SRIGAYATRI EDUCATIONAL INSTITUTIONS

INDIA

JR MPC | **JEE MAINS MODEL WT-02** | **Date: 26-07-2020**

Time: 3 Hours | **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: **Maths – A: Trigonometric Ratios**

Maths - B: 2D – coordinate system; locus

1. **If** $\tan 20^0 = \lambda$**, then** $\dfrac{\tan 250^0 + \tan 340^0}{\tan 200^0 - \tan 110^0} =$

A) $\dfrac{1+\lambda^2}{1-\lambda^2}$ B) $\dfrac{1-\lambda^2}{1+\lambda^2}$ C) $\dfrac{1+\lambda^2}{2\lambda}$ D) $\dfrac{1-\lambda^2}{2\lambda}$

2. **If** α, β **are complementary angles, then** $\sin^2\alpha + \sin^2\beta =$

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

3. $Sin\,120^0 \cos 150^0 - \cos 240^0 \sin 330^0 =$

A) 1 B) -1 C) $\dfrac{2}{3}$ D) $\dfrac{3}{4}$

4. **In a** ΔABC**,** $\cos\left(\dfrac{B+2C+3A}{2}\right) + \cos\left(\dfrac{A-B}{2}\right) =$

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

5. **If** θ **lies in the first quadrant and** $5\tan\theta = 4$ **then** $\dfrac{5\sin\theta - 3\cos\theta}{\sin\theta + 2\cos\theta} =$

A) $\dfrac{5}{14}$ B) $\dfrac{3}{14}$ C) $\dfrac{4}{3}$ D) $\dfrac{-3}{4}$

6. **If** $\sin\theta_1 + \sin\theta_2 + \sin\theta_3 = 3$ **then** $\cos\theta_1 + \cos\theta_2 + \cos\theta_3 =$

A) 3 B) 2 C) 1 D) 0

7. **If** $\sin\theta + \sin^2\theta = 1$ **then** $\cos^2\theta + \cos^4\theta =$

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

8. **If** $\cos\theta - \sin\theta = \sqrt{2}\sin\theta$ **then** $\cos\theta + \sin\theta =$

A) 0 B) $\pm\sqrt{2}\cos\theta$ C) $\pm\sqrt{2}\sin\theta$ D) 1

9. $\dfrac{Sec\theta + \tan\theta - 1}{\tan\theta - \sec\theta + 1} =$

A) $\sec\theta - \tan\theta$ B) $\tan\theta - \sec\theta$ C) $\sec\theta + \tan\theta$ D) 1

10. $\cos 5^0 + \cos 24^0 + \cos 175^0 + \cos 204^0 + \cos 300^0 =$

A) 1 B) 0 C) -1 D) $\dfrac{1}{2}$

11. **The distance between two points is 5. One of them is** $(3,2)$ **and the ordinate of the second is -1, then its** $x-$ **coordinates are**

A) 7, -1 B) -7, 1 C) -7, -1 D) 7,1

12. **The orthocentre of the triangle having vertices as $(2,3),(2,5),(4,3)$ is**

A) $(0,0)$ B) $(4,3)$ C) $(2,5)$ D) $(2,3)$

13. **The number of points equidistance from three given non collinear points is**

A) 0 B) 1 C) 2 D) Infinite

14. **The ratio in which $x-$axis divides the join of $(2,-3)$ and $(5,6)$ is**

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

15. **The orthocentre and circumcentre of a triangle are $(-3,5),(6,2)$ then the centroid is**

A) $(2,-3)$ B) $(3,3)$ C) $(4,3)$ D) $(-3,5)$

16. **If PQRS is a trapezium with PQ and RS are parallel PQ = 6, QR = 5, RS = 3, PS = 4, $\angle P = 90^0$ then area of PQRS is**

A) 27 sq. units B) 12 sq. units C) 18 sq. units D) 36 sq. units

17. **The equation of the locus of the points whose distance from the $x-$axis is twice that of from the $y-$axis is**

A) $y^2 = 4x^2$ B) $4y^2 = x^2$ C) $y = 2x$ D) $x = 2y$

18. **The locus of the point $(\sec\theta + \tan\theta, \sec\theta - \tan\theta)$ is**

A) $x^2 + y^2 = 1$ B) $x^2 - y^2 = 1$ C) $xy = 1$ D) $xy + 1 = 0$

19. **If $A = (6,0)$ and $B = (0,4)$ and O is the origin, then the locus of P such that area of $\Delta POB = 2(area\ of\ \Delta POA)$**

