FSRG1
Code-A1

MM : 360 Term Exam. Test - 1 **Time : 3 Hrs.**

for

First Step JEE (Main & Advanced) 2019

Topics covered :

Physics : Units & Measurement, Motion in a Straight Line.

Chemistry : Some Basic Concepts of Chemistry, Structure of Atom, Classification of Elements and Periodicity in properties.

Mathematics : Sets, Relations & Functions (XI Syllabus).

Instructions :

(i) Duration of Test is 3 hrs.

(ii) The Test booklet consists of 90 questions. The maximum marks are 360.

(iii) There are **three** parts in the question paper A, B, C consisting of **Physics**, **Chemistry** and **Mathematics** having 30 questions in each part of equal weightage. Each question is allotted 4 **(four)** marks for each correct response.

(iv) From total score one fourth (¼) marks will be deducted for indicating incorrect response of each question. No deduction from the total score will be made if no response is indicated for an item in the answer sheet.

[PART - A : PHYSICS]

Choose the correct answer :

1. Which of the following measurements is most precise?

(1) 5.00 mm (2) 5.00 cm

(3) 5.00 m (4) 500 km

2. You measure two quantities as $A = 1.0\text{ m} \pm 0.2\text{ m}$ and $B = 2.0\text{ m} \pm 0.2\text{ m}$. We should report correct value for $\sqrt{AB}$ as

(1) 1.4 m ± 0.4 m

(2) 1.4 m ± 0.1 m

(3) 1.4 m ± 0.3 m

(4) 1.4 m ± 0.2 m

3. The number of significant figure in 34.00 m is

(1) 4 (2) 3

(3) 2 (4) 1

4. A wire has length $l = (6 \pm 0.06)$ cm, radius $r = (0.5 \pm 0.005)$ cm and mass $m = (0.3 \pm 0.003)$ g. Maximum percentage error in density is

(1) 4 (2) 2

(3) 1 (4) 6.8

5. A body starts from rest and travels 120 m along a straight line in the 8^{th} second, then the distance travelled by body in first 4 seconds is

(1) 128 m (2) 64 m

(3) 256 m (4) 160 m

6. The displacement of the particle moving along x-axis with respect to time is given by $x = at + bt^2 - ct^3$. The dimension of c is

(1) T^{-3} (2) LT^{-1}

(3) LT^{-3} (4) LT^{-2}

7. A particle moves along x-axis. At a time t (in seconds) the position of particle is given by

$$x = 40 + 12t - t^3$$

The position of the particle when it comes to rest is

(1) 24 m (2) 40 m

(3) 56 m (4) 16 m

8. A ball is dropped from a high rise platform at $t = 0$ starting from rest. After 6 seconds another ball is thrown downwards from the same platform with speed v. The two balls meet at $t = 18$ s. The value of v is [Take $g = 10$ m/s^2]

(1) 75 ms^{-1} (2) 55 m/s

(3) 40 m/s (4) 60 ms^{-1}

9. In a planetary motion, the areal velocity $\left(\frac{dA}{dt}\right)$ of position vector of a planet depends on the angular velocity (ω) and the distance of the planet from sun (r). If so, the correct relation for areal velocity is

(1) $\frac{dA}{dt} \propto \omega r$ (2) $\frac{dA}{dt} \propto \omega r^2$

(3) $\frac{dA}{dt} \propto \omega^2 r$ (4) $\frac{dA}{dt} \propto \sqrt{\omega r}$

10. The dimensional formula of the product of two quantities P and Q is ML^2T^{-2}. The dimensional formula for P/Q is MT^{-2}, P and Q respectively are

(1) Force, Velocity

(2) Momentum, Displacement

(3) Force, Displacement

(4) Work, Velocity

11. A body is thrown vertically upward and reaches maximum height in time 't' seconds. The total time from the time of projection to reach a point at half of its maximum height while returning (in seconds) is

