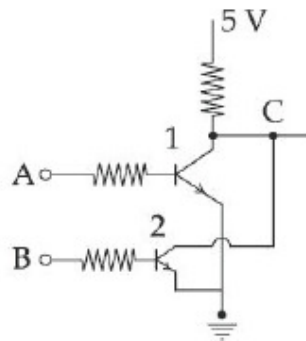


Q.1

Consider two npn transistors as shown in figure. If 0 Volts corresponds to false and 5 Volts correspond to true then the output at C corresponds to :



- 1) A NAND B
- 2) A OR B
- 3) A AND B
- 4) A NOR B

Q.2

In a metre bridge experiment null point is obtained at 40 cm from one end of the wire when resistance X is balanced against another resistance Y. If  $X < Y$ , then the new position of the null point from the same end, if one decides to balance a resistance of  $3X$  against Y, will be close to :

- 1) 80 cm
- 2) 75 cm
- 3) 67 cm
- 4) 50 cm

Q.3

Two springs of force constants 300 N/m (Spring A) and 400 N/m (Spring B) are joined together in series. The combination is compressed by 8.75 cm. The ratio of

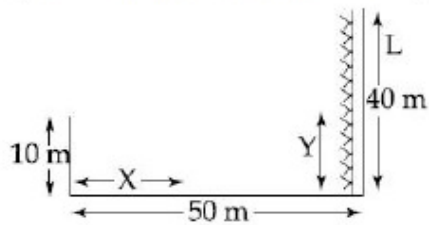
energy stored in A and B is  $\frac{E_A}{E_B}$  .

Then  $\frac{E_A}{E_B}$  is equal to :

- 1)  $\frac{4}{3}$
- 2)  $\frac{16}{9}$
- 3)  $\frac{3}{4}$
- 4)  $\frac{9}{16}$

Q.4

A person lives in a high-rise building on the bank of a river 50 m wide. Across the river is a well lit tower of height 40 m. When the person, who is at a height of 10 m, looks through a polarizer at an appropriate angle at light of the tower reflecting from the river surface, he notes that intensity of light coming from distance X from his building is the least and this corresponds to the light coming from light bulbs at height 'Y' on the tower. The values of X and Y are respectively close to (refractive index of water  $\simeq \frac{4}{3}$ )



1) 25 m, 10 m

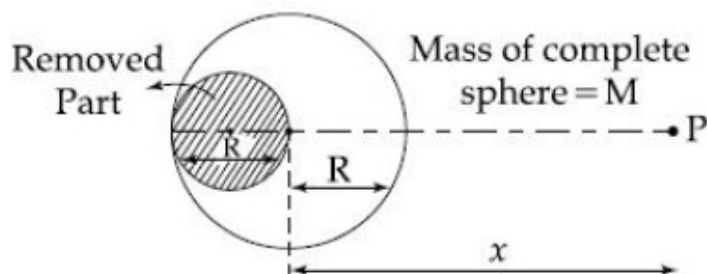
2) 13 m, 27 m

3) 22 m, 13 m

4) 17 m, 20 m

Q.5

The gravitational field, due to the 'left over part' of a uniform sphere (from which a part as shown, has been 'removed out'), at a very far off point, P, located as shown, would be (nearly) :



- |    |                              |
|----|------------------------------|
| 1) | $\frac{5}{6} \frac{GM}{x^2}$ |
| 2) | $\frac{8}{9} \frac{GM}{x^2}$ |
| 3) | $\frac{7}{8} \frac{GM}{x^2}$ |
| 4) | $\frac{6}{7} \frac{GM}{x^2}$ |

Q.6

A bullet of mass 10 g and speed 500 m/s is fired into a door and gets embedded exactly at the centre of the door. The door is 1.0 m wide and weighs 12 kg. It is hinged at one end and rotates about a vertical axis practically without friction. The angular speed of the door just after the bullet embeds into it will be :

- |    |               |
|----|---------------|
| 1) | 6.25 rad/sec  |
| 2) | 0.625 rad/sec |
| 3) | 3.35 rad/sec  |
| 4) | 0.335 rad/sec |

Q.7

On a linear temperature scale Y, water freezes at  $-160^{\circ}\text{Y}$  and boils at  $-50^{\circ}\text{Y}$ . On this Y scale, a temperature of 340 K would be read as : (water freezes at 273 K and boils at 373 K)

1)  $-73.7^{\circ}\text{Y}$

2)  $-233.7^{\circ}\text{Y}$

3)  $-86.3^{\circ}\text{Y}$

4)  $-106.3^{\circ}\text{Y}$

Q.8

A uniform electric field  $\vec{E}$  exists between the plates of a charged condenser. A charged particle enters the space between the plates and perpendicular to  $\vec{E}$ . The path of the particle between the plates is a :

1) straight line

2) hyperbola

3) parabola

4) circle

Q.9

Photons of an electromagnetic radiation has an energy 11 keV each. To which region of electromagnetic spectrum does it belong ?

1) X-ray region

2) Ultra violet region

3) Infrared region

4) visible region

Q.10

*This question has Statement-1 and Statement-2. Of the four choices given after the Statements, choose the one that best describes the two Statements.*

**Statement 1 :** A capillary is dipped in a liquid and liquid rises to a height  $h$  in it. As the temperature of the liquid is raised, the height  $h$  increases (if the density of the liquid and the angle of contact remain the same)

**Statement 2 :** Surface tension of a liquid decreases with the rise in its temperature.

1) Statement-1 is true, Statement-2 is true, Statement-2 is not the correct explanation for Statement-1.

