SRIGAYATRI EDUCATIONAL INSTITUTIONS

INDIA

SR MPC | **JEE MAINS MODEL WEEK END-2** | **Date:17-05-2020**

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 (A), (B), (C) and (D) 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: ***MA: Quadratic Expressions and équations. MB : Indéfinité Intégration (up to 6.2 ex)***

1. **If α,β are the roots of $=3x^2+5x-7=0$, then $\frac{1}{(3\alpha+5)^2}+\frac{1}{(3\beta+5)^2}=$**

A) $\frac{-17}{21}$ B) $\frac{67}{21}$ C) $\frac{67}{441}$ D) $\frac{76}{441}$

2. **If $20^{(3-2x^2)}=\left(40\sqrt{5}\right)^{(3x^2-2)}$ then x =**

A) $\pm\sqrt{\frac{13}{12}}$ B) $\pm\sqrt{\frac{12}{13}}$ C) $\pm\sqrt{\frac{4}{5}}$ D) $\pm\sqrt{\frac{5}{4}}$

3. **For the equation $3x^2+px+3=0, p>0$, if one of the root is square of the other, then p =**

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

4. **In a triangle PQR, $\angle R=\frac{\pi}{2}$. If $\tan\left(\frac{P}{2}\right)$ and $\tan\left(\frac{Q}{2}\right)$ are the roots of $ax^2+bx+c=0, a\neq 0$ then**

A) $a=b+c$ B) $c=a+b$ C) $b=c$ D) $b=a+c$

5. **If $x^2-(5m-2)x+4m^2+10m+25=0$ is a perfect square then m =**

A) $4,9$ B) $3,\frac{4}{3}$ C) $8,\frac{-4}{3}$ D) $2,\frac{3}{4}$

6. **The product of roots of the equation, $5x^2-4x+2+k(4x^2-2x-1)=0$ is 2 then k =**

A) $\frac{-8}{9}$ B) $\frac{8}{9}$ C) $\frac{4}{9}$ D) $\frac{-4}{9}$

7. **If r is the ratio of the roots of $ax^2+bx+c=0$ then $\frac{(r+1)^2}{r}=$**

A) $\frac{b}{ac}$ B) $\frac{2b}{a}$ C) $\frac{b^2}{ac}$ D) $\frac{2b}{c}$

8. **If $3+4i$ is a root of $x^2+px+q=0$ then $(p,q)=$**

A) $(6,25)$ B) $(6,1)$ C) $(-6,-7)$ D) $(-6,25)$

9. **If α,β are the roots of $x^2+px+1=0$ and γ,δ are the roots of $x^2+qx+1=0$ then $(\alpha-\gamma)(\beta-\gamma)(\alpha+\delta)(\beta+\delta)=$**

A) q^2-p^2 B) p^2-q^2 C) p^2+q^2 D) p^2q^2

10. **If** α,β **are two roots of** $2x^2+x+3=0$ **then** $\frac{(1-\alpha)(1-\beta)}{(1-\alpha)(1+\beta)}$ **is**

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

11. $\int\frac{1+\cos^2 x}{\sqrt{1+\cos 2x}}dx$

A) $Tan\,x-x+c$ B) $\cot x+x+c$ C) $\frac{Tan\,x}{2}+x+c$ D) $\frac{1}{2}(Tan\,x+x)+c$

12. $\int\frac{1}{1+e^{-x}}dx$

A) $1+e^x+c$ B) $\frac{1}{2}(1+e^x)+c$ C) $\log|1+e^x|+c$ D) $\frac{1}{2}\log|1+e^x|+c$

13. **If** $\int\frac{\sin 2x}{a^2\cos^2 x+b^2\sin x}dx=\ k\log|a^2\cos^2 x+b^2\sin^2 x|+c$ **then k =**

A) $\frac{1}{b^2-a^2}$ B) $\frac{1}{(b^2-a^2)^2}$ C) $\frac{1}{a^2-b^2}$ D) $\frac{1}{a^2+b^2}$

