SECTION–I : (Maximum Marks : 80)

● This section contains **TWENTY** questions.

● Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is correct.

● For each question, darken the bubble corresponding to the correct option in the ORS.

● For each question, marks will be awarded in <u>one of the following categories</u> :
Full Marks : +4 If only the bubble corresponding to the correct option is darkened.
Zero Marks : 0 If none of the bubbles is darkened.
Negative Marks : –1 In all other cases

1. Angular spread of the central maxima in a single slit diffraction, if a light of wavelength (λ) is incident on a slit of width 'a' and screen is kept at distance D ; is :-

(A) $\dfrac{\lambda}{a}$ (B) $\dfrac{2\lambda}{a}$

(C) $\dfrac{\lambda D}{a}$ (D) $\dfrac{2\lambda D}{a}$

2. Choose **CORRECT** statement :-

(A) Electron & proton which are accelerated through same potential difference from rest will have same de-broglie wavelength.

(B) Proton and α particle which are accelerated through same potential difference from rest will have same de-broglie wavelength.

(C) Two particles having same kinetic energy must have same de-broglie wavelength.

(D) Two particles having different momentum may have same de-broglie wavelength.

3. An electric dipole antenna is kept at the origin. The dipole is oriented along y-axis. As the antenna radiates electromagnetic waves, at a point on x-axis :-

(A) There is no electromagnetic wave.

(B) Electric field is along y-direction and magnetic field is along z-direction.

(C) Electric field is along z-direction and magnetic field is along y-direction

(D) Electric field is along x-direction and magnetic field is along y-direction.

4. In calculation of time period using simple pendulum experiment, if percentage error in length of string is 4% and percentage error in calculation of 'g' is 2%, then percentage error in Time period (T) is

(A) 1% (B) 2%

(C) 3% (D) 6%

5. A charge particle of mass m having charge q is accelerated by certain potential difference V starting from rest. Particle moves on a straight line when it is projected perpendicularly in a region where electric field (E_0) and magnetic field (B_0) are perpendicular to each other. Value of potential difference V is :-

(A) $\dfrac{mE_0^2}{4qB_0^2}$ (B) $\dfrac{mE_0^2}{2qB_0^2}$

(C) $\dfrac{4qB_0^2}{mE_0^2}$ (D) $\dfrac{2qB_0^2}{mE_0^2}$

**6.** Minimum force required to move block on ground as shown in figure is :-
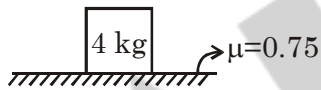
(A) 12 N
(B) 18 N
(C) 24 N
(D) 30 N

7. Two square plates of capacitor are of length 32 cm each. Between the plates, material having thickness 640 μm is sandwiched whose dielectric strength is 20 MV/m. The maximum charge that can be put on the capacitor is (Permittivity of free space = 9×10^{-12} SI unit & dielectric constant of material is 4)

(A) 4.6 μC (B) 5 μC

(C) 73.7 μC (D) 18.4 μC

8. The time period of small oscillation of block along y axis is given by (Neglect gravity)
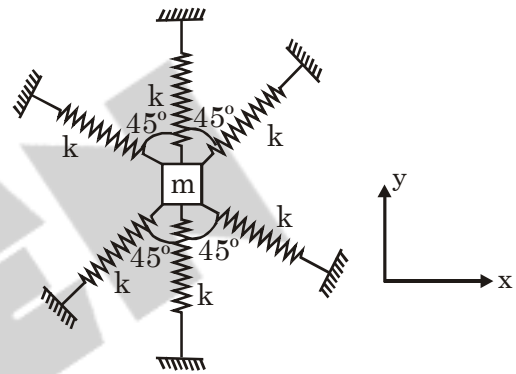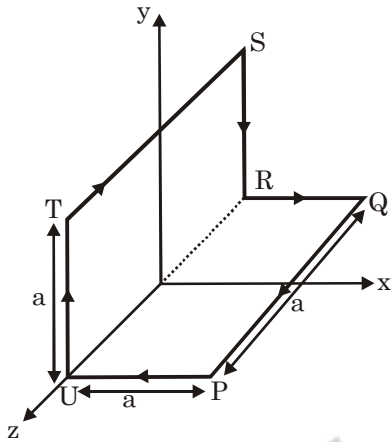

(A) $T = 2\pi\sqrt{\dfrac{m}{k}}$ (B) $T = 2\pi\sqrt{\dfrac{m}{4k}}$

(C) $T = 2\pi\sqrt{\dfrac{m}{2k}}$ (D) $T = 2\pi\sqrt{\dfrac{2m}{k}}$

9. Block have velocities as shown in the figure. Final velocity of Block C after all possible elastic collisions is


A m $\xrightarrow{}$ V   B 2m   C m

smooth
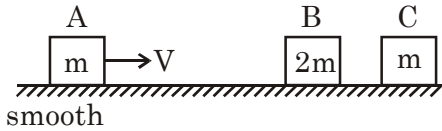
(A) $\dfrac{8V}{9}$ (B) V   (C) $\dfrac{4V}{9}$ (D) $\dfrac{V}{2}$

