AIEEE - Previous year Papers -MATHEMATICS - 2007

1. $\int dx/\cos x + \sqrt{3}\sin x$ equals

(a) $\log \tan (x/2 - \pi/12) + C$
(b) $1/2 \log \tan (x/2 + \pi/12) + C$
(c) $1/2 \log \tan (x/2 - \pi/12) + C$
(d) $\log \tan (x/2 + \pi/12) + C$

2. A pair of fair dice is thrown independently three times. The probability of getting a score of exactly 9 twice is

(a) 8/243 (b) 8/729 (c) 1/729 (d) 8/9.

3. The area enclosed between the curves $y^2 = x$ and $y = |x|$ is

(a) 1. (b) 1/6 (c) 1/3 (d) 2/3

4. A value of c for which conclusion of Mean Value Theorem holds for the function $f(x) = \log_e x$ on the interval [1, 3] is

(a) $2 \log_3 e$ (b) $1/2 \log_e 3$.
(c) $\log_3 e$ (d) $\log_e 3$

5. The function $f(x) = \tan^{-1} (\sin x + \cos x)$ is an increasing function in

(a) $(\pi/4, \pi/2)$ (b) $(-\pi/2, \pi/2)$
(c) $(0, \pi/2)$ (d) $(-\pi/2, \pi/2)$.

6. If $D = \begin{vmatrix} 1 & 1 & 1 \\ 1 & 1+x & 1 \\ 1 & 1 & 1+y \end{vmatrix}$

for $x \neq 0$, $y \neq 0$ then D is

(a) divisible by y but not x
(b) divisible by neither x nor y
(c) divisible by x but not y
(d) divisible by both x and y.

7. For the Hyperbola $x^2/\cos^2\alpha - y^2/\sin^2\alpha = 1$, which of the following remains constant when α varies?

(a) directrix.
(b) abscissae of foci
(c) eccentricity
(d) abscissae of vertices

8. The largest interval lying in $(-\pi/2, \pi/2)$ for which the function,
$f(x) = 4^{-x^2} + \cos^{-1} (x/2 - 1) + \log (\cos x)$, is defined, is

(a) $(-\pi/2, \pi/2)$. (b) $[-\pi/4, \pi/2)$

(c) [0, π/2) (d) [0, π]

9. The sum of the series 1/2! – 1/3! + 1/4! - ….upto infinity is

(a) e^{-2} (b) $e^{-1/2}$ (c) $e^{+1/2}$ (d) e^{-1}.

10. The set S : = {1, 2, 3,…..,12} is to be partitioned into three sets A, B, C of equal size. Thus A $\cup$ B $\cup$ C = S, A ∩ B = B ∩ C = A ∩ C = Φ.
The number of ways to partition S is

(a) $12!/3!(4!)^3$ (b) $12!/(4!)^3$
(c) $12!/(4!)^4$ (d) $12!/3!(4!)^4$.

11. If (2, 3, 5) is one end of a diameter of the sphere $x^2 + y^2 + z^2 – 6x – 12y – 2z + 20 = 0$, then the coordinates of the other end of the diameter are

(a) (4, 3, 5) (b) (4, 3, -3)
(c) (4, 9, -3) (d) (4, -3, 3).

12. A particle just clears a wall of height b at a distance a and strikes the ground at a distance c from the point of projection. The angle of projection is

(a) $\tan^{-1}$ bc/a (b) $\tan^{-1}$ bc/a(c - a)
(c) $\tan^{-1}$ b/ac (d) 45°.

13. If $|z + 4| \leq 3$, then the maximum value of $|z + 1|$ is

(a) 0 (b) 10. (c) 6 (d) 4

14. If p and q are positive real numbers such that $p^2 + q^2 = 1$, then the maximum value of (p + q) is

(a) √2 (b) 1/√2 (c) 2. (d) 1/2

15. The average marks of boys in class is 52 and that of girls is 42. The average marks of boys and girls combined is 50. The percentage of boys in the class is

(a) 80 (b) 40 (c) 20. (d) 60

16. Let L be the line of intersection of the planes 2x + 3y + z = 1 and x + 3y + 2z = 2. If L makes an angle α with the positive x-axis, then cos α equals

(a) 1/2. (b) 1/√2 (c) 1 (d) 1/√3

17. If $\hat{u}$ and $\hat{v}$ are unit vectors and θ is the acute angle between them, then 2 $\hat{u}$ X 3 $\hat{v}$ is a unit vector for

(a) exactly one value of θ
(b) no value of θ
(c) exactly two values of θ
(d) more than two values of θ

18. A tower stands at the centre of a circular park. A and B are two points on the boundary of the park such that AB(= a) subtends an angle of 60° at the foot of the tower, and the angle of elevation of the top of the tower from A or B is 30°. The height of the tower is

(a) a/√3 (b) a√3
(c) 2a√3. (d) 2a√3

19. Let A(h, k), B(1, 1) and C(2, 1) be the vertices of a right angled triangle with AC as its hypotenuse. If the area of the triangle is 1 square unit, then the set of values which 'k' can take is given by