2) Statement-1 is false, Statement-2 is true.

3) Statement-1 is true, Statement-2 is false.

4) Statement-1 is true, Statement-2 is true, Statement-2 is the correct explanation for Statement-1.

Q.11

यदि एक वाहक तरंग  $c(t) = A \sin \omega_c t$  एक माडुलक सिग्नल  $m(t) = A \sin \omega_m t$  द्वारा आयाम माडुलित होती है, तब माडुलित सिग्नल  $[C_m(t)]$  का समीकरण और इसके माडुलन सूचकांक होंगे क्रमशः :

1)  $C_m(t) = A (1 + \sin \omega_m t) \sin \omega_c t$  और 2

2)  $C_m(t) = A (1 + \sin \omega_c t) \sin \omega_m t$  और 1

3)  $C_m(t) = A (1 + \sin \omega_m t) \sin \omega_c t$  और 1

4)  $C_m(t) = A (1 + \sin \omega_c t) \sin \omega_m t$  और 2

Q.12

A letter 'A' is constructed of a uniform wire with resistance  $1.0 \Omega$  per cm. The sides of the letter are 20 cm and the cross piece in the middle is 10 cm long. The apex angle is  $60^\circ$ . The resistance between the ends of the legs is close to :

1)  $50.0 \Omega$

2)  $10 \Omega$

3)  $36.7 \Omega$

4)  $26.7 \Omega$

Q.13

An electric current is flowing through a circular coil of radius  $R$ . The ratio of the magnetic field at the centre of the coil and that at a distance  $2\sqrt{2} R$  from the centre of the coil and on its axis is :

1)  $2\sqrt{2}$

2) 27

3) 36

4) 8

Q.14

Two simple pendulums of length 1m and 4m respectively are both given small displacement in the same direction at the same instant. They will be again in phase after the shorter pendulum has completed number of oscillations equal to :

1) 2

2) 7

3) 5

4) 3

Q.15

Light is incident from a medium into air at two possible angles of incidence (a)  $20^\circ$  and (b)  $40^\circ$ . In the medium light travels 3.0 cm in 0.2 ns. The ray will :

1) suffer total internal reflection in both cases (a) and (b)

2) suffer total internal reflection in case (b) only

3) have partial reflection and partial transmission in case (b)

4) have 100% transmission in case (a)

Q.16

Two point dipoles of dipole moment  $\vec{p}_1$  and  $\vec{p}_2$  are at a distance  $x$  from each other and  $\vec{p}_1 \parallel \vec{p}_2$ . The force between the dipoles is :

1)  $\frac{1}{4\pi\epsilon_0} \frac{4p_1 p_2}{x^4}$

2)  $\frac{1}{4\pi\epsilon_0} \frac{3p_1 p_2}{x^3}$

3)  $\frac{1}{4\pi\epsilon_0} \frac{6p_1 p_2}{x^4}$

4)  $\frac{1}{4\pi\epsilon_0} \frac{8p_1 p_2}{x^4}$



Q.17

When two sound waves travel in the same direction in a medium, the displacements of a particle located at 'x' at time 't' is given by :

$$y_1 = 0.05 \cos (0.50 \pi x - 100 \pi t)$$

$$y_2 = 0.05 \cos (0.46 \pi x - 92 \pi t)$$

where  $y_1$ ,  $y_2$  and  $x$  are in meters and  $t$  in seconds. The speed of sound in the medium is :

1) 92 m/s

2) 200 m/s

3) 100 m/s

4) 332 m/s

Q.18

An engine approaches a hill with a constant speed. When it is at a distance of 0.9 km, it blows a whistle whose echo is heard by the driver after 5 seconds. If the speed of sound in air is 330 m/s, then the speed of the engine is :

1) 32 m/s

2) 27.5 m/s

3) 60 m/s

4) 30 m/s



Q.19

Two balls of same mass and carrying equal charge are hung from a fixed support of length  $l$ . At electrostatic equilibrium, assuming that angles made by each thread is small, the separation,  $x$  between the balls is proportional to :

1)  $l$

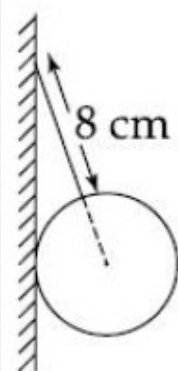
2)  $l^2$

3)  $l^{2/3}$

4)  $l^{1/3}$

Q.20

A uniform sphere of weight  $W$  and radius 5 cm is being held by a string as shown in the figure. The tension in the string will be :



1)  $\frac{12}{5} W$

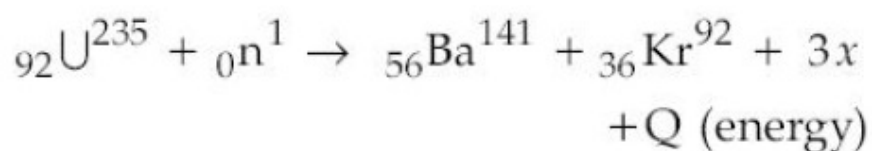
2)  $\frac{5}{12} W$

3)  $\frac{13}{5} W$

4)  $\frac{13}{12} W$

Q.21

When Uranium is bombarded with neutrons, it undergoes fission. The fission reaction can be written as :



where three particles named  $x$  are produced and energy  $Q$  is released. What is the name of the particle  $x$  ?

