PRACTISE PAPER 8
PAPER-I
Part-I (Physics)
Section-I

Straight Objective Type

Q1

According to Bernoulli's theorem $P + \frac{1}{2}\rho v^2 + \rho g h = K$ (constant). The dimensions of K/P are same as that of which of the following?

a. Thrust
b. Pressure
c. Angle
d. Viscosity

Q2

The displacement x of a particle varies with time t as $x = ae^{\propto t} + be^{\beta t}$, where a, b, α and β are positive constants. The velocity of particle will

a. Go on decreasing with tune.
b. Be independent of α and β
c. Drop to zero where $\alpha = \beta$
d. Go on increasing with time.

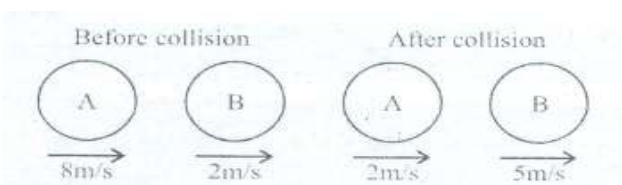
Q3

Two boys are standing at the ends A and B of a ground, where $AB = a$. The boy at B starts running in a direction perpendicular to AB with velocity v_1. The boy at A starts running simultaneously with velocity v and catches the other boy in a time t_1 where t is

a. $a^2/\sqrt{v^2 + v_1^2}$
b. $a/\sqrt{v^2 - v_1^2}$
c. $a^2/(v + v_1)$
d. $a(v + v_1)$

Q4

The two diagrams show the situation before and after a collision between two spheres A and B of eQual radii moving along the same straight line on a smooth horizontal surface. The coefficient of restitution e is:



a. $\frac{4}{3}$
b. $\frac{1}{2}$
c. $\frac{2}{3}$
d. $\frac{3}{4}$

Q5

A vertical cylinder closed at both ends is fitted with a smooth piston dividing the volume into two parts each containing one mole of air. At the eQuilibrium temperature of 320 K, the upper end and lower parts are in the ratio 4 : 1. The ratio will become 3 : 1 at a temperature of :

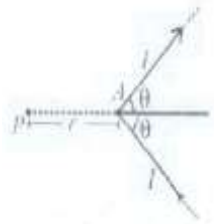
a. 450 K

b. 328 K

c. 480 K

d. 670 K

Q6



An infinite V-shaped wire carrying current I is shown in figure. Find the magnitude of magnetic field at point P due to the wire, $AP = r$ if

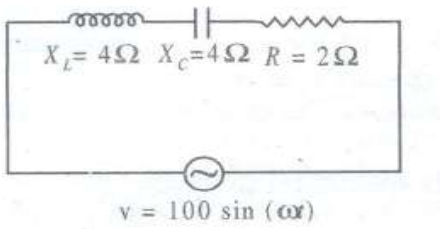
a. $\frac{\mu_0 I}{2\pi r} tan\theta$

b. $\frac{\mu_0 I}{\pi r} tan\left(\frac{\theta}{2}\right)$

c. $\frac{\mu_0 I}{2\pi r} cot\left(\frac{\theta}{2}\right)$

d. $\frac{\mu_0 I}{2\pi r} sin\left(\frac{\theta}{2}\right)$

Q7



Which of the following statement is correct regarding the AC circuit shown in the figure ?

a. The rms value of current through the circuit is 15 $\sqrt{2}$A

b. The phase difference between source emf and current is $\phi = cos^{-1}\left(\frac{4}{3}\right)$

c. Average power dissipated in the circuit is 500 W.

d. None of the above

Q8

An inductor is placed in series with a resistor. An emf is applied to the combination. The rate at which power delivered by the battery is P_1. The rate at which power dissipated in the resistor is P_3. Rate at which energy stored in inductor is then which of the following statements is correct ?

a. $P_1 = P_3 - P_2$

b. $P_1 = P_3$

c. $P_1 = P_2 + P_3$

d. $P_1 < (P_2 + P_3)$

Q9

% kg of ice at - 10°C are added to 5 kg of water at 10°C. The temperature of resulting mixture is

a. 0°C

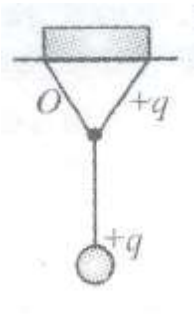
b. -12°C

c. 14°C

d. 12°C

Section-II

Multiple Objective Type



Q10

A simple pendulum of length l is suspended from point O. If a charge q is placed on the bob as well as on the point of suspension then:

a. Time period of small oscillation of bob will be eQual to $2\pi\sqrt{\frac{l}{g}}$

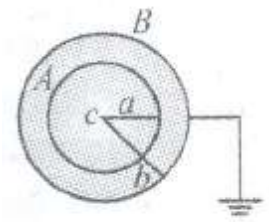
b. Time period of small oscillation of bob will be smaller than $2\pi\sqrt{\frac{l}{g}}$

c. During simple harmonic motion, the tension in the string at vertical condition will be greater than $mg + qE$, where E is the field at bob due charge at O.

d. The acceleration of bob in vertical condition will be zero.

Q11

A conducting sphere A of radius with charge Q is placed concentrically inside a conducting shell B of radius b which is earthed. c is common centre of A and B :



a. The field at a distance r from centre c is $\frac{Q}{4\pi\varepsilon_0 r^2}$ $(a \le r \le b)$

b. The potential at a distance r from c, is $\frac{Q}{4\pi\varepsilon_0 r}$ $(a \le r \le b)$

c. The potential difference between $A\ and\ B$ is $\frac{Q}{4\pi\varepsilon_0}\left[\frac{1}{a} - \frac{1}{b}\right]$

d. The potential at a distance r from c, where $(a \le r \le b) is$ $\frac{Q}{4\pi\varepsilon_0}\left(\frac{1}{r} - \frac{1}{b}\right)$

Q12

In projectile motion, power of the gravitational force :

a. Varies linearly with time.

b. Is constant throughout.

c. Is negative for the first half, positive for the second half.

d. Is zero for the whole path.

Q13

Two waves travelling in opposite directions produce standing wave. The individual wave functions are given by $y_1 = 4\sin(3x - 2t)$ cm and $y_2 = \sin(3x + 2t)$ cm, where x and y are in cm. now, select the correct statements :

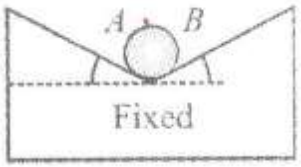
a. Nodes are formed at $x = \frac{\pi}{6}, \frac{\pi}{2}, \frac{5\pi}{6}, \frac{7\pi}{6}$ ... ...

b. Antinodes are formed at $x = 0,\ \frac{\pi}{3}\frac{2\pi}{3}, \pi, \frac{4\pi}{3}$ ... ...

c. Nodes are formed at $x = 0, \frac{\pi}{3}, \frac{2\pi}{3}, \pi, \frac{4\pi}{3}$ ... .

d. Antinodes are formed at $x = \frac{\pi}{6}, \frac{\pi}{2}, \frac{5\pi}{6}, \frac{7\pi}{6}$ ... .

Q14



A circular cylinder of weight W and radius R rests in a V-shaped groove whose sides are inclined at angles $\propto$ and β to the horizontal. All surfaces are smooth. N_A and N_B are the contact forces at point A and B respectively. Which of the following is correct?

a. $\frac{W\sin\propto}{\sin\propto+\sin\beta}=N_A;\frac{W\sin\beta}{\sin\propto+\sin\beta}=N_B$

b. $\frac{W\sin\beta}{\sin(\propto+\beta)}=N_A;\frac{W\sin\propto}{\sin(\propto+\beta)}=N_B$

c. $W=N_A\sin\beta+N_B\sin\propto$

d. $N_A\cos\beta=N_B\cos\propto$

Q15

Which of the following is/are correct?

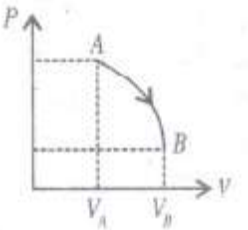
a. The eQuation of continuity expresses the principle of conservation of mass in fluid mechanics.

b. The Bernoulli's eQuation expresses the work-energy theorem in fluid mechanics.

c. The Bernoulli's eQuation is valid for incompressible and non-viscous fluids, $i.e.,$ for ideal fluids only.

d. Two streamlines never cut each other in a laminar pipe flow.

Q16



One mole of an ideal mono-atomic gas is taken through process AB given by $P=\propto-\beta V^2$ (where $\propto$ and β are positive constants) on $P-V$ diagram. Which of the following is correct statement regarding the given process ?

a. Temperature is maximum at $V=\sqrt{\frac{\propto}{3\beta}}$

b. Temperature is minimum at $V=\sqrt{\frac{2\propto}{3\beta}}$

c. Rate of increase of temperature gas with volume is maximum at A

d. Rate of increase of temperature of gas with volume is maximum at $V=\sqrt{\frac{\propto}{\beta}}$

Q17

A car runs around a curve of radius 0.3 km at a constant speed of 60 ms^{-1}. The car covers a curve of 60° arc. Which of the following statements is/are true ?

a. Change in velocity of car is 60 ms^{-1}

b. Instantaneous acceleration of the car is 12 m/s^2

c. Average acceleration of the car is 12 m/s^s

d. Instantaneous and average acceleration are same in this case.

Section-III

Assertion-Reason Type

Q18

Statement-1:

The relative velocity of two photons travelling in opposite direction is the velocity of light. because

Statyement-2:

The rest mass of photon is zero.

a. Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1

b. Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1

c. Statement-1 is True, Statement-2 is False

d. Statement-1 is False, Statement-2 is True

Q19

Statement-1:

The discharge tube appears black, when evacuated to very high low pressure. because

Statement-2:

Discharge stops passing through the discharge tube

a. Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1

b. Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1

c. Statement-1 is True, Statement-2 is False

d. Statement-1 is False, Statement-2 is True

Q20

Statement-1:

If we consider electrons and photons of the same wave length, they will have the same momentum. because

Statement-2:

Electrons and photons have same energy.

a. Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1

b. Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1

c. Statement-1 is True, Statement-2 is False

d. Statement-1 is False, Statement-2 is True

Q21

Statement-1:

Cathode rays are electromagnetic waves. because

Statement-2:

Cathode rays cast the shadow of the opaQue object placed in their path.

a. Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1

b. Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1

c. Statement-1 is True, Statement-2 is False

d. Statement-1 is False, Statement-2 is True

Section-IV

Linked Comprehension Type

$P_{22\text{-}24}$: Paragraph for Question Nos. 22 to 24

A block of mass 2 kg is placed over a 4 kg. If $\mu = 0.1$ is the coefficient of friction between both the blocks and the system is placed on smooth horizontal floor.

