                      4) 50 m
15. If  $|z-1|=1$ , Then  $\text{Arg } z =$  \_\_\_\_\_
- 1)  $\frac{\pi}{4}$                                       2)  $\frac{1}{2} \text{Arg}(z+1)$                                       3)  $\frac{1}{2} \text{Arg}(z-1)$                                       4)  $\frac{\pi}{2}$
16. If  $x = i(i + \sqrt{2})$ , Then  $x^4 + 4x^3 + 6x^2 + 4x + 3 =$  \_\_\_\_\_
- 1) 6                                      2) -6                                      3) 0                                      4) 9
17. If  $z_1, z_2, z_3$  are 3 complex numbers in A.P; then they lie on \_\_\_\_\_
- 1) a circle                                      2) a straight line                                      3) a parabola                                      4) an ellipse
18. Let  $1, \alpha_1, \alpha_2, \dots, \alpha_{n-1}$  are the  $n^{\text{th}}$  roots of unity, then  $(2 - \alpha_1)(2 - \alpha_2) \dots (2 - \alpha_{n-1}) = ?$
- 1)  $2^n - 1$                                       2)  $2^n + 1$                                       3)  $2^n$                                       4)  $n$
19. If  $|z^2 - 3| = 3|z|$ , then maximum value of  $|z|$  is \_\_\_\_\_
- 1) 1                                      2)  $\frac{3 + \sqrt{21}}{2}$                                       3)  $\frac{-3 + \sqrt{21}}{2}$                                       4)  $\frac{21 - \sqrt{3}}{2}$
20. Least positive argument of the 4<sup>th</sup> root of the complex number  $2 - i\sqrt{12}$  is \_\_\_\_\_
- 1)  $\frac{\pi}{6}$                                       2)  $\frac{\pi}{12}$                                       3)  $\frac{5\pi}{12}$                                       4)  $\frac{7\pi}{12}$

## **SECTION-II**

### **(Numerical Value Answer Type)**

This section contains 5 questions. The answer to each question is a Numerical values comprising of positive or negative decimal numbers.

**Marking Scheme:** +4 for correct answer, 0 in all other cases.

21. Sum of squares of all trigonometrical ratios has minimum value as \_\_\_\_\_
22. If roots of  $x^3 - 66x^2 + 165x - 1 = 0$  be sides of  $\Delta ABC$ , Then  $\sum \left(\frac{\cos A}{a}\right) =$  \_\_\_\_\_
23. The value of  $\cos(\tan^{-1} 1 + \tan^{-1} 2 + \tan^{-1} 3)$  is \_\_\_\_\_
24. If  $(5x^3 + Mx + N)$  is perfectly divisible by  $(x^2 + x + 1)$ , Then  $M + N =$  \_\_\_\_\_
25. If  $z$  satisfies  $\bar{z} + z = 0$  and  $|z|^2 - 4zi = z^2$ , then  $|z| =$  \_\_\_\_\_

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**SECTION-I**  
**(SINGLE CORRECT ANSWER TYPE)**

This section contains 20 multiple choice questions. Each question has 4 options (1), (2), (3) and (4) for its answer, out of which **ONLY ONE** option can be correct.

