BSC-LATERAL ENTRY-60 QUESTION

1. The time dependence of a physical quantity P is given by $P = P_0 e^{-\alpha t^2}$, where α is a constant and t is time. Then constant α is

(a) dimensionless (b) dimension of t^{-2} (c) dimension of P (d) dimension of t^2

2. Two cars A and B are travelling in the same direction with velocities v_A and v_B ($v_A > v_B$). When the car A is at a distance s behind car B, the driver of the car A applies the brakes producing a uniform retardation a, there will be no collision when

(a) $s < \frac{(v_A - v_B)^2}{2a}$ (b) $s = \frac{(v_A - v_B)^2}{2a}$ (c) $s \geq \frac{(v_A - v_B)^2}{2a}$ (d) $s \leq \frac{(v_A - v_B)^2}{2a}$

3. A solid sphere of mass M and radius R has a spherical cavity of radius $R/2$ such that the centre of cavity is at a distance $R/2$ from the centre of the sphere. A point mass m is placed inside the cavity at a distance $R/4$ from the centre of the sphere. The gravitational pull between the sphere and point mass m is

(a) $\frac{11GMm}{R^2}$ (b) $\frac{14GMm}{R^2}$ (c) $\frac{GMm}{2R^2}$ (d) $\frac{GMm}{R^2}$

4. The kinetic energy K of a particle moving along a circle of radius R depends on the distance covered s as $K = as^2$, where a is a constant. The force acting on the particle is

(a) $2a\frac{s^2}{R}$ (b) $2as\left(1+\frac{s^2}{R^2}\right)^{1/2}$ (c) $2as$ (d) $2a\frac{R^2}{s}$

5. Steam is passed into 22 g of water at 20^0C. The mass of water that will be present when the water acquires a temperature of 90^0C (latent heat of steam is 540 *cal/g*) is

(a) 24.8 g (b) 24 g (c) 36.6 g (d) 30 g

6. Hot food cools from 94^0 C to 86^0 C in 2 min when the room temperature is 20^0 C. How long would the food take to cool from 71^0 C to 69^0 C?

(a) 12 s (b) 25 s (c) 16 s (d) 42s

7. A wire of length *L* and radius *r* fixed at one end and a force *F* applied to the other end produces an extension *l*. The extension produced in another wire of the same material of length *2L* and radius *2r* by a force *2F*, is

(a) *l* (b) *2l* (c) *4l* (d) $\frac{l}{2}$

8. The length of a sonometer wire *AB* is 110 *cm*. Where should the two bridges be placed from *A* to divide the wire in three segments whose fundamental frequencies are in the ratios of 1 : 2 : 3.

(a) 30 *cm*, 90 *cm* (b) 60 *cm*, 90 *cm* (c) 40 *cm*, 70 *cm* (d) None of these

9. Four charges equal to $-Q$ are placed at the four corners of a square and a charge q is at its centre. If the system is in equilibrium, the value of q is

(a) $-\frac{Q}{4}\left(1+2\sqrt{2}\right)$ (b) $\frac{Q}{2}\left(1+2\sqrt{2}\right)$ (c) $-\frac{Q}{2}\left(1+2\sqrt{2}\right)$ (d) $\frac{Q}{4}\left(1+2\sqrt{2}\right)$

10. Two long and parallel straight wires *A* and *B* carrying currents of 8.0 A and 5.0 A in the same direction are separated by a distance of 4.0 *cm*. Estimate the force on a 10 *cm* section of wire *A*? (Assume that $\mu_o = 4\pi \times 10^{-7}$ H)

(a) 1.5×10^{-5} N (b) 2×10^{-5} N (c) 4×10^{-5} N (d) 3.2×10^{-5} N

11. The armature of a DC motor has resistance of 20 Ω. It draws a current of 1.5 A when run by 220 V of DC. The value of peak *emf* induced in it will be

(a) 150 V (b) 170 V (c) 190 V (d) 180 V

12. A parallel plate capacitor is charged and then disconnected from the charging battery. If the plates are now moved farther apart by pulling at them by means of insulating handles, then

(a) the energy stored in the capacitor decreases

(b) the capacitance of the capacitor increases

(c) the charge on the capacitor decreases

(d) the voltage across the capacitor increases

13. For maintaining sustained chain reaction, which of the following is required

(a) Protons (b) Electrons (c) Neutrons (d) Positrons

14. A **Si** and a **Ge** diode has identical physical dimensions. The band gap of **Si** is larger than that of **Ge**. An identical reverse bias is applied across the diodes.