Q22

If 9 N is applied horizontally on 4 kg block, the frictional force between the two blocks is :

a. 16 N

b. 8 N

c. 4 N

d. 2 N

Q23

The maximum horizontal force reQuired so that there is no relative motion between the two blocks :

a. 42 N

b. 10 N

c. 6 N

d. 4 N

Q24

The maximum horizontal force applied on 2 kg block so that there is no relative motion between the two blocks is :

a. 16 N

b. 12 N

c. 3 N

d. 2N

$P_{25\text{-}27}$: Paragraph for Question Nos. 25 to 27

A particle of mass 1 kg is projected at an angel $\theta = \pi/4$ from horizontal with a muzzle velocity of 20 m/s. A long slender rod of mass 5 kg and length 30 m is suspended vertically from a point at the same horizontal as that of projection and at a distance of 60 m from the projection point. The rod can rotate freely. If collision occurs, it is perfectly inelastic. ($g = 10 m/s^2$)

Q25

The particle will :

a. Not hit the rod at all

b. Hit the rod at A

c. Hit the rod between O and A, not at its mid point.

d. Hit the rod at its mid point.

Q26

Angular velocity of the rod after collision is :

a. $\frac{1}{4\sqrt{2}}$ rad/sec

b. $\frac{14}{\sqrt{2}}$ rad/sec

c. $14\sqrt{2}$ rad/sec

d. Zero

Q27

If the rod tilts to an angle after collision, then :

a. $\theta = 0°$

b. $\theta = \cos^{-1}(40/41)$

c. $\theta = cos^{-1}\left(\frac{27}{28}\right)$

d. $\theta = \left(\frac{3\pi}{2}\right)$

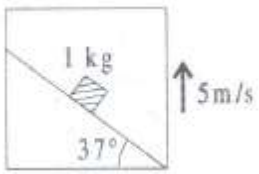
Section-V

Subjective Type

0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

Q28

A block of mass 1 kg is kept on smooth inclined surface of an elevator moving up with a constant velocity of 5 m/s. calculate the work done by normal reaction (as seen from the ground) on the block in 2 seconds.



Q29

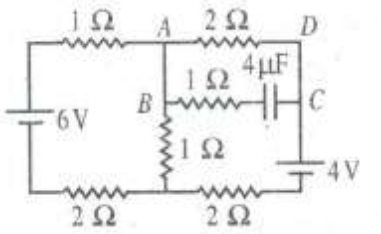
If 2 seconds be the time in which a projectile reaches a point P in its path and 8 seconds is the time from P till it reaches the horizontal plane through the point of projection. Find the height of P above the horizontal plane (Take g = 10 m/s^2)

Q30

When an object is placed at a distance of 25 cm from a concave mirror, the magnification is m_2. If $\frac{m_1}{m_2} = 2.5$, then find focal length of the mirror. (Assume image is real in both cases m_1, m_2 are numerical values)

Q31

Find the charge (in microcoulomb) on capacitor in steady state.



Q32

Column I	Column II
a. Neutron was discovered by	p. Fermi
b. Radioactivity was discovered by	Q. Einstein
c. Mass energy eQuation was given by	r. Chadwick
d. First atomic reactor was designed by	s. Henry BecQueral

Q33

Column I	Column II
a. Rectifier	p. Transistor
b. Amplifier	Q. Zener diode
c. Constant voltage power supply	r. Photo diode
d. In switching the light on and off.	s. p – n junction diode

Q34

Column I	Column II
a. Mass	p. angular momentum
b. Force	Q. Moment of Inertia
c. Linear momentum	r. torQue
d. Displacement	s. Angle

Part-II (Chemistry)
Section-I

Straight Objective Type

Q35

0.1 millimole of $CdSO_4$ are present in 10 ml, and 0.08 NHCI is also present. H_2S is passed to precipitate all the Cd^{2+} ions. The pH of solution after filtering off the ppt and making solution upto 100 ml by adding water is

a. 2
b. 5
c. 4
d. 6

Q36

Alkali metal hydride reacts with water to form

a. acidic solution and H_2 gas
b. Basic solution and hydrogen gas
c. Neutral solution and H_2 gas
d. Hydride ion only

Q37

A 3p orbital has

a. Two radial nodes
b. Two angular nodes
c. One radial and one angular node
d. One radial and two angular nodes.

Q38

Compound $[Cr(NH_3)_5NCS][ZnCI_4]$ will be

a. Colourless
b. Diamagnetic
c. Green coloured and shows coordination isomerism
d. Green coloured and diamagnetic.

Q39

The e.m.f of cell $Zn(s)|Zn^{2+}\ (0.01M)||Fe^{2+}(0.001M)|Fe(s)\ at\ 298\ K$ is 0.2905 V. The value of eQuilibrium constant is

a. $e^{\frac{0.32}{0.0295}}$

b. $10^{-\frac{0.32}{0.0295}}$

c. $10^{\frac{0.28}{0.0295}}$

d. $10^{\frac{0.32}{0.0295}}$

Q40

Nitrogen dioxide cannot be obtained from

a. $Pb(NO_3)_2$

b. $Hg(NO_3)_2$

c. $NaNO_3$

d. $AgNO_3$

Q41

the solubility product of lead bromide is 8×10^{-5} If the salt is 80% dissociated in Saturday solution, then the solubility of salt is

a. 4×10^{-5}

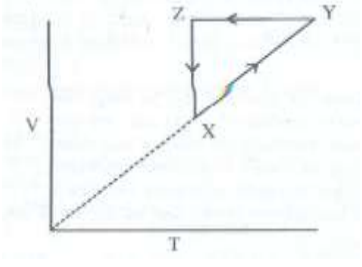
b. 3.4×10^{-2}

c. 3.9×10^{-2}

d. 4×10^{-6}

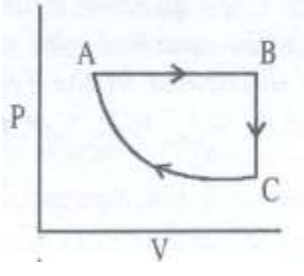
Q42

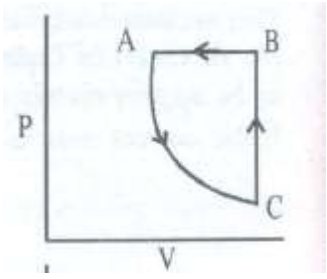
For a cyclic process XYZX as shown in the graph of V vs T



The corresponding P-V diagram would be :

(a)





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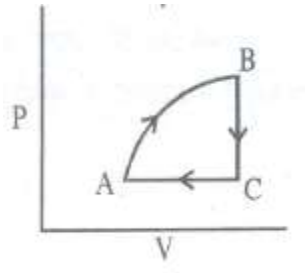

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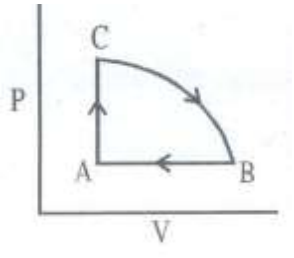


(d)

Q43

The pressure exerted by 12 g of an ideal gas at temperature $t°C$ in a vessel of volume V which is one atmosphere. When the temperature is increased by 10°C at the same volume the pressure increases by 10%

The temperature is……[The molecular weight of gas = 120 g mol^{-1}]

a. 200 K

b. 100 K

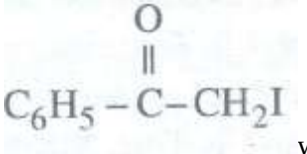
c. 200°C

d. 100°C

Section-II

Multiple Objective Type

Q44



The compound $C_6H_5-\overset{\overset{O}{\|}}{C}-CH_2I$ will give yellow ppt. with which of the following ?

a. Ag_2O (moist)

b. I_2/NaOH

c. 2, 4 – DNP (2, 4-dinitrophenyIhydrazine)

d. $CuSO_4$ + NaOH

Q45

Which of the following act as Lewis bases ?

a. Alcohol

b. Ethers

c. NH_4^+

d. BF_3

Q46

Bohr's theory does not explain the spectrum of which of the following ?

a. He^+

b. Li^{2+}

c. He^{2+}

d. He

Q47

Which of the following will produce C_6H_5-$OCH_2C_6H_5$?

a. $C_6H_5ONa + C_6H_5CH_2CI \rightarrow$

b. $C_6H_5CI + C_6H_5CH_2ONa \rightarrow$

c. $C_6H_5ONa + C_6H_5CH_2I \rightarrow$

d. All of these

Q48

Which of the following are correct mathematical relations for ideal gas?

a. $\left(\frac{\partial U}{\partial V}\right)_r = 0$

b. $\left(\frac{\partial H}{\partial P}\right)_r = 0$

c. $C_p - C_v = R$

d. $\left(\frac{\partial C_v}{\partial V}\right)_r = 0$

Q49

When a non-volatile solute is added to pure solvent

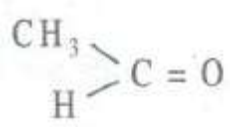
a. Vapour pressure of solution decreases.

b. Boiling point of solution increases.

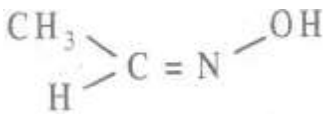
c. Solution does not affect osmotic pressure of solution.

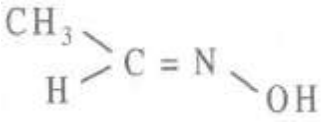
d. The escaping tendency of solvent molecules into vapours from solution decrease.

