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Name.: ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

Date : 25/10/2015

Test No.: 1 1

Subject Code.: 2 2 2

Time : 3 Hrs.   **M.M. : 720**

HORIZON TEST SERIES
for
Medical
Entrance Exam.
2016

[Test No. 11]

INSTRUCTIONS FOR STUDENTS

1. Read each question carefully.

2. It is mandatory to use Blue/Black Ball Point Pen to darken the appropriate circle in the answer sheet.

3. Mark should be dark and should complete fill the circle.

4. Rough work must be done on the Question Paper, no additional sheet will be provided for this purpose.

5. Do not use white-fluid or any other rubbing material on answer sheet. No change in the answer once marked.

6. Student cannot use log tables and calculators or any other material in the examination hall.

7. Before attempting the question paper, student should ensure that the test paper contains all pages and no page is missing.

8. Each correct answer carries four marks. One mark will be deducted for each incorrect answer from the total score.

9. Before handing over the answer sheet to the invigilator, candidate should check the particulars have been filled and marked correctly.

10. Immediately after the prescribed examination time is over, the answer sheet to be returned to the invigilator.

11. Use of Calculator and other Electronic device is not permitted.

Test No. 11

Topics of The Test

Physics	Work, Energy and Power + Centre of Mass.

Chemistry	Equilibrium.

| Biology	Zoology : Excretion. Botany : Mineral nutrition.

Test No. 11

[PHYSICS]

1. A batsman hits back a ball straight in the direction of the bowler without changing its initial speed of 12 ms^{-1}. If the mass of the ball is 0.15 kg, the imparted to the ball is
   (A) 36 N-s   (B) 3.6 N-s
   (C) 0.36 N-s   (D) 0.036 N-s

2. For a moving particle (mass m, velocity v) having a momentum p, which one of the following correctly describes the kinetic energy of the particle?
   (A) $\dfrac{p^2}{2m}$ (B) $\dfrac{p}{2m}$
   (C) $\dfrac{v^2}{2m}$ (D) $\dfrac{v}{2m}$

3. A plate of mass m, length b and breadth a is initially lying on a horizontal floor with length parallel to the floor and breadth perpendicular to the floor. The work done to exect it on its breadth is
   (A) $mg\left[\dfrac{b}{2}\right]$ (B) $mg\left[a+\dfrac{b}{2}\right]$
   (C) $mg\left[\dfrac{b-a}{2}\right]$ (D) $mg\left[\dfrac{b+a}{2}\right]$

4. A quarter horse power motor runs at a speed of 600 rpm. Assuming 40% efficiency, the work done by the motor in one rotation will be
   (A) 7.46 J   (B) 7400 J
   (C) 7.46 erg   (D) 74.6 J

5. The work done by a particle moving with a velocity of $0.7\,c$ (where c is the velocity of light) in empty space free of electromagnetic field and far away from all matter is
   (A) positive   (B) negative
   (C) zero   (D) infinite

6. A body of mass 3 kg is under a constant force which causes a displacement s in metre in it, given by the relation $s = \dfrac{1}{3}t^2$, where t is in second. Work done by the force in 2 s is
   (A) $\dfrac{5}{19}$ J   (B) $\dfrac{3}{8}$ J
   (C) $\dfrac{8}{3}$ J   (D) $\dfrac{19}{5}$ J

7. A particle accelerating uniformly has velocity v at time t_1. What is work done in time t?
   (A) $\dfrac{1}{2}\left(\dfrac{mv^2}{t_1^2}\right)t^2$ (B) $\dfrac{1}{2}\left(\dfrac{mv}{t_1}\right)^2 t^2$
   (C) $\left(\dfrac{mv^2}{t_1^2}\right)t^2$ (D) $\left(\dfrac{2mv^2}{t_1^2}\right)t^2$

8. A bullet of mass m moving with velocity v block strikes a suspended wooden block of mass M. If the block rises to a height h, the initial velocity of the block will be
   (A) $\sqrt{2gh}$ (B) $\dfrac{M+m}{m}\sqrt{gh}$
   (C) $\dfrac{m}{M+m}2gh$ (D) $\dfrac{M+m}{M}\sqrt{2gh}$

9. A particle of mass m at rest is acted upon by a force P for a time t. Its kinetic energy after an interval t is
   (A) $\dfrac{P^2 t^2}{m}$ (B) $\dfrac{P^2 t^2}{2m}$
   (C) $\dfrac{P^2 t^2}{3m}$ (D) $\dfrac{Pt}{2m}$

Space for Rough Work

10. A body of mass 2 kg is thrown up vertically with kinetic energy of 490 J. If $g = 9.8$ ms^{-2}, the height at which the kinetic energy of the body becomes half of the original value, is
   (A) 50 m   (B) 25 m
   (C) 12.5 m   (D) 19.6 m

11. A sphere of mass m makes SHM in a hemispherical bowl ABC and it moves from A to C and back to A via ABC, so that $PB = h$. If acceleration due to gravity is g the speed of the ball when it just crosses the point B is
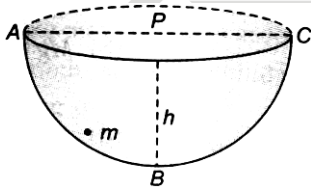

   (A) $2gh$ (B) mgh

   (C) $\sqrt{2gh}$ (D) $\dfrac{gh}{2}$

12. A stone is tied to a string of length l and is whirled in a vertical circle with the other end of the string at the centre. At a certain instant of time, the stone is at its lowest position and has a speed u. The magnitude of the change in velocity of string when horizontal (g being acceleration due to gravity) is

   (A) $\sqrt{2(u^2 - gl)}$ (B) $\sqrt{u^2 - gl}$

   (C) $u - \sqrt{u^2 - 2gl}$ (D) $\sqrt{2gl}$

13. A block C of mass m is moving with velocity v_0 and collides elastically with block A of mass m and connected to another block B of mass $2m$ through spring of spring constant k. What is k, if x_0 is compression of spring when velocity of A and B is same?