A) $x^2 - 3y^2 = 0$ B) $x^2 - 9y^2 = 0$ C) $x^2 + 3y^2 = 0$ D) $x^2 - 4y^2 = 0$

20. **If the equation to the locus of the points equidistant from the points $(-2,3),(6,-5)$ is $ax + by + c = 0$ where $a > 0$, then ascending order of a,b,c is**

A) a,b,c B) c,b,a C) b,c,a D) a,c,b

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. **Find the value of** $\cot\frac{\pi}{20}\cot\frac{3\pi}{20}\cot\frac{5\pi}{20}\cot\frac{7\pi}{20}\cot\frac{9\pi}{20} =$

22. **Find the value of** $\sin^2 1^0 + \sin^2 2^0 + \sin^2 3^0 + \_\_\_\_\_ + \sin^2 180^0 =$

23. **Find the value of** $\sin^4\theta + 2\sin^2\theta\left(1 - \frac{1}{\cos ec^2\theta}\right) + \cos^4\theta =$

24. **The first point of trisection of the line segment joining $(2,3)$ and $(11,6)$ is (h,k) then $3h - 2k =$**

25. **Mid points of the sides AB and AC of ΔABC are $(3,5)$ and $(-3,-3)$ respectively then the length of BC =**

SECTION – I
(SINGLE CORRECT ANSWER TYPE)

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Marking scheme: +4 for correct answer, 0 if not attempted and -1 if not correct.

PHYSICS

SYLLABUS: **s – t, v – t, a – t v – h graph; Kinetic equations for uniform accelerated motion; freely falling body and its applications Relative velocity in 1D; Vertical projection of body from the ground; Vertical projection from the top of the tower**

26. **A stone is dropped from a height in a high wind. The wind exerts a steady force on the stone as it falls. The path of the body is**

A) Circle B) Straight line

C) Parabola D) Complicated to decide

27. **The acceleration of a moving body can be found from**

A) Area under velocity – time graph B) Area under distance – time graph

C) Slope of the velocity – time graph D) Slope of the distance – time graph

28. **Three bodies A, B, C are thrown from the top of a tower with the same speed . A is thrown straight up, B is thrown straight down and C is thrown horizontally. They hit the ground with speeds v_A, v_B and v_c respectively, then**

A) $v_A = v_B = v_c$ B) $v_A = v_B > v_c$ C) $v_A > v_B > v_c$ D) $v_A < v_B < v_c$

29. **A particle starts moving from rest under uniform acceleration. It travels a distance 'x' in the first two seconds and a distance 'y' in the next two seconds. If $y = nx$, then n =**

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

30. **The velocity of a freely falling body after t seconds is $49 ms^{-1}$. Its velocity after $(t+2)$ seconds will be in ms^{-1}**

A) 58.8 B) 68.6 C) 78.4 D) 88.2

31. **A body dropped from a height reaches the ground is 5s. the velocity with which it reaches the ground is**

A) 0 m/s B) 49 m/s C) 29 m/s D) 9.8 m/s

32. **Two bodies begin to fall freely from the same height. The second one begins to fall τ S after the first. The time after which the 1st body begins to fall, the distance between the bodies equal to l is**

A) $\frac{l}{g\tau} + \frac{\tau}{2}$ B) $\frac{g\tau}{l} + \tau$ C) $\frac{\tau}{\lg} + \frac{2}{\tau}$ D) $\frac{g}{l\tau} + \frac{\tau}{2}$

33. **A body released from the top of tower of height 'h' takes 'T' seconds to reach the ground. At (T/2) s is**

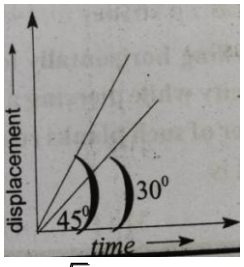
A) at $\frac{h}{16}$ from the ground B) at $\frac{h}{4}$ below the top of the tower

C) at $\frac{15h}{16}$ from the ground D) at $\frac{3h}{16}$ below the top of the tower

34. **Two balls are dropped simultaneously from two points separated by a vertical height of 6m. The distance of separation between them after next 2s is**

A) 9.8m B) 6m C) 12m D) Zero

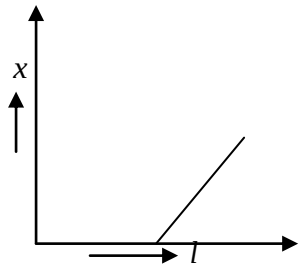
35. **The displacement – time graphs of two moving particles make angles of 30^0 and 45^0 with the x – axis. The ratio of the two velocity is**



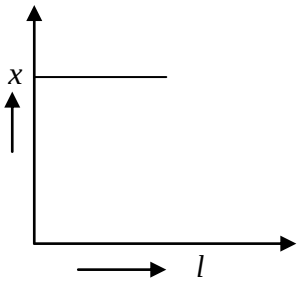
A) $\sqrt{3}:1$ B) $1:1$ C) $1:2$ D) $1:\sqrt{3}$