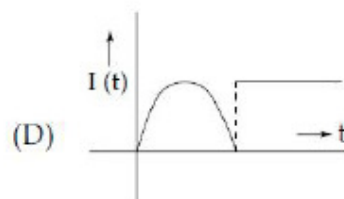
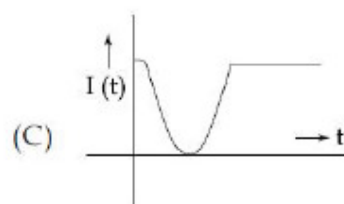
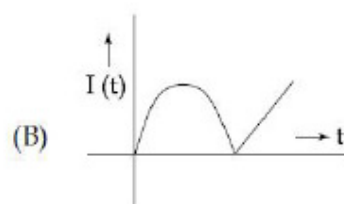
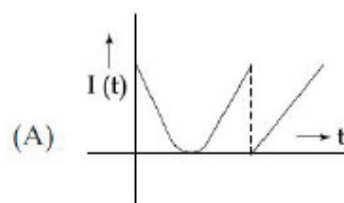
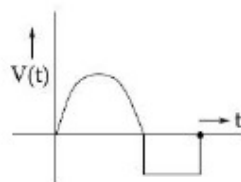
1) electron

2)  $\alpha$ -particle

3) neutron

4) neutrino

Two coils, X and Y, are kept in close vicinity of each other. When a varying current,  $I(t)$ , flows through coil X, the induced emf ( $V(t)$ ) in coil Y, varies in the manner shown here. The variation of  $I(t)$ , with time, can then be represented by the graph labelled as graph :



1) A

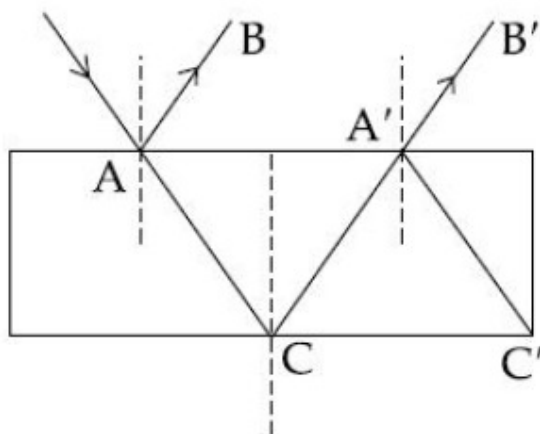
2) C

3) B

4) D

Q.23

A ray of light of intensity  $I$  is incident on a parallel glass slab at point A as shown in diagram. It undergoes partial reflection and refraction. At each reflection, 25% of incident energy is reflected. The rays AB and A'B' undergo interference. The ratio of  $I_{\max}$  and  $I_{\min}$  is :



1) 49 : 1

2) 7 : 1

3) 4 : 1

4) 8 : 1

Q.24

A shunt of resistance  $1\ \Omega$  is connected across a galvanometer of  $120\ \Omega$  resistance. A current of 5.5 ampere gives full scale deflection in the galvanometer. The current that will give full scale deflection in the absence of the shunt is nearly :

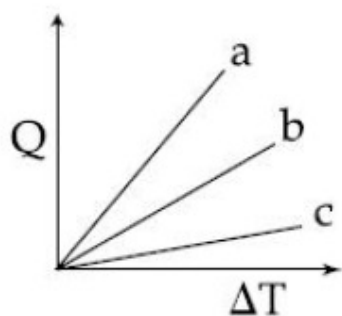
- |    |              |
|----|--------------|
| 1) | 5.5 ampere   |
| 2) | 0.5 ampere   |
| 3) | 0.004 ampere |
| 4) | 0.045 ampere |

Q.25

From the following, the quantity (constructed from the basic constants of nature), that has the dimensions, as well as correct order of magnitude, vis-a-vis typical atomic size, is :

- |    |                                   |
|----|-----------------------------------|
| 1) | $\frac{e^2}{4\pi\epsilon_0 mc^2}$ |
| 2) | $\frac{4\pi\epsilon_0 h^2}{me^2}$ |
| 3) | $\frac{me^2}{4\pi\epsilon_0 h^2}$ |
| 4) | $\frac{4\pi\epsilon_0 hc^2}{e^2}$ |

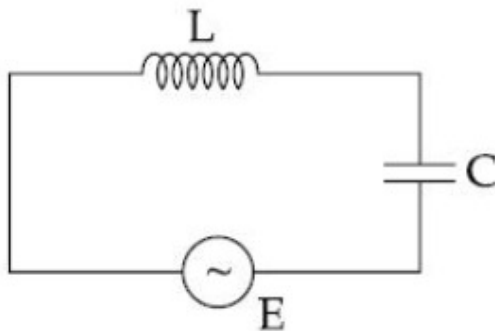
Figure shows the variation in temperature ( $\Delta T$ ) with the amount of heat supplied ( $Q$ ) in an isobaric process corresponding to a monoatomic (M), diatomic (D) and a polyatomic (P) gas. The initial state of all the gases are the same and the scales for the two axes coincide. Ignoring vibrational degrees of freedom, the lines a, b and c respectively correspond to :



- |    |            |
|----|------------|
| 1) | P, M and D |
| 2) | M, D and P |
| 3) | P, D and M |
| 4) | D, M and P |

Q.27

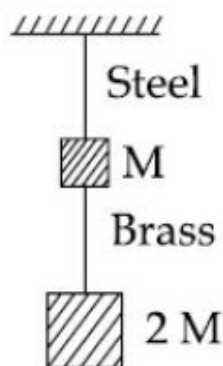
In the circuit shown here, the voltage across L and C are respectively 300 V and 400 V. The voltage E of the ac source is :