   (A) $\dfrac{mv_0^2}{x_0^2}$ (B) $\dfrac{mv_0^2}{2x_0^2}$

   (C) $\dfrac{3}{2}\dfrac{mv_0^2}{x_0^2}$ (D) $\dfrac{2}{3}\dfrac{mv_0^2}{x_0^2}$

14. The velocity of an 800 g object changes from $\mathbf{v}_o = (3\mathbf{i} - 4\mathbf{j})$ ms^{-1} to $\mathbf{v}_f = (-6\mathbf{j} + 2\mathbf{k})$ ms^{-1} change in kinetic energy is
   (A) 3 J   (B) 6 J
   (C) 2 J   (D) 1.5 J

15. A machine is delivering constant power to drive a body along a straight line. What is the relation between the distance travelled by the body against time ?
   (A) $s^2 \propto t^3$ (B) $s^2 \propto t^{-3}$
   (C) $s^3 \propto t^2$ (D) $s \propto t^3$

16. A particle of mass m is moving in a circular path of constant radius r such that centripetal acceleration a_c varying with time is $a_c = k^2 r t^2$, where k is a constant. What is the power delivered to the particle by the force acting on it ?
   (A) $2mkr^2 t$ (B) $mkr^2 t^2$
   (C) $mk^2 r^2 t$ (D) $mk^2 r t^2$

17. An engine pumps up 100 kg of water through a height of 10 m in 5 s. Given that the efficiency of engine is 60%. If $g = 10$ ms^{-2}, the power of the engine is
   (A) 3.3 kW   (B) 0.33 kW
   (C) 0.033 kW   (D) 33 kW

18. A body is initially at rest. It undergoes one-dimensional motion with constant acceleration. The power delivered to it at time t is proportional to
   (A) $t^{1/2}$ (B) t
   (C) $t^{3/2}$ (D) t^2

19. A body of mass 2 kg is projected at 20 ms^{-1} at an angle 60° above the horizontal. Power due to the gravitational force at its highest point is
   (A) 200 W   (B) $100\sqrt{3}$ W
   (C) 50 W   (D) zero

Space for Rough Work

20. In the figure, pendulum bob on left side is pulled a side to a height h from its initial position. After it is released it collides with the right pendulum bob at rest, which is of same mass. After the collision the two bobs stick together and rise to a height
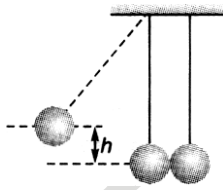
   (A) $\dfrac{3h}{4}$ (B) $\dfrac{2h}{3}$

   (C) $\dfrac{h}{2}$ (D) $\dfrac{h}{4}$

21. Two balls of same mass each m are moving with same velocities v on a smooth surface as shown in figure. If all collisions between the masses and with the wall are perfectly elastic, the possible number of collisions between the bodies and wall together is
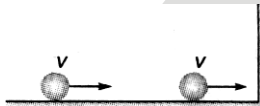
   (A) 1   (B) 2
   (C) 3   (D) infinity

22. A ball of mass m elastically collides with a wall with velocity v, the change in its momentum is equal to

   (A) $2m$ (B) $2mv$

   (C) $8mv$ (D) zero

23. In two separate collisions, the coefficients of restitutions e_1 and e_2 are in the ratio 3 : 1. In the first, collision the relative velocity of approach is twice the relative velocity of separation. Then the ratio between the relative velocity of approach and relative velocity of separation in the second collision is

   (A) 1 : 6   (B) 2 : 3
   (C) 3 : 2   (D) 6 : 1

24. A body of mass m is moving towards east and another body of equal mass is moving towards north. If after collision both stick together, their speed after collision would be

   (A) v (B) $v/2$

   (C) $\sqrt{2}v$ (D) $v/\sqrt{2}$

25. 1 kg body explodes into three fragments. The ratio of their masses is 1:1:3. The fragments of same mass move perpendicular to each other with speed 30 ms^{-1}, while the heavier part remains in the initial direction. The speed of heavier part is

   (A) $\dfrac{10}{\sqrt{2}}$ ms^{-1} (B) $10\sqrt{2}$ ms^{-1}

   (C) $20\sqrt{2}$ ms^{-1} (D) $30\sqrt{2}$ ms^{-1}

26. A body of mass 4 kg moving with velocity 12 ms^{-1} collides with another body of mass 6 kg at rest. If two bodies stick together after collision, then the loss of kinetic energy of system is

   (A) zero   (B) 288 J
   (C) 172.8 J   (D) 144 J

27. A ball is dropped from a height of 20 cm. Ball rebounds to a height of 10 cm. What is the loss of energy ?

   (A) 25%   (B) 75%
   (C) 50%   (D) 100%

28. A body x with a momentum p collides with another identical stationary body y one dimensionally. During the collision y gives an impulse J to the body x. Then, the coefficient of restitution is

   (A) $\dfrac{2J}{p}-1$ (B) $\dfrac{J}{p}+1$

   (C) $\dfrac{J}{p}-1$ (D) $\dfrac{J}{2p}-1$

29. A ball is dropped from a height h. If the coefficient of restitution is e then to what height will it rise after jumping twice from the ground ?

   (A) $\dfrac{eh}{2}$ (B) $2eh$

   (C) eh (D) e^4h

Space for Rough Work

30. The centre of mass of a solid cone along the line from the centre of the base to the vertex is at
    (A) one-fourth of the height
    (B) one-third of the height
    (C) one-fifth of the height
    (D) None of the above

31. The centre of mass of a system of three particles of masses 1 g, 2 g and 3 g is taken as the origin of a coordinate system. The position vector of a fourth particle of mass 4 g such that the centre of mass of the four particle system lies at the point (1,2,3) is $\alpha(\hat{i}+2\hat{j}+3\hat{k})$, where α is a constant. The value of α is
    (A) $\dfrac{10}{3}$
    (B) $\dfrac{5}{2}$
    (C) $\dfrac{1}{2}$
    (D) $\dfrac{2}{5}$

