AIEEE - COMMON PRACTICE TEST-

Time: 3 hours **Maximum marks: 315**

MATHEMATICS

PART – I

1. The family of curves in which the subs-tangent at any point of a curve is double the abscissa, is given by :
(A) $x = cy^2$ (B) $y = cx^2$
(C) $x^2 = cy^2$ (D) $y = cx$

2. At each point (x, y) of the curve the intercept of the tangent on y-axis is equal to $2xy^2$. The equation of the curves is :
(A) $x + x^2y = cy$ (B) $x - x^2y = cy$
(C) $y + y^2x = cx$ (D) none of these

3. The curve for which the slope of the tangent at any point equals the ratio of the abscissa to the ordinate of the point is :
(A) a circle (B) an ellipse
(C) a rectangular hyperbola (D) none of these

4. The equation of the curve which passes through the point (1, 1) and whose slope is given by $\frac{2y}{x}$, is :
(A) $y = x^2$ (B) $x^2 - y^2 = 0$
(C) $2x^2 + y^2 = 3$ (D) none of these

5. An integrating factor for the differential equation $(1 + y^2)dx - (\tan^{-1}y - x)dy = 0$, is
(A) $\tan^{-1} y$ (B) $e^{\tan^{-1} y}$
(C) $\frac{1}{1+y^2}$ (D) $\frac{1}{x(1+y^2)}$

6. If $\frac{dy}{dx} = 1 + x + y + xy$ and y(- 1) = 0, then function y is :
(A) $e^{(1-x)^2/2}$ (B) $e^{((1+x)^2/2)} - 1$
(C) $\log_e(1+x) - 1$ (D) $1 + x$

7. The solution of the differential equation $\frac{dy}{dx} - ky = 0,\ y(0) = 1$, approaches zero when $x \to \infty$, if :
(A) $k = 0$ (B) $k > 0$
(C) $k < 0$ (D) none of these

8. Solution of the differential equation x dy – y dx = 0 represents :
(A) parabola whose vertex is at origin
(B) circle whose centre is at origin
(C) a rectangular hyperbola
(D) straight line passing through origin

9. A normal is drawn at a point P(x, y) of a curve. It meets the x-axis at Q. If PQ is of constant length k, then the differential equation describing such a curve is :
(A) $y\frac{dy}{dx} = \pm\sqrt{k^2 - y^2}$ (B) $x\frac{dy}{dx} = \pm\sqrt{k^2 - x^2}$
(C) $y\frac{dy}{dx} = \pm\sqrt{y^2 - k^2}$ (D) $x\frac{dy}{dx} = \pm\sqrt{x^2 - k^2}$

10. If a rain drop, evaporates at a rate proportional to its surface area and its original radius is 3 mm. Which reduces to 2 mm after 1 hour, then the radius of the rain drop at time t is :

(A) $1 + t$
(B) $t^{1/2}$
(C) $3 - t$
(D) $3 + t$

11. A(6, 3), B(- 3, 5), C(4, - 2) and D(x, 3x) are four points. If the ratio of area of ΔDBC and ΔABC is 1 : 2, then the value of x, will be

(A) $\frac{11}{8}$
(B) $\frac{8}{11}$
(C) 3
(D) none of these

12. If the line segment joining the points A(a, b) and B(c, d) subtends an angle θ at the origin, then cos θ is equal to :

(A) $\frac{ab+cd}{\sqrt{(a^2+b^2)(c^2+d^2)}}$
(B) $\frac{ac+bd}{\sqrt{(a^2+b^2)(c^2+d^2)}}$
(C) $\frac{ac-bd}{\sqrt{(a^2+b^2)(c^2+d^2)}}$
(D) none of these

13. If O be the origin and if the coordinates of any two points Q_1 and Q_2 be (x_1, y_1) and (x_2, y_2) respectively, then $OQ_1 . OQ_2 \cos Q_1OQ_2 =$

(A) $x_1x_2 - y_1y_2$
(B) $x_1y_1 - x_2y_2$
(C) $x_1x_2 + y_1y_2$
(D) $x_1y_1 + x_2y_2$