- 1) 400 Volt
- 2) 500 Volt
- 3) 100 Volt
- 4) 700 Volt

Q.28

If the ratio of lengths, radii and Young's moduli of steel and brass wires in the figure are  $a$ ,  $b$  and  $c$  respectively, then the corresponding ratio of increase in their lengths is :



- 1)  $\frac{3c}{2ab^2}$
- 2)  $\frac{2a^2c}{b}$
- 3)  $\frac{3a}{2b^2c}$
- 4)  $\frac{2ac}{b^2}$



Q.29

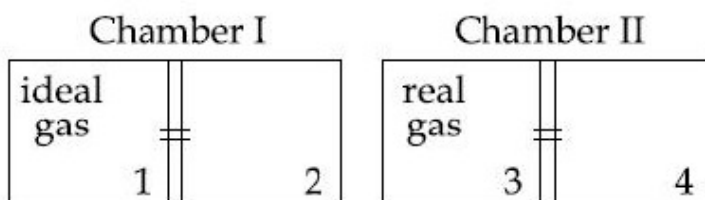
In the Bohr model an electron moves in a circular orbit around the proton. Considering the orbiting electron to be a circular current loop, the magnetic moment of the hydrogen atom, when the electron is in  $n^{\text{th}}$  excited state, is :

1)  $\left(\frac{e}{2m}\right) \frac{n^2 h}{2\pi}$

2)  $\left(\frac{e}{m}\right) \frac{nh}{2\pi}$

3)  $\left(\frac{e}{2m}\right) \frac{nh}{2\pi}$

4)  $\left(\frac{e}{m}\right) \frac{n^2 h}{2\pi}$



There are two identical chambers, completely thermally insulated from surroundings. Both chambers have a partition wall dividing the chambers in two compartments. Compartment 1 is filled with an ideal gas and Compartment 3 is filled with a real gas. Compartments 2 and 4 are vacuum. A small hole (orifice) is made in the partition walls and the gases are allowed to expand in vacuum.

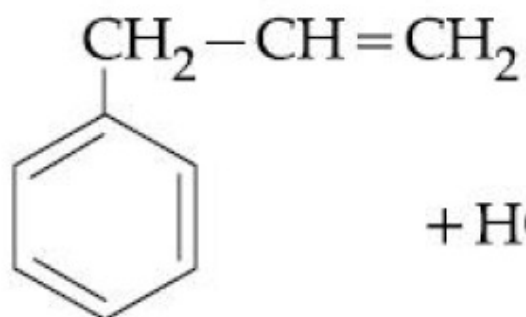
**Statement 1 :** No change in the temperature of the gas takes place when ideal gas expands in vacuum. However, the temperature of real gas goes down (cooling) when it expands in vacuum.

**Statement 2 :** The internal energy of an ideal gas is only kinetic. The internal energy of a real gas is kinetic as well as potential.





1)	Statement 1 is false and Statement 2 is true.
2)	Statement 1 and Statement 2 both are true. Statement 2 is the correct explanation of Statement 1.
3)	Statement 1 is true and Statement 2 is false.
4)	Statement 1 and Statement 2 both are true. But Statement 2 is <b>not</b> the correct explanation of Statement 1.

Q.31

Given :

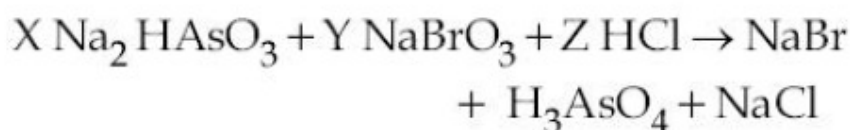


X is :

- |    |                                                                                   |
|----|-----------------------------------------------------------------------------------|
| 1) |  |
| 2) |  |
| 3) |  |
| 4) |  |

Q.32

Given :



The values of X, Y and Z in the above redox reaction are respectively :

- |    |         |
|----|---------|
| 1) | 2, 1, 2 |
| 2) | 2, 1, 3 |
| 3) | 3, 1, 6 |
| 4) | 3, 1, 4 |

Q.33

The migration of dispersion medium under the influence of an electric potential is called :

- |    |                 |
|----|-----------------|
| 1) | Cataphoresis    |
| 2) | Electroosmosis  |
| 3) | Electrophoresis |
| 4) | Sedimentation   |

Q.34

The addition of HI in the presence of peroxide catalyst does not follow anti-Markovnikov's rule because :

- |    |                                                                |
|----|----------------------------------------------------------------|
| 1) | HI is a strong reducing agent                                  |
| 2) | H-I bond is too strong to be broken homolytically              |
| 3) | I atom combines with H atom to give back HI                    |
| 4) | Iodine atom is not reactive enough to add across a double bond |

Q.35

In reaction  $A + 2B \rightleftharpoons 2C + D$ , initial concentration of B was 1.5 times of [A], but at equilibrium the concentrations of A and B became equal. The equilibrium constant for the reaction is :

- |    |    |
|----|----|
| 1) | 8  |
| 2) | 4  |
| 3) | 12 |
| 4) | 6  |

Q.36

Trigonal bipyramidal geometry is shown by :

- |    |                           |
|----|---------------------------|
| 1) | $\text{XeOF}_2$           |
| 2) | $\text{XeO}_3\text{F}_2$  |
| 3) | $\text{FXeOSO}_2\text{F}$ |
| 4) | $[\text{XeF}_8]^{2-}$     |