32. A pulley fixed to the ceiling carries a string with blocks of masses m and $3m$ attached to its ends. The masses of string and pulley are negligible. When the system is released, the acceleration of centre of mass will be
    (A) zero
    (B) $-\dfrac{g}{4}$
    (C) $\dfrac{g}{2}$
    (D) $-\dfrac{g}{2}$

33. Two bodies of different masses of 2 kg and 4 kg moving with velocities 2 ms^{-1} and 10 ms^{-1} towards each other due to mutual gravitational attraction. What is the velocity of their centre of mass ?
    (A) 5 ms^{-1}
    (B) 6 ms^{-1}
    (C) 8 ms^{-1}
    (D) zero

34. A system consisting of two masses connected by a massless rod lies along the x-axis. A 0.4 kg mass is at a distance x = 2 m while a 0.6 kg mass is at a distance x = 7 m. The x-coordinate of the centre of mass is
    (A) 5 m
    (B) 3.5 m
    (C) 4.5 m
    (D) 4 m

35. Four point masses P,Q,R and S with respective masses 1kg, 1kg, 2kg and 2 kg form the corners of a square of side a. The centre of mass of the system will be farthest from
    (A) P only
    (B) R and S
    (C) R only
    (D) P and Q

36. Find the velocity of centre of mass of the system shown in the figure ?
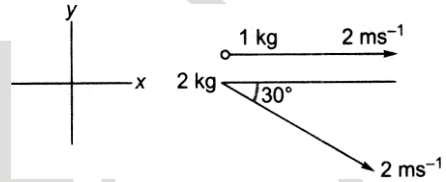
    (A) $\left(\dfrac{2+2\sqrt{3}}{3}\right)\hat{i}-\dfrac{2}{3}\hat{j}$
    (B) $4\hat{i}$
    (C) $\left(\dfrac{2-2\sqrt{3}}{3}\right)\hat{i}-\dfrac{1}{3}\hat{j}$
    (D) None of these

37. A straight rod of length L has one of its ends at the origin and the other at $x = L$. If the mass per unit length of the rod is given by Ax here A is constant, where is its mass centre ?
    (A) $L/3$
    (B) $L/2$
    (C) $2L/3$
    (D) $3L/4$

38. Four particles, each of mass 1 kg are placed at the corners of a square $OABC$ of side 1 m. O is at the origin of the coordinate system. OA and OC are aligned along positive X-axis and positive Y-axis respectively. The position vector of the centre of mass is (in metre)
    (A) $\hat{i}+\hat{j}$
    (B) $\dfrac{1}{2}(\hat{i}+\hat{j})$
    (C) $(\hat{i}-\hat{j})$
    (D) $\dfrac{1}{2}(\hat{i}-\hat{j})$

Space for Rough Work

39. Three identical spheres of mass M each are placed at the corners of an equilateral triangle of side $2\,m$. Taking one of the corner as the origin, the position vector of the centre of mass is
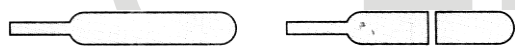
(A) $\sqrt{3}(\hat{i} - \hat{j})$ (B) $\dfrac{\hat{i}}{\sqrt{3}} + \hat{j}$

(C) $\dfrac{\hat{i} + \hat{j}}{3}$ (D) $\hat{i} + \dfrac{\hat{j}}{\sqrt{3}}$

40. A ladder is leaned against a smooth wall and it is allowed to slip on a frictionless floor. Which figure represents the track of its centre of mass ?
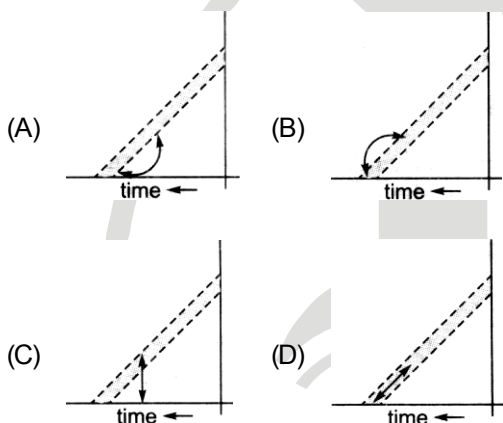
41. A cricket bat is cut at the location of its centre of mass as shown. Then

(A) the two pieces will have the same mass
(B) the bottom piece will have larger mass
(C) the handle piece will have larger mass
(D) mass of handle piece is double the mass of bottom piece

42. Three particles each of mass 1 kg are placed at the corners of a right angled triangle AOB, O being the origin of the coordinate system (OA and OB along positive X-direction and positive Y-direction). If $OA = OB = 1m$, the positive vector of the centre of mass (in metre) is

(A) $\dfrac{\hat{i} + \hat{j}}{3}$ (B) $\dfrac{\hat{i} - \hat{j}}{3}$

(C) $\dfrac{2(\hat{i} + \hat{j})}{3}$ (D) $(\hat{i} - \hat{j})$

43. If linear density of a rod of length 3 m varies as $\lambda = 2 + x$, then the position of the centre of gravity of the rod is

(A) $\dfrac{7}{3}\,m$ (B) $\dfrac{12}{7}\,m$

(C) $\dfrac{10}{7}\,m$ (D) $\dfrac{9}{7}\,m$

44. Four particles, each of mass 1 kg, are placed at the corners of a square of side 1 m in the X-Y plane. If the point of intersection of the diagonals of the square, is taken as the origin, the coordinates of the centre of mass are

(A) (1,1)   (B) (–1,1)
(C) (1,–1)   (D) (0,0)

45. The centre of mass of a system of two particles divides the distance between them

(A) in inverse ratio of square of masses of particles
(B) in direct ratio of square of masses of particles
(C) in inverse ratio of masses of particles
(D) in direct ratio of masses of particles

[CHEMISTRY]

46. In the equilibrium, $N_2O_4(g) \rightleftharpoons 2NO_2(g)$, the N_2O_4 is fifty per cent dissociated at 60°C. What will be the value of K_p at this temperature and one atmosphere ?