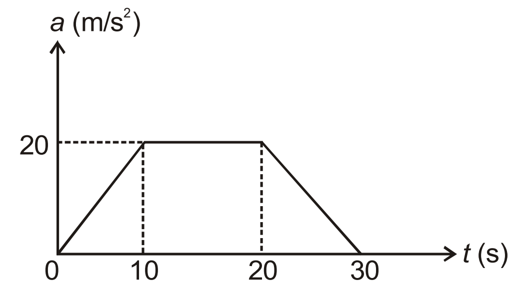
(1) $\sqrt{2}t$

(2) $\left(1+\frac{1}{\sqrt{2}}\right)t$

(3) $\frac{3}{2}t$

(4) $\frac{t}{\sqrt{2}}$

12. For the acceleration-time graph given below



The average acceleration in $t = 0$ to 20 seconds is

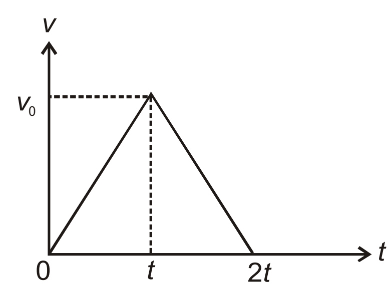
(1) 10 ms^{-2}

(2) 15 ms^{-2}

(3) 20 ms^{-2}

(4) 18 ms^{-2}

13. For the given velocity-time (v-t) graph of a particle moving in a straight line, the position-time (x-t) graph is



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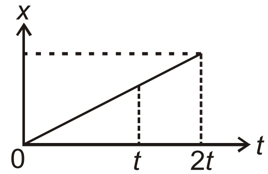
(1)



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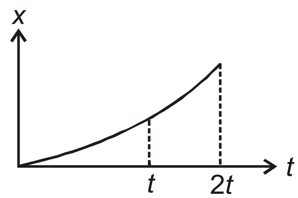

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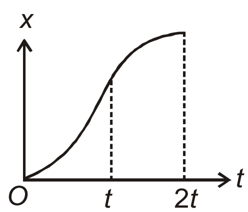

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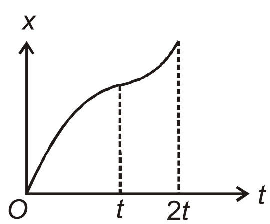
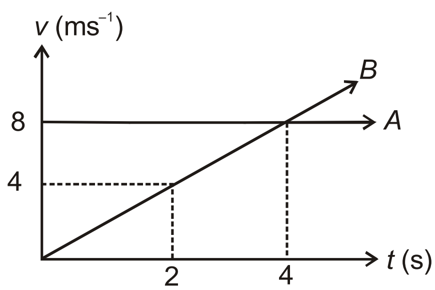


14. The velocity-time graph of particles A and B moving in a straight line is shown below. Initially both the particles are at same position, then



(1) Both particles A and B will meet at t = 4 sec

(2) Both particles A and B will meet at t = 6 sec

(3) Both particles A and B will meet at t = 8 sec

(4) A and B will never meet

15. A particle is moving along the x-axis whose instantaneous speed (v) is given by $v^2 = 108 - 9x^2$, where x is position of the particle. The acceleration of the particle is

(1) $-9x$ (2) $-18x$

(3) $-\frac{9}{2}x$ (4) $-\frac{9}{4}x$

16. B_1 and B_2 are two balloons ascending with velocities v and $2v$ respectively. If a stone is dropped from each when they are at same height then

(1) Stone from B_1 will reach the ground first

(2) Stone from B_2 will reach the ground first

(3) Both stones will reach the ground simultaneously

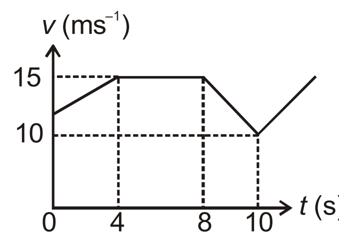
(4) It cannot be determined

17. A train is moving at a constant speed v when its driver observed another train in front of him on the same track and moving in the same direction with constant speed u. If the distance between the trains is x, then what should be the minimum retardation of the train so as to avoid collision?