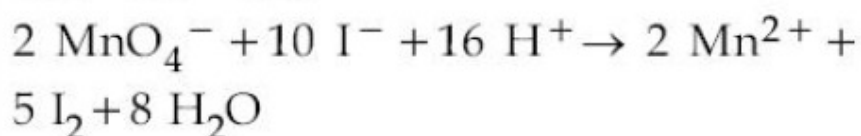
Q.37

If a polythene sample contains two monodisperse fractions in the ratio 2 : 3 with degree of polymerization 100 and 200, respectively, then its weight average molecular weight will be :

- 1) 4900
- 2) 4600
- 3) 4300
- 4) 5200

Q.38

The instantaneous rate of disappearance of  $\text{MnO}_4^-$  ion in the following reaction is  $4.56 \times 10^{-3} \text{Ms}^{-1}$



The rate of appearance  $\text{I}_2$  is :

- 1)  $4.56 \times 10^{-4} \text{Ms}^{-1}$
- 2)  $1.14 \times 10^{-2} \text{Ms}^{-1}$
- 3)  $1.14 \times 10^{-3} \text{Ms}^{-1}$
- 4)  $5.7 \times 10^{-3} \text{Ms}^{-1}$

Q.39

Which one of the following is most Stable ?



Q.40

In an atom how many orbital (s) will have the quantum numbers;  $n = 3$ ,  $l = 2$  and  $m_l = +2$  ?

1) 5

2) 3

3) 1

4) 7

Q.41

Potassium dichromate when heated with concentrated sulphuric acid and a soluble chloride, gives brown - red vapours of :

1)  $\text{CrO}_3$ 2)  $\text{CrCl}_3$ 3)  $\text{CrO}_2\text{Cl}_2$ 4)  $\text{Cr}_2\text{O}_3$ 

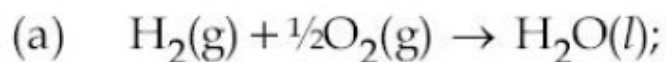
Q.42

Rate of dehydration of alcohols follows the order :

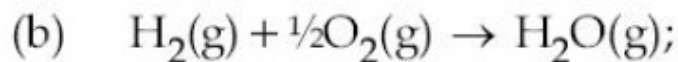
1)  $2^\circ > 1^\circ > \text{CH}_3\text{OH} > 3^\circ$ 2)  $3^\circ > 2^\circ > 1^\circ > \text{CH}_3\text{OH}$ 3)  $2^\circ > 3^\circ > 1^\circ > \text{CH}_3\text{OH}$ 4)  $\text{CH}_3\text{OH} > 1^\circ > 2^\circ > 3^\circ$

Q.43

Given :



$$\Delta H^\circ_{298\text{K}} = -285.9 \text{ kJ mol}^{-1}$$



$$\Delta H^\circ_{298\text{K}} = -241.8 \text{ kJ mol}^{-1}$$

The molar enthalpy of vapourisation of water will be :

1)  $241.8 \text{ kJ mol}^{-1}$

2)  $22.0 \text{ kJ mol}^{-1}$

3)  $44.1 \text{ kJ mol}^{-1}$

4)  $527.7 \text{ kJ mol}^{-1}$

Q.44

Calcination is the process in which :

1) One is heated strongly above its melting point in the limited supply of air to convert sulphide ores to their respective oxides.

2) One is heated strongly below its melting point in the presence of current of air and to avoid the conversion of sulphide and hydrated oxide ores to their respective oxides.

3) One is heated strongly below its melting point in the absence of limited supply of air and to avoid the conversion of sulphide ores to their respective oxides.

4) One is heated strongly below its melting point after oxide heated in absence of air and to avoid the conversion of sulphide and hydrated oxide ores to their respective oxides.

Q.45

Sodium Carbonate cannot be used in place of  $(\text{NH}_4)_2\text{CO}_3$  for the identification of  $\text{Ca}^{2+}$ ,  $\text{Ba}^{2+}$  and  $\text{Sr}^{2+}$  ions (in group V) during mixture analysis because :

1)  $\text{Mg}^{2+}$  ions will also be precipitated2) Concentration of  $\text{CO}_3^{2-}$  ions is very low

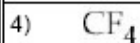
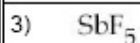
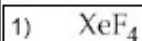
3) Sodium ions will react with acid radicals

4)  $\text{Na}^+$  ions will interfere with the detection of  $\text{Ca}^{2+}$ ,  $\text{Ba}^{2+}$ ,  $\text{Sr}^{2+}$  ions



Q.46

Which one of the following molecules is polar ?



Q.47

Type of isomerism which exists between  $[\text{Pd}(\text{C}_6\text{H}_5)_2(\text{SCN})_2]$  and  $[\text{Pd}(\text{C}_6\text{H}_5)_2(\text{NCS})_2]$  is :

1) Linkage isomerism

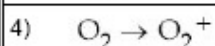
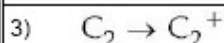
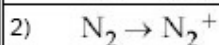
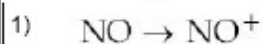
2) Coordination isomerism

3) Ionisation isomerism

4) Solvate isomerism

Q.48

In which of the following ionization processes the bond energy has increased and also the magnetic behaviour has changed from paramagnetic to diamagnetic ?



Q.49

12g of a nonvolatile solute dissolved in 108g of water produces the relative lowering of vapour pressure of 0.1. The molecular mass of the solute is :

1) 80

2) 60

3) 20

4) 40

Q.50

Which of the following enzyme converts starch into maltose ?