14. $\int\frac{\sin^{10}x}{\cos^{12}x}dx=$

A) $\frac{Tan^{11}x}{11}+c$ B) $\frac{Tan^{10}x}{10}+c$ C) $10\,Tan^7x+c$ D) $\frac{Tan^9x}{10}+c$

15. $\int\frac{Tan\,x-Tan\frac{x}{2}}{1+Tan\,x\,Tan\frac{x}{2}}dx$

A) $\log\left|\sec\frac{x}{2}\right|+c$ B) $\log\left|\cos\frac{x}{2}\right|+c$ C) $2\log\left|\sec\frac{x}{2}\right|+c$ D) $2\log\left|\cos\frac{x}{2}\right|+c$

16. $\int\frac{x^3\tan^{-1}(x^4)}{1+x^8}dx$

A) $\frac{\tan^{-1}(x^4)}{4}+c$ B) $\frac{x^3\tan^{-1}(x^4)}{4}+c$ C) $\frac{1}{8}(\tan^{-1}(x^4))^2+c$ D) $\frac{x^3\tan^{-1}(x^4)}{8}+c$

17. $\int\frac{\sin^2\alpha-\sin^2 x}{\cos x-\cos\alpha}dx=f(x)+Ax+B$ **and** $B\in R$ **then**

A) $f(x)=2\sin x\quad A=\cos\alpha$ B) $f(x)=2\sin x\quad A=2\cos\alpha$

C) $f(x)=\sin x\quad A=\cos\alpha$ D) $f(x)=\sin x\quad A=2\cos\alpha$

18. **If** $\int(\sin 2x-\cos 2x)dx=\frac{1}{\sqrt{2}}\sin(2x-a)+b$ **then**

A) $a=\frac{\pi}{4},b\in R$ B) $a=-\frac{\pi}{4},b\in R$ C) $a=\frac{5\pi}{4},b\in R$ D) $a=\frac{-5\pi}{4},b\in R$

19. $\int\frac{4\sec^2 x\,Tanx}{\sec^2 x+Tan^2x}dx=\log|1+f(x)|+c$ **then** $f(x)=$

A) $2\sin^2 x$ B) $2\cos^2 x$ C) $2Tan^2x$ D) $2\cot^2 x$

20. $\int \frac{\left(x-x^3\right)^{\frac{1}{3}}}{x^4}dx$

A) $\frac{3}{8}\left(\frac{1}{x^2}-1\right)^{\frac{4}{3}}+c$ B) $-\frac{3}{8}\left(\frac{1}{x^2}-1\right)^{\frac{4}{3}}+c$ C) $\frac{3}{8}\left(1-\frac{1}{x^2}\right)^{\frac{4}{3}}+c$ D) $-\frac{3}{8}\left(1-\frac{1}{x^2}\right)^{\frac{4}{3}}+c$

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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21. **The sum of the non-real roots of** $\left(x^2+x-2\right)\left(x^2+x-3\right)=12$ **is** _____

22. **Given** α *and* β **are the roots of the quadratic equation** $x^2-4x+k=0\left(k\neq 0\right)$**. If** $\alpha\beta,\alpha\beta^2+\alpha^2\beta,\alpha^3+\beta^3$ **are in geometric progression, then the value of 7k =** _____**.**

23. $\int \sec^2 x\cos ec^4 x\,dx=-\frac{1}{3}\cot^3 x+k\tan x-2\cot x+c$ **then k =**

24. **If** $\int \frac{1}{x^2-13x+42}dx=\log\left|\frac{x-a}{x-b}\right|+c$ **then a + b =**_____

25. $\int \frac{1+x}{1+\sqrt[3]{x}}dx=lx+mx^{\frac{4}{3}}+nx^{\frac{5}{3}}+c$ **Then** $1+m+n=$_____

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PHYSICS

SYLLABUS: ***Speed of transverse wave, longitudinal wave speed of sound in solids, gases, Newton's formula, La place correction , Principle of superposition, Reflection of waves, standing waves***

