

ENTRANCE EXAMINATION FOR ADMISSION, MAY 2013.

M.Tech. (ENVIRONMENTAL ENGINEERING AND MANAGEMENT)

COURSE CODE : 393

Register Number :

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*Signature of the Invigilator*  
(with date)

COURSE CODE : 393

Time : 2 Hours

Max : 400 Marks

*Instructions to Candidates :*

1. Write your Register Number within the box provided on the top of this page and fill in the page 1 of the answer sheet using pen.
2. Do not write your name anywhere in this booklet or answer sheet. Violation of this entails disqualification.
3. Read each of the question carefully and shade the relevant answer (A) or (B) or (C) or (D) or (E) in the relevant box of the ANSWER SHEET using HB pencil.
4. Avoid blind guessing. A wrong answer will fetch you -1 mark and the correct answer will fetch 4 marks.
5. Do not write anything in the question paper. Use the white sheets attached at the end for rough works.
6. Do not open the question paper until the start signal is given.
7. Do not attempt to answer after stop signal is given. Any such attempt will disqualify your candidature.
8. On stop signal, keep the question paper and the answer sheet on your table and wait for the invigilator to collect them.
9. Use of Calculators, Tables, etc. are prohibited.

1. If  $K$  represents kinetic energy,  $V$  velocity and  $T$  time, and these are chosen as the fundamental units then, the units of surface tension will be  
 (A)  $KV^{-2}T^{-2}$       (B)  $KV^{-1}T^{-2}$       (C)  $K^2V^{-1}T^{-3}$       (D)  $KV^{-2}T^{-1}$
2. The dimensional formula for intensity of magnetic field is  
 (A)  $ML^{-1}$       (B)  $MT^{-2}L^{-1}A^{-1}$       (C)  $AL^{-1}$       (D)  $M^{\circ}L^{\circ}T^{\circ}$
3. The initial velocity of the particle is 10 m/sec and its retardation is 2 m/sec<sup>2</sup>. The distance moved by the particle in 5<sup>th</sup> second of its motion is:  
 (A) 1 m      (B) 19 m      (C) 50 m      (D) 75 m
4. Two stones of different masses are dropped simultaneously from the top of a building  
 (A) smaller stone hit the ground earlier  
 (B) larger stone hit the ground earlier  
 (C) both the stones reach the ground simultaneously  
 (D) which of the stones reach the ground earlier depend on the composition of the stone.
5. A balloon is moving upwards with velocity 9.8 m/sec. It releases a stone which comes down to the ground in 11 sec. The height of the balloon from the ground at the moment when the stone was dropped is:  
 (A) 592.9 m      (B) 490 m      (C) 485.1 m      (D) 494.9 m
6. A bullet is fired by a light rifle and the other with a heavy rifle by the same force. Which rifle will cause more injury to the shoulder?  
 (A) light rifle      (B) heavy rifle  
 (C) both will cause same injury      (D) none of these
7. If  $r$  represents the radius of the orbit of the satellite of mass  $m$  moving around a planet of mass  $M$ , the velocity  $v$  of the satellite is given by the relation  
 (A)  $v^2 = G M/r$       (B)  $v = G M/r$       (C)  $v^2 = G M m/r$       (D)  $v^2 = G m/r$
8. If  $R$  is the radius of the earth and  $g$  the acceleration due to gravity on the earth's surface, the mean density of the earth is  
 (A)  $4\pi G/3gR$       (B)  $3\pi R/4gG$       (C)  $3g/4\pi RG$       (D)  $\pi Rg/12G$