10. In given figure, P & Q lie on xz plane and S & T lie on yz plane. The direction of magnetic moment of the loop carrying current I is given by :-


(A) $\dfrac{\hat{i} + \hat{j}}{\sqrt{2}}$ (B) $-\left(\dfrac{\hat{i} + \hat{j}}{\sqrt{2}}\right)$

(C) $\dfrac{\hat{i} + \hat{k}}{\sqrt{2}}$ (D) $\dfrac{\hat{i} - \hat{k}}{\sqrt{2}}$

11. In the given meter bridge configuration, initial null point occurs for $\ell = 60$ cm. If a resistance of 10Ω is added in series to R_1, null point shifts to 50 cm without any change in remaining circuit, then value of R_1 is :-

(A) 60 Ω

(B) 50 Ω

(C) 40 Ω
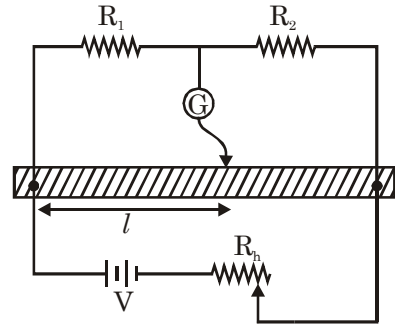
(D) Situation is not possible

12. Q charge given to a uniform hemispherical charged distribution of radius R. Then potential at two diametrically opposite points $v_A + v_B$ is equal to :
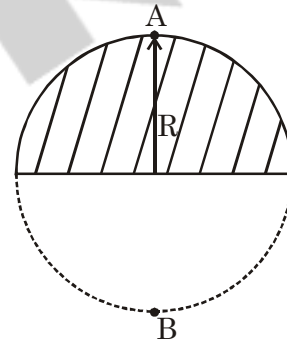
(A) $\dfrac{kQ}{R}$ (B) $\dfrac{2kQ}{R}$ (C) $\dfrac{kQ}{2R}$ (D) $\dfrac{kQ}{3R}$

ALLEN

13. A light ray travelling in air strikes a glass of refractive index 3/2. The reflected ray becomes polarised. The angle of incidence must be :-

(A) $\sin^{-1}\left(\dfrac{3}{\sqrt{13}}\right)$

(B) $\sin^{-1}\left(\dfrac{2}{\sqrt{13}}\right)$

(C) $\sin^{-1}\left(\dfrac{\sqrt{5}}{3}\right)$

(D) $\sin^{-1}\left(\dfrac{2}{\sqrt{5}}\right)$

14. Moment of inertia of a semicircular ring of mass M & radius R about an axis passing through its centre of mass and perpendicular to plane of ring is :-

(A) MR^2
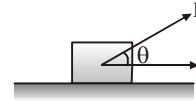
(B) $MR^2 - M\left(\dfrac{2R}{\pi}\right)^2$

(C) $MR^2 + M\left(\dfrac{2R}{\pi}\right)^2$

(D) $\dfrac{MR^2}{2} - M\left(\dfrac{2R}{\pi}\right)^2$

15. A block of mass m resting on a smooth horizontal plane starts moving due to a force $F = \dfrac{mg}{3}$ of constant magnitude. In the process of rectilinear motion, the angle θ between the direction of this force and the horizontal (as shown) varies as θ = ks, where k is a constant and s represent displacement. The velocity of block as a function of θ is :-
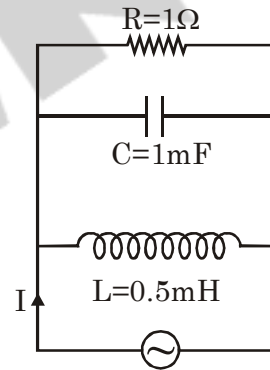

(A) $v = \sqrt{\dfrac{2g}{3}\sin\theta}$ (B) $v = \sqrt{\dfrac{2g}{3k}\cos\theta}$

(C) $v = \sqrt{\dfrac{2g}{3k}\sin\theta}$ (D) $v = \sqrt{\dfrac{2g}{k}\cos\theta}$

16. Phase difference between the voltage of source and current from the source in the given AC circuit is given by :-

R=1Ω

C=1mF

L=0.5mH

I

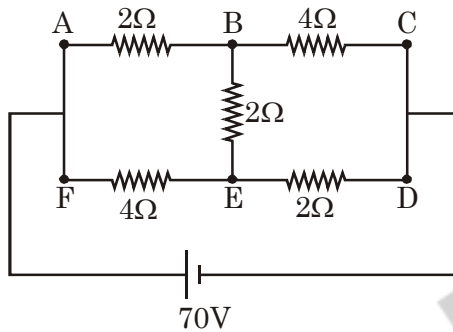$V = V_0\sin(1000t + 30°)$

(A) 30° (B) 37° (C) 45° (D) 53°

17. Brakes in truck can produce a maximum retardation of 2 m/s^2. Minimum distance required by truck moving with speed 4 m/s for stopping if reaction time of the driver is 0.2 sec, is :-