(A) 0.33 atm   (B) 1.33 atm
(C) 2.33 atm   (D) 3.33 atm

47. The equilibrium constant for the reaction, $2G + J \rightleftharpoons D + 2T$ is 1.5×10^{-3}. When 1.0 mol of G, 2.0 mol of J and 0.5 mol of D are put in a 1.0 L flask and allowed to reach equilibrium, then the equilibrium concentration of T is

(A) 0.039   (B) 0.078
(C) 2   (D) 5

Space for Rough Work

48. Calculate K_c for the reversible process given below if $K_p = 167$ and $T = 800°C$

    $$CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$$

    (A) 1.95   (B) 1.85

    (C) 1.89   (D) 1.60

49. Two moles of each reactant A and B are taken in a reaction flask. They react in the following manner,

    $$A(g) + B(g) \rightleftharpoons C(g) + D(g)$$

    At equilibrium, it was found that the concentration of C is triple to that of B. The equilibrium constant for the reaction is

    (A) 4.5   (B) 6

    (C) 9   (D) $\dfrac{1}{6}$

50. The following equilibrium constants are given

    $$N_2 + 3H_2 \rightleftharpoons 2NH_3, \qquad K_1$$

    $$N_2 + O_2 \rightleftharpoons 2NO, \qquad K_2$$

    $$H_2 + \dfrac{1}{2}O_2 \rightleftharpoons H_2O, \qquad K_3$$

    The equilibrium constant for the oxidation of NH_3 by oxygen to give NO is

    (A) $\dfrac{K_2 K_3^3}{K_1}$ (B) $\dfrac{K_2 K_3^2}{K_1}$

    (C) $\dfrac{K_2^2 K_3^6}{K_1^2}$ (D) $\dfrac{K_1 K_2}{K_3}$

51. For a given exothermic reaction, K_p and K_p' are the equilibrium constants at temperatures T_1 and T_2, respectively. Assuming that heat of reaction is constant in temperature range between T_1 and T_2, it is readily observed that

    (A) $K_p > K_p'$ (B) $K_p < K_p'$

    (C) $K_p = K_p'$ (D) $K_p = 1/K_p'$

52. The value of ΔH for the reaction,

    $$X_2(g) + 4Y_2(g) \rightleftharpoons 2XY_4(g)$$ is less than zero. Formation of $XY_4(g)$ will be favoured at

    (A) high pressure and low temperature

    (B) high temperature and high pressure

    (C) low pressure and low temperature

    (D) high temperature and low pressure

53. Given exothermic reaction,

    $$CoCl_4^{2-}(aq) + 6H_2O(l) \rightleftharpoons [Co(H_2O)_6]^{2+} + 4Cl^-$$

    Which one of the following will decrease the equilibrium concentration of $CoCl_4^{2-}$?

    (A) Addition of HCl

    (B) Addition of $Co(NO_3)_2$

    (C) The solution is diluted with water

    (D) The temperature is increased

54. A reversible chemical reaction is having two reactants, in equilibrium. If concentration of the reactants are doubled, then the equilibrium constant will

    (A) be doubled   (B) become one-fourth

    (C) be halved   (D) remain the same

55. For the given equilibrium,

    $$2NO_2(g) \rightleftharpoons N_2O_4(g) + 14.6 \text{ kcal}$$

    increase in temperature

    (A) favours the formation of N_2O_4

    (B) favours the decomposition of N_2O_4

    (C) does not affect equilibrium

    (D) stop the reaction

56. Which is the strongest acid in the following ?

    (A) H_2SO_4 (B) $HClO_3$

    (C) $HClO_4$ (D) H_2SO_3

57. Which of the following is not a conjugate acid-base pairs ?

    (A) HPO_3^{2-}, PO_3^{3-} (B) $H_2PO_4^-, HPO_4^{2-}$

    (C) $H_2PO_4^-, H_3PO_4$ (D) $H_2PO_4^-, PO_3^{2-}$

Space for Rough Work

58. Which of the following is least likely to behave as Lewis base ?
    (A) OH^- (B) H_2O
    (C) NH_3 (D) BF_3

59. Which one of the following is not acid-base conjugate pair ?
    (A) $HONO, NO_2^-$
    (B) $CH_3NH_3^+, CH_3NH_2$
    (C) $C_6H_5 - COOH, C_6H_5COO^-$
    (D) H_3O^+, OH^-

60. In a solution, 0.02 M acetic acid is 4% dissociated. The $[OH^-]$ in the solution is
    (A) 8×10^{-4} (B) 2×10^{-14}
    (C) 88×10^{10} (D) 1.25×10^{-11}

61. Basic strength of
    I. $H_3 C \overset{\ominus}{C} H_2$ II. $H_2 C = \overset{\ominus}{C} H$ and II. $H - C \equiv \overset{\ominus}{C}$,
    is in the order of
    (A) II > I > III   (B) III > II > I
    (C) I > III > II   (D) I > II > III

62. According to Lowry and Bronsted, the strength of an acid depends upon
    (A) the tendency to gain electrons
    (B) the tendency to lose protons
    (C) the tendency to accept protons
    (D) the tendency to lose electrons

63. Ionisation depends upon
    (A) pressure   (B) volume
    (C) dilution   (D) None of these

64. The pair of amphoteric hydroxides is
    (A) $Al(OH)_3, LiOH$
    (B) $Be(OH)_2, Mg(OH)_2$
    (C) $B(OH)_3, Be(OH)_2$
    (D) $Be(OH)_2, Zn(OH)_2$

65. Which is Lewis base $I_2 + I^- \rightarrow I_3^-$?
    (A) I_2 (B) I_3^-
    (C) I^- (D) None of these

66. What is the pH of millimolar solution of ammonium hydroxide which is 20% dissociated ?
    (A) 3.699   (B) 10.301
    (C) 4.691   (D) 9.301

67. The pH of 10^{-4} M KOH solution will be
    (A) 4   (B) 11
    (C) 10.5   (D) 10

68. A saturated solution of $Ca_3(PO_4)_2$ contains 2.0×10^{-8} M of Ca^{2+} and 1.6×10^{-5} M of PO_4^{3-} at a certain temperature. The solubility product (K_{sp}) of $Ca_3(PO_4)_2$ at that temperature is
    (A) 2.048×10^{-34} (B) 2.048×10^{-33}
    (C) 3.20×10^{-34} (D) 8.00×10^{-34}