9. A cork of density  $250 \text{ kg/m}^3$  floats in a liquid with one-third of its volume below the liquid. The correct value of the density of the liquid is (in  $\text{kg/m}^3$ )
- (A) 550                      (B) 650                      (C) 750                      (D) 850
10. We find that water sticks to a glass rod, it is because:
- (A) The force of cohesion is  $>$  force of adhesion  
 (B) The force of adhesion is  $>$  force of cohesion  
 (C) Force of adhesion = force of cohesion  
 (D) None of these
11. A lead sphere of mass  $m$  falls in a viscous liquid with a terminal velocity  $v_0$ . Another lead sphere of mass  $8m$  will fall through the same liquid with a terminal velocity:
- (A)  $v_0$                       (B)  $4v_0$                       (C)  $8v_0$                       (D)  $64v_0$
12. We write the relation for Boyle's law in the form  $PV = C$  when the temperature remains constant. In this relation, the magnitude of  $C$  depends upon
- (A) The nature of the gas used in the experiment  
 (B) The magnitude of  $g$  in the laboratory  
 (C) The atmospheric pressure  
 (D) The quantity of the gas enclosed
13. If the volume of a gas is to be increased by 4 times
- (A) Temperature must be doubled  
 (B) At constant 'P' temperature must be increased by four times  
 (C) At constant 'T' the pressure must be increased four times  
 (D) It cannot be increased
14. (1) The boiling point of a liquid is affected by addition of soluble solid  
 (2) The boiling point of a liquid is affected by external vapour pressure  
 (3) The boiling point is a fixed characteristic of a liquid and does not vary
- (A) Only (3) is correct                      (B) Only (1) is correct  
 (C) (1) and (2) correct                      (D) Only (2) is correct

15. Which one of the following information is required for the complete knowledge of a physical quantity?
- (A) Size of the unit alone  
(B) The numerical value  
(C) Both the size as well as numerical value  
(D) None of the quantities (A) and (B) are required
16. An aeroplane moves 400 m towards the north, 300 metres towards west and then 1200 m vertically upwards, then its displacement from the initial position is
- (A) 1400 m            (B) 1500 m            (C) 1300 m            (D) 1600 m
17. The thermometric liquid used to measure upto  $-100^{\circ}\text{C}$  is
- (A) Alcohol            (B) Mercury            (C) Water            (D) All the above
18. 5 gm of ice at  $0^{\circ}\text{C}$  is dropped in a beaker containing 20 gm of water at  $40^{\circ}\text{C}$ , then
- (A) All the ice will not melt in the water  
(B) All the ice will melt and the resulting temperature of water will be  $0^{\circ}\text{C}$   
(C) All the ice will melt and the resulting temperature of the water will be  $25^{\circ}\text{C}$   
(D) All the ice will melt and the resulting temperature of the water will be  $16^{\circ}\text{C}$
19. A particle of mass  $m$  moving east-ward with a speed  $V$  collides with another particle of the same mass moving north-ward with the same speed  $V$ . The two particles coalesce on collision. The new particle of mass  $2m$  will move in the north-easterly direction with a velocity
- (A)  $V/2$             (B)  $2V$             (C)  $V/\sqrt{2}$             (D) None of these
20. A lift moving up comes to rest with a retardation. The weight of the man in it
- (A) increases            (B) decreases  
(C) remains constant            (D) either increases or decreases
21. A child weighing 25 kg slides down a rope hanging from the branch of a tree. If the force of friction against him is 200N, what is the child's acceleration? (Take  $g = 10 \text{ m/s}^2$ )
- (A)  $22.5 \text{ m/s}^2$             (B)  $8 \text{ m/s}^2$             (C)  $5 \text{ m/s}^2$             (D)  $2 \text{ m/s}^2$