(A) 4 m

(B) 4.2 m

(C) 4.8 m

(D) 5.2 m

18. The circuit is as given in figure. The current through the branch BE of the circuit is :-

(A) 2A

(B) 5A

(C) 7A

(D) 10A

19. The figure below shows a graph of potential energy U(x) verses position x for a particle executing one dimensional motion along the x-axis. The total mechanical energy of the system is indicated by the dashed line. At t = 0 the particle is somewhere between points A and G. For later times, choose the **CORRECT** statement :-
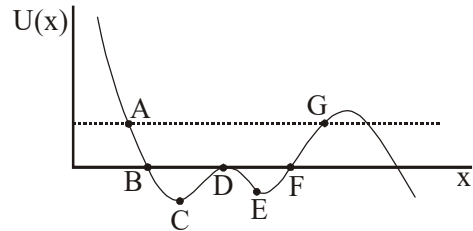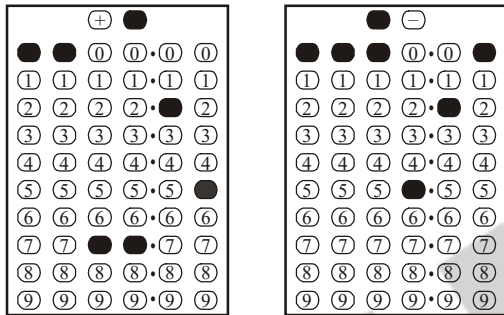

(A) The magnitude of force is maximum at D

(B) The kinetic energy is maximum at B

(C) The velocity is zero at A & G

(D) The magnitude of force is minimum at F

20. A string free from one end is vibrating with a frequency of 150 Hz. Which of the following cannot be the possible frequency of vibration of same string ?

(A) 50 Hz

(B) 250 Hz

(C) 300 Hz

(D) 450 Hz

SECTION-II : (Maximum Marks: 20)

● This section contains **FIVE** questions.

● The answer to each question is a **NUMERICAL VALUE**.

● For each question, enter the correct numerical value (If the numerical value has more than two decimal places, **truncate/ round-off** the value to **TWO** decimal places; e.g. 6.25, 7.00, –0.33, –.30, 30.27, –127.30, if answer is 11.36777..... then both 11.36 and 11.37 will be correct) by darken the corresponding bubbles in the ORS.

For Example : If answer is –77.25, 5.2 then fill the bubbles as follows.

● Answer to each question will be evaluated according to the following marking scheme: *Full Marks* : +4 If ONLY the correct numerical value is entered as answer. *Zero Marks* : 0 In all other cases.

1. Electric field in a region of space is given by $\vec{E} = 2x\hat{i} + 3y^2\hat{j}(V/m)$. Magnitude of potential difference between the points (1, 2) & (3, 4) is α volt. Fill $\left(\dfrac{\alpha}{10}\right)$.

2. A particle attached to one end of a string of length l is given minimum velocity at lower most point to complete vertical circular motion. Net acceleration of the particle at the point P is $\dfrac{g\sqrt{\alpha}}{\beta}$ where α and β are lowest possible integers then fill the value of $\dfrac{\alpha}{\beta}$.
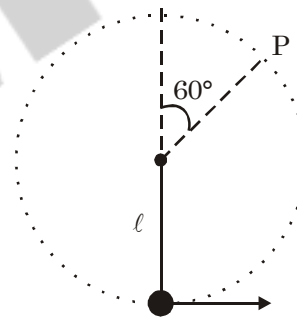
3. A longitudinal sound wave given by

$P = 25\sin\dfrac{\pi}{2}(x - 660t)$ (P is in N/m² and x is

in m and t is in s) is sent down a closed organ pipe. If the pipe vibrates in second overtone then the length of the pipe (in m) is :

4. A monoatomic gas undergoes a process in which 25% of the heat is used in work done by gas. If the equation of the process is P^3V^x = Constant, then fill value of x.