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**PHYSICS**

**SYLLABUS: GRAVITATION, OSCILLATIONS AND WAVES**

26. The time period of mass loaded spring is 'T'. If 20% of its turns are cut and removed, the same mass is attached to the remaining spring would oscillates with a time period of
- 1)  $\frac{T}{\sqrt{5}}$                       2)  $\frac{2T}{\sqrt{5}}$                       3)  $\frac{T}{5\sqrt{2}}$                       4)  $\sqrt{2} T$
27. A pendulum is taken 1km inside the earth from sea level. Then the gain or loss of time period of the pendulum in second is
- 1) 2                                      2) 4                                      3) 7                                      4) 9
28. A simple pendulum has a time period  $T_1$ , when on the earth's surface  $T_2$  when it is taken a height 'R' above the earths surface, where R is the radius of the earth. The value of  $\frac{T_2}{T_1}$  is
- 1) 2                                      2) 4                                      3) 6                                      4) 8
29. Two pendulums of length 16L and L are in phase at the mean position at a certain time. If T is the time period of shorter pendulum, the minimum time after which they will be again in phase is
- 1)  $\frac{2}{3}T$                                       2)  $\frac{2}{5}T$                                       3)  $\frac{4}{3}T$                                       4)  $\frac{4}{5}T$
30. When a body of mass 1kg is suspended from a certain light spring hanging vertically. Its length increases by 5cm. By suspending 2kg block to the spring and if the block is pulled through 10cm and released the maximum velocity in it in m/sec is ( $g = 10m/sec^2$ )
- 1) 1                                      2) 2                                      3) 3                                      4) 4
31. If the radius of the earth is 6400km, the height above the surface of the earth, where the acceleration due to gravity value will be 1% of its value from the surface of the earth is
- 1) 3R                                      2) 5R                                      3) 7R                                      4) 9R
32. If g is the acceleration due to gravity on the earth and R is the radius of the earth and angular speed of rotation of the earth about its axis is made to be  $\sqrt{\frac{2g}{5R}}$ . Then weight of a body at equator decreases by
- 1) 10%                                      2) 40%                                      3) 70%                                      4) 100%
33. The energy required to shift a satellite from orbital radius r to radius 2r is E. What energy will be required to shift the satellite from orbital radius 2r to 3r
- 1)  $\frac{E}{2}$                                       2)  $\frac{E}{3}$                                       3)  $\frac{E}{4}$                                       4) E
34. Ratio of the radius of the planet A to that of planet B is 20. The ratio of acceleration due to gravity on the surface of the two planets is 5. The ratio of the escape velocity of the two planets is
- 1) 5                                      2) 10                                      3) 15                                      4) 20
35. The altitude at which the weight of a body is 36% less than its weight on the surface of the earth value is
- 1) 6400km                                      2) 3200km                                      3) 1600km                                      4) 400km

36. The wave velocity of a progressive wave is 480 m/s and the phase difference between the two particles separated by distance of 12m is  $1080^\circ$ . The number of waves passing across a point in 1sec is  
 1) 120                                      2) 240                                      3) 160                                      4) 360
37. When the temperature of an ideal gas is increased by 600k, the velocity of sound in the gas becomes  $\sqrt{3}$  times the initial velocity in it. The initial temperature of the gas is  
 1)  $-73^\circ C$                                       2)  $27^\circ C$                                       3)  $127^\circ C$                                       4)  $327^\circ C$
38. A wave of frequency 200Hz is sent along a string towards a fixed point (end). When this wave travels back then after reflection, a node is formed at a minimum distance of 5cm from the fixed end of the string. The speed of the incident wave is  
 1) 5 m/s                                      2) 10 m/s                                      3) 20 m/s                                      4) 40 m/s
39. A source of sound producing wavelength 50 cm is moving away from a stationary observer with  $1/5^{\text{th}}$ . Speed of sound. Then what is the wavelength of sound heard by the observer  
 1) 60 cm                                      2) 70 cm                                      3) 40 cm                                      4) 55 cm
40. The successive resonance frequencies in an open organ pipe are 1944 Hz and 2600 Hz. The length of the pipe of the speed of sound in air is 328 m/s  
 1) 0.04 m                                      2) 0.25 m                                      3) 0.4 m                                      4) 0.5 m
41. The maximum particle velocity is 3 times the wave velocity of a progressive wave. If the amplitude of the particle is 'a'. The phase difference between the two particles separated by a distance 'x' is  
 1)  $x/a$                                       2)  $3x/a$                                       3)  $3a/x$                                       4)  $3\pi x/a$
42. A metallic wire with tension T and temperature  $30^\circ C$  vibrates with it fundamental frequency of 1K.Hz . The same wire with the same tension but at  $10^\circ C$  temperature vibrates with a fundamental frequency of 1.001 KHz. The coefficient of linear expansion of the wire is  
 1)  $1 \times 10^{-4} C^{-1}$                                       2)  $0.5 \times 10^{-4} C^{-1}$                                       3)  $1.5 \times 10^{-4} C^{-1}$                                       4)  $2 \times 10^{-4} C^{-1}$
43. Two stationary sources A and B produces sounds of same frequency. A person running from A to B hears 6 beats/sec. If the frequency of each source increases by 100Hz then 8 beats/sec are heard. Then the original frequency of each source is  
 1) 100 Hz                                      2) 150 Hz                                      3) 200 Hz                                      4) 300 Hz
44. Two different sound sources  $S_1$  and  $S_2$  have frequencies ratio 1:2, source  $S_1$  is approaching towards an observer and  $S_2$  is receding from the same observer. Speeds of both  $S_1$  and  $S_2$  are the same and equal to V. Speed of sound in air is 300 m/s. If no beats are heard by the observer the value of V is  
 1) 50 m/s                                      2) 75 m/s                                      3) 100 m/s                                      4) 125 m/s
45. A whistle of frequency 540 Hz rotates in a horizontal circle of radius 2m at an angular speed of 15 rad/s. The highest frequency heard by a listener at rest with respect to the centre of circle (velocity of sound in air is 330 m/s)  
 1) 509 Hz                                      2) 594 Hz                                      3) 598 Hz                                      4) 602 Hz