36. Which of the following cannot be the distance – time graph?

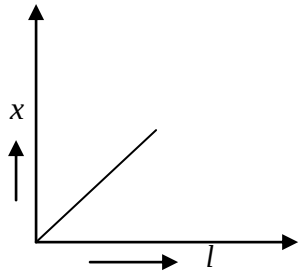
A)



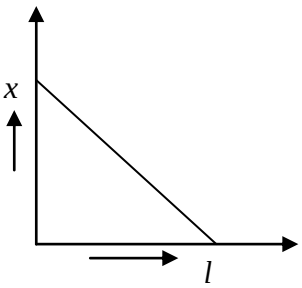
B)



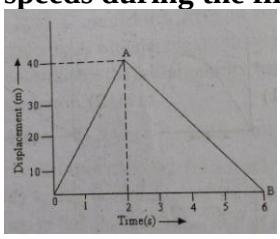
C)



D)



37. The displacement – time graph of a motion is shown in fig. the ratio of the magnitudes of the speeds during the first two seconds and the next four seconds is

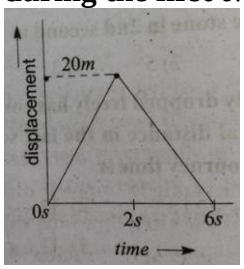


A) 1:1 B) 1:2 C) 2:1 D) $1:\sqrt{2}$

38. A bus accelerates uniformly from rest and acquires a speed of 36kmph in 10s. the acceleration is

A) $1m/s^2$ B) $2m/s^2$ C) $1/2m/s^2$ D) $3m/s^2$

39. For the displacement – time graph shown in figure, the ratio of the magnitudes of the speeds during the first two second and the next four second is



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

40. A body released from the top of a tower of height 'h' takes 'T' second to reach the ground. the position of the body at (T/4) second is

A) At $\frac{h}{16}$ from the ground B) At $\frac{3h}{4}$ above the ground

C) At $\frac{15h}{16}$ from the ground D) At $\frac{3h}{16}$ below the top of the tower

41. An electron starting from rest has a velocity that increases linearly with time that is $v = kt$ where $k = 2m/s^2$. Distance covered in first 3s will be

A) 9m B) 16m C) 27m D) 36m

42. An object falls from a bridge that is 45m above the water. It falls directly into a small row – boat moving with constant velocity that was 12m from the point of impact when the object was released. The speed of the boat is $\left(g = 10ms^{-2}\right)$

A) $3ms^{-1}$ B) $4ms^{-1}$ C) $5ms^{-1}$ D) $6ms^{-1}$

43. A car starts from rest and travels with uniform acceleration α for some time and then with uniform retardation β and comes to rest. If the total time of travel of the car is 't', the maximum velocity attained by it is given by

A) $\frac{\alpha\beta}{(\alpha+\beta)}t$ B) $\frac{1}{2}\frac{\alpha\beta}{(\alpha+\beta)}t^2$ C) $\frac{\alpha\beta}{(\alpha-\beta)}t$ D) $\frac{1}{2}\frac{\alpha\beta}{(\alpha-\beta)}t^2$

44. A ball is released from the top of a tower of height h meters. It takes T seconds to reach the ground. What is the position of the ball in T/3 seconds?

A) h/9 meters from the ground B) 7h/9 meters from the ground
C) 8h/9 meters from the ground D) 17h/9 meters from the ground

45. A freely falling body covers 44.1m in the last second of its journey. The total distance travelled by the body

A) 88.2m B) 66.2m C) 108.3m D) 122.5m

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.
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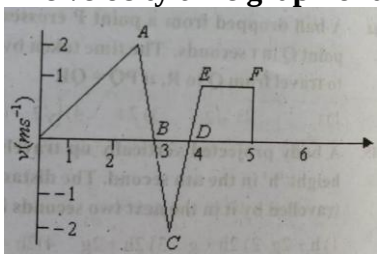
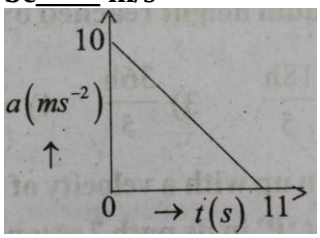
46. A body projected up with a velocity reached will be a maximum height of 100m. Another body projected up with double the initial velocity. The maximum height reached will be _____m

