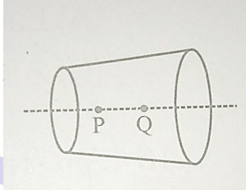
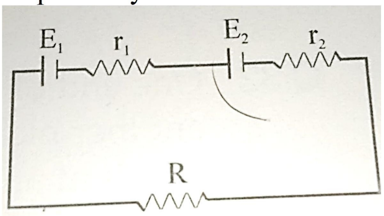
PHYSICS

1. Two wires each of radius of cross section r but of different materials are connected together end to end (in series) .If the densities of charge carriers in the two two wires are in the ratio 1:4, the drift velocity of electrons in the two wires will be in the ratio:
(a) 1:2 (b) 2:1
(c) 4:1 (d) 1:4
2. In a wire of cross-section radius r, free electrons travel with drift velocity v when a current I flows through the wire. What is the current in another wire of half the radius and of the same material when the drift velocity is 2v?
(a) 2I (b) I
(c) I/2 (d) I/4
3. An insulating pipe of cross-section area A contains an electrolyte which has two types of ions → their charges being -e and + 2e. A potential difference applied between the ends of the pipe results in the drifting of the two types of ions, having drift speed = v (- ve ion) and v/4 (+ve ion). Both ions have the same number per unit volume = n. The current flowing through the pipe is
(a) nev A/2 (b) nev A/4
(c) 5 nev A/2 (d) 3 nev A/2
4. As the temperature of a conductor increases, its resistivity and conductivity change. The ratio of resistivity to conductivity
(a) increases (b) decreases
(c) remains constant
(d) may increase or decrease depending on the actual temperature.
5. A current I flows through a uniform wire of diameter d when the mean electron drift velocity is v. The same current will flow through a wire of diameter d/2 made of the same material if the mean drift velocity of the electron is:
(a) v/4 (b) v/2
(c) 2v (d) 4v
6. A wire has a non-uniform cross-section as shown in figure. A steady current flows through it. The drift speed of electrons at points P and Q is vp and Vo



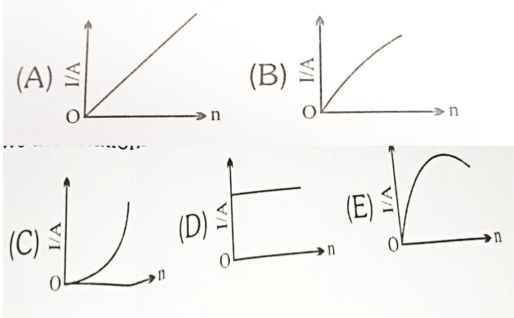
(a) Vp = VQ (b) Vp < VQ
(c) VP > VQ (d) Data insufficient
7. Two resistance R and 2R are connected in parallel in an electric circuit. The thermal energy developed in R and 2R are in the ratio
(a) 1:2 (b) 2:1
(c) 1:4 (d) 4:1
8. A cell of internal resistance r drives a current through an external resistance R. The power delivered by the cell to the external resistance is maximum when
(a) R = r (b) R >> r
(c) R<<r (d) R = 2r
9. A battery X is formed by connecting two batteries in parallel combinations having emi and internal resistance 5V (2Ω), 4V (3 Ω) respectively. The equivalent emf of the system formed is:
(a) 4.6 V (b) 5.08 V
(c) 4.85 V (d) 5.5V
10. A storage battery is connected to a charger for charging with a voltage of 125 Volts. The internal resistance of the storage battery is 10 When the charging current is 0.5 A. the emf of the storage battery is.
(a) 13 Volts (b) 12.5 Volts
(c) 12 Volts (d) 11.5 Volts
11. N identical cells, each of emf E and internal resistance r are joined in series. Out of these, n cells are wrongly connected ile, their terminals are connected in reverse of that required for series connection, n < N/2, let E be the emf of the resulting battery and r be its internal resistance
(a) E = (N-n)E, r = (N-n)r
(b) E = (N-2n)E.r. = (N-2nir
(c) E = (N-2n)E, r = Nr
(d) E= (N-n)E. r = Nr
12. Under what condition current passing through the resistance R. can be increased by short circuiting the battery of emf E_2. The internal

resistances of the two batteries are r_1 and r_2 respectively



(a) $E_2E_1 > (R+ r_2)$ (b) $E_1r_2> E_2 (R+ r_1)$
(c) $E_2r_2> E_1 (R+r_2)$ (d) $E_1r_1 > E_2 (R+r_1)$

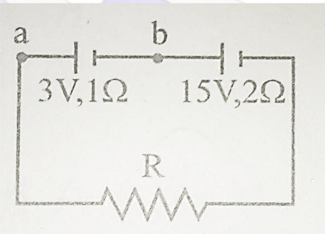
13. A battery consists of a variable number n of identical cells having internal resistance connected in series. The terminals of the battery are short circuited and the current I measured. Which one of the graph below shows the relationship between I and n?