14. Orthocentre of the triangle whose vertices are (0, 0), (2, - 1) and (1, 3) is :

(A) $\left(\frac{4}{7}, \frac{1}{7}\right)$
(B) $\left(-\frac{4}{7}, -\frac{1}{7}\right)$
(C) (- 4, - 1)
(D) (4, 1)

15. The points (- a, b), (0, 0), (a, b) and (a^2, ab) are :

(A) Collinear
(B) Vertices of a rectangle
(C) Vertices of a Parallelogram
(D) none of these

16. The medians AD and BE of the triangle with vertices A(0, b), B(0, 0), C(a, 0) are mutually perpendicular if :

(A) $2b^2 = -a^2$
(B) $2b^2 = a^2$
(C) $a^2 = 2b^2$
(D) none of these

17. A(3, 1), B(6, 5) and C(x, y) are three points such that the angle CAB is a right angle and the area of ΔCAB = 7, then number of such point C is :

(A) 0
(B) 1
(C) 2
(D) 4

18. The new co-ordinate of a point (4, 5) when the origin shifted to the point (1, - 2) are :

(A) (5, 3)
(B) (3, 5)
(C) (3, 7)
(D) none of these

19. If P(1, 2), Q(4, 6), R(5, 7) and S(a, b) are the vertices of a parallelogram PQRS, then

(A) a = 2, b = 4
(B) a = 3, b = 4
(C) a = 2, b = 3
(D) a = 3, b = 5

20. The opposite angular points of a square ABCD are A(3, 4) and C(1, - 1). Then the coordinates of other two vertices are :

(A) $D\left(\frac{1}{2}, \frac{9}{2}\right), B\left(-\frac{1}{2}, \frac{5}{2}\right)$
(B) $D\left(-\frac{1}{2}, \frac{9}{2}\right), B\left(\frac{1}{2}, \frac{5}{2}\right)$
(C) $D\left(\frac{9}{2}, \frac{1}{2}\right), B\left(-\frac{1}{2}, \frac{5}{2}\right)$
(D) none of these

21. The integrating factor of the differential equation $\frac{dy}{dx} + \frac{1}{x}y = 3x$ is

(A) x
(B) $\ln x$
(C) 0
(D) ∞

22. The differential equation satisfied by $ax^2 + by^2 = 1$ is :

(A) $xy\,y'' + xy'^2 + yy' = 0$
(B) $xy\,y'' + 2xy'^2 - yy' = 0$
(C) $xy\,y'' - xy'^2 + yy' = 0$
(D) none of these

23. Solution of $y\,dx - x\,dy = x^2y\,dx$ is

(A) $ye^{x^2} = cx^2$ (B) $ye^{-x^2} = cx^2$

(C) $y^2e^{x^2} = cx^2$ (D) $y^2e^{-x^2} = cx^2$

24. The solution of the differential equation $\left(x + 2y^3\right)\frac{dy}{dx} = y$ is

(A) $x = y^2 + c$ (B) $y = x^2 + c$

(C) $x = y(y^2 + c)$ (D) $y = x(x^2 + c)$

25. If $\frac{dy}{dx} = \frac{xy + y}{xy + x}$, then the solution of the differential equation is

(A) $y = xe^x + c$ (B) $y = e^x + c$

(C) $y = cxe^{x-y}$ (D) $y = x + c$

26. The order and degree of the differential equation $\frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^{1/3} + x^{1/4} = 0$ are respectively :

(A) 2, 3 (B) 3, 3

(C) 2, 6 (D) 2, 4

27. Area bounded by lines $y = 2 + x$, $y = 2 - x$ and $x = 2$ is

(A) 3 (B) 4

(C) 8 (D) 16

28. A solution of differential equation $\left(\frac{dy}{dx}\right)^2 - \left(\frac{dy}{dx}\right)\left(e^x + e^{-x}\right) + 1 = 0$ is given by