26. **The equation of the wave is given by** $y=10\sin\left[\frac{2\pi t}{30}+\alpha\right]$**.If the displacement is 5cm at t =0 then total phase at t= 7.5sec will be**

A) $\left(\frac{2\pi}{3}\right)rad$ B) $\left(\frac{2\pi}{5}\right)rad$ C) $\left(\frac{\pi}{5}\right)rad$ D) $\left(\frac{\pi}{2}\right)rad$

27. **If the length of a stretch sting is shortened by** 40% **and tension is increased by** 44% **then the ratio of the final and initial fundamental frequency is**

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

28. **At what temperature is the velocity of sound in a gas is twice the velocity of sound in the same gas at** 27^0C

A) 54^0C B) 627^0C C) 927^0C D) 327^0C

29. An open and closed organ pipe have the same length. The ratio of p^{th} mode of frequency of vibration of two pipes is

A) 1 B) p C) $p(2p+1)$ 4) $\frac{2p}{2p-1}$

30. A pressure of 100k pa causes a decrease in volume of water by 5×10^{-3} percent. The speed of sound in water is

A) 1414 m/s B) 1000 m/s C) 2000 m/s D) 3000 m/s

31. A sound wave of frequency 1360 Hz falls from normally on a perfectly reflecting wall. The shortest distance from the wall at which the air particles have maximum amplitude of vibration is

A) 25 cm B) 6.25 cm C) 62.5 cm D) 2.5 cm

32. The speed of sound in oxygen O_2 at a certain temperature is $460\,m/s$ .The speed of sound in helium (He) at the same temperature will be (assume both gasses to be ideal)

A) $1460\,m/s$ B) $1421\,m/s$ C) $650\,m/s$ D) $330\,m/s$

33. A ratio of speed of sound in nitrogen gas to that in helium at 300 k is

A) $\sqrt{\frac{2}{7}}$ B) $\sqrt{\frac{1}{7}}$ C) $\frac{\sqrt{3}}{5}$ D) $\frac{\sqrt{16}}{5}$

34. Equation of travelling wave on a stretched string of linear density 5 g/m is $y=0.03\sin(450t-9x)$ .Where distance and time are measured in SI units. The tension in the string is

A) 12.5 N B) 7.5 N C) 10 N D) 5 N

35. A uniform string of length 20 m is suspended from a rigid support. A short wave pulse is introduced at its lowest end. It starts moving up the string. The time taken to reach the support is (take $g=10\,m/s^2$)

A) $2\pi\sqrt{2}$ sec B) 2 sec C) $2\sqrt{2}$ sec D) $\sqrt{2}$ sec

36. A pipe of length 85 cm is closed from one end find the number of possible natural oscillations of air column in the pipe whose frequencies lie below 1250 Hz. The velocity of sound in air is 340 m/s

A) 12 B) 8 C) 6 D) 4

37. A cylindrical tube open at both ends has a fundamental frequency f in air. The tube is dipped vertically in water so that half of its in water .The fundamental frequency of the air column is now

A) f B) $\frac{f}{2}$ C) $\frac{3f}{4}$ D) 2f

38. Two waves produce displacement at a point given by $y_1=a\sin wt$ and $y_2=a\sin\left(wt+\frac{\pi}{2}\right)$ .The resultant of amplitude is

A) 0 B) 2a C) $a\sqrt{2}$ D) $\frac{a}{\sqrt{2}}$

39. Two sound waves travelling in same direction are represented by equation $y_1=A_1\sin 504\pi t$ and $y_2=A_2\sin 512\pi t$ .These two sound waves super impose to produce beats. The intensity of sounds charges from minimum to maximum in a time if

A) $\frac{1}{2S}$ B) $\frac{1}{4S}$ C) $\frac{1}{8S}$ D) $\frac{1}{16S}$

40. In order to double the frequency of the fundamental note emitted by a stretched string .The length is reduced to $\frac{3}{4}th$ of the original length and tension is charged. The factor by which the tension is to be charged is