(a) {-1, 3} (b) {0, 2}.
(c) {1, 3} (d) {-3, -2}

20. The sum of the series
$^{20}C_0 - {}^{20}C_1 + {}^{20}C_2 - {}^{20}C_3 + \ldots\ldots - \ldots\ldots + {}^{20}C_{10}$ is

(a) 0 (b) $1/2\ {}^{20}C_{10}$. (c) $^{20}C_{10}$ (d) $-{}^{20}C_{10}$

21. The differential equation of all circles passing through the origin and having their centres on the x-axis is

(a) $y^2 = x^2 - 2xy\ dy/dx$ (b) $x^2 = y^2 + xy\ dy/dx$
(c) $y^2 = x^2 + 2xy\ dy/dx$ (d) $x^2 = y^2 + 3xy\ dy/dx$.

22. If a line makes an angle of π/4 with the positive directions of each of x-axis and y-axis, then the angle that the line makes with the positive direction of the z-axis is

(a) π/4 (b) π/2 (c) π/3. (d) π/6

23. The normal to a curve at P(x, y) meets the x-axis at G. If the distance of G from the origin is twice the abscissa of P, then the curve is a

(a) hyperbola (b) ellipse (c) circle (d) parabola.

24. The solution for x of the equation $\int_{\sqrt{2}}^{x} dt/\sqrt{t^2 - 1} = \pi/2$ is

(a) √3/2 (b) 2 (c) π. (d) 2√2

25. In the binomial expansion of $(a - b)^n$, $n \geq 5$, the sum of 5^{th} and 6^{th} terms is zero, then a/b equals

(a) 5/n – 4 (b) 6/n – 5.
(c) n – 5/6 (d) n – 4/5

26. The equation of a tangent to the parabola $y^2 = 8x$ is y = x + 2. The point on this line from which the other tangent to the parabola is perpendicular to the given tangent is

(a) (2, 4) (b) (0, 2). (c) (-1, 1) (d) (-2, 0)

27. Consider a family of circles which are passing through the point (-1, 1) and are tangent to x-axis. If (h, k) are the coordinate of the centre of the circles, then the set of values of k is given by the interval

(a) $-1/2 \leq k \leq 1/2$ (b) $k \leq 1/2$
(c) $0 \leq k \leq 1/2$ (d) $l \geq 1/2$.

28. A body weighing 13 kg is suspended by two strings 5 m and 12 m long, their other ends being fastened to the extremities of a rod 13 m long. If the rod be so held that the body hangs immediately below the middle point, Then tensions in the strings are

(a) 5 kg and 13 kg (b) 12 kg and 13 kg
(c) 5 kg and 12 kg (d) 5 kg and 5 kg.

29. In a geometric progression consisting of positive terms, each term equals the sum of the next two terms. Then the common ratio of this progression is equals

(a) $1/2 (1 - \sqrt{5})$ (b) $1/2 \sqrt{5}$.
(c) $\sqrt{5}$ (d) $1/2 (\sqrt{5} - 1)$

30. The resultant of two forces Pn and 3n is a force of 7n. If the direction of 3n force were reversed, the resultant would be $\sqrt{19}$ n. The value of P is

(a) 4 n (b) 5 n (c) 6 n. (d) 3 n

31. Two aeroplanes I and II bomb a target in succession. The probabilities of I and II scoring a hit correctly are 0.3 and 0.2, respectively. The second plane will bomb only if the first misses the target. The probability that the target is hit by the second plane is

(a) 0.2 (b) 0.7 (c) 0.06 (d) 0.14.

32. If the difference between the roots of the equation $x^2 + ax + 1 = 0$ is less than $\sqrt{5}$, then the set of possible values of a is
(a) (-3, 3) (b) (3. ∞) (c) (-3, ∞). (d) (-∞, -3)

33. If $\sin^{-1}(x/5) + \text{cosec}^{-1}(5/4) = \pi/2$, then the values of x is

(a) 1 (b) 3. (c) 5 (d) 4

34. Let $A = \begin{bmatrix} 5 & 5\alpha & \alpha \\ 0 & \alpha & 5\alpha \\ 0 & 0 & 5 \end{bmatrix}$ If $|A^2| = 25$, then $|\alpha|$ equals

(a) 1. (b) 5 (c) 1/5 (d) 5^2

35. Let $f : R \to R$ be a function defined by $f(x) = \min \{x + 1, |x| + 1\}$. Then which of the following is true?

(a) f(x) is differentiable everywhere
(b) f(x) is not differentiable at x = 1.
(c) f(x) is not differentiable at x = 0
(d) $f(x) \geq 1$ for all $x \in R$

36. The function f : R / {0} → R given by f(x) = 1/x – 2/e^{2x} – 1 can be made continuous at x = 0 by defining f(0) as

(a) 2 (b) 1 . (c) 0 (d) –1

37. Let $\vec{a} = \hat{i} + \hat{j} + \hat{k}$, $\vec{b} = \hat{i} - \hat{j} + 2\hat{k}$ and $\vec{c} = x\,\hat{i} + (x - 2)\,\hat{j} - \hat{k}$ If the vectors $\vec{c}$ lies in the plane of $\vec{a}$ and $\vec{b}$, then x equals

(a) –2 (b) –4 (c) 0 (d) 1.