(A) $y + e^{-x} = C$ (B) $y - e^{-x} = C$

(C) $y + e^x = C$ (D) none of these

29. The period of the function $f(x) = \cos x^2$ is

(A) 2π (B) π

(C) $\frac{\pi}{2}$ (D) none of these

30. The value of $\lim_{x\to\infty} x\cos\left(\frac{\pi}{4x}\right)\sin\left(\frac{\pi}{4x}\right)$ is :

(A) $\frac{\pi}{2}$ (B) $\frac{\pi}{4}$

(C) 1 (D) none of these

31. The value of b for which the function

$$F(x) = \begin{cases} 5x - 4, & 0 < x \le 1 \\ 4x^2 + 3bx, & 1 < x < 2 \end{cases}$$

is continuous at every point of its domain, is

(A) -1 (B) 0

(C) $\frac{13}{3}$ (D) 1

32. The angle between the curves $y^2 = 4x$ and $x^2 + y^2 = 5$ at (1, 2) is :

(A) $\tan^{-1} 2$ (B) $\frac{\pi}{2}$

(C) $\frac{\pi}{4}$ (D) $\tan^{-1} 3$

33. For the curve $y = xe^x$, the point :

(A) $x = -1$ is a point of minima (B) $x = 0$ is a point of maxima

(C) $x = -1$ is a point of maxima (D) $x = 0$ is a point of maxima

34. $\int_0^{\pi/2} \frac{\cos x\,dx}{(1+\sin x)(2+\sin x)} =$

(A) $\log\left(\frac{3}{4}\right)$ (B) $\log\left(\frac{4}{3}\right)$ (C) $\log\left(\frac{5}{3}\right)$ (D) $\log\left(\frac{7}{3}\right)$

35. The area bonded by the curves $\sqrt{x}+\sqrt{y}=1$ and x + y = 1 is

(A) 1/3 (B) 1/6 (C) 1/2 (D) none of these

CHEMISTRY

PART – II

36. Consider the following gas phase reaction at equilibrium

$Cl_{2(g)} + 3F_{2(g)} \rightleftharpoons 2ClF_{3(g)}$

If the concentration of $F_{2(g)}$ is suddenly doubled, which of the following best describes what will happen?

(A) The concentration of both $F_{2(g)}$ and $Cl_{2(g)}$ will decrease; $ClF_{3(g)}$ will increase

(B) The concentration of $ClF_{3(g)}$ will decrease; $Cl_{2(g)}$ and $F_{2(g)}$ will both increase

(C) The concentration of all three species will be unaffected

(D) It is impossible to tell without the value of the equilibrium constant

37. A vessel at 1000K contains CO_2 with a pressure of 0.5 atm. Some of the CO_2 is converted into CO on the addition of graphite. The value of K_p if the total pressure at equilibrium is 0.8 atm is:

(A) 1.8 atm (B) 3 atm

(C) 0.3 atm (D) 0.18 atm

38. The molecular weight of PCl_5 is 208.32 but when heated to 230°C, it is reduced to 124. The extent of dissociation of PCl_5 at this temperature will be

(A) 6.8% (B) 68%

(C) 46% (D) 64%

39. The equilibrium constant K_C for the reaction $SO_{2(g)} + NO_{2(g)} \rightleftharpoons SO_{3(g)} + NO_{(g)}$ is 16. If 1 mole each of all four gases is taken in 1 dm^3 vessel the equilibrium concentration of NO would be

(A) 0.04 (B) 0.6 M

(C) 4.4 M (D) 1.6 M

40. In the reaction $A_2(g) + 4B_2(g) \rightleftharpoons 2AB_4(g)$, $\Delta H > 0$. The decomposition of AB_4 (g) will be favoured at

(A) low temperature and high pressure (B) high temperature and low pressure

(C) low temperature and low pressure (D) high temperature and high pressure

41. When KOH is dissolved in water, heat is evolved. If the temperature is raised, the solubility of KOH.

(A) Increases (B) Decreases

(C) Remains the same (D) Cannot be predicted

42. One mole of ethanol is treated with one mole of ethanoic acid at 25°C. One–fourth of the acid changes into ester at equilibrium. The equilibrium constant for the reaction will be

(A) 1/9 (B) 4/9

(C) 9 (D) 9/4

43. The equilibrium, $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$ is attained at 25°C in a closed container and an inert gas He is introduced. Which of the following statements are correct.

