<u>Practice Paper 6</u>

Paper-I

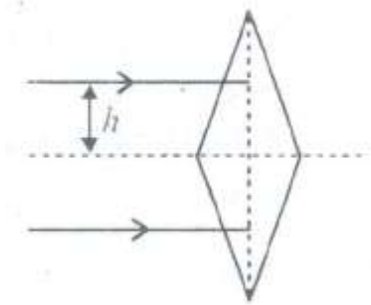
Part-1 (physics)

Section-I

Straight Objective Type

<u>Q1</u>

Two identical isosceles prisms of small prism angle A and refractive index μ are placed with their bases touching each other. This system can act as a crude converging lens. Assuming a ray of light is incident on a prism at a height h from its base the focal length of this system is



a. $\frac{A}{h(\mu-1)}$

b$\frac{(\mu-1)}{hA}$

c. $\frac{A}{(\mu-1)h^2}$

d. $\frac{h}{(\mu-1)A}$

<u>Q2</u>

The wavelength of $K_\propto$ X-ray produced by a X-ray tube is 0.76Å. The atomic number of the anode material of the tube is

a. 38

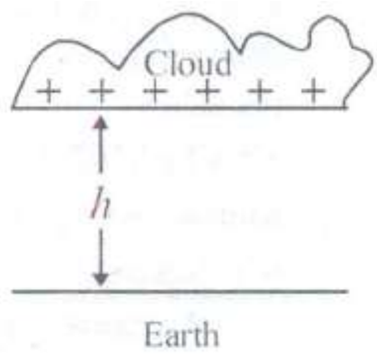
b. 40

c. 43

d. 47

Q3

A thunder cloud and the earth's surface may be regarded as a pair of charged parallel plates separated by a distance h as shown. The capacitance of the system is C. When a lighting flash of mean current I and time duration t occurs the electric field strength between cloud and earth is reduced by



a. $\frac{it}{C}$

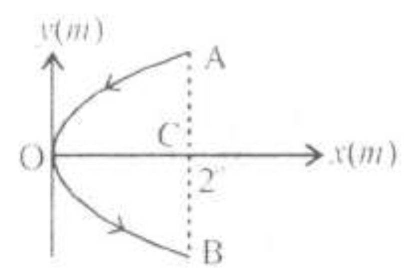
b. Cit

c. $\frac{Cit}{h}$

d. $\frac{it}{Ch}$

Q4

A conducting wire bent in the form of a parabola $y^2 = 2x$ carries a current $i = 2A$ as shown. The wire is placed in a uniform magnetic field $\vec{B} = -4\hat{k}$ tesla. The magnetic force on the wire (in newton) is



a. $-16\hat{\imath}$

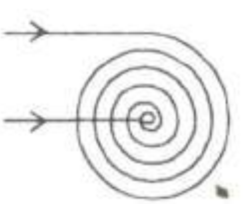
b. $32\hat{\imath}$

c. $-32\hat{\imath}$

d. $16\hat{\imath}$

Q5

A plane spiral with large N number of turns wound tightly to one another is located in a uniform magnetic field perpendicular to the plane of spiral. The outside radius of the spiral's turn is equal to a. magnetic field varies with time as $B = B_0 \sin \omega t$, where B_0 and ω are constants. The amplitude of induced emf in the spiral is



a. $4\,\pi\, Na^2B_0\omega$

b. $7\pi\, Na^2\, B_0 2\omega$

c. $\frac{1}{3}\pi Na^2B_0\omega$

d. $\frac{1}{3}\mu_0\pi N^2 aB_0\omega$

Q6

Two particle 1 and 2 move with constant velocities V_1 and V_2. At initial moment their radius vectors are equal r_1 and r_2. How must these four vectors be related for the particles to collide?

a. $\frac{\vec{r}_1-\vec{r}_2}{|\vec{r}_1-\vec{r}_2|} = \frac{\vec{v}_1-\vec{v}_2}{|\vec{v}_1-\vec{v}_2|}$

b. $\frac{\vec{r}_1+\vec{r}_2}{|\vec{r}_1-\vec{r}_2|} = \frac{\vec{v}_1-\vec{v}_2}{|\vec{v}_1+\vec{v}_2|}$

c. $\frac{\vec{r}_1-\vec{r}_2}{|\vec{r}_1+\vec{r}_2|} = \frac{\vec{v}_1-\vec{v}_2}{|\vec{v}_1+\vec{v}_2|}$

d. $\frac{\vec{r}_1-\vec{r}_2}{|\vec{r}_1+\vec{r}_2|} = \frac{\vec{v}_1+\vec{v}_2}{|\vec{v}_1-\vec{v}_2|}$

Q7

A point moves along the arc of a circle of radius R. Its velocity varies as $v = a\sqrt{s}$ where a is constant.

The angle $\propto$ between the vector of total acceleration and the vector of velocity is given by

a. $\tan^{-1}\left(\frac{R}{s}\right)$

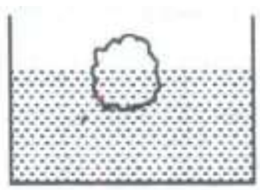
b. $\tan^{-1}\left(\frac{R}{2s}\right)$

c. $\tan^{-1}\left(\frac{2s}{R}\right)$

d. $\tan^{-1}\left(\frac{s}{R}\right)$

Q8

A body floats In a liquid contained in a beaker. If the whole system as shown in figure falls freely under gravity then the up thrust on the body due to liquid is



a. zero

b. equal to the weight of liquid displaced.

c. equal to the weight of the body in air.

d. equal to the weight of the immersed portion of the body.

Q9

A plate of mass M remains in equilibrium in air when n bullets are fired per second on it. The mass of each bullet is m and it strikes the plate with speed v. if the coefficient of restitution is e, then (M >> m)

a. $M = \frac{nm(e+e).v}{g}$

b. $M = \frac{nmv}{g}$

c. $M = \frac{2nm(e+e^2)}{g}$

c. $M = 2nmg$

Section-II

Q10

Statement-1:

A body of mass m_1 collides head on elastically with another stationary body of mass m_2. After the collision, velocity of mass m_2 is maximum, when $m_1 \ll m_2$.

Statement-2:

Velocity of second body is always maximum, when its mass m_2 is greater than mass of the hitting body.

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 True, Statement-2 is True

Q11

Statement-1:

A uniform solid cylinder rolling with angular velocity ω along a plane surface strikes a vertical rigid wall. Angular velocity of cylinder when it begins to roll up a wall is less than the initial Angular velocity (ω) because

Statement-2:

After striking the vertical wall angular velocity increases.