Q50

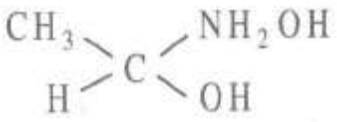


When is reacted with NH_2OH, then the final product formed is

(a) 

(b) 

(c) 

(d) 

51. the cell reactions taking place are $AgCI(s) + e^- \rightarrow Ag(s) + CI^-(aq)\,; E° = +0.22V\; Ag^+e^- \rightarrow Ag(s); E° = 0.80V$

a. The E_{cell} value is 1.08V

b. The E_{cell} value is – 0.58V

c. The E_{sp} value of AgCI = 1.6×10^{-10}

d. The K_{sp} value of AgCI = 1.6×10^{-5}

Section-III

Assertion-Reason Type

Q52

Statement-1:

In a balloon the pressure and volume both are directly proportional. because

Statement-2:

Boyle's law is not obeyed in a balloon.

a. Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1

b. Statement-1 is True, Statement-2 is True; Statement-2 is not a correct explanation for Statement-1

c. Statement-1 is True, Statement-2 is False

d. Statement-1 is False, Statement-2 is True

Q53

Statement-1:

Phenol gives effervescence when sodium carbonate is added. because

Statement-2:

H_2co_3 is more acidic than phenol.

a. Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1

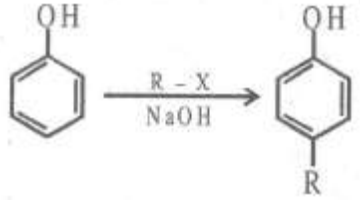
b. Statement-1 is True, Statement-2 is True; Statement-2 is not a correct explanation for Statement-1

c. Statement-1 is True, Statement-2 is False

d. Statement-1 is False, Statement-2 is True

Q54

Statement-1:



because

Statyement-2:

The benzene ring in phenol is more electron rich than simple benzene.

a. Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1

b. Statement-1 is True, Statement-2 is True; Statement-2 is not a correct explanation for Statement-1

c. Statement-1 is True, Statement-2 is False

d. Statement-1 is False, Statement-2 is True

Q55

Statement-1:

Sodium carbonate does not decompose on heating to give CO_2.

because

Statement-2:

Sodium carbonate is highly ionic in nature.

a. Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1

b. Statement-1 is True, Statement-2 is True; Statement-2 is not a correct explanation for Statement-1

c. Statement-1 is True, Statement-2 is False

d. Statement-1 is False, Statement-2 is True

Section-IV

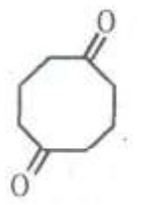
Linked Comprehension Type

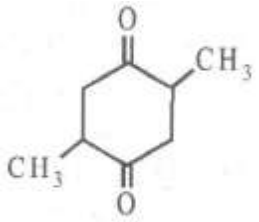
$C_{56\text{-}58}$: Paragraph for Question Nos. 56 to 58

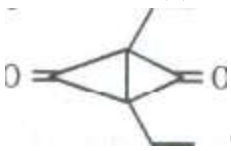
One mole of the compound (X) C_8H_{12} does not show stereoisomerism, reacts with only one mole of H_2 on hydrogenation over Pd. `X' undergoes ozonolysis to give a symmetrical diketones (Y) of formula reduction of compound Y with Zn – Hg/HCI gives C_8H_{16} which is a symmetrical diketone is

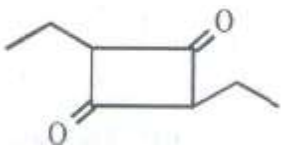
Q56

The compound (Y) which is a symmetrical diketone is

(a) 

(b) 

(c) 

(d) 

Since formula of compound $C_8H_{12}O_2$ is and is symmetrical diketone.

Q57

compound (X) must be

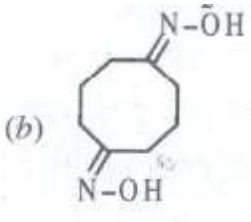
(a) 

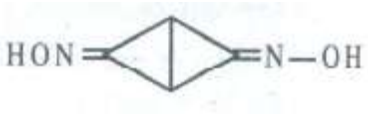
(b) 

Q58

Compound (Y) on treatment with NH_2OH would give

(a) 

(b) 



(c) **(d)**

59-61: Paragraph for Question Nos. 59 to 61

The reduction potential of few transition metals are given below :

Reaction at electrode	**E°(volt)**
$Hg^{2+}+2e^{-}\rightarrow Hg$	+0.79V
$Cu^{2+}+2e^{-}\rightarrow Cu$	+0.34V
$Ni^{2+}+2e^{-}\rightarrow Ni$	-0.25V
$Zn^{2+}+2e^{-}\rightarrow Zn$	-0.76V
$Fe^{2+}+2e^{-}\rightarrow Fe$	-0.44V
$Sc^{3+}+3e^{-}\rightarrow Sc$	-2.08V
$La^{3+}+3e^{-}\rightarrow La$	-2.37V
$Mn^{2+}+2e^{-}\rightarrow Mn$	-1.05V

Q59

Which is best reducing agent among the above metals ?

a. La

b. Sc

c. Zn

d. Ni

Q60

Which of these is best oxidising agent ?

a. Hg^{2+}

b. Cu^{2+}

c. Ni^{2+}

d. Zn^{2+}

Q61

Which of the following cannot displace hydrogen from dil acid ?

a. Hg

b. Ni

c. Zn

d. Sc

Section-V

Subjective Type

0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

Q62

An excess of liQuid mercury is added to an acidified solution 10^{-4} M Fe^{3+}. It is found that 10% of Fe^{3+} ions remains at eQuilibrium at 25°C. What is the $E^{\circ}_{Hg_2^{2+}/Hg}$ Assuming that the reaction taking place is mainly $2Hg + 2Fe^{3+} \rightarrow Hg_2^{2+} + 2Fe^{2+}$ Given $E^{\circ}_{Fe^{3+}/Fe^{2+}} = 0.77V$

Q63

A mixture of ethane (C_2H_6) and ethane (C_2H_4) occupies 40 litres at 1.00 atm at 400 K. The mixture reacts completely with 130 g of O_2 to produce CO_2 and H_2O. Assuming ideal gas behavior, calculate the mole fraction of C_2H_4 in the mixture.

Q64

What is the mole fraction of H_2 present at eQuilibrium if pure ethane is passed over Pd at 900 K and 1.0 atm such that dehydrogenation takes place, to etthene ?

ΔG for process = 22.38 kJ mol^{-1} at 900 K.

Q65

One litre of oxygen diffuses through a porous plug in 150 seconds. Under the same condition, one litre of a mixture of O_2 and ethane containing 30% by volume of oxygen diffuses in 160 seconds. Calculate the density of ethane. The density of oxygen is 1.42 g L^{-1}.

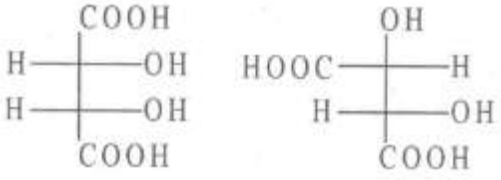
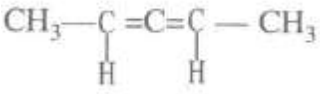
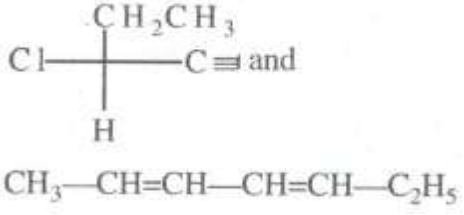
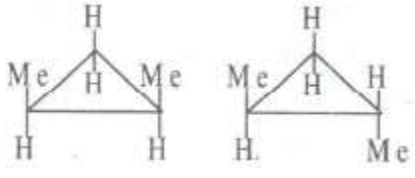
Section-VI

Matrix-Match Type

Q66

Column I	**Column II**
a. $M + 2H_2O \rightarrow M(OH_2 + H_2$	p. All metals of group-II form metal oxide bu Ba also forms peroxide. This ability of oxide increases down the group.
b. $M + 2HCI \rightarrow MCI_2 + H_2$	Q. All metals dissolve in NH_3 to give deep blue black solution from which ammoniates $[M(NH_3)_6]^{2+}$ can be recovered.
c. $M + 2NH_3 \rightarrow M(NH_2)_2 + H_2$	r. the reactivity of metals with this reagent increases down the group.
d. $2M + O_2 \rightarrow 2MO$	s. all metals react with dil. Acids liberating H_2 but with HNO_3, Be becomes passive due to the formation of passive layer.

Q67

Column I	**Column II**
a. 	p. S-isomers, 4 isomers
b. 	Q. Geometrical isomers
c. 	r. Optical isomerism
d. 	s. Identical

Q68

Column I	**Column II**
a. Saponification	p. caltionic detergent
b. Glueose	Q. Test for 1°, 2°, 3° amines
c. Hofmann's method	r. Osazone
d. Quarternary ammonium salt of long chain tertiary amine	d. Glycerol

PART-III (MATHEMATICS)

Section-I

Straight Objective Type

Q69

The eQuation $ax^2 = \log x$, has one solution if ($x > 0, a$ is a real number)

a. $a < 0 \; or \; a = \frac{1}{2e}$

b. $a > 0$

c. $a = \frac{1}{e}$

d. $a = e/2$

Q70

Let AB be any chord of the circle $x^2 + y^2 - 4x - 4y + 4 = 0$, which subtends an angle of 90° at the point (2, 3), then the locus of the mid-point of AB is circle whose centre is

a. (1, 5)

b. (1, 5/2)

c. (1, 3/2)

d. (2, 5/2)

Q71

Six persons A, B, C, D, E and F are to be seated at a circular table. The number of ways in which A always has either B or C on her right and B always has either C or D on his right must be

a. 12

c. 16

c. 18

d. None of these

Q72

The remainder when^{101} is divided by 101 is

a. 4

b. 36

c. 64

d. 84

Q73

Given that $log_p x = \propto and\ log_q x = \beta$, the value of $log_{\frac{p}{q}} x$ eQuals

a. $\frac{\propto\beta}{\beta-\propto}$

b. $\frac{\propto-\beta}{\propto\beta}$

c. $\frac{\propto\beta}{\propto-\beta}$

d. $\frac{\beta-\propto}{\propto\beta}$

Q74

a stick of length 20 units is to be divided into n parts so that the product of the lengths of the parts is greater than unity. The maximum possible value of n is

a. 18

b. 21

c. 19

d. 20

Q75

A rectangle $ABCD$ is inscribed in a circle. Let PQ be the diameter of the circle parallel to the side AB. If ∠BPC=30°, then the ratio of area of the rectangle to the area of the circle is

a. $\frac{\sqrt{3}}{2\pi}$

b. $\frac{\sqrt{3}}{9\pi}$

c. $\frac{3}{\pi}$

d. $\frac{\sqrt{3}}{\pi}$

Q76

Consider continuous function f on the interval [0, 1], which satisfies the following two conditions :