22. Consider a satellite going round the earth in a circular orbit. Which of the following statements is wrong?
- (A) It is a freely falling body  
 (B) It is acted upon by a force directed away from the centre of the earth which counter-balances the gravitational pull  
 (C) It is moving with a constant speed  
 (D) Its angular momentum remains constant
23. The weight of a body at earth's surface is  $W$ . At a depth half way to the centre of the earth it will be (assuming uniform density in earth)
- (A)  $W$                       (B)  $W/2$                       (C)  $W/4$                       (D)  $W/8$
24. A cube of size 10 cm is floating in equilibrium in a tank of water. When a mass of 10 gm is placed on the cube. The depth of cube inside water increases by ( $g = 10 \text{ ms}^{-2}$ , density of water =  $10^3 \text{ kg m}^{-3}$ )
- (A) 0.1 mm                      (B) 1 mm                      (C) 1 cm                      (D) 0.1 m
25. More liquid rises in a thin tube because of:
- (A) Larger value of radius                      (B) Larger value of surface tension  
 (C) Small value of surface tension                      (D) Small value of radius
26. Maximum possibility of turbulent flow is in a fluid of
- (A) Low density and low viscosity                      (B) High density and high viscosity  
 (C) Low density and high viscosity                      (D) High density and low viscosity
27. The unit of universal gas constant is
- (A) watts/K                      (B) dynes/ $^{\circ}\text{C}$                       (C) ergs/K                      (D) newtons/ $^{\circ}\text{R}$
28. According to the kinetic theory of gases, the intermolecular forces between the gas molecules are
- (A) Zero                      (B) Very small                      (C) Large                      (D) Very large
29. The gas thermometers are more sensitive than liquid thermometers because
- (A) Gases expand more than liquids  
 (B) Gases are easily obtained  
 (C) Gases are much lighter  
 (D) Gases do not easily change their states

30. The amount of mechanical work to be done to completely melt 1 gm of ice is  
 (A) 4.2 joules      (B) 42 joules      (C) 80 joules      (D) 336 joules
31. A woman of mass 50 kg stands on a wooden block placed over a tank of water. The wooden block is such that the woman is entirely above water. If relative density of wood is 0.85, the volume of the wooden block is  
 (A)  $0.5 \times 10^{-1} \text{ m}^3$       (B)  $0.585 \times 10^{-1} \text{ m}^3$   
 (C)  $0.33 \text{ m}^3$       (D)  $0.54 \times 10^{-1} \text{ m}^3$
32. A liquid rises in a capillary tube when the angle of contact is  
 (A) An acute angle      (B) An obtuse angle  
 (C)  $\pi$  radian      (D)  $\pi/2$  radian
33. A metal ball of radius 2 mm and density  $10.5 \text{ gm/cm}^3$  is dropped in glycerine of coefficient of viscosity 9.8 poise and density  $1.5 \text{ gm/cm}^3$ . The terminal velocity of the ball is  
 (A) 2 cm/s      (B) 4 cm/s      (C) 6 cm/s      (D) 8 cm/s
34. A circular wire of radius 3 cm. is cut and bent so as to lie along the circumference of a hoop whose radius is 48 cm. The angle in grades which is subtended at the centre of the hoop is  
 (A) 50      (B) 25      (C) 20      (D) None of these
35. Which of the followings is correct?  
 (A)  $\sin 1^\circ > \sin 1$       (B)  $\sin 1^\circ < \sin 1$   
 (C)  $\sin 1^\circ = \sin 1$       (D)  $\sin 1^\circ = (\pi/180) \sin 1$
36. In a  $\Delta ABC$ , if  $a = 3$ ,  $b = 4$ ,  $c = 5$ , then the value of  $\sin 2B$  is  
 (A)  $24/25$       (B)  $25/24$       (C)  $1/25$       (D) None of these
37.  $AB$  is a vertical pole. The end  $A$  is on the level ground,  $C$  is the middle point of  $AB$ .  $P$  is a point on the level ground. The portion  $BC$  subtends an angle  $\beta$  at  $P$ . If  $AP = nAB$ , then  $\tan \beta =$   
 (A)  $\frac{n}{2n^2 + 1}$       (B)  $\frac{n}{n^2 - 1}$       (C)  $\frac{n}{n^2 + 1}$       (D) None of these