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 True, Statement-2 is True

Q12

Statement-1:

A current carrying conductor of any arbitrary shape in uniform magnetic field experiences a force given by $\vec{F} = i(\vec{l'} \times \vec{B})$ where l' is the length vector joining initial to final points. because

Statement-1:

Force on a current carrying conductor is given by $F = i\left(\int \vec{d}l\right) \times \vec{B}$ when for a conductor $\int \vec{d}l$ represents vector sum of all the length elements from initial to final points.

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 True, Statement-2 is True

Q13

Statement-1:

Ionization energy of atomic hydrogen is greater than atomic deuterium. because

Statement-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 True, Statement-2 is True

Section-III

Linked Comprehension Type

$M_{14\text{-}16}$: Paragraph for Question Nos. 14 to 16

Q14

Number of photoelectrons released per second is :

a. $\frac{PR^2}{E}$

b. $\frac{P}{R}$

c. $\frac{PR^2}{r^2}$

d. $\frac{Pr^2}{R^2}$

Q15

The wavelength of incident photon is :

a. $\frac{hc}{NE}$

b. $\frac{hc}{E}$

c. $\frac{Nhc}{E}$

d. None of these

Q16

The electric potential of the sphere:

a. remains unchanged

b. increases

c. decreases

d. cannot be found

M$_{17-19}$: Paragraph for Question Nos. 17 to 19

Vectors are those which have both magnitude and direction and also satisfy the law of vector addition. Unit vectors $\hat{i}$, $\hat{j}$ and $\hat{k}$ point along x, y and z- directions. It is very essential to subtract or add vectorially while dealing with vector quantities. The resultant vector may be in the plane of the ground or in perpendicular plane. Use of the directions of poles is a common practice.

Q17

A man walks 30 m north, 20 m East and 30 $\sqrt{2}$ South west. The displacement is

a. $80\sqrt{2}$ m North West

b. 10 m West

c. 10 m East

d. zero

Q18

A man rotates a frame 45° and then 30° clockwise. He repeats them in reverse. The angular displacement involved is/are

a. vectors

b. scalars

c. tensor

d. axial vectors.

<u>Q19</u>

A stone to a string of length `l′ is whirled in vertical circle. If its speed at the lower-most position is u, the magnitude of the change in velocity as it reaches the horizontal position is

a. $\sqrt{u^2 - 2gl}$

b. $\sqrt{2gl}$

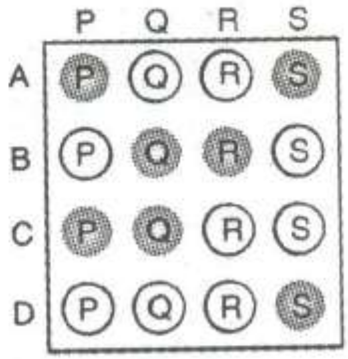
c. $\sqrt{u^2 - gl}$

d. $\sqrt{2(u^2 - gl)}$

Section-IV

Matrix-Match Type

If the correct matches are A – P, A – S, B – Q, B – R, C – P, C – Q and D – S then the correctly 4 x 4 matrix should be as given



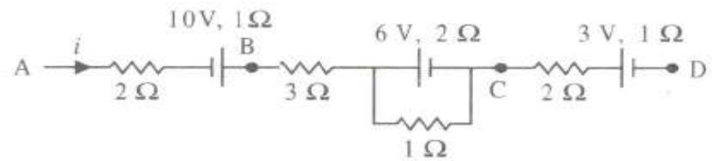
<u>Q20</u>

Considering a projectile motion

Column I	**Column II**
a. Change in magnitude momentum.	p. At highest point of the parabolic path.
b. Maximum angular momentum about the point of projection.	q. $2mv\sin\theta$ between the point of projection and target.
c. Minimum velocity.	r. $L = \frac{mv^3\sin^2\theta\cos\theta}{2g}$
d. Magnitude of change in momentum.	s. Present along vertical direction

Q21

Circuit shown is a part of complicated circuit. The potential difference between A and B is – 1 volt.



Column I	**Column II**
a. Current iin the circuit	p. 4 A
b. Current through 1 Ω resistor	q. 3 A
c. Potential difference between A and D	r. 12 V
d. Potential difference between Cand D	s. 24 V

Q22

Match the following :

Column I	**Column II**
a. Range and least count of ammeter	p. Inverse relation
b. Least count and sensitivity of ammeter	q. Linear relation
c. Range and accuracy of ammeter	
d. Range and multiplication factor of a voltmeter	

Part-II (Chemistry)

Section-I

Straight Objective Type

Q23

The pH of a buffer solution of 0. 1 M $HCOONH_4$ $[pK_b = 5, pK_a = 4]$ is equal to

a. 6.5

b. 7.0

c. 7.5

d. 8.0

Q24

The room where you live is spread with a radioactive element.

Its half-life is 60 days. Its activity is 100 times the permissible value.

After how many days will it be advisable to enter the room?

a. 10 days

b. 398 days

c. 600 days d. 39.8 days

Q25

The average oxidation number of `C' in C_3O_2 and Mg_2C_3 are………………respectively.

a. $-\frac{4}{3}, +\frac{4}{3}$

b. $+\frac{4}{3}, -\frac{4}{3}$

c. $4, 4$

d. $+\frac{2}{3}, -\frac{2}{3}$

Q26

Which of the following is the most stable?

a. But -1-ene

b. But-2-ene

c. Pent-1-ene

d. Ethane

Q27

An engine absorbs heat of 5000 kcal from source at 127°C. The efficiency of the engine when it is connected to a sink at 27°C will be

a. 0.75

b. 0.25

c. 0.85

d. 0.15

Q28

The time required for 99% of Ist order reaction to complete is 100 min. How much time will it take to 99% completion?

a. 100 min

b. 200 min

c. 300 min

d. 400 min

Q29

Which of the following will produce H_2?

(i). $\mathrm{Fe} + \mathrm{H_2SO_4(dil)} \rightarrow$

(ii). $\mathrm{Mg} + \mathrm{HN)_3(5\%)} \rightarrow$

(iii). $\mathrm{Sn} + \mathrm{HCI(dil)} \rightarrow$

(iv). $\mathrm{Cu} + \mathrm{H_2SO_4(conc.)} \rightarrow$

a. (i) and (iv)

b. (i), (ii) and (iv)

c. (i), (ii), (iii) and (iv)

d. (i), (ii) and (iii)

Q30

The gold numbers of P, Q, R and S are 0.04, 0.002, 10 and 25 respectively. The protecting powers of P, Q, R and S are in the order

a. $P > Q > R > S$

b. $Q > P > R > S$

c. $Q > S > R > P$

d. $S > R > Q > P$

Q31

The product of I^{-} withO_4^{-} in alkaline medium is

a. I_2

b. IO_3^{-}

c. IO^{-}

d. IO_4^{-}

Section-II

Assertion-Reason Type

Q32

Statement-1:

The energy of an electron is mainly determined by the value of principle quantum number. Because

Statement-2:

The principle quantum number `n’ is measure of the most probable distance of finding the electron around the nucleus.