69. A solution of pH 9.0 is 1000 times as basic as a solution. The pH of this solution is
    (A) 9   (B) 8
    (C) 7   (D) 6

70. The solubility product of calcium fluoride is 3.2×10^{-11} M^3. Its solubility in saturated solution is
    (A) 8×10^{-12} mol L^{-1} (B) 2×10^{-4} mol L^{-1}
    (C) 4×10^{-12} mol L^{-1} (D) 1×10^{-4} mol L^{-1}

71. On adding $AlCl_3$ to water
    (A) the ionisation of water increases
    (B) the ionisation of water decreases
    (C) the ionisation of water remains constant
    (D) the ionic product of water increases

72. H_2S is passed into one dm^3 of a solution containing 0.1 mole of Zn^{2+} and 0.01 mole of the Cu^{2+} till the sulphide ion concentration reaches 8.1×10^{-19} moles. Which one of the following statements is true ?
    (K_{sp} of ZnS and CuS are 3×10^{-22} and 8×10^{-36} respectively)
    (A) Only ZnS precipitates
    (B) Both CuS and ZnS precipitate
    (C) Only CuS precipitates
    (D) No precipitation occurs

Space for Rough Work

73. If pH of a saturated solution of $Ba(OH)_2$ is 12, the value of its K_{sp} is

(A) $5.00 \times 10^{-7} M^3$ (B) $4.00 \times 10^{-6} M^3$
(C) $4.00 \times 10^{-7} M^3$ (D) $5.00 \times 10^{-6} M^3$

74. Two acids A and B have pK_a 4 and 6, then

(A) A is 4/6 times stronger than B
(B) A is 10 times stronger than B
(C) A is 6/4 times stronger than B
(D) B is 10 times stronger than A

75. If 20 mL of an acidic solution of pH 3 is diluted to 100 mL, the H^+ ion concentration will be

(A) $1 \times 10^{-3} M$ (B) $2 \times 10^{-3} M$
(C) $2 \times 10^{-4} M$ (D) $0.02 \times 10^{-4} M$

76. The solubility product of a sparingly soluble metal hydroxide $M(OH)_2$ at 298 K is 5×10^{-16} mol^3 dm^{-9}. The pH value of its aqueous and saturated solution is

(A) 5 (B) 9
(C) 11.5 (D) 2.5

77. solubility (s) of CaF_2 in terms of its solubility product is given as

(A) $s = (K_{sp})^{1/3}$ (B) $s = (K_{sp}/2)^{1/3}$
(C) $s = (K_{sp}/4)^{1/3}$ (D) $s = (K_{sp}/2)^{1/2}$

78. On adding 0.1 M solution each of $[Ag^+], [Ba^{2+}], [Ca^{2+}]$ in a Na_2SO_4 solution, species first precipitated is $[K_{sp}$ of $BaSO_4 = 10^{-11}$, K_{sp} of $CaSO_4 = 10^{-6}$, K_{sp} of $Ag_2SO_4 = 10^{-5}]$

(A) Ag_2SO_4 (B) $BaSO_4$
(C) $CaSO_4$ (D) All of these

79. Which of the following is correct ?

(A) The pH of 1 L solution containing 0.49 g of H_2SO_4 is 2.0
(B) The conjugate base of H_2S is S^{2-}
(C) BF_3 is a Lewis base
(D) Phenolphthalein is colourless in basic medium

80. A weak acid, HA has K_a of 1.00×10^{-5}. If 0.100 mole of this acid is dissolved in 1 L of water, the percentage of acid dissociated at equilibrium is closest to

(A) 99.0% (B) 1.00%
(C) 99.9% (D) 0.100%

81. 20 mL, 0.1 N acetic acid is mixed with 10 mL 0.1 N solution of NaOH. The pH of the resulting solution is (pK_a of acetic acid is 4.74)

(A) 3.74 (B) 4.74
(C) 5.74 (D) 6.74

82. A buffer solution is prepared in which the concentration of NH_3 is 0.30 M and the concentration of NH_4^+ is 0.20 M. If the equilibrium constant, K_b for NH_3 equals 1.8×10^{-5}, what is the pH of this solution ?

(A) 8.73 (B) 9.08
(C) 9.44 (D) 11.72

83. A buffer solution is used in

(A) preparation of potash alum
(B) the removal of PO_4^{3-} ions
(C) increasing the pH value of a solution
(D) precipitation of $Cr(OH)_3$ from $CrCl_3$

84. What is the pH at equivalence point in the titration of 0.1 M CH_3COOH and 0.1 M NaOH ? (K_a for acetic acid is 1.8×10^{-5})

(A) 7 (B) Between 7 and 8
(C) Between 8 and 9 (D) Between 6 and 7

85. The indicator used for the titration of weak base and strong acid is

(A) thymol blue (B) methyl orange
(C) phenolphthalein (D) fluorescein

86. Which of the following salts will give highest pH in water?

(A) KCl (B) NaCl
(C) Na_2CO_3 (D) $CuSO_4$

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87. NH_4Cl is acidic due to
(A) cationic hydrolysis
(B) anionic hydrolysis
(C) its ionic nature
(D) pH > 7

88. Hydrolysis of sodium acetate will give
(A) acidic solution (B) basic solution
(C) neutral solution (D) normal solution

89. The ionisation of strong electrolytes in acetic acid, compared to water, is
(A) weak, low
(B) strong, more
(C) medium, the same
(D) no ionisation, 100%

90. A solution of $FeCl_3$ in water acts as acidic solution due to
(A) hydrolysis of Fe^{3+}
(B) acidic impurities
(C) dissociation
(D) ionisation

[ZOOLOGY]

91. Animals that do not actively control osmotic condition of their body fluids are called as :
(A) Euryhalines (B) Stenohalines
(C) Osmoregulators (D) Osmoconformers

92. The amount of water loss that can be fatal in human beings can be as minimal as :
(A) 5-6% (B) 10-12%
(C) 20-24% (D) 30-36%