47. The velocity time graph of a body is as follows. What is the displacement in 5sec_____m?



48. The a – t graph is shown in the figure. The maximum velocity attained by the body will be____ m/s



49. A balloon s rising vertically with a velocity of 9.8 m/s. a packet is dropped from it when it is a height of 39.2m. Time taken by the packet to reach the ground is _____ sec

50. A stone is dropped from the top of a tower of height 45m. One second later another stone is thrown down from the top of the same tower. Both stone reach the ground at the same time. If $g = 10m/s^2$, magnitude of the initial velocity of the second stone is _____ m/s

SECTION – I
(SINGLE CORRECT ANSWER TYPE)

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CHEMISTRY

SYLLABUS: **Electromagnetic radiation and measurable characteristics of it, Problems on EMR Level-1: 24 to 28, Max planck's Quantum theory, Black body radiation, Photoelectric effect Problems on photoelectric effect, Level-1: 29 to 32, Bohr's model of an atom , hydrogen spectrum, Merits and demerits of Bohr's model, Energy of electron in Bohr's orbit and radius of the orbits, Problems on Energy, Radius, of Hydrogen and hydrogen like species. Level-1: 33 to 59**

51. On the basis of Bohr's model, the radius of the 3rd orbit is:
A) Equal to the radius of first orbit B) Three times the radius of first orbit
C) Five times the radius of first orbit D) Nine times the radius of first orbit

52. The distance between 4th and 3rd Bohr orbit of He^+ is:
A) $2.645\times10^{-10}m$ B) $1.322\times10^{-10}m$ C) $1.851\times10^{-10}m$ D) None of these

53. The kinetic and potential energy (in eV) of electron present in third Bohr's orbit of hydrogen atom are respectively
A) $-1.51,-3.02$ B) $1.51,-3.02$ C) $-3.02,1.51$ D) $1.51,-1.51$

54. The ratio of velocity of the electron in the third and fifth orbit of Li^{2+} would be
A) $3:5$ B) $5:3$ C) $25:9$ D) $9:25$

55. If radius of second stationary orbit is R then radius of third orbit will be
A) R/S B) 9R C) R/9 D) 2.25R

56. Which of the following statement does not from part of Bohr's model of the hydrogen atom?
A) Energy of the electrons in the orbit is quantized
B) The electron in the orbit which is nearest to the nucleus has the lowest energy
C) Electrons revolve in different orbits around the nucleus
D) The position and velocity of the electron in the orbit cannot be determined simultaneously

57. What is the separation energy (in eV) for electron present in the first excited state of Be^{3+} ?
A) 13.6 eV B) 27.2 eV C) 40.8eV D) 54.5 eV

58. Which of the following statement(s) is (are) consistent with the Bohr Theory of the atom (and no other)?
1) An electron can remain in a particular orbit as long as it continuously absorbs radiation of a definite frequency
2) The lowest energy orbits are those closest to the nucleus
3) All electrons can jump from the K shell to the M shell by emitting radiation of a definite frequency
A) 1, 2, 3 B) 2 only C) 3 only D) 1, 2

59. What is the energy content per photon (J) for light of frequency $4.2\times10^{14}\,Hz$?
A) 2.8×10^{-21} B) 2.5×10^{-19} C) 2.8×10^{-19} D) 2.5×10^{-18}

60. Assume that $2\times10^{-17}\,J$ of light energy is needed by the interior of the human eye to see an object. How many photons of yellow light with $\lambda=595.2nm$ are needed to generate this minimum energy?
A) 6 B) 30 C) 45 D) 60

61. Line spectra is characteristic of:
A) Molecules B) Atoms C) Radicals D) None of these

62. Electric transition in He^+ ion takes from n_2 to n_1 shell such that:

$2n_2 + 3n_1 = 18$

$2n_2 - 3n_1 = 6$

What will be the total number of photons emitted when electron transit to n_1 shell?

A) 21 B) 15 C) 20 D) 10

63. What is the shortest wavelength line in the paschen series of Li^{2+} ion

A) $\frac{R}{9}$ B) $\frac{9}{R}$ C) $\frac{1}{R}$ D) $\frac{9R}{4}$

64. Electron magnetic radiation (photon) with highest wavelength results when an electron in the hydrogen atom falls from $n = 6$ to:

A) $n = 1$ B) $n = 2$ C) $n = 3$ D) $n = 5$

65. Splitting of spectral lines under the influence of magnetic field is called

A) Zeeman effect B) Stark effect C) Photoelectric effect D) none of these

66. In photoelectric effect, the kinetic energy of photoelectron increases linearly with the

A) Wavelength of incident light B) Frequency of incident light

C) Velocity incident light D) Atomic mass of an electron

67. Electromagnetic radiation having $\lambda = 310A^0$ is subject to a metal sheet having work function $= 12.8eV$. What will be the velocity of photoelectrons having maximum kinetic energy?