5. A uniform magnetic field exists in region given by $\vec{B} = 3\hat{i} + 4\hat{j} + 5\hat{k}$. A conducting rod of length 5m placed along y-axis is moved along x-axis with constant speed 1 m/sec. Then induced EMF (in V) in the rod will be

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1. In the reaction : $Na_2S_2O_3 + Cl_2 + H_2O \longrightarrow$
$Na_2SO_4 + H_2SO_4 + HCl$,
the equivalent weight of $Na_2S_2O_3$ will be :
(M = molecular weight of $Na_2S_2O_3$)

   (A) M/4   (B) M/8
   (C) M/1   (D) M/2

2.. Rate constant k varies with temperature by equation , $\log k(min^{-1}) = 5 - \dfrac{2000}{T(K)}$. We can conclude:
   (A) pre–exponential factor A is 5 min^{-1}
   (B) E_a is 2000 kcal
   (C) pre–exponential factor A is 10^5 min^{-1}
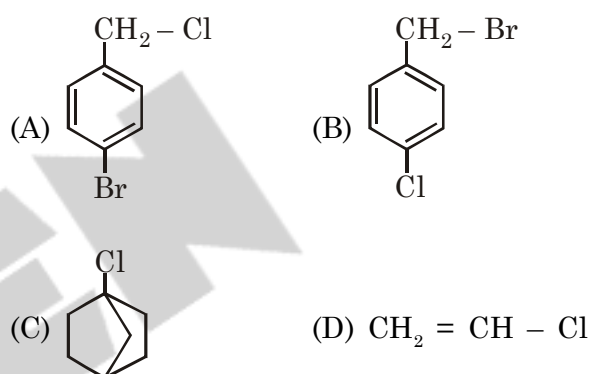   (D) E_a is 9.212 cal

3. The enthalpy of combustion of propane (C_3H_8) gas in terms of given data is :
   Bond energy (kJ/mol)

ε_{C-H}	$\varepsilon_{O=O}$	$\varepsilon_{C=O}$	ε_{O-H}	ε_{C-C}
$+x_1$	$+x_2$	$+x_3$	$+x_4$	$+x_5$

   Resonance energy of CO_2 is $- z$ kJ/mol and $\Delta H_{vaporization}$ [$H_2O(\ell)$] is ykJ/mol.
   (A) $8x_1 + 2x_5 + 5x_2 - 6x_3 - 8x_4 - 4y - 3z$
   (B) $6x_1 + x_5 + 5x_2 - 3x_3 - 4x_4 - 4y - 3z$
   (C) $8x_1 + 2x_5 + 5x_2 - 6x_3 - 8x_4 - y - z$
   (D) $8x_1 + x_5 + 5x_2 - 6x_3 - 8x_4 - 4y + 3z$

4. Which of the following compound gives white ppt with aqueous $AgNO_3$?

   (A) [structure: benzene ring with CH_2-Cl at top and Br at bottom]

   (B) [structure: benzene ring with CH_2-Br at top and Cl at bottom]

   (C) [structure: bicyclic with Cl]

   (D) $CH_2 = CH - Cl$

5. (X) $\xrightarrow{SeO_2}$ (Y) $\xrightarrow{MnO_2}$ Crotonaldehyde

   In above reaction sequence X is?
   (A) Propene
   (B) 2-Butene
   (C) 1-Butene
   (D) 2-Methylbut-2-ene

6. Which of the following amine gives positive isocyanide test but negative azo dye test with benzene diazonium chloride?

(A)
NH_2

(B)
$H\diagdown_N\diagup^{CH_3}$

(C)
CH_2-NH_2

(D) $(CH_3)_3N$
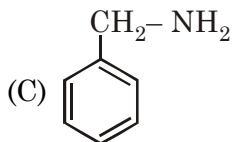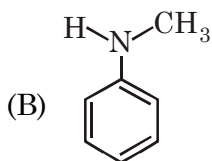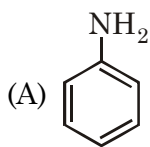
7. Which of the following ore contains copper metal?
(A) Fool's gold   (B) Dolomite
(C) Malachite   (D) Galena

8. Choose the **CORRECT** option in the given following statements :
(I) Clean water contains BOD value more than 5 ppm
(II) The soluble F^- ion makes the enamel on teeth into much harder as it converts hydroxyapatite,into much harder fluorapatite.
(III) When the pH of the rain water drops below 5.6, it is called acid rain
(A) (I), (II)   (B) (II) & (III)
(C) (I) & (III)   (D) (I), (II) & (III)

9. The **CORRECT** order of ionic radius is :
(A) $La^{3+} > Ce^{3+} > Gd^{3+} > Sc^{3+}$
(B) $La^{3+} > Sc^{3+} > Ce^{3+} > Gd^{3+}$
(C) $Sc^{3+} > La^{3+} > Ce^{3+} > Gd^{3+}$
(D) $Sc^{3+} > Gd^{3+} > Ce^{3+} > La^{3+}$

10. When 0.1 mole solid NaOH is added in 1 litre of 0.1M NH_3(aq) then which statement is INCORRECT? ($K_b = 2 \times 10^{-5}$, log 2 = 0.3)

(A) degree of dissociation of NH_3 approaches to zero.

(B) change in pH would be 1.85

(C) Finally conc. of $[Na^+] = 0.1M$, $[NH_3] = 0.1M$ & $[OH^-] = 0.2M$

(D) on addition of OH^-, K_b of NH_3 does not change.