93. The camel stores fat in its hump as a source of :
(A) Metabolic water
(B) Energy
(C) Insulation from the environment
(D) Cushion for prevention of injury to the body surface

94. Consider the following figures as mechanism of water gain by a certain animal:
I. Ingested liquid — 0%
II. Liquid ingested in food — 10%
III. Liquid derived from metabolism — 90%
This organism is most likely to be
(A) A marine teleost fish
(B) A fresh water fish
(C) A mammal living on land
(D) A desert mammal

95. Consider the following statements:
I. Uricotelism enables terrestrial organisms to excrete nitrogenous wastes with a minimum loss of water.
II. Uric acid is highly soluble in water so that minimal water is required to eliminate it.
III. Uricotelism is not advantageous for animals that lay shelled eggs as it would be to toxic for developing embryo.
The incorrect statements are
(A) II alone (B) III alone
(C) II and III (D) I, II and III

96. Consider the following animals
I. Arthropods
II. Platyhelminthes
III. Rotifers
IV. Cephalochordates
V. Most annelids
Protonephridia, simplest excretory system are found among which of the following animals listed below.
(A) I, II, III, IV (B) I, II, III
(C) II, III, IV (D) II, III, IV, V

97. The substance, ideal for estimation of GFR, is
(A) Creatine (B) Creatinine
(C) Inulin (D) Insulin

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98. About 90% of the important buffer, bicarbonate, is reabsorbed from the filtrate by
    (A) PCT
    (B) DCT
    (C) Loop of Henle
    (D) Collecting duct

99. Consider the following statements
    I. The release of ADH is triggered when osmo-receptors in hypothalamus detect an increase in osmotality of blood above a set point of 300 mosm L^{-1}
    II. In this situation, thirst receptors are also stimulated leading to excess drinking of water
    III. Drinking ultimately leads to inhibition of secretion of ADH thereby completing the feedback circuit
    The correct statement would be
    (A) I and II
    (B) I and III
    (C) II and III
    (D) I, II and III

100. The deficiency of ADH would produce
    (A) Glycosuria
    (B) Diabetes mellitus
    (C) Diabetes insipidus
    (D) Ketonuria

101. Consider the following statements
    I. The cortical nephrons are more common than the juxtamedullary nephrons
    II. Cortical nephrons have relatively short loops of Henle that extend a short distance into the medulla
    III. Cortical nephrons lack vasa recta and peritubular capillaries
    The correct statements would include
    (A) I, II and III
    (B) I and II
    (C) II and III
    (D) I and III

102. The Malphighian corpuscle
    (A) is the excretory organ of insects
    (B) is a blood cells seen in non primate mammals
    (C) is a slit in the glomerular membrane
    (D) includes glomerulus and its surrounding Bowman's capsule

103. The normal value of GFR is approximately
    (A) 650 ml/min
    (B) 180 ml/min
    (C) 180 ml/day
    (D) 125 ml/min

104. The nature of the glomerular ultra-filtrate can be best described as
    (A) Blood –[blood cells and clotting factors]
    (B) Plasma minus proteins but with few WBCs
    (C) Blood – [RBC + proteins]
    (D) Blood –[Blood cells and proteins]

105. A urine out put of 300 ml per day would be called
    (A) Diuresis
    (B) Anuria
    (C) Enuresis
    (D) Oliguria

106. The myogenic mechanism of auto-regulation of GFR:
    (A) Reduces variations in flow to the glomerulus in case of fluctuations in blood volume
    (B) Reduces variation in flow to the glomerulus in case of fluctuation in blood pressure
    (C) Reduces the hydrostatic pressure in the afferent arteriole in case of fluctuations in blood pressure
    (D) Reduces the hydrostatic pressure in the efferent arteriole in case of fluctuations in blood pressure.

107. If the diameter of the efferent arteriole is increased, the urine output
    (A) is likely to be reduced
    (B) is likely to be increased
    (C) is not affected
    (D) will become zero

108. Which of the following is NOT an abnormal constituent of Urine ?
    (A) Sodium
    (B) Glucose
    (C) Albumin
    (D) Protein

109. What is the mechanism of re-absorption of Fructose in PCT ?
    (A) Simple diffusion
    (B) Active transport
    (C) Facilitated diffusion
    (D) Co-transport with sodium

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110. The ANF is secreted by
    - (A) Wall of right atrium
    - (B) Coronary sinus
    - (C) Infundibulum of right ventricle
    - (D) Juxta Glomerular Apparatus

111. The pressure in peritubular capillary network is about
    - (A) 20 mm Hg   (B) 60 mm Hg
    - (C) 07 mm Hg   (D) 13 mm Hg

112. During hemo-dialysis, the role of artificial kidney is played by
    - (A) Blood pump
    - (B) Dialysate
    - (C) Cellulose membrane
    - (D) Infusion pump

113. The micturition reflex is primarily coordinated at :
    - (A) Sacral spinal level
    - (B) Lower brain level
    - (C) Higher brain level
    - (D) Urinary bladder level

114. Greater the ability of an organism to excrete hypertonic urine.
    - (A) More the number of cortical nephrons in its kidneys
    - (B) More is the medullary blood supply in its kidneys
    - (C) Longer are the loop of henle in its kidney
    - (D) Longer is the PCT in its kidney

115. Which of the following carries the ultra filtrate towards the renal medulla for the second time ?
    - (A) Descending limb of loop of henle
    - (B) Ascending limb of loop of Henle
    - (C) Peritubular capillary network
    - (D) Collecting duct

116. Tubular reabsorption is an important part of the formation of urine as
    - (A) Filtration is non-selective
    - (B) Some useful substances are secreted into the tubule
    - (C) Protein that gets filtered must be taken up again
    - (D) It is the only process by which some wastes can be eliminated in the urine

117. Consider the following functions:
    - I. Gluconeogenesis
    - II. RBC production
    - III. Calcium level regulation
    - The human kidneys are involved in :
    - (A) I, II, III   (B) I and II
    - (C) II nd III   (D) I and III