A) 0, no emission will occur B) $4.352 \times 10^6 m/s$

C) $3.09 \times 10^6 m/s$ D) $8.72 \times 10^6 m/s$

68. Select the incorrect statement

A) K.E of photo – electron does not depend upon the wavelength of incident radiation

B) Photo electric current depends on intensity of incident radiation and not on frequency

C) Stopping potential depends on frequency of radiation and not on intensity

D) None of these

69. A dye absorbs a photon of wavelength λ and reemits the same energy into two photons of wavelength λ_1 and λ_2 respectively. the wavelength λ is related with λ_1 and λ_2 as :

A) $\lambda = \frac{\lambda_1 + \lambda_2}{\lambda_1 \lambda_2}$ B) $\lambda = \frac{\lambda_1 \lambda_2}{\lambda_1 + \lambda_2}$ C) $\lambda = \frac{\lambda_1^2 \lambda_2^2}{\lambda_1 + \lambda_2}$ D) $\lambda = \frac{\lambda_1 \lambda_2}{(\lambda_1 + \lambda_2)^2}$

70. The number of photons of light having wave number 'x' in 10J of energy source is:

A) $10hcx$ B) $\frac{hc}{10x}$ C) $\frac{10}{hcx}$ D) None of these

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.

71. What is the wavelength in nm of the spectral line associated with a transition from $n = 3$ to $n = 2$ for the Li^{2+} ion?

72. If radiation corresponding second line of "Balmer Series" of Li^{2+} ion, knocked out electron from first excited state of H – atom, the kinetic energy of ejected electron would be (in eV)

73. In a collection of H – atoms, all the electrons jump from n = 5 to ground state finally (directly or indirectly), without emitting any line in balmer series. The number of possible different radiations is:

74. What is the wave length (nm) of light emitted when the electron in a hydrogen atom undergoes transition from an energy level with n = 4 to an energy level with n =2 ?

75. Which Bohr's orbit of Be^{2+} has the same orbit radius as that of the ground state of hydrogen atom?

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INDIA

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KEY SHEET

MATHEMATICS

1) **B**	2) **A**	3) **B**	4) **B**	5) **A**	6) **D**	7) **C**	8) **B**	9) **C**	10) **D**
11) **A**	12) **D**	13) **B**	14) **D**	15) **B**	16) **C**	17) **A**	18) **C**	19) **B**	20) **A**
21) **1**	22) **90**	23) **1**	24) **7**	25) **20**					

PHYSICS

26) **B**	27) **C**	28) **A**	29) **C**	30) **B**	31) **B**	32) **A**	33) **B**	34) **B**	35) **D**
36) **D**	37) **C**	38) **A**	39) **B**	40) **C**	41) **A**	42) **B**	43) **A**	44) **C**	45) **D**
46) **400**	47) **3**	48) **55**	49) **4**	50) **12.5**					

CHEMISTRY

51) **D**	52) **C**	53) **A**	54) **B**	55) **D**	56) **D**	57) **D**	58) **B**	59) **C**	60) **D**
61) **B**	62) **D**	63) **C**	64) **D**	65) **A**	66) **B**	67) **C**	68) **A**	69) **B**	70) **C**
71) **73**	72) **19.55**	73) **6**	74) **4**	75) **2**					

HINTS & SOLUTIONS
MATHEMATICS

1. Given $\tan 20^0 = \lambda$

$$\cot 20^0 = \frac{1}{\tan 20} = \frac{1}{\lambda}$$

$$\frac{\tan(270-20)+\tan(360-20)}{\tan(180+20)-\tan(90+20)} = \frac{\cot 20 - \tan 20}{\tan 20 + \cot 20}$$

$$= \frac{\frac{1}{\lambda}-\lambda}{\lambda+\frac{1}{\lambda}} = \frac{1-\lambda^2}{1+\lambda^2}$$

2. **Given** $\alpha+\beta = 90^0$

$$\beta = 90^0 - \alpha$$

$$= \sin^2\alpha + \cos^2\alpha = 1$$

3. $\sin 120\cos 150 - \cos 240 \sin 330^0$

$$= \sin(180-60)\cos(180-30) - \cos(180+60)\sin(360-30)$$

$$= -\sin 60\cos 30 - \cos 60 \sin 30$$

$$= \frac{-\sqrt{3}}{2}\times\frac{\sqrt{3}}{2} - \frac{1}{2}\times\frac{1}{2} = \frac{-3}{4} - \frac{-1}{4} = \frac{-4}{4} = -1$$