A) $\frac{3}{8}$ B) $\frac{2}{3}$ C) $\frac{8}{9}$ D) $\frac{9}{4}$

41. Two uniform strings A and B made of steel are made to vibrate under the same tension. It is the first overtone of A is equal to second overtone of B and if the radius of A is twice that of B, the ratio pf length of stings is

A) 1:2 B) 1:3 C) 1:4 D) 1:5

42. A stretched string of length 1m fixed 1m fixed on the both ends, having mass of $5\times10^{-4}kg$ is under a tension of 20N. If is plucked at a point situated at 25cm from one end. The string would vibrate with frequency of

A) 400 Hz B) 100 Hz C) 200 Hz D) 256 Hz

43. A sound wave of length 90cm in glass is retracted into air with a velocity of 330 m/s. If the velocity of sound in glass is 5400 m/s, then the wave length of sound wave in air is

A) 11 cm B) 2.75 cm C) 22 cm D) 5.5 cm

44. Organ pipes of lengths $l_1, l_1 \text{ and } l_3$ emit notes of frequency $n_1, n_2 \text{ and } n_3$. If l_1, l_2, l_3 are in A.P. Then n_2 is

A) $\frac{2n_1n_3}{n_1+n_3}$ B) $\frac{n_1+n_3}{2}$ C) $\sqrt{n_1n_3}$ D) $\sqrt{\frac{n_1^2+n_3^2}{2}}$

45. Fundamental frequency of an open organ pipe is in resonance with first overtone of a closed pipe. The ratio of their lengths

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

SECTION-II
(Numerical Value Answer Type)

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46. A transverse wave propagating on a stretched string of linear density $3\times10^{-4}kg\,m^{-1}$ is represented by the equation $y=0.2\sin(1.5x+60t)$ where x is in meter and t is in sec. The tension in the string in N is _____

47. A tube of certain diameter and of length l is open at both the ends. The radius of tube is 2cm, the end correction in cm is _____

48. Standing waves are produced in 10cm long stretched wire. If the wire vibrates in 5 segments and wave velocity is 20 m/s the frequency in Hz is _____

49. An open pipe 30cm long and a closed pipe 23 cm long both of the same diameter are each sounding its first overtone and there are in unison, The end correction of these pipes in cm is _____

50. A closed organ pipe has a fundamental frequency of a 1.5 khz. The number of overtones that can be distinctly head by a person with this organ pipe will be (Assume that the highest frequency of a person can hear is 20000 Hz _____

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CHEMISTRY

SYLLABUS: **Solutions[from solubility to osmotic pressure].**

51. As the temperature increases, vapour pressure of a liquid
A) decreases linearly B) increases linearly
C) decreases exponentially D) increases exponentially

52. Which of the following is a colligative property
A) vapour pressure of a liquid B) freezing point
C) elevation in boiling point D) boiling point

53. Which of the following is having higher vapour pressure at same temperature?
A) C_2H_5OH B) H_2O C) $CH_3-O-C_2H_5$ D) C_6H_6

54. The V.P of a dilute aqueous solutions of glucose is 750 torr at 373k. The mole fraction of solute is
A) $\frac{1}{76}$ B) $\frac{1}{7.6}$ C) $\frac{1}{38}$ D) $\frac{1}{10}$

55. Isotonic solutions have
A) same boiling point B) same melting point
C) same osmotic pressure D) same vapour pressure

56. For which of the following Raoult's law is not applicable
A) $NaCl$ B) Glucose C) $Al_2(SO_4)_3$ D) Both 1 & 3

57. The rise in boiling point if a solution containing 1.8 g of glucose in 100 g of solvent is 0.1^0c. The molal elevation constant of the liquid is
A) 0.01 k/m B) 0.1 k/m C) 1 k/m D) 10 k/m

58. The boiling point of 0.1 molal glucose solution will be (given k_b for water is $0.52\,k.kg\,mol^{-1}$)
A) 100.052^0C B) 100.1^0C C) 100.26^0C D) 102.6^0C