(A) concentration of PCl_5, PCl_3 and Cl_2 are changed

(B) more Cl_2 is formed

(C) concentration of PCl_3 is reduced

(D) Nothing happens

44. In which of the following equilibrium, the value of K_P is less than K_C?

(A) $N_2O_4 \rightleftharpoons 2NO_2$ (B) $N_2 + O_2 \rightleftharpoons 2NO$

(C) $N_2 + 3H_2 \rightleftharpoons 2NH_3$ (D) None of these

45. For the reaction $PCl_{3(g)} + Cl_{2(g)} \rightleftharpoons PCl_{5(g)}$, the value of K_C at 250°C is 26 mol^{-1}/litre. The value of K_p at this temperature will be

(A) 0.61 atm^{-1}
(B) 0.57 atm^{-1}
(C) 0.85 atm^{-1}
(D) 0.46 atm^{-1}

46. On applying pressure to the equilibrium

Ice $\rightleftharpoons$ water

Which phenomenon will happen

(A) More ice will be formed
(B) More water will be formed
(C) Equilibrium will not be disturbed
(D) Water will evaporate

47. For the decomposition reaction: NH_2COONH_4 (s) $\rightleftharpoons$ $2NH_3(g) + CO_2(g)$

The $K_P = 2.9 \times 10^{-5}$ atm^3. The total pressure of gases at equilibrium when 1 mole of $NH_2COONH_4(s)$ was taken to start with would be

(A) 0.0194 atm
(B) 0.0388 atm
(C) 0.0582 atm
(D) 0.0766 atm

48. For the reaction $CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$, the pressure of $CO_2(g)$ depends on

(A) the mass of $CaCO_3(s)$
(B) the mass of CaO(s)
(C) the masses of both $CaCO_3(s)$ and CaO(s)
(D) temperature of the system.

49. The equilibrium constant for the reaction

$N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$ is 4×10^{-4} at 200 K. In the presence of a catalyst the equilibrium is attained 10 times faster. Therefore the equilibrium constant in presence of the catalyst at 200 K is

(A) 4×10^{-3}
(B) 4×10^{-4}
(C) 4×10^{-5}
(D) None

50. Correct statement regarding pure water amongst the following is

(A) It contains only single specie i.e. H_2O molecules
(B) It contains three species: H_2O (molecules), H^+ and OH^-
(C) It contains only two species H_3O^+ and OH^-
(D) It contains three species H_2O(molecules), H_3O^+ and OH^-

51. Equal volumes of two solutions of a strong acid having pH 3 and pH 4 are mixed together. The pH of the resulting solution will then be equal to

(A) 3.5
(B) 3.26
(C) 7
(D) 1.0

52. In a mixture of CH_3COOH and CH_3COONa, the ratio of salt to acid concentration is increased by ten folds. The pH of the solution will increase by

(A) Zero
(B) 1
(C) 2
(D) 3

53. The following equilibrium is established when hydrogen chloride is dissolved in acetic acid;

$HCl + CH_3COOH \rightleftharpoons Cl^- + CH_3COOH_2^+$

The set that characterises the conjugate acid-base pair is

(A) (HCl, CH_3COOH) and ($CH_3COOH_2^+$, Cl^-)
(B) (HCl, $CH_3COOH_2^+$) and (CH_3COOH, Cl^-)
(C) $CH_3COOH_2^+$, HCl) and (Cl^-, CH_3COOH)
(D) (HCl, Cl^-) and ($CH_3COOH_2^+$, CH_3COOH)

54. Which of the following expressions is not true?

(A) $[H^+] = [OH^-] = \sqrt{K_W}$ for a neutral solution

(B) $[H^+] > \sqrt{K_w}$ and $[OH^-] < \sqrt{K_W}$ for an acidic solution

(C) $[H^+] < \sqrt{K_w}$ and $[OH^-] > \sqrt{K_w}$ for an alkaline solution

(D) $[H^+] = [OH^-] = 10^{-7}$ M for a neutral solution at all temperatures

55. 10^{-5} M NaOH solution at 25°C is diluted 1000 times. The pH of the solution will

(A) be equal to 8 (B) lie between 7 and 8

(C) lie between 6 and 7 (D) remain unchanged

56. In decinormal solution, CH_3COOH is ionised to the extent of 1.3%. If log 1.3 = 0.11 what is the pH of the solution?

(A) 3.89 (B) 4.89

(C) 2.89 (D) 2.89

57. Dissociation constant of two acids HA & HB are respectively 4×10^{-10} & 1.8×10^{-5} whose pH value will be higher for a given molarity:

(A) HA (B) HB

(C) Both same (D) Can't say

58. pH of a mixture of 1M benzoic acid (pKa = 4.20) and 1M C_6H_5COONa is 4.5. In 300 ml buffer, benzoic acid is [log 2 = 0.3]

(A) 200 ml (B) 150 ml

(C) 100 ml (D) 50 ml

59. For an aqueous solution to be neutral it must have

(A) pH = 7 (B) $[H^+]=[OH^-]$

(C) $[H^+] = \sqrt{K_w}$ (D) $[H^+] < [OH^-]$

60. 0.1 M acetic acid solution is titrated against 0.1 M NaOH solution. What would be the different in pH between 1/4 and 3/4 stages of neutralisation of acid

(A) 2 log 3/4 (B) 2 log ¼

(C) log 1/3 (D) 2 log 3

61. 10^{-2} mole of NaOH was added to 10 litre of water the pH will change by

(A) 4 (B) 3

(C) 11 (D) 7

62. If the degree of ionization of water be 1.8×10^{-9} at 298K. Its ionization constant will be

(A) 1.8×10^{-16} (B) 1×10^{-14}

(C) 1×10^{-16} (D) 1.67×10^{-14}

63. 50% neutralisation of a solution of formic acid ($K_a = 2 \times 10^{-4}$) with NaOH would result in a solution having a hydrogen ion concentration of

(A) 2×10^{-4} (B) 3.7

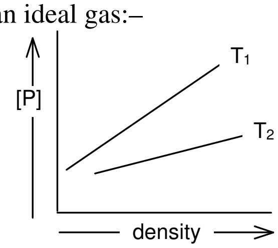
(C) 2.7 (D) 1.85

64. If 1 litre of a gas A at 600 mm and 0.5 lt of gas B at 800 mm are taken in a two litre bulb. The resulting pressure is:–

(A) 1500 mm (B) 1000 mm

(C) 2000 mm (D) 500 mm

65. For an ideal gas:–



(A) $T_1 > T_2$ (B) $T_1 = T_2$

(C) $T_1 < T_2$ (D) none of the above

66. NH_3 reacts with BF_3 to form the adduct $H_3N \longrightarrow BF_3$. In doing so the hybridisation of

(A) B and N both change (B) Only N changes

(C) Only B changes (D) Neither B nor N changes

67. Match List I (species) with List II (Hybridisation) and select the correct answer using the codes given below

List – I	List – II
A. BCl_3	a. sp^3
B. NH_3	b. $sp^3 d^2$
C. PCl_5	c. sp^2
D. XeF_4	d. sp^3d

Codes

	A	B	C	D
(A)	c	a	d	b
(C)	a	c	d	b
(C)	a	b	d	c
(D)	c	a	b	d

68. For a 4d electron the orbital angular momentum is

(A) $\sqrt{6}\frac{h}{2\pi}$
(B) $\sqrt{12}\frac{h}{2\pi}$
(C) $\sqrt{2}\frac{h}{2\pi}$
(D) zero

69. The rate expression for a reaction is
rate = $k[A]^{3/2}[B]^{-1}$, the order of reaction is

(A) 0
(B) 1/2
(C) 3/2
(D) 5/2

70. 0.62 g $Na_2CO_3.xH_2O$ completely neturalises 100 ml of $\frac{N}{10}$ H_2SO_4. The value of x must be

(A) 1
(B) 6
(C) 8
(D) 10

PHYSICS

PART – III

71. A bullet is fired from a gun. The force on the bullet is given by $F = 600 - (2\times10^5)t$, where F is in Newton and t in second. The force on the bullet becomes zero as soon as it leaves the barrel. The impulse imparted to the bullet is

(A) 8 *N-s*
(B) 0.9 *N-s*
(C) 1.8 *N-s*
(D) 2.4 *N-s*

72. An earth satellite of mass *M* circles the earth with speed *V*. The change in momentum when it goes halfway around the earth is :

(A) 0
(B) *Mv*
(C) 2*Mv*
(D) $\frac{Mv}{2}$

73. A body of mass 2 kg moves under the influence of a force. Its position x changes with time according to the relation $x = \frac{t^3}{3}$ where x is in meter and t in seconds. The work done by this force in first two seconds will be

(A) 1600 Joule
(B) 160 Joule
(C) 16 Joule
(D) 1.6 Joule.