4. $\cos\left(\frac{B+2C+3A}{2}\right) + \cos\left(\frac{A-B}{2}\right)$

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

$$= \cos\left(\frac{180+2A+C}{2}\right) + \cos\left(\frac{A-B}{2}\right)$$

$$= \cos\left(\frac{360-B+A}{2}\right) + \cos\left(\frac{A-B}{2}\right)$$

$$= -\cos\left(\frac{A-B}{2}\right) + \cos\left(\frac{A+B}{2}\right) = 0$$

5. **Given** $\theta \in Q_1$ and $\tan\theta = \frac{4}{5}$

$$\sin\theta = \frac{4}{\sqrt{41}}, \cos\theta = \frac{5}{\sqrt{41}}$$

$$\frac{5\sin\theta - 3\cos\theta}{\sin\theta + 2\cos\theta} = \frac{5\times 4}{\sqrt{41}} - 3\times\frac{5}{\sqrt{41}}$$

$$\frac{4}{\sqrt{41}} + 2\times\frac{5}{\sqrt{41}}$$

$$= \frac{\frac{20-15}{\sqrt{41}}}{\frac{4+10}{\sqrt{41}}} = \frac{5}{14}$$

6. **Put** $\theta_1 = \theta_2 = \theta_3 = 90^0$

Now $\cos\theta_1 + \cos\theta_2 + \cos\theta_3 = \cos 90^0 + \cos 90^0 + \cos 90^0 = 0$

7. Given $\sin\theta + \sin^2\theta = 1 \Rightarrow \sin\theta = 1 - \sin^2\theta = \cos^2\theta$

Now $\cos^2\theta+\cos^4\theta=\sin\theta+\sin^2=1$

8. Given $\cos\theta-\sin\theta=\sqrt{2}\sin\theta$

$\cos\theta=\sqrt{2}\sin\theta+\sin\theta$

$\cos\theta=\left(\sqrt{2}+1\right)\sin\theta$

$\left(\sqrt{2}-1\right)\cos\theta=\left(\sqrt{2}+1\right)\left(\sqrt{2}-1\right)\sin\theta$

$\sqrt{2}\cos\theta-\cos\theta=\sin\theta$

$\cos\theta+\sin\theta=\sqrt{2}\cos\theta$ (or) $\pm\sqrt{2}\cos\theta$

9. $\dfrac{\sec\theta+\tan\theta-1}{\tan\theta-\sec\theta+1}=\dfrac{\sec\theta+\tan\theta-\left(\sec^2\theta-\tan^2\theta\right)}{\tan\theta-\sec\theta+1}$

$=\dfrac{\left(\sec\theta+\tan\theta\right)\left(1-\sec\theta+\tan\theta\right)}{\tan\theta-\sec\theta+1}$

$=\sec\theta+\tan\theta$

10. $\cos5^0+\cos24^0+\cos175^0+\cos204^0+\cos300^0$

$=\cos5^0+\cos24^0-\cos5-\cos24+\cos60$

$=\cos60=\dfrac{1}{2}$

11. $A(3,2)\,B(x,-1)$

Given $PA=5$

$\Rightarrow(PA)^2=25$

$\Rightarrow(x-3)^2+(2+1)^2=25$

$\Rightarrow(x-3)^2=16$

$\Rightarrow x-3=\pm4$

$\Rightarrow x-3=4\,(or)\;x-3=-4$

$\Rightarrow x=7,-1$

12. The triangle formed by the points $(2,3),(2,5),(4,3)$ is right angle triangle at $(2,3)$ orthocenter is $(2,3)$

13. Circumcentre is only the point equidistance to given three non collinear points.

14. $A(2,-3)$, $B(5,6)$ $x-$axis divides $\overline{AB}$ in the ratio $-y_1:y_2$

$\Rightarrow-(-3):6$

$\Rightarrow1:2$

15. Centroid divides orthocentre and circumcentre in the ratio 2:1

16. Use area $=\dfrac{h}{2}(a+b)$

$=\dfrac{4}{2}(6+3)$

$=18$

17. Given $|y|=2|x|$ squaring on B.S $\Rightarrow y^2=4x^2$

18. $x=\sec\theta+\tan\theta;\; y=\sec\theta-\tan\theta$

Let $xy=\sec\theta^2-\tan^2\theta$

$\therefore xy=1$

19. $A(6,0),B(0,4),O(0,0)$ area of $\Delta POB=2(Area\ of\ POA)$

$\Rightarrow\dfrac{1}{2}|4x|=2\times\dfrac{1}{2}|-6y|$

$\Rightarrow |x| = |-3y|$

$\Rightarrow x^2 = 9y^2$

$\Rightarrow x^2 - 9y^2 = 0$

20. $A(-2,3),\ B(6,-5),\ P(x,y)$

Let $PA = PB$

$\Rightarrow (PA)^2 = (PB)^2$

$\Rightarrow (x+2)^2 + (y-3)^2 = (x-6)^2 + (y+5)^2$

$\Rightarrow x - y - 3 = 0$

Comparing with $ax + by + c = 0$

$a = 1,\ b = -1\ c = -3$

Ascending order is c, b, a

21. **Take** $\cot\frac{\pi}{20}\cot\frac{3\pi}{20}\cot\frac{5\pi}{20}\cot\frac{7\pi}{20}\cot\frac{9\pi}{20}$