(a) The reverse current in **Ge** is larger than that in **Si.**

(b) The reverse current in **Si** is larger than that in **Ge.**

(c) The reverse current is identical in the two diodes

(d) The relative magnitude of the reverse current cannot be determined from the given data only

15. In Young's double slit experiment, the two slits act as coherent sources of equal amplitude *A* and wavelength λ. In another experiment with the same set up, the two slits are sources of equal amplitude *A* and wavelength λ but are incoherent. The ratio of the intensity of light at the mid-point of the screen in the first case to that of second case is

(a) 2 : 1 (b) 1: 2 (c) 3 : 4 (d) 4 : 3

16. Eka silico and Eka-aluminium are known as:

a) gallium and germenium b) germanium and gallium

c) indium and silicon d) zinc and arsenic

17. Which of the following order is wrong with respect to the properties mentioned?

a) $Al^{3+} < Li^{+} < Mg^{2+} < Na^{+}$ (ionic radius)

b) $I < Br < F < Cl$ (electron affinity)

c) $Al_2O_3 < MgO < Na_2O < K_2O$ (basic nature)

d) $Li < Na < K < Rb < Cs$ (increasing order of density)

18. In which of the following the central atom has least number of lone pair of electron(s)?

a) XeF_4 b) ClO_3^-

c) IO_2^- d) I_3^-

19. The ion which is not tetrahedral in shape is:

a) NH_4^+ b) ClO_4^-

c) $NiCl_4^{2-}$ d) $PtCl_4^{2-}$

20. Which compound has maximum O–N–O bond angle?

a) NO_2 b) NO_2^+

c) NO_3^- d) NO_2^-

21. Ka_1, Ka_2 and Ka_3 are the respective ionization constant for the following reactions

$$H_2S \rightleftharpoons HS^- + H^+$$

$$HS^- \rightleftharpoons S^{2-} + H^+$$

$$H_2S \rightleftharpoons S^{2-} + 2H^+$$

The correct relationship between Ka_1, Ka_2 and Ka_3 is

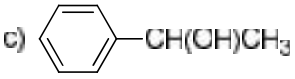
a) $Ka_1 \times Ka_2 = Ka_3$ b) $Ka_1 + Ka_2 = Ka_3$

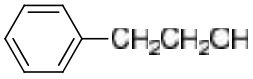
c) $Ka_1 / Ka_2 = Ka_3$ d) $Ka_2 / Ka_1 = Ka_3$

22. Which of the following alcohol will react fastest with conc. HCl ?

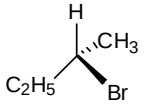
a) $CH_2=CH-CH_2OH$

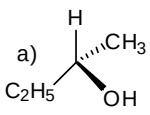
b) $(CH_3)_3C-OH$

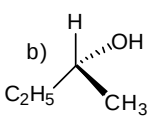
c) 

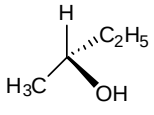
d) 

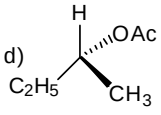
23. The enantiomer of the following molecule (P) on reaction with NaOAc followed by hydrolysis with NaOH gives the compound


(P)

a) 

b) 

c) 

d) 

24. The conversion of acetophenone to acetanilide is best accomplished by using which reaction as one of the key step.

a) Hofmann rearrangement b) Curtius rearrangement

c) Beckman rearrangement d) Lossen rearrangement

25. Green chemistry means such reactions which

a) are related to depletion of ozone layer

b) study the reaction in green plants

c) produces colour during reaction

d) reduce the use and production of hazardous chemicals

26. An unknown organic compound (X) $C_8H_{10}O_3$ on acetylation with CH_3COCl/Py forms acetyl derivative of X whose M.W. is 280. X on treatment with CH_2N_2 gives a compound Y having M. W. 182. The number of phenolic hydroxyls and alcoholic hydroxyls in the compound X will respectively be:

a) 1,3 b) 3,1 c) 2,1 d) 1,2

27. Acetaldehyde can directly be converted into ethyl acetate by which one of the following reactions

a) Cannizzaro reaction b) Tischenko reaction

c) Baeyer Villiger oxidation reaction d) Claisen ester condensaation reaction

28. The number of radial nodes in 3s and 2p orbital respectively are

a) 2 and 0 b) 1 and 2 c) 0 and 2 d) 2 and 1

29. 0.004 M solution of Na_2SO_4 is isotonic with 0.01 M solution of glucose at same temperature. Degree of dissociation of Na_2SO_4 is

a) 85% b) 25% c) 50% d) 75%

30. A 50 mL solution of pH = 1 is mixed with equal volume of solution of pH = 2. The pH of the resultant solution will be nearly

