Techior Solutions Pvt. Ltd.

JEE Mains Mock Test

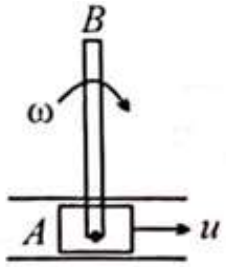
Total Time: 3 Hr | Total Marks: 300.0

Physics

Section A

MCQ Single Correct. Attempt all 20 Questions.

1) A mechanism consists of a part which is translated with a velocity u and a rod AB of length L and mass M hinged at A. The rod rotates about axis A with angular velocity ω. The kinetic energy of rod when it is vertical as shown is. **4**



A) $\frac{1}{2}Mu^2+\frac{1}{6}ML^2\omega^2$

B) $\frac{1}{2}Mu^2+\frac{1}{6}ML\omega u$

C) $\frac{1}{2}Mu^2+\frac{1}{6}ML^2\omega^2+\frac{1}{2}ML\omega u$

D) $\frac{1}{6}ML^2\omega^2+\frac{1}{2}Mu^2+\frac{-}{3}ML\omega u$

2) A uniform rod is placed inside a smooth hemispherical fixed bowl as shown and released. Then which of the option is correct? **4**

A) The line of action of normal reaction at B, does not pass through centre (C).

B) The rod can never stay in equilibrium

C) In the free body diagram of the rod, none of the forces on the rod is parallel or perpendicular to the rod

D) None of these

3) The person in the drawing is standing on light crutches. Assume that the force exerted on each crutch by the ground is directed along the crutch. If the coefficient of static friction between a crutch and the ground is 0.90 , determine the largest angle θ_{max} that the crutch can have just before it begins to slip on the floor. **4**

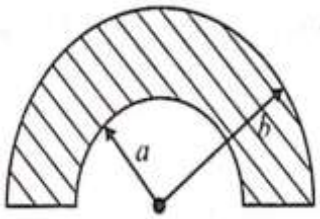
A) $\tan^{-1}(0.9)$

B) $\cot^{-1}(0.9)$

C) $\sin^{-1}(0.9)$

D) $\cos^{-1}(0.9)$

4) A non conducting semi-circular disc (as shown in figure) has a uniform surface charge density σ. The electric field intensity at the centre of the disc **4**



A) $\frac{\sigma(b-a)}{4\pi\varepsilon_0}$

B) $\frac{\sigma(b-a)}{2\pi\varepsilon_0}$

C) $\frac{\sigma \ln(b-a)}{2\pi\varepsilon_0(b-a)}$

D) $\frac{\sigma}{2\pi\varepsilon_0}\ln\left(\frac{b}{a}\right)$

5) A musician using an open flute of length 50 cm produces second harmonic sound waves. A person runs towards the musician from another end of a hall at a speed of 10 km/h. If the wave speed is 330 m/s, the frequency heard by the running person shall be close to **4**

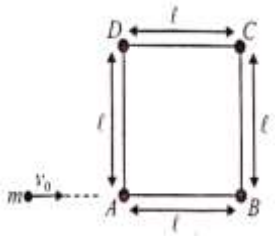
A) 666 Hz

B) 753 Hz

C) 500 Hz

D) 333 Hz

6) Four particles (A, B, C and D) each of mass m are connected by four massless rods each of length 1 . All four particles lie on a smooth horizontal plane. A particle of mass m moving along the rod AB with a velocity v_o strikes the particle $A$and stops (as shown in figure) Find the angular velocity of each particle after collision **4**



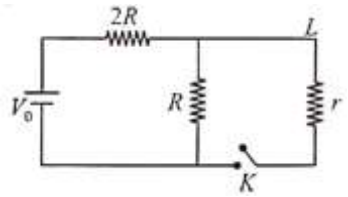
A) $\frac{v_0}{\sqrt{3}}$

B) $\frac{v_0}{4}$

C) $\frac{v_0}{}$

D) $\frac{v_0}{2}$

7) In the given figure, the battery is ideal. If the key is closed, the current through the ' 2R ' resistor increases by ' 1 A '. Then, the value of current through the ' r ' resistor is: **4**



A) 2 A

B) 3 A

C) 1/2 A

D) 1/3 A

8) A thin uniform cylindrical shell, closed at both ends, is partially filled with water. It is floating vertically in water in half-submerged state. If ρ_c is the relative density of the material of the shell with respect to water, then the correct statement is that the shell is **4**

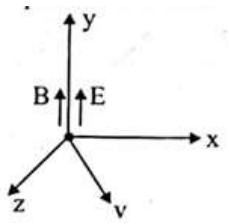
A) More than half-filled, if ρ_c is less than 0.5

B) More than half-filled, if ρ_c is more than 1.0

C) Half-filled, if ρ_c is more than 0.5

D) Less than half-filled, if ρ_c is less than 0.5

9) A positive charge particle having charge q and mass m has velocity $v = v\left(\frac{\hat{i}+\hat{k}}{\sqrt{2}}\right)$ in the magnetic field at the origin. It speed as the function of y is **4**



A) $\sqrt{v^2+\frac{qE}{2m}y}$

B) $\sqrt{\left(\frac{B}{E}\right)^2+v^2+\frac{qE}{2m}y}$

C) $\sqrt{v^2+\frac{2qE}{m}y}$

D) None of the above

10) There exist a uniform magnetic field of 1 T and a uniform electric field of $1\ \mathrm{V/m}$ both along $(-\hat{\imath}+\hat{\jmath})$. A charged particle of mass 1 Kg and of charge 1 C is having a velocity of $\frac{1}{\sqrt{2}}(\hat{\imath}+\hat{\jmath})\mathrm{m/s}$ and is at origin at $t=0$. Then, the coordinates of the particle at time ' π ' seconds will be (take $\pi^2=10$) **4**

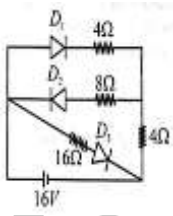
A) $(0,5,2)\mathrm{m}$

B) $\left(0,\frac{5}{\sqrt{2}},-2\right)\mathrm{m}$

C) $\left(\frac{-5}{\sqrt{2}},\frac{5}{\sqrt{2}},2\right)\mathrm{m}$

D) $(-5,5,-2)\mathrm{m}$

11) In the given circuit, the current through the battery is: **4**



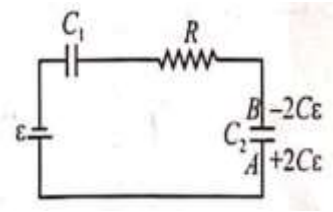
A) 1.5 A

B) 2 A

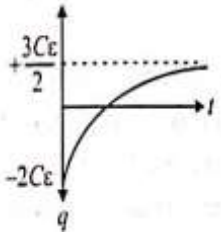
C) 3 A

D) 5.33 A

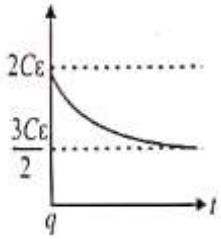
12) The capacitance of both the capacitors, C_1 and C_2 shown in the diagram is C. C_1 is initially $(t = 0)$ uncharged and C_2 is given a charge $2C\varepsilon$ as shown. Which of the following graph represents charge on plate B of capacitor C_2 as function of time? **4**



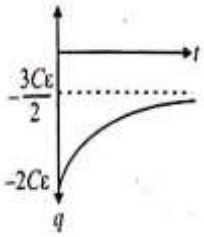
A)



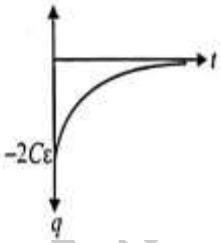
B)



C)



D)



13) A boatman moves his boat with a velocity ' v ' (relative to water) in river and finds that velocity of river ' u ' (with respect to ground) is more than ' v '. He has to reach a point directly opposite to the starting point on another bank by travelling minimum possible distance. Then **4**

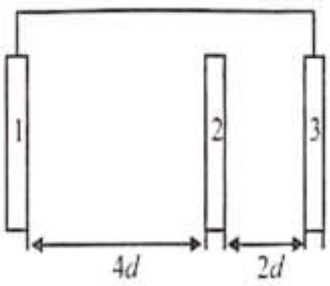
A) He must steer the boat (with velocity v) at certain angle with river flow so that he can reach the opposite point on other bank directly

B) His velocity ' v ' must be towards directly opposite point, So, that he can travel rest of distance by walking on other bank to reach the directly opposite point

C) Boatman should maintain velocity v of boat at certain angle greater than 90^{o} with direction of river flow to minimize drifting and then walk rest of distance on other bank

D) Boat velocity ' v ' should be at an angle less than $90°$ with direction of river flow to minimize the drift and then walk to the point

14) Three identical metal plates of large area A numbered 1,2,3 are arranged as shown in the diagram. The plates 1 and 3 are connected by a conducting wire. The charge given to plate 2 is $2q_0$ and no other plate is given any charge. Find the potential difference between the plate 2 and 3 . (ε_0 electrical permittivity of free space) **4**



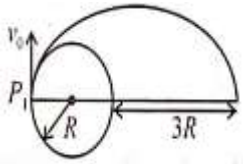
A) $\frac{4}{3}\frac{q_0 d}{A\epsilon_0}$

B) $\frac{8}{3}\frac{q_0 d}{A\epsilon_0}$

C) $\frac{12}{3}\frac{q_0 d}{A\epsilon_0}$

D) $\frac{2}{3}\frac{q_0 d}{A\epsilon_0}$

15) The acceleration due to gravity on the surface of earth is g & radius R. A ball is projected horizontally from point P_1 on the surface of earth (as shown in the figure) If the maximum height attained by the ball above the earth surface is $3R$ then speed of projection V_0 is (neglect cosmic dust resistance & earth rotation about its axis) **4**



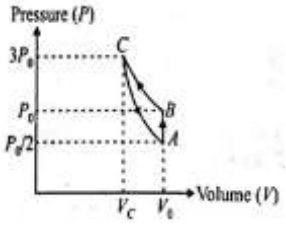
A) $\sqrt{\frac{8}{5}gR}$

B) $\sqrt{10gR}$

C) $\sqrt{6gR}$

D) $\sqrt{\frac{6}{5}gR}$

16) One mole of an ideal gas is carried through a thermodynamic cycle as shown in the figure. The cycle consists of an isochoric, an isothermal and an adiabatic processes. The adiabatic exponent of the gas is γ. Choose the correct option(s). **4**



A) $\gamma = \frac{\ln 6}{\ln 3}$

B) $\gamma = \frac{\ln 5}{\ln 3}$

C) $\gamma = \frac{\ln 2}{\ln 3}$

D) $\gamma = \frac{\ln 4}{\ln 3}$

17) A stationary hydrogen atom emits photon corresponding to the first line of Balmer series. If R is the Rydberg's constant and M is the mass of atom and h is plank's constant, then the velocity acquired by atom is **4**

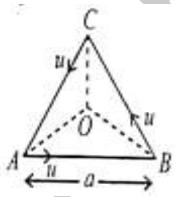
A) $\frac{5}{36}\frac{hR}{M}$

B) $\frac{3}{17}\frac{hR}{M}$

C) $\frac{3}{4}\frac{hR}{M}$

D) $\frac{5}{4}\frac{hR}{M}$

18) Three particles A, B and C situated at vertices of an equilateral triangle, all moving with same constant speed such that A always move towards B, B always towards C and C always towards A. Initial separation between each of the particle is $a. O$ is the centroid of the triangle. Distance covered by particle A when it completes one revolution around O is **4**



A) $2a\left(1 - e^{-2\sqrt{3}\pi}\right)$

B) $\frac{2a}{3}\left(1 - e^{-2\sqrt{3}\pi}\right)$

C) $a\left(1 + e^{-2\sqrt{3}\pi}\right)$

D) $\frac{2a}{3}(1 - e^{-\sqrt{3\pi}})$

19) A uniform solid cylinder of mass m and radius R is released from rest on a sufficiently rough inclined plane. During its downward journey along the incline, the cylinder moves distance l along the incline. The angle of inclination from horizontal is α. Mark incorrect statement: **4**

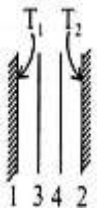
A) The acceleration of centre of mass of cylinder is $\frac{2\,g\sin\alpha}{3}$

B) The final angular speed of cylinder is $\sqrt{\frac{4gl\sin(\alpha)}{3R^2}}$

C) The minimum coefficient of friction required so that there is no slipping is $\frac{\tan\alpha}{3}$.

D) If released from rest cylinder will undergo pure rolling even on smooth inclined plane

20) Two large black plane surfaces are maintained at constant temperature T_1 and $T_2(T_1 > T_2)$. Two thin black plates are placed between the two surfaces and in parallel to these. After some time, steady conditions are obtained. What is the ratio η of heat transfer rate between plate-1 & plate-2 to the original heat transfer rate when plate-3 & plate-4 was not present **4**



A) $\eta = \frac{1}{2}$

B) $\eta = \frac{1}{3}$

C) $\eta = 1$

D) $\eta = \frac{1}{4}$

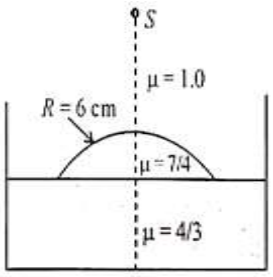
Section B

Integer Type. Attempt all 5 Questions.

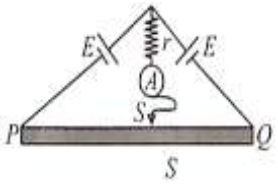
21) A uniform rod of length 2 rocks to and fro on the top of a rough semi-circular fixed cylinder of radius a. The period of small oscillations, of rod is $\frac{2\pi l}{\sqrt{ng\alpha}}$. Find n **4**

22) A rocket is projected straight up and explodes into three equally massive fragments just as it reaches the top of its flight (refer figure) One of the fragments is observed to come straight down in 2 sec , while the other two take 4 sec to come to ground, after the burst. Find the height h (in m) at which the fragmentation occurred. (Take $g = 10\ \mathrm{m/s^2}$) **4**

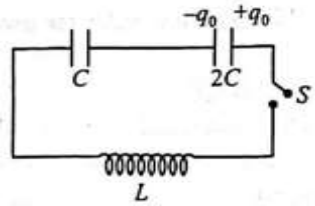
23) Water (with refractive index $= \frac{4}{3}$) in a tank is 18 cm deep. Oil of refractive index $\frac{7}{4}$ lies on water making a convex surface of radius of curvature $'R = 6\ \text{cm}$ ' as shown. Consider oil to act as a thin lens. An object ' S is placed 24 cm above water surface. The location of its image is at ' x ' cm above the bottom of the tank. Then ' x ' is **4**



24) In the figure. PQ is a wire of uniform cross-section and of resistance R_0. A is an ideal ammeter and the cells are of negligible resistance. The jockey J can freely slide over the wire PQ making contact on it at S. If the length of the wire PS is $1/n^{\text{th}}$ of length of wire PQ. Find the value of ' n ' for minimum reading on the ammeter. **4**



25) The switch in the circuit below is open; the capacitor of capacitance $2C$ carries electric charge q_0; the capacitor of capacitance C is uncharged; and there is electric current in the inductor. The value of the maximum current through the switch after it is closed is $\frac{q_0}{\sqrt{nLC}}$. Find n **4**

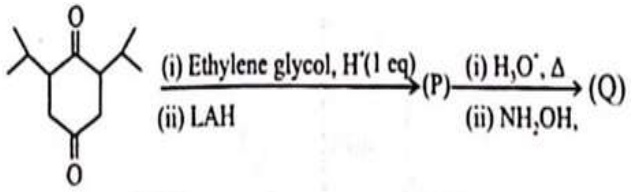


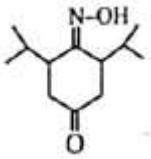
Chemistry

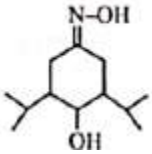
Section A

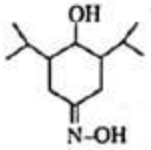
MCQ Single Correct. Attempt all 20 Questions.

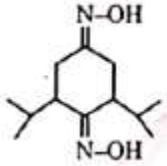
1) Major product (Q) in following sequence is: **4**



A) 

B) 

C) 

D) 

2) What would be the reduction potential of an electrode at 298 K , which originally contained $1MK_2Cr_2O_7$ solution in acidic buffer solution of $pH = 1.0$ and which was treated with 50% of the Sn necessary to reduce all $Cr_2O_7^{2-}$ to Cr^{3+}. Assume pH of solution remains constant. **4**

Given: $E^0_{Cr_2O_7^{2-}/Cr^{3+},H^+} = 1.33\ V; \log 2 = 0.3$;

$\frac{2.303RT}{F} = 0.06$

A) 1.285 V

B) 1.193 V

C) 1.187 V

D) 1.473 V

3) The percentage composition by weight of an aqueous solution of a non-electrolyte solute (Molar mass = 150) which boils at 373.52 K is: (Given K_b for $H_2O = 0.52\ K\ kg\ mol^{-1}$) **4**

A) 20%

B) 13%

C) 7%

D) 25%

4) $CH_3 - CH_3 \longrightarrow CH_4$ **4**

Identify reagent sequence for above conversion:

A) (i) $Cl_2/h\nu$; (ii) Na/Et_2O

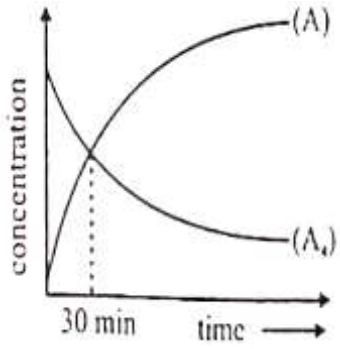
B) (i) $Cl_2/h\nu$; (ii) Aqueous KOH ; (iii) PCC; (iv) Red P/HI

C) (i) $Cl_2/h\nu$; (ii) Aq. KOH ; (iii) $KMnO_4, NaOH, \Delta$; (iv) $NaOH/CaO/\Delta$

D) (i) $Br_2/h\nu$; (ii) Alc. KOH/Δ; (iii) O_3, Zn; (iv) H_2, Pd

5) Consider the following first order decomposition reaction, **4**

$A_4(g) \rightarrow 4\ A(g)$Which of the following statements regarding the reaction is incorrect?
[Given: $\log 2 = 0.30$]



A) At 30 min , only 20% reaction is complete

B) $t_{1/2}$ of reaction is approximately 90 min

C) Rate of reaction decreases linearly with time

D) The time for intersection of two curves is independent of initial concentration of A_4

6) An aqueous solution contains $2M - AlCl_3$ and $3\ m - SnCl_4$. If the molarity and molality of Cl^- ion in the solution is same, the density of solution is ($Al = 27, Sn = 119$) (Consider both $AlCl_3$ and $SnCl_4$ are 100% ionisable) **4**

A) 1.05gm/ml

B) 1.15gm/ml

C) 1.95gm/ml

D) 2.05gm/ml

7) A weak base BOH was titrated against a strong acid. The pH at $1/4^{th}$ equivalence point was 8.0. Enough strong base was now added (7.5 millimole) to completely convert the salt. The total volume was 10 ml . Find the pOH at this point. **4**

A) 1

B) 2

C) 3

D) 4

8) Which of the following order for given property is WRONG - **4**

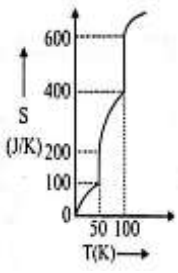
A) $O^{2-} > O > O^{+}$ (size)

B) $Mg < S^{+} < Mn^{+}$ (valence electron)

C) $Fe^{2+} < Mn^{2+} < Cr^{3+}$ (total number of unpaired electrons)

D) $Sc < Y < La$ (atomic size)

9) For 1 mole substance, variation of absolute entropy with temperature is given by following graph. What is molar enthalpy of vapourisation (ΔH_{vap}). **4**



A) 2 kJ

B) 5 kJ

C) 20 kJ

D) 10 kJ

10) $NH_4ClO_4 + HNO_3\,(\text{dilute}) \longrightarrow X + HClO_4 \quad X \xrightarrow{\text{heat}} Y\,(\text{gas})$ **4**

Gas (Y) is

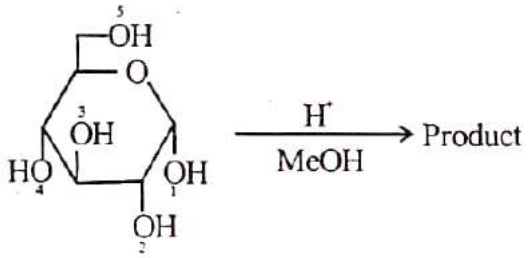
A) O_2

B) N_2

C) NO_2

D) N_2O

11) Correct option regarding product **4**



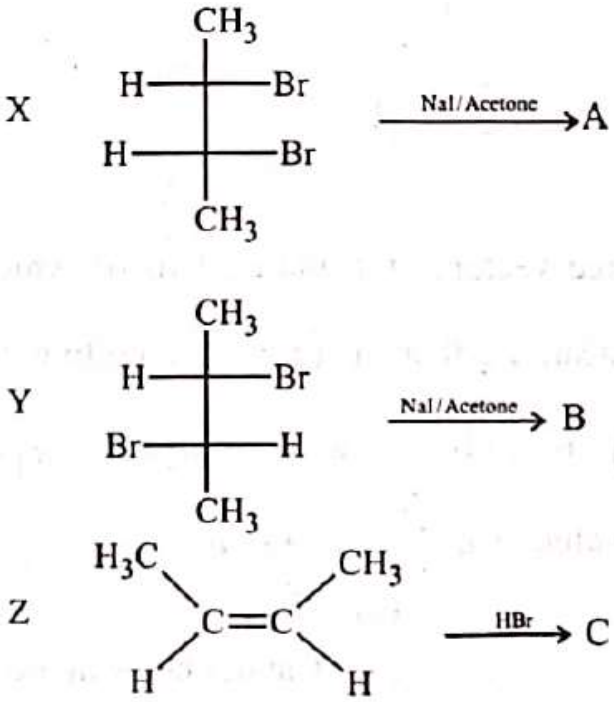
A) The product gives +ve test with Tollen's reagent

B) Only $5-OH$ groups will be methylated

C) This reaction involves carbanion mechanism

D) Product when reacts with HIO_4, a new product having multifunctional group is formed. The groups in new product are aldehyde, alcohol and ether.

12) In the following reaction, which statement is true? **4**



A) X is optically inactive, B is cis alkene, C is a single optical active compound

B) B is cis alkene, Y is optically active, C is a single optical active compound. A is cis alkene too

C) A is trans alkene, B is cis alkene, C is mixture of optically active compounds. X is optically inactive compound

D) Y is optically active, B is trans alkene, C is mixture of optically active compound, X is optically inactive compound

13) Salt $+Na_2[Fe(CN)_5NO] \xrightarrow{\text{Basic solution}}$ Purple colour complex **4**

Which of the following statement is correct for purple colour complex?

A) Oxidation state of Fe is +1

B) It's magnetic behaviour is paramagnetic

C) It is low spins complex

D) Hybridisation of Fe is $sp^3\ d^2$

14) Which of the following statements is CORRECT ? **4**

A) $[CoF_6]^{-3}$ ion is low spin complex due to pairing energy $> \Delta_0$

B) In Zeise's salt, back donation weakens the double bond of alkene

C) Among $AlCl_3, MgCl_2$ and $NaCl, MgCl_2$ has highest covalent character

D) $O_2^{2\Theta}$ and $NO^{\oplus}$ have same bond order

15) 0.1 mole of $_{92}U^{238}$ undergo radioactive decay to form $_{82}Pb^{206}$ by emitting α and β particles. The number of moles of β-particles emitted in two half lives would be **4**

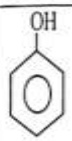
A) 0.9

B) 0.45

C) 1.2

D) 0.6

16) Match the following **4**

	List-I (Compounds)		List-II (Tests)
I	$CH_3CH_2CH_2Cl$	P	Br_2/H_2O
II		Q	Baker-mulliken test
III		R	Iodoform test
IV		S	Beilstein test

A) I- S II - R III - P IV- Q

B) I - Q II - R III - P IV -S

C) I - R II - Q III - P IV - S

D) I - Q II - S III - P IV - R

17) In which of the following, the elevation in boiling point of the final solution is less than that of initially taken solution (No limiting reagent) (Assume $\alpha = 1$ where ever needed) **4**

(i) $BaCl_2$ (aq.) $+Na_2SO_4$ (aq.) (added) $\rightarrow BaSO_4 + 2$ NaCl (aq.)

(ii) $K_4[Fe(CN)_6]$ (aq.) $+2CuSO_4$ (aq.) (added) $\rightarrow Cu_2[Fe(CN)_6] + 2\ K_2SO_4$

(iii) $Al_2(SO_4)_3$ (aq.) $+3BaCl_2$ (aq.) (added) $\rightarrow 3BaSO_4 + 2AlCl_3$ (aq.)

(iv) $AgNO_3$ (aq.) +2 KCN (added) $\rightarrow K[Ag(CN_2)]$ (aq.) $+KNO_3$ (aq.)

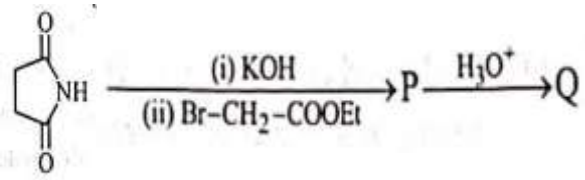
A) i, ii, iii, and iv

B) i and ii only

C) iii only

D) i , iii, and iv only

18) Amino acid (Q) obtained in following sequence is: **4**



A) Alanine

B) Valine

C) Glycine

D) Leucine

19) A mixture of FeO and Fe_2O_3 is reacted with acidified $KMnO_4$ solution having a concentration of $2/5M, 100\ mL$ of which was used. The solution was then titrated with Zn dust which converted Fe^{3+} of the solution to Fe^{2+}. The Fe^{2+} required 1000 mL of $2/15MK_2Cr_2O_7$ solution. Find the ratio by mol of FeO and Fe_2O_3. **4**

A) $2/3$

B) $3/2$

C) ½

D) $3/1$

20) With respect to valence bond theory, the correct statement is **4**

A) Bond energy order is $H_2 > F_2$

B) Order of number of lone pair of electrons: $I_3^{\oplus} > I_3^-$

C) s% character order in lone pair of electron(s) is OCl 2 > OF 2 $OCl_2 > OF_2$

D) Bond angle order is $SCl_2 > OCl_2$

Section B

Integer Type. Attempt all 5 Questions.

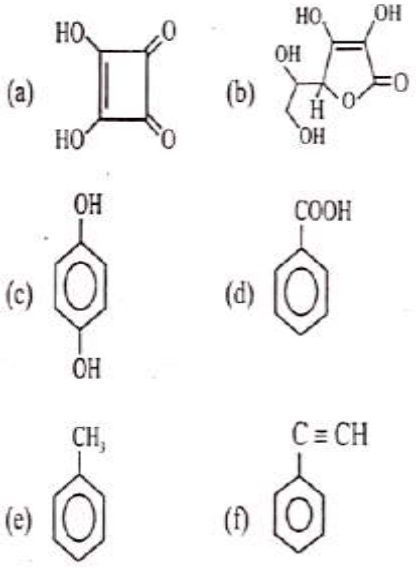
21) Find the sum of bond order in the given species which have fractional bond order. **4**

$NO, O_2^-, N_2, H_2^{\oplus}, CO, CO_3^{2-}, O_2$(Report your answer after multiplying by 12)

22) From the following data. Calculate the magnitude of standard enthalpy of formation of propane (in kcal) $\Delta_f{}^0H(CH_4) = -17 kcal mol^{-1}$. **4**
$\Delta_f{}^0H(C_2H_6) = -24 kcal mol^{-1}$;
$BE(C-H) = 99 kcal mol^{-1} (C-C) = 84 kcal mol^{-1}$

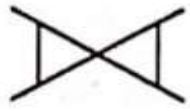
23) Find the number of the paramagnetic and inner orbital complex in the following:- **4**
$[Ni(CO)_4], [Ni(CN)_4]^{-2}, [Co(H_2O)_6]^{3+}$,
$[Cu(NH_3)_4]^{2+}, [Cr(NH_3)_6]^{3+}, [Fe(CN)_6]^{3-}$

24) The total number of compounds among the following which librate $CO_2 \uparrow$ gas on reaction with aqueous $NaHCO_3$? **4**



(g) H_2SO_4 (h) MeCOOH

25) Find the number of stereoisomer of following compound **4**



Maths

Section A

MCQ Single Correct. Attempt all 20 Questions.

1) A square matrix P satisfies $P^2 = I - P$, where I is an identity matrix. If $P^n = 5I - 8P$, then n is- **4**

A) 4
B) 5
C) 6
D) 7

2) If mean deviations about median of ., $6x, 7x, 8x, 9x, 10x$ is 30 , then $|x|$ equals - **4**

A) 12
B) 11
C) 0
D) 9

3) A polynomial function satisfies **4**
$f(x) \cdot f\left(\frac{1}{x}\right) = f(x) + f\left(\frac{1}{x}\right), x \neq 0, f(3) = -26$, then value of $f(4)$ is

A) -15
B) -63
C) -47
D) -255

4) Let $f(x) = \max\{|x^2 - 3|x||, |x|\}$ and **4**
$g(x) = \min\{|x^2 - 3|x||, |x|\}$, then

A) $f(x)$ and $g(x)$ not differentiable at 5 and 7 points respectively
B) $f(x)$ and $g(x)$ not differentiable at 7 and 5 points respectively
C) $f(x)$ and $g(x)$ not differentiable at 5 and 6 points respectively
D) $f(x)$ and $g(x)$ not differentiable at 6 and 5 points respectively

5) $\sin^{-1}(3x - 4x^3)$ **4**

A) $3\sin^{-1} x$, if $\frac{1}{2} \leq x \leq 1$
B) $-\pi - 3\sin^{-1} x$, if $-\frac{1}{2} \leq x \leq \frac{1}{2}$
C) $\pi - 3\sin^{-1} x, \frac{1}{2} < x \leq 1$
D) $3\cos^{-1} x$, if $\frac{1}{2} \leq x \leq 1$

6) Given three vectors a, b and c, two of which are non-collinear. Further if $(a+b)$ is collinear with c, $(b+c)$ is collinear with a, $|a| = |b| = |c| = \sqrt{2}$. Find the value of $a \cdot b + b \cdot c + c \cdot a$. **4**

A) 3

B) -3

C) 0

D) Cannot be evaluated

7) If any line with slope 2 meets hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ at not more than one point, then eccentricity of the hyperbola is **4**

A) $\sqrt{3}$

B) 2

C) $\sqrt{5}$

D) $\sqrt{6}$

8) Area bounded by $y = -x^2 + 6x - 5, y = -x^2 + 4x - 3$ and $y = 3x - 15$, for $x > 1$, is **4**

A) $17/6$

B) $13/6$

C) $73/6$

D) $29/6$

9) The vertices of a triangle are $A(-1,-7), B(5,1)$ and $C(2,-3)$. If the internal angle bisector of $\angle B$ meets the side AC in D, then the length BD is **4**

A) $\frac{19}{3}$

B) $\frac{20}{3}$

C) $\frac{22}{3}$

D) $\frac{23}{3}$

10) The sum of the series $\frac{2}{1\cdot2} + \frac{5}{2\cdot3}2 + \frac{10}{3\cdot4}2^2 + \frac{17}{4\cdot5}2^3 + \cdots$. up to n term is **4**

A) $\frac{n2^n}{n+1}$

B) $\left(\frac{n}{n+1}\right)2^n + 1$

C) $\frac{n2^n}{n+1} - 1$

D) $\frac{(n-1)2^n}{n+1}$

11) Let $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ and $\frac{x^2}{A^2}-\frac{y^2}{B^2}=1$ are confocal ($>$ A and $a>b$) having the foci at S_1 and S_2. Let P be their point of intersection then, S_1P and S_2P are the roots of quadratic equation - **4**

A) $x^2+2ax+(a^2-A^2)=0$

B) $x^2-2Ax+(a^2+A^2)=0$

C) $x^2-2Ax+(a^2-A^2)=0$

D) $x^2-2ax+(a^2-A^2)=0$

12) Let $f(x)=x^3+ax+b$ with $a\neq b$ and suppose the tangent lines to the graph of f at $x=a$ and $x=b$ have the same gradient. Then the value of $f(1)$ is equal to **4**

A) 0

B) 1

C) $-\frac{1}{3}$

D) $\frac{2}{3}$

13) If ABCD is regular tetrahedron with length of any edge ' λ ', then the minimum distance of any vertex from the opposite face is - **4**

A) $\sqrt{\frac{2}{3}}$

B) $\sqrt{\frac{3}{2}}$

C) $\frac{2^2}{3}$

D) $\frac{1}{\sqrt{3}}$

14) Let α and β be the number of divisors of 88200 which are of the form $(4k+2)$ and $(4k+1)$ respectively, (is integer). The value of $\alpha-\beta$ is equal to **4**

A) 8

B) 12

C) 24

D) 36

15) If $f(x)$ is an even function which is also periodic with the period T and $\int_0^a f(x)dx=3$ and $\int_{-T/2}^{3T/2} f(x)dx=18$, then $\int_{-a}^{a+5T} f(x)dx$ is equal to **4**

A) 96

B) 93

C) 51

D) 48

16) If $x = a + ib$ is a complex number such that $x^2 = 3 + 4i$ and $x^3 = 2 + 11i$, where $i = \sqrt{-1}$, then $a + b$ is **4**

A) 1

B) 2

C) 3

D) 4

17) If ' P' is probability of an event $E$of a random experiment and $\{P\} = P$. then (where $\{\cdot\}$denotes fractional part function) **4**

A) Emust be a sure event

B) Ecan't be a sure event

C) $\{(P(\bar{E})\} = P(\bar{E})$for all possible values of $P(E)$

D) $\{P(\bar{E})\} \neq \mathrm{P}(\bar{E})$for all possible values of $P(E)$

18) Which of the following results is valid? **4**

A) $(1 + x)^n > (1 + nx)$ for all natural number n n

B) $(1 + x)^n \geq (1 + nx)$ for all natural number n n

C) $(1 + x)^n \leq (1 + nx)$ for all natural number n n

D) $(1 + x)^n < (1 + nx)$ for all natural number n

19) Solution of $\int \frac{9\cos 2x + 12\cos x - 6\sin x}{(2 + 3\sin x)(4 + 3\cos x)}\, dx$ **4**

A) $\log_c\left(\frac{2 + 3\sin x}{4 + 3\cos x}\right) + c$

B) $\log_e\left(\frac{4 + 3\cos x}{2 + 3\sin x}\right) + c$

C) $\log_c((2 + 3\sin x)(4 + 3\cos x)) + c$

D) $-\log_e(2 + 3\sin x)(4 + 3\cos x) + c$

20) If α, β are the integral roots of the quadratic equation $x^2 - \alpha\beta x + \alpha^2 + \beta = 0$, then number of possible different quadratic equation(s) is: **4**

A) 0

B) 1

C) 2

D) 4

Section B

Integer Type. Attempt all 5 Questions.

21) Let $y(x) = \sin(x - \sin x)$ and $y''(x)$ denotes the second order derivative of $y(x)$ w.r.t. x. The value of $\left[y''\left(\frac{\pi}{2}\right) + \cos 1\right]$ is (where [.] denotes the greatest integer function. **4**

22) A real valued functions $f(x), f: \left(0, \frac{\pi}{2}\right) \to R^+$ satisfies the differential equation $f^2(x) = \frac{f(x)+xf'(x)-1}{x^2}$ and $f\left(\frac{\pi}{4}\right) = \frac{4}{\pi}$, then the value of $\lim_{x\to 0}(1 + f(x) + f^2(x) + f^3(x))$ is **4**

23) $\tan 200°(\cot 10° - \tan 10°) + 1$ is equal to **4**

24) A number consists of three digits which are in G.P. The sum of the right and left hand digit exceeds twice the middle digit by 1 and the sum of the left hand and middle digits is two third of the sum of the middle and right hand digit. Find the number. **4**

25) If ${}^nC_0 - {}^nC_1 + {}^nC_2 - {}^nC_3 + .. + (-1)^r \cdot {}^nC_r = 28$, then n is $\frac{k!}{8!}$. . . Find the value of k. **4**