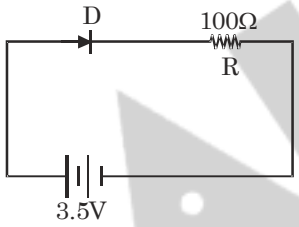
SECTION–I : (Maximum Marks : 80)

- 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 one of the following categories :
  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. In the given figure, a diode D is connected to an external resistance R =100 Ω and an e.m.f of 3.5 V. If the barrier potential developed across the diode is 0.5 V, the current in the circuit will be :



(A) 35 mA (B) 30 mA
(C) 40 mA (D) 20 mA

2. A reflecting telescope is to be made by using spherical mirror of radius of curvature 1.2 m and an eye piece with a focal length of 1.25 cm. For maximum strain position of eye what will be the angular magnification? (For normal eye least distance of vision is 25 cm) :

(A) 22.7

(B) 50.4

(C) 48.5

(D) 118.2

3. The electric potential in a certain region of space depends only on x coordinate as $V = -\alpha x^3 + \beta$, here α and β are constants. The volume charge distribution of space charge is given as :

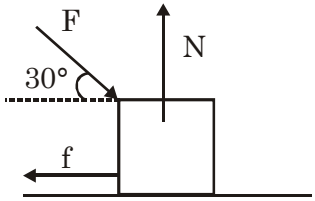
(A) $\rho(x) = 3\alpha\varepsilon_0 x^2$

(B) $\rho(x) = -3\alpha\varepsilon_0 x^2$

(C) $\rho(x) = 6\alpha\varepsilon_0 x^2$

(D) $\rho(x) = 6\alpha\varepsilon_0 x$

4. A body of mass 10 kg placed on rough surface is pushed by force F making an angle of 30° to the horizontal. If the angle of friction is also 30° then the magnitude of force F required to move the body is equal to ($g = 10\ m/s^2$)



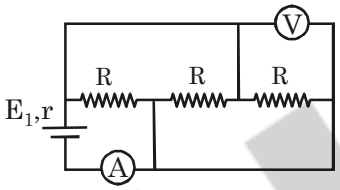
(A) 100 N

(B) $50\sqrt{2}$ N

(C) $100\sqrt{2}$ N

(D) 50 N

5. In the circuit shown in figure, ammeter and voltmeter are ideal. If E = 4V, R = 9Ω and r = 1Ω, then readings of ammeter and voltmeter are



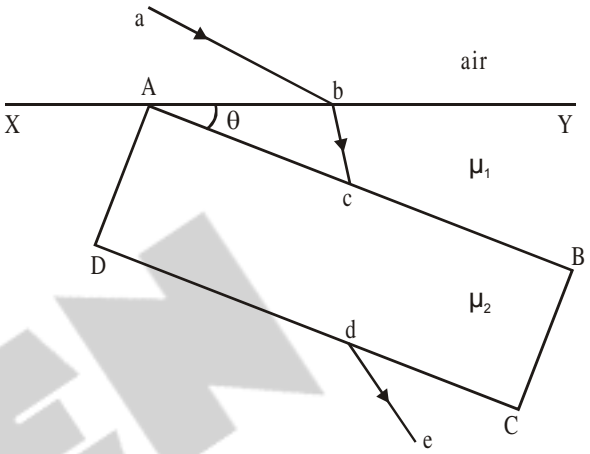
(A) 1A, 3V

(B) 2A, 3V

(C) 3A, 4V

(D) 4A, 4V

6. A ray of light ab passing through air, enters a liquid of refractive index μ_1, at the boundary XY. In the liquid, the ray is shown as bc. The angle between ab and bc is δ (angle of deviation). The ray then passes through a rectangular slab ABCD of refractive index μ_2 ($\mu_2 > \mu_1$), and emerges from the slab as ray de. The angle between XY and AB is θ. The angle between ab and de is :-



(A) δ

(B) δ + θ

(C) $\delta + \sin^{-1}\left(\frac{\mu_1}{\mu_2}\right)$

(D) $\delta + \theta - \sin^{-1}\left(\frac{\mu_1}{\mu_2}\right)$

7. A magnetic flux through stationary loop with resistance R varies during the time interval t = 0 to t = ν as $\phi = at(\nu - t)$. The amount of heat generated in the loop during this time is :-

(A) $\frac{a\nu^2}{2R}$

(B) $\frac{a^2\nu^3}{3R}$

(C) $\frac{2a^2\nu^3}{3R}$

(D) $\frac{a\nu}{3R}$

8. In gravity free space **Iron Man** of mass 'M' standing at height 'h' above the floor throws a **Precious Stone** of mass 'm' straight down with speed u. When stone reaches the floor, what is the distance of **Iron Man** above the floor?