(i) $f(x) \leq \sqrt{5}$ for all $x \in [0,1]$

(ii) $f(x) \leq \frac{2}{x}$ for all $x \in [\frac{1}{2}, 1]$

Then, the smallest real number $\propto$ such that the ineQuality $\int_0^1 f(x) \leq \propto$ holds for any such f is

a. $\frac{\sqrt{5}}{2} + 2\log 2$

b. $2 + \log\frac{\sqrt{5}}{2}$

c. $2 + 2\log\frac{\sqrt{5}}{2}$

d. $\sqrt{5}$

Q77

If z is a complex number satisfying $|z|^2 + 2(z + \bar{z}) + 3i(z - \bar{z}) + 4 = 0$, then complex number $z + 3 + 2i$ will lie on

a. circle with centre $1 - 5i$ radius 4

b. circle with centre $1 + 5i$ radius 4

c. circle with centre $1 + 5i$ radius 3

d. circle with centre $1 - 5i$ radius 3

Section-II

Multiple Objective Type

Q78

Given $(1 + \cos \propto)\ (1 + cos\beta)(1 + \cos y) = (1 - \cos \propto)(1 - cos\beta)(1 - \cos y)$ then both LHS or RHS may be eQual to

a. $\sin \propto \sin\beta \sin y$

b. $\cos \propto \cos\beta \cos y$

c. $-\sin \propto \sin\beta \sin y$

d. $-\cos \propto \cos\beta \cos y$

Q79

If n is a positive integer and $a > 1$, then

a. $a^n - 1 \geq n\left(a^{\frac{n+1}{2}} - a^{\frac{n-1}{2}}\right)$

b. $\frac{a^n - 1}{a - 1} \geq n.a^{\frac{n-1}{2}}$

c. $\frac{a^n-1}{a-1} < na^n$

d. $a^n - 1 < n\left(a^{\frac{n+1}{2}} - a^{\frac{n-1}{2}}\right)$

Part-II (Mathematics)

Section-II

Q80

If $\propto > -1, \beta > -1$ and $I(\propto, \beta) = \int_0^1 \frac{x^\beta - x^a}{\log x} dx$ then

a. $I(\propto, \beta) = log_e \frac{1+\beta}{1+\propto}$

b. $I(\propto, \beta) = log_e \frac{1+\propto}{1+\beta}$

c. $I(\propto, \beta) = I(\beta, \propto)$

d. $I(\propto, \beta) = -I(\beta, \propto)$

Q81

Let $f_n(x) = \frac{1}{n}(sin^n\, x + cos^n\, x)$, where is an arbitrary positive integer then

a. $f_n(x)$ is a periodic function with least positive period for all n.

b. $f_n(x)$ is a periodic function with least positive period for all $n > 2$.

c. $f_4(x) - f_6(x) = 1/12$

d. $f_4(x) - f_6(x) = 1/24$

Q82

$I = \int_0^\infty \frac{sin^4 x}{2^x} dx, J = \int_0^\infty \frac{\sin x}{x} dx$

a. $I = 2J$

b. $I = J^4$

c. $I = J/2$

d. $1 > 0$

Q84

The cubic eQuation $(a+b+x)^3-4\,(a^3+b^3+x^3)-12\,abx=0$

a. has two roots whose sum is 1

b. has two roots whose sum is zero

c. has one root $a+b$

d. has one roots $a+b+ab$

Q85

$P(1,\sqrt{3})$ and $Q(\sqrt{3},1)$ be two points on the circle $x^2+y^2=4$. Tangent and normal are drawn at P and Q, let Δ_1 be the area of triangle formed by tangent, normal drawn at P and with x-axis. Similar by Δ_2 be the area of triangle formed by x-axs and tangent, normal drawn at Q then

a. $\Delta_1=4\sqrt{3}$

b. $\Delta_1=2\sqrt{3}$

c. $\Delta_2\,\frac{2}{\sqrt{3}}$

d. $\Delta_2\,\frac{2}{\sqrt{3}}$

Section-III

Assertion-Reason Type

Q86

Statement-1:

The function $\int_0^1 \frac{dz}{\sqrt{x^2+z^2}}$ is not defined at $x=0$. because

Statement-2:

$\int \frac{dz}{\sqrt{x^2+z^2}}=log\left(x+\sqrt{x^2+z^2}\right)+c$

a. Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1
b. Statement-1 is True, Statement-2 is True; Statement-2 is not a correct explanation for Statement-1
c. Statement-1 is True, Statement-2 is False
d. Statement-1 is False, Statement-2 is True

Q87

Statement-1:

If $a+b+c=0$ then $a^6+b^6+c^6=3a^2b^2c^2-2(ab+bc+ac)^3$ because

Statement-2:

$a^6+b^6+c^6$ Is identifically eQual to $3a^2b^2c^2-2(ab+bc+ac)^3$

a. Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1
b. Statement-1 is True, Statement-2 is True; Statement-2 is not a correct explanation for Statement-1
c. Statement-1 is True, Statement-2 is False
d. Statement-1 is False, Statement-2 is True

Q88

Statement-1:

If $e=1+\frac{1}{1!}+\frac{1}{2!}+\frac{1}{3!}+\frac{1}{4!}+\ldots\infty\ S_n=1+\frac{1}{1!}+\frac{1}{2!}+\frac{1}{3!}+\ldots+\frac{1}{(n+1)!}\ ,then\ 0<e-S_n<1$

because

Statement-2:

e is irrational.

a. Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1
b. Statement-1 is True, Statement-2 is True; Statement-2 is not a correct explanation for Statement-1
c. Statement-1 is True, Statement-2 is False
d. Statement-1 is False, Statement-2 is True

Q89

Statement-1:

If $U_1=u_2=1$ and $u_n=u_{n-1}+u_{n-2}\ for\ n>2$ then $u_{2n+2}=u_1+u_3+u_5+\ldots\ldots\ldots+u_{2n+1}$

because

Statement-2:

Sum of first $n+1$ odd numbers is a perfect sQuare.

a. Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1
b. Statement-1 is True, Statement-2 is True; Statement-2 is not a correct explanation for Statement-1
c. Statement-1 is True, Statement-2 is False
d. Statement-1 is False, Statement-2 is True

Section-IV

Linked Comprehension Type

$M_{90\text{-}92}$: Paragraph for Question Nos. 90 to 92

Consider the passion integral $\int_0^\infty e^{-z^2}\,dz$ whose value is $\frac{\sqrt{\pi}}{2}$. Answer the following Question :

Q90

$\frac{1}{\sqrt{x}}$ must be eQual to

a. $\frac{2}{\sqrt{\pi}}\int_0^\infty e^{-2z^2}dz$

b. $\frac{2}{\sqrt{\pi}}\int_0^\infty e^{-2z^2x}dz$

c. $\frac{1}{\sqrt{\pi}}\int_0^\infty e^{-2z^2x}dz$

d. None of these

Q91

$\int_0^\infty \frac{\sin x}{\sqrt{x}}$ must be eQual to

a. $\frac{\sqrt{\pi}}{2}$

b. $\sqrt{\frac{\pi}{2}}$

c. $\frac{1}{\sqrt{2\pi}}$

d. None of these

Q92

$\int_0^\infty \frac{\cos x}{\sqrt{x}}dx$ must be eQual to

a. $\frac{\sqrt{\pi}}{2}$

b. $\sqrt{\frac{\pi}{2}}$

c. $\frac{1}{\sqrt{2\pi}}$

d. None of these

$M_{93\text{-}95}$: Paragraph for Question Nos. 93 to 95

Let $a_2 = \sqrt{2} + \sqrt{3} + \sqrt{6}$ and $a_{n+1} = \frac{a_n^2 - 5}{2(a_n + 2)}$ for positive integers. Answer the following Questions :

Q93

$a_0 + 2$ must be eQual to

a. $\cot\frac{\pi}{24}$

b. $\cot \pi/10$

c. $\cot \pi/48$

d. None of these

Q94

$a_n = cot\left(\frac{2^{n-3}\pi}{3}\right) - 2$

a. is true for $n = 0$ only

b. is true for $n = 0$ and $n = 1$ only

c. is true for all n

d. None of these

Q95

If $b_n = a_n + 2, (n \geq 1)$ then b_{n+1} is given by

a. $\frac{b_n^2+1}{2b_n}$

b. $\frac{b_n^2-1}{2b_n}$

c. $\frac{b_n^2+1}{b_n}$

d. None of these

Section-V

Subjective Type

0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

Q96

In ΔABC if BC is unity, $\sin\frac{A}{2} = a_1, \sin\frac{B}{2} = a_2, \cos\frac{A}{2} = a_3$ and $\cos\frac{B}{2} = a_4$ with $\left(\frac{a_1}{a_2}\right)^{2007} - \left(\frac{a_3}{a_4}\right)^{2006} = 0$, then the length of AC is

Q97

If $\propto$ and β are non-real complex cube roots of unity then the value of $\propto^4 + \beta^4 + \frac{1}{\propto\beta}$ must be

Q98

If the latus rectum of an ellipse is half of its minor axis then the eccentricity of the ellipse is $\frac{\sqrt{\lambda}}{2}.\lambda$ must be

Q99

The number of dissimilar terms in the expansion of $\left(x + y + \frac{1}{x} + \frac{1}{y}\right)^{14}$ is

Section-VI

Matrix-Match Type

Q100

Let $A = x_1 + x_2\omega + x_3\omega^2, B = x_1 + x_3\omega^2 + x_3\omega$ where ω, ω^2 are non-real complex cube roots of unity and x_1, x_2, x_3 are the roots of $x^3 + pxq = 0$. If A^3 and B^3 are the roots of the Quadratic eQuation $Pz^2 + Qz$R=0, then match the following :

Column I	**Column II**
a. P	p. $27q$
b. Q	Q. $-27p^3$
c. R	r. 1

Q101

If $sin^{-1}x + sin^{-1}y = Asin^{-1}\left[x\sqrt{1-x^2} + y\sqrt{1-x^2}\right] + B\pi$, where A and B are numerical Quantities, then match the following :