14. N identical cells are joined in series with series with its two cells A and B in the loop with reversed polarities. EMF of each cell is E and internal resistance r. Potential difference across cell A or B is (here n>4)

(a) $\frac{2E}{n}$ (b) $2E\left(1-\frac{1}{n}\right)$
(c) $\frac{4E}{n}$ (d) $2E\left(1-\frac{2}{n}\right)$

15. Two batteries one of the emf 3V, internal resistance 1 ohm and the other of emf 15 V. internal resistance 2 ohm are connected in series with a resistance Ras shown If the potential difference between a and b is the resistance of R in ohm is



(a) 5 (b) 7
(c) 3 (d) 1

16. A wire of cross-section area A, length L_1. resistivity ρ_1, and temperature coefficient of resistivity α_1, is connected to a second wire of length L_2, resistivity ρ_2, temperature coefficient of resistivity α_2, and the same area A, so that the wires carry same current. Total resistance R is independent of temperature for small temperature change if (Thermal expansion effect is negligible)

(a) $\alpha_1 = -\alpha_2$ (b) $\rho_1 L_1 \alpha_1 + \rho_2 L_2 \alpha_2 = 0$
(c) $L_1 \alpha_1 + L_2 \alpha_2 = 0$ (d) None

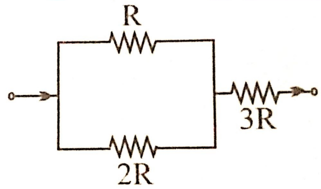
17. The charge flowing through a resistance R varies with time as $Q = 2t-8t^2$. The total heat produced in the resistance is (for $0 \le t \le \frac{1}{8}$)

(a) $\frac{R}{6}$ joules (b) $\frac{R}{3}$ Joules
(c) $\frac{R}{2}$ Joules (d) R joules

18. A heater A gives out 300 W of heat when connected to a 200 V d.c. supply. A second heater B gives out 600 W when connected to a 200 V d.c. supply. If a series combination of the two heaters is connected to a 200 V d.c. supply, the heat output will be

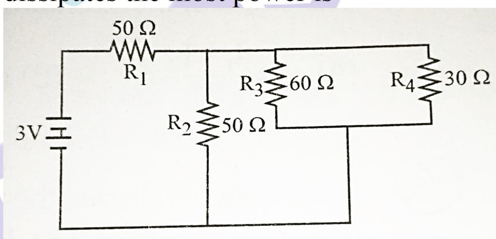
(a) 100 W (b) 450 W
(c) 300 W (d) 200 W

19. The ratio of powers dissipated respectively in R and 3R, as shown is



(a) 9 (b) 27/4
(c) 4/9 (d) 4/27

20. In the circuit shown, the resistances are given in ohms and the battery is assumed ideal with emf equal to 3.0 volts. The resistor that dissipates the most power is



(a) R_1 (b) R_2
(c) R_3 (d) R_4

21. The variation of current (1) and voltage (V) is as shown in figure A. The variation of power P with current/ is best shown by which of the following graph

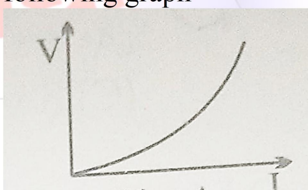
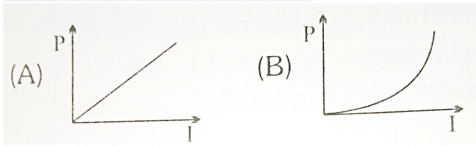
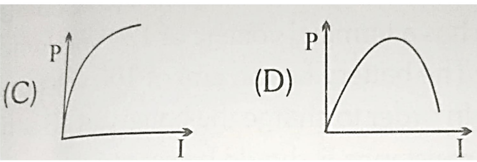