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 True, Statement-2 is True

Q33

Statement-1:

At isoelectric point of an amino acid, the solubility of amino acid becomes minimum. because

Statement-2:

It is because +ve and –ve charge on Zwitter ion is equal at isoelectric point.

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 True, Statement-2 is True

Q34

Statement-1:

Phenoxide ion is stronger base as compared to ethoxide ion.

because

Statement-2:

Phenol is stronger acid in comparison to ethanol.

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 True, Statement-2 is True

Q35

Statement-1:

Most of the endothermic reactions are not spontaneous at room temperature but become spontaneous at higher temperature.

Because.

Statement-2:

Entropy of system increase with increase in temperature and $T\Delta S$ becomes greater than ΔH.

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 True, Statement-2 is True

Section-III

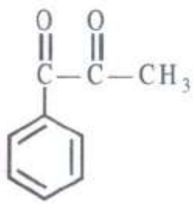
Linked Comprehension Type

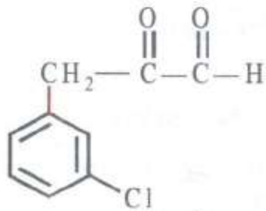
$C_{36\text{-}38}$: Paragraph for Question Nos. 36 to 38

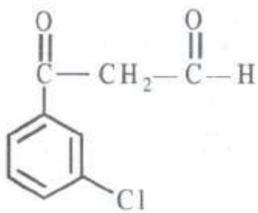
Compound ‘A’ of molecular formula $C_9H_7O_2CI$ exists in keto form and predominantly in enolic form ‘B’. On oxidation with $KMnO_4$ ‘A’ gives m- chlorobenzoic acid.

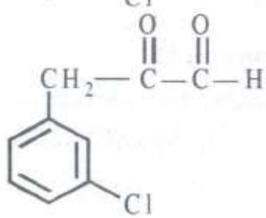
Q36

The structure `A’ in keto form is

(a) 

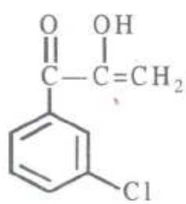
(b) 

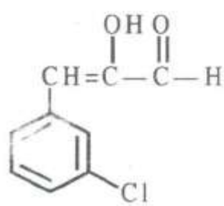
(c) 

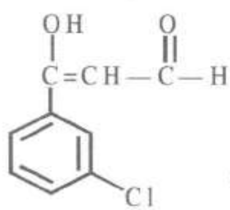
(d) 

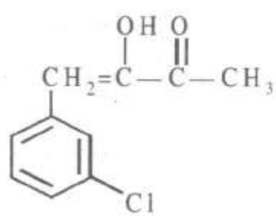
Q37

The structure of enol form of `A’ is

(a) 

(b) 

(c) 

(d) 

Q38

Out of `A’ and `B’ which will give violet color with $FeCl_3$?

a. Both `A’ and `B’

b. Only `B’

c. Only `A’

d. Neither `A’ nor `B’

C_{39-41}: Paragraph for Question Nos. 39 to 41

Hydrogen is the most abundant element in the universe because it is present in the Sun and the stars. It has 7 isotopes discovered so far: ${}_1^1H$, ${}_1^2H$, ${}_1^3H$, ${}_1^4H$, ${}_1^5H$, ${}_1^6H$, ${}_1^7H$. The half-life of ${}_1^4H$, ${}_1^5H$, ${}_1^6H$ are 9.93×10^{-23}, 8.01×10^{-23}, 3.26×10^{-22} second respectively. In 2003, hydrogen -7 was produced at the Riken lab in Japan By colliding a high energy beam of He- 8 atoms with cryogenic hydrogen target and detecting tritons, the Nuclei of tritium atom and neutrons from break up of hydrogen -7, the same method is used to produce Hydrogen -5. It can be liquefied at low temperature. It can be solidified at -196° C and 2.5 million atm Pressure to a black metal like solid. It is the lightest gas. Due to its controversial position in periodic table, It is known as rogue element. Ortho hydrogen and para hydrogen are allotropes of hydrogen.

Q39

The half-life of ${}_1^3H$ is

a. 12.32 years

b. 12.32 month

c. 12.32 min

d. 12.32 s.

Q40

$2Na + H_2 \xrightarrow{\text{heat}} 2NaH$ (sodium hydride) In the above reaction, H_2 acts as

a. Oxidising agent

b. Reducing agent

c. Both (a) and (b)

d. None of these

Q41

Which of the following isotope of hydrogen is radioactive ?

a. ${}_1^1H$

b. ${}_1^2H$

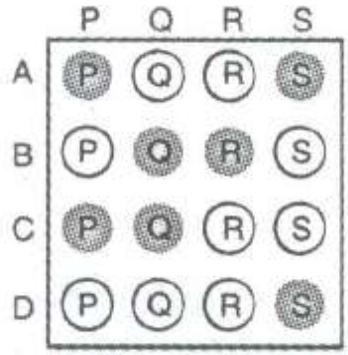
c. ${}_1^3H$

d. None of these.

Section-IV

Matrix-Match Type

If the correct matches are $A - P, A - S, B - Q, B - R, C - p < C - q$ and $D - S$, then the correctly bubbled matrix should be as follows:



Q42

Column I
a. Fusion mixture
b. Diborane
c. Nitric oxide
d. Producer gas

Column II
p. $CO + N_2$
q. $K_2CO_3 + Na_2CO_3$
r. reducing agent
s. Colorless, paramagnetic

Q43

Column I
a. Ni^{2+} + DMG → (dimethy1 glyoxime)
b. $Co^{2+} + (NH_4)SCN \xrightarrow{\text{Acetone}}$
c. $Ba^{2+}CrO_4 2 - \rightarrow$
d. $Ca^{2+} + C_2C_4 2 - \rightarrow$

Column II
p. White ppt.
q. Scarlet red ppt.
r. Blue coloration
s. Yellow ppt.