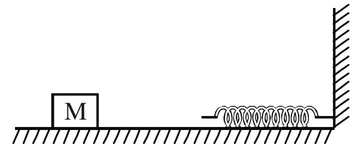
74. A bullet of mass P is fired with velocity Q in a large body of mass R. The final velocity of the system will be–

(A) $\frac{R}{P+R}$
(B) $\frac{PQ}{P+R}$
(C) $\frac{(P+Q)}{R}$
(D) $\frac{(P+R)}{P}Q$.

75. A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle, the motion of the particles takes place in a plane. It follows that

(A) its kinetic energy is constant
(B) its acceleration is constant
(C) its velocity is constant
(D) it moves in a straight line.

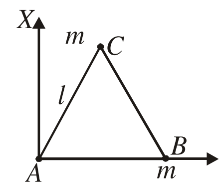
76. The block of mass M moving on the frictionless horizontal surface collides with the spring of constant k and compresses it by length L. The maximum momentum of the block after collision is



(A) $\frac{kL^2}{2M}$ (B) $\sqrt{Mk}\,L$

(C) $\frac{ML^2}{k}$ (D) zero.

77. Three particles, each of mass m gram, are situated at the vertices of an equilateral triangle ABC of side l cm (as shown in figure). The moment of inertia of the system about a line AX perpendicular to AB and in the plane of ABC, in gram-cm^2 units will be



(A) $\frac{3}{4}ml^2$ (B) $2ml^2$

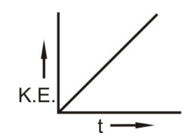
(C) $\frac{5}{4}ml^2$ (D) $\frac{3}{2}ml^2$

78. A child is standing with folded hands at the centre of a platform rotating about its central axis. The kinetic energy of the system is K. The child now stretches his arms so that the moment of inertia of the system doubles. The kinetic energy of the system now is

(A) $2K$ (B) $K/2$

(C) $K/4$ (D) $4K$

79. The kinetic energy of a body moving along a straight line varies with time as shown in figure. The force acting on the body is



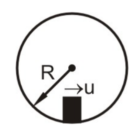
(A) zero

(B) constant

(C) directly proportional to velocity

(D) inversely proportional to velocity

80. A particle is given an initial speed u inside a smooth spherical shell of radius R = 1 m that it is just able to complete the circle. Acceleration of the particle when its velocity is vertical is



(A) $g\sqrt{10}$ (B) g

(C) $g\sqrt{2}$ (D) 3 g

81. A simple pendulum of length one metre is taken to a height R which is the radius of earth. If the acceleration due to gravity on the surface of earth is π^2 m/s^2, what is the period of the pendulum at this height?

(A) 1 s (B) 2 s

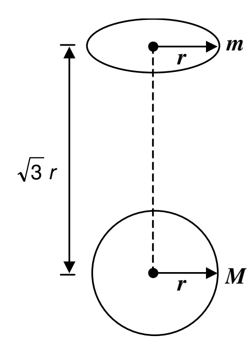
(C) 3 s (D) 4 s

82. The ratio of the energy required to raise a satellite up to a height h above the earth to that required to put it into orbit there is

(A) h : R (B) R : h

(C) 2h : R (D) R : 2h

83. A uniform ring of mass m and radius r is placed directly above a uniform sphere of mass M and of equal radius. The centre of the ring is at a distance $\sqrt{3}$ r from the centre of the sphere as shown in the figure. The gravitational force exerted by the sphere on the ring will be