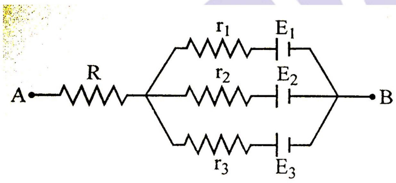
Fig. A





22. A current of (2.5 ± 0.05) A flows through a wire and develops a potential difference of 22 (10±0.1) volt. Resistance of the wire in ohm, is
(a) 4±0.12 (b) 4±0.04
(c) 4 ± 0.08 (d) 4 ± 0.02

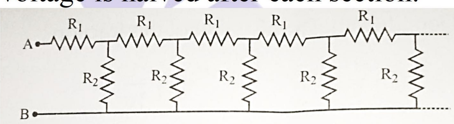
23. In the network shown, the potential difference between A and B is



($R = r_1 = 2 = 3 = 12$, $E_1 = 3V$, $E_2 = 2$ V, E = 1V)
(a) 1 V (b) 2 V
(c) 3 V (d) 4 V

24. Current density in a cylindrical wire of radius R is given as $J = \begin{cases} J_0\left(\frac{x}{R}-1\right) \; for \; 0 \le x < \frac{R}{2} \\ J_0\frac{x}{R} \; for \frac{R}{2} \le x \le R \end{cases}$.
The current flowing in the wire is
(a) $7/24\ \pi J_0 R^2$ (b) $1/6\ \pi J_0 R^2$
(c) $7/12\ \pi J_0 R^2$ (d) $5/12\ \pi J_0 R^2$

25. Consider an infinite ladder network shown in figure. A voltage V is applied between the points 25 A and B. This applied value of voltage is halved after each section.



(a) $R_1/R_2 = 1$ (b) $R_1/R_2 = 1/2$
(c) $R_1/R_2 = 2$ (d) $R_1/R_2 = 3$

CHEMISTRY

26. For the reaction $N_2 + 3H_2 \rightarrow 2NH_3$ if $\frac{\Delta[NH_3]}{\Delta t} =$ 2×10^{-4} mol L^{-1} s^{-1} the value of $\frac{-\Delta[H_2]}{\Delta t}$ would be
(a) 1×10^{-4} mol L^{-1} s^{-1}
(b) 3×10^{-4} mol L^{-1} s^{-1}
(c) 4×10^{-4} mol L^{-1} s^{-1}
(d) 6×10^{-4} mol L^{-1} s^{-1}

27. A gaseous hypothetical chemical equation
$2A \rightleftharpoons 4B + C$
is carried out in a closed vessel. The concentration of B is found to increase by 5×10^{-3} mol L^{-1} in 10 second. The rate of appearance of B is
(a) 5×10^{-4} mol L^{-1} sec^{-1}
(b) 5×10^{-5} mol L^{-1} sec^{-1}
(c) 6×10^{-5} mol L^{-1} sec^{-1}
(d) 4×10^{-4} mol L^{-1} sec^{-1}

28. The velocity of the chemical reaction doubles every 10 ^{0}C rise of temperature. If the temperature is raised by 50 ^{0}C the velocity of the reaction increases to about
(a) 32 times (b) 16 times
(c) 20 times (d) 50 times

29. Rate of reaction
(a) Decreases with increase in temperature
(b) Increases with increase in temperature
(c) May increase or decrease with increase in temperature
(d) Does not depend on temperature

30. A first order reaction complete its 10% in 20 minutes then time required to complete its 19% is
(a) 30 minutes (b) 40 minutes
(c) 50 minutes (d) 38 minutes

31. For a zero order reaction
(a) The concentration of the reactant does not change during the reaction
(b) The concentration change only when the temperature changes
(c) The rate remains constant throughout
(d) The rate of the reaction is proportional to the concentration

32. Rate constant for a reaction $H_2 + I_2 \rightarrow 2HI$ is 49, then rate constant for reaction $2HI \rightarrow H_2 + I_2$ is
(a) 7 (b) 1/49
(c) 49 (d) 21
(e) 63

33. The alkaline hydrolysis of ethyl acetate is represented by the equation
$CH_3COOC_2H_5 + NaOH \rightarrow CH_3COONa + C_2H_5OH$
Experimentally it is found that for this reaction
$\frac{dx}{dt} = k[CH_3COOC_2H_5]\,[NaOH]$ Then the reaction is
(a) Bimolecular and of first order
(b) Bimolecular and of second order
(c) Pseudo-bimolecular
(d) Pseudo-unimolecular