**11.** Colloidal solution of silver is prepared by :
(A) Colloidal milk
(B) Double decomposition method
(C) Bredig's arc method
(D) Peptization

12. Which of the following compound is not correctly matched with their linkage or bond?

(A) Pepsin enzyme $\rightarrow$ Peptide linkage

(B) Starch $\rightarrow$ Glycosidic linkage

(C) DNA $\rightarrow$ Phosphodiester bond

(D) Insulin $\rightarrow$ Phosphodiester bond

13. The major product and DBE (Double bond equivalent) in major product of following reaction is :

(A) , DBE = 6

(B) , DBE = 7

(C) , DBE = 6

(D) , DBE = 7
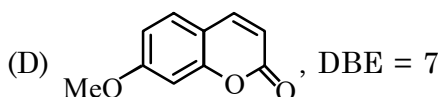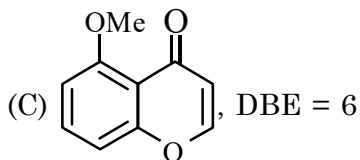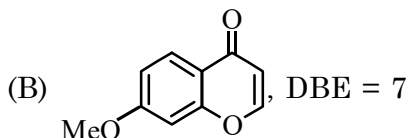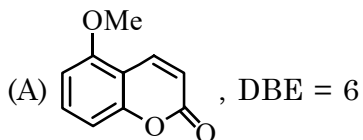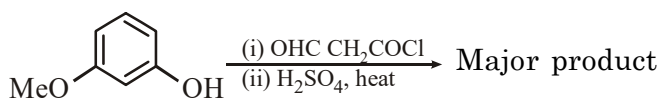
14. When the Lithium metal burns in a free supply of air, the predominant product(s) is

(A) Li_2O_2 (Minor) + Li_2O (Major)

(B) Li_2O_2 (Major) + Li_2O (Minor)

(C) Li_2O (Major) + Li_2O_2 & LiO_2 (Minor)

(D) Li_2O (Minor) + Li_2O_2 & LiO_2 (Major)

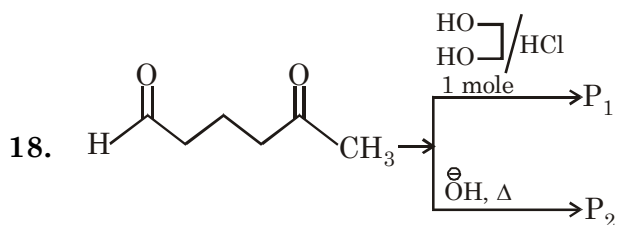**15.** Which of the following reaction(s) is **CORRECTLY** represented for the preparation of chlorine?

(A) $NaCl + H_2SO_4 + MnO_2 \longrightarrow$

(B) $NH_3 + CaOCl_2 \longrightarrow$

(C) $NaCl + H_2SO_4 \longrightarrow$

(D) $NaCl + K_2Cr_2O_7 + H_2SO_4 \longrightarrow$

16. Which of the following statements about state of equilibrium in a chemical system is correct-

(A) At equilibrium, the Gibb's function of system is at it's highest value

(B) At equilibrium, the entropy of system is at it's highest value

(C) At equilibrium, change in Gibb's function of system is minimum.

(D) At equilibrium, the entropy of an isolated system is at its maximum value

**17.** Which of the following statement is incorrect :

(A) The probability of finding a 4d electron right at the nucleus is zero.

(B) For all values of n, the p-orbitals have the same shape, but the overall size increases as n increases, for a given atom

(C) A $2p_x$ atomic orbital consists of two lobes of electron probability

(D) There is maximum probability of finding a s-electron at the nucleus

18.

Major product P_1 and P_2 are respectively

(A)

(B)

(C)

(D)

19. (X) $\xrightarrow[\text{(ii)}]{\text{(i) Na}}$ 4-Methyl hept-2-yne
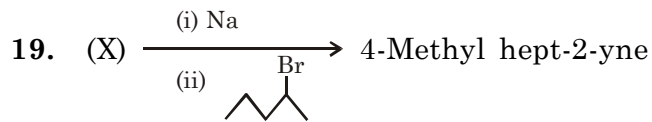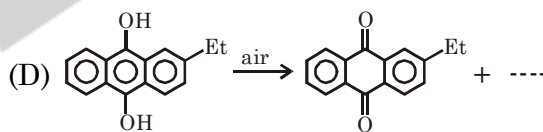

Structure of (X) is

(A) 1-Butyne

(B) 2-Butyne

(C) Propyne

(D) None of these

20. In which of the following reaction(s), the missing product is O_2 ?

(A) $PbS + H_2O_2 \longrightarrow$ Sulphur containing product + -------

(B) $Fe^{2+} + H_2O_2 \xrightarrow{H^+}$ Iron containing product + -----

(C) $HOCl + H_2O_2 \longrightarrow$ Chlorine containing product + -------

(D)

ALLEN

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   For Example : If answer is –77.25, 5.2 then fill the bubbles as follows.