Q44

Column I
a. Baeyer's reagent
b. Ammoniacal curpous chloride
c. Aqueous KOH + dil. $HNO_3 + AgNO_3$
d. Aqueous KHO + 2, 4- DNP

Column II
p. Ethylidene chloride and ethylene chloride
q. Benzyl chloride and benzyl bromide
r. But-1-yne and but-2-yne
s. Benzene and cyclohexene

Part-III (Mathematics)

Section-I

Straight Objective Type

Q45

If $f(x) = \log\left(\frac{1+x}{1-x}\right)$ then $f(x) + f(y)$ is

a. $f(x + y)$

b. $f\left(\frac{x+y}{1+xy}\right)$

c. $(x + y)\ f\ \left(\frac{1}{1+xy}\right)$

d. $f(x) + \frac{f(y)}{1+xy}$

Q46

The smallest positive solution of the equation $(81)^{\sin^2 x} + (81)^{\cos^2 x} = 30$ is

a. $\frac{\pi}{12}$

b. $\frac{\pi}{6}$

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

d. None of these

Q47

Let length of the common chord of two circles of radii 15 cm and 20 cm, whose centres are 25 cm apart, is (in cm)

a. 16

b. 24

c. 15

d. 20

Q48

Let A be the fixed point (0, 4). And B be a moving point $(2t, 0)$.Let M be the mid-point of AB and let the perpendicular bisector of AB meet the y-axis at R. The locus of the mid-point P of MR is

a. $y + x^2 = 2$

b. $x^2 + (y - 2)^2 = 1/4$

c. $(y - 2)^2 - x^2 = 1/4$

d. None of these

Q49

The number of tangents that can be drawn from the point (2, 3) to the parabola $y^2 = 8x$ is

a. 1

b. 2

c. 0

d. 3

Q50

If the two tangents drawn from a point P to the parabola $y^2 = 4x$ are at right angles, then the locus of P is

a. $x - 1 = 0$

b. $2x + 1 = 0$

c. $x + 1 = 0$

d. $2x - 1 = 0$

Q51

The maximum distance between two points of the unit cube is

a. $\sqrt{2} + 1$

b. $\sqrt{2}$

c. $\sqrt{3}$

d. $\sqrt{2} + \sqrt{3}$

Q52

A variable plane passes through a fixed point (a, b, c) and cuts the co-ordinate axes at P, Q, R. Then the co-ordinates (x, y, z) or the centre of the sphere passing through P, Q, R and the origin satisfy the equation

a. $\frac{a}{x}+\frac{b}{y}+\frac{c}{z}=2$

b. $\frac{x}{y}+\frac{y}{b}+\frac{z}{c}=3$

c. $ax+by+cz=1$

d. $ax+by+cz=a^2+b^2+c^2$

Q53

If $f(x)=\frac{1-x}{1+x}$ then $f(f(\cos x))$ equal

a. x

b. $\cos x$

c. $\tan^2(x/2)$

d. None of these

Section-II

Assertion-Reason Type

Q54

Statement-1:

Let P_n be the probability that 2 balls drawn from a bag containing n white and n black balls will be of the same color. Then $\lim_{n\to\infty} p_n=\frac{1}{2}$ because

Statement-2:

$p_n=\frac{n+1}{2n+1}$

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 True, Statement-2 is True

Q55

Statement-1:

If $I_n = \int_0^{\frac{\pi}{2}} \log\cos x.\cos 2nx\,dx\ \ I_n = -\frac{n-1}{n} I_{n-1}$

because

Statement-2

$I_n = \frac{1}{2n}\int_0^{\pi/2} \tan x \sin 2nx.$

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

Q 56.

Statement-1

In a triangle ABC, $A - B = 120°. R = 8r$ then $\cos c = \frac{7}{8}$ because

Statement-2

If a triangle $R = 8r$ and $A - B = 120°$,then $\sin\frac{c}{2} = \frac{1}{4}$.

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

Q 57.

Statement-1:$\lim_{x\to\infty}\frac{x+\log\sqrt{1+x^2}}{x^2} = \frac{1}{6}$. Because

Statement-2: $\lim_{x\to\infty}\frac{1-\frac{1}{\sqrt{1+x^2}}}{3x^2} = \frac{1}{6}$

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-III

Linked Comprehension Type

$M_{58\text{-}60}$: Paragraph for Question Nos. 58 to 60

The graph of a function f(x) in the first quadrant is said to be convex if f"(x) > 0. We can also say that in such a graph chord is above the curve. A graph which is not convex is said to be concave. Answer the following questions:

<u>Q 58.</u>

Let x_1, x_2 be the abscissae of two points in the first quadrant which lie on the graph of a convex function f(xz) then

a. $f\left(\frac{x_1+x_2}{2}\right) \leq \frac{f(x_1)+f(x_2)}{2}$

b. $f\left(\frac{x_1+x_2}{2}\right) \geq \frac{f(x_1)+f(x_2)}{2}$

c. $f\left(\frac{x_1+x_2}{2}\right) = 0$ for all x_1, x_2

d. None of these

<u>Q 59.</u>

Which of the following function's graph is convex in the first quadrant

a. $\log x$

b. $\sin x$

c. x^3

d. None of these

<u>Q 60.</u>

In the first quadrant, the graph of the function $y = x^2 \log x$

a. is convex only

b. is concave only

c. can be both convex and concave

d. None of these

$M_{61\text{-}63}$: Paragraph for Question Nos. 61 to 63

An inequality f (a, b, c) ≥ g (a, b, c) is said to be a superior inequality as compared of f (a, b, c) ≥ h (a, b, c) if g (a, b, c) > h (a, b, c). Further an inequality f (a, b, c) ≥ g (a, b, c) is said to be a better result as compared to f (a, b, c) ≥ h (a, b, c) if whenever former is true, the later is essentially true. The functions f(a, b, c), g (a, b, c), h (a, b, c) may also contain two or one variable. Answer the following questions:

Q 61.

For $0 < x < \frac{\pi}{2}$, $\sin x = \tan x . \cos x$

$$= \tan x \left(1 - 2\sin^2 \frac{x}{2}\right) > x\left(1 - 2.\frac{x^2}{4}\right)$$

$$\left(\because \tan x > x, \sin\frac{x}{2} < \frac{x}{2}, -2\sin^2\frac{x}{2} > -2\frac{x^2}{4}\right)$$

Thus $\sin x > x - \frac{x^3}{2}$.

Which if the following is a superior inequality than $\sin x > x\frac{x^2}{2}$?

a. $\sin x > x + \frac{x^2}{2}$

b. $\sin x > x - \frac{x^3}{8}$

c. $\sin x > x - \frac{x^3}{4}$

d. None of these

Q 62.

Which of the following is a superior inequality than $\sin x > x - \frac{x^2}{4}\left(0 < x < \frac{\pi}{2}\right)$?

a. $\sin x > x + \frac{x^2}{4}$

b. $\sin x > x - \frac{x^3}{6}$

c. $\sin x < x$

d. None of these

Q 63.