(A) $h\left(1+\frac{m}{M}\right)$

(B) $h\left(1-\frac{m}{M}\right)$

(C) $h\left(\frac{m}{M}\right)$

(D) h

9. A charged particle of specific charge α is released from origin at time t = 0 with velocity $\vec{V} = V_o\hat{i}+V_o\hat{j}$ in magnetic field $\vec{B} = B_o\hat{i}$. The coordinates of the particle at time $t = \frac{\pi}{B_o\alpha}$ are (specific charge α = q/m)

(A) $\left(\frac{V_o}{2B_o\alpha}, \frac{\sqrt{2}V_o}{\alpha B_o}, \frac{-V_o}{B_o\alpha}\right)$

(B) $\left(\frac{-V_o}{2B_o\alpha}, 0, 0\right)$

(C) $\left(0, \frac{2V_o}{B_o\alpha}, \frac{V_o\pi}{2B_o\alpha}\right)$

(D) $\left(\frac{V_o\pi}{B_o\alpha}, 0, -\frac{2V_o}{B_o\alpha},\right)$

10. A black body, initially at temperature T, cools to temperature (T/2) in time Δt in surrounding which is near absolute zero. It will cool further to a temperature (T/4) in additional time

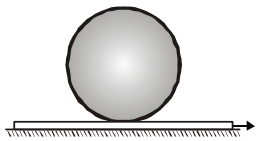
(A) 8Δt

(B) 7Δt

(C) 9Δt

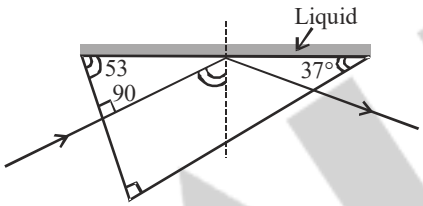
(D) None

11. A ball rests upon a flat piece of paper on a table top. The paper is pulled quickly and horizontally to the right as shown. Just after the paper is pulled, the ball



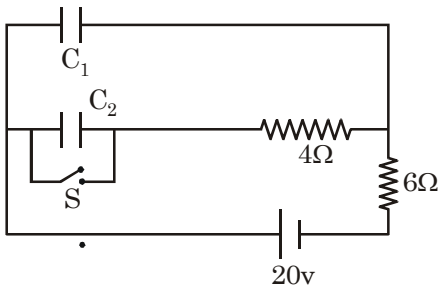
(A) moves to the left & rotates anticlockwise
(B) moves to the right & rotates anticlockwise
(C) moves to the left & rotates clockwise
(D) moves to the right & rotates clockwise

12. Light incident normally on the short face of a right angle prism as shown. A layer of liquid is placed on the hypotenuse of prism. Refractive index of prism is $\mu = 1.5$. Find possible value of refractive index that liquid may have if the light is totally reflected.



(A) 1.4 (B) 1.3
(C) 1.1 (D) All of these

13. Ratio of charges at capacitor C_1 after long time when switch S is open and closed respectively, in the given circuit, is



(A) 1 : 1
(B) 1 : 8
(C) 5 : 2
(D) data insufficient

14. Consider an excited hydrogen atom in n^{th} state moving with velocity v ($v << c$). It emits a photon in the direction of its motion and change its state to lower energy state 'm'. Now if the frequency of photon emitted is f in this case, while if atom is stationary and for same transition of electron from excited state 'n' to 'm', the frequency emitted is f_0 then which relation is correct after doing reasonable approximations?