118. Consider the following :
    - I. Glucose
    - II. Amino acids
    - III. Fructose
    - IV. Galactose
    - Which of these are co-transported along with sodium during reabsorption in the nephron ?
    - (A) I, II, III, IV   (B) I, II, III
    - (C) I, II, IV   (D) I, III, IV

119. Consider the following statements :
    - I. Mictuirition is controlled by a reflex center located in the median portion of the hypothalamus.
    - II. Stretch receptors in the bladder initiate this reflex when stretched by filling with urine.
    - (A) Both I and II are correct
    - (B) I is incorrect, II is correct
    - (C) I is correct, II is incorrect
    - (D) Both I and II are incorrect

120. Which substance is filtered, reabsorbed, and secreted by different regions of the nephron tubules ?
    - (A) potassium ion(K^+)
    - (B) insulin
    - (C) urea
    - (D) glucose

121. Consider the following statements regarding juxta glomerular apparatus :
    - I. It is a location in each nephron where the afferent arteriole and the distal convoluted tubule contact each other.
    - II. The role of the macula densa region of the distal tubule is to secrete the enzyme renin.
    - III. The granular cells within the afferent arteriole are sensitive to renal blood flow
    - IV. High Na^+ concentrations in the filtrate can inhibit the secretion of renin.
    - The incorrect statement is/are :
    - (A) II   (B) III
    - (C) IV   (D) II, III, IV

Space for Rough Work

122. The acid base balance in the human body is primarily regulated by:
    (A) Liver and kidney
    (B) Kidney and Alimentary canal
    (C) Kidney and Lungs
    (D) Lungs and Liver

123. The renal pyramids are located within the :
    (A) Cortex   (B) Medulla
    (C) Renal Pelvis   (D) Papilla

124. Which of the following can reabsorb enough water from their glomerular filtrate to produce a urine that is hypertonic to blood ?
    (A) Birds and mammals
    (B) Reptiles and mammals
    (C) Birds and reptiles
    (D) Sharks and reptiles

125. Kidneys are thought to have evolved first among the
    (A) Marine teleosts   (B) Fresh water teleosts
    (C) Amphibians   (D) reptiles

126. The urine of marine bony fish is _____ concentrated than the urine of freshwater fish, but not as concentrated as that of birds and _____
    (A) less; mammals   (B) more, reptiles
    (C) more; mammals   (D) Less, reptiles

127. Most mammals have an enzyme called uricase, that converts:
    (A) Urea to uric acid
    (B) Ammonia to urea
    (C) Ammonia to uric acid
    (D) Uric acid to allantoin

128. Which of these could appear in the urine from dieting or the utilization of excess lipids ?
    (A) urea   (B) uric acid
    (C) glycine   (D) ketone

129. What causes urine to flow from the kidneys to the bladder ?
    (A) gravity   (B) hydrostatic pressure
    (C) peristalsis   (D) osmotic pressure

130. The mucosa of the bladder is comprised of _____.
    (A) smooth muscle
    (B) squamous epithelium
    (C) transitional epithelium
    (D) simple columnar epithelium

131. Which of these is under voluntary control ?
    (A) urethra
    (B) detrusor muscle
    (C) internal sphincter
    (D) external sphincter

132. Renal secretion of a compound usually occurs from the _____ into the distal convoluted tubule.
    (A) loop of Henle   (B) glomerulus
    (C) vasa recta   (D) peritubular capillaries

133. Eating large amounts of meat will increase the levels of _____ in the blood.
    (A) protein   (B) creatinine
    (C) urea   (D) uric acid

134. The countercurrent multiplier mechanism occurs at the _____.
    (A) proximal convoluted tubule
    (B) loop of Henle
    (C) distal convoluted tubule
    (D) collecting ducts

135. The fluid in the descending limb of the loop of Henle is _____ relative to the capillaries.
    (A) isotonic
    (B) weakly hypotonic
    (C) strongly hypotonic
    (D) hypertonic

Space for Rough Work

[BOTANY]

136. Mineral salts which are absorbed by the roots from the soil are in the form of :

   (A) Very dilute solution

   (B) Isotonic solution

   (C) Concentrated solution

   (D) Very concentrated solution

137. Carrier protein helped in a

   (A) Active absorption of ions

   (B) Passive absorption of ions

   (C) Water absorption

   (D) Vaporization

138. The disease related with deficiency of molybdenum is :

   (A) Whiptail disease of cauliflower

   (B) Little leaf disease

   (C) Reclamation disease of cereals

   (D) Brown heart disease

139. Farmers in a particular region were concerned that pre-mature yellowing of leaves of a pulse crop might cause decrease in the yield. Which treatment could be most beneficial to obtain maximum seed yield?

   (A) Removal of all yellow leaves and spraying the remaining green leaves with 2, 4, 5-trichlorophenoxy acetic acid.

   (B) Application of iron and magnesium to promote synthesis of chlorophyll

   (C) Frequent irrigation of the crop

   (D) Treatment of the plants with cytokinins alongwith a small dose of nitrogenous fertilizer.

140. In which of the following form, sugar is transported within the body of a plant?

   (A) Sucrose   (B) Lactose

   (C) Glucose   (D) Maltose

141. Which of the following is not caused by deficiency of mineral nutrition?

   (A) Necrosis   (B) Chlorosis

   (C) Etiolation   (D) Yellowing

142. Interveinal chlorosis of leaves is caused by the deficiency of

   (A) Nitrogen   (B) Calcium

   (C) Potassium   (D) Magnesium

143. Which of the following will not make minerals more available to plants?

   (A) Increasing the rainfall in a wet forested area

   (B) Raising the pH of a very acidic soil

   (C) Tillering a packed-down or water-logged soil

   (D) Introducing fungi that can form mycorrhiza into a soil that lacks them

144. Hydroponics is a technique in which plants are grown in

   (A) Green house

   (B) Water saturated sand

   (C) Balanced nutrient solution

   (D) Purified distilled water

145. Criteria for essentiality in mineral nutrition were shown firstly by

   (A) Arnon   (B) Liebig

   (C) Steward   (D) Levitt

146. The plant ash is an indication of :

   (A) Mineral salts absorbed by the plant

   (B) Organic matter of the plant

   (C) Both the mineral salts and organic matter

   (D) None of the above

147. Where does most nutrient uptake occur in roots?

   (A) At the root tip, where root tissue first encounters soil away from the zone of nutrient depletion.