Consider a true statement, if a, b, c are sides of a triangle then $abc \geq (a + b - c)(b + c - a)$. Which of the following is a better(true) result than this ?

a. If a, b, c are real numbers there then. $abc \geq (a + b - c)(b + c - a)(c + a - b)$

b. If a, b, c are positive then $abc \geq (a + b - c)(b + c - a)(c + a - b)$

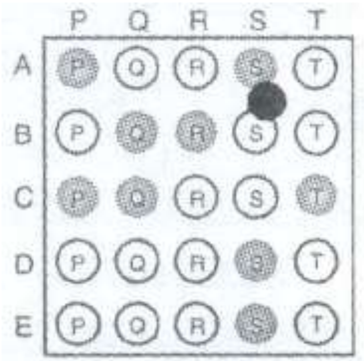
c. If a, b, c are negative numbers then $abc \geq (a + b - c)(b + c - a)(c + a - b)$

d. None of these

Section-IV

Matrix-Match Type

If the correct matches are A – P, A – S, B – Q, B – R, C – P, C – Q, D – S and C – T, then the correctly bubbled 5 x 5 matrix should be as follow



Q 64.

Match the following events with their probabilities when 4 balls are drawn from bag containing 4n balls of four different color. (Balls of same color are identical and number of balls of each color is $n, n \geq 4$).

a. Balls drawn are of same color | p. $\frac{3n^3}{(2n-1)(4n-1)(4n-3)}$

b. Balls drawn are of different colors | q. $\frac{3n(n-1)(7n+1)}{(4n-1)(2n-1)(4n-3)}$

c. Balls drawn are of two colors | r. $\frac{3n(n-1)}{(4n-1)(2n-1)(4n-3)}$

d. Balls drawn are of three colors | s. $\frac{(4-1)(n-2)(n-3)}{(4n-1)(4n-2)(4n-3)}$

Q 65.

Match the following :

a. If β be a root of the equation $x^5 - 1 = 0$ then $\beta^{15} + \beta^{16} + \ldots + \beta^{50}$ must be equation | p. 4

b. If $2f(x^2) + 3f\left(\frac{1}{x^2}\right) = x^2 - 1$, then $f(1)$ is equal to | q. 1

c. The number of solutions of $|x+1| = |x-1|$ is | r. 3

d. The least positive integer for which $4^x + 8^{\frac{2}{3}(x-2)} - 72 - 4^{x-\frac{3}{2}}$ is non-negative | s. 0

Q 66.

Match the following :

a. The distance between circumcentre and Incentre of triangle, the affixes of whose vertices are $1, w, w^2$ is	p. 6
b. If ${}^{2n}C_4, {}^{2n}C_5, {}^{2n}C_6$ are in A.P then n is	q. 3
c. On $[0, 2]$ the maximum value of $f(x) = \max\{x^2, x - 1, 3x\}$ is	r. 0
d. If $f(x) = [x] + \sum_{r=1}^{2008} \frac{x+r-[x+r]}{2008}$ then $f(3) =$	s. 7

Paper – II

Part-I (physics)

Section-I

Straight Objective Type

<u>Q1</u>

The ratio of de-Broglie wavelength of molecules of Hydrogen and Helium which are at 27°C and 127°C respectively is

a. $\sqrt{\frac{5}{3}}$

b. $\sqrt{\frac{8}{3}}$

c. $\sqrt{\frac{3}{5}}$

d. $\sqrt{\frac{3}{8}}$

<u>Q2</u>

A uniform rod of length l is placed with one end in contact with the horizontal table and is then inclined to an angle $\propto$ to the horizontal and allowed to fall. When it becomes horizontal, its angular velocity will be.

a. $\omega = \sqrt{\frac{3g\sin\propto}{l}}$

b. $\omega = \sqrt{\frac{2l}{3g\sin\propto}}$

c. $\omega = \sqrt{\frac{g\sin\propto}{l}}$

d. $\omega = \sqrt{\frac{l}{g\sin\propto}}$

Q3

Two wires A and B of same material but radii r_1 and r_2 support a mass M as shown. If a force of $\frac{Mg}{3}$ is applied at the free end, then :

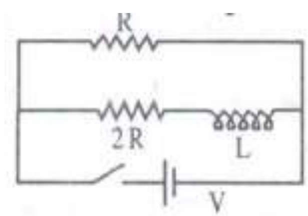
a. for $r_1 = r_2$, string B breaks before A

b. for $r_1 < 2r_2$, string B breaks before A

c. string B breaks always first

d. for $r_1 = 2r_2$, any of them may break

Q4



A plane mirror is made of glass slab of refractive index $\mu = 1.5$, thickness 2.5 cm and silvered on the back. A point object is placed 5 cm in front of the un-silvered face of the mirror. The position of final image is from front face.

a. 12 cm.

b. 14.6 cm.

c. 5.67 cm.

d. 8.33 cm.

Q5

The ratio of time constant during charging and discharging in the circuit shown is

a. 1 : 1

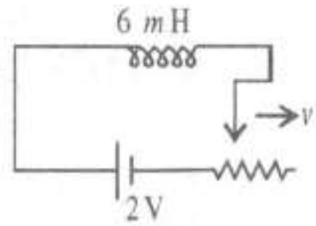
b. 3 : 2

c. 2 : 3

d. 1 :3

Q6

Sliding contact in circuit shown, moves with uniform velocity towards right. Value of resistance at an instant is 4 Ω. Then at that instant



a. Current in the circuit 0.5A

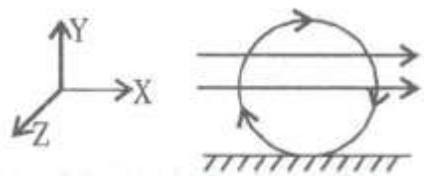
b. Current in the circuit is greater than 0.5A

c. Current in the circuit is less than 0.5 A

d. There is a small current of 6mA in the circuit

Q7

A conducting ring of mass 2 kg and radius 0.5 m is placed on a smooth horizontal plane. The ring carries a current of 4 A. A horizontal magnetic field b= 10T is switched on at time $t = 0$. The initial angular acceleration of the ring will be



a. $40\ \pi\ \mathrm{rad/s^2}$

b. $20\ \pi\ \mathrm{rad/sec^2}$

c. $5\ \pi\ \mathrm{rad/s^2}$

d. $15\ \pi\ \mathrm{rad/sec^2}$

Q8

A particle is projected with a speed u_0 at an angle θ with the horizontal. Radius of curvature of the highest point is :

a. $\frac{u^2 \cos^2\theta}{g}$

b. $\frac{u^2 \sin^2\theta}{g}$

c. $\frac{u^2}{g}$

d. $\frac{u^2}{g\cos\theta}$

Q9

In as Isothermal expansion of ideal gas

a. $\Delta T = 0$

b. $\Delta U = 0$

c. the work done by gas is equal to heat supplied to the gas.

d. $W = \Delta U$

Section-II

Assertion-Reason Type

Q10

Statement-1:

Kirchhoff's rule law represents conservation of energy. because

Statement-2:

If the sum of potential changes around a closed loop is not zero, unlimited energy could be gained b repeatedly carrying a charge around a loop

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

Q11

Statement-1:

Internal energy change is zero if the temperature is constant, irrespective of the process being cyclic or non-cyclic. because

Statement-2:

$dU = nC_V dT$ for all processes and is independent of 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

Q12

Statement-1:

Rise of water level in capillary tube should be accounted vertically and not on the length of the pipe in which it has raised.

because

Statement-2:

More the radius, the rise will decrease for different liquids tested.