- Answer to each question will be evaluated according to the following marking scheme:

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   Zero Marks : 0 In all other cases.

1. An ideal mixture of liquids A and B with 2 moles of A and 2 moles of B has a total vapour pressure of 1 atm at a certain temperature. Another mixture with 1 mole of A and 3 moles of B has a vapour pressure greater than 1 atm. But if 4 moles of C are added to the second mixture, the vapour pressure comes down to 1 atm. Vapour pressure of C in pure state is 0.8 atm. Calculate the vapour pressure of pure B (in atm):-

2. Consider the cell $\begin{array}{c} H_2(Pt) \\ 1\ atm \end{array} \left| \begin{array}{c} H_3O^+(aq) \\ pH = 5.00 \end{array} \right| \left| \begin{array}{c} Ag^+ \\ x\ M \end{array} \right|$ Ag.

   The measured EMF of the cell is 1.0 V. What is the value of x ? $E^0_{Ag^+,Ag}$ = + 0.8 V. [T = 25°C]

   $\left[\dfrac{2.303RT}{F} = 0.06, \log 0.02 = -\dfrac{5}{3} \right].$

3. How many organic compound(s) is/are correctly matched with number of chiral carbon(s) present in it's structure :

(i)

Histamine = 0

(ii)

Chloramphenicol = 2

(iii)

Penicillin = 3

(iv)

Aspartame = 4

(v)

Sucralose = 9
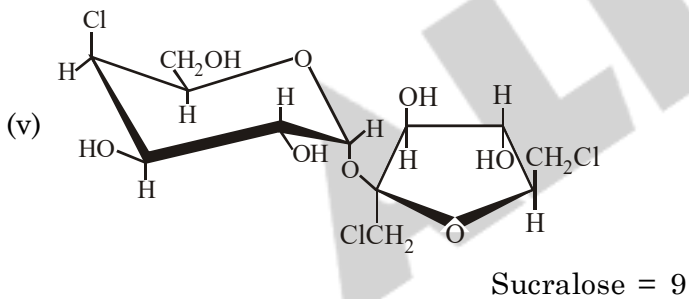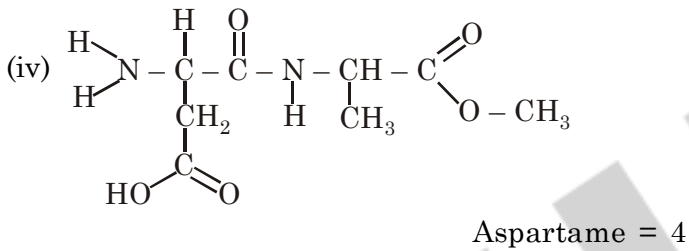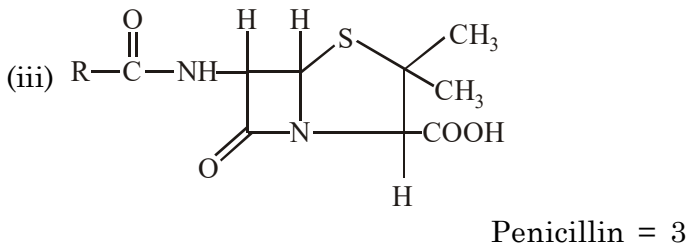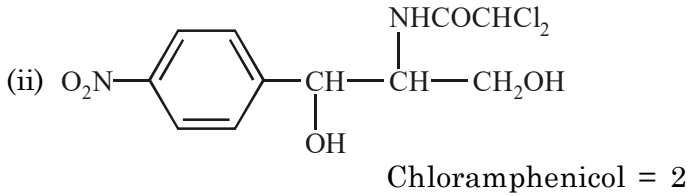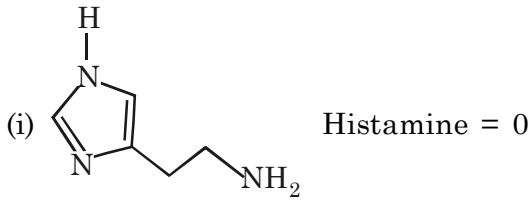
4. Find out the total number of diamagnetic species is :

K_2O_2, $[Ni(NH_3)_6]^{2+}$, $[MnBr_4]^{2-}$, NO_2, $[CuCl_4]^{3-}$, $[Co(ox)_3]^{3-}$, BaO_2, KO_2, KCN
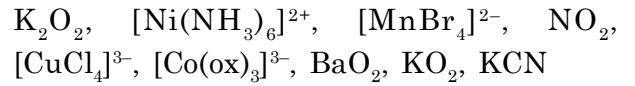
5. The total number of cationic radicals that give black precipitate with H_2S in acid solution is :
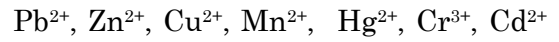
Pb^{2+}, Zn^{2+}, Cu^{2+}, Mn^{2+}, Hg^{2+}, Cr^{3+}, Cd^{2+}

SECTION–I : (Maximum Marks : 80)

● This section contains **TWENTY** questions.

● Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is correct.

● For each question, darken the bubble corresponding to the correct option in the ORS.

● For each question, marks will be awarded in <u>one of the following categories</u> :

Full Marks : +4 If only the bubble corresponding to the correct option is darkened.

Zero Marks : 0 If none of the bubbles is darkened.

Negative Marks : –1 In all other cases

1. Let $f(x) = |x|\sin x + |x^2 - \pi^2|\cos x$, then the number of points where $y = f(x)$ is **NOT** differentiable is/are

(A) 0   (B) 1

(C) 2   (D) 3

2. If all the real values of m for which the function $f(x) = \dfrac{x^3}{3} - (m-3)\dfrac{x^2}{2} + mx - 2020$ is strictly increasing for $x \in R$ is [a, b] then a + b is

(A) 9   (B) 10

(C) 11   (D) 12

3. Number of ways in which pack of 52 cards can be divided equally among four players such that each player has equal number of face cards is

(A) $\dfrac{22(40!)}{(3!)^3(10!)^3}$ (B) $\dfrac{(12!)(40!)}{(3!)^4(10!)^4 4!}$

(C) $\dfrac{(40!)(12!)}{(10!)^4 4!}$ (D) $\dfrac{(40!)}{(3!)^4(10!)^4}$

4. If z_1 and z_2 both satisfy the equation $\text{Re}(z) = |z - 2|$ and $\arg(z_1 - z_2) = \dfrac{\pi}{3}$ then $\text{Im}(z_1 + z_2)$ is

(A) $\dfrac{1}{\sqrt{3}}$ (B) $\dfrac{2}{\sqrt{3}}$

(C) $\sqrt{3}$ (D) $\dfrac{4}{\sqrt{3}}$

5. Let $A = [a_{ij}]_{2\times 2}$ be a matrix such that $\text{Tr}(A) = 5$. If $f(x) = \det(A - xI)$ and $f(A) = A^2 + aA + 3I$ then value of $\text{Tr}[(\text{adj}A)^2 + (a+1)\text{adj}A + 3I]$ is equal to [Tr(P) is trace of matrix P]

(A) 0   (B) 1   (C) 7   (D) 5

6. A circle touches y-axis at (0, 3) and makes an intercept of 2 units on the positive x-axis. intercept made by the circle on the line $\sqrt{10}x - 3y = 1$ in units is

(A) 3   (B) 6

(C) $2\sqrt{10}$ (D) $\sqrt{10}$

7. Let $\vec{p}, \vec{q}, \vec{r}$ are non-zero vectors such that $\vec{r} \times (\vec{p} \times \vec{q}) = \vec{p} \times (\vec{p} \times \vec{q})$. If $|\vec{p} \times \vec{q}| = 3$ and $[\vec{p}\ \vec{q}\ \vec{r}] = 12$ then value of $|\vec{r} - \vec{p}|$ is

(A) 2　　(B) 4　　(C) 6　　(D) 8

8. If $y = f(x)$ satisfy differential equation $\dfrac{dy}{dx} - y = e^x$ with $f(0) = 1$ then value of $f''(0)$ is

(A) 1　　(B) 2　　(C) 3　　(D) 4

9. The coefficient of x^5 in $(1 + x)^5(1 + x^3)^3(1 + x^5)$ is

(A) 32　(B) 34　(C) 40　(D) 45

10. $(p \to q) \leftrightarrow (q \vee \sim p)$ is

(A) Equivalent to $p \wedge q$

(B) Tautology

(C) Fallacly

(D) Equivalent to $p \vee q$

11. In a class 30% students failed in physics, 20% failed in mathematics and 10% students failed in physics and mathematics both. A student is selected at random, then the probability that he is fail in physics if he has failed in mathematics is

(A) $\dfrac{1}{2}$　　　　　(B) $\dfrac{1}{3}$

(C) $\dfrac{2}{3}$　　　　　(D) $\dfrac{1}{6}$

12. The value of 'a' for which the line passing through $(a, 2, 2)$ and $(6, 11, -1)$ is perpendicular to the line of intersection of planes $2x - y - 3z = 8$ and $x + 2y - 4z = 14$ is

(A) 10　(B) 9　(C) 8　(D) 5

13. Area enclosed by the curves $y = |x^2 - 4|$ and $y = \dfrac{x^2}{2} + 4$

(A) $\dfrac{64}{3}$　(B) $\dfrac{32}{3}$　(C) 32　(D) 64

14. If $x, y, z \in R^+$ such that $x + y + z = 4$ then maximum possible value of xyz^2 is

(A) 3　　(B) 4　　(C) 5　　(D) 6

15. Length of normal chord of parabola $y^2 = 4x$ which makes an angle of $\dfrac{\pi}{4}$ with the axis of x is

(A) 8　　(B) $8\sqrt{2}$　(C) 4　　(D) $4\sqrt{2}$

16. If σ_A, σ_B, σ_C are the variance of heights of students of three sections each containing 10 students as follows.

Section A	20	21	22	23	24	25	26	27	28	29
Section B	30	31	32	33	34	35	36	37	38	39
Section C	40	41	42	43	44	45	46	47	48	49