## SECTION-II

### (Numerical Value Answer Type)

46. A body executing S.H.M has a maximum acceleration equal to  $48 \text{ m/sec}^2$  and a maximum velocity equal to 12 m/sec. The amplitude of S.H.M in metre is \_\_\_\_\_
47. A geostationary satellite orbits around the earth in a circular orbit which is at height of 36000 km from the surface of the earth. Then the period of spy satellite orbiting a few hundred km above the earth surface in hour is \_\_\_\_\_ ( $R_{\text{earth}} = 6400 \text{ km}$ )
48. Two satellite of masses 100 kg and 200 kg are revolving the earth altitudes 6400 km and 44800km. The ratio of orbital velocity of satellite is \_\_\_\_\_
49. The frequency of a stretched uniform wire under tension is in resonance with the fundamental frequency of a closed tube. If the tension in the wire is increased by 8N. It is in resonance with the first over tone of the closed tube . The initial tension in wire \_\_\_\_\_ N.

50. Two identical flutes produces fundamental nodes of frequency 300 Hz at 27°C. If the temperature of air in one flute increases to 31°C the number of beats per second will be \_\_\_\_\_

### SECTION-I

#### (SINGLE CORRECT ANSWER TYPE)

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### CHEMISTRY

#### SYLLABUS: SECOND YEAR INORGANIC CHEMISTRY

51. A metal 'x' on heating in nitrogen gas gives Y. Y on treatment with H<sub>2</sub>O gives a colourless gas which when passed through CuSO<sub>4</sub> solution gives a blue colour 'Y' is

1) Mg(NO<sub>3</sub>)<sub>2</sub>                      2) Mg<sub>3</sub>N<sub>2</sub>                      3) NH<sub>3</sub>                      4) MgO

52. Extra pure Nitrogen can be obtained by heating

1) NH<sub>3</sub> with CuO                      2) NH<sub>3</sub>NO<sub>3</sub>                      3) (NH<sub>4</sub>)<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>                      4) Ba(N<sub>3</sub>)<sub>2</sub>

53. Among the following oxyacid acid of phosphorous which contains p-p bond is

1) H<sub>4</sub>P<sub>2</sub>O<sub>7</sub>                      2) H<sub>4</sub>P<sub>2</sub>O<sub>5</sub>                      3) H<sub>3</sub>P<sub>3</sub>O<sub>9</sub>                      4) H<sub>4</sub>P<sub>2</sub>O<sub>6</sub>

54. Which of the following are incorrect statements

1) solid PCl<sub>5</sub> exists as tetrahedral (PCl<sub>4</sub>)<sup>+</sup> and octahedral (PCl<sub>6</sub>)<sup>-</sup> ions

2) solid PBr<sub>5</sub> exists as (PBr<sub>4</sub>)<sup>+</sup> Br<sup>-</sup>

3) solid N<sub>2</sub>O<sub>5</sub> exists as NO<sub>2</sub><sup>+</sup>NO<sub>3</sub><sup>-</sup>

4) PCl<sub>6</sub><sup>-</sup> is trigonal bipyramidal in shape

55. Which of the following statement is true

1) both rhombic and monoclinic sulphur are soluble in water

2) both rhombic and monoclinic sulphur are soluble in CS<sub>2</sub>

3) both rhombic and monoclinic sulphur are insoluble in CS<sub>2</sub>

4) Rhombic sulphur can be converted in to monoclinic sulphur but the reverse is not possible

56. Which of the following statement is wrong

1) H<sub>2</sub>S is a dibasic acid

2) H<sub>2</sub>S acts only as a reducing agent

3) the bond angle is H<sub>2</sub>S is 109°28'

4) H<sub>2</sub>S has rotten egg smell

57. Which of the following statements regarding sulphur is incorrect ?

1) S<sub>2</sub> is para magnetic

2) the vapour at 200°C consists mostly S<sub>8</sub> rings

3) At 600°C, the gas mainly consists S<sub>2</sub> molecules

4) the oxidation state of sulphur is never less than +4 in its compounds

58. Which of the following acids contain peroxy linkage

I) oleum

II) marshall's acid

III) caro's acid

IV) sulphuric acid

1) I & II only

2) II & III only

3) I, II & IV only

4) II, III and IV only

- 59.