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

Q13

Statement-1:

An iron ball and a wooden ball are both released at the same height. In the presence of a medium both the balls reach the ground with different velocities and different times. because

Statement-2:

Both the balls reach the ground simultaneously.

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-III

Linked Comprehension Type

$M_{14\text{-}16}$: Paragraph for Question Nos. 14 to 16

A potentiometer wire of length 10 m shows null points shifted by 60 cm for two cells with a emf difference of 0.4 volt.

Q14

Potential gradient along the potentiometer wire is, (in V/m)

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

b. $\frac{3}{2}$

c. $\frac{20}{3}$

d. $\frac{4}{5}$

Q15

Potential across the potentiometer wire is, (in volt)

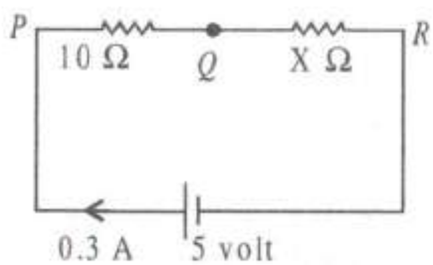
a. $\frac{2}{3}$

b. $\frac{20}{3}$

c. $\frac{3}{2}$

d. $\frac{30}{2}$

Q16



If the point P is connected to the +ve end of the potentiometer wire and Q is connected to the galvanometer, the balancing length is

a. 30 cm

b. 60 cm

c. 90 cm

d. 45 cm

$M_{17\text{-}19}$: Paragraph for Question Nos. 17 to 19

A particle of mass 3 kg is moving under the action of central force, whose potential energy is given by $U(r) = 10\, r^3$ Joule.

Q17

For the particle to move in a circle of radius 10 m, the velocity is :

a. 10 m/s

b. 1 m/s

c. 100 m/s

d. 1000m/s

Q18

The angular momentum for the particle to orbit in the circle, is :

a. 3 kg m^2/sec

b. 30 kg m^2/sec

c. 300 kg m^2/sec

d. 3000 kg m^2/sec

Q19

The total energy in circular motion is :

a. 5 J

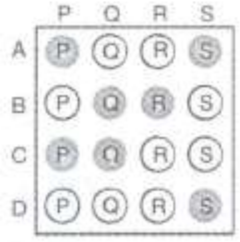
b. 25×10^3 J

c. 5×10^3 J

d. 0.5 J

Section-IV

Matrix-Match Type



Q20

Column I	**Column II**
a. Area between $V = 0, t = 0$ and a constant $V \neq 0, t \neq 0$	p. Uniform motion
b. Intersecting straight line $x - t$ graphs for two bodies.	q. Uniform Acceleration.
c. Intersecting straight line $V - t$ graphs for two bodies.	r. Displacement of the body on motion.
d. Equations of Motion.	s. Equal velocity at a time.
	t. Same position.

Q21

Column I	Column II
a. Wires made of some material	p. Elasticity is less
b. Work done in stretching a wire	q. Volume = constant
c. poisson's ratio = 0.5	r. Modulus of elasticity is constant
d. Extension is more	s. 1/2 × Volume × Stress × Strain
	t. $\frac{dr}{r} = -\frac{1}{2}\frac{dl}{l}$

Q22

Column I	Column II
a. Rocket Propulsion	p. Impulse
b. Area under force-time graph	q. For one being at rest oblique collision will move them at right angles
c. change in speed of a 5 kg mass from say 2 to 5 ms^{-1}	r. Acceleration with reducing mass.
d. Equal masses under collision	s. Have some velocity when coefficient of restitution is zero

Part-II (Chemistry)

Section-I

Straight Objective Type

Q23

On heating one mole $KCIO_3$, one mole of O_2 is formed. Calculate the mole fraction of $KCIO_4$ in the final mixture containing only KCI and $KCIO_4$, $KCIO_4$ is obtained by parallel reaction.

a. 0.50

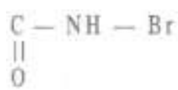
b. 0.25

c. 0.33

d. 0.20

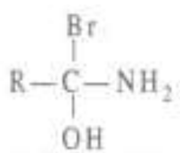
Q24

The different intermediates formed during Hofmann bromamide synthesis are

a. R - 

b. $R - N = C = 0$

c. Both (a) and (b)

d. 

Q25

Pb and Sn can be extracted from their sulphide and oxide ore respectively by

a. Froth floatation, roasting, self-reduction; Hydraulic washing, calcination, carbon reduction

b. Hydraulic washing, calcination, electrolysis; Froth floatation, roasting, carbon reduction

c. Froth floatation, roasting, carbon reduction; Hydraulic washing, roasting, self-reduction

d. None of these

Q26

KO_2 (Potassium superoxide) is used in oxygen cylinders in space and submarines because it

a. Absorbs CO_2 and increase O_2 content

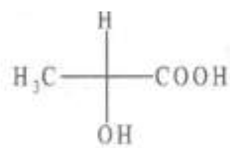
b. Eliminates moisture

c. Absorbs CO_2

d. Produces ozone

Q27

The Fischer projection formula of (+)-lactic acid is as



Which of the following is correct ?

a. H_3C- and –COOH groups are coming out of the plane.

b. H-0 and _OH are coming out of the plane.

c. H_3C- and –COOH group are going into the plane.

d. All are correct.

Q28

What will be binding energy per nucleon of ${}^{16}_{8}0$ if mass defect is 0.210 amu ?

a. 195.61 MeV

b. 12.2 MeV

c. 14.0 MeV

d. 16.0 MeV

Q29

Sn reacts with conc. HNO_3 to give

a. Sn $(NO_3)_2$

b. H_2SnO_3

c. SnO

d. None of these

Q30

Which of the following are isotonic with one another ?