34. Consider the chemical reaction, $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$. The rate of this reaction expressed in terms time derivative of concentration of $N_2(g)$ $H_2(g)$ or $NH_3(g)$ Identify the correct relationship amongst the rate expressions.
(a) $rate = -[N_2]/dt = -\frac{1}{3}d[H_2]/dt = \frac{1}{2}d[NH_3]/dt$
(b) $rate = -d[N_2]/dt = -3d[H_2]/dt = 2d[NH,]/dt$
(c) $rate = d[N_2]/dt = \frac{1}{3}\,d[H_2]/dt = \frac{1}{2}d[NH_3]/dt$
(d) $rate = d[N_2]/dt = d[H_2]/dt = d[NH_3]/dt$

35. Average rate of reaction $2SO_2(g) + O_2(g) \rightarrow 2SO_3(g)$ is written as

(a) $\frac{\Delta[SO_2]}{\Delta t}$ (b) $-\frac{\Delta[O_2]}{\Delta t}$

(c) $\frac{1}{2}\frac{\Delta[SO_2]}{\Delta t}$ (d) $\frac{\Delta[SO_3]}{\Delta t}$

36. The decomposition of hydrogen peroxide, H_2O_2 in aqueous solution occurs to produce water, H_2O and oxygen gas, O_2

$2H_2O_2(aq) \rightarrow 2H_2O(l) + O_2(g)$

If the average rate of disappearance of H_2O_2 over a certain time interval be 6.80×10^{-5} Mol $L^{-1}s^{-1}$, what is the average rate of appearance of O_2 during this same time interval?

(a) 4.62×10^{-9} Mol $L^{-1}s^{-1}$

(b) 3.40×10^{-5} Mol $L^{-1}s^{-1}$

(c) 6.80×10^{-5} Mol $L^{-1}s^{-1}$

(d) 1.36×10^{-4} Mol $L^{-1}s^{-1}$

37. Which one of the following statement for order of reaction is not correct?

(a) Order can be determined experimentally

(b) Order of reaction is equal to sum of powers of concentration terms is differential rate law

(c) It is not affected by the stoichiometric coefficient of the reactant

(d) Order cannot be fractional

38. The hydrolysis of ester in alkaline medium is a

(a) First order reaction with molecularity 1

(b) Second order reaction with molecularity > 2

(c) First order reaction with molecularity 2

(d) Second order reaction with molecularity 1

39. The order of a reaction with rate equals $k\, C_A^{3/2}\, C_B^{-1/2}$ is

(a) 2 (b) 1

(c) - 1/2 (d) 3/2

40. The rate law of the reaction $2N_2O_5 \rightarrow 4NO_2 + O_2$ is

(a) $r = k[N_2O_5]$ (b) $r = k\,[N_2O_5]^2$

(c) $r = k\,[N_2O_5]^0$ (d) $r = k\,[NO_2]^4\,[O_2]$

41. The rate of the reaction

$CCl_3CHO + NO \rightarrow CHCl_3 + NO + CO$ is given by Rate = $K[CCl_3CHO][NO]$.

If concentration is expressed in moles/litre, the units of K are

(a) litre^2 mole^{-2} sec^{-1} (b) mole litre^{-1} sec^{-1}

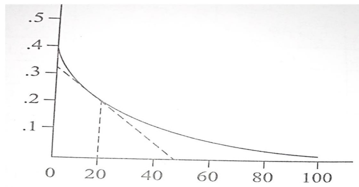
(c) litre mole^{-1} sec^{-1} (d) sec^{-1}

42. In the reaction $2N_2O_5 \rightarrow 4NO_2 + O_2$ initial pressure is 500 atm and rate constant K is 3.38×10^{-5} sec^{-1}. After 10 minutes the final pressure of N_2O_5 is

(a) 490 atm (b) 250 atm

(c) 480 atm (d) 420 atm

43. In the given graph rate for reaction at 20 seconds in



(a) 1×10^{-3} m s^{-1} (b) 2×10^{-2} m s^{-1}

(c) 3.5×10^{-2} m s^{-1} (d) 7×10^{-3} m s^{-1}

44. Half life of a reaction is found to be inversely proportional to the cube of its initial concentration. The order of reaction IS

(a) 2 (b) 5

(d) 3 (d) 4

45. The time of completion of 90% of a first order reaction is approximately

(a) 1.1 times that of half life

(b) 2.2 times that of half life

(c) 3.3 times that of half life

(d) 4.4 times that of half life

46. For a first order reaction A → B the reaction rate at reactant concentration of 0.01 M is found to be 2.0×10^{-5} mol L^{-1} s^{-1} The half life period of the reaction is

(a) 220 s (b) 30 s

(c) 300 s (d) 347 s

47. A reaction that is of the first order with respect to reactant A has a rate constant 6 min^{-1} If we start with [A] = 0.5 mol L^{-1} when would [A] reach the value 0.05 mol L^{-1} ?