38. Let F(x) = f(x) + f(1/x), where f(x) = $\int_1^x$ log t/1 + t dt, Then F(e) equals

(a) 2 (b) 1/2 (c) 1 (d) 0.

39. Let P = (-1, 0), Q = (0, 0) and R = (3, 3√3) be three points. The equation of the bisector of the angle PQR is

(a) √3x+y = 0 (b) x+√3/2y = 0.
(c) x+√3y = 0 (d) √3/2x+y = 0

40. If one of the lines of $my^2 + (1 – m^2)xy – mx^2 = 0$ is a bisector of the angle between the lines xy = 0, then m is

(a) –2. (b) 1 (c) –1/2 (d) 2

AIEEE - Previous year Papers -PHYSICS - 2007

1. If g_E and g_M are the accelerations due to gravity on the surfaces of the earth and the moon respectively and if Millikan's oil drop experiment could be performed on the two surfaces, one will find the ratio
(electronic charge on the moon / electronic charge on the earth to be)

(a) g_E/g_M (b) 0 (c) g_M/g_E (d) 1

2. A parallel plate condenser with a dielectric of dielectric constant K between the plates has a capacity C and is charged to potential V volt. The dielectric slab is slowly removed from between the plates and then reinserted. The new work done by the system in this process is

(a) $1/2\ (K-1)\ CV^2$ (b) zero (c) $CV^2(K-1)/K$ (d) $(K-1)\ CV^2$

3. The resistance of a wire is 5 ohm at 50°C and 6 ohm at 100°C. The resistance of the wire at 0°C will be

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

4. In an a.c. circuit the voltage applied is $E = E_0 \sin \omega t$. The resulting current is the circuit is $I = I_0 \sin (\omega t - \pi/2)$. The power consumption in the circuit given by

(a) P = zero (b) $P = \sqrt{2}E_0I_0$ (c) $P = E_0I_0/2$ (d) $P = E_0I_0/\sqrt{2}$

5. A sound absorber attenuates the sound level by 20 dB. The intensity decreases by a factor of

(a) 10 (b) 1000 (c) 100 (d) 10000

6. A Carnot engine, having an efficiency of $\eta = 1/10$ as heat engine, is used as refrigerator. If the work done on the system is 10 J, the amount of energy absorbed from the reservoir at lower temperature is

(a) 90 J (b) 99 J (c) 1 J (d) 100 J

7. A point mass oscillates along the x-axis according to the law $x = x_0 \cos (\omega t - \pi/4)$. If the acceleration of the particle is written as $a = A\cos(\omega t + \delta)$, then

(a) $A = x_0\omega^2$, $\delta = \pi/4$
(b) $A = x_0\omega^2$, $\delta = 3\pi/4$
(c) $A = x_0$, $\delta = -\pi/4$
(d) $A = x_0\omega^2$, $\delta = -\pi/4$

8. The velocity of a particle is $v = v_0 + gt + ft^2$. If its position is x = 0 at t = 0, then its displacement after unit time (t = 1) is

(a) $v_0 + g/2 + f/3$ (b) $v_0 + 2g + 3f$ (c) $v_0 + g + f$ (d) $v_0 + g/2 + f$

9. The half-life period of a radioactive element X is same as the mean life time of another radioactive element Y. Initially they have the same number of atoms. Then

(a) Y will decay faster than X

(b) X and Y have same decay rate initially
(c) X and Y decay at same rate always
(d) X will decay faster than Y

10. A 2 kg block slides on a horizontal floor with a speed of 4 m/s. It strikes a uncompressed spring, and compresses it till the block is motionless. The kinetic friction force is 15 N and spring constant is 10,000 N/m. The spring compresses by

(a) 11.0 cm (b) 8.5 cm (c) 5.5 cm (d) 2.5 cm

11. The displacement of an object attached to a spring and executing simple harmonic motion is given by $x = 2 \times 10^{-2} \cos \pi t$ metre. The time at which the maximum speed first occurs is

(a) 0.5 s (b) 0.25 s (c) 0.75 s (d) 0.125 s

12. Two identical conducting wires AOB and COD are placed at right angles to each other. The wire AOB carries an electric current I_1 and COD carries a current I_2. The magnetic field on a point lying at a distance d from O, in a direction perpendicular to the plane of the wires AOB and COD, will be given by

(a) $\mu_0/2\pi d(I_1 + I_2)$ (b) $\mu_0/2\pi d(I_1^2 + I_2^2)^{1/2}$ (c) $\mu_0/2\pi(I_1 + I_2/d)^{1/2}$ (d) $\mu_0/2\pi d(I_1^2 + I_2^2)$