1. 0.15 M urea

2. 0.15 M$CaCl_2$

3. 0.15 M $MgSO_4$

4. 0.15 M glucose

a. (i) and (ii)

b. (i), (ii), (iii), (iv)

c. (i) and (iv)

d. (ii) and (iii)

Q31

One gram of ${}^{226}_{88}Ra$ has an activity nearly one Ci(Curie). The $t_{1/2}$ of ${}^{226}_{88}Ra$ is

a. 1600 years

b. 12.5 years

c. 3200 years

c. 1700 years

Section-II

Assertion-Reason Type

Q32

Statement-1:

Mathanoic acid changes mercuric chloride to mercurous chloride (white ppt.) on heating but acetic acid does not. because

Statement-2:

Methanoic acid is stronger reducing agent than ethanoic acid.

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

Q33

Statement-1:

The vapour pressure of water at 27 27°C in a one litre closed flask is greater than the vapour pressure of same amount of water in 3 L flask at 27°C. because

Statement-2:

The pressure of gas at a particular temperature is inversely proportional to volume of the gas.

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

Q34

Statement-1:

The conversion of NH_4CNO into urea is an isomerization reaction. because

Statement-2:

Urea is the first organic compound prepared in the lab.

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

Q35

Statement-1:

C-H bond in $CH \equiv CH$ is stronger than C-H bond in $CH_2 = CH_2$. because

Statement-2:

Sp-s overlapping is more effective than sp^2-s overlapping due to increase in size of sp^2 hybridised orbital.

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 – III

Linked Comprehension Type

For a particular ion to be deposited at cathode, it requires minimum voltage which must be applied across the electrodes. The minimum voltage required is called discharge potential.

Increasing order of deposition of some metals:

$Li^{+} < K^{+} < Ca^{2+} < Na^{+} < Mg^{2+} < Al^{3+} < Zn^{2+} < Fe^{2+} < Ni^{2+} < H^{+} < Cu^{2+} < Hg_2^{2+} < Ag^{+} < Au^{3+}$

For anions $SO_4^{2-} < NO_3^{-} < OH^{-} < Br^{-} < I^{-}$

Lower the value of discharge potential, grater will be ease of deposition.

Q36

The products formed at anode and cathode, when dil. H_2SO_4 is electrolyzed are

a. O_2, H_2

b. SO_2 H_2

c. $H_2S_2O_8$, H_2

d. SO_3, H_2

Q37

The amount of energy expanded when current of 1 amp is passed for 100 seconds under a potential difference of 115 V is equal to

a. 11.5 J

b. 11.5 kJ

c. 11.5 kW

d. 11.5 kcal

Q38

When H_2O is electrolyzed using 1 Faraday of charge, volume of O_2 liberated at anode at STP is equal to

a. 22.4 L

b. 11.2 L

c. 5.6 L

d. 2.8 L

C_{39-41}: Paragraph for Question Nos. 39 to 41

A compound (W) $C_{15}H_{17}N$ is treated with benzene sulphonyl chloride and aqueous KOH no apparent change occurs. Acidification of the mixture gives a clear solution. When W is reacted with CH_3I, an optically active compound (Y) is formed. Y gives yellow precipitate with $AgNO_3$ solution. When Y is heated with Ag_2O then an amine of molecular formula $C_{13}H_{18}N$ and ethylene are formed.

Q39

The degree of unsaturation in $C_{15}H_{17}N$ is….and the number of pheny1 group could be…

a. 8, 8

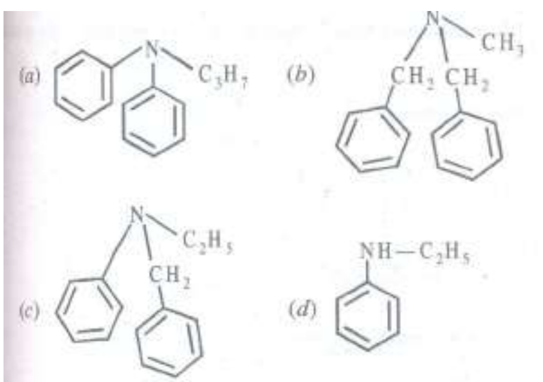
b. 2, 8

c. 2, 2

d. 8, 2

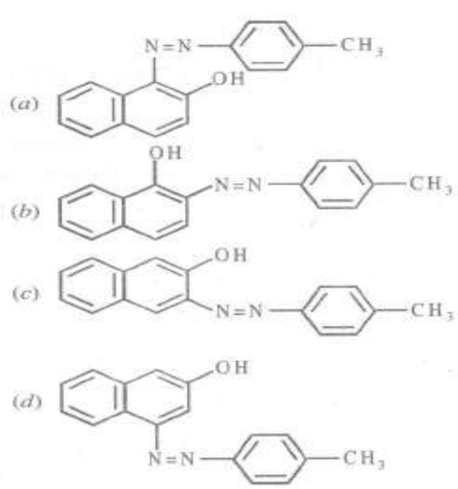
Q40

The compound W is therefore



Q41

When p-toluidine is diazotized and reacted with β-naphthol in basic medium then the compound formed is



Section-IV

Matrix-Match Type

Q42

Column I

a. Dilution
b. Increase in temperature
c. Atmospheric pressure
d. Nature of electrode

Column II

p. discharging of ions
q. reduction potential
r. Equilibrium constant
s. Vapour pressure

Q43

Column I

a. $>=0 \rightarrow \propto$-Hydroxy carboxylic acid
$R\text{-}COOH \rightarrow R\text{-}CH_2COOH$
$R\text{-}CH{=}CH\text{-}CHO \rightarrow R\text{-}CH{=}CH\text{-}CH_2OH$
d. Regioselective conversion of alkenes to alcohols.

Column II

p. Arndt Eistert synthesis
q. $Hg(OAc)_2/AcOH$
r. (i) HCN (ii) H^+/H_2O
s. $NaBH_4$.

Q44

Column I

a. 2^{nd} most abundant element in the earth crust.
b. Most abundant transition element
c. Most abundant element in the earth crust.
d. Most abundant element in the universe.