Orange solid  $\xrightarrow{\Delta}$  diamagnetic + green

(X<sub>1</sub>)

(gas) (residue)

Orange  $\xrightarrow{\Delta}$  paramagnetic + green + yellow

solid(X<sub>2</sub>)

(gas)

(residue)

(solid)



- 1) II, III only correct    2) I, III only correct    3) II, IV only correct    4) IV only correct
67. **When copper ore is mixed with silica, in a reverberatory furnace copper matte is produced. The copper matte contains:**  
 1) sulphides of copper (II) and iron (II)                      2) sulphides of copper (II) and iron (III)  
 3) sulphides of copper (I) and iron (II)                      4) sulphides of copper (I) and iron (III)
68. **Actinoids exhibit more number of oxidation states in general than lanthanoids. This is because**  
 1) the 5f orbitals are more buried than the 4f orbitals  
 2) there is a similarity between 4f and 5f orbitals in their angular part of the wave function  
 3) actinoids are more reactive than lanthanoids  
 4) the 5f orbitals extend farther from the nucleus than the 4f orbitals
69. **One mole of the complex compound  $\text{Co}(\text{NH}_3)_5\text{Cl}_3$  gives 3 moles of ions on dissolution in water. One mole of the same complex reacts with two moles of  $\text{AgNO}_3$  solution to yield two moles of  $\text{AgCl}$  (s). The structure of complex is**  
 1)  $[\text{Co}(\text{NH}_3)_4\text{Cl}]\text{Cl}_2, \text{NH}_3$     2)  $[\text{Co}(\text{NH}_3)_5\text{Cl}]\text{Cl}_2$   
 3)  $[\text{Co}(\text{NH}_3)_3\text{Cl}_3]2.\text{NH}_3$     4)  $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]\text{Cl}.\text{NH}_3$
70.  **$[\text{Ni}(\text{CN})_4]^{2-}$ ,  $[\text{MnBr}_4]^{2-}$  and  $[\text{FeF}_6]^{3-}$ . Geometry, hybridization and magnetic moment of the ions respectively are**  
 1) Tetrahedral, square planar, octahedral:  $sp^3, dsp^2, sp^3d^2 : 5.9, 0, 5.9$   
 2) Tetrahedral, square planar, octahedral:  $dsp^2, sp^3, sp^3d^2 : 0, 5.9, 5.9$   
 3) Square planar, tetrahedral, octahedral:  $dsp^2, sp^3, d^2sp^3 : 5.9, 5.9, 0$   
 4) Square planar, tetrahedral, octahedral:  $dsp^2, sp^3, sp^3d^2 : 0, 5.9, 5.9$

## SECTION-II

### (Numerical Value Answer Type)

71. **How many of the following are diamagnetic ?**  
 $[\text{Ag}(\text{NH}_3)_2]^+$ ,  $[\text{Cd}(\text{NH}_3)_4]^{2+}$ ,  $\text{Cr}(\text{CO})_6$ ,  $[\text{Ni}(\text{NH}_3)_6]^{2+}$ ,  $[\text{Ni}(\text{CN})_4]^{2-}$
72. **How many of the following have  $d^2sp^3$  hybridization ?**  
 $[\text{Ni}(\text{NH}_3)_6]^{2+}$ ,  $[\text{Co}(\text{NH}_3)_6]^{3+}$ ,  $[\text{Fe}(\text{CN})_6]^{4-}$ ,  $[\text{Cr}(\text{NH}_3)_6]^{3+}$ ,  $[\text{Co}(\text{en})_3]^{3+}$ ,  $[\text{Co}(\text{EDTA})]^{2-}$ ,  
 $[\text{CoF}_6]^{3-}$ ,  $[\text{Co}(\text{H}_2\text{O})_6]^{2+}$
73. **The number of stereoisomers possible in  $\text{Ma}_2\text{b}_2\text{c}_2$  are**
74. **A molten mixture contain following substance, Cu, FeO, PbO, CaO, MgO, Ag Find the total no.of substances which are removed when molten mixture is treated with  $\text{SiO}_2$ .**
75. **The number of isomers possible for  $[\text{Ir}(\text{Cl})(\text{Br})(\text{NH}_3)(\text{py})]$  is**