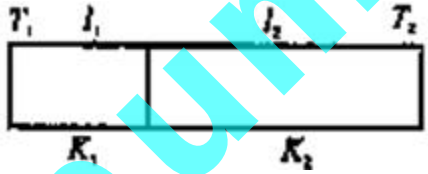
13. Two lenses of power –15 D and +5 D are in contact with each other. The focal length of the combination is

(a) –10 cm (b) –20 cm (c) +10 cm (d) + 20 cm

14. A particle of mass m executes simple harmonic motion with amplitude a and frequency v. The average kinetic energy during its motion from the position of equilibrium to the end is

(a) $4\pi^2ma^2v^2$ (b) $\pi^2ma^2v^2$ (c) $2\pi^2 m a^2 v^2$ (d) $1/4ma^2v^2$

15. One end of a thermally insulated rod is kept at a temperature T_1 and the other at T_2. The rod is composed of two section of lengths l_1 and l_2 and thermal conductivities K_1 and K_2 respectively. The temperature at the interface of the two sections is



(a) $(K_1l_2T_1 + K_2l_1T_2) / (K_1l_2 + K_2l_1)$
(b) $(K_1l_1T_1 + K_2l_2T_2) / (K_1l_1 + K_2l_2)$
(c) $(K_2l_2T_1 + K_1l_1T_2) / (K_1l_1 + K_2l_2)$
(d) $(K_2l_1T_1 + K_1l_2T_2) / (K_2l_1 + K_1l_2)$

16. A current I flows along the length of an infinitely long, straight, thin walled pipe. Then

(a) the magnetic field at all points inside the pipe is the same, but not zero
(b) the magnetic field is different at different points inside the pipe
(c) the magnetic field at any point inside the pipe is zero

(d) the magnetic field is zero only on the axis of the pipe

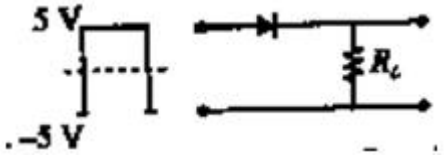
17. A particle is projected at 60° to the horizontal with a kinetic energy K. The kinetic energy at the highest point is

(a) K/4 (b) K (c) zero (d) K/2

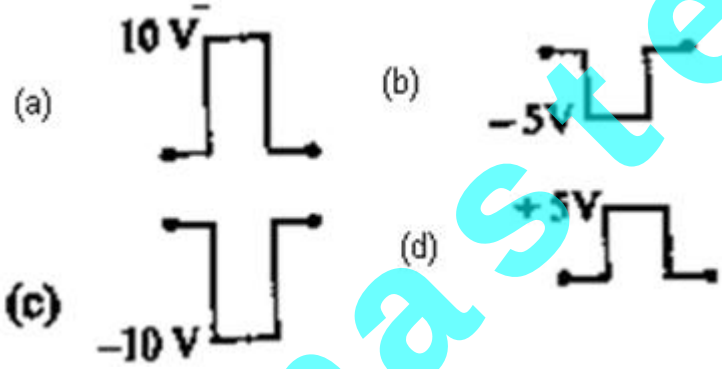
18. The potential at a point x (measured in μm) due to some charges situated on the x-axis is given by $V(x) = 20/(x^2 - 4)$ volt
The electric field E at x = 4 μm is given by

(a) (10/9) volt/μm in the –ve x direction
(b) (5/3) volt/μm and in the –ve x direction
(c) (5/3) volt/μm and in the +ve x direction
(d) (10/9) volt/μm and in the +ve x direction

19. If in a p – n junction diode, a square input signal of 10 V is applied as shown



Then the output signal across R_L will be



20. If M_O is the mass of an oxygen isotope $_8O^{17}$, M_P and M_N are the masses of a proton and a neutron respectively, the nuclear binding energy of the isotope is

(a) $(M_O - 8 M_P - 9 M_N)C^2$ (b) $(M_O - 8 M_P)C^2$ (c) $(M_O - 17 M_N)C^2$ (d) M_OC^2

21. Photon of frequency v has a momentum associated with it. If c is the velocity of light, the momentum is

(a) v/c (b) hv/c^2 (c) hvc (d) hv/c

22. A circular disc of radius R is removed from a bigger circular disc of radius 2R such that the circumferences of the discs coincide. The centre of mass of the new disc is α/R from the centre of the bigger disc. The value of α is

(a) 1/4 (b) 1/3 (c) 1/6. (d) 1/2

23. A block of mass m is connected to another block of mass M by a spring (massless) of spring constant k. The blocks are kept on a smooth horizontal plane. Initially the blocks are at rest and the spring is unstretched. Then a constant force F starts acting on the block of mass M to pull it. Find the force of the block of mass m.