(1) $\frac{(u+v)^2}{x}$ (2) $\frac{(v-u)^2}{x}$

(3) $\frac{(v+u)^2}{2x}$ (4) $\frac{(v-u)^2}{2x}$

18. The velocity-time graph of a particle moving in a straight line is shown in the figure. The acceleration of the particle at t = 9 s is



(1) Zero (2) $\frac{5}{2}$ ms^{-2}

(3) $\frac{-5}{2}$ ms^{-2} (4) -2 ms^{-2}

(Space for Rough Work)

19. In the relation $y = A \sin(\omega t - kx)$, the dimension of ω/k is

(1) $M^0L^0T^0$ (2) M^0LT^{-1}

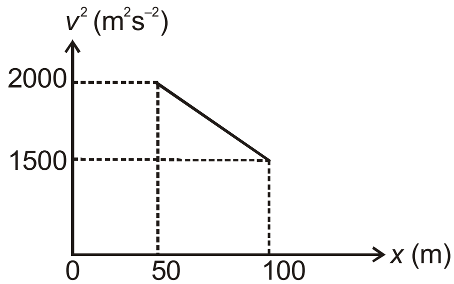
(3) $M^0L^0T^{-1}$ (4) $M^0L^{-1}T^{-1}$

20. A length is measured as 5.60 m and converted into another unit then this is same as

(1) 5600 mm (2) 0.0056 km

(3) 560 cm (4) 56 dm

21. Referring to v^2 - x graph of motion of a particle, the acceleration of the particle is

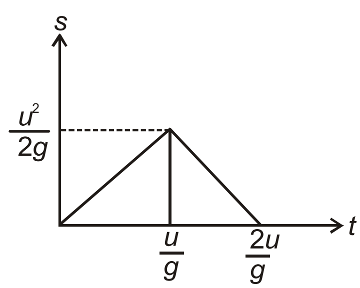


(1) 5 ms^{-2} (2) –5 ms^{-2}

(3) $\frac{5}{2}$ ms^{-2} (4) Zero

22. An object is thrown vertically upward under gravity with initial velocity u. Then the displacement-time (s-t) graph for the motion is shown as

(1)



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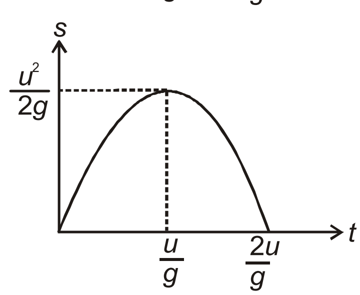

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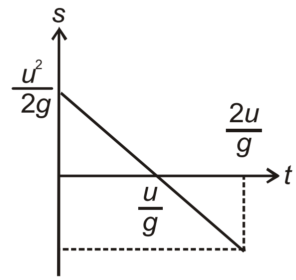

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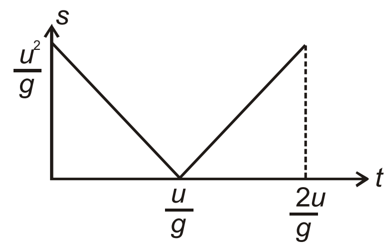
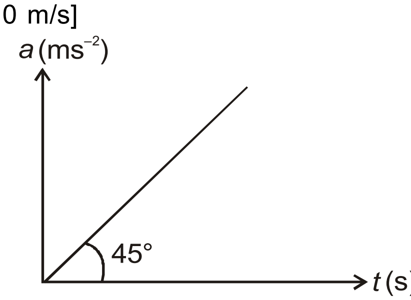


23. A police van moving on a highway with a velocity 30 kmh^{-1}, fires a bullet at thief's car speeding away in same direction with a speed of 192 kmh^{-1}. If the muzzle speed of the bullet is 150 ms^{-1}, with what speed does the bullet hit the thief's car?

(1) 105 ms^{-1} (2) 95 ms^{-1}

(3) 103 ms^{-1} (4) 101 ms^{-1}

24. The acceleration-time (a-t) graph of a particle moving in a straight line is shown below. The displacement of particle in the time interval from t = 2 s to t = 4 s is [given that at t = 0 s, velocity v = 0 m/s]



(1) $\frac{14}{3}$ m (2) $\frac{21}{3}$ m

(3) $\frac{16}{3}$ m (4) $\frac{28}{3}$ m

(Space for Rough Work)

25. If the dimensions of a physical quantity is given by $M^aL^bT^c$, then the physical quantity will be

(1) Velocity if $a = 1$, $b = 0$, $c = -1$

(2) Acceleration if $a = 1$, $b = 1$, $c = -2$

(3) Force if $a = 0$, $b = -1$, $c = -2$

(4) Pressure if $a = 1$, $b = -1$, $c = -2$

26. A body of mass = 3.513 kg is moving along the x-axis with speed of 5.00 ms^{-1}. The magnitude of its momentum is recorded as

(1) 17.6 kg ms^{-1} (2) 17.565 kg ms^{-1}

(3) 17.56 kg ms^{-1} (4) 17.57 kg ms^{-1}

27. A lift is coming from 8^{th} floor to 4^{th} floor and is just about to reach 4th floor. Taking ground floor as origin and positive direction upward for all quantities, which one of the following is correct?