38. The angle of elevation of the top of a tower at any point on the ground is  $30^\circ$  and moving 200 metres towards the tower it becomes  $45^\circ$ . The height of tower is  
 (A) 10 mt. (B)  $100(\sqrt{3}+1)$  mt. (C)  $10/\sqrt{3}$  mt. (D) None of these
39. The argument of  $(1 - i\sqrt{3}) / (1 + i\sqrt{3})$  is  
 (A)  $60^\circ$  (B)  $120^\circ$  (C)  $210^\circ$  (D)  $240^\circ$
40.  $1 + i^2 + i^4 + i^6 + \dots + i^{2n}$  is  
 (A) Positive (B) Negative  
 (C) 0 (D) Cannot be determined
41. Mid points of the sides  $AB$  and  $AC$  of a  $\Delta ABC$  are  $(3, 5)$  and  $(-3, -3)$  respectively, then the length of the side  $BC$  is  
 (A) 10 (B) 20 (C) 15 (D) 30
42. A line passes through  $(2, 2)$  and is perpendicular to the line  $3x + y = 3$ . Its y intercept is  
 (A)  $1/3$  (B)  $2/3$  (C) 1 (D)  $4/3$
43. Centre of a circle is  $(2, 3)$ . If the line  $x + y = 1$  touches it, its equation is  
 (A)  $x^2 + y^2 - 4x - 6y + 4 = 0$   
 (B)  $x^2 + y^2 - 4x - 6y + 5 = 0$   
 (C)  $x^2 + y^2 - 4x - 6y - 5 = 0$   
 (D) None of these
44. Four distinct points  $(2k, 3k)$ ,  $(1, 0)$ ,  $(0, 1)$  and  $(0, 0)$  lie on a circle for  
 (A) all integral values of  $k$  (B)  $0 < k < 1$   
 (C)  $k < 0$  (D)  $k = 5/13$
45. If  $f(x)$  is a polynomial satisfying  $f(x)$ ,  $f\left(\frac{1}{x}\right) = f(x) + f\left(\frac{1}{x}\right)$  and  $f(3) = 28$ , then  $f(4) =$   
 (A) 63 (B) 65 (C) 17 (D) None of these

46.  $f(x) = x \sin\left(\frac{1}{x}\right)$ ,  $x \neq 0$ , then  $\lim_{x \rightarrow 0} f(x) =$   
 (A) 1 (B) 0 (C) -1 (D) Not exist
47. If  $f(x) = (x - x_0)g(x)$  where  $g(x)$  is continuous at  $x_0$ , then  $f'(x_0)$  is equal to  
 (A) 0 (B)  $x_0$  (C)  $g(x_0)$  (D) None of these
48. The diff. coeffi. of  $f(\log x)$  w.r.t.  $x$ , where  $f(x) = \log x$  is  
 (A)  $x / \log x$  (B)  $\log x / x$  (C)  $(x \log x)^{-1}$  (D) None of these
49. If  $f(x) = \frac{\cos^2 x}{1 + \sin^2 x}$ , then  $f(\pi/4) - 3f'(\pi/4)$  is  
 (A) -1 (B) 1 (C) 2 (D) 3
50. If  $y = \sin(m \sin^{-1} x)$ , then  
 (A)  $(1 - x^2)y_2 - xy_1 + m^2y = 0$  (B)  $(1 - x^2)y_2 + xy_1 - m^2y = 0$   
 (C)  $(1 - x^2)y_2 - xy_1 - m^2y = 0$  (D) None of these
51. If  $f(x, y, z) = (x^2 + y^2 + z^2)^{-1/2}$ , then  $f_{xx} + f_{yy} = f_{zz} =$   
 (A) 0 (B) 1 (C) -1 (D) None of these
52. The maximum possible area that can be enclosed by a wire of length 20 cm. By bending it into the form of a sector in square cms. is  
 (A) 10 (B) 25 (C) 30 (D) None of these
53. If  $f(x) = x^3 + ax^2 + bx + c$  has a minima at  $x = 3$  and maxima at  $x = -1$ , then  
 (A)  $a = -3, b = -9, c = 0$  (B)  $a = 3, b = 9, c = 0$   
 (C)  $a = -3, b = -9, c \in R$  (D) None of these
54. A man 2 mt. high walks at a uniform speed of 5mt./min. away from a lamp post 6 mt. high. The rate at which the length of his shadow increases is  
 (A)  $2/5$  m/s (B)  $5/2$  km/hr (C) 10 mt/min (D) None of these