(A) $f_0 = f\left(1 - \frac{v}{c}\right)$ (B) $f = f_0\left(1 - \frac{v}{c}\right)$

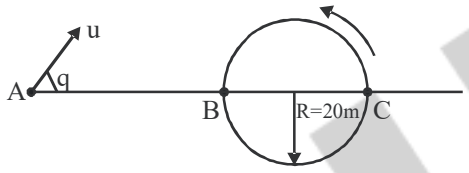
(C) $f = f_0\left(1 + \frac{v^2}{c^2}\right)$ (D) $f = f_0\left(1 - \frac{v^2}{c^2}\right)$

SPACE FOR ROUGH WORK

15. Through an ideal inductor coil of L = 0.2 H, an A.C current of amplitude 2A is passed, first with frequency 'f_1' then with frequency 'f_2'. Then ratio of maximum value of induced emf in two cases e_1 and e_2 respectively. Find $\left(\frac{e_1}{e_2}\right)$ in the coil, in the two cases is :

(A) $\frac{f_1}{f_2}$ (B) $\frac{f_2}{f_1}$ (C) $\left(\frac{f_1}{f_2}\right)^2$ (D) 1 : 1

16. A particle is moving along vertical circle of radius R = 20 m with constant speed v = 31.4 m/s as shown. Straight line ABC is horizontal and passes through the centre of circle. A shell is fired from point A at the instant when particle is at 'C'. If distance between AB is $20\sqrt{3}$ and shell collides with the particle 'B' then what is the smallest possible value of projection angle 'θ' ?



(A) $\frac{\pi}{4}$rad (B) $\frac{\pi}{6}$rad

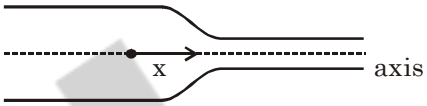
(C) $\frac{\pi}{8}$rad (D) $\frac{\pi}{3}$rad

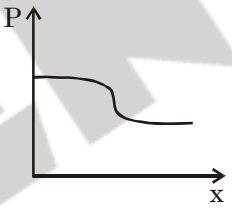
17. A satellite is in a circular orbit very close to the surface of a planet. At some point it is given an impulse along its direction of motion, causing its velocity to increase η times. It now goes into an elliptical orbit. The maximum possible value of η for this to occur should be slightly less than :

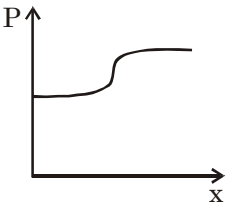
(A) 2 (B) $\sqrt{2}$

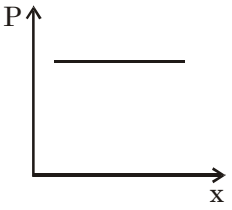
(C) $\sqrt{2}+1$ (D) $\frac{1}{\sqrt{2}-1}$

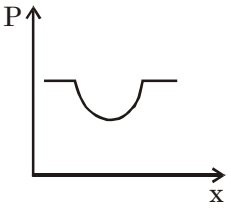
18. An ideal liquid in streamline motion flows through a frictionless duct with varying cross section as shown in figure. Pressure P at points along x-axis of duct is most likely to be represented by.



(A)


(B)


(C)


(D)


19. A siren (point source) creates a sound level of 60 dB at location 500m from the speaker. The siren is powered by a battery that deliver a total energy of 1 kJ. Assuming that efficiency of siren is 30% then the total time for which siren will produce sound is

(A) 180 s

(B) 95.5 s

(C) 1405 s

(D) 60 s

20. The equation of state of a gas is given by PV = nRT + Pb, here b = constant, n = number of moles. If 2 moles of a gas is isothermally expanded from volume V to 2V then work done during the process is

(A) $2RT\ln\left(\frac{2V-b}{V-b}\right)$

(B) $2RT\ln\left(\frac{2V}{V}\right)$

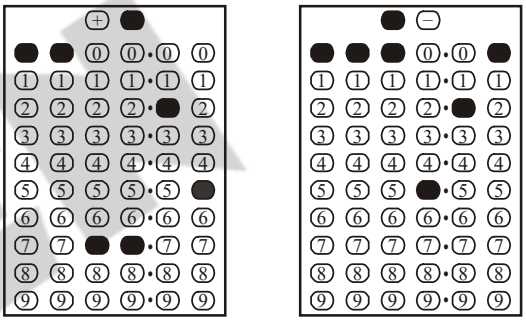
(C) $RT\ln\left(\frac{2V}{2V-b}\right)$

(D) $RT\ln\left(\frac{2V-b}{V-b}\right)$

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.



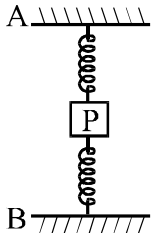
- Answer to each question will be evaluated according to the following marking scheme:

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

Zero Marks : 0 In all other cases.