(a) mF/(m + M) (b) MF/(m + M) (c) mF/M (d) (M + m)F/m

24. Angular momentum of the particle rotating with a central force is constant due to

(a) Constant force
(b) Constant torque
(c) Zero torque
(d) Constant linear momentum

25. In gamma ray emission from a nucleus

(a) there is no change in the proton number and the neutron number
(b) only the proton number changes
(c) only the neutron number changes
(d) both the neutron number and the proton number change

26. A long straight wire of radius a carries a steady current i. The current is uniformly distributed across its cross section. The ratio of the magnetic field at a/2 and 2a is

(a) 1 (b) 1/2 (c) 4 (d) 1/4

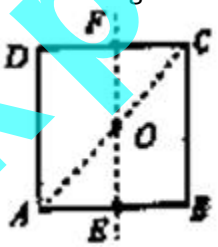
27. Carbon, silicon and germanium have four valence electrons each. At room temperature which one of the following statements is most appropriate?

(a) The number of free electrons for conduction is significant only in Si and Ge but small in C.
(b) The number of free conduction electrons is significant in C but small in Si and Ge.
(c) The number of free electrons for conduction is significant in all the three.
(d) The number of free conduction electrons is negligibly small in all the three.

28. A battery is used to charge a parallel plate capacitor till the potential difference between the plates becomes equal to the electromotive force of the battery. The ratio of the energy stored in the capacitor and the work done by the battery will be

(a) 1/2 (b) 1 (c) 2 (d) 1/4

29. For the given uniform square lamina ABCD, whose centre is O,



(a) $I_{AC} = \sqrt{2} I_{EF}$
(b) $I_{AC} = I_{EF}$

(c) $I_{AD} = 3I_{EF}$
(d) $\sqrt{2}I_{AC} = I_{EF}$

30. A round uniform body of radius R, mass M and moment of inertia I rolls down (without slipping) an inclined plane making an angle θ with the horizontal. Then its acceleration is

(a) $g \sin\theta/1 - I/MR^2$ (b) $g \sin\theta/1 - MR^2/I$ (c) $g \sin\theta/1 + MR^2/I$ (d) $g \sin\theta/1 + I/MR^2$

31. Two springs, of force constants k_1 and k_2 are connected to a mass m as shown. The frequency of oscillation of the mass is f. If both k_1 and k_2 are made four times their original values, the frequency of oscillation becomes

(a) 4f (b) 2f (c) f/2 (d) f/4

32. Which of the following transitions in hydrogen atoms emit photons of highest frequency?

(a) n = 2 to n = 1 (b) n = 6 to n = 2 (c) n = 1 to n = 2 (d) n = 2 to n = 6

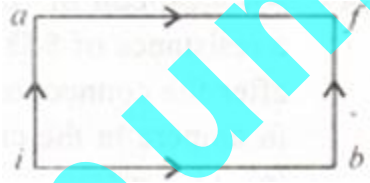
33. A charged particle moves through a magnetic field perpendicular to its direction. Then

(a) kinetic energy changes but the momentum is constant
(b) the momentum changes but the kinetic energy is constant
(c) both, momentum and kinetic energy of the particle are constant
(d) both momentum and kinetic energy of the particle are not constant

34. If C_P and C_V denote the specific heats of nitrogen per unit mass at constant pressure and constant volume respectively, then

(a) $C_P - C_V = 28R$ (b) $C_P - C_V = R/14$ (c) $C_P - C_V = R/28$ (d) $C_P - C_V = R$

35. When a system is taken from state i to state f along the path iaf, it is found that Q = 50 cal and W = 20 cal. Along the path ibf, Q = 36 cal. W along the path ibf is



(a) 16 cal (b) 66 cal (c) 14 cal (d) 6 cal

36. A charged particle with charge q enters a region of constant, uniform and mutually orthogonal fields $\vec{E}$ and $\vec{B}$ with a velocity $\vec{v}$ perpendicular to both $\vec{E}$ and $\vec{B}$, and comes out without any change in magnitude or direction of $\vec{v}$. Then

(a) $\vec{v} = \vec{B} \times \vec{E}/B^2$ (b) $\vec{v} = \vec{E} \times \vec{B}/B^2$

(c) $\vec{v} = \vec{B} \times \vec{E} / E^2$ (d) $\vec{v} = \vec{E} \times \vec{B} / E^2$

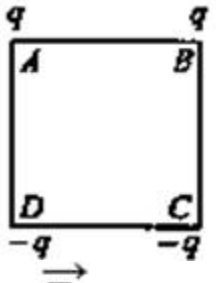
37. An ideal coil of 10 H is connected in series with a resistance of 5 Ω and a battery of 5 V. 2 second after the connection is made, the current flowing in ampere in the circuit is

(a) e (b) (1 - e) (c) $(1 - e^{-1})$ (d) e^{-1}

38. In a Young's double slit experiment the intensity at point where the path difference is λ/6 (λ being the wavelength of light used) is I. If I_0 denotes the maximum intensity, I/I_0 is equal to

(a) 1/2 (b) √3/2 (c) 1/√2 (d) 3/4

39. Charges are placed on the vertices of a square as shown. Let $\vec{E}$ be the electric field and V the potential at the centre. If the charges on A and B are interchanged with those on D and C respectively, then