55.  $\int x^3(\log x)^2 dx$
- (A)  $\frac{1}{32}x^4[8(\log x)^2 + 4\log x - 1]$  (B)  $\frac{1}{32}x^4[8(\log x)^2 + 4\log x + 1]$   
 (C)  $\frac{1}{32}x^4[8\log x)^2 - 4\log x - 1]$  (D) None of these
56. The area of the region bounded by the curve  $y = 2x - x^2$  and the line  $y = x$  is  
 (A)  $1/2$  (B)  $1/3$  (C)  $1/4$  (D)  $1/6$
57. The area bounded by the normal at (1, 2) to the parabola  $y^2 = 4x$ ,  $x$ -axis and the curve is given by  
 (A)  $10/3$  (B)  $7/3$  (C)  $4/3$  (D) None of these
58. Equation of the curve passing through (3, 9) which satisfies the diff. Equation  $\frac{dy}{dx} = x + \left(\frac{1}{x^2}\right)$  is  
 (A)  $6xy = 3x^2 - 6x + 29$  (B)  $6xy = 3x^3 - 29x + 6$   
 (C)  $6xy = 3x^3 + 29x - 6$  (D) None of these
59. If  $a \times b = c$  and  $b \times c = a$ , then  
 (A)  $a, b, c$  are orthogonal in pairs and  $|a| = |c|$  and  $|b| = 1$   
 (B)  $a, b, c$  are not orthogonal to each other  
 (C)  $a, b, c$  are orthogonal in pairs but  $|a| \neq |c|$   
 (D)  $a, b, c$  are orthogonal but  $|b| \neq 1$
60. If  $\alpha$  is a vector and  $x$  is a non-zero scalar, then  
 (A)  $x\alpha$  is a vector in the direction of  $\alpha$   
 (B)  $x\alpha$  is a vector collinear to  $\alpha$   
 (C)  $x\alpha$  and  $\alpha$  have independent direction  
 (D) None of these
61. Solution of the in equation  $x^2 + 2|x| - 15 \geq 0$  is given by  
 (A)  $x \leq -\sqrt{3}$  or  $x \geq \sqrt{3}$  (B)  $x \leq -3$  or  $x \geq 3$   
 (C)  $-3 \leq x \leq 3$  (D) None of these

62. Three identical dice are rolled. The probability that the same number will appear on each of them is  
 (A)  $1/6$  (B)  $1/18$  (C)  $1/36$  (D) None of these
63. If  $x = a \cos^3 \theta$ ,  $y = b \sin^3 \theta$ , then  
 (A)  $(x/a)^{2/3} + (y/b)^{2/3} = 1$  (B)  $(x/b)^{2/3} + (y/a)^{2/3} = 1$   
 (C)  $(a/x)^{2/3} + (b/y)^{2/3} = 1$  (D)  $(b/x)^{2/3} + (a/y)^{2/3} = 1$
64. If the angles of a triangle are in the ratio  $1 : 2 : 3$ , the corresponding sides are in the ratio  
 (A)  $2 : 3 : 1$  (B)  $\sqrt{3} : 2 : 1$  (C)  $2 : \sqrt{3} : 1$  (D)  $1 : \sqrt{3} : 2$
65. Let  $z_1$  and  $z_2$  be complex numbers such that  $z_1 \neq z_2$  and  $|z_1| = |z_2|$ . If  $z_1$  has positive real part and  $z_2$  has negative imaginary part, then  $(z_1 + z_2)/(z_1 - z_2)$  may be  
 (A) zero (B) real and positive  
 (C) real and negative (D) purely imaginary  
 (E) none of these
66. The line which is parallel to  $x$ -axis and crosses the curve  $y = \sqrt{x}$  at an angle of  $45^\circ$  is  
 (A)  $x = 1/4$  (B)  $y = 1/4$  (C)  $y = 1/2$  (D)  $y = 1$
67. The line  $y = mx + c$  intersects the circle  $x^2 + y^2 = r^2$  at the two real distinct points if  
 (A)  $-r\sqrt{1+m^2} < c < r\sqrt{1+m^2}$  (B)  $-c\sqrt{1-m^2} < r < c\sqrt{1-m^2}$   
 (C)  $-r\sqrt{1-m^2} < c < r\sqrt{1+m^2}$  (D) None of these
68. If more solvent is added to solution, the magnitude of heat of reaction?  
 (A) Decreases (B) Increases  
 (C) Remains constant (D) None
69. 100 mL of 0.2 MKOH and 100 mL of 0.1 MH<sub>2</sub>SO<sub>4</sub> solutions are mixed. The resulting solution will be?  
 (A) Acidic (B) Basic (C) Amphoteric (D) Neutral