Given (x is displacement, v is velocity and a is acceleration)

(1) $x < 0$, $v < 0$, $a > 0$

(2) $x > 0$, $v < 0$, $a < 0$

(3) $x > 0$, $v < 0$, $a > 0$

(4) $x > 0$, $v > 0$, $a < 0$

28. The position of a particle is given by $x = (t - 2)^2$, where x is in metre and t is in second. The distance covered by the particle in first 4 seconds is

(1) 4 m (2) 8 m

(3) 12 m (4) 16 m

29. A force F is applied perpendicular on a square plate of side L. If the percentage error in the determination of L is 2% and that in the F is 4%, what is the maximum permissible error in pressure?

(1) 8% (2) 6%

(3) 4% (4) 2%

30. Given that $y = A\sin\left[\frac{2\pi}{\lambda}(Ct - x)\right]$, where y and x are positions and t is time. Which of the following statement is true?

(1) The unit of λ is same as that of x and A

(2) The unit of λ is same as that of x but not of A

(3) The unit of C is same as that of $\frac{2\pi}{\lambda}$

(4) The unit of $(Ct - x)$ is same as that of $\frac{2\pi}{\lambda}$

[PART - B : CHEMISTRY]

31. Oxygen can be prepared by the catalytic decomposition of potassium chlorate ($KClO_3$). Decomposition of potassium chlorate gives potassium chloride (KCl) and oxygen (O_2). The mass $KClO_3$ decomposed to produce 3.6 mol of oxygen is (K = 39, Cl = 35.5, O = 16)

(1) 196 g (2) 245 g

(3) 294 g (4) 168 g

32. The de-Broglie wavelength associated with an electron which moves with kinetic energy of 4×10^{-19} J

(1) 77×10^{-8} cm (2) 6.53×10^{-8} cm

(3) 65.3×10^{-8} cm (4) 7.7×10^{-8} cm

33. The element with atomic number 63 belongs to

(1) s-block

(2) p-block

(3) d-block

(4) f-block

34. Among the following, the minimum number of molecules is present in

(1) 20 g of SO_3

(2) 2 gram molecules of MgO

(3) 49 g of H_2SO_4

(4) 11.2 L of CO_2 at STP

(Space for Rough Work)

35. The magnetic moment of $_{42}Mo$ is found to be 5.916 B.M. The total number of unpaired electron is

(1) 4 (2) 3

(3) 5 (4) 6

36. Following reactions occur while performing the microcosmic bead test

$$\underset{\text{(Excess)}}{NH_4Cl + Na_2HPO_4} \xrightarrow[\text{yield}]{80\%} Na(NH_4)HPO_4 + NaCl$$

$$Na(NH_4)HPO_4 \xrightarrow[\text{yield}]{85\%} NH_3 + H_2O + \underset{\substack{\text{(Glassy bead)} \\ \text{(Sod.metaphosphate)}}}{NaPO_3}$$

How many moles of glassy bead sodium metaphosphate are obtained when 2.5 moles of NH_4Cl were taken?