1) Diastase

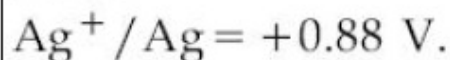
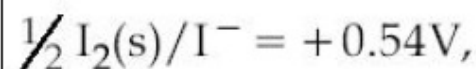
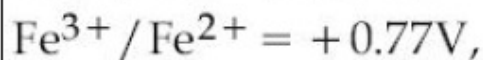
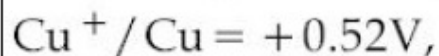
2) Maltase

3) Zymase

4) Invertase

Q.51

Electrode potentials ( $E^0$ ) are given below :



Based on the above potentials, strongest oxidizing agent will be :

1)  $\text{Cu}^+$ 2)  $\text{Fe}^{3+}$ 3)  $\text{Ag}^+$ 4)  $\text{I}_2$

Q.52

Aryl fluoride may be prepared from arene diazonium chloride using :

- 1)  $\text{HBF}_4/\Delta$
- 2)  $\text{HBF}_4/\text{NaNO}_2, \text{Cu}, \Delta$
- 3)  $\text{CuF}/\text{HF}$
- 4)  $\text{Cu}/\text{HF}$

Q.53

An ether (A),  $\text{C}_5\text{H}_{12}\text{O}$ , when heated with excess of hot concentrated HI produced two alkyl halides which when treated with NaOH yielded compounds (B) and (C). Oxidation of (B) and (C) gave a propanone and an ethanoic acid respectively. The IUPAC name of the ether (A) is :

- 1) 2 - ethoxypropane
- 2) ethoxypropane
- 3) methoxybutane
- 4) 2 - methoxybutane

Q.54

Electron gain enthalpy with negative sign of fluorine is less than that of chlorine due to :

- 1) High ionization enthalpy of fluorine
- 2) Smaller size of chlorine atom
- 3) Smaller size of fluorine atom
- 4) Bigger size of 2p orbital of fluorine

Q.55

Solid  $\text{Ba}(\text{NO}_3)_2$  is gradually dissolved in a  $1.0 \times 10^{-4} \text{ M}$   $\text{Na}_2\text{CO}_3$  solution. At which concentration of  $\text{Ba}^{2+}$ , precipitate of  $\text{BaCO}_3$  begins to form ? ( $K_{\text{sp}}$  for  $\text{BaCO}_3 = 5.1 \times 10^{-9}$ )

- |    |                                |
|----|--------------------------------|
| 1) | $5.1 \times 10^{-5} \text{ M}$ |
| 2) | $7.1 \times 10^{-8} \text{ M}$ |
| 3) | $4.1 \times 10^{-5} \text{ M}$ |
| 4) | $8.1 \times 10^{-7} \text{ M}$ |

Q.56

An element having an atomic radius of 0.14 nm crystallizes in an fcc unit cell. What is the length of a side of the cell ?

- |    |         |
|----|---------|
| 1) | 0.56 nm |
| 2) | 0.24 nm |
| 3) | 0.96 nm |
| 4) | 0.4 nm  |

Q.57

Which of the following compounds is **not** expected to show Lassaignes' test for nitrogen ?

- |    |                             |
|----|-----------------------------|
| 1) | Propanenitrile              |
| 2) | Hydroxylamine hydrochloride |
| 3) | Nitromethane                |
| 4) | Ethanamine                  |

Q.58

Formaldehyde can be distinguished from acetaldehyde by the use of :

- |                       |
|-----------------------|
| 1) Schiff's reagent   |
| 2) Tollen's reagent   |
| 3) $I_2$ /Alkali      |
| 4) Fehling's solution |

Q.59

By how many folds the temperature of a gas would increase when the root mean square velocity of the gas molecules in a container of fixed volume is increased from  $5 \times 10^4$  cm/s to  $10 \times 10^4$  cm/s ?

- |          |
|----------|
| 1) Two   |
| 2) Three |
| 3) Six   |
| 4) Four  |

Q.60

The element with which of the following outer electron configuration may exhibit the largest number of oxidation states in its compounds :

- |                |
|----------------|
| 1) $3d^5 4s^2$ |
| 2) $3d^8 4s^2$ |
| 3) $3d^7 4s^2$ |
| 4) $3d^6 4s^2$ |

Q.61

If the lines  $\frac{x+1}{2} = \frac{y-1}{1} = \frac{z+1}{3}$  and  $\frac{x+2}{2} = \frac{y-k}{3} = \frac{z}{4}$  are coplanar, then the value of k is :

1)  $\frac{11}{2}$

2)  $-\frac{11}{2}$

3)  $\frac{9}{2}$

4)  $-\frac{9}{2}$

Q.62

**Statement 1:** The slope of the tangent at any point P on a parabola, whose axis is the axis of x and vertex is at the origin, is inversely proportional to the ordinate of the point P.

**Statement 2 :** The system of parabolas  $y^2 = 4ax$  satisfies a differential equation of degree 1 and order 1.

1) Statement 1 is true; Statement 2 is true; Statement 2 is a correct explanation for Statement 1.

2) Statement 1 is true; Statement 2 is true; Statement 2 is not a correct explanation for Statement 1.

3) Statement 1 is true; Statement 2 is false.

4) Statement 1 is false; Statement 2 is true.