70. Which of the following gases has a boiling point nearly equal to the boiling point of rare gas argon?
- (A)  $H_2$  (B)  $F_2$   
 (C)  $Cl_2$  (D)  $NO$   
 (E)  $Cl$
71. The extent of adsorption of a gas on a solid depends on
- (A) Nature of gas (B) Pressure of gas  
 (C) Temperature of the system (D) All are correct
72. For the endothermic reaction  $N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$  which of the following is true?
- (A)  $K$  is independent of temperature  
 (B)  $K$  increases as temperature increases  
 (C)  $K$  decreases as temperature decreases  
 (D)  $K$  varies with the addition of  $NO$
73. Once the equilibrium is reached, under given condition
- (A) Concentration of products changes  
 (B) Concentration of reactants changes  
 (C) Concentrations remain the same inspite of change in temperature  
 (D) Concentration of all substance present do not change
74. In the reaction  $A \rightarrow B$ , if the concentration of  $A$  is increased four times the rate of reaction is doubled. The order of the reaction is?
- (A) 1 (B) 0 (C)  $1/2$  (D) 2
75. In a reversible reaction, a catalyst?
- (A) Increases the rate of forward reaction  
 (B) Increases the rate of backward reaction  
 (C) Increases the rate of forward and backward reaction equally  
 (D) None of these
76. Which of the following is intensive property?
- (A) Temperature (B) Molarity  
 (C) Density (D) All are correct

77. The solvent which is neither proton donor nor proton acceptor is called?  
 (A) Amphoteric (B) Neutral (C) Aprotic (D) Protonic
78. How many grams of  $\text{KMnO}_4$  (M.W. = 158) per litre of solution are needed to prepare 0.01 N solution,  $\text{KMnO}_4$  which is to be used as oxidant in alkaline medium?  
 (A) 1.58 g (B) 0.316 g (C) 3.16 g (D) 1.58/2 g
79. The relationship between osmotic pressure at 273 K when 10 g. glucose ( $P_1$ ) 10 g. urea ( $P_2$ ) and 10 g. sucrose ( $P_3$ ) are dissolved in 250 mL of water is?  
 (A)  $P_1 > P_2 > P_3$  (B)  $P_1 > P_2 > P_3$  (C)  $P_2 > P_1 > P_3$  (D)  $P_2 > P_3 > P_1$
80. 45 gm of acid of mol. Wt. 90 neutralised by 20 mL of 0.5 N caustic potash. The basicity of the acid is  
 (A) 1 (B) 2 (C) 3 (D) 4
81. Two solution have difference osmotic pressures. The solution of higher osmotic pressure is called?  
 (A) Isotonic solution (B) Hypertonic solution  
 (C) Hypotonic solution (D) None
82. When mercuric iodide is added to the aqueous solution of KI, the  
 (A) Freezing point is raised (B) Freezing point does not change  
 (C) Freezing point is decreased (D) Boiling point does not change
83. Smoke is an example of?  
 (A) Gas dispersed in liquid (B) Gas dispersed in solid  
 (C) Solid dispersed in gas (D) Solid dispersed in solid
84. Detergent action of soaps and synthetic detergents is due to their?  
 (A) Interfacial area (B) High molecular weight  
 (C) Ionization (D) Emulsifying properties
85. The oxidation of  $\text{SO}_2$  by  $\text{O}_2$  to form  $\text{SO}_3$  is an exothermic reaction. Production of  $\text{SO}_3$  will be maximum  
 (A) If temperature is raised (B) If temperature is decreased  
 (C) If concentration of  $\text{SO}_2$  is decreased (D) None