(1) 2.5 (2) 2.87

(3) 1.7 (4) 1.22

37. Which of the following has two spherical nodes?

(1) 4*p* (2) 4*d*

(3) 3*p* (4) 2*s*

38. Among the following compounds, chromium has maximum radius in

(1) Cr^{+6} (2) Cr^{+3}

(3) Cr^{+2} (4) Cr^{+4}

39. A gas molecule contains equal mass of sulphur and oxygen. The gas is

(1) SO (2) SO_2

(3) S_2O_2 (4) SO_3

40. The density of aqueous solution containing 30% by weight of KOH is 1.3 g/mL. The molarity of the solution is

(1) 5.72 M (2) 1.08 M

(3) 7.36 M (4) 6.96 M

41. What is the velocity of electron in the orbit of radius 4.25 Å of He^+ ion?

(1) 1.09×10^6 m/s (2) 5.45×10^5 m/s

(3) 2.18×10^6 m/s (4) 4.36×10^6 m/s

42. Which of the following is incorrect order of property mentioned?

(1) $Na^+ < K^+ < Rb^+$ (Size)

(2) B < C < N (Electron affinity)

(3) O < N < F (Ionisation energy)

(4) $N^{-3} > N^{-2} > N^-$ (Ionic radius)

43. The frequency of revolutions made by electron in third orbit is 8 times of its frequency in n^{th} orbit. The value of n is

(1) 4 (2) 6

(3) 3 (4) 5

44. A bulb emit a light of wavelength 8000 Å. Find the number of photons emitted by the bulb per second if it consumes 100 watts power.

(1) 1×10^{18} (2) 4×10^{19}

(3) 3×10^{19} (4) 4×10^{20}

45. If 6 g of Fe reacts with 1 g of oxygen, the amount of FeO formed will be (Fe = 56), if only FeO is formed as a product

(1) 4.5 g (2) 0.45 g

(3) 7.72 g (4) 6 g

46. The set of quantum numbers that is not allowed for the electron is

(1) $n = 3,\ \ell = 1,\ m = -1$

(2) $n = 2,\ \ell = 1,\ m = 0$

(3) $n = 3,\ \ell = 0,\ m = 0$

(4) $n = 2,\ \ell = 2,\ m = -1$

47. An element A has electronic configuration 2, 8, 13, 2. The number of electrons in the element having l = 0 is

(1) 6 (2) 8

(3) 5 (4) 4

48. 8 g of divalent metal produces 9.8 g of its nitride. The approx atomic weight of metal is

(1) 9.8 (2) 42

(3) 35 (4) 8

(Space for Rough Work)

49. The pair of atoms having same number of neutrons is

(1) ${}^{14}_{7}N, {}^{24}_{12}Mg$

(2) ${}^{23}_{11}Na, {}^{19}_{9}F$

(3) ${}^{23}_{11}Na, {}^{24}_{12}Mg$

(4) ${}^{14}_{7}N, {}^{19}_{9}F$

50. Electrons in a sample of H-atoms are present in n = 5 shell. Assuming no transition occurs to and from second shell (n = 2). The maximum number of spectral lines observed when they return to ground state is

(1) 2 (2) 6

(3) 10 (4) 3

51. 1.82 g of a metal required 32.5 mL of 1 M HCl to dissolve it. What is the equivalent mass of metal?

(1) 56 (2) 63

(3) 42 (4) 50

52. The simplest formula of a compound containing 60% of element X (atomic mass = 15) and 40% of element Y (atomic mass = 20) is

(1) XY (2) X_2Y

(3) X_3Y_2 (4) X_2Y_3

53. What is the difference between the wave number of first line of Lyman series and second line of Balmer series in H-atom?

(1) $\frac{9R_H}{16}$

(2) $\frac{31R_H}{36}$

(3) $\frac{10\,R_H}{9}$

(4) $\frac{3\,R_H}{8}$

54. The order of magnitude of electron gain enthalpy of group 16 elements is

(1) O > S > Se > Te

(2) S > Se > Te > O

(3) Te > Se > S > O

(4) S > O > Se > Te

55. The orbital angular momentum of an electron in 2p-orbital is

(1) $\frac{1}{2}\frac{h}{2\pi}$ (2) Zero

(3) $\frac{h}{2\pi}$ (4) $\sqrt{2}\frac{h}{2\pi}$

56. Among Be, B, C and N, which has minimum value of first ionisation energy?

(1) Be (2) B

(3) C (4) N

57. The n-factor of H_3PO_4 in the reaction is

$$Ca(OH)_2 + H_3PO_4 \longrightarrow CaHPO_4 + 2H_2O$$

(1) 3 (2) 1

(3) 2 (4) Zero

58. The molecular mass of compound containing 40.68% C, 5.08% H and 54.24% O is 118. The molecular formula of the compound is