(a) $\vec{E}$ changes, V remains unchanged

(b) $\vec{E}$ remains unchanged, V changes

(c) both $\vec{E}$ and V change

(d) $\vec{E}$ and V remain unchanged

40. An electric charge 10^{-3} μC is placed at the origin (0, 0) of X – Y co-ordinate system. Two points A and B are situated at (√2,√2) and (2, 0) respectively. The potential difference between the points A and B will be

(a) zero (b) 4.5 volt (c) 9 volt (d) 2 volt

AIEEE - Previous year Papers -CHEMISTRY - 2007

1. Which of the following reactions will yield 2,2-dibromopropane?

(a) $CH_3 – CH \equiv CH + 2HBr \rightarrow$
(b) $CH_3CH = CHBr + HBr \rightarrow$
(c) $CH_3 – CH = CH_2 + HBr \rightarrow$
(d) $CH \equiv CH + 2HBr \rightarrow$

2. Identify the correct statement regarding a spontaneous process:

(a) Exothermic processes are always spontaneous.
(b) For a spontaneous process in an isolated system, the change in entropy is positive.
(c) Endothermic processes are never spontaneous.
(d) Lowering of energy in the reaction process is the only criterion for spontaneity.

3. Equal masses of methane and oxygen are mixed in an empty container at 25°C. The fraction of the total pressure exerted by oxygen is

(a) 2/3 (b) 1/3. (c) 1/2 (d) 1/3 x 273/298

4. Which one of the following is the strongest base in aqueous solution?

(a) Dimethylamine. (b) Aniline (c) Trimethylamine (d) Methylamin

5. A radioactive element gets spilled over the floor of a room. Its half-life period is 30 days. If the initial velocity is ten times the permissible value, after how many days will it be safe to enter the room?

(a) 10 days. (b) 100 days (c) 300 days (d) 1000 days

6. Which one of the following conformations of cyclohexane is chiral?

(a) Rigid (b) Twist boat (c) Boat (d) Chair.

7. The equivalent conductances of two strong electrolytes at infinite dilution in H_2O (where ions move freely through a solution) at 25°C are given below:

$\Lambda^\circ_{CH_3COONa} = 91.0\ S\ cm^2/equiv.$

$\Lambda^\circ_{HCl} = 426.2\ S\ cm^2/equiv.$

What additional information/quantity on needs to calculate Λ° of an aqueous solution of acetic acid?

(a) Λ° of CH_3COOK
(b) the limiting equivalent conductance of H^+ ($\lambda^\circ_{H^+}$)
(c) Λ° of NaCl
(d) Λ° of chloroacetic acid ($ClCH_2COOH$)

8. The density (in g mL^{-1}) of a 3.60 M sulphuric acid solution that is 29% H_2SO_4 (molar mass = 98 g mol^{-1}) by mass will be

(a) 1.22 (b) 1.45 (c) 1.64 (d) 1.88

9. The actinoids exhibit more number of oxidation states in general than the lanthanoids. This is because

(a) the 5f orbitals are more buried than the 4f orbitals
(b) the actinoids are more reactive than the lanthanoids.
(c) there is a similarity between 4f and 5f orbitals in their angular part of the wave function
(d) the 5f orbitals extend further from the nucleus than the 4f orbitals

10. A 5.25 % solution of a substance is isotonic with a 1.5% solution of urea (molar mass = 60 g mol^{-1}) in the same solvent. If the densities of both the solutions are assumed to be equal to 1.0 g cm^{-3}, molar mass of the substance will be

(a) 90.0 g mol^{-1} (b) 115.0 g mol^{-1} (c) 105.0 g mol^{-1}. (d) 210.0 g mol^{-1}

11. Which of the following nuclear reactions will generate an isotope?

(a) β-particle emission
(b) Positron emission
(c) α-particle emission.
(d) Neutron particle emission

12. In the following sequence of reactions,

$$CH_3CH_2OH \xrightarrow{P+I_2} A \xrightarrow[ether]{Mg} B \xrightarrow{HCHO} C \xrightarrow{H_2O} D$$

the compound D is

(a) butanal (b) propanal (c) n-propyl alcohol. (d) n-butyl alcohol

13. Identify the incorrect statement among the following.

(a) Cl_2 reacts with excess of NH_3 to given N_2 and HCl.
(b) Br_2 reacts with hot and strong NaOH solution to give NaBr and H_2O.
(c) Ozone reacts with SO_2 to give SO_3.
(d) Silicon reacts with $NaOH_{(aq)}$ in the presence of air to give Na_2SiO_3 and H_2O.

14. Which of the following is the correct order of decreasing S_N2 reactivity?

(a) $R_3CX > R_2CH\ X > RCH_2X$.
(b) $RCH\ X > R_3C\ X > R_2CH\ X$
(c) $RCH_2\ X > R_2CH\ X > R_3C\ X$
(d) $R_2CH\ X > R_3C\ X > RCH_2\ X$
(X is a halogen)

15. The first and second dissociation constants of an acid H_2A are 1.0×10^{-5} and 5.0×10^{-10} respectively. The overall dissociation constant of the acid will be

(a) 5.0×10^{-5} (b) 5.0×10^{15} (c) 0.2×10^{5} (d) 5.0×10^{-15}.