a) 0.76 b) 2.26 c) 1.26 d) 1.76

31. If α, β are roots of the equation $x^2 + x + 1 = 0$ then the equation whose roots are $\alpha^{100}, \beta^{100}$ will be
    a) $x^2 + x + 1 = 0$
    b) $x^2 - x + 1 = 0$
    c) $x^2 + x - 1 = 0$
    d) $x^2 - x - 1 = 0$
32. If $[x]$ represents the greatest integer less than or equal to x, then the function $f(x) = [x+1] - [x-1]$ is
    a) not continuous in the interval (-1,1).
    b) continuous but not differentiable in the interval (-1,1).
    c) differentiable in the interval (-1,1).
    d) strictly increasing in the interval (-1,1).
33. If the pair of equation $x^2 + ax + b = 0$ and $x^2 + bx + a = 0$ have a common root then
    a) $a^2 = b^2$
    b) $(a-b)(a+b+1) = 0$
    c) $(a-b)(a+b-1) = 0$
    d) $(a+b)(a+b+1) = 0$
34. If $\cos 8x \cos 4x \cos 2x \cos x = -1/16$, then the value of x will be
    a) $\pi/16$
    b) $-\pi/15$
    c) $-\pi/16$
    d) $\pi/15$
35. In the sitting arrangement for ten girls and ten boys around a round table with twenty identical chairs, the number of arrangements that no two girls will sit together is
    a) $3 \times (10)!$
    b) $2 \times (10)!$
    c) $(10)!$
    d) $5 \times (10)!$

36. If a, b, c are three real numbers satisfying the pair of conditions $a + b + c = 0$ and $(a-b)^2 + (b-c)^2 + (c-a)^2 > 0$ then the system of equations
$$ax + by + cz = 0$$
$$bx + cy + az = 0$$
$$cx + by + az = 0$$
    will represent
    a) the straight line $x = y = z$.
    b) the straight line $x + 1 = y - 1 = z$.
    c) the straight line $x = -y = z$.
    d) the straight line $x - 1 = y = z + 1$.

37. The value of $\lim_{a\to 0}(1+2a)^{1/2a}$ will be

a) $-e$

b) $1/e$

c) e

d) 1

38. The value of the integral $\int_0^{\pi/4} \log|\tan 2x|\, dx$ will be

a) 0

b) 1

c) $-\frac{\pi}{2}\log 2$

d) $\pi \log 2$

39. If angle between the unit vectors $\vec{a}$, $\vec{b}$ is $\pi/4$ then the value of $\begin{vmatrix} \vec{a}.\vec{a} & \vec{a}.\vec{b} \\ \vec{a}.\vec{b} & \vec{b}.\vec{b} \end{vmatrix}$ is

a) 0

b) 1

c) $1/2$

d) $1/\sqrt{2}$

40. If $\vec{a}$, $\vec{b}$, $\vec{c}$ are position vectors of the points A, B, C and O is the origin, then the vector $\vec{a}\times\vec{b}+\vec{b}\times\vec{c}+\vec{c}\times\vec{a}$ is

a) a vector paraller to the plane of the triangle ABC

b) a vector perpendicular to the plane of the triangle ABC

c) a vector perpendicular to the plane of the triangle OBC

d) a vector perpendicular to the plane of the triangle OAB

41. The line $\vec{r} = (\hat{i}+\hat{j}+\hat{k}) + \lambda(\hat{i}-\hat{j}+\hat{k})$ lies in the plane

a) $\vec{r}\cdot(\hat{i}+2\hat{j}+\hat{k}) = 4.$

b) $\vec{r}\cdot(\hat{i}-2\hat{j}+\hat{k}) = 4$

c) $\vec{r}\cdot(\hat{i}+2\hat{j}-\hat{k}) = 4$

d) $\vec{r}\cdot(\hat{i}+2\hat{j}+\hat{k}) = -4$

42. Let S_n be the sum of first n terms of the A.P. having first term a and common difference d. Then S_n be the nth term of

a) an A.P. with first term a and common difference d.

b) an A.P. with first term a be and common difference $a+d$.

c) an G.P. with first term a and common ratio d.

d) none of the above.