(1) $C_4H_6O_4$ (2) C_2H_4O

(3) $C_4H_8O_2$ (4) C_3H_4O

59. The electron affinity of which pair is correctly represented?

(1) N > O (2) F > Cl

(3) B > C (4) S > O

60. The outermost electronic configuration of the most electronegative element is

(1) $ns^2\ np^3$ (2) $ns^2\ np^2$

(3) $ns^2\ np^5$ (4) $ns^2\ np^4$

(Space for Rough Work)

[PART - C : MATHEMATICS]

61. If $A_1 \subset A_2 \subset A_3 \subset \ldots\subset A_{100}$, $n(A_i) = 2i + 1$ and $n\left(\bigcap_{i=1}^{100} A_i\right) = k_1$ also $B_1 \subset B_2 \subset B_3 \subset \ldots\subset B_{100}$, $n(B_i) = 2i - 1$ and $n\left(\bigcup_{i=1}^{100} B_i\right) = k_2$ then the value of $k_1 + k_2$ is

(1) 101 (2) 202

(3) 303 (4) 404

62. If A and B are two sets such that $n(A) = 8$, $n(B) = 7$ and $A \cap B \neq \phi$. Then the greatest possible value of $n(A \Delta B)$, is

(1) 15 (2) 14

(3) 13 (4) 12

63. Two finite sets have m and n elements. The number of elements in the power set of first set is 252 more than the total number of elements in power set of second set. Then the value of $m^2 + n^2$ is

(1) 68 (2) 34

(3) 17 (4) 10

64. Let X be a set represented by the cubes of natural numbers and x, y are any two elements of X. Then

(1) $x + y \in X$ (2) $x - y \in X$

(3) $xy \in X$ (4) $\frac{x}{y} \in X$

65. If a relation R is defined on the set Z of integers as follows

$(x, y) \in R \Leftrightarrow x^2 + y^2 = 169$

then domain of (R) is

(1) $\{0, \pm 5, \pm 12, \pm 13\}$

(2) $\{\pm 5, \pm 12, \pm 13\}$

(3) $\{0, \pm 5, \pm 12\}$

(4) $\{\pm 5, \pm 12\}$

66. Let R be a relation in N defined by

$R = \{(1 + x, 1 + x^2); x \leq 5; x \in N\}$

Then range of (R) is

(1) {2, 5, 9, 16, 25} (2) {1, 2, 3, 4, 5}

(3) {2, 3, 4, 5} (4) {2, 5, 10, 17, 26}

67. If X and Y are two sets such that $n(X \cap \bar{Y}) = 12, n(\bar{X} \cap Y) = 15$ and $n(X \cup Y) = 30$ then $n(X \times Y) =$

(1) 210 (2) 270

(3) 180 (4) 300

68. If $f(x) + f\left(\frac{x-4}{x-3}\right) = x^2$, $\forall x \in R \sim \{3\}$, then $f(2)$ is equal to

(1) 4 (2) 2

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

69. If $f(x^3) = 3x^6 + 2x^3$, then $f(-8)$ is equal to

(1) 176 (2) 192

(3) 210 (4) 232

70. Which of the following pairs of functions are the identical one's?

(1) $f(x) = \frac{x^2}{x}$ and $g(x) = x$

(2) $f(x) = \log x^3 + \log x^5$ and $g(x) = 3\log x + 5\log x$

(3) $f(x) = \sec^2 x - \tan^2 x$ and $g(x) = 1$

(4) $f(x) = \log x^2 + \log x^6$ and $g(x) = 2\log x + 6\log x$

71. Equation $|x + 2| + |x - 2| = 4$ has

(1) No real solution

(2) Exactly one real solution

(3) Exactly two real solution

(4) Infinitely many real solutions

(Space for Rough Work)