SPACE FOR ROUGH WORK

1. Two identical springs are attached to a small block P. The outer ends of the springs are fixed at A and B such that AB is vertical. When P is in equilibrium the extension of top spring is 20 cm and extension of bottom spring is 10 cm. If the period of small vertical oscillations of P about its equilibrium position is $\frac{\pi}{N\sqrt{2}}$ sec, then fill the value of N.



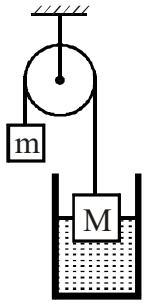
2. Two long straight wires A and B are placed 50 cm apart and carry current 20 A and 15A respectively in same direction. A point P is 40 cm from wire A and 30 cm from wire B. What is the magnitude of resultant magnetic field at 'P' in (μT) unit ? $(\sqrt{2}=1.414)$

3. If 27.3 gm ice is at –136.5°C then find change in its entropy in Cal/K if all ice melt and final temperature becomes 0°C.

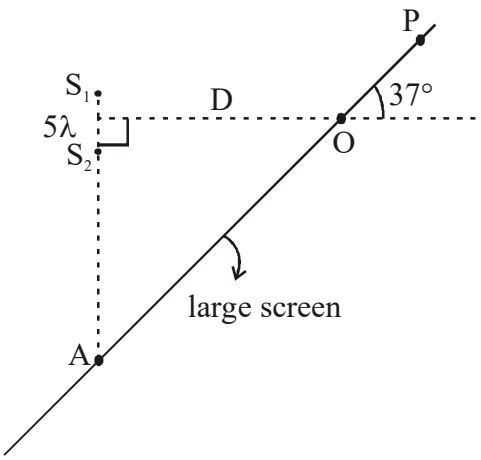
Given that $s_{ice} = 0.5\frac{cal}{gm.K}$, $s_{water} = 1.0\frac{cal}{gm.K}$,

$L_f = 80\frac{cal}{gm.K}$, ln 2 = 0.6

4. To one end of thread thrown over the pulley we suspended load of mass M = 10kg, made from a material specific gravity 2.5. The mass M is suspended in a container with water. By the other end of the thread we suspended a mass m (see figure). For what minimum value of m (in kg) mass M can float in liquid in equilibrium? Friction negligible everywhere.



5. In the figure S_1 and S_2 are two identical coherent sources of light. D >> λ (wavelength) and screen is very large. If a detector starts from A and moves along the screen along line AP upto an infinite distance then find total number of minima detected by the detector.



ALLEN

SECTION–I : (Maximum Marks : 80)

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- For each question, marks will be awarded in one of the following categories :

  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. A 30 litre sample of moist air at 50°C and 1 atm has 75% relative humidity. Then what will be the final volume if it is compressed isothermally untill 100% relative humidity.(given: Vapour pressure of water at 50°C is 0.2 atm)

(A) 25 litre

(B) 27 litre

(C) 22.5 litre

(D) 30 litre

2. Arrange the following compounds in the order of decreasing acidic strength.

(i) $CH_3CHClCOOH$

(ii) CH_3CH_2OH

(iii) CH_3CH_2COOH

(iv) HCOOH

(A) i > iv > iii > ii

(B) ii > iii > i > iv

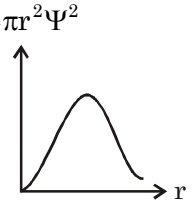
(C) iii > i > ii > iv

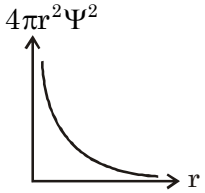
(D) i > iii > iv > ii

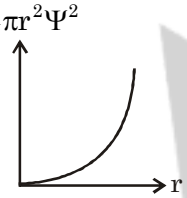
3. Which of the following is incorrectly matched ?

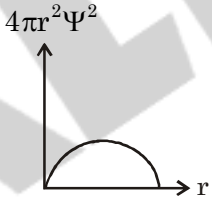
Order	**Corresponding property**
(A) $N^{3-} < Cl^- < S^{2-}$	Ionic radii
(B) $Fe^{2+} < Co^{2+} < Ni^{2+}$	Ionisation energy
(C) Al < Ga < Zn	Ionisation energy
(D) Sc > Y > La	Atomic radii

4. The normalised wave function of 1s orbital is $\Psi = \sqrt{N} \cdot e^{-\left(\frac{Zr}{a_0}\right)}$ and radial distribution function is $4\pi r^2\Psi^2$, where N is normalisation constant $\left(N = \frac{Z^3}{\pi a_0^3}\right)$. Which of the following graph is correct for the radial distribution $(4\pi r^2\Psi^2)$ of 1s electron with respect to 'r' for H-like specie of atomic number Z ? (Where r is radial distance from nucleus)

(A) 

(B) 

(C) 

(D) 

5. Which of the following statement is incorrect for 3,4-dimethylcyclopentan-1-one

(A) It posses 2 chiral carbons

(B) It shows geometrical isomerism

(C) It posses 3 optical isomers

(D) I.U.P.A.C. name of its optically active stereoisomer is (3R,4S)-3,4-dimethylcyclopentan-1-one

6. Following reactions occur in solvay process

(a) $2NH_3 + H_2O + CO_2 \longrightarrow (A)$

(b) $(NH_4)_2CO_3 + H_2O + CO_2 \longrightarrow (B)$

(c) $NH_4HCO_3 + NaCl \longrightarrow (C) + (D)$

(d) $D \xrightarrow{\Delta}$ 3 number of products :

Which of the following statements is incorrect regarding compound A, B, C, D?

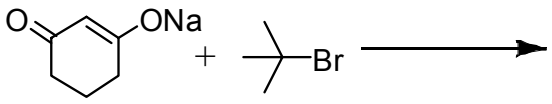
(A) Phenolphthalein indicator does not give pink colour in aqueous solution of D

(B) compound A is more basic than C

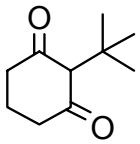
(C) Massive hydrogen bonding is present in D(s)

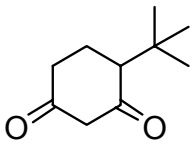
(D) Only co-ordinate and covalent bonds are present in 'C'.

7. A particular water sample is saturated in CaF_2 and has Ca^{+2} content of 120 ppm. Then the F^- content of water in ppm would be:
[Given $K_{sp}(CaF_2) = 6.0 \times 10^{-9}M^3$]
(A) 26.8 pm
(B) 268 ppm
(C) 2.68 ppm
(D) 0.268 ppm

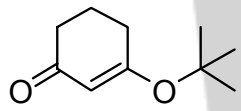
8. 

Major product obtained will be ?

(A) 

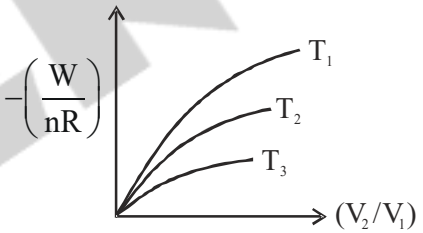
(B) 

(C)

(D) 

9. Which of the following staements is/are correct ?
(i) Orange solution of sodium dichromate, can be crystallised as $Na_2Cr_2O_7.2H_2O$.
(ii) Cu^+ ion disproportionate in aqueous solution into Cu and Cu^{3+}
(iii) Cr^{+2} can liberate hydrogen gas from a dilute acid
(iv) Cr_2O_3 and MnO_2 are amphoteric oxides
(v) Sc and Zn are transition metals
(A) i, ii, iv, v (B) i, iii, v
(C) i, iii, iv (D) ii, iii, iv

10. Following plots are obtained between workdone(W) and ratio of volume V_2(final) and V_1((initial) for ideal gas in isothermal process.



The correct order of temperature is
(A) $T_1 = T_2 = T_3$
(B) $T_1 < T_2 < T_3$
(C) $T_3 < T_2 < T_1$
(D) Can not be predicted

SPACE FOR ROUGH WORK

11. Identify the product (P) of given reaction.

$$C_6H_5CHO + CH_3CH_2CHO \xrightarrow[\Delta]{\text{dil NaOH}} P$$

(A) $C_6H_5CH{=}CHCH_2CHO$

(B) $C_6H_5CH_2OH$

(C) C_6H_5COONa

(D) $C_6H_5CH = \underset{\displaystyle CH_3}{\overset{\displaystyle |}{C}}CHO$

12. Which of the following ion has greater bond order than its parent molecule ?

(A) C_2^+ (B) O_2^+ (C) N_2^+ (D) B_2^+

13. M^+ form M_3C_{60} where C_{60}^{-3} fulleride (a superconductor) form octahedral holes. If radius of C_{60}^{-3} is 500 pm then the minimum possible radius for M^+ is

(A) 307 pm (B) 367 pm

(C) 207 pm (D) 500 pm

14. Which of the following statement is **INCORRECT** ?

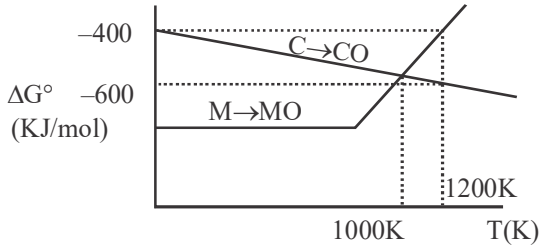
(A) Aniline and N,N-dimethylaniline can be differentiated by hinsberg reagent .

(B) Sucrose and glucose can be differentiated by Tollen's reagent.

(C) Diethylamine and aniline can be differentiated by carbylamine test.

(D) Phenetole and anisole can be differentiated by neutral ferric chloride test

15. Correct representation at 1200 K according to the given plot is :



(A) $M_{(s)} + CO_{(g)} \rightarrow MO_{(s)} + C_{(s)}$;
$\Delta G^\circ = -200 kJ/mol$

(B) $M_{(l)} + CO_{(g)} \rightarrow MO_{(s)} + C_{(S)}$;
$\Delta G^\circ = -200 kJ/mol$

(C) $MO_{(s)} + C_{(s)} \rightarrow M_{(l)} + CO_{(g)}$;
$\Delta G^\circ = -200 kJ/mol$

(D) $MO_{(s)} + C_{(s)} \rightarrow M_{(s)} + CO_{(g)}$;

$\Delta G^\circ = -200 kJ/mol$

16. Which one of the following statement is **INCORRECT** ?

(A) The net increase in entropy of a system is zero in any reversible Cyclic process.

(B) At constant temperature & pressure available energy present in system is called free energy.

(C) The change in Gibb's free energy with pressure for one mole ideal gas at constant temperature is $\Delta G = RT\ell n\frac{P_2}{P_1}$

(D) For a spontaneous change $(\Delta G)_{T,P} > 0$

17. Which of the following is Antacid drug ?

(A) Ranitidine

(B) Penicillin

(C) Tetracycline

(D) NaOH

18. Which of the following statement(s) is/are correct regarding complex ion $[Co(en)_2(NH_3)_2]^{3+}$

(I) Central metal is sp^3d^2 hybridised

(II) Complex ion shows geometrical as well as optical isomerism.

(III) It has two N–Co–N bond angles.

(A) I & II

(B) II & III

(C) Only II

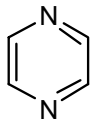
(D) Only III

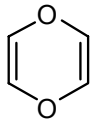
19. For a first order reaction. Rate constant is represented by $\log k(s^{-1}) = 15 - \frac{9.19\times10^3(K)}{T}$, then the temperature at which its half life is 28 min ($\ln 2 = 0.7$, $\log 3 = 0.48$, $\log 2 = 0.30$)

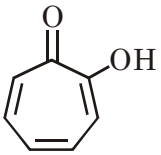
(A) 500K (B) 919 K

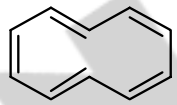
(C) 1000K (D) 638 K

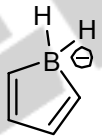
20. How many of the following are aromatic ?

(a) 

(b) 

(c) 

(d) 

(e) 

(f)

(A) 1 (B) 2

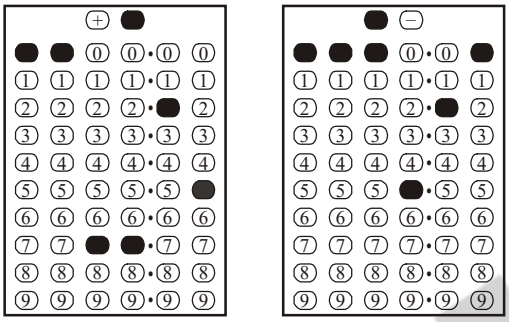
(C) 3 (D) 4

SPACE FOR ROUGH WORK

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. Number of geometrical isomers of a complex ion $[Pt(NH_3)_2(py)_2F_2]^{2+}$ are x, if 1 mole of ethylenediamine replaces two weakest ligands, then the new complex formed has 'y' number of geometrical isomers. Find the value of $\frac{x}{y}$.

2. The Ksp of AgCl is 10^{-10} M^2 .Find E (volt) for $Ag_{(aq)}^{+}/Ag_{(s)}$ if Ag electrode is immersed in 1M KCl at 25°C. [Given:$E°Ag_{(aq)}^{+}/Ag_{(s)}$ = 0.80 V, $\frac{2.303RT}{F} = 0.059$]

3. How many of the following reactions can produce ethane ?

(i) $\begin{matrix} CH_2- COOH \\ | \\ CH_2- COOH \end{matrix} \xrightarrow{\Delta}$

(ii) $CH_3COONa \xrightarrow[\Delta]{NaOH \& CaO}$

(iii) $(CH_3COO)_2Ca \xrightarrow{\Delta}$

(iv) $CH_3CH_2COONa \xrightarrow[\Delta]{NaOH \& CaO}$

(v) $CH_3CH\begin{matrix} COOH \\ \diagdown \\ \diagup \\ COOH \end{matrix} \xrightarrow{\Delta}$

4. Total number of lanthanoids (4f-elements) having 5d electrons in their electronic configuration are:

5. A solution of isopropyl alcohol and propyl alcohol has a vapour pressure 200 mm of Hg if it has 25% mole of isopropyl alcohol. Another solution of same components containing 25% mole propyl alcohol has vapour pressure 300 mm of Hg.Then vapor pressure of isopropyl alcohol in mm of Hg is :

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 one of the following categories :

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. The number of complex number(s) satisfying the curves $|z-5| \le 5$ and $\arg(z-5i)=\frac{3\pi}{4}$ is

(A) 0

(B) 1

(C) 2

(D) More than 2

2. Area of quadrilateral formed by angle bisectors of lines $3x - 4y + 1 = 0$, $3x + 4y - 7 = 0$ and co-ordiante axes is (in sq. units)

(A) 1 (B) 2

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

3. Sum of series $({}^{25}C_{13} + {}^{25}C_{14} + ... + {}^{25}C_{25})$ is equal to

(A) 2^{25} (B) 2^{24}

(C) $2^{24}.{}^{24}C_{11}$ (D) ${}^{25}C_{12}$

4. If $f(x)=\begin{cases}(x+1)2^{-\left(\frac{1}{|x|}+\frac{1}{x}\right)} & , x \neq 0 \\ 0 & , x=0\end{cases}$, then

(A) f(x) is continuous at x = 0

(B) f(x) is differentiable at x = 0

(C) $\lim\limits_{x\to 0^+} f(x)$ does not exist

(D) $\lim\limits_{x\to 0^+} f(x) \neq \lim\limits_{x\to 0^-} f(x)$

5. We roll three identical dice and we find that the sum of upper face number on the three dice is 10, then the probability that one die shows '6', is

(A) $\frac{2}{7}$ (B) $\frac{33}{216}$

(C) $\frac{1}{3}$ (D) None of these

6. The range of 'α' for which all the points of local extrema of the function $f(x) = x^3 - 3\alpha x^2 + 3(\alpha^2 - 1)x + 1$ lie in the interval (–2, 4), is

(A) (–1, 3) (B) (3, 4)

(C) (–4, –2) (D) (–2, –1)

7. If the truth value of the statement $(P \to Q) \leftrightarrow R$ is 'F'then truth values of P, Q, R can be respectively

(A) TFF (B) TFT (C) FFT (D) FTT

8. If A and B are non zero matrices of order 3 such that $3A + 2B = A^T$, then det(A + B) is

(A) 1 (B) –1 (C) 2 (D) 0

9. In ΔABC, if AB = x, BC = x + 1 and $\angle C = \frac{\pi}{3}$, then least integral value of x is

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

10. An isosceles triangle is inscribed in the parabola $y^2 = 4ax$ with its base as the line segment joining the vertex and positive end of the latus rectum of the parabola. If $(at^2, 2at)$ is the vertex of this triangle, then

(A) $2t^2 - 8t + 5 = 0$ (B) $2t^2 + 8t - 5 = 0$

(C) $2t^2 + 8t + 5 = 0$ (D) $2t^2 - 8t - 5 = 0$

11. Let $x_1, x_2, ...x_n$ are 'n' observations such that $\sum_{i=1}^{n} x_i = 10$ and $\sum_{i=1}^{n} x_i^2 = 260$ and standard deviation is 5, then n is equal to

(A) 13 (B) 12 (C) 10 (D) 8

12. If $\int \sec^2 x \, \text{cosec}^4 x \, dx = f(x)$ and $f\left(\frac{\pi}{6}\right) = -\frac{8}{\sqrt{3}}$, then $f\left(\frac{\pi}{4}\right)$ is

(A) 1 (B) $-\frac{1}{3}$ (C) $-\frac{4}{3}$ (D) 0

13. The value of $\sum_{r=0}^{\infty} \tan^{-1}\left(\frac{2r+1}{1+\left(r(r+1)\right)^2}\right)$ is

(A) $\frac{\pi}{3}$ (B) $\frac{\pi}{2}$ (C) $\frac{\pi}{4}$ (D) $\frac{\pi}{6}$

14. If $\vec{a}$ and $\vec{b}$ are any two unit vectors and range of $\frac{3|\vec{a}+\vec{b}|}{2} + 2|\vec{a}-\vec{b}|$ is $[k_1, k_2]$, then $k_1 + k_2$ is

(A) 5 (B) 3 (C) 8 (D) 9

15. There are three distinct boxes and six different balls. Any box can receive any number of balls. The number of ways in which these balls can be put into boxes so that no box remains empty, is

(A) 729 (B) 537 (C) 480 (D) 540

16. Number of solutions of equation $\sec x + \tan x = \frac{1}{3}$ in $[0, 4\pi]$, is

(A) 0 (B) 3 (C) 2 (D) 4

17. General solution of differential equation $e^x \frac{dy}{dx} + e^x y = 1$, is

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

(C) $y = e^{-x} + ce^x$ (D) $y = xe^{-x} + ce^{-x}$

(where c is constant of integration)

18. For the circle $x^2 + y^2 = r^2$, the value of 'r' for which area enclosed by the pair of tangents drawn from the point (6, 8) to the circle and the chord of contact, is maximum, is

(A) $\sqrt{5}$ (B) 10

(C) 5 (D) None of these

19. Roots of quadratic equation $\pi(x - 2)(x - 3) + e(x - 3)(x - 4) = 1$, are

(A) Imaginary (B) Real and equal

(C) Real and distinct (D) Real and negative

20. The value of $\int_0^{2\pi} [\sin x]dx$, is

(where [.] is greatest integer function)

(A) π (B) $-\pi$ (C) 0 (D) $-\frac{\pi}{2}$

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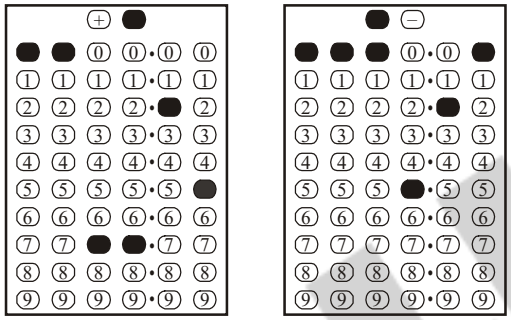

- Answer to each question will be evaluated according to the following marking scheme:

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

  Zero Marks : 0 In all other cases.

1. The integer 'n' for which the value of

$$\lim_{x\to 0}\frac{(1-\cos x)(e^x-\cos x)-\frac{x^3}{2}}{x^n}$$ is a finite non zero number, is

2. If $f(x)=\sin^{-1}x$ and $g(x)=[\cos(\sin x)]$, where [.] denotes greatest integer function. Then number of element(s) in the range of f(g(x)) is

3. If normal at point (4, 1) of the curve xy = 4 intersects the curve again at the point (α,β), then $\alpha+\beta$ is equal to

4. The value of

$$\frac{(1+\sqrt{3}\tan1^\circ)(1+\sqrt{3}\tan2^\circ)(\tan1^\circ+\tan59^\circ)(\tan2^\circ+\tan58^\circ)}{(1+\tan^2 1^\circ)(1+\tan^2 2^\circ)}$$

is-

5. If $\sum_{r=1}^{19}\frac{3(r+1)r+1}{(r+1)(r^5+2r^4+r^3)}=K$ then 1000 K is

SPACE FOR ROUGH WORK