59. Which of the following 0.10 m aqueous solution will have the lower freezing point?
A) $Al_2(SO_4)_3$ B) $C_6H_{12}O_6$ C) $C_{12}H_{22}O_{11}$ D) KI

60. At high altitudes, the boiling point of water lowers because
A) Temperature is low B) Atmospheric pressure is low
C) Atmospheric pressure is high D) All the above

61. The weight in grams of nonvolatile solute $(Mol.wt:60)$ **to be dissolved in 90 g of water to produce** a relative lowering of vapour pressure of 0.02 is
A) 4 B) 8 C) 6 D) 10

62. Which of the following solution pairs can be separated into its pure components by fractional distillation?
A) Water- C_2H_5OH B) Water- HCl C) Benzene- toluene D) Water- HNO_3

63. Which of the following solution pair will not form an ideal solution?
A) CCl_4+SiCl_4 B) $C_6H_{14}+C_7H_{16}$ C) $C_2H_5Br+C_2H_5I$ D) $H_2O+C_2H_5OH$

64. The relative lowering of vapour pressure of 0.4 molal solution in which solvent is Benzene is
A) 31.2×10^{-4} B) 31.2×10^{-3} C) 31.2×10^{-1} D) 3.12×10^{-1}

65. 18 g of non-volatile solute is dissolved in 900 g of water such that the relative lowering of vapour pressure is 0.0019. The molecular weight of the solute is
A) 60 B) 342 C) 189 D) 18

66. Raoult's law is applicable
i) To dilute solutions only **ii) When the solute is nonvolatile**
iii) If the solution behaves ideally **iv) If the solute doesn't dissociate or associate**
Correct combination is
A) i,ii only B) ii, iii only C) iii,iv only D) i,ii,iii and iv

67. The vapour pressure of water at 20^0C is 17.5mmHg. If 18 g of glucose is added to 178.2g of water at 20^0C, the vapour pressure of the resulting solution will be
A) 15.750 mmHg B) 16.500 mmHg C) 17.325 mmHg D) 17.675mmHg

68. **Henry's Law constant for** CO_2 in water is 1.67k 5 bar at 25^0C. The quantity of CO_2 in 1000 ml of soda water when packed under bar CO_2 pressure at 25^0C is

A) 0.084 mol B) 0.167 mol C) 0.252 mol D) 0.336 mol

69. **If** P^0 = the vapour pressure of pure solvent and P = the vapour pressure of a solution obtained by dissolving a non volatile solute in it , the lowering of vapour pressure of a solution is given by

A) $P - P^0$ B) $\frac{P^0 - P}{P^0}$ C) $P^0 - P$ D) $\frac{P^0 - P^0}{P^0}$

70. **The solubility of NaCl in water**

A) Increase with increase in temperature

B) decrease with increase in temperature

C) First increase and then decrease

D) Neither increases nor decreases i.e solubility in not influenced by temperature

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71. **Vapour pressure in mmHg of 0.1 mole of urea in 180g of water at** 25^0C **is (the vapour pressure of water at** 25^0C **is 24mmHg)_____**

72. **6g of a non volatile, non electrolyte x dissolved in 100 g of water freezer at** -0.93^0C **.The molar mass of x in** $g\,mol^{-1}$ **is (kf of** $H_2O = 1.86k\,kg\,mol^{-1}$**) _____**

73. **The solubility of** N_2 **in water at 300 k and 500 torr partial pressure is 0.1g** L^{-1} **. The solubility** $\left(in\ gL^{-1}\right)$ **at 750 torr partial pressure is _____**

74. **At** 27^0C **, the osmotic pressure of a solution containing 4g of non-electrolyte solute in 1.0L of solution is 0.4 atm the molar mass of the solute in** $gmol^{-1}$ **is _____**

75. **The vapour pressure in mm of Hg of an aqueous solution obtained by adding18 g of glucose to 180 g of water at** 100^0C **is _____**

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