$= \cot 9^0 \cot 27^0 \cot 45^0 \cot 63^0 \cot 81^0$

$= \cot 9^0 \cot 27^0 (1) \tan 27 \tan 9$

$= (\tan 9^0 \cot 9)(\tan 27 \cot 27^0) \times 1$

$= 1 \times 1 \times 1 = 1$

22. $\sin^2 1 + \sin^2 2 + \sin^2 3 + ... + \sin^2 180^0$

$= \sin^2 1 + \sin^2 2 + ... + \sin^2 90^0 + \sin^2 89^0 + ... + \sin^2 1 + 0$

$= 2(\sin^2 1 + \sin^2 2^0 + ... + \sin^2 89) + 1$

$= 2\left(44 + \frac{1}{2}\right) + 1 = \frac{2(89)}{2} + 1 = 89 + 1 = 90^0$

23. $\sin^4\theta + 2\sin^2\theta\left(1 - \frac{1}{\cos ec^2\theta}\right) + \cos^4\theta$

$= \sin^4\theta + 2\sin^2\theta(1 - \sin^2\theta) + \cos^4\theta$

$= (\sin^2\theta + \cos^2\theta)^2 = 1^2 = 1$

24. $A(2,3)\ B(11,6)$ first point of trisection divides $\overline{AB}$ in the ratio 1:2

$\Rightarrow \left(\frac{1(11)+2(2)}{1+2}, \frac{1(6)+2(3)}{1+2}\right)$

$= (5,4) = (h,k)$

Now $3h - 2k = 15 - 8 = 7$

25. $E = (3,5),\ F(-3,-3)$

Now $BC = 2EF$

$= 2(10) = 20$

PHYSICS

26. Conceptual

27. Conceptual

28. Conceptual

29. $S_1 = \frac{1}{2}at_1^2$

$S_1 + S_2 = \frac{1}{2}(t_1 + t_2)^2$

30. $gt = 49$

$g(t+2) = v$

31. $V = gt$

32 $S_1 = \frac{1}{2}gt^2, \quad S_2 = \frac{1}{2}g(t-\tau)^2$

$S_1 - S_2 = l$

33. $h \alpha t^2$

34. Separation between do not change

35. $V \alpha \tan\theta$

36. Distance cannot be negative

37. Slope of S – t curve for the first – 2sec is

$V_1 = \frac{20}{2} = 10$

For the next 4 sec

$V_2 = \frac{20}{4} = 5$

38. $a = \frac{v-u}{t}$

39. $v \alpha \frac{1}{t}$

40. $h \alpha t^2$

$T_1 = T$

$T_2 = \frac{T}{4}$

$h_2 = \frac{h}{16}$

$h^1 = h - \frac{h}{16} = \frac{15h}{16}$

41. $a = \frac{dv}{dt}$, $s = \frac{1}{2}at^2$

42. $t = \sqrt{\frac{2h}{g}} = 3\text{sec}$

$s = vt$

43. $t = t_1 + t_2 = \frac{v}{\alpha} + \frac{v}{\beta}$

44.

$h = \frac{1}{2}gt^2, \; h^1 = \frac{1}{2}g\left(\frac{T}{3}\right)^2$

$\frac{h_1}{h} = ?$

Height of the ball from the ground = $h - h^1$

45. $s_n = g\left(n - \frac{1}{2}\right)\ h = \frac{1}{2}gn^2$

46. $h \alpha u^2$

47. $s =$ area under the curve

48. Area under the graph $= \frac{1}{2} \times base \times height$

49. $h = -ut + \frac{1}{2}gt^2$

$t^2 - 2t - 8 = 0$

50. $h = \frac{1}{2}gt^2 \Rightarrow t = 3\text{sec}$

$h = u(t-1) + \frac{1}{2}g(t-1)^2$

$45 = 2u + 5(2)^2$

$u = 12.5 m/s$

CHEMISTRY

51. $r \alpha \frac{n^2}{z}; \frac{t_1}{r_2} = \frac{(1)^2}{(3)^2}$

52. $r = 0.529 \frac{n_2}{z} A^0$

$r_4 - r_3 = 0.529\left(\frac{16}{2} - \frac{9}{2}\right)A^0 = 1.851 \times 10^{-10} m$