Column I	**Column II**
a. $A = 1, B = 0$	p. $x^2 + y^2 > 1, x > 0, y > 0$
b. $A = -1, B = -1$	Q. $x^2 + y^2 = 0$
c. $A = -1, B = +1$	r. $x^2 + y^2 > 1, x < 0, y < 0$
d. $A = 0, B = 0$	s. $xy < 0, x^2 + y^2 \leq 1$

Q102

Let $f(x) = Ax^2 + Bx + C$ given that $f'(1) = 8, f(2) + f'(2) = 33, \int_0^1 f(x)dx = \frac{7}{3}$, then match the following :

Column I	**Column II**
a. A	p. -32
b. B	Q. -6
c. C	r. 7
d. $\int_{-2}^{2} xf(x)dx$	s. 3

PAPER – II

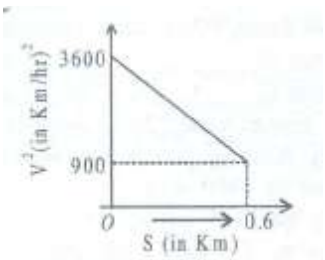
Part-I (Physics)

Section-I

Straight Objective Type

Q1

A graph between the sQuare of the velocity of a particle and the distance `S' moved by the particle is shown in figure. The acceleration of the particle in kilometer per hour sQuare



a. 4250

b. 425

c. -2250

d. -275

Q2

A body falling freely under the action of gravity passes through tow point 9 m apart (vertically) in 0.2 sec. from what height above the higher point did it start to fall ?

a. 99 m

b. 200 m

c. 20 m

d. 109 m

Q3

A car starts from rest with an acceleration of 6m/s^2 which decreases to zero linearly with time, in 10 sec, after which the car continues at a constant speed. Find the time reQuired for the car to travel 400 m from the starts ?

a. 16.675

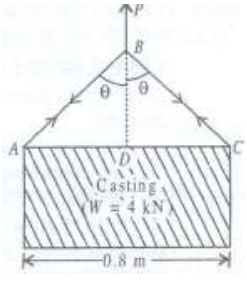
b. 25.6

c. 20.56

d. 19.56

Q4

A casting weighing 4 kN is to be lifted by means of a rope as shown in figure. If allowable tension in the rope is 2.5 kN, minimum length of rope ABC is ?



a. 0.667

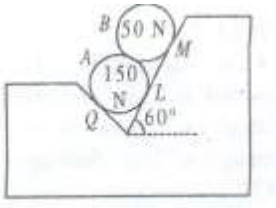
b. 4.22

c. 4.334

d. none of these

Q5

Two spheres A and B weighing 150 N and 50 N respectively are placed on a rough inclined surface as shown in fig. the contact reactions at Q, L, M and S are R_Q, R_L, R_M and R_S respectively. The correct option is/are:



a. $R_S = 153\ N$

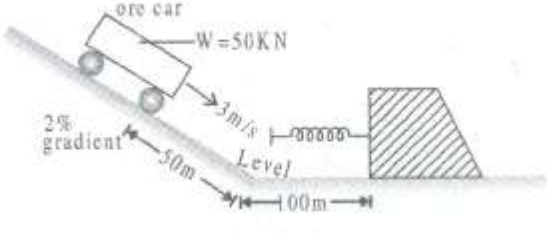
b. $R_M = 135\ N$

c. $R_Q = 140\ N$

d. $R_L = 75\ N$

Q6

At a mine, the end of a side track is to be provided with a spring bumper. The spring must be capable of stopping a 50 kN ore car which has a velocity of 3 m/s down the incline at a point 50 m up the incline from A, and then coasts from there to the bumper, as shown in fig. the track resistance remains constant at 400 N. if the spring is being compressed by 0.6 m in order to stop the car, the modulus, K must be :



a. 60.53 N/mm

b. 70.53 N/mm

c. 60.53 N/m

d. 170.53 N/m

Q7

A sphere of mass `M' moving with velocity u hits another stationary sphere of same mass. If e is the coefficient of restitution, what is the ratio of velocities of two sphere after the collision

a. $\frac{(1+e)}{(1-e)}$

b. $\frac{(1-e)}{(1+e)}$

c. $\frac{(1+e)}{e}$

d. $\frac{e}{(1-e)}$

Q8

A block hangs from the free end of a sonometer wire of vibrating length 40 cm, when it was tuned to a tuning fork. The block when hung completely immersed in water, the resonant length is reduced to 30 cm. the relative density of block is

a. 16/3

b. 16/5

c. 16/7

d. 16/9

Q9

A solid cube and solid sphere have eQual surface areas. Both are at the same temperature of 120°C then

a. The cube will cool down faster than sphere.

b. The sphere will cool down faster than cube.

c. Both of them will cool down at the same rate.

d. Which ever of the two is heavier, will cool down faster.

Section-II

Multiple Objective Type

Q10

if a_r and a_t represent radial and tangential acceleration, the motion of a particle will be circular if

a. $a_r = 0, a_t = 0$

b. $a_r = 0, a_t \neq 0$

c. $a_r \neq 0, a_t = 0$

d. $a_r \neq 0, a_t \neq 0$

Q11

Two satellites of same mass of a planet in circular orbits have periods of revolutions 32 days and 256 days. If the radius of the orbit at the first is R, then the

a. Radius of the orbit at the second is $4R$

b. Radius at the orbit at the second is $8R$

c. Total mechanical energy of the second is greater than that of the first

d. Kinetic energy of the second is more than that of the first.

Q12

Water is being poured in a vessel at a constant rate $\beta^3 s^{-1}$. There is a small hole of area $\propto$ at the bottom of the tank. The maximum level of water in the vessel is proportional to

a. β

b. β^2

c. $\propto^{-1}$

d. $\propto^{-2}$

Q13

Action and reaction :

a. Act on two different objects

b. Have opposite directions

c. Have eQual magnitude

d. Have zero resultant

Q14

A projectile has the same range R for two angles of projections. If T_1 and T_2 be the times of flight in the two cases, then (using θ as the angle of projection corresponding to T_1)

a. $T_1 T_2 \propto R$

b. $T_1 T_2 \propto R^2$

c. $\frac{T_1}{T_2} = \tan\theta$

d. $\frac{T_1}{T_2} = 1$

Q15

A long straight wire carries a current along the x-axis, consider the points $A\ (0,1,0), B(0,1,1), C(1,0,1)$ and $D(1,1,1)$, which of the following pairs at point will have magnetic field of the same magnitude ?

a. A and B

b. A and C

c. B and C

d. B and D

Q16

An a.c. source rated 220 V supplies a current of 5 A in a circuit. Average power delivered by the source

a. Must be 100 watt

b. May be 1100 watt

c. May be less than 1100 watt

d. May be greater than 1100 watt

Q17

A uniform wire of resistance R is shaped into a regular n-sides polygon (n is even). The eQuivalent resistance between any two corners can have

a. The maximum value of $R/4$

b. The maximum value of R/n

c. The minimum value of $R\left(\frac{n-1}{n^2}\right)$

d. The minimum value of R/n

Section-III

Assertion-Reason Type

Q18

Statement-1

On going away from a point charge or a small electric dipole, electric field decreases at the same rate in both the cases.

Statement-2

Electric field is inversely proportional to sQuare of the distance form centre.

a. Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1
b. Statement-1 is True, Statement-2 is True; Statement-2 is NOTa correct explanation for Statement-1
c. Statement-1 is True, Statement-2 is False
d. Statement-1 is False, Statement-2 is True

Q19

Statement-1

A small metal ball is suspended in a uniform electric field with an insulated thread. If high energy x-ray beam falls on the ball, the ball will be deflected in the electric field. because

Statement-2

X-ray emits photoelectron and metal becomes negatively charged.

a. Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1
b. Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
c. Statement-1 is True, Statement-2 is False
d. Statement-1 is False, Statement-2 is True

Q20

Statement-1

Electrons move away from a region of higher potential level to a region of lower potential. because

Statement-2

Electrons have –ve charge.

a. Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1
b. Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
c. Statement-1 is True, Statement-2 is False
d. Statement-1 is False, Statement-2 is True

Q21

Statement-1

Circuits containing capacitors should be handled cautiously even when there is no current. because

Statement-2

The capacitors are very delicate and so Quickly breakdown.

a. Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1
b. Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
c. Statement-1 is True, Statement-2 is False
d. Statement-1 is False, Statement-2 is True

Section-IV

Linked Comprehension Type

$P_{22\text{-}24}$: Paragraph For Question Nos. 22 to 24

The internal resistance of a flashlight battery increase gradually with age, even though the battery is not used. The emf, however, remains fairly constant about 1.5 V. Batteries may be test5ed for age at the time of purchase by connecting an ammeter directly across the terminals of the battery and reading the current. The resistance of the ammeter is so small that the battery is practically short circuited.

Q22

What is the internal resistance, if the short circuit current of a fresh flashlight battery (emf 1.5 V) is 14.8 A ?

a. 101 Ω
b. 0.011 Ω
c. 0.101 Ω
d. 0.202 Ω

Q23

What is the internal resistance, if the short circuit current is only 6.8 A ?

a. 0.11 Ω
b. 0.22 Ω
c. 0.33 Ω
d. 0.44 Ω

Q24

The short circuit current of a 12.6 Vcar battery may be as great as 1000 A then what will be the internal resistance?

a. 0.0123
b. 0.0124
c. 0.125
d. 0.0126

$P_{25\text{-}27}$: Paragraph For Question Nos. 24 to 27

A beam of alpha particles is incident on a target of lead. A particular alpha particle comes in “head on” to a particular lead nucleus and stop 5.50×10^{-14} m away from the center of the nucleus. (This point is well

outside the nucleus). Assume that the lead nucleus with 82 protons, remains at rest. The mass of alpha particle is 6.64×10^{-27} kg.