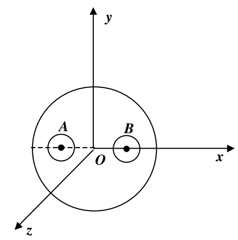


(A) $\frac{GMm}{8r^2}$ (B) $\frac{GMm}{4r^2}$

(C) $\frac{\sqrt{3}GMm}{8r^2}$ (D) $\frac{GMm}{8r^3}$

84. A solid sphere of uniform density and radius 4 units is located with its centre at the origin O of co-ordinates. Two spheres of equal radii 1 unit with their centers at A(-2, 0, 0) and B(2, 0, 0) respectively are taken out of the solid leaving behind spherical cavities as shown in the figure. Choose the ***wrong*** statement from the following:

(A) The gravitational field due to this object at the origin is zero
(B) The gravitational field at the point B(2, 0, 0) is zero
(C) The gravitational potential is the same at all points of the circle $y^2 + z^2 = 36$.
(D) The gravitational potential is the same at all points on the circle $y^2 + z^2 = 4$



85. The magnitude of the gravitational field at distance r_1 and r_2 from the centre of a uniform sphere of radius R and mass M are F_1 and F_2 respectively. Then
(A) $\frac{F_1}{F_2} = \frac{r_1}{r_2}$ if $r_1 < R$ & $r_2 < R$ and $\frac{F_1}{F_2} = \frac{r_2^2}{r_1^2}$ if $r_1 > R$ & $r_2 > R$
(B) $\frac{F_1}{F_2} = \frac{r_1}{r_2}$ if $r_1 > R$ and $r_2 > R$
(C) $\frac{F_1}{F_2} = \frac{r_1^2}{r_2^2}$ if $r_1 < R$ and $r_2 < R$
(D) none of these

86. Consider an attractive force which is central but is inversely proportional to the first power of distance. If such a particle is in circular orbit under such a force, which of the following statements are correct.
(A) The speed is directly proportional to the square root of orbital radius
(B) The speed is independent of radius
(C) The period is independent of radius
(D) All are correct.

87. Pressure inside two soap bubbles is 1.01and 1.02 atmospheres. Ratio between their volumes is
(A) 102 : 101 (B) $(102)^3 : (101)^3$
(C) 8 : 1 (D) 2 : 1

88. Two soap bubbles, each with radius r, coalesce in vacuum under isothermal conditions to form a bigger bubble of radius R. Then R is equal to
(A) $2^{-1/2} r$ (B) $2^{1/3} r$
(C) $2^{1/2} r$ (D) $2r$

89. Liquid rises to a height of 2 cm in a capillary tube. The angle of contact between the solid and the liquid is zero. The tube is depressed more now so that the top of the capillary is only 1 cm above the liquid. Then the apparent angle of contact between the solid and the liquid is
(A) 0° (B) 30°
(C) 60° (D) 90°

90. An air bubble of radius r in water is at a depth h below the water surface at some instant. If P is atmospheric pressure, d and T are density and surface tension of water respectively, the pressure inside the bubble will be
(A) $P + hdg - \frac{4T}{r}$ (B) $P + hdg + \frac{2T}{r}$
(C) $P + hdg - \frac{2T}{r}$ (D) $P + hdg + \frac{4T}{r}$

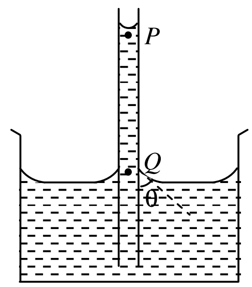
91. Water rises in a capillary tube to a certain height such that the upward force due to surface tension is balanced by 75×10^{-4} N force due to the weight of the liquid. If the surface tension of water is 6×10^{-2} N/m, the inner circumference of the capillary tube must be
(A) 1.25×10^{-2} m (B) 0.50×10^{-2} m
(C) 6.5×10^{-2} m (D) 12.5×10^{-2} m

92. A U-tube is such that the diameter of one limb is 0.4 mm and that of other is d mm. If the surface tension of water contained in the tube is 0.07 N/m and the difference in the levels of liquid in the limbs is 3.6 cm, then the value of d is
(A) 1.6×10^{-3} m (B) 0.4×10^{-3} m
(C) 8×10^{-3} m (D) 4×10^{-3} m

93. A drop of liquid pressed between two glass plates spreads into a circle of diameter 10 cm. Thickness of the liquid film is 0.5 mm and coefficient of surface tension is 70×10^{-3} N/m. The force required to pull them apart