53. Total energy of third shell $= \frac{-13.6}{3^2} = -1.51 eV$

KE = - total energy $\Rightarrow 1.51 eV$

PE = $2 \times T.E = -3.02 eV$

54. $\frac{V_1}{v_2} = \frac{n_2}{n_1} = \frac{5}{3}$

55. $\frac{\gamma_1}{\gamma_2} = \left(\frac{n_1}{n_2}\right)^2 = \frac{4}{9}$

56. **Conceptual**

57. For $Be^{3+}\ E_\infty - E_2 = 13.6\frac{z^2}{n^2}$

$= 13.6 \times \frac{4^2}{2^2} = 54.4 eV$

58. **Conceptual**

59. $E = h\nu = 6.62 \times 10^{-34} \times 4.2 \times 10^{14}$

$= 2.8 \times 10^{-19} J$

60. $E = n\frac{hc}{\lambda}$

$\Rightarrow \frac{2 \times 10^{-17}}{1.6 \times 10^{-19}} eV = n \times \frac{1240}{595.2} \times \frac{eV.nm}{nm}$

61. **Conceptual**

62. $n_1 = 2; n_2 = 6$

Total number of photon emitted $= \frac{(6-2)(6-2+1)}{2} = 10$

63. $\frac{1}{\lambda} = Rz^2\left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right] = R \times 3^2\left[\frac{1}{3^2} - \frac{1}{\infty^2}\right]$

$\lambda = \frac{1}{R}$

64. $\Delta E \alpha \frac{1}{\lambda}$ **for** $\lambda_{\max}, \Delta E_{\min}$

65. **Conceptual**

66. $h\nu = h\nu_0 + KE$

67. $\frac{1}{2}mv^2 = \frac{1240eVnm}{31nm} = 12.8eV = 27.2eV$

$= \frac{1}{2} \times 9.1 \times 10^{-81} \times v^2$

$= 27.2 \times 1.6 \times 10^{-19}$

$= 3.09 \times 10^6 m/s$

68. **Conceptual**

69. $E = E_1 + E_2$**;** $\frac{hc}{\lambda} = \frac{hc}{\lambda_1} + \frac{hc}{\lambda_2}$

$\Rightarrow \frac{hc}{\lambda} = hc\left(\frac{\lambda_2 + \lambda_1}{\lambda_1 \lambda_2}\right)$

$\lambda = \frac{\lambda_1 \lambda_2}{\lambda_1 + \lambda_2}$

70. $e = \frac{nhc}{\lambda} = nhc\bar{\nu}\left(\bar{\nu} = \frac{1}{\lambda}\right)$

$10 = nhc\bar{\nu}$ (or) $n = \frac{10}{hc\bar{\nu}} = \frac{10}{hcx}$

71. $\lambda = \frac{912}{9\left[\frac{1}{2^2} - \frac{1}{3^2}\right]} = 91.2 \times \frac{36}{9 \times 5} = 73nm$

72. **Energy of photon corresponding to second line of Balmer series for** Li^{2+} **ion**

$= (13.6) \times 3^2\left[\frac{1}{2^2} - \frac{1}{4^2}\right]$

$= 13.6 \times \frac{27}{16}$

Energy needed to eject electron from $n = 2$ level in $H-$atom

$= 13.6 \times 1^2 \times \left[\frac{1}{1^2} - \frac{1}{\infty^2}\right] \Rightarrow \frac{13.6}{4}$

K. E of ejected electron

$= 13.6 \times \frac{9 \times 3}{16} - \frac{13.6}{4} = 13.6 \times \left(\frac{27-4}{16}\right)$

$= 19.55eV$

73.

Total radiations are = 6

74. Conceptual

75. γ_1 of H – atom $0.529A^0$

γ_n (H like atom) $= \frac{n_2}{z} \times \gamma_1 \left(H - atom\right)$

γ_n of $Be^{2+} \Rightarrow \frac{n^2}{z} \times \gamma_1 \left(H - atom\right)$

$= 0.529A^0 \left(z = 4 \ for \ Be^{3+}\right)$

$\Rightarrow \frac{n^2}{z} \times 0.529 = 0.529$

$n^2 = z$

$n^2 = 4 = n = 2$

Paper Setters:

SNO	Subject	Name of the Paper Setter	Phone No	Branch
1	MATHS – A	JMR	9581070120	HYD CN
2	MATHS – B	CSR	9581070122	HYD CN
3	PHYSICS	KEDARESWAR	9959876462	HYD CN
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