Q25

Calculate the electrostatic potential energy at the ;instant that the alpha particle stops.

a. 36.3 MeV

b. 45.0 MeV

c. 3.63 MeV

d. 40.0 MeV

Q26

What initial K.E> (in joules and in MeV) did the alpha particle have ?

a. 36.3

b. 0.36

c. 3.63

d. 2.63

Q27

what was the initial speed of the alpha particle ?

a. 132×10^2 m/s

b. 1.32×10^7 m/s

c. 13.2×10^2 m/s

d. 0.13×10^7 m/s

Section-V

Subjective Type

0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

Q28

An air filled parallel plate capacitor is to be constructed which can store 12 μC of charge when operated at1200 V. what can be the minimum area of capacitor? The dielectric strength of air is 3×10^7 V/m. [in $10^{-2\ m}2$]

Q29

A coil of inductance 0.7 H is joined in series with a resistance of 220 Ω. Find the wattles component of current in the circuit, when an alternating emf of 220 V at a freQuency of 50Hz is supplied to it.

Q30

A cubical vessel of height 1 m is full of water. What is the work done in pumping water out of the vessel ?

Q31

A diatomic gas (y = 1.4) does 200 J of work, when it is expanded isobarically. Find the heat given to the gas in the process ?

Section-VI

Matrix-Match Type Questions

Q32

Column I	Column II
a. Weight of a body is maximum	p. Zero gravitational field
b. weight of a body decreases	Q. At the surface of earth
c. Weight of a body increases	r. With increase in height from the surface of earth
d. weight of a body is zero	s. When body is moved from null point towards moon

Q33

Column I	Column II
a. In a perfectly elastic collision.	p. 100%
b. Co-efficient of restitution is zero	Q. No K.E. is lost
c. Transfer of K.E. when two bodies of eQual masses collide elastically	r. Inelastic collision
d. Loss in K.E.	d. Perfectly inelastic collision

Q34

Column I	Column II
a. Change in freQuency due to relative motion between source and listener	P. Beats
b. Intensity of sound varies with time	Q. Transverse
c. Sound waves in air	r. Doppler effect
d. Light waves	s. Longitudinal

Part-II(Chemistry)

Section-I

Straight Objective Type

Q35

the molar conductance of

a. 1st group chloride salt solution decreases down the group.

b. 2nd group chloride salt solution decreases down the group.

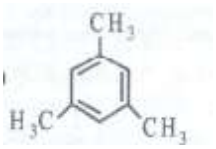
c. 1st group chloride salt solution increase down the group.

d. 2nd group sulphate salt solution increases down the group.

Q36

4 moles of acetylene when heated in presence of iron tube we get

(a)  **(b)** $CH_2=CH-C\equiv C-CH=CH_2$

(c)  (d) 

Q37

A metal exists in BCC structure and has density 7.5 g cm^{-3}. If edge of the cell is 5Å, how many atoms are present in 15 g of metal ?

a. 3.2×10^{22}

b. 1.66×10^{22}

c. 1.66×10^{24}

d. None of these

Q38

For a reaction A⇌E, the value of K will be

A⇌B	$K_1 = 5$
B⇌C	$K_2 = 4$
C⇌D	$K_3 = 3$
D⇌E	$K_4 = 2$

a. 120

b. 60

c. 24

d. 30

Q39

The volume of water to be added to a mixture of 25 L of 6 M HCI and 15 L of 2 M HCI to have normality eQual to 3 is

a. 15 L

b. 20 L

c. 25 L

d. 60 L

Q40

For a reversible reaction involving reactants A and B and products C and D. A and B react in the ratio 2 : 3 and are mixed in the ratio 4 : 5 to form C and D in the ratio 3 : 4. The eQuilibrium concentration of B and C are eQual. What are the eQuilibrium concentrations of A, B, C and D respectively ?

a. $\frac{5}{2}, \frac{7}{3}, \frac{5}{2}, \frac{10}{3}$

b. $\frac{7}{3}, \frac{5}{2}, \frac{5}{2}, \frac{10}{3}$

c. $\frac{5}{2}, \frac{10}{3}, \frac{7}{3}, \frac{5}{2}$

d. $\frac{10}{3}, \frac{10}{3}, \frac{5}{2}, \frac{5}{2}$

Q41

Which of the following relations are correct?

a. $r_1(H) = r_2(He^+)$

b. $r_1(H) = r_2(Li^{2+})$

c. $r_1(H) = r_2(Be^{3+})$

d. $r_1(H) = r_2(B^{4+})$

Q42

If the wavelength of the principal series limit of Rb atom spectrum is 296 nm then the ionization energy of Rb is

a. 900 kJ/ml

b. 1000 KJ/ml

c. 403 kJ/ml

d. 100 kJ/ml

Q43

Which of the following follow 1st order kinetic ?

a. decomposition of $NH_4NO_2(s)$

b. Decomposition of NH_3

c. Decomposition of SO_2

d. Decomposition of H_2O_2 under all conditions.

Section-II

Multiple Objective Type

Q44

The ratio of H^+ and H_2O molecules in one litre of water will be

a. $1 : 6.023\times10^{23}$

b. $1 : 2\times6.023\times10^{23}$

c. $1 : M_{H_2}o \times 10^7$

d. $1 : 55.4\times10^7$

Q45

Which of the following do not give alkane on decarboxylation on heating with sodalime ?

a. C_6H_5COOH

b. HCOOH

c. CH_3COOH

d. CH_3CH_2COOH

Q46

Which of the following statements are true about Breeder reactor ?

a. It produces more fuel than it consumes.

b. It makes use of $^{239}_{94}Pu$ as fissionable material obtained by bombardment of $^{239}_{92}U$ with neutron followed by emission of the β-particles.

c. It consumes more fuel than it produces.

d. It makes use of fusion reaction.

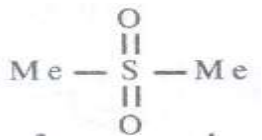
Q47

Which of the following statement are correct ?

a. The enolate of CH_3NO_2 is stable due to $p\pi - p\pi$ bond.

b. The enolate  of $CHCl_3$ is stable due to $p\pi - d\pi$ bond

c. The enolate of is stable due to aromaticity

d. The enolate  of can never be formed

Q48

The dissociation of ammonium carbonate may be represented by the eQuation $NH_4COONH_2(s) \rightleftharpoons 2NH_3(g) + CO_2(g)$.

ΔH = -ve for forward reaction. The eQuilibrium will shift from left to right if there is

a. A decrease in pressure

b. A decrease in temperature

c. An increase in concentration of ammonia

d. A decrease in concentration of CO_2

Q49

Glycerol, on being heated with oxalic acid at 110°C, followed by hydrolysis

a. Glycerylmojnoformate

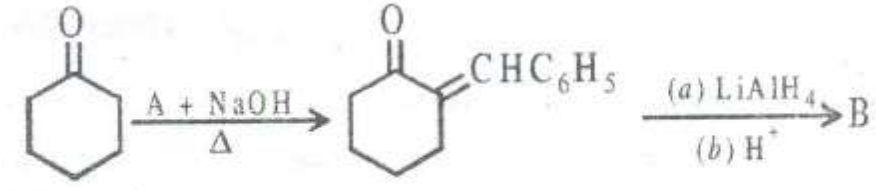
b. Glycerylmonooxalate

c. Formic acid

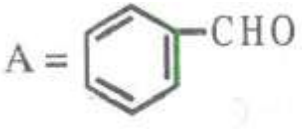
d. Allyl alcohol

Q50

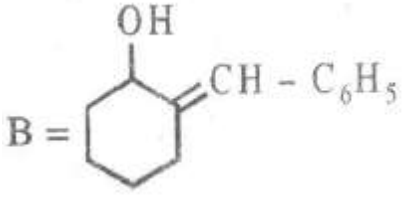
In the reaction seQuence given



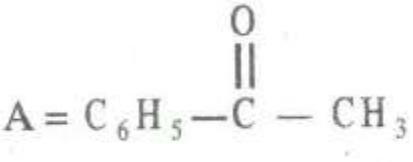
Hence here



(a)



(b)



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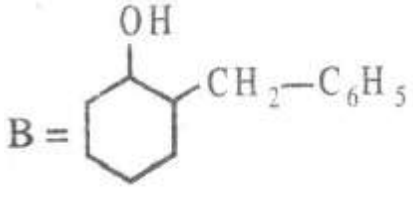


(d)

Q51

In an adiabatic process, the work done by an ideal gas during expansion or compression is given by

a. $nC_v\Delta T$

b. $\frac{nR}{y-1}(T_2 - T_1)$

c. $-RP_{ext}\left[\frac{T_1P_1 - T_1P_2}{P_1P_2}\right]$

d. $-2.303RT\log\frac{V_2}{V_1}$

Section-III

Assertion-Reason Type

Q52

Statement-1:

F_2 can displace CI_2 from chloride solution. because

Statement-2:

F_2 is more reactive than CI_2.

a. Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1

b. Statement-1 is True, Statement-2 is True; Statement-2 is not a correct explanation for Statement-1

c. Statement-1 is True, Statement-2 is False

d. Statement-1 is False, Statement-2 is True

Q53

Statement-1:

Cis-2-Butene on reaction with cold alkaline $KMnO_4$ gives optically active butan-2, 3-diol. because

Statement-2:

Reaction of alkenes with alkaline $KMnO_4$ is a cis addition.

a. Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1

b. Statement-1 is True, Statement-2 is True; Statement-2 is not a correct explanation for Statement-1

c. Statement-1 is True, Statement-2 is False

d. Statement-1 is False, Statement-2 is True

Q54

Statement-1:

For an adiabatic expansion of ideal gas $\Delta U = 0$ because

Statement-2:

During adiabatic expansion, temperature decreases.

a. Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1

b. Statement-1 is True, Statement-2 is True; Statement-2 is not a correct explanation for Statement-1

c. Statement-1 is True, Statement-2 is False

d. Statement-1 is False, Statement-2 is True

Q55

Statement-1:

Phenolphthalein is used as an indicator during the titration of oxalic acid against sodium hydroxide. because

Statement-2:

The pH range of phenolphthalein is from to 9.6.

a. Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1

b. Statement-1 is True, Statement-2 is True; Statement-2 is not a correct explanation for Statement-1

c. Statement-1 is True, Statement-2 is False

d. Statement-1 is False, Statement-2 is True

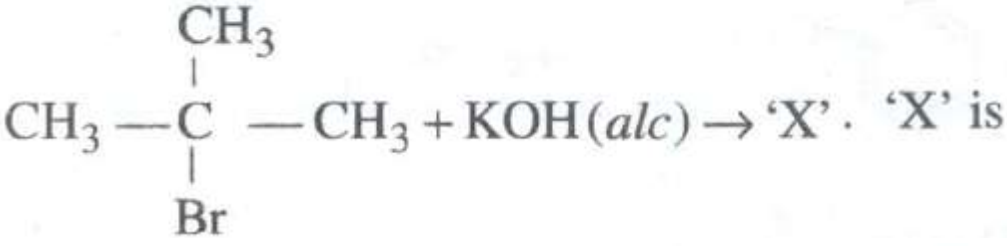
Section-IV

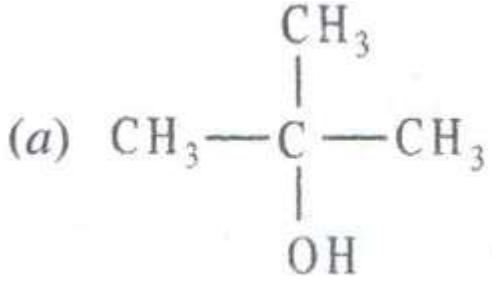
Linked Comprehension Type

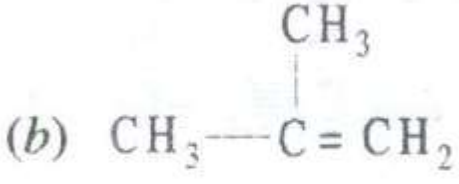
C_{56-58}: Paragraph for Question Nos. 56 to 58

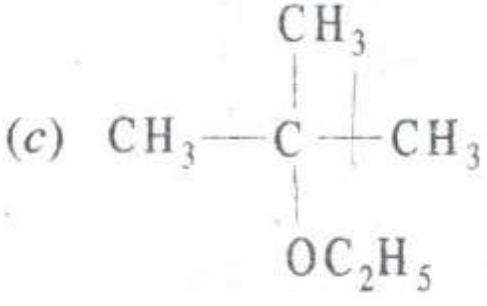
Nucleophillic substitution reactions depend upon nature of nucleophile. Nucleophiles are –vely charged bases and have tendency to abstract a proton but also nucleophile can attack itself to +ve centre. It means substitution and elimination reaction complete with each other. 3° halides undergo elimination faster than substitution. In protic polar solvent, 1° halide mostly favour substitution but no9n-polar solvent, high temperature, stronger nucleophile favour elimination.

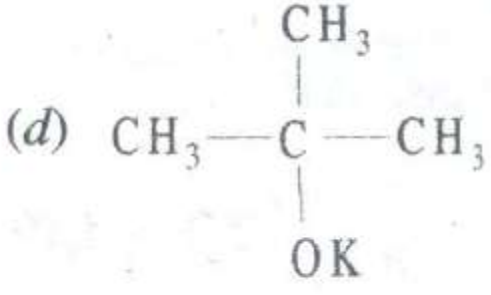
Q56











Q57

Which of the following ethers cannot be obtained?

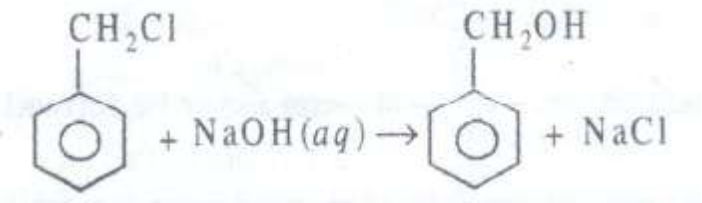
a. $(CH_3)_3C\text{-}O\text{-}C(CH_3)_3$

b. $C_2H_5OC_2H_5$

c. CH_3COCH_3

d. $C_6H_5OC_6H_5$

Q58

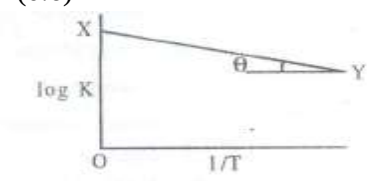


The above reaction follows

a. S_N1 mechanism and is nucleophilic substitution
b. $S_N2$mechanism and is nucleophilic substitution
c. S_N1 mechanism and is nucleophilic addition reaction
d. S_N2 mechanism and is nucleophilic addition reaction

$C_{59\text{-}61}$: Paragraph for Question Nos. 59 to 61

The variation of eQuilibrium constant K with temperature is given by $\log K = \frac{\Delta S}{R} - \frac{\Delta H}{2.303RT}$ for a graph between log K and 1/T a straight line was observed as shown in the figure. The OX value = 9 and $\theta = \tan^{-1}(0.6)$



Q59

The value of ΔH for the reaction

a. 15 J/mol
b. 11.48 J/mol
c. 20 J/mol
d. 30 J/mol

Q60

log K is eQual to

a. $9 - \frac{0.6}{298}$
b. $10 - \frac{0.6}{298}$
c. $9 + \frac{0.6}{298}$
d. $10 + \frac{0.6}{298}$

Q61

The value of ΔS for the reaction

a. 9 R
b. $\frac{9}{R}$
c. $0.6\ R^2$
d. $\frac{R}{0.6}$

Section-V

Subjective Type

0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

Q62

A sample of magnesium was burnt in air to give a mixture of MgO and Mg_3N_2. The ash was dissolved in 60 meQ HCI and the resulting solution back titrated with NaOH. 12 meQ of NaOH were reQuired to reach the end point. An excess of NaOH was then added to the solution distilled. The ammonia released was then trapped in 10 meQ of second acid solution. Back titration oif this reQuired 6 meQ of the base. Calculate the percentage of Mg burnt it the nitride.

Q63

calculate the enthalpy change for the combustion of cyclopropane at 298K. the enthalpy of formation of CO_2(g) and H_2O(I) and propene (g) are -393.5 kJ, -285.8 kJ and 20.42 kJ mol^{-1} respectively. The enthalpy of isomerization of cyclopropane to propene is -33.0 kJ mol^{-1}

Q64

A 250 ml flask and 100ml flask are separated by a stop cork. At 350 K the nitric oxide in the larger flask exerts a pressure of 0.46 atm and the smaller one contains oxygen at 0.86 atm. The gases are mixed by opening the stop cork. The reactions occurring are

$2NO + O_2 \rightarrow 2NO_2 \rightleftharpoons N_2O_4$

The first reaction is complete while the second one is at eQuilibrium. Assuming all the gases behave ideally calculate the K_p if final pressure is 0.37 atm.

Q65

The reaction $A + Ho^- \rightarrow$ products obey the rate law expression. $\frac{-d[A]}{dt} = k[A][OH^-]$

If the initial concentration of [A] and $[OH^-]$ are 0.002 M and 0.3 M respectively. Calculate the rate constant if it takes 30 seconds for 1% A to react.

Section-VI

Matrix-Match Type

Q66

Column I	**Column II**
a. $[Sc(H_2O)_6]^{3+}$	p. Coloured
b. $[Ti(H_2O)_6]^{3+}$	Q. Colourless
c. $[Cr(H_2O)_6]^{3+}$	r. Paramagnetic μ_{BM} = 3.7 app
d. $[Co(NH_3)_6]^{3+}$	s. d^2sp^3 hydridization

Q67

Column I	Column II
a. Spinel	p. water softener
b. Feldspar	Q. $MgAl_2O_4$
c. Malachite	r. $KAlSi_3O_8$
d. Sodium polumetaphosphate	s. $CuCO_3.Cu(OH)_2$

Q68

Column I	Column II
a. Oxidation potential	p. $+Pt(s)\left\vert \begin{matrix} H_2 \\ P_{1\ atm} \end{matrix}\right\vert \begin{matrix} H^+ \\ C_1 \end{matrix}\left\vert\left\vert \begin{matrix} H^+ \\ C_1 \end{matrix}\right\vert \begin{matrix} H_2 \\ P_{2\ atm} \end{matrix}\right\vert Pt(s)$
b. Discharge potential	Q. Reduction potential = 0
c. Concentration cell	r. Depends upon the nature of electrode.
d. Standard hydrogen electrode	s. Increases with dilution.
	t. $Zn(s)\left\vert \begin{matrix} Zn^{2+} \\ C_1 \end{matrix}\right\vert\left\vert \begin{matrix} Cu^{2+} \\ C_1 \end{matrix}\right\vert Cu(s)$

PART-III (Mathematics)

Section-I

Straight Objective Type

Q69

If ∝, β are the roots of $x^2 + (\sin\phi - 1)x - \frac{1}{2}cos^2\phi = 0$, then the values of ϕ for which $\propto^{2+}\beta^2$i maximum are

a. $2n\pi + \pi/2$

b. $2n\pi - \pi/2$

c. $n\pi + (-1)^n \pi/3$

d. None of these

Q70

When $3^{2002}+7^{2002}+2002$ is divided by 29, the remainder is

a. 7

b. 1

c. 0

d. 2

Q71

If $log_{30}3 = a$ and $log_{30}5 = b$, then $log_{30}\ 8$ is eQual to

a. $\frac{1}{2}(1 - a - b)$

b. $3(1 - a - b)$

c. $a + b$

d. $\frac{8}{3}(1 - a - b)$

Q72

The eQuation $x - log_e(1 + e^{x)} = c$ has a solution

a. for every $c < 1$

b. for every $c > -1$

c. for every $c < 0$

d. for every $c \geq 1$

Q73

The smallest value of $\propto$ satisfying the conditions that $\propto$ is a positive integer and that $\frac{\propto}{540}$ is the sQuare of a rational number is

a. 15

b. 3

c. 5

d. 6

Q74

If $f(x - y) = f(x)g(y) - f(y)g(x) \forall x, y \in R$, where $f(x)$ is non-zero function, then

a. if $f'(0^+)$ exists then it is eQual to $f'(0^-)$

b. if exists $f'(0^+)$ exists then $f'(0^-)$ does not exist

c. if exists $f'(0^+)$ exists then $f'(0^-)$ also exists but not eQual

d. None of these

Q75

If n be a positive integers, then the number of values of n satisfyin $\int_0^{\pi/2} \left[n^2 \left(\cos 3x + \frac{1}{2}\cos x\right) + \sin x - 2n \cos x\right] dx \leq 1$, is

a. 10

b. 11

c. 12

d. None of these

Q76

The value of the integral $\int \cos \log x \, dx$ is

a. x/2[$\cos \log x - \sin \log x$]

b. x/2[$\cos \log x + \sin \log x$]

c. x[$\cos \log x + \sin \log x$]

d. x/2[$\sin \log x - \cos \log x$]