Q.63

If  $Z_1 \neq 0$  and  $Z_2$  be two complex numbers such that  $\frac{Z_2}{Z_1}$  is a purely imaginary number, then  $\left| \frac{2Z_1 + 3Z_2}{2Z_1 - 3Z_2} \right|$  is equal to :

1) 2

2) 5

3) 3

4) 1

Q.64

If  $\int \frac{dx}{x + x^7} = p(x)$  then,  $\int \frac{x^6}{x + x^7} dx$  is equal to :

1)  $\ln |x| - p(x) + c$

2)  $\ln |x| + p(x) + c$

3)  $x - p(x) + c$

4)  $x + p(x) + c$

Q.65

If each of the lines  $5x + 8y = 13$  and  $4x - y = 3$  contains a diameter of the circle  $x^2 + y^2 - 2(a^2 - 7a + 11)x - 2(a^2 - 6a + 6)y + b^3 + 1 = 0$ , then :

1)  $a = 5$  and  $b \notin (-1, 1)$

2)  $a = 1$  and  $b \in (-1, 1)$

3)  $a = 2$  and  $b \in (-\infty, 1)$

4)  $a = 5$  and  $b \in (-\infty, 1)$



Q.66

If  $a, b, c$  are sides of a scalene triangle, then

the value of  $\begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix}$  is :

- 1) non - negative
- 2) negative
- 3) positive
- 4) non - positive

Q.67

If  $x = \int_0^y \frac{dt}{\sqrt{1+t^2}}$ , then  $\frac{d^2 y}{dx^2}$  is equal to :

- 1)  $y$
- 2)  $\sqrt{1+y^2}$
- 3)  $\frac{y}{\sqrt{1+y^2}}$
- 4)  $y^2$

Q.68

Let  $a_1, a_2, a_3, \dots$  be an A.P. such that

$$\frac{a_1 + a_2 + \dots + a_p}{a_1 + a_2 + a_3 + \dots + a_q} = \frac{p^3}{q^3}; p \neq q. \text{ Then}$$

$\frac{a_6}{a_{21}}$  is equal to :

- 1)  $\frac{41}{11}$
- 2)  $\frac{121}{1681}$
- 3)  $\frac{11}{41}$
- 4)  $\frac{121}{1861}$

Q.69

**Statement 1 :** The equation  $x \log x = 2 - x$  is satisfied by at least one value of  $x$  lying between 1 and 2.

**Statement 2 :** The function  $f(x) = x \log x$  is an increasing function in  $[1, 2]$  and  $g(x) = 2 - x$  is a decreasing function in  $[1, 2]$  and the graphs represented by these functions intersect at a point in  $[1, 2]$

- |    |                                                                                                     |
|----|-----------------------------------------------------------------------------------------------------|
| 1) | Statement-1 is true, Statement-2 is true; Statement-2 is a correct explanation for Statement-1.     |
| 2) | Statement-1 is true, Statement-2 is true; Statement-2 is not a correct explanation for Statement-1. |
| 3) | Statement-1 is false, Statement-2 is true.                                                          |
| 4) | Statement-1 is true, Statement-2 is false.                                                          |

Q.70

Let  $\vec{a} = 2\hat{i} - \hat{j} + \hat{k}$ ,  $\vec{b} = \hat{i} + 2\hat{j} - \hat{k}$

and  $\vec{c} = \hat{i} + \hat{j} - 2\hat{k}$  be three vectors.

A vector of the type  $\vec{b} + \lambda \vec{c}$  for some scalar  $\lambda$ , whose projection on  $\vec{a}$  is of magnitude

$\sqrt{\frac{2}{3}}$ , is :

- |    |                                  |
|----|----------------------------------|
| 1) | $2\hat{i} + \hat{j} + 5\hat{k}$  |
| 2) | $2\hat{i} + 3\hat{j} - 3\hat{k}$ |
| 3) | $2\hat{i} - \hat{j} + 5\hat{k}$  |
| 4) | $2\hat{i} + 3\hat{j} + 3\hat{k}$ |

Q.71

The area bounded by the curve  $y = \ln(x)$  and the lines  $y = 0$ ,  $y = \ln(3)$  and  $x = 0$  is equal to :

- |    |                |
|----|----------------|
| 1) | 3              |
| 2) | $3 \ln(3) - 2$ |
| 3) | $3 \ln(3) + 2$ |
| 4) | 2              |

Q.72

The values of 'a' for which one root of the equation  $x^2 - (a + 1)x + a^2 + a - 8 = 0$  exceeds 2 and the other is lesser than 2, are given by :

- |    |              |
|----|--------------|
| 1) | $3 < a < 10$ |
| 2) | $a \geq 10$  |
| 3) | $-2 < a < 3$ |
| 4) | $a \leq -2$  |

Q.73

If the surface area of a sphere of radius  $r$  is increasing uniformly at the rate  $8\text{cm}^2/\text{s}$ , then the rate of change of its volume is :

- |    |                            |
|----|----------------------------|
| 1) | constant                   |
| 2) | proportional to $\sqrt{r}$ |
| 3) | proportional to $r^2$      |
| 4) | proportional to $r$        |

Q.74

The probability of a man hitting a target is  $\frac{2}{5}$ . He fires at the target  $k$  times ( $k$ , a given number). Then the minimum  $k$ , so that the probability of hitting the target at least once is more than  $\frac{7}{10}$ , is :

1) 3

2) 5

3) 2

4) 4

Q.75

Equation of the line passing through the points of intersection of the parabola  $x^2 = 8y$  and the ellipse  $\frac{x^2}{3} + y^2 = 1$  is :

1)  $y - 3 = 0$

2)  $y + 3 = 0$

3)  $3y + 1 = 0$

4)  $3y - 1 = 0$

Q.76

The sum of the series :

$1 + \frac{1}{1+2} + \frac{1}{1+2+3} + \dots$  upto 10 terms, is :