(a) 0.384 min (b) 0.15 min

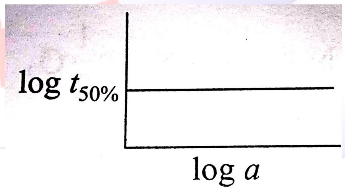
(c) 3 min (d) 3.84 min

48. Initial concentration of A = 2M and after 10 min, reaction is 10% completed. Thus, half-life period is

(a) 50 min (b) 66.0 min

(c) 69.3 min (d) 6.93 min

49. A graph plotted between log $t_{50\%}$ vs. log concentration is a straight line. What conclusion can you draw from this graph.



(a) n = 1 $t_{1/2} \propto a$

(b) n = 2 $t_{1/2}a \propto 1 / a$

(c) n = 1 $t_{1/2} = (0.693 / k)$

(d) None of these

50. For a reaction ,time of75% reaction is thrice of time of 50 reaction . thus order of reaction is

(a) 0 (b) 1

©2 (d) 3

MATH

51. If the function *f(x)* = $\begin{cases} \frac{k\cos x}{\pi-2x} & when\ x \neq \frac{\pi}{2} \\ 3 & when x = \frac{\pi}{2} \end{cases}$ is continuous at $x = \frac{\pi}{2}, then\ K =$

(a) 3 (b) 6
(c) 12 (d) none of these

52. If *f(x)*= $\begin{cases} e^{1/x} & When \neq 0 \\ 0 & when = 0 \end{cases}$ then

(a) $\lim_{x\to 0^+} f(x) = e$
(b) $\lim_{x\to 0^+} f(x) = 0$
(c) *f(x) is* discontinuous
(d) None of these

53. If f(x) = $\begin{cases} (1+2x)^{1/2} & for\ x \neq 0 \\ e^2 & for\ x = 0 \end{cases}$ then

(a) $\lim_{x\to 0^+} f(x) = e$
(b) $\lim_{x\to 0^+} f(x) = e^2$
(c) *f(x) is* discontinuous at x =0
(d) None of these

54. If *f(x)* = $\begin{cases} ax^2 - b, when\ 0 \le x < 1 \\ 2\ when\ x = 1 \\ x+1, when\ 1 < x \le 2 \end{cases}$ is continuous at x = 1, then the most suitable values of a,b are

(a) a=2, b=0 (b) a=1,b= -1
(c) a= 4,b=2 (d) All the above

55. The value of *f(0)*,so that then function f(x) = $\frac{(27-2x)^{1/3}-3}{9-3(243+5\,x)^{\frac{1}{5}}}$,(x≠ 0)is continuous is given by

(a) 2/3 (b) 6
(c) 2 (d) 4

56. The function y = $e^{-|x|}$ is

(a) continuous and differentiable at x= 0
(b) nither continuous nor differentiable at x = 0
(c) continuous but not differentiable at x= 0
(d) not continuous but differentiable at x= 0

57. The function f(x) = $\begin{cases} e^{2x} - 1, & x \le 0 \\ ax + \frac{bx^2}{2} - 1 & x > 0 \end{cases}$ *is continuous* and differentiable for

(a) a =1, b = 2 (b) a =2, b = 4
(c) a =2,any b (d) any a, b = 4

58. The value of *p* for which the function f(x) $\begin{cases} \frac{(4^x-1)^3}{\sin\frac{x}{p}\log\left[1+\frac{x^2}{3}\right]} & x \neq 0 \\ 12(\log 4)^3 & x = 0 \end{cases}$ may be continuous at x = 0, is

(a) 1 (b) 2
(c) 3 (d) none of these

59. If *f(x)* = $\begin{cases} \frac{\sin 5x}{x^2+2x}, & x \neq 0 \\ k + \frac{1}{2}, & x = 0 \end{cases}$ is continuous at x = 0 then the value of k is

(a) 1 (b) -4
(c) 2 (d) -8

60. If *f:R→ R* defined by f(x)= $\begin{cases} \frac{1+3x^2-\cos 2x}{x^2} & for\ x \neq 0 \\ k & for\ x = 0 \end{cases}$ $is\ continuous\ at\ x = 0\ then\ k =$