16. Consider the reaction, 2A + B → products. When concentration of B alone was doubled, the half-life did not change. When the concentration of A alone was doubled, the rate increased by two times. The unit of rate constant for this reaction is

(a) s^{-1} (b) no unit (c) $L\ mol^{-1}\ s^{-1}$ (d) $mol\ L^{-1}\ s^{-1}$.

17. Which of the following species exhibits the diamagnetic behaviour?

(a) O_2^{2-} (b) O_2^{+} (c) O_2. (d) NO

18. Which of the following hydrogen bonds is the strongest?

(a) F H ------- F (b) O H ------ F (c) O H ----- H (d) O H ------ O.

19. In the chemical reaction,
$CH_3CH_2NH_2 + CHCl_3 + 3KOH \rightarrow (A) + (B) + 3H_2O$, the compounds (A and (B) are respectively

(a) C_2H_5CN and 3 KCl
(b) C_2H_5NC and 3 KCl
(c) C_2H_5NC and K_2CO_3.
(d) $CH_3CH_2CONH_2$ and 3KCl

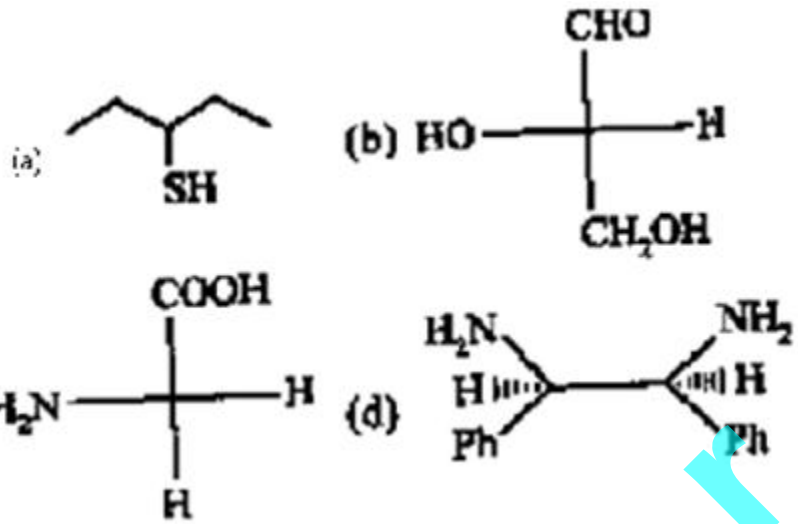
20. In conversion of lime-stone to lime.
$CaCO_{3(s)} \rightarrow CaO_{(s)} + CO_{2(g)}$ the values of ?H° and ?S° are +179. 1 kJ mol^{-1} and 160.2 J/K respectively at 298 K and 1 bar. Assuming that ?H° and ?S° do not change with temperature, temperature above which conversion of limestone to lime will be spontaneous is

(a) 1200 K (b) 845 K. (c) 1118 K (d) 1008 K

21. The compound formed as a result of oxidation of ethyl benzene by $KMnO_4$ is

(a) benzophenone (b) benzyl alcohol (c) acetophenone (d) benzoic acid.

22. Which of the following molecules is expected to rotate the plane of plane-polarised light?



23. Which of the following has a square planar geometry?

(a) $[CoCl_4]^{2-}$ (b) $[FeCl_4]^{2-}$ (c) $[PtCl_4]^{2-}$ (d) $[NiCl_4]^{2-}$.

(At. nos. : Fe = 26, Co = 27, Ni = 28, Pt = 78)

24. The secondary structure of a protein refers to
(a) α-helical backbone
(b) sequence of α-amino acids.
(c) fixed configuration of the polypeptide backbone
(d) hydrophobic interactions

ANS: d

25. The charge/size ratio of a cation determines its polarizing power. Which one of the following sequences represents the increasing order of the polarizing power of the cationic species, K^+, Ca^{2+}, Mg^{2+}, Be^{2+}?

(a) $Mg^{2+} < Be^{2+} < K^+ < Ca^{2+}$
(b) $Be^{2+} < K^+ < Ca^{2+} < Mg^{2+}$
(c) $Ca^{2+} < Mg^{2+} < Be^+ < K^+$
(d) $K^+ < Ca^{2+} < Mg^{2+} < Be^{2+}$.

26. The stability of dihalides of Si, Ge, Sn and Pb increases steadily in the sequence

(a) $SiX_2 << GeX_2 << PbX_2 << SnX_2$
(b) $GeX_2 << SiX_2 << SnX_2 << PbX_2$
(c) $PbX_2 << SnX_2 << GeX_2 << SiX_2$
(d) $SiX_2 << GeX_2 << SnX_2 << PbX_2$.