43. The line of interaction of the pair of planes, $\vec{r} \cdot (\hat{\imath} + 2\hat{\jmath} + 3\hat{k}) = 0$ and $\vec{r} \cdot (3\hat{\imath} + 2\hat{\jmath} + \hat{k}) = 0$ is equally inclined to the axes
    a) $\hat{\imath}, \hat{\jmath}$
    b) $\hat{\jmath}, \hat{k}$
    c) $\hat{\imath}, \hat{k}$
    d) $\hat{\imath}, \hat{\jmath}, \hat{k}$

44. The equation of a sphere that have points $\vec{g}$, $\vec{h}$ as the extreme points of one diameter is
    a) $(\vec{r} - \vec{g}) \cdot (\vec{r} - \frac{\vec{h}}{2}) = 0$
    b) $(\vec{r} - \vec{g}) \cdot (\vec{r} - \vec{h}) = 0$
    c) $(\vec{r} - 2\vec{g}) \cdot (\vec{r} - 2\vec{h}) = 0$
    d) $(\vec{r} - 2\vec{g}) \cdot (\vec{r} - 2\vec{h}) = 0$

45. If $y = \frac{1}{1+\sin x}$ and $z = \frac{x}{(\sec x + \tan x)}$ then the value of x at which $\frac{dz}{dy} = 0$
    a) $-\frac{\pi}{4}$
    b) $\frac{\pi}{6}$
    c) $-\frac{\pi}{2}$
    d) $\frac{\pi}{3}$

46. *Which of the following statement is not true in general?*
    a) *(AĘB) Ę¼A is a tautology, for any B.*
    b) *A implies B if and only if B implies A.*
    c) *A is a tautology if and only if ¼A is a contradiction.*
    d) *(AĘB)ė¼A is not a contradiction, for any B always.*

47. *All points (x,y) satisfying the differential equation* $\frac{d^2y}{dx^2} = 0$ *belong to*
    a) *The perimeter of a closed curve centered at origin.*
    b) *The area bounded by a circle centered at origin.*
    c) *Any one of the infinite number of straight line in XY plane.*
    d) *The area bounded by a circle not centered at origin.*

48. *The differential equation formed by the primitive* lx + my = n *is*
    a) $\frac{dy}{dx} = -l/m$
    b) $\frac{d^2y}{dx^2} = k/n$, *where k is any constant*
    c) $\frac{dy}{dx} = -m/n$
    d) $\frac{d^2y}{dx^2} = 0$

49. *The differential equation* $3\frac{d^2y}{dx^2} + 5x(\frac{dy}{dx})^4 + 4y = 5x$ *-4 has degree and order*
    a) *1,2.*

b) *1,3.*
c) *2,2.*
d) *3,2.*

50. *Conditional probability P(A|B) is undefined only when*
    a) *A is a certain event*
    b) *P(B)=0*
    c) *P(A)=0*
    d) *B is a certain event.*

51. *The binary representation of the decimal number 39 is*
    a) *101111*
    b) *100111*
    c) *101011*
    d) *111011*

52. *The plane containing the origin and passing through the line of intersection of the planes* $2x + 2y - 4z = 2$ *and* $3x + 9y - 3z = 12$ *is*
    a) *3x+y=7z*
    b) *x+3y=4z*
    c) *2x+3y=5z*
    d) *3x+2y+7z=0*

53. *The general solution of the differential equation* $y = 5xp + 3e^p$, *where* $p = \frac{dy}{dx}$ *is*
    a) $y = 5x + 3e^c$
    b) $y = 5c + 3e^c$
    c) $y = 5xc + 3xe^c$
    d) $y = 5xc + 3e^c$
    where c is a constant.

54. The parabolas $y = 2(x+1)^2$ and $y = -2(x-1)^2$ has
    a) x axis as one common tangent.
    b) Two common tangents $y = 0$ and $x + y = 0$
    c) Two common tangents $3x = 0$ and $2y = 3x$
    d) No common tangent

55. *The equation* $5x^2 - 5y^2 + 3x + 3y = 4$ *represents*
    a) *A parabola*
    b) *A pair of straight lines*
    c) *A hyperbola*
    d) *An ellipse*

56. *Mean and Standard deviation of a sample of 15 positive numbers are 15 and 3 respectively. The sum of squares of the numbers is*
    a) *(225+10)6*
    b) *(225+11)9*
    c) *(225+9)15*
    d) *(225+9)11*
57. *The value of the integral* $\int_{-3}^{3} 3x\,dx$ *is*
    a) *3*
    b) *-3*
    c) *1*
    d) *0*
58. State which of the following is not true:
    a) *Addition of two real numbers is always commutative.*
    b) *Multiplication of two integers is commutative.*
    c) *Perpendicularity in the set of straight lines is not an equivalence relation.*
    d) *Parallelism in the set of straight lines is not an equivalence relation.*
59. The sphere $5x^2 + 5y^2 + 5z^2 + 10x + 10y - 10z = 40$ *has center*
    a) $(1,1,1)$
    b) $(-1,-1,1)$
    c) $(1,1,-1)$
    d) $(1,-1,1)$
60. For a natural number $n(>2)$, the number $n(n+1)(n-1)$ is not always divisible by
    a) *6*
    b) 2
    c) 7
    d) 3