Column II

p. Fe
q. H_2
r. Si
s. O_2

Part-III (Mathematics)

Section-I

Straight Objective Type

Q45

The value of $\left(\frac{\sqrt{3}}{2}+i.\frac{1}{2}\right)^{165}$ is

a. -1

b. $\frac{\sqrt{3}}{2}+i.\frac{1}{2}$

c. i

d. $-i$

Q46

The area of the triangle whose vertices are $(a,a),(a+1,a+1),(a+2,a)$ is

a. a^3

b. $2a$

c. 1

d. $\sqrt{2}$

Q47

If in a triangle, $a=2b$ and $A=3B$, then the triangle

a. is isosceles

b. is right-angled but not isosceles

c. is right-angled and isosceles

d. None of these

Q48

The number of values of x satisfying the equation $\sqrt{sin\,x} - \frac{1}{\sqrt{sin\,x}} = cos\,x$ is

a. 0

b. 2

c. 3

d. more than 3

Q49

The least period of the function $sin\,x + tan\,x/2 - cos\,3x$ must be

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

b. $2\frac{\pi}{3}$

c. $2\,\pi$

d. $4\,\pi$

Q50

The equation of $y^5 x + y - x\frac{dy}{dx} = 0$ is

a. $\frac{x^4}{4} + \frac{1}{5}\left(\frac{x}{y}\right)^5 = C$

b. $\frac{x^5}{5} + \frac{1}{4}\left(\frac{x}{y}\right)^4 = C$

c. $\left(\frac{x}{y}\right)^5 + \frac{x^4}{4} = C$

d. $(x\,y)^4 + \frac{x^5}{5} = C$

Q51

If w is a complex cube root of unity, then the matrix $A = \begin{bmatrix} 1 & w^2 & w \\ w^2 & w & 1 \\ w & 1 & w^2 \end{bmatrix}$ is a

a. singular matrix

b. non-singular matrix

c. skew symmetric matrix

d. None of these

Q52

The number of real values of a for which the system of equations $x + ay - z = 0, 2x - y + az = 0, ax + y + 2z = 0$ has a non-trivial solution, is

a. 3

b. 1

c. 0

d. infinite

Q53

Let there be two points A, B on the curve $y = x^2$ in plane OXY satisfying $OA\,.\,i = 1$ and $OB\,.\,i = -2$ then the length of the vector $2OA - 3OB$ is

a. $\sqrt{14}$

b. $2\sqrt{15}$

c. $3\sqrt{41}$

d. None of these

Section-II

Assertion-Reason Type

Q54

Statement-1:

n letters are put in n corresponding envelopes at random. The probability that exactly $r(r \leq n)$, letters go to the correct envelop is $1 - \frac{C_r}{n!}$. because

Statement-2:

n letters in n corresponding envelopes can be put in $n!$ ways.

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:

The minimum value of $|2x - 1| + |3x - 2| + |4x - 3|\ is\ \frac{2}{3}$. because

Statement-2:

If $a < b < c$, then minimum value of $A|x - a| + B|x - b| + C|x - c|\ (A, B,\ C > 0)$ is attained at $x =$ b.

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

Q56

Statement-1:

If $l_n = \int_0^{\pi/2} sin^n x\ dx$ where n is a positive integer then l_n is rational if n is odd. because

Statement-2:

$.l_n = \frac{n-1}{n} l_{n-2}$

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

Q57

Statement-1:

$\frac{\tan 3x}{\tan x} = \tan\left(\frac{\pi}{3} - x\right)\tan\left(\frac{\pi}{3} + x\right)$ is an identity if $x \neq \frac{K\pi}{6}$, where K is an integer. because

Statement-2:

$\tan x$ is defined if $x \neq (2m+1)\frac{\pi}{2}$, whrere m is a positive integer.

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-III

Linked Comprehension Type

M_{58-60}: Paragraph for Question Nos. 58 to 60

Consider the ellipses E_1: $a^2x^2 + b^2y^2 = 1$, E_2. $B^2x^2 + a^2y^2 = 1$ $(0 < a < b)$ and answer the following questions

Q58

The distance between any foci of E_1 and any foci of E_2 must be

a. $\frac{\sqrt{2}\sqrt{b^2-a^2}}{ab}$

b. $\frac{\sqrt{3}\sqrt{b^2-a^2}}{ab}$

c. $\sqrt{a^2+b^2}$

d. None of these

Q59

If area bounded by E_1 and E_2 is $4\int_0^{\propto}\frac{\sqrt{1-a^2x^2}}{b} + \int_{\propto}^{\beta}\frac{\sqrt{1-b^2x^2}}{a}dx$ then

a. $\propto = \frac{1}{\sqrt{ab}},\ \beta = \frac{1}{b}$

b. $\propto = \frac{1}{\sqrt{a^2+b^2}}, \beta = \frac{1}{a}$

c. $\propto = \frac{1}{\sqrt{a^2+b^2}},\ \beta = \frac{1}{b}$

d. None of these

Q60

The value of the integral described in Q. 59 above is

a. $\frac{4}{ab} tan^{-1} \frac{a}{b}$

b. $\frac{4}{\sqrt{ab}} tan^{-1} \frac{a}{b}$

c. $\frac{4}{\sqrt{ab}} tan^{-1} \frac{a}{b}$

d. None of the above

$M_{61\text{-}63}$: Paragraph for Question Nos. 61 to 63

Consider the number function f (n) defined by f(n) = 2^{2^n} + 1 (n ∈ N).

Q61

$(f(n) - 1)^2$ is equal to

a. $f(2n) - 1$

b. $f(n+1) - 1$

c. $f(n+1) - 1$

d. None of these

Q62

If m and n are distinct positive integers then

a. HCF of (m) and $f(n)$ can be a non-unity number

b. HCF of $f(m)$ and $f(n)$ is essentially

c. HCF =min (m, n)

d. None of these

Q63

The correct answer in Q. 62 implies

a. The number of prime numbers is finite

b. The number of prime numbers is infinite

c. The gaps between two successive primes can be as large as possible

d. None of these

Section-IV

Matrix-Match Type

Q64

Let $I_m = \int_0^\infty e^{-x}(\sin x)^m\, dx$ where m is a positive integer greater than 2, then $A\, I_5 = BI_3$ whence A, B are positive integers. Then match the following :

a. A	p. 24
b. B	q. 26
c. 85 I_4	r. 20

Q65

If $\int \frac{dx}{(2x-3)\sqrt{4x-x^2}} = C - \frac{1}{\sqrt{A}} \ln\left|\frac{x+B\sqrt{Dx-Ex^2}}{2x-3}\right|$, $(A, B, C, D$ are independent of x, then match the following:

a. A	p. 6
b. B	q. 60
c. C	r. 15
d. D	
e. E	

Q66

Match the limits of following expressions when$\to \infty$:

a. $\frac{1}{n}+\frac{n^2}{(n+1)^3}+\frac{n^2}{(n+2)^3}+\ldots+\frac{1}{8n}$

b. $\frac{1}{n}+\frac{1}{n+1}+\frac{1}{n+2}+\ldots+\frac{1}{4n}$

c. $\sum_{r=1}^{3n}\frac{n^3}{(3n+r)^3}$

d. $\frac{1}{\sqrt{2n-1^2}}+\frac{1}{\sqrt{4n-2^2}}+\frac{1}{\sqrt{6n-3^2}}+\ldots+\frac{1}{n}$

p. 1/24

q. $\pi/2$

r. log 4

s. 3/8