(A) 4.4 N (B) 1.1 N
(C) 2.2 N (D) 3.6 N

94. Liquid reaches an equilibrium as shown, in a capillary tube of internal radius r. If the surface tension of the liquid is T, the angle of contact θ and density of liquid ρ, then the pressure difference between P and Q is



(A) $\left(\frac{2T}{r}\right)\cos\theta$ (B) $\frac{T}{r\cos\theta}$
(C) $\frac{2T}{r\cos\theta}$ (D) $\left(\frac{4T}{r}\right)\cos\theta$

95. The radius of the bore of a capillary tube is r and the angle of contact of the liquid is θ. When the tube is dipped in the liquid, the radius of curvature of the meniscus of liquid rising in the tube is

(A) $r\sin\theta$ (B) $r/\sin\theta$
(C) $r\cos\theta$ (D) $r/\cos\theta$

96. Two spherical soap bubbles of radii r_1 and r_2 in vacuum combine under isothermal conditions. The resulting bubble has a radius equal to

(A) $\frac{r_1+r_2}{2}$ (B) $\sqrt{r_1 r_2}$
(C) $\frac{r_1 r_2}{r_1+r_2}$ (D) $\sqrt{r_1^2+r_2^2}$

97. The height to which a cylindrical vessel be filled with a homogeneous liquid, to make the average force with which the liquid presses the side of the vessel equal to the force exerted by the liquid on the bottom of the vessel, is equal to

(A) half of the radius of the vessel (B) radius of the vessel
(C) one-fourth of the radius of the vessel (D) three-fourth of the radius of the vessel

98. Water flows steadily through a horizontal pipe of variable cross-section. If the pressure of water is P at a point where flow speed is v, the pressure at another point where the flow speed is $2v$, is
(Take density of water as ρ)

(A) $P-\frac{3\rho v^2}{2}$ (B) $P-\frac{\rho v^2}{2}$
(C) $P-\frac{3\rho v^2}{4}$ (D) $P-\rho v^2$

99. A wooden cube just floats inside water, when a 200 g mass is placed on it. When the mass is removed the cube is 2 cm above the water level. The size of the cube is

(A) 5 cm (B) 10 cm
(C) 15 cm (D) 20 cm

100. A U-tube containing a liquid is accelerated horizontally with a constant acceleration a. If the separation between the two vertical limbs is l, then the difference in the heights of the liquid in the two arms is

(A) zero (B) l
(C) $\frac{la}{g}$ (D) $\frac{lg}{a}$

101. A ball floats on the surface of water in a container exposed to the atmosphere. Volume V_1 of its volume is inside the water. If the container is now covered and the air pumped out, let V_2 be the volume now immersed in water. Then

(A) $V_1 = V_2$ (B) $V_1 > V_2$
(C) $V_2 > V_1$ (D) $V_2 = 0$

102. A rectangular vessel when full of water takes 10 minutes to be emptied through an orifice in its bottom. How much time will it take to be emptied when half filled with water?

(A) 9 minute (B) 7 minute
(C) 5 minute (D) 3 minute

103. A satellite S is moving in an elliptical orbit around the earth. The mass of the satellite is very small compared to the mass of the earth:

(A) The acceleration of S is always directed towards the centre of the earth.

(B) The angular momentum of S about the centre of the earth changes in direction, but its magnitude remains constant.

(C) The total mechanical energy of S varies periodically with time.

(D) The linear momentum of S remains constant in magnitude.

104. Two particles of mass m_1 and m_2 are initially at rest at infinite distance. Find their velocity of approach due to gravitational attraction, when their separation is d:

(A) $\sqrt{\dfrac{2G(m_1m_2)}{d}}$ (B) $\sqrt{\dfrac{G(2m_1+m_2)}{3d}}$

(C) $\sqrt{\dfrac{3G(2m_1+m_2)}{d}}$ (D) $\sqrt{\dfrac{G(m_1+m_2)}{d}}$

105. If the radius of the earth be increased by a factor of 5, by what factor its density be changed to keep the value of g unchanged ?

(A) 5 (B) 1/5

(C) $\dfrac{1}{\sqrt{5}}$ (D) 1/25