72. The domain of $f(x) = \dfrac{\sqrt{x^2 - 4x + 3}}{\sqrt{x^2 - 3x + 2}}$ is

(1) $(-\infty, 1] \cup [3, \infty)$ (2) $(-\infty, 1) \cup (3, \infty)$

(3) $(-\infty, 2) \cup [3, \infty)$ (4) $(-\infty, 1) \cup [3, \infty)$

73. Which one has exactly three real solutions?

(1) $2^{-x} = x$ (2) $2^x = x$

(3) $2^x = x^2$ (4) $2^x + x = 0$

74. The domain of $f(x) = \dfrac{1}{\sqrt{x - |x|}}$ is

(1) R^+ (2) R^-

(3) R (4) ϕ

75. The range of $f(x) = 2^{x-[x]}$; (where [·] denotes greatest integer function) is

(1) $[0, 1)$ (2) $[1, 2)$

(3) $[0, \infty)$ (4) R

76. The range of $f(x) = \text{sgn}(2^x)$ is

(1) $\{-1, 0, 1\}$ (2) $\{0, 1\}$

(3) $\{-1, 0\}$ (4) $\{1\}$

77. The domain of $f(x) = \log_{10}(\log_{10}(\log_{10}(\log_{10}x)))$ is (l^m, ∞) then $l + m$ is; ($l, m \in N$)

(1) 10 (2) 20

(3) 30 (4) 40

78. If

$$[x] + \left[x + \frac{1}{100}\right] + \left[x + \frac{2}{100}\right] + ... + \left[x + \frac{99}{100}\right] = [\lambda x]$$

Where $\lambda \in N$ and [·] denote greatest integer function, then λ is equal to

(1) 100 (2) 99

(3) 98 (4) 50

79. The domain of function $f(x) = \log_e([x] - x)$ where [·] denotes greatest integer function, is

(1) R (2) $(0, \infty)$

(3) $(-\infty, 0)$ (4) ϕ

80. If x is not an integer, then the range of $f(x) = [x] + [-x]$; [·] denotes greatest integer function, is

(1) Z, the set of integers (2) R

(3) $\{0\}$ (4) $\{-1\}$

81. Equation $|x - 3| - |x - 5| = \lambda$ has exactly one real solution if λ is equal to

(1) –2 (2) 1

(3) 2 (4) 3

82. The range of the function

$f(x) = \sqrt{x-2} + \sqrt{4-x}$ is

(1) $\{\sqrt{2}\}$ (2) $[-\sqrt{2}, \sqrt{2}]$

(3) $[\sqrt{2}, 2]$ (4) $[0, \infty]$

83. If cardinal numbers of A and B are 5 and 4 respectively then total number of functions from A to B is

(1) 5^4 (2) 4^5

(3) ${}^5P_4$ (4) ${}^5C_4$

84. The value of $2^{\log_5 7} - 7^{\log_5 2}$ is

(1) 0 (2) 1

(3) 2 (4) 5

85. If $x > 1$, then range of $f(x) = 3\log_{10}x - \log_x 0.001$

(1) $[2, \infty)$ (2) $[3, \infty)$

(3) $[6, \infty)$ (4) R

(Space for Rough Work)

86. The domain of the function

$f(x) = \sqrt{2+\log_3(1-3x)}$ is

(1) $\left[\frac{1}{3}, \infty\right)$ (2) $\left(-\infty, \frac{1}{3}\right]$

(3) $\left(-\infty, \frac{8}{27}\right]$ (4) $\left[\frac{8}{27}, \infty\right)$

87. If $A = \{1, 2, 3, 4\}$ and $B = \{a, b, c\}$ then the total number of relations from A to B which are not functions, is

(1) 4096 (2) 4014

(3) 4015 (4) 4016

88. If $n(A \times B) = 75$, then $n(B)$ cannot be

(1) 5 (2) 15

(3) 25 (4) 50

89. An investigator interviewed 100 students to determine the performance of three drinks : milk, coffee and tea. The investigator reported that 15 students take all three drinks milk, coffee and tea; 25 students take milk and coffee, 30 students take milk and tea, 35 students take coffee and tea, 10 students take milk only, 3 students take coffee only and 5 students take tea only. The number of students who did not take any of three drinks is

(1) 22 (2) 25

(3) 30 (4) 32

90. Let sets A and B are defined as

$A = \{(x, y): y = e^x, x \in R\}$

$B = \{(x, y): y = e^{-x}, x \in R\}$. Then $A \cap B$ is

(1) Null set

(2) Singleton set

(3) A set containing exactly 2 elements

(4) Infinite set

❑ ❑ ❑

(Space for Rough Work)