27. Which of the following sets of quantum numbers represents the highest energy of an atom?

(a) n = 3, l = 0, m = 0, s = + 1/2
(b) n = 3, l = 1, m = 1, s = + 1/2
(c) n = 4, l = 0, m = 0, s = + 1/2.
(d) n = 3, l = 2, m = 1, s = + 1/2

28. Presence of a nitro group in a benzene ring

(a) Renders the ring basic
(b) Activates the ring towards electrophilic substitution
(c) Deactivates the ring towards nucleophilic substitution.
(d) Deactivates the ring towards electrophilic substitution

29. In a saturated solution of the sparingly soluble strong electrolyte $AgIO_3$ (molecular mass = 283) the equilibrium which sets in is

$AgIO_3(s) \rightleftharpoons Ag^+_{(aq)} + IO_3^-{}_{(aq)}$

If the solubility product constant K_{sp} of $AgIO_3$ at a given temperature is 1.0×10^{-8}, what is the mass of $AgIO_3$ contained in 100 ml of its saturated solution?

(a) 2.83×10^{-3} g (b) 1.0×10^{-4} g (c) 28.3×10^{-2} g (d) 1.0×10^{-7} g.

30. The reaction of toluene with Cl_2 in presence of $FeCl_3$ gives predominantly
(a) o-and p-chlorotoluene.
(b) benzoyl chloride
(c) benzyl chloride
(d) m-chlorobenzene

31. The pK_a of a weak acid (HA) is 4.5. The pOH of an aqueous buffered solution of HA in which 50% of the acid is ionized is

(a) 7.0 (b) 2.5 (c) 4.5 (d) 9.5

32. Identify the incorrect statement among the following:

(a) 4f and 5f orbitals are equally shielded.
.
(b) La and Lu have partially filled d-orbitals and no other partially filled orbitals.
(c) The chemistry of various lanthanoids is very similar.
(d) d-Block elements show irregular and erratic chemical properties among themselves

33. In the reaction,

$2Al_{(s)} + 6HCl_{(aq)} \rightarrow 2Al^{3+}_{(aq)} + 6Cl^-_{(aq)} + 3H_{2(g)}$

(a) 6 L $HCl_{(aq)}$ is consumed for every 3 L $H_{2(g)}$ produced
(b) 33.6 L $H_{2(g)}$ is produced regardless of temperature and pressure for every mole Al that reacts
(c) 67.2 $H_{2(g)}$ at STP is produced for every mole Al that reacts.
(d) 11.2 L $H_{2(g)}$ at STP is produced for every mole $HCl_{(aq)}$ consumed

34. In which of the following ionization processes, the bond order has increased and the magnetic behaviour has changed?

(a) $NO \rightarrow NO^+$ (b) $O_2 \rightarrow O_2^+$. (c) $N_2 \rightarrow N_2^+$ (d) $C_2 \rightarrow C_2^+$

35. A mixture of ethyl alcohol and propyl alcohol has a vapour pressure of 290 mm at 300 K. The vapour pressure of propyl alcohol is 200 nm. If the mole fraction of ethyl alcohol is 0.6, its vapour pressure (in mm) at the same temperature will be

(a) 350 (b) 300 (c) 700. (d) 360

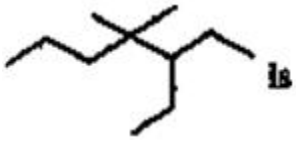
36. Assuming that water vapour is an ideal gas, the internal energy change (Δ U) when 1 mol of water is vapourised at 1 bar pressure and 100°C, (given: molar enthalpy of vaporisation of water at 1 bar and 373 K = 41 kJ mol^{-1} and R = 8.3 J mol^{-1} K^{-1})will be

(a) 37.904 kJ mol^{-1}. (b) 3.7904 kJ mol^{-1} (c) 41.00 kJ mol^{-1} (d) 4.100 kJ mol^{-1}

37. The cell,
Zn $|Zn^{2+}$ (1 M)|| Cu^{2+} (1 M)| Cu ($E°_{cell}$ = 1.10 V) was allowed to be completely discharged at 298 K. The relative concentration of Zn^{2+} to Cu^{2+}
($[Zn^{2+} / Cu^{2+}]$) is

(a) $10^{37.3}$ (b) 37.3 (c) 9.65 x 10^4 (d) antilog (24.08)

38. The IUPAC name



(a) 3-ethyl-4,4-dimethylheptane
(b) 4,4-dimethyl-5,5-diethylpentane
(c) 1,1-diethyl-2,2-dimethylpentane
(d) 5,5-diethyl-4,4-dimethylpentane.

39. The energies of activation for forward and reverse reaction for $A_2 + B_2 \rightleftharpoons 2AB$ are 180 kJ mol^{-1} and 200 kJ mol^{-1} respectively. The presence of a catalyst lowers the activation energy of both (forward and reverse) reactions by 100 kJ mol^{-1}. The enthalpy change of the reaction ($A_2 + B_2 \rightarrow 2AB$) in the presence of catalyst will be (in kJ mol^{-1})

(a) 120 (b) 300 (c) 20 (d) 280.

40. Regular use of the following fertilizers increases the acidity of soil?

(a) Superphosphate of lime.
(b) Urea
(c) Ammonium sulphate
(d) Potassium nitrate