(a) 1 (b) 5
(c) 6 (d) 0

61. If the function is *f(x)*= $\frac{1}{x+2}$ then the point of discontinuity of the composite function y = f(f(x)) is

(a) $\frac{2}{5}$ (b) $\frac{1}{2}$
(c) -$\frac{5}{2}$ (d) $\frac{5}{2}$

62. Let S_n = 1+3x+9x^2+27x^3+…n terms and -$\frac{1}{3} < x < \frac{1}{3}$.If $\lim_{n\to\infty} s_n = f(x), then\ f(x) is\ discontinuous\ at\ point\ x = \to \infty$

(a) 0 (b)$\frac{1}{3}$
(c) 1 (d) -1

63. If *f(x)*= $\begin{cases} \frac{8^x-4^x-2^x+1}{x^2}, & x > 0 \\ e^x \sin x + \pi x + \lambda In\,4, & x \le 0 \end{cases}$ is continuous at x =0 . Then the value of λ is

(a) 4$\log_e 2$ (b) 2$\log_e 2$
(c) $\log_e 2$ (d) none of these

64. Function *f(x)* = $(\sin 2x)^{\tan^2 2x}$is not defined at x= $\frac{\pi}{4}$. If f(x) is continuous at x= $\frac{\pi}{4}$ then f$\left(\frac{\pi}{4}\right)$ s equal to

(a) 1 (b) 2
(c) $1/\sqrt{e}$ (d) None of these

65. If f(x) = $\begin{cases} \left(\sin\frac{2x^2}{a} + \cos\left(\frac{3x}{b}\right)\right)^{ab/x^2} & x \neq 0 \\ e^{x^2-2x+3} & x = 0 \end{cases}$
is continuous at x=$\forall b \in R$ then $a_{min} is$
(a) -1/8 (b) -1/4
(c) -1/2 (d) 0

66. If f(a) = sgn($\sin^2$x – sinx -1) has exactly four points of discontinuity for x$\in (0, n\pi), n \in N$ *then*
(a)*minimum* value of n is 5
(b) maximum value of n is 6
(c) there are exactly two possible value of n
(d) none of these

67. If f(x) = $\begin{cases} x^2 - ax + 3 & x \text{ is rational} \\ 2 - x, & x \text{is irrational} \end{cases}$
is continuous at exactly two points then possible values of a are
(a)(2,∞) (b) (-∞, 3)
(c) (-∞, −1)∪ (3,∞) (d) none of these

68. The number of points at which g(x) = $\frac{1}{1+\frac{2}{f(x)}}$ is not differentiable , where f(x) = $\frac{1}{1+\frac{1}{x}}$, is
(a) 1 (b) 2
(c) 3 (d) 4

69. If f(x) = $\begin{cases} ax^2 + 1, x \leq 1 \\ x^2 + ax + b, x > 1 \end{cases}$ is differentiable at x=1, then
(a) a=1, b=1 (b) a=1,b=0
(c) a=2, b =0 (d) a= 2 ,b=1

70. The number of point of non –differentiability for the function *f(x)* = |*x*|+|*cos x*|+*tan*(*x*+$\frac{\pi}{4}$)*in the interval (-2,2) is*
(a) 1 (b) 2
(c) 4 (d) 5

71. The set of points where the function f(x) = |x-2| cos x is differentiable is
(a) $(-\infty, \infty)$ (b) {2}
(c) (0,∞) (d) none of these

72. Let *f(x)* = $\begin{cases} 0; & x < 0 \\ x^2; & x \geq 0 \end{cases}$. then for all x , which one is false?
(a) f 'is differentiable *(b) f is differentiable*
(c) f 'is continuous *(d) f is continuous*

73. If f(x) =$\sqrt{1 - \sqrt{1 - x^2}}$, *then* $f(x)$*is*
(a) continuous on [-1,1] and differentiable on (-1,1)
(b) continuous on [-1,1] and differentiable on (-1,0)∪ (0,1)
(c) continuous and differentiable on [-1,1]
(d) none of these

74. If f(x) = |log|x||, then
(a) f(x) is continuous and differentiable for all x in its domain
(b) f(x) is continuous for all x in its domain but not differentiable at x ± 1
© f(x) is nither continuous nor differentiable at x=± 1
(d) none of these

75. Let f:[-1,2] → R *be given by* $f(x) =$ $2x^2$+x+[x^2]-[x], where [t] denotes the greatest integer less than or equal to t. The number of point where f is not continuous is
(a) 3 (b) 4
(c) 5 (d) 6