86. The specific rate constant of a first order reaction depends on?  
 (A) Concentration of the reactant                      (B) Concentration of the product  
 (C) Time    (D) Temperature
87. Which of the following statements is true?  
 (A) Endothermic reactions have higher activation energies than exothermic reactions  
 (B) The rate of catalysed reaction is independent of concentration of catalyst  
 (C) The specific rate constant for a reaction is independent of the concentration of the reacting species  
 (D) There is a single rate determining step in any reaction mechanism
88. In the reaction  $A + 2B \rightarrow \text{Products}$ , doubling the concentration of B (keeping the concentration of A constant) increases, the rate?  
 (A) 2 times                      (B) 4 times                      (C) 3 times                      (D) 6 times
89. An auto catalyst is?  
 (A) Catalyst for catalyst  
 (B) One which starts a reaction  
 (C) One of the products of the reaction which acts as a catalyst  
 (D) None
90. Which of the following statements/ relationships is not correct?  
 (A) In an exothermic reaction, the enthalpy of products is less than that of reactants  
 (B)  $\Delta H_{\text{fusion}} = \Delta H_{\text{sublimation}} - \Delta H_{\text{vapourisation}}$   
 (C) A reaction for which  $\Delta H^\circ < 0$  and  $\Delta S^\circ > 0$  is possible at all temperatures  
 (D)  $\Delta H$  is less than  $\Delta E$  for the reaction  $C(s) + \frac{1}{2}O_2(g) \rightarrow CO_2(g)$
91. Decrease of free energy of a reacting system indicates of a/an?  
 (A) Exothermic reaction                                      (B) Equilibrium reaction  
 (C) Spontaneous reaction                                      (D) Slow reaction
92. In electrolysis mass of discharged ion is not proportional to?  
 (A) Time    (B) Quantity of electricity  
 (C) Resistance    (D) Chemical equivalent of ions

93. Which is not the Lewis acid?  
(A)  $\text{H}_2\text{O}$  (B)  $\text{Ag}^+$  (C)  $\text{BF}_3$  (D)  $\text{ZnCl}_2$
94. The pH of  $10^{-8}$  M HCl is  
(A) 6.96 (B) 8.2 (C) 6.0 (D) 8.9
95. When  $\text{K}_2\text{O}$  is added to water, the solution is basic because it contains a significant concentration of?  
(A)  $\text{K}^+$  (B)  $\text{K}_2\text{O}$   
(C)  $\text{O}^{2-}$  (D)  $\text{O}_2^{2-}$   
(E)  $\text{OH}^-$
96. Which of the following absorbs heat when dissolved in water?  
(A) Sodium thiosulphate (B) Sodium chloride  
(C) Sodium carbonate (D) Sodium hydroxide
97. In what manner will increase of pressure affect the equation  
 $\text{C(s)} + \text{H}_2\text{O(g)} \rightleftharpoons \text{CO(g)} + \text{H}_2\text{(g)}$ .  
(A) Shift in the forward direction (B) Shift in the reverse direction  
(C) Increase in the yield of  $\text{H}_2$  (D) No effect
98. The half life of a first order reaction is?  
(A) Independent of initial concentration  
(B) Directly proportional to initial  
(C) Inversely proportional to initial concentration  
(D) None
99. How many grams of  $\text{CH}_3\text{OH}$  would have to be added to water to prepare 150 mL of solution that is 2.0 M  $\text{CH}_3\text{OH}$ ?  
(A) 9.6 (B) 2.4 (C)  $9.6 \times 10^3$  (D)  $4.3 \times 10^2$
100. Which of the following colloidal system contains solid as the dispersed phase?  
(A) Smoke (B) Clouds (C) \*Lather (D) Boot polish