Then $\sigma_A : \sigma_B : \sigma_C$ is

(A) $1 : 2 : 3$

(B) $2 : 3 : 4$

(C) $1 : 1 : 1$

(D) $1 : 2 : 4$

17. The value of $f(x) = \int \dfrac{(2x + 5)\,dx}{(x+1)(x+2)(x+3)(x+4)+1}$ is (where C is constant of integration)

(A) $\dfrac{-1}{x^2 + 5x + 5} + C$　(B) $\dfrac{-1}{x^2 + 4x + 1} + C$

(C) $\dfrac{1}{x^2 + 5x + 1} + C$　(D) $\dfrac{-1}{x^2 + 5x + 1} + C$

18. If α, β and γ are roots of equation $5x^3 - 2x - 1 = 0$ the value of

$$\frac{\alpha^2 - 3}{\beta\gamma} + \frac{\beta^2 - 3}{\alpha\gamma} + \frac{\gamma^2 - 3}{\alpha\beta} \text{ is}$$

(A) 3   (B) 6

(C) 9   (D) 12

19. A ladder rests against a wall at an acute angle α to the horizontal. Its foot is pulled away from the wall through a distance 2m, so that it slides a distance 3m down the wall making an acute angle β with the horizontal, then the value of $\tan\left(\dfrac{\alpha + \beta}{2}\right)$ is
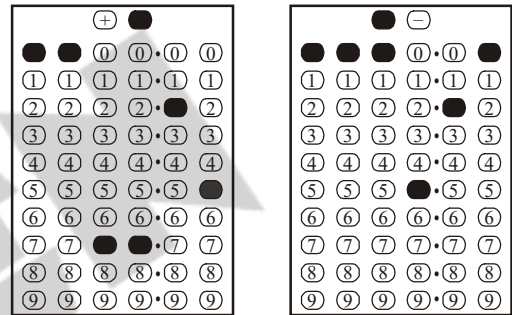
(A) $\dfrac{3}{2}$ (B) $\dfrac{2}{3}$

(C) $\dfrac{4}{9}$ (D) $\dfrac{9}{4}$

20. The ellipse $x^2 + 4y^2 = 4$ is inscribed in a rectangle aligned with the co-ordinate axes, which is in turn is inscribed in another ellipse that passes through the point (4, 0). Then the eccentricity of the ellipse is

(A) $\dfrac{\sqrt{11}}{4}$ (B) $\dfrac{\sqrt{11}}{2\sqrt{3}}$

(C) $\dfrac{\sqrt{3}}{2}$ (D) $\dfrac{\sqrt{3}}{4}$

SECTION-II : (Maximum Marks: 20)

● This section contains **FIVE** questions.

● The answer to each question is a **NUMERICAL VALUE**.

● For each question, enter the correct numerical value (If the numerical value has more than two decimal places, **truncate/ round-off** the value to **TWO** decimal places; e.g. 6.25, 7.00, –0.33, –.30, 30.27, –127.30, if answer is 11.36777..... then both 11.36 and 11.37 will be correct) by darken the corresponding bubbles in the ORS.

For Example : If answer is –77.25, 5.2 then fill the bubbles as follows.

● Answer to each question will be evaluated according to the following marking scheme:

Full Marks : +4 If ONLY the correct numerical value is entered as answer.

Zero Marks : 0 In all other cases.

1. If L_1 and L_2 are two lines belonging to family of straight lines

$2x - y - 9 + \lambda(3x + y - 21) = 0$ and

$2x + y - 5 + \mu(4x - y - 1) = 0$

respectively. The maximum distance between L_1 and L_2 if L_1 and L_2 are parallel is d, then value of $\dfrac{d}{4}$ is

2. $\displaystyle\int_{\frac{-3\pi}{2}}^{\frac{-\pi}{2}} \left[(x+\pi)^3 + \cos^2(x+3\pi)\right]dx$ is

3. If f is a differentiable function for all real x and $f'(x) \leq 5 \ \forall \ x \in R$. If $f(2) = 0$ and $f(5) = 15$ value of $\dfrac{f(3)}{2}$ is

4. If the system of equations

$3x + 4y + 5z = a$

$4x + 5y + 6z = b$

$5x + 6y + 7z = c$

are consistent then value of $\dfrac{a+c}{8b}$.

(where $a, b, c \in R$)

5. If $p = \cos 55°$, $q = \cos 65°$, $r = \cos 175°$ then the value of $\dfrac{1}{p} + \dfrac{1}{q} + \dfrac{r}{pq}$ is