## PHYSICS

1) **The root mean square velocity of molecules of gas is**

   Inversely proportional to square root of
   a) temperature $\left(\sqrt{\frac{1}{T}}\right)$

   Proportional to square root of temperature
   b) $\left(\sqrt{T}\right)$

   c) Proportional to square of temperature ($T^2$)

   d) Proportional to temperature (T)

2) **Match List I with List II**

   | | List I | | List II |
   |---|---|---|---|
   | **a.** | Surface tension | **i.** | $kg\ m^{-1}\ s^{-1}$ |
   | **b.** | Pressure | **ii.** | $kg\ ms^{-1}$ |
   | **c.** | Vescosity | **iii.** | $kg\ m^{-1}\ s^{-2}$ |
   | **d.** | Impulse | **iv.** | $kg\ s^{-2}$ |

   **Choose the correct answer from the options given below :**
   a) a-iv, b-iii, c-ii, d-i
   b) a-ii, b-i, c-iii, d-iv
   c) a-iii, b-iv, c-i, d-ii
   d) a-iv, b-iii, c-i, d-ii

3) Match List I with List II

   | | List I | | List II |
   |---|---|---|---|
   | **a.** |  | **i.** | $B_0 = \frac{\mu_0 I}{4\pi r}\left[\pi + 2\right]$ |
   | **b.** |  | **ii.** | $B_0 = \frac{\mu_0}{4}\frac{I}{r}$ |
   | **c.** |  | **iii.** | $B_0 = \frac{\mu_0 I}{2\pi r}\left[\pi - 1\right]$ |
   | **d.** |  | **iv.** | $B_0 = \frac{\mu_0 I}{4\pi r}\left[\pi + 1\right]$ |

   Choose the correct answer from the options given below :
   a) a-i, b-iii, c-iv, d-ii
   b) a-iii, b-iv, c-i, d-ii
   c) a-iii, b-i, c-iv, d-ii
   d) a-ii, b-i, c-iv, d-iii

4) **Assume that the earth is a solid sphere of uniform density and a tunnel is dug along its diameter throughout the earth. It is found that when a particle is released in this tunnel, it executes a simple harmonic motion. The mass of the particle is 100 g. The time period of the motion of the particle will be (approximately)**
   **(Take g = m s$^{-2}$, radius of earth = 6400 km)**
   a) 24 hours
   b) 1 hour 40 minutes
   c) 12 hours
   d) 1 hours 24 minutes

5) **A message signal of frequency 5 kHz is used to modulate a carrier signal of frequency 2 MHz. The bandwidth for amplitude modulation is :**
   a) 10 kHz
   b) 20 kHz
   c) 5 kHz
   d) 2.5 kHz

6) **Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R.**

   **Assertion A: Photodiodes are used in forward bias usually for measuring the light intensity.**

   **Reason R: For a p-n junction diode, at applied voltage V the current in the forward bias is more than the current in the reverse bias for $|V_z| > \pm V \geq |V_0|$ where $V_0$ is the threshold voltage and $V_z$ is the breakdown voltage.**

   **In the light of the above statements, choose the correct answer from the options given below:**

   a) Both A and R are true and R is correct explanation A

   b) A is false but R is true.

   c) A is true but R is false

   d) Both A and R are true but R is NOT the correct explanation A

7) **A Carnot engine with efficiency 50% takes heat from a source at 600 K. In order to increase the efficiency to 70%, keeping the temperature of sink same, the new temperature of the source will be :**

   a) 1000 K          b) 360 K

   c) 300 K           d) 900 K

8) **In an LC oscillator, if values of inductance and capacitance become twice and eight times, respectively, then the resonant frequency of oscillator becomes x times its initial resonant frequency $\omega_0$. The value of x is :**

   a) 1/16            b) 16

   c) 4               d) 1/4

9) **A car is moving with a constant speed of 20 m/s in a circular horizontal track of radius 40 m. A bob is suspended from the roof of the car by a massless string. The angle made by the string with the vertical will be : (Take g = 10 m/s²)**

   a) $\frac{\pi}{3}$          b) $\frac{\pi}{4}$

   c) $\frac{\pi}{2}$          d) $\frac{\pi}{6}$

10) **The ratio of the density of oxygen nucleus $\left(^{16}_{8}O\right)$ and helium nucleus $\left(^{4}_{2}He\right)$ is**

    a) 1 : 1           b) 8 : 1

    c) 2 : 1           d) 4 : 1

11) **A uniform metallic wire carