JEE MAIN

COURSE
NUCLEUS

TEST CODE				
1	1	2	7	8

MOCK TEST-6

Class: **XII** ***Time:*** **3 Hours.** ***Max. Marks:*** **360**

IMPORTANT INSTRUCTIONS

1. The question paper consists of **'90'** objective type questions. There are **'30'** questions each in **Physics**, **Mathematics** and **Chemistry** respectively. **Please fill the OMR answer Sheet accordingly and carefully.**

2. Each question has four choices (1), (2), (3) and (4) out of which **ONLY ONE** is correct.

3. You will be **awarded 4 marks** for each question, if you have darkened only the bubble corresponding to the correct answer and zero mark if no bubble are darkened. In all other cases, **minus one (–1) mark** will be awarded.

4. There is only one correct response for each question. Filling up more than one response in each question will be treated as wrong response and marks for wrong response will be deducted accordingly as per instruction 3 above.

5. Use **Black or Blue Ball Point Pen** only for filling particulars.

6. Use of **Calculator, Log Table, Slide Rule and Mobile** is not allowed.

7. Rough work is to be done on the space provided at the bottom and in end of the booklet for this purpose in the Test Booklet only.

8. On completion of the test, the candidate must hand over the Answer Sheet to the Invigilator. However, the candidates are allowed to take away this Test Booklet with them.

9. Do not fold or make any stray marks on the Answer Sheet.

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USEFUL DATA

Atomic weights: Al = 27, Mg = 24, Cu = 63.5, Mn = 55, Cl = 35.5, O = 16, H = 1, P = 31, Ag = 108, N = 14, Li = 7, I = 127, Cr = 52, K=39, S = 32, Na = 23, C = 12, Br = 80, Fe = 56, Ca = 40, Zn = 65.5, Ti = 48, Ba = 137, U = 238, Co= 59, B =11, F = 19, He = 4, Ne = 20, Ar = 40 , Mo = 96

[Take : $ln\ 2 = 0.693$, $ln\ 1.1 = 0.095$, $ln\ 3 = 1.09$, $e = 1.6 \times 10^{-19}$, $m_e = 9.1 \times 10^{-31}$ kg]

Take: $\in_0 = 8.85 \times 10^{-12}\ C^2/Nm^2$, $g = 10\ m/s^2$, $S_{water} = 1$ cal/gm °C, $L_{ice} = 80$ cal/gm. , $g = 10\ m/s^2$ unless otherwise stated

PHYSICS

Q.1 A particle starts from rest and moves with an acceleration of $a = \{2 + |t - 2|\}\ m/s^2$, the velocity of the particle at t = 4 sec is

(1) 2 m/s (2) 4 m/s (3) zero (4) 12 m/s

Q.2 In an artificial satellite which of the following process of heat transfer will not take place?

(1) Conduction (2) Convection (3) Radiation (4) All of the above

Q.3 A block of mass 'm' is placed on an another rough block of mass 'M' and both are moving horizontally with same acceleration 'a' due to a force which is applied on the lower block, then work done by lower block on the upper block in moving a distance 's' will be

(1) Mas (2) (m + M) as (3) $\frac{M^2}{m}as$ (4) mas

Q.4 The radius of a planet is R_1 and a satellite revolves around it in a circle of radius R_2. The time period of revolution of satellite is T. Acceleration due to the gravitation of the planet at its surface will be

(1) $\frac{4\pi^2 R_2^3}{T^2 R_1^2}$ (2) $\frac{R_2^3}{4\pi^2 T^2 R_1^2}$ (3) $\frac{4\pi^2 R_1^3}{T^2 R_2^2}$ (4) $\frac{R_1^3}{4\pi^2 T^2 R_2^2}$

Q.5 A 1 cm long string fixed at both ends, sustains a standing wave such that all the points on the string having displacement amplitude 1 mm (less than maximum amplitude) are separated by d cm. The string is oscillating in its third overtone then

(1) $\frac{1}{d} = 2\ cm^{-1}$ (2) $\frac{1}{d} = 3\ cm^{-1}$ (3) $\frac{1}{d} = 6\ cm^{-1}$ (4) $\frac{1}{d} = 8\ cm^{-1}$

SPACE FOR ROUGH WORK

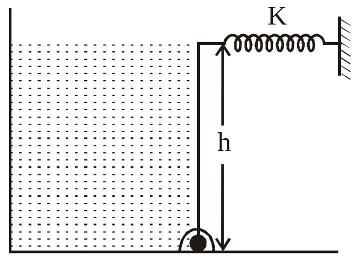
Q.6 The air in a open pipe of length 36 cm long is vibrating with 2 nodes and 2 antinodes. The temperature of the air inside the pipe is 51°C. What is the wavelength of waves produced in air outside the tube where the temperature of air is 16°C?

(1) 32.1 cm (2) 68 cm (3) 34 cm (4) 10.2 cm

Q.7 A boat goes downstream for half an hour and then goes upstream for half an hour. The total distance travelled by the boat in the ground frame for this is 20 km. It is known that speed of the boat relative to the river for the whole trip was constant and greater than the speed of the river. The distance travelled by the boat in the frame of the river for this is

(1) zero (2) 20 km (3) 10 km (4) can't be determined

Q.8 A plank of length h and width b (perpendicular to plane of paper) is hinged at one end. The upper end is attached with a spring of spring constant k and water is filled up to high h. If plank is in equilibrium in vertical position then potential energy stored in spring is (ignore effect of atmospheric pressure)



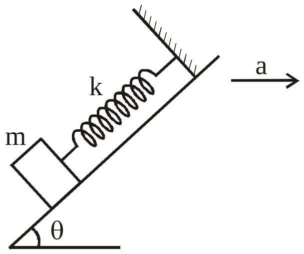
(1) $\frac{b^2\rho^2g^2h^4}{18k}$ (2) $\frac{b^2\rho^2g^2h^4}{36k}$ (3) $\frac{b^2\rho^2g^2h^4}{72k}$ (4) $\frac{b^2\rho^2g^2h^4}{128k}$

Q.9 An inductor of inductance $\frac{1}{\pi^2}$ mH is connected in series with a capacitor of 2.5 μF charged to 30 V and the circuit is completed (t = 0). The time when the voltage across the capacitor becomes 15 V for the first time is

(1) $\frac{1}{12}\times10^{-4}$ s (2) $\frac{1}{2}\times10^{-4}$ s (3) $\frac{1}{6}\times10^{-4}$ s (4) $\frac{1}{8}\times10^{-4}$ s

SPACE FOR ROUGH WORK

Q.10 A spring block system (mass = m, spring constant k) is placed on a smooth inclined plane (θ = angle of inclination). The plane is accelerated horizontally with an acceleration 'a' such that the block does not loose contact with the plane. The time period of small oscillation of the block is



(1) $2\pi\sqrt{\frac{m}{k}}$ (2) $2\pi\sqrt{\frac{m\sin\theta}{k}}$ (3) $2\pi\sqrt{\frac{mg}{ka}}$ (4) None of the above

Q.11 A block is suspended by an ideal spring constant K. If the block is pulled down by constant force F and if maximum displacement of block from it's initial position of rest is z, then

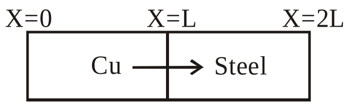
(1) z = F/K

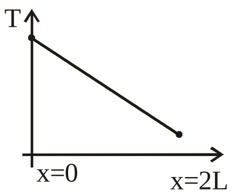
(2) z = 2F/K

(3) work done by force F is equal to 2Fz.

(4) increase in potential energy of the spring is $\frac{1}{2}Kz^2$

Q.12 A copper rod and a steel rod of equal cross-sections and lengths (L) are joined side by side and connected between two heat baths as shown in the figure. If heat flows through them from x = 0 to x = 2L at a steady rate, and conductivities of the metals are K_{cu} & K_{steel} ($K_{cu} > K_{steel}$), then the temperature varies as: (convection and radiation heat loss are negligible)



(1)


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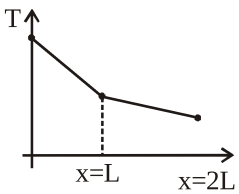

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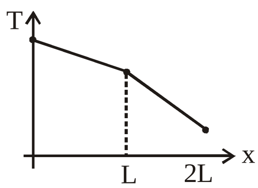

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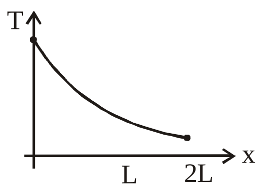
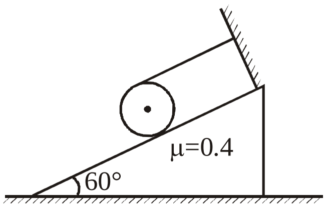


SPACE FOR ROUGH WORK

Q.13 A block of mass 2 kg is attached to one end of a massless rod of length $\frac{1}{\pi}$ m. The rod's one end is fixed to a horizontal plane at the other end such that the block and rod are free to revolve on a horizontal plane. The coefficient of friction between the block and surface is 0.1. Block is made to rotate with uniform speed by applying a constant external force in tangential direction on the block. The work done by external force when the rod rotates by 90° is

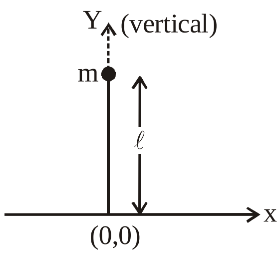
(1) 0 (2) 10 joule (3) $\frac{\pi}{2}$ joule (4) 1 joule

Q.14 A solid cylinder having mass m is wrapped with a string and placed on an inclined plane as shown in the figure. Then the frictional force acting between cylinder and plane is



(1) $\sqrt{3}\frac{mg}{4}$ (2) 5 mg (3) $\frac{7mg}{2}$ (4) $\frac{mg}{5}$

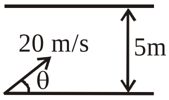
Q.15 A mass m is attached to one end of a light rod. This assembly is placed on the origin as shown in the figure. If all surfaces are smooth then the position of lower end when the rod becomes horizontal after its upper end has been disturbed gently towards right is



(1) ℓ, 0 (2) $\frac{\ell}{2}$, 0 (3) $-\ell$, 0 (4) $-\frac{\ell}{2}$, 0

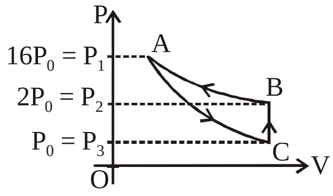
SPACE FOR ROUGH WORK

Q.16 A projectile is projected with a speed = 20 m/s from the floor of a 5 m high room as shown. Find the maximum horizontal range of the projectile and the corresponding angle of projection θ.



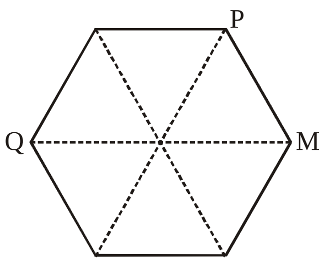
(1) 20m, 45°
(2) $20\sqrt{3}$ m, 30°
(3) 38.4 m, 37°
(4) can't be determined

Q.17 In the figure three process on a gas are shown. Determine the value of C_v for the gas in terms of P_1, P_2 and P_3, if AC represents adiabatic process and BA represents isothermal process.



(1) R
(2) 2R
(3) 3R
(4) 4R

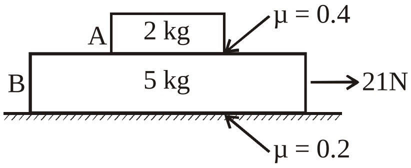
Q.18 Two identical point like sound sources emitting sound in same phase of wavelength 1 m are located at points P and Q as shown in figure. All sides of the polygon are equal and of length 1m. The intensity of sound at M due to source P alone is I_0. If the intensity of sound at point M when both the sources are on is I, find the value of $\frac{4I}{I_0}$.



(1) 3
(2) 6
(3) 9
(4) 12

SPACE FOR ROUGH WORK

Q.19 A block B of mass 5 kg rests on a rough horizontal surface ($\mu = 0.2$). A block A of mass 2kg rests on block B($\mu = 0.4$). If a horizontal force of 21 N be applied to the block B, what is force (in N) of friction acting between the blocks A and B ? ($g = 10\ ms^{-2}$)



(1) 1 (2) 2 (3) 3 (4) 4

Q.20 A light wire 10 cm long is placed horizontal on the surface of water and is gently pulled up with a force of 1.8×10^{-2} N to keep the wire in equilibrium. What is the surface tension of water ?

(1) 9 N/m (2) 0.9 N/m (3) 0.09 N/m (4) 0.18 N/m

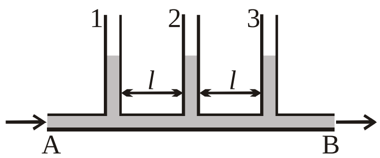
Q.21 The bottom end of a cubical block of side 5×10^{-2} m is fixed. A force of 10^5 N tangential to the top face displaces it by 1.2×10^{-4} m. The rigidity modulus is

(1) $6 \times 10^{-10}\ Nm^{-2}$ (2) $6 \times 10^{-9}\ Nm^{-2}$ (3) $1.67 \times 10^{10}\ Nm^{-2}$ (4) $10^{11}\ Nm^{-2}$

Q.22 Isothermal expansion, isothermal compression, adiabatic expansion and adiabatic compression are respectively denoted as IE, IC, AE and AC. The correct order of the four operations in one cycle of a Carnot's heat engine is

(1) IE, IC, AE, AC (2) IC, AE, AC, IE
(3) IE, AE, IC, AC (4) AE, IC, IE, AC

Q.23 An ideal liquid flows through the horizontal pipe AB, which is of uniform cross-section. The vertical pipes 1, 2 and 3 are equispaced. the liquid levels in these pipes are at heights h_1, h_2 and h_3 respectively above AB. Liquid flows from A to B in AB.



(1) $h_1 = h_2 = h_3$ (2) $h_2 = \frac{1}{2}(h_1 + h_3)$ (3) $h_2 > \frac{1}{2}(h_1 + h_3)$ (4) $h_2 < \frac{1}{2}(h_1 + h_3)$

SPACE FOR ROUGH WORK

Q.24 A flywheel rotating about an axis experiences an angular retardation proportional to the angle through which it rotates. If its rotational kinetic energy gets reduced by ΔE while it rotates through an angle θ then

(1) $\Delta E \propto \theta^2$ (2) $\Delta E \propto \sqrt{\theta}$ (3) $\Delta E \propto \theta$ (4) $\Delta E \propto \theta^{3/2}$

Q.25 A capillary tube is immersed vertically in water and the height of the water column is x. When this arrangement is taken into a mine of depth d, the height of the water column is y. If R is the radius of the earth, the ratio $\frac{x}{y}$ is

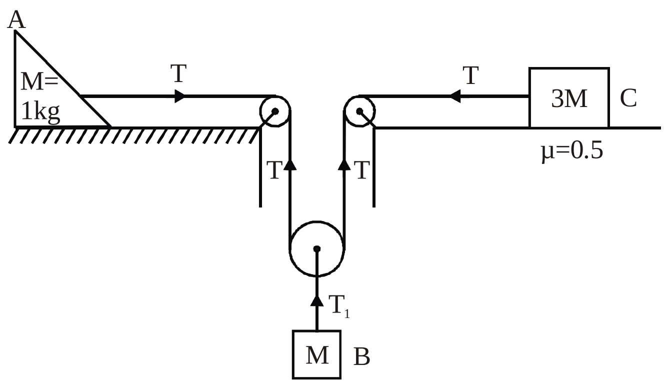
(1) $\left(1-\frac{d}{R}\right)$ (2) $\left(1+\frac{d}{R}\right)$ (3) $\left(\frac{R-d}{R+d}\right)$ (4) $\left(\frac{R+d}{R-d}\right)$

Q.26 The dimensions of mutual inductance (M) and capacitance (C) are respectively.

(1) $[M^1LT^{-1}A^{-1}]$, $[M^1L^{-1}T^1A^2]$ (2) $[M^1LT^{-1}A^{-1}]$, $[M^1L^1T^1A^2]$

(3) $[M^1L^2T^{-2}A^{-2}]$, $[M^{-1}L^{-2}T^4A^2]$ (4) $[M^1L^{-2}T^2A^{-2}]$, $[M^{-1}L^2T^{-4}A^2]$

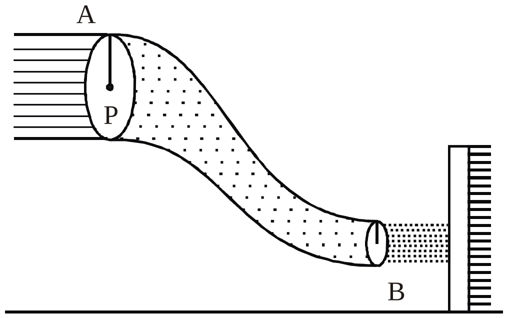
Q.27 In the given figure, the work done by the tension T_1 on the block B in 1 sec is



(1) –3J (2) –8J (3) 8 J (4) –4J

SPACE FOR ROUGH WORK

Q.28 Consider the section of long pipe as shown, water enters at A with a speed of 1 m/s and comes out at B horizontally. Area of cross section at A = 0.6 m^2 and at B = 0.3 m^2. The water coming out at B strikes the wall horizontally and immediately after striking comes to rest. The average force exerted by the water on the wall is

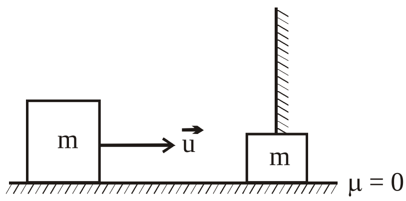


(1) 0.6 kN (2) 0.9 kN (3) 1.2 kN (4) 1.6 kN

Q.29 A source of sound of small radius r is emitting sound of loudness B decibels at its surface. The intensity of sound at a distance R from the centre of the source is (I_0 is intensity of zero decibel sound).

(1) $\frac{r^2}{R^2} I_0 e^{0.1B}$ (2) $\frac{r^2}{R^2} I_0 10^{0.1B}$ (3) $\frac{r^2}{4R^2} I_0 e^{B}$ (4) $\frac{r^2}{4R^2} I_0 10^{0.1B}$

Q.30 An object of mass m is moving with velocity $\vec{u}$ towards a plane mirror kept on a stand as shown in the figure. The mass of the mirror and stand system is m. A head-on elastic collision takes place between the object and the mirror stand, the velocity of image before and after the collision is



(1) $\vec{u}, 2\vec{u}$ (2) $-\vec{u}, -2\vec{u}$ (3) $-\vec{u}, 2\vec{u}$ (4) $\vec{u}, -2\vec{u}$

SPACE FOR ROUGH WORK

Q.31 If all possible solutions to the equation $\log_4(3-x)+\log_{0.25}(3+x)=\log_4(1-x)+\log_{0.25}(2x+1)$ are found, there will be

(1) 2 positive solutions (2) no prime solution
(3) 1 positive and 1 negative solution (4) two integral solutions

Q.32 The area of the domain of the function $f(x, y)=\sqrt{16-x^2-y^2}-\sqrt{|x|-y}$ is $k\pi$ where k equals

(1) 8 (2) 9 (3) 10 (4) 12

Q.33 If the equation $x^2-(2+m)x+(m^2-4m+4)=0$ has coincident roots, then the range of m is

(1) $\left\{1, \frac{2}{3}\right\}$ (2) $\left\{\frac{2}{3}, 6\right\}$ (3) {1, 6} (4) {0, 1}

Q.34 Let a solution y = y(x) of the differential equation $e^y\,dy-(2+\cos x)\,dx=0$ satisfy y(0) = 0 then the value of $f\left(\frac{\pi}{2}\right)$ is equal to

(1) $ln\,\pi$ (2) $ln\,(2+\pi)$ (3) $ln\,(1+\pi)$ (4) does not exist

Q.35 If the equation $x^3-12x+a=0$ has exactly one real root, then range of a is equal to

(1) $(-\infty, -16)\cup(16, \infty)$ (2) $\{-16, 16\}$
(3) $(-16, 16)$ (4) $(-\infty, -16]\cup[16, \infty)$

Q.36 If $(1+x)^{15}=a_0+a_1x+a_2x^2+\ldots\ldots+a_{15}x^{15}$, then $\sum_{r=1}^{15} r\cdot\frac{a_r}{a_{r-1}}$ is equal to

(1) 110 (2) 115 (3) 120 (4) 135

Q.37 If $f(1)=3$ and $f'(x)\le 1.4$ for $1\le x\le 8$. The largest possible value which f (8) can have, is

(1) 12.8 (2) 6.8 (3) 16.8 (4) none

SPACE FOR ROUGH WORK

Q.38 If $\int (x^9 + x^6 + x^3)(2x^6 + 3x^3 + 6)^{\frac{1}{3}} dx = \frac{1}{A}(2x^9 + 3x^6 + 6x^3)^B + C$, where C is integration constant then AB is equal to

(1) 32 (2) 16 (3) 8 (4) 4

Q.39 If $\cos\theta + \sqrt{3}\sin\theta = 2\sin\theta$, then $\left(\frac{\sin\theta - \sqrt{3}\cos\theta}{\cos\theta}\right)$ is equal to

(1) 0 (2) 1 (3) 2 (4) $\sqrt{3}$

Q.40 $\lim\limits_{x\to\infty} \frac{\int_0^x \tan^{-1} t\, dt}{\sqrt{x^2+1}}$ has the value

(1) $\frac{\pi}{2}$ (2) 0 (3) 1 (4) π

Q.41 The range of the function $f(\theta) = \frac{\sin\theta}{\theta} + \frac{\theta}{\tan\theta}$, $\theta \in \left(0, \frac{\pi}{2}\right)$ is equal to

(1) $(0, \infty)$ (2) $\left(\frac{1}{\pi}, 2\right)$ (3) $(2, \infty)$ (4) $\left(\frac{2}{\pi}, 2\right)$

Q.42 If $S = \frac{2^2-1}{2} + \frac{3^2-2}{6} + \frac{4^2-3}{12} + \ldots\ldots$ upto 10 terms, then S is equal to

(1) $\frac{123}{11}$ (2) $\frac{10}{11}$ (3) $\frac{13}{11}$ (4) $\frac{120}{11}$

SPACE FOR ROUGH WORK

Q.43 Let the area enclosed by the curve $y = 1 - x^2$ and the line $y = a$, where $0 \le a < 1$, be represented by A(a).

If $\frac{A(0)}{A\left(\frac{1}{2}\right)} = k$, then

(1) $1 < k < \frac{3}{2}$ (2) $\frac{3}{2} < k < 2$ (3) $2 < k < \frac{5}{2}$ (4) $\frac{5}{2} < k < 3$

Q.44 Let $f(x) = \begin{cases} \frac{(\sin x)^{13} - \ln\left(1 + (\sin x)^{13}\right)}{(\tan x)^{26}}, & x \ne 0 \\ k, & x = 0 \end{cases}$.

If $f(x)$ is continuous at $x = 0$ then the value of k is

(1) $\frac{1}{2}$ (2) $\frac{1}{4}$ (3) 1 (4) 2

Q.45 Let f(x) satisfies $\frac{f^2(x)}{f(1-x)} = x^3$, where $f(1-x) \ne 0$, then $f\left(\frac{1}{2}\right)$ equals

(1) $\frac{1}{2}$ (2) $\frac{1}{4}$ (3) $\frac{1}{8}$ (4) $\frac{1}{64}$

Q.46 A function f(x) satisfies $f(x) = f\left(\frac{c}{x}\right)$ for some real number c (c > 1) and $\forall\, x > 0$. If $\int_1^{\sqrt{c}} \frac{f(x)}{x} dx = 3$,

then the value of $\int_1^{c} \frac{f(x)}{x} dx$ is

(1) 2 (2) 4 (3) 6 (4) 8

SPACE FOR ROUGH WORK

Q.47 If α, β, γ are the roots of $2x^3 - x + 1 = 0$ then the value of $\alpha^3 + \beta^3 + \gamma^3$ is

(1) $-\frac{1}{2}$ (2) $\frac{1}{2}$ (3) $-\frac{3}{2}$ (4) $-\frac{5}{4}$

Q.48 If $\int e^x (\tan x - x - 2\tan x \sec^2 x)dx = e^x f(x) + C$ where $f(0) = 0$, then the value of $f\left(\frac{\pi}{4}\right)$ equals (where C is the constant of integration)

(1) $\frac{\pi}{4}$ (2) $1 - \frac{\pi}{4}$ (3) $\frac{-\pi}{4}$ (4) $\frac{\pi}{2}$

Q.49 If $ln\left((e-1)e^{xy} + x^2\right) = x^2 + y^2$, then $\left(\frac{dy}{dx}\right)_{(1,0)}$ is given by

(1) 1 (2) 2 (3) 3 (4) 4

Q.50 A tangent is drawn at the point M with abscissa unity on the curve $y = \sqrt{\left(5 - x^{\frac{2}{3}}\right)^3}$. If length of segment of tangent intercepted between the co-ordinate axes is $\sqrt{N}$, then N is equal to

(1) 25 (2) 50 (3) 75 (4) 125

Q.51 If least positive value of x satisfying the equation $\sin\left(\frac{5x}{6}\right) + \cos\left(\frac{10x}{9}\right) = 2$ is $\left(\frac{m}{n}\right)\pi$, $m, n \in N$, then least value of $(2m - n + 1)$ is

(1) 30 (2) 50 (3) 90 (4) 100

Q.52 If $\lim_{x \to 1} \sin^{-1}\left(\frac{k}{ln\, x} - \frac{k}{x-1}\right)$ exist, then the number of integers in the range of k, is

(1) 3 (2) 4 (3) 5 (4) 6

SPACE FOR ROUGH WORK

Q.53 If $\log_\pi x > 0$ then the value of $\log_{\frac{1}{\pi}}\left(\sin^{-1}\frac{2x}{1+x^2} + 2\tan^{-1}x\right)$ is equal to

(1) 1 (2) – 1 (3) 0 (4) π

Q.54 Let $y(x) = e^{2\sin^{-1}x}$, $x \in [-1, 1]$ and $(1 - x^2)\, y''(x) = xy'(x) + \lambda y(x)$, then λ equals

(1) 1 (2) 2 (3) 3 (4) 4

Q.55 The value of definite integral $\int_1^{\sqrt{2}} x\tan^{-1}(x^2 - 1)\,dx$ equals

(1) $\frac{\pi}{4} - \frac{ln 3}{2}$ (2) $\frac{\pi}{8} - \frac{ln 2}{4}$ (3) $\frac{\pi}{6} - \frac{ln 2}{8}$ (4) $\frac{\pi}{2} - \frac{ln 5}{4}$

Q.56 Number of integral values of k for which the equation $4\cos^{-1}(-|x|) = k$ has exactly two solutions, is

(1) 4 (2) 5 (3) 6 (4) 7

Q.57 Water is poured at the rate of $2m^3$/sec. into a cone of semi-vertical angle 45°. The rate at which periphery of water surface changes when height of the water in the cone is 2 meter, is

(1) 1 m/sec. (2) 2 m/sec. (3) 3m/sec. (4) 4 m/sec.

Q.58 The sum of the series $(2)^2 + 2(4)^2 + 3(6)^2 + \ldots\ldots\ldots\ldots$ upto 10 terms is equal to

(1) 11300 (2) 12100 (3) 12300 (4) 11200

Q.59 Let $f : R \to R$ be defined as $f(x) = 2x^3 + 7x - 5$ and $g(x) = f^{-1}(x)$. If $g'(4) = \frac{a}{b}$ where a and b are relatively prime positive integers then (a + b) is equal to

(1) 12 (2) 13 (3) 14 (4) 15

Q.60 Let $f(x) = \begin{cases} \cos(x^3); & -\infty < x < 0 \\ \sin(x^3) - |x^3 - 1|; & 0 \le x < \infty \end{cases}$

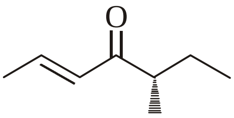
then number of points where $g(x) = f(|x|)$ is non-differentiable is

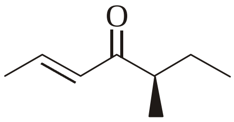
(1) 0 (2) 1 (3) 2 (4) 3

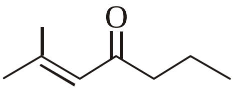
SPACE FOR ROUGH WORK

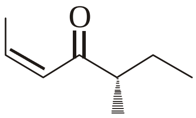
Q.61 The correct IUPAC name of $[Pt(NH_3)_2Cl_2]$ is
(1) Diamminedichloridoplatinum (II)
(2) Diamminedichloridoplatinum (IV)
(3) Diamminedichloridoplatinum (0)
(4) Dichloridodiammineplatinum (IV)

Q.62 What is correct structure of (2E, 5R)-5-methylhept-2-en-4-one.

(1) 

(2) 

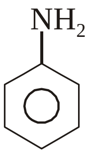
(3) 

(4) 

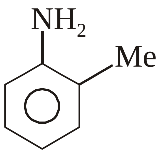
Q.63 Which of the following , shows metal deficiency defect ?
(1) NaCl (2) KCl (3) FeO (4) AgBr

Q.64 Due to the presence of ambidentate ligands coordination compounds show isomerism. Palladium complexes of the type $[Pd(C_6H_5)_2(SCN)_2]$ and $[Pd(C_6H_5)_2(NCS)_2]$ are
(1) linkage isomers
(2) coordination isomers
(3) ionisation isomers
(4) geometrical isomers

Q.65 Which of the following compound give isocyanide test ?

(a) 

(b) $Me-\overset{\overset{O}{\|}}{C}-NH_2$

(c) 

(d) $Me-NH_2$

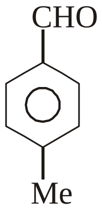
(1) a, b (2) a, c (3) a, d (4) c, d

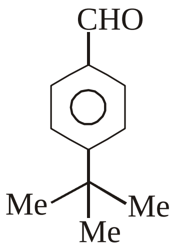
Q.66 Which of the following pairs contain ferromagnetic and ferrimagnetic solids respectively?
(1) Fe_2O_3, Fe_3O_4 (2) Fe_3O_4, Fe_2O_3 (3) CrO_2, Fe_3O_4 (4) Cr_2O_3, CrO_2

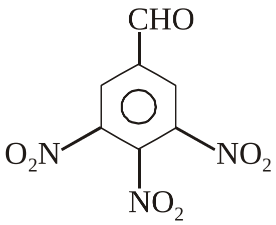
Q.67 Identify the incorrect statements for the behaviour of ethane-1, 2-diamine as a ligand.
(1) It is a neutral ligand.
(2) It is a didentate ligand
(3) It is a chelating ligand.
(4) It is a unidentate ligand

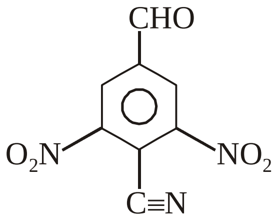
SPACE FOR ROUGH WORK

Q.68 Arrange the given compounds in decreasing order of their reactivity towards cannizaro reaction.

(a) 

(b) 

(c) 

(d) 

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

Q.69 The diffraction of barium with X-radiation of wavelength 227 pm gives a first order diffraction at 30°. Thus, distance between the two planes is -

(1) 114.5 pm (2) 113.5 pm (3) 4.54 pm (4) 227 pm

Q.70 Generally transition elements and their salts are coloured due to the presence of unpaired electrons in metal ions. Which of the following compounds are coloured?

(1) $KMnO_4$ (2) $Ag_2C_2O_4$ (3) $TiCl_4$ (4) Cu_2Cl_2

Q.71 Which pair of compound will be show mutarotation ?

(1) Glucose, Fructose (2) Glucose, Sucrose
(3) Maltose, Sucrose (4) Starch, Fructose

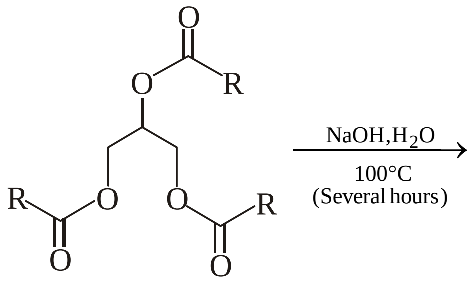
Q.72 Determine the solubility of $Co_2[Fe(CN)_6]$ in water at 25°C from the following data : Conductivity of saturated solution of $Co_2[Fe(CN)_6] = 2.06 \times 10^{-6}$ ohm^{-1} cm^{-1} and that of water $= 4.1 \times 10^{-7}$ ohm^{-1} cm^{-1}. The ionic molar conductivities of Co^{2+} and $[Fe(CN)_6]^{4-}$ are 86 and 444 ohm^{-1} cm^2 mol^{-1} respectively.

(1) 7.69×10^{-17} (2) 2.67×10^{-6} (3) 9.68×10^{-6} (4) 8.23×10^{-17}

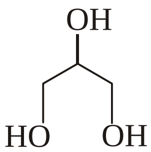
SPACE FOR ROUGH WORK

Q.73 General electronic configuration of actionoids is $(n-2)f^{1-14}(n-1)d^{0-2}ns^2$. Which of the following actinoids have one electron in 6d orbital?

(1) Pu (Atomic no. 94)
(2) Am (Atomic no. 95)
(3) Cm (Atomic no. 96)
(4) Bk (Atomic no. 97)

Q.74 

Product obtained in the above reaction is -

(1) $R-\overset{\overset{\displaystyle O}{||}}{C}-ONa$
(2) 

(3) Both (1) and (2)
(4) None of these

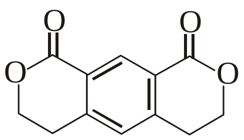
Q.75 A certain reaction proceeds in sequence of three elementary steps with rate contant k_1, k_2 and k_3. If $k_{obs} = \left(\frac{k_1}{k_2}\right)^{1/2}.k_3$ the observed E_a is -

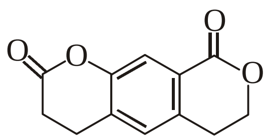
(1) $\frac{1}{2}\left(\frac{k_1}{k_2}\right)+E_3$
(2) $E_3+\frac{1}{2}(E_2-E_1)$
(3) $E_3\left(\frac{k_1}{k_2}\right)^{1/2}$
(4) $E_3+\frac{1}{2}(E_1-E_2)$

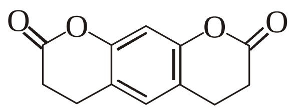
Q.76 In alkaline medium, H_2O_2 reacts with Fe^{3+} and Mn^{2+} respectively to give :

(1) Fe^{4+} and Mn^{4+}
(2) Fe^{2+} and Mn^{2+}
(3) Fe^{2+} and Mn^{4+}
(4) Fe^{4+} and Mn^{2+}

Q.77 Increasing order of rate of reaction with HNO_3 / H_2SO_4 is

(i) 

(ii) 

(iii) 

(1) (iii) < (ii) < (i)
(2) (ii) < (iii) < (i)
(3) (i) < (iii) < (ii)
(4) (i) < (ii) < (iii)

SPACE FOR ROUGH WORK

Q.78 Inversion of sucrose ($C_{12}H_{22}O_{11}$) is a first order reaction and is studied by measuring angle of rotation at different interval of time

$$\underset{\substack{\text{sucrose}\\ d(+)}}{C_{12}H_{22}O_{11}} + H_2O \xrightarrow{H^+} \underset{\substack{\text{glucose}\\ d(+)}}{C_6H_{12}O_6} + \underset{\substack{\text{fructose}\\ l(-)}}{C_6H_{12}O_6}$$

r_0 = angle of rotation at the start, r_1 = angle of rotation at time t.
r_∞ = angle of rotation at the complete reaction.
There is 50% inversion, when

(1) $r_0 = r_1 - 2r_\infty$ (2) $r_0 = 2r_1 - r_\infty$ (3) $r_0 = r_1 + r_\infty$ (4) $r_0 = r_1 - r_\infty$

Q.79 For the metallurgical process of which of the following calcined ore can be reduced by carbon ?

(1) haematite (2) chalcocite (3) iron pyrites (4) sphalerite

Q.80 p-nitrophenol and o-nitrophenol are separated by :

(1) Fractional distillation (2) Steam distillation
(3) Crystallisation (4) Fractional crystallisation

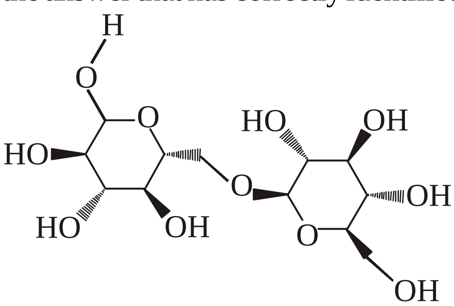
Q.81 25 ml of an aqueous solution of KCl was found to require 20 ml of 1 M $AgNO_3$ solution when titrated using a K_2CrO_4 as indicator. Depression in freezing point of KCl solution with 100% ionisation will be [**Given :** K_f = 1.86 K kg mol^{-1}]

(1) 5.0 °C (2) 2.97 °C (3) 1.6 °C (4) 0.8 °C

Q.82 The main reaction is not occuring in blast furnace during extraction of iron from haematite is ______.

(1) $Fe_2O_3 + 3CO \longrightarrow 2Fe + 3CO_2$ (2) $FeO + SiO_2 \longrightarrow FeSiO_3$
(3) $FeO + 3C \longrightarrow 2Fe + 3CO$ (4) $CaO + SiO_2 \longrightarrow CaSiO_3$

Q.83 Choose the answer that has correctly identified the number of acetals and hemiacetals in isomaltose:



	Acetal	**Hemiacetal**
(1)	0	0
(2)	1	0
(3)	0	1
(4)	1	1

Q.84 A solution containing 4g of polyvinyl chloride in 1 litre of dioxane was found to have an osmotic pressure of 6×10^{-4} atm at 300 K. The molecular mass of polymer is -

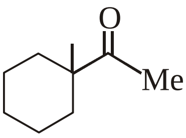
(1) 3×10^3 (2) 1.6×10^5 (3) 5×10^4 (4) 6.4×10^2

Q.85 In which of the following method of purification, metal is converted to its volatile compound which is decomposed to give pure metal?

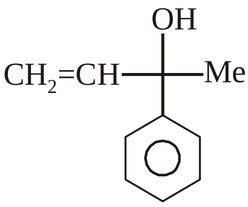
(1) heating with stream of carbon monoxide. (2) Cupellation

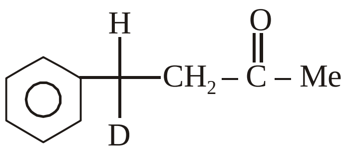
(3) liquation (4) distillation

Q.86 Which of following is in capable to show iodoform test ?

(1) 

(2) $Ph - CH = CH - \underset{\displaystyle OH}{\underset{|}{CH}} - Me$

(3) 

(4) 

Q.87 The reaction : $A(g) + 2B(g) \rightarrow C(g) + D(g)$ is an elementary process. In an experiment, the initial partial pressures of A and B are $P_A = 0.80$ atm, $P_B = 0.80$ When $P_C = 0.2$ atm, the rate of reaction relative to the initial rate is -

(1) 1/48 (2) 1/24 (3) 3/16 (4) 1/6

Q.88 $I_2 + Na_2CO_3$ sol^n. $\xrightarrow{\Delta}$ X + Y

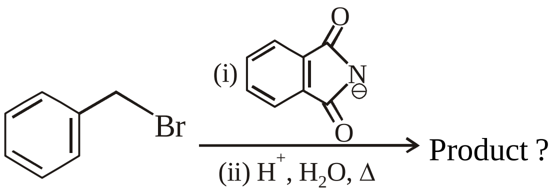
If 'X' gives coloured ppt with $Pb(CH_3COO)_2$ solution, then 'Y' will not be respond to which of the following

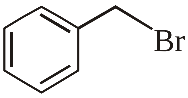
(1) $Y + H^+(aq) + H_2S$ (2) $Y + Cr_2O_7^{2-}(aq) + OH^-(aq)$

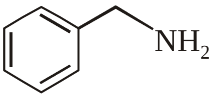
(3) $Y + H^+(aq) + SO_2$ (4) $Y + H^+(aq) + I^-(aq)$

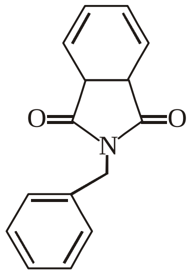
SPACE FOR ROUGH WORK

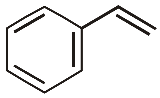
Q.89 What would be the product for the following reaction?



(1) 

(2) 

(3) 

(4) 

Q.90 Which of the following is **incorrect** regarding 1 mol of H_2 ?

$$H_2O(s, 1\text{ atm}, 272\text{ K}) \longrightarrow H_2O(l, 1\text{ atm}, 272\text{ K})$$

(1) $\Delta H° = +ve$ (2) $\Delta S° = +ve$ (3) $\Delta G° = +ve$ (4) $\Delta G° = -ve$

SPACE FOR ROUGH WORK

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ANSWER KEY

COURSE
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XII

TEST CODE				
1	1	2	7	8

Q.No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans	4	2	4	1	4	3	2	3	3	1	2	3	4	4	3
Q.No.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Ans	2	3	3	2	3	3	3	1	1	1	3	2	3	2	3
Q.No.	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Ans	2	4	2	2	1	3	1	1	3	1	4	4	4	1	3
Q.No.	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Ans	3	3	3	2	4	2	3	2	4	2	3	1	2	3	3
	IOP	OC	PC	IOP	OC	PC	IOP	OC	PC	IOP	OC	PC	IOP	OC	PC
Q.No.	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
Ans	1	2	3	1	3	3	4	4	4	1	1	2	3	3	4
	IOP	OC	PC	IOP	OC	PC	IOP	OC	PC	IOP	OC	PC	IOP	OC	PC
Q.No.	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
Ans	3	4	2	1	2	2	2	4	2	1	3	3	2	2	4

HINTS & SOLUTIONS

PHYSICS

Q.1 $A = 2 + |T - 2|$

for $t \le 2$

$a = 2 - t + 2$

$a = 4 - t$

$dv = (4 - t)\, dt$

$v = 4t - t^2/2$

at t = 2, v = 6 m/s

for t > 2

$a = 2 + t - 2 = t$

$$\int_6^v dv = \int_2^1 t dv$$

$$v - 6 = \left[t^2/2\right]_2^t$$

$$v = \frac{t^2}{2} + 4$$

at t = 4, v = 12 m/s

Friction f… is f = ma

So work …

=

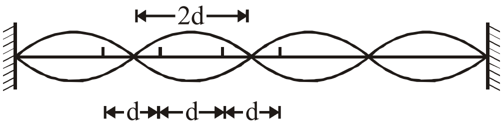
$$\Rightarrow \frac{GM}{R_2^3} = \frac{4\pi^2}{T^2}$$

$$g = \frac{GM}{R_1^2} = \frac{4\pi^2 R_2^3}{T^2 R_1^2}$$

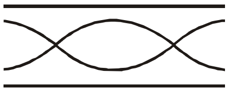
$$\frac{1}{4\pi\varepsilon_0}\left(\frac{-2Q}{PA}\right) + \frac{1}{4\pi\varepsilon_0}\frac{Q}{PB} = 0$$

$$\frac{2}{PA} = \frac{1}{PB} \Rightarrow 4PB^2 - 4PB^2 = PA^2$$

$(x = 5a)^2 + y^2 = (4a)^2$

Q.5 

length of string is 8d.

Q.6 

36cm

$\lambda = 36$ cm

frequency remains same

now $C = \sqrt{\frac{rRT}{M}} = f\lambda$

$\Rightarrow \quad \frac{\lambda}{\sqrt{T}} = \text{constant}$

Q.7 Say speed of boat is v w.r.t. water and speed of river is C. Then, distance travelled in ground frame

$= (c + v) \times \frac{1}{2}$ hour $+ (v - c) \times \frac{1}{2}$ hour

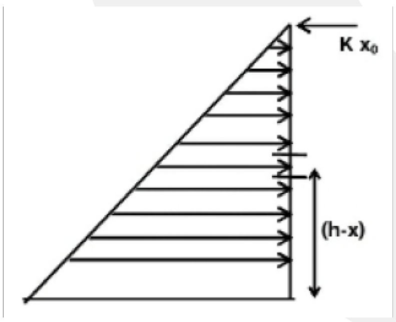
$= v \times 1$ hour

= distance travelled by boat w.r.t. river.

Q.8 $kx_0 h = \int_0^h (bdx)\rho gx(h - x)$

$\Rightarrow kx_0 h$

$= b\rho g \int_0^h (hx - x^2)dx = b\rho g\left[h\frac{h^2}{2} - \frac{h^3}{3}\right]$



$\Rightarrow kx_0 h = b\rho g\,\frac{h^3}{6} \Rightarrow x_0 = \frac{b\rho gh^2}{6k}$

$PE = \frac{1}{2}kx_0^2 = \frac{1}{2}k\frac{b^2\rho^2g^2h^4}{36k^2} = \frac{b^2\rho^2g^2h^4}{72k}$

Q.9 $T = 2\pi\sqrt{LC}$

In SHM time from A to $\frac{A}{2}$ is $\frac{T}{6}$ so here also it is $\frac{T}{6}$.

Q.10 Spring time period is always

$T = 2\pi\sqrt{\frac{m}{k}}$

Q.11 Initial extension is $x = \frac{mg}{k}$

at mean position

$F + mg = k\left(\frac{mg}{k} + y\right)$

$y = \frac{F}{m} = A$ (amplitude of SHM)

maximum displacement is 2A.

Q.12 $\frac{dT}{dx} = -\frac{l}{kA}$

Q.13 $\omega = F \times \frac{\pi R}{2} = \mu mg \times \frac{\pi l}{2}$

Q.14 The cylinder will step so

$f = \mu mg \cos\theta$

Q.15 Centre of mass falls vertically down so that mass m falls at origin.

Q.16 $H_{max} = \frac{(20)^2 \sin^2\theta}{2g} \le 5$

$\Rightarrow \sin\theta \le \frac{1}{2} \Rightarrow \theta \le 30^\circ$

$\therefore R = \frac{(20)^2 \sin 2\theta}{g} \rightarrow \text{max. for } \theta = 30^\circ$

$\Rightarrow R_{max} = 20\sqrt{3}$ m.

Q.17 $T_A = T_B = T$(say)

Now $V_A = \frac{nRT}{16P_0} = V$

$\Rightarrow V_B = V_C = \frac{nRT}{2P_0} = 8V$

Now in A $\rightarrow$ C, $16\,P_0\,V^\gamma = P_0\,(8V)^\gamma$

$$\Rightarrow \gamma = \frac{4}{3} \Rightarrow C_V = \frac{R}{\gamma - 1} = 3R$$

Q.18 Both waves at M from P and Q are in same phase as originated.

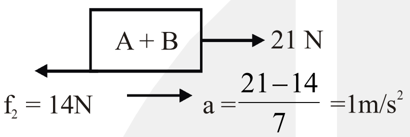
$\therefore$ Constructive interference

$$\Rightarrow I = \left(\sqrt{I_0} + \sqrt{I_0/4}\right)^2 = \frac{9I_0}{4}$$

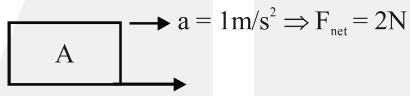
Q.19 $f_{1_{max}}$ (between A and B) = 0.4 × 20 = 8 N

$f_{2_{max}}$ (between B and ground) = 0.2 × 70 = 14 N

Assuming system,



$\therefore$



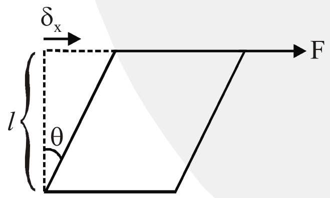
$\therefore f_1 = 2\text{ N} < f_{1max} \Rightarrow$ Assumption correct

$\therefore \quad f_1 - f_2 = 2$N.

Q.20 $2Sl = 1.8 \times 10^{-2}$ N

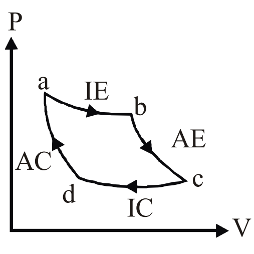
$$\Rightarrow S = \frac{1.8 \times 10^{-2}}{2 \times 0.1} = 0.09 \text{ N/m}$$

Q.21 $\theta \approx \frac{\delta x}{l} = \frac{1.2 \times 10^{-4}}{5 \times 10^{-2}}$



$$\therefore \eta = \frac{F/A}{\theta} = 1.67 \times 10^{10} \text{ N/m}^2$$

Q.22



Q.23 By equation of continuity, 'A' in horizontal pipe $\rightarrow$ constant $\Rightarrow$ v $\rightarrow$ constant $\Rightarrow$ same 'P' at all points.

Q.24 $\alpha = -\omega \frac{d\omega}{d\theta} \propto \theta = -k\theta$

$$E = \frac{1}{2} I\omega^2 \Rightarrow \frac{dE}{d\theta} = \frac{1}{2} I \cdot 2\omega \frac{d\omega}{d\theta} = -k I \theta$$

$$\therefore \int dE = -k I \int \theta \, d\theta \Rightarrow \Delta E \propto \theta^2$$

Q.25 On earth's surface, $\sigma = \frac{x\rho r g}{2}$

In the mine, $\sigma = \frac{y\rho r g_d}{2}$

Dividing, we get $\frac{x}{y} = \frac{g_d}{g}$

$$= \frac{g\left(1 - \frac{d}{R}\right)}{g} = 1 - \frac{d}{R}$$

Hence the correct choice is (1)

Q.26 $f = M \Rightarrow M = \frac{\text{Tesla} - m^2}{\text{Ampere}}$

F = qVB

$$\Rightarrow \text{Tesla} = \frac{N}{\text{coulomb} \times (\text{meter/second})}$$

$$\frac{kg - ms^2}{\text{Ampere} \times \text{meter}} = \frac{kg - s^{-2}}{\text{Ampere}}$$

$$M = \frac{kg - m^2 s^{-2}}{\text{Ampere}^2} \Rightarrow ML^2T^{-2}A^{-2} = [M]$$

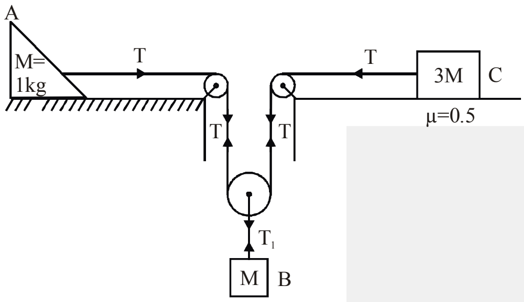
Also, $\frac{L}{R} = T$

$CR = T \Rightarrow LC = T^2$

$$\therefore C = \frac{T^2}{L} = \frac{T^2}{M}$$

$\Rightarrow [C] = M^{-1}T^{-2}T^4A^2$

Q.27 Clearly the block on the right hand side will not move



$Mg - 2T = Ma_B$
$T = Ma_A = 2Ma_B$ (constraint)
$2T = 4M\, a_B$
$Mg = 5M\, a_B$

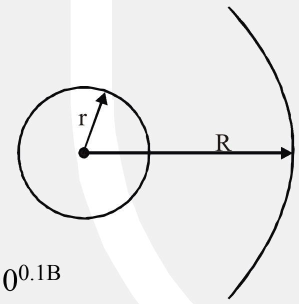
$a_B = \dfrac{g}{5} = 2 m/s^2$

$T_1 = 2T = 4M \times 2 = 8$ N

$W = 8 \times \left(-\dfrac{1}{2} \times 2 \times 1^2\right) = -8$ J

Q.28 $1 \times 0.6 = v_B \times 0.3$, $v_B = 2$ m/s
Force = $\rho A V^2 = 10^3(0.3)(2 \times 2) = 1.2 \times 10^3$

Q.29 $B = 10\log_{10}\left(\dfrac{I}{I_0}\right)$



$\Rightarrow \dfrac{I}{I_0} = 10^{B/10}$

$\Rightarrow I = \dfrac{P}{4\pi r^2} = I_0 10^{0.1B}$

$\Rightarrow P = 4\pi r^2 I_0 10^{0.1}$ B

$I_R = \dfrac{4\pi r^2 I_0 10^{0.1B}}{4\pi R^2} = \dfrac{r^2}{R^2}[I_0]10^{0.1B}$

Q.30 Before collision $v_0 = \vec{u}$; $\vec{v}_m = 0$
$v_3 = -\vec{u}$
After collision $v_0 = 0$; $v_m = \vec{u}$
$v_3 = 3\vec{u}$

MATHEMATICS

Q.31 $\log_4\left(\dfrac{3-x}{3+x}\right) = \log_4\left(\dfrac{1-x}{2x+1}\right)$

$\Rightarrow \dfrac{3-x}{3+x} = \dfrac{1-x}{2x+1}$

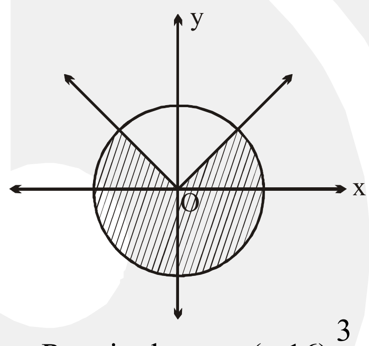
$(3-x)(2x+1) = (1-x)(3+x)$
$5x - 2x^2 + 3 = 3 - 2x - x^2$
$x^2 - 7x = 0 \Rightarrow x = 0$ or $x = 7$.

Reject x = 7; as domain $= x \in \left(\dfrac{-1}{2}, 1\right)$.

$\therefore$ Only solution is $x = 0$.

Q.32 From the first radical sign
$x^2 + y^2 \le 16$ i.e. interior of a circle with circle (0, 0) and radius 4.
From the 2nd radical sign $y \le |x|$

i.e. $\dfrac{3}{4}$ th of the circle



$\therefore$ Required area $= (\pi \cdot 16)\dfrac{3}{4} = 12\pi$. **Ans.**

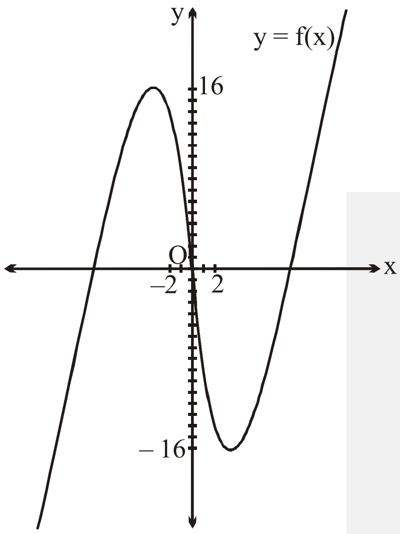
Q.33 D = 0 gives $m = 6, \dfrac{2}{3}$

Q.34 Seperable $\int_0^y e^y\, dy = \int_0^x (2 + \cos x)\, dx$

$\Rightarrow e^y - 1 = 2x + \sin x$

For $x = \dfrac{\pi}{2}$, we find $y = \ln(2+\pi)$. **Ans.**

Q.35 Let $y = f(x) = x^3 - 12x$ and $y = -a$
For $f(x) = -a$ to have exactly one real root, we must have
$-a > 16$ or $-a < -16$
$\Rightarrow a \in (-\infty, -16) \cup (16, \infty)$



Ans.

Alternate: Let $f(x) = x^3 - 12x + a$

$f'(x) = 3x^2 - 12 = 3(x+2)(x-2)$

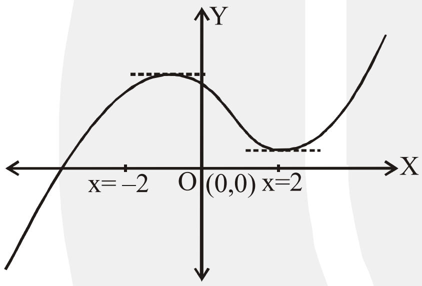
$\therefore$ The equation $f(x) = 0$

has exactly one real root, if

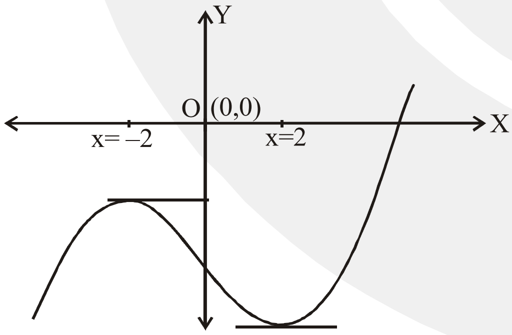
$f(-2)\,f(2) > 0 \Rightarrow (16 + a)(-16 + a) > 0$

$\Rightarrow (a - 16)(a + 16) > 0$

$\therefore a \in (-\infty, -16) \cup (16, \infty)$



OR



Two possible graph of f(x). **Ans.**

Q.36 $\displaystyle\sum_{r=1}^{15} r\cdot\frac{a_r}{a_{r-1}} = \sum_{r=1}^{15} r\cdot\frac{^{15}C_r}{^{15}C_{r-1}}$

$$= \sum_{r=1}^{15} r\cdot\frac{(15)!}{(15-r)!\,r!} \times \frac{(r-1)!\,(15-r+1)!}{(15)!}$$

$$= \sum_{r=1}^{15} (16-r) = (1 + 2 + 3 + \ldots\ldots + 15)$$

$$= \frac{15\times 16}{2} = 120.$$

Q.37 Using LMVT, $\forall$ some $c \in (1, 8)$ s. t.

$$f'(c) = \frac{f(8) - f(1)}{7} = \frac{f(8) - 3}{7} \le 1.4$$

$f(8) = 9 \cdot 8 + 3 = 12.8$ Ans.

Q.38 $\because \displaystyle\int (x^9 + x^6 + x^3)(2x^6 + 3x^3 + 6)^{\frac{1}{3}}\,dx$

$$= \int (x^8 + x^5 + x^2)\,(2x^9 + 3x^6 + 6x^3)^{\frac{1}{3}}\,dx$$

Let $2x^9 + 3x^6 + 6x^3 = t$

$\Rightarrow$ $18(x^8 + x^5 + x^2)dx = dt$

$$\therefore\ I = \int \frac{t^{1/3}}{18}dt = \frac{1}{18}\cdot\frac{t^{4/3}}{4/3} + C = \frac{1}{24}t^{4/3} + C$$

$\therefore AB = 24 \times \dfrac{4}{3} = 32$ **Ans.**

Q.39 $\cos\theta + \sqrt{3}\sin\theta = 2\sin\theta$

$\Rightarrow \cot\theta = 2 - \sqrt{3}$ and $\tan\theta = 2 + \sqrt{3}$

$$\frac{\sin\theta - \sqrt{3}\cos\theta}{\cos\theta} = \tan\theta - \sqrt{3}$$

$= 2 + \sqrt{3} - \sqrt{3} = 2$ **Ans.**

Q.40 Use L'Hospital's rule

$$\lim_{x\to\infty}\frac{(\tan^{-1}x)\sqrt{x^2+1}}{x}\ ;\ \frac{\pi}{2}\lim_{x\to\infty}\frac{\sqrt{x^2+1}}{x}$$

$= \dfrac{\pi}{2}$. **Ans.**

Q.41 We know that

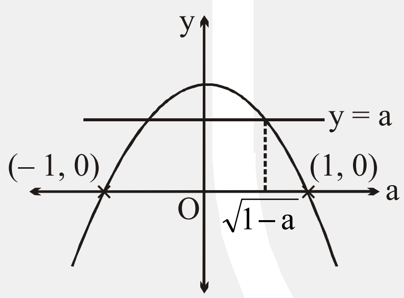
$\frac{\sin\theta}{\theta}$ and $\frac{\theta}{\tan\theta}$ both are decreasing functions of θ in $\left(0, \frac{\pi}{2}\right)$. So maximum value, when $\theta \to 0$ is $1 + 1 = 2$ and minimum value, when $\theta \to \frac{\pi}{2}$ is $\frac{2}{\pi}$.

Q.42 $T_n = \frac{(n+1)^2 - n}{n(n+1)} = 1 + \left(\frac{1}{n} - \frac{1}{n+1}\right)$

$\therefore\ S_{10} = 10 + \left(1 - \frac{1}{11}\right) = \frac{120}{11}$ **Ans.**

Q.43 $A(a) = 2\int_0^{\sqrt{1-a}} \left((1 - x^2) - a\right)dx = \frac{4}{3}(1 - a)^{3/2}$

$\therefore\ A(0) = \frac{4}{3}$



and $A\left(\frac{1}{2}\right) = \frac{4}{3}\left(\frac{1}{2}\right)^{\frac{3}{2}} \Rightarrow \frac{A(0)}{A\left(\frac{1}{2}\right)} = 2\sqrt{2}$.

Q.44 Use expansion.

Q.45 Replace x by $(1 - x)$, we get

$$\frac{f^2(1-x)}{f(x)} = (1 - x)^3$$

$\therefore\ f^3(x) = x^6(1 - x)^3 \Rightarrow f(x) = x^2(1 - x)$

$\Rightarrow f\left(\frac{1}{2}\right) = \frac{1}{2}$ **Ans.**

Q.46 Let $u = \frac{c}{x}$, so $du = \frac{-c}{x^2}dx$, so $\int_1^{\sqrt{c}} \frac{f(x)}{x}dx$

$= \int_c^{\sqrt{c}} \frac{u f(u)}{c}\left(\frac{-x^2}{c}\right)du = \int_{\sqrt{c}}^{c} \frac{f(u)}{u}du$

Therefore, $\int_1^c \frac{f(x)}{x}dx$

$= \int_1^{\sqrt{c}} \frac{f(x)}{x}dx + \int_{\sqrt{c}}^{c} \frac{f(u)}{u}du = 3 + 3 = 6$ **Ans.**

Q.47 $2\alpha^3 = \alpha - 1 \Rightarrow \alpha^3 = \frac{\alpha - 1}{2}$

$\therefore\ \alpha^3 + \beta^3 + \gamma^3 = \frac{1}{2}(\alpha - 1 + \beta - 1 + \gamma - 1)$

$= \frac{1}{2}(\alpha + \beta + \gamma - 3) = -\frac{3}{2}$ **Ans.**

Q.48 $\int e^x(\tan x - x + \tan^2 x - \tan^2 x - 2\tan x \sec^2 x)dx$

$= \int e^x(\tan x - x + \tan^2 x)\,dx - \int e^x(\tan^2 x + 2\tan x \sec^2 x)dx$

$= e^x(\tan x - x - \tan^2 x) + C$

$f(x) = \tan x - x - \tan^2 x$

$f\left(\frac{\pi}{4}\right) = \frac{-\pi}{4}$.

Q.49 $(e - 1)e^{xy} + x^2 = e^{x^2} + y^2$

$(e - 1)\,e^{xy}(xy' + y) + 2x = e^{x^2+y^2}(2x + 2yy')$

Put $x = 1$ and $y = 0$ to get $\left.\frac{dy}{dx}\right|_{(1,0)} = 2$.

Q.50 $y = \left(5 - x^{2/3}\right)^{\frac{3}{2}}$

$\frac{dy}{dx} = \frac{-3}{2}\sqrt{\left(5 - x^{2/3}\right)}\left(\frac{2}{3}, \frac{1}{x^{1/3}}\right)$

$\left.\frac{dy}{dx}\right|_{M(1,8)} = \sqrt{5 - 1} = -2$

When $x = 1$, $y = 8$

tangent is $y - 8 = -2(x - 1)$

$2x + y = 10$

length of intercept $= \sqrt{100 + 25} = \sqrt{125}$

$\Rightarrow\ N = 125$ **Ans.**

Q.51 $\sin\left(\frac{5x}{6}\right)+\cos\left(\frac{10x}{9}\right)=2$

$\sin\left(\frac{5x}{6}\right)=1$

$\Rightarrow \frac{5x}{6}=2n\pi+\frac{\pi}{2} \Rightarrow x=(4n+1)\frac{3\pi}{5}, n \in I$

and $\cos\left(\frac{10x}{9}\right)=1$

$\Rightarrow \frac{10x}{9}=2m\pi$

$\Rightarrow x=\frac{9m\pi}{5}, m \in I$

$\therefore$ least common value of x is $\frac{27\pi}{5}$.

Q.52 $l = \lim_{x\to 1} k\left(\frac{x-1-\ln x}{(x-1)\ln x}\right)$

$x = 1 + h$

$l = k\lim_{h\to 0}\frac{h-\ln(1+h)}{h^2} = \frac{k}{2}$

$\therefore$ For $\sin^{-1}\left(\frac{k}{2}\right)$ to exist

$-1 \le \frac{k}{2} \le 1 \Rightarrow k \in [-2, 2]$

Number of integers is 5. **Ans.**

Q.53 $\log_{\pi}x > 0 \Rightarrow x > 1$

For $x > 1$, $\sin^{-1}\frac{2x}{1+x^2} = \pi - 2\tan^{-1}x$

$\log_{\frac{1}{\pi}}\left(\pi - 2\tan^{-1}x + 2\tan^{-1}x\right) = \log_{\frac{1}{\pi}}(\pi)$

$= -1$ **Ans.**

Q.54 $y_1 = e^{2\sin^{-1}x}\cdot\frac{2}{\sqrt{1-x^2}} = \frac{2y}{\sqrt{1-x^2}}$

$y_1^2(1-x^2) = 4y^2$

$y_1^2(-2x) + (1-x^2)2y_1y_2 = 8yy_1$

$(1-x^2)y_2 = xy_1 + 4y$

$\therefore \lambda = 4$. **Ans.**

Q.55 Put $x^2 - 1 = t$

$I = \frac{1}{2}\int_0^1 \tan^{-1}t\,dt = \frac{1}{2}\left[\tan^{-1}t\cdot t\Big|_0^1 - \int_0^1\frac{t}{1+t^2}dt\right]$

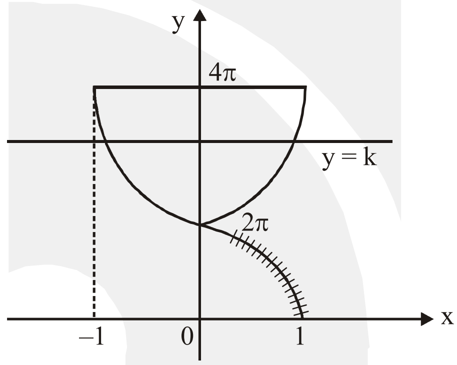
$I = \frac{\pi}{8}-\frac{1}{2}\cdot\frac{1}{2}\ln(2) = \frac{\pi}{8}-\frac{\ln 2}{4}$. **Ans.**

Q.56 Graph of $y = 4\cos^{-1}(-|x|)$

From the graph it is

Clear that $k \in (2\pi, 4\pi]$

$\therefore$ integral values of k are 7, 8, 9, 10, 11, 12



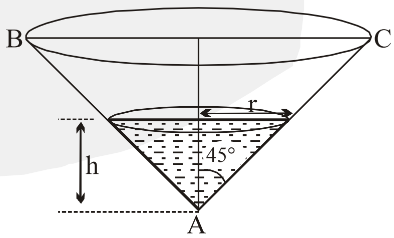
Q.57 We have

$\frac{dV}{dt}=2 \Rightarrow \frac{d}{dt}\left(\frac{1}{3}\pi r^3\right)=2$

[Here r = h, as $\theta = 45°$]

$\Rightarrow \pi r^2\frac{dr}{dt}=2 \Rightarrow \frac{dr}{dt}=\frac{2}{\pi r^2}$ ....(1)

Now, perimeter = $2\pi r$ = p (let)



$\Rightarrow \frac{d}{dt}(2\pi r) = 2\pi\left(\frac{2}{\pi r^2}\right) = \frac{4}{r^2}$ ....(2)

(Using equation (1))

When h = 2 meters $\Rightarrow$ r = 2 meters

Hence $\frac{dp}{dt} = \frac{4}{4} = 1$ m/sec. **Ans.**

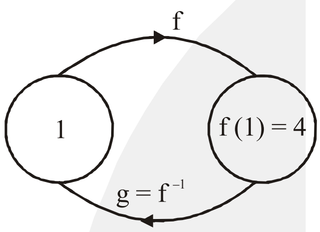
Q.58 Here, $T_n = n\,(2n)^2 = 4n^3$

$$\therefore\ S_{10} = \sum_{n=1}^{10} T_n = 4\sum_{n=1}^{10} n^3$$

$$= 4\left(\frac{10\times 11}{2}\right)^2 = 4 \times (55)^2 = (2 \times 55)^2$$

$= (110)^2 = 12100$. **Ans.**

Q.59 $g'(4) = \frac{1}{f'(1)} = \frac{1}{13} \equiv \frac{a}{b}$



So, a = 1 and b = 13
Hence, (a + b) = 14 **Ans.**

Q.60 g(x) =

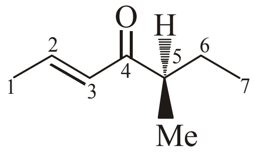
$$f(|x|) = \begin{cases} -\sin(x^3) + x^3 + 1; & -\infty < x \le -1 \\ -\sin(x^3) - x^3 - 1; & -1 \le x < 0 \\ \sin(x^3) + x^3 - 1; & 0 \le x < 1 \\ \sin(x^3) - x^3 + 1; & 1 \le x < \infty \end{cases}$$

$\therefore$ g(x) is non-derivable at x = –1, 1.

CHEMISTRY

Q.61 $[Pt(NH_3)_2Cl_2]$
x + 0 + (–2) = 0
x = +2
NH_3 (Ammine)–Neutral ligand
Cl^- (Chloride) $\rightarrow$ Anionic ligand
* Oxidation state of Pt = +2
* It is a neutral complex $\rightarrow$
CMI name – Platinum
* Ligands are named alphabetically
* Naming of complex $\rightarrow$
Diamminedichloridoplatinum(II)

Q.62

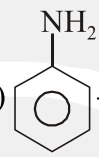


(2E, 5R)-5-methylhept-2-en-4-one.

Q.63 Theory based

Q.64 $[Pd(C_6H_5)_2(SCN)_2] \longleftrightarrow [Pd(C_6H_5)_2(NCS)_2]$
SCN $\rightarrow$ Thiocynato
NCS $\rightarrow$ Isothiocynato
In both complexes Pd is co-ordinated by ambidentate ligands it shows linkage isomerism.

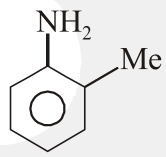
Q.65 (a)



$\longrightarrow$ Give isocyanide test

(b) $Me - \overset{O}{\overset{\|}{C}} - NH_2 \longrightarrow$ Amide functional group

(c)

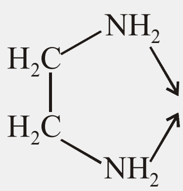


$\longrightarrow$ Ortho methyl aniline

not give isocyanide test
(d) $Me - NH_2 \longrightarrow 1°$-Amine give isocyanide test

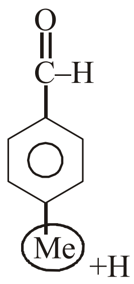
Q.66 Theory based

Q.67 Ethane-1, 2-diamine

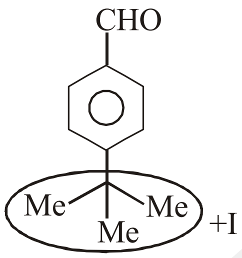


* It is a neutral ligand
* Bidentate ligand
* Chelating ligand

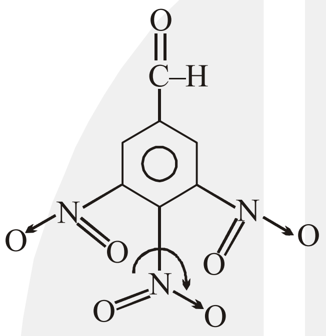
Q.68 (a)



(b)

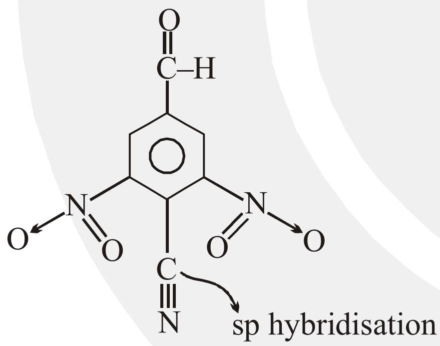


(c)



SIR

(d)



Planar

Q.69 $2d\sin\theta = n\lambda$

$2d\sin 30° = 227 \times 1$

$$d = \frac{227}{2 \times \sin 30°} = \frac{227}{2 \times \frac{1}{2}} = 227 \text{ pm}$$

Q.70 $KMnO_4 \rightarrow$ Purple – due to charge transfer

$Ag_2C_2O_4 \rightarrow$ Colourless

$TiCl_4 \rightarrow$ Colourless

$Cu_2Cl_2 \rightarrow$ Colourless

Q.71 Glucose and Fructose are monosaccharides than show mutarotation

Q.72 $K_{\text{saturated solution}} = 2.06 \times 10^{-6}$ ohm^{-1} cm^{-1}

$K_{\text{water}} = 4.1 \times 10^{-7}$ ohm^{-1} cm^{-1}

$K_{CO_2[Fe(CN)_6]} = K_{sol} - K_{H_2O}$

$= 2.06 \times 10^{-6} - 0.41 \times 10^{-6}$

$= 1.65 \times 10^{-6}$ ohm^{-1} cm^{-1}

$\Lambda_m^0\ [Co_2(Fe(CN)_6)] = 2\Lambda_m^0\,(Co^{2+}) + \Lambda_m^0\,[Fe(CN)_6]^{-4}$

$= 2 \times 86 + 444$

$= 616$ ohm^{-1} cm^{-1} mol^{-1}

For SSS

$\Lambda_m^0 = \Lambda_m$

$$\Lambda_m = \frac{K \times 1000}{M}$$

$$611 = \frac{1.65 \times 10^{-6} \times 1000}{M}$$

$M = 0.267 \times 10^{-5}$

S or M $= 2.67 \times 10^{-6}$

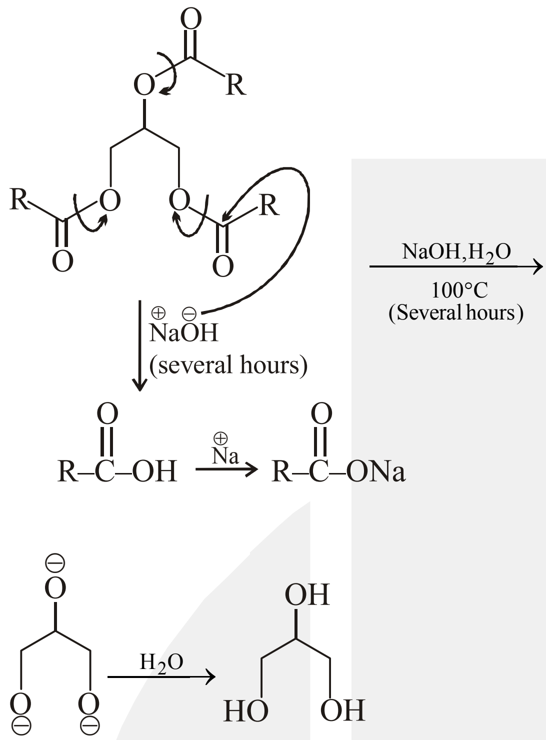
Q.73 (1) Pu (Atomic no. 94) $\rightarrow$ [Rn], $5f^6, 6d^0, 7s^2$

(2) Am (Atomic no. 95) $\rightarrow$ [Rn], $5f^7, 6d^0, 7s^2$

(3) Cm (Atomic no. 96) $\rightarrow$ [Rn], $5f^7, 6d^1, 7s^2$

(4) Bk (Atomic no. 97) $\rightarrow$ [Rn], $5f^9, 6d^0, 7s^2$

Q.74



Q.75 $k_{obs} = \left(\frac{k_1}{k_2}\right)^{1/2} . k_3$

$$= \left(\frac{A_1 e^{-E_1/RT_1}}{A_2 e^{-E_2/RT_2}}\right)\left(A_3 e^{-E_3/RT}\right)$$

$$= \left(\frac{A_1}{A_2}\right)^{1/2} . A_3 \left[e^{\frac{-E_1+E_2}{RT}}\right]^{1/2} e^{-E_3/RT}$$

$$= \left(\frac{A_1}{A_2}\right)^{1/2} . A_3 \left[e^{\frac{-\left(\frac{1}{2}(E_1-E_2)+E_3\right)}{RT}}\right]$$

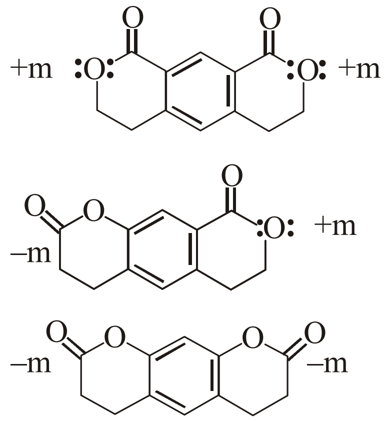
Comparing with $Ae^{-Ea/RT}$

$$E_a = E_3 + \frac{1}{2}(E_1 - E_2)$$

Q.76 $Fe^{3+} + H_2O_2 / OH^- \longrightarrow Fe^{2+} + O_2$

$Mn^{2+} + H_2O_2 / OH^- \longrightarrow \overset{+4}{Mn}O_2 + H_2O$

Q.77



Increasing rate of reaction with HNO_3 / H_2SO_4 is (i) < (ii) < (iii)

Q.78 Let γ, β and γ be the angle of rotation of sucrose, glucose and fructose per mol respectvely.

$C_{12}H_{22}O_{11} + H_2O \xrightarrow{H^{\oplus}} C_6H_{12}O_6 + C_6H_{22}O_6$

t = 0 a 0 0

$\Rightarrow a.\alpha = r_0$ ....(1)

t = 50% $a - \frac{a}{2} = \frac{a}{2}$ $\frac{a}{2}$ $\frac{a}{2}$

$\Rightarrow \frac{a}{2}(\alpha + \beta + \gamma) = r_1$ ...(2)

t = ∞ 0 a a

$\Rightarrow a(\beta + \gamma) = r_\infty$

$$\frac{a}{2}(\alpha + \beta + \gamma) = r_1$$

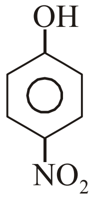
$$a\alpha + a(\beta + \gamma) = 2r_1$$

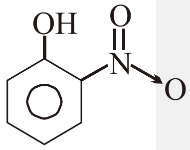
$$r_0 + r_\infty = 2r_1$$

$$r_0 = 2r_1 - r_\infty$$

Q.79

(1) Haematite(Fe_2O_3)
→ Oxides ore is directly reduced by carbon ($Fe_2O_3 + 3C \longrightarrow 2Fe + CO\uparrow$)
(2) Chalcocite(Cu_2S)
(3) Iron pyrites (FeS_2)
(4) Sphalerite (ZnS)
} Sulphide ores are roasted first converted to oxide and then reduced by coke.

Q.80 p-nitrophenol 

o-nitrophenol 

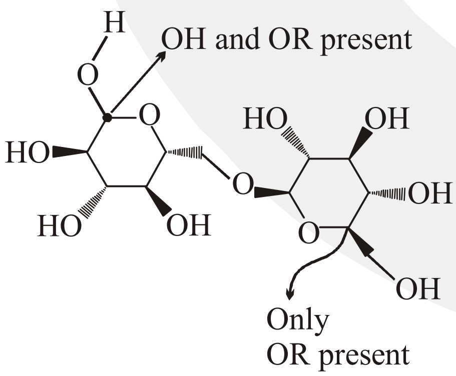
p-nitrophenol and o-nitrophenol are separated by Steam distillation

Q.81 $AgNO_3 + KCl$
20 ml 25 ml
1M xM
$20 \times 1 \times 1 = 25 \times x \times 1$

$$m \text{ or } M = 25 = \frac{20}{25} = \frac{4}{5} = 0.8$$

$\Delta T_f = K_f .m.i$
$\Delta T_f = (1.86)\ (0.8)\ (2)$
$\Delta T_f = 3.2$ **Ans**

Q.82 (1) $Fe_2O_3 + 3CO \longrightarrow 2Fe + 3CO_2$
(In reduction zone)
(2) $FeO + SiO_2 \longrightarrow FeSiO_3$
(No reaction in blast furnance)
(3) $FeO + 3C \longrightarrow 2Fe + 3CO$
(In combustion zone)
(4) $CaO + SiO_2 \longrightarrow CaSiO_3$
(Slag formation)

Q.83 

If one C have OH and OR than hemiacetals.
If one C have OR and OR than acetal.

Q.84 Given :
Weight of PVC : W = 4 gm
Volume of solution, V = 1L
Osmotic pressure, $\pi = 6 \times 10^{-4}$
Temperature (T) = 300 K
$\pi V = nRT$

$$(6 \times 10^{-4}) \times 1 = \frac{4}{M} \times 0.0821 \times 300$$

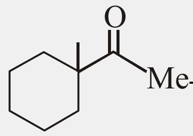
$$M = \frac{4}{6 \times 10^{-4}} \times 0.0821 \times 300$$

$M = 1.6 \times 10^5$

Q.85 This type of method of purification is used in Mond's process.
For - Ni ; Reagent - CO

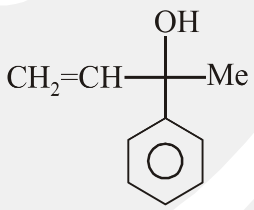
$$Ni(impure) + CO(reagent) \xrightarrow{\Delta} Ni(CO)_4$$

$$Ni(CO)_4 \xrightarrow{\Delta} \underset{(Pure)}{Ni} + CO\uparrow$$

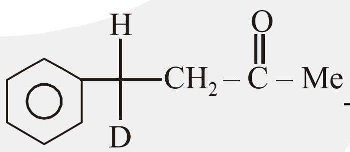
Q.86 (1)  $\longrightarrow$ Give Iodoform Test

(2) $Ph - CH = CH - \underset{\displaystyle OH}{\underset{|}{CH}} - Me \longrightarrow$

Give Iodoform Test

(3)  $\longrightarrow$

In capable to show Iodoform Test

(4)  $\longrightarrow$ Give

Iodoform Test

Q.87 $A(g) + 2B(g) \rightarrow C(g) + D(g)$
0.6 0.8 0 0
0.6 – x 0.8 – 2x x x
[0.4] [0.4] x = 0.2
$R_1 = K[A]\ [B]$
$= K[0.8]\ [0.8]^2$

$R_2 = K\,[0.6]\,[0.4]^2$

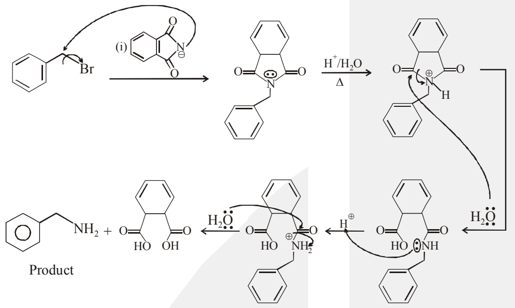
$$\frac{R_2}{R_1} = \frac{K[0.6][0.4]^2}{K[0.8][0.8]^2} = \frac{3}{16}$$ **Ans.**

Q.88 $I_2 + Na_2CO_3 \xrightarrow{\Delta} NaI(X) + NaIO_3(Y)$

$Y = NaIO_3$(Oxidising agent)

It will not oxidise $Cr_2O_7^{2-}$ in basic medium.

Q.89



Q.90 Theory based