   (B) At the casparian strip, where ions must enter the symplast prior to entering xylem cells.

   (C) In the symplastic and apoplastic pathways.

   (D) In root hairs and in the zone of muturation.

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148. It is possible to determine whether an element is essential by observing growth of plants
    (a) On soil in which the particular element is removed
    (B) On soil in which only the particular element is present
    (C) On an inert medium to which solution of only the particular element is added
    (D) On an inter medium to which a nutrient solution excluding that particular element, is added.

149. Which elements are considered as balancing elements?
    (A) Ca and K   (B) C and H
    (C) N and S   (D) Mg and Fe

150. The group of mineral nutrients known as frame work elements are
    (A) N, S, P   (B) C, H, O
    (C) Mg, Fe, Zn   (D) Zn, Mn, Cu

151. Which element essential for the stability of chromosome structure?
    (A) Zn   (B) Ca
    (C) Mo   (D) Fe

152. Which element is required in comparatively least quantity for the growth of plant?
    (A) Zn   (B) N
    (C) P   (D) Ca

153. Which of the following essential element is not properly placed in the given category?
    (A) Cu   (B) Zn
    (C) Mg   (D) Mn

154. Which mineral nutrients are called critical element for crops?
    (A) N, P, K   (B) C, H, O
    (C) N, S, Mg   (D) K, Ca, Fe

155. The mineral nutrient mainly concerning with apical meristematic activity is –
    (A) K   (B) Ca
    (C) N   (D) S

156. Which is free ion present in a cell?
    (A) P   (B) K
    (C) Fe   (D) B

157. Which element can not be placed along with micro nutrients?
    (A) Mn   (B) Mo
    (C) Cu   (D) Ca

158. Cobalt present in :
    (A) Vit. A   (B) Vit. B_2
    (C) Vit. B_{12} (D) Vit. C

159. The major portion of the dry weight of plants comprises of –
    (A) Nitrogen, phosphorus and potassium
    (B) Calcium, magnesium and sulphur
    (C) Carbon, nitrogen and hydrogen
    (D) Carbon, hydrogen and oxygen

160. The most abundant element present in the plants is
    (A) Iron   (B) Carbon
    (C) Nitrogen   (D) Manganese

161. Which of the following is a component of middle lamella in plant cells ?
    (A) Mn   (B) Ca
    (C) K   (D) Fe

162. Which of the following element is necessary for translocation of sugars in plants?
    (A) Boron   (B) Molybdenum
    (C) Manganese   (D) Iron

163. Deficiency of iron causes :
    (A) interveinal chlorosis first on young leaves
    (B) decrease in protein synthesis
    (C) reduced leaves and stunted growth
    (D) bending of stem tip

164. The deficiencies of micronutrients, not only affects growth of plants but also vital functions such as photosynthetic and mitochondrial electron flow. Among the list given below, which group of three elements shall affect most, both photosynthetic and mitochondrial electron transport :
    (A) Co, Ni, Mo   (B) Ca, K, Na
    (C) Mn, Co, Ca   (D) Cu, Mn, Fe

165. A plant requires magnesium for
    (A) protein synthesis
    (B) chlorophyll synthesis
    (C) cell wall development
    (D) holding cells together

166. Which one of the following elements is not an essential micronutrient for plant growth?
    (A) Zn   (B) Cu
    (C) Ca   (D) Mn

Space for Rough Work

167. Nitrogen fixation in root nodules of Alnus is brought about by :
    (A) Bradyrhizobium　(B) Clostridium
    (C) Frankia　(D) Azorhizobium

168. Manganese is required in :
    (A) plant cell wall formation
    (B) Photolysis of water during photosynthesis
    (C) chlorophyll synthesis
    (D) nucleic acid synthesis

169. Which of the following is a symbiotic nitrogen fixer?
    (A) Azotobacter　(B) Frankia
    (C) Azolla　(D) Glomus

170. An element playing important role in nitrogen fixation is :
    (A) Molybdenum　(B) Copper
    (C) Manganese　(D) Zinc

171. Which one of the following is not a micronutrient?
    (A) Molybdenum　(B) Magnesium
    (C) Zinc　(D) Boron

172. A prokaryotic autotrophic nitrogen fixing symboint is found in :
    (A) Alnus　(B) Cycas
    (C) Cicer　(D) Pisum

173. Which one of the following elements in plants is not remobilised?
    (A) Phosphorus　(B) Calcium
    (C) Potassium　(D) Sulphur

174. Nitrifying bacteria :
    (A) oxidize ammonia to nitrates
    (B) convert free nitrogen to nitrogen compounds
    (C) convert proteins into ammonia
    (D) reduce nitrates to free nitrogen

175. The function of leghaemoglobin in the root nodules of legumes is :
    (A) inhibition of nitrogenase activity
    (B) oxygen removal
    (C) nodule differentiation
    (D) expression of nif gene

176. Which one of the following is essential for photolysis of water?
    (A) Manganese　(B) Zinc
    (C) Copper　(D) Boron

177. Conduction of inorganic materials in plants occur mainly through
    (A) Xylem　(B) Phloem
    (C) Sieve tube　(D) None of these

178. Most of the plants obtain or absorb nitrogen from soil in the form of
    (A) Free nitrogen gas
    (B) Nitric acid
    (C) Nitrite
    (D) Nitrates

179. In root nudules of legumes, leg-haemoglobin is important because
    (A) It transports oxygen to the root nudule
    (B) It acts as an oxygen scavenger
    (C) It provides energy to the nitrogen fixing bacterium
    (D) It acts as a catalyst in trans-amination

180. Which of the following element is a constituent of protein synthesis?
    (A) Sulphur　(B) Silver
    (C) Lead　(D) Phosphorus

❑　❑　❑

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