1)  $\frac{18}{11}$

2)  $\frac{22}{13}$

3)  $\frac{20}{11}$

4)  $\frac{16}{9}$

Q.77

A value of  $x$  for which

$$\sin(\cot^{-1}(1+x)) = \cos(\tan^{-1}x), \text{ is :}$$

- 1)  $-\frac{1}{2}$
- 2)  $1$
- 3)  $0$
- 4)  $\frac{1}{2}$

Q.78

If  $a$  and  $c$  are positive real numbers and

the ellipse  $\frac{x^2}{4c^2} + \frac{y^2}{c^2} = 1$  has four distinct points in common with the circle  $x^2 + y^2 = 9a^2$ , then

- 1)  $9ac - 9a^2 - 2c^2 < 0$
- 2)  $6ac + 9a^2 - 2c^2 < 0$
- 3)  $9ac - 9a^2 - 2c^2 > 0$
- 4)  $6ac + 9a^2 - 2c^2 > 0$

Q.79

The vector

$(\hat{i} \times \vec{a} \cdot \vec{b})\hat{i} + (\hat{j} \times \vec{a} \cdot \vec{b})\hat{j} + (\hat{k} \times \vec{a} \cdot \vec{b})\hat{k}$  is equal to :

- 1)  $\vec{b} \times \vec{a}$
- 2)  $\vec{a}$
- 3)  $\vec{a} \times \vec{b}$
- 4)  $\vec{b}$

Q.80

A light ray emerging from the point source placed at  $P(1, 3)$  is reflected at a point  $Q$  in the axis of  $x$ . If the reflected ray passes through the point  $R(6, 7)$ , then the abscissa of  $Q$  is :

1) 1

2) 3

3)  $\frac{7}{2}$

4)  $\frac{5}{2}$

Q.81

The mean of a data set consisting of 20 observations is 40. If one observation 53 was wrongly recorded as 33, then the correct mean will be :

1) 41

2) 49

3) 40.5

4) 42.5

Q.82

Let  $A = \{1, 2, 3, 4\}$  and  $R : A \rightarrow A$  be the relation defined by :

$R = \{(1, 1), (2, 3), (3, 4), (4, 2)\}$ . The correct statement is :

1)  $R$  does not have an inverse.2)  $R$  is not a one to one function.3)  $R$  is an onto function.4)  $R$  is not a function.

Q.83

If the three lines  $x - 3y = p$ ,  $ax + 2y = q$  and  $ax + y = r$  form a right - angled triangle then :

1)  $a^2 - 9a + 18 = 0$

2)  $a^2 - 6a - 12 = 0$

3)  $a^2 - 6a - 18 = 0$

4)  $a^2 - 9a + 12 = 0$

Q.84

The matrix  $A^2 + 4A - 5I$ , where  $I$  is identity

matrix and  $A = \begin{bmatrix} 1 & 2 \\ 4 & -3 \end{bmatrix}$ , equals :

1)  $4 \begin{bmatrix} 2 & 1 \\ 2 & 0 \end{bmatrix}$

2)  $4 \begin{bmatrix} 0 & -1 \\ 2 & 2 \end{bmatrix}$

3)  $32 \begin{bmatrix} 2 & 1 \\ 2 & 0 \end{bmatrix}$

4)  $32 \begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix}$

Q.85

The ratio of the coefficient of  $x^{15}$  to the term independent of  $x$  in the expansion of

$\left(x^2 + \frac{2}{x}\right)^{15}$  is :

1)  $7 : 16$

2)  $7 : 64$

3)  $1 : 4$

4)  $1 : 32$



Q.86

The value of

$$\lim_{x \rightarrow 0} \frac{1}{x} \left[ \tan^{-1} \left( \frac{x+1}{2x+1} \right) - \frac{\pi}{4} \right] \text{ is :}$$

- 1) 1
- 2)  $-\frac{1}{2}$
- 3) 2
- 4) 0

Q.87

A vector  $\vec{n}$  is inclined to  $x$ -axis at  $45^\circ$ , to  $y$ -axis at  $60^\circ$  and at an acute angle to  $z$ -axis. If  $\vec{n}$  is a normal to a plane passing through the point  $(\sqrt{2}, -1, 1)$ , then the equation of the plane is :

- 1)  $4\sqrt{2}x + 7y + z = 2$
- 2)  $\sqrt{2}x + y + z = 2$
- 3)  $3\sqrt{2}x - 4y - 3z = 7$
- 4)  $\sqrt{2}x - y - z = 2$

Q.88

**Statement 1 :** The statement  $A \rightarrow (B \rightarrow A)$  is equivalent to  $A \rightarrow (A \vee B)$ .

**Statement 2 :** The statement  $\sim[(A \wedge B) \rightarrow (\sim A \vee B)]$  is a Tautology.

- 1) Statement 1 is False, Statement 2 is True.
- 2) Statement 1 is true, Statement 2 is True; Statement 2 is not a correct explanation for Statement 1.
- 3) Statement 1 is True, Statement 2 is False.
- 4) Statement 1 is true, Statement 2 is True; Statement 2 is a correct explanation for Statement 1.

Q.89

A committee of 4 persons is to be formed from 2 ladies, 2 old men and 4 young men such that it includes at least 1 lady, at least 1 old man and at most 2 young men. Then the total number of ways in which this committee can be formed is :

1) 40

2) 41

3) 16

4) 32

Q.90

Let  $f(x) = \frac{x^2 - x}{x^2 + 2x}$ ,  $x \neq 0, -2$ . Then

$\frac{d}{dx} [f^{-1}(x)]$  (wherever it is defined) is equal to :

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

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

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

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