Q77

Consider the functions $f(x) = a|x + 1|, g(x) = x + a^2|x|$, where a is real parameter, Then the graphs of $f(x)$ and $g(x)$

a. will cut at three distinct points if $a = 1/2$

b. will cut at three distinct points if $a = 3/2$

c. will not cut at three distinct points if $a = 0$

d. will cut at three distinct points for no value of a

Section-II

Multiple Objective Type

Q78

If $\tan\theta = n\tan\phi$ $(n > 0)$, then

a. $tan^2(\theta - \phi) = \frac{(n-1)^2}{(\cot\phi - n\tan\phi)^2 + 4n}$

b. $tan^2(\theta - \phi) = \frac{(n-1)^2}{(\cot\phi - n\tan\phi)^2}$

c. $tan^2(\theta - \phi) \leq \frac{(n-1)^2}{4n}$

d. $tan^2(\theta - \phi) \geq \frac{(n-1)^2}{4n}$

Q79

If $0 \leq , y, z < \pi/2$ and $x + y + z = \pi/2$ then $\tan x \tan y \tan z$

a. is minimum if $x = y = z$

b. is maximum if $x = y = z$

c. has a maximum value $\left(\frac{1}{\sqrt{3}}\right)^3$

d. has a minimum value $\left(\frac{1}{\sqrt{3}}\right)^3$

Q80

If $a + b + c = 0$, then

a. $a^4 + b^4 + c^4 = \frac{1}{2}(a^2 + b^2 + c^2)^2$

b. $a^4 + b^4 + c^4 = \frac{1}{4}(a^2 + b^2 + c^2)^2$

c. $a^5 + b^5 + c^5 = -5\,abc\,(ab + bc + ac)$

d. $a^5 + b^5 + c^5 = -10\,abc\,(ab + bc + ac)$

Q81

The ineQuality $\left(1 + \frac{a}{\sin x}\right)\left(1 + \frac{b}{\cos x}\right) \geq (1 + \sqrt{2ab})^2$

a. is defined if $a, b > 0, 0 < x < \pi/2$

b. is defined if $ab > 0, 0 < x < \pi/2$

c. can not become an eQuality for any x

d. can become an eQuality for some x

Q82

if $y = \int_0^\infty \frac{e^x}{1+z^2} dz$, then

a. y as a function of x is increasing

b. y as a function of x is decreasing

c. $y" + y = 1/x$

d. $y" - y = 1/x$

Q83

If $a + b = c + d = p$ and $\left(x + \frac{P}{2}\right)^2 = y$, then the eQuation $(x + a)(x + b)(x + c)(x + d) = m$

a. is reducible to $\left(y + ab - \frac{P^2}{4}\right)\left(y + cd - \frac{P^2}{4}\right) = m$

b. . is reducible to $\left(y + ab - \frac{P^2}{4}\right)\left(y + cd + \frac{P^2}{4}\right) = m$

c. has four real roots if a, b, c, d, m are real

d. can not have four positive roots for $a, b, c, d, m \in R \; if \; ab + cd < P^2/2$

Q84

If n is a natural number of the type $6k + 1$ and is greater than 6 then $(x + y)^n - x^n - y^n$

a. is divisible by $x^2 + xy + y^2$

b. is divisible by $(x^2 + xy + y^2)^2$

c. is divisible by $(x^2 + xy + y^2)^3$

d. is divisible by $xy(x + y)$

Q85

If the third term of the expansion of $\left(\frac{1}{x}+x^{log_{10}x}\right)^5$ is 1000, is then x may be

a. 5000

b. x=100

c. $1/\sqrt{10}$

d. $x = 1/10$

Section-III

Assertion-Reason Type

Q86

Statement-1:

$\int_0^b \frac{xdx}{(1+ax)^2} = \frac{1}{a^2}\log(1+ab) - \frac{b}{a(1+ab)}$ where $b > a > 0$ because

Statement-2:

$\int \frac{dx}{(1+ax)^2} = -\frac{1}{(1+ax)}$

a. Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1
b. Statement-1 is True, Statement-2 is True; Statement-2 is not a correct explanation for Statement-1
c. Statement-1 is True, Statement-2 is False
d. Statement-1 is False, Statement-2 is True

Q87

Statement-1:

If $a+b+c=0$, then $6(a^5+b^5+c^5) = 5(a^2+b^2+c^2)(a^3+b^3+c^3)$ because

Statement-2:

If $a+b+c=0$, then $a^n+b^n+c^n = 3a^{n/3}b^{n/3}c^{n/3}$ if n is odd.

a. Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1
b. Statement-1 is True, Statement-2 is True; Statement-2 is not a correct explanation for Statement-1
c. Statement-1 is True, Statement-2 is False
d. Statement-1 is False, Statement-2 is True

Q88

Statement-1:

The locus of point of intersectional variable lines (l, m variables, a, b constants)

$lx + my = a, mx - ly = b$ where $l^2 + m^2 = 1$ is a circle because

Statement-2:

The eliminant is $x^2 + y^2 = 1$

a. Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1
b. Statement-1 is True, Statement-2 is True; Statement-2 is not a correct explanation for Statement-1
c. Statement-1 is True, Statement-2 is False
d. Statement-1 is False, Statement-2 is True

Q89

Statement-1:

If $f(n) = \frac{n}{2n+1} + \frac{1}{2^3-2} + \frac{1}{4^3-4} + \frac{1}{6^3-6} + \ldots + \frac{1}{(2n)^3-2n}$ and $g(n) = \frac{1}{n+1} + \frac{1}{n+2} + \frac{1}{n+3} + \ldots + \frac{1}{2n}$, then $f(n) = g(n)$ for all n. because

Statement-2:

$f(1) = g(1)$ and $f(n+1) - f(n) = g(n+1) - g(n)$.

a. Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1
b. Statement-1 is True, Statement-2 is True; Statement-2 is not a correct explanation for Statement-1
c. Statement-1 is True, Statement-2 is False
d. Statement-1 is False, Statement-2 is True

Section-IV

Linked Comprehension Type

$M_{90\text{-}92}$: Paragraph for Question Nos. 90 to 92

Let the function $f(x)$ be continuous on $[0, \infty)$ and $a > 0, b > 0$. Answer the following Questions :

Q90

$\int_0^z \frac{f(ax)-f(bx)}{x} dx$ must be eQual to

a. $\big(f(\infty) - f(0)\big) log \frac{a}{b}$

b. $\big(f(\infty) + f(0)\big) \log \frac{a}{b}$

c. $\log f(\infty) - \log f(0)$

d. None of these

Q91

The value of the integral $a > 0, b > 0$ $\int_0^\infty \frac{e^{-ax}-e^{-bx}}{x} dx$ must be eQual to

a. $\log a/b$

b. $\log \frac{b}{a}$

c. $\frac{a+b}{2}$

d. None of these

Q92

The value of the integral $\int_0^\infty \frac{sin^3 x}{x^2} dx$

a. $1/4 \log 3$

b. $3/4 \log 3$

c. $1/3 \log 3$

d. None of these

$M_{93\text{-}95}$: Paragraph for Question Nos. 93 to 95

The cevian of a triangle is any segment joining any of its vertices to a point on the opposite sides. Let AD, BE, CE be three cevians, let $r = \frac{\sin ABE}{sin\ DAV} \frac{sin\ BCF}{sin\ EBC} \frac{sin\ CAD}{sin\ FCA}$, $s = \frac{AF}{FB}.\frac{BD}{DC}.\frac{CE}{EA}$.

Answer the following Questions :

Q93

If AD, BE, CF are concurrent, them

a. $r = 1/2$

b. $r = 2$

c. $r = 1$

d. None of these

Q94

If $r \neq 1$, then

a. $s \neq 1$

b. $s = 1$

c. $s = 1/2$

d. None of these

Q95

If $s \neq 1$, then which of the conclusions is false

a. AD, Be, CF cannot be medians of the triangle ABC

b. AD, BE, CF cannot be altitudes of the triangle ABC

c. AD, BE, CF cannot be bisectors of ΔABC

d. None of these

Section-V

Subjective Type

0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

Q96

$x, y \in R, x^2 + y^2 + xy = 1$, then the minimum value of $x^3y + xy^3 + 4$ is

Q97

If p and q are real and $x^2 + px + q$ divides $x^4 + 1$ then $\sqrt{2}\,pq$ must be eQual to

Q98

If the length of the perpendicular from origin to the common tangent of the conics $y^2 = 4x$ and $x^2 + 4y^2 = 8$ is $\frac{4}{\sqrt{\lambda}}$, then λ must be

Q99

If $1^k + 2^k + 3^k + \ldots + n^k = An^k + Bn^k + Cn^{k-1} + \ldots Ln$ then $1/B$ must be eQual to

Section-VI

Matrix-Match Type

Q100

Let $f(x) = \frac{Kx^2+L}{x-1} + Mx$, where $f(2) = 23, f'(0) = 4$ and $\int_1^0 (x-1)f(x)dx = \frac{37}{6}$ match the following :

Column I	**Column II**
a. K	p. 5
b. L	Q. 3
c. M	r. 1

Q101

Match the following seQuence with their characteristics :

Column I	**Column II**
a. $\left(1+\frac{1}{n}\right)^n$	p. bounded
b. $n^{1/n}$	Q. monotonic
c. $\frac{\sin n}{n}$	r. convergent
d. $\sin n$	s. oscillatory

Q102

Match the following functions with their domains (in integer)

Column I	**Column II**
a. $\sqrt{sin\sqrt{x}}$	p. $\left[\frac{\pi}{6}+n\pi, \frac{\pi}{6}+n\pi\right]$
b. $\sqrt{\cos x^2}$	Q. $\left[\frac{1}{3}, 1\right]$
c. $sin^{-1}\frac{2x}{1+x}$	r. $[4n^2\pi^2, (2n+1)^2\pi^2]$
d. $cos^{-1}(2\sin x)$	s. $\left[-\sqrt{\frac{\pi}{2}}, \sqrt{\frac{\pi}{2}}\right] \cup \left[\sqrt{\frac{\pi}{2}(4n-1)}, \sqrt{\frac{\pi}{2}(4n+1)}\right] \cup \left[\sqrt{\frac{\pi}{2}(4n-1)}, \sqrt{\frac{\pi}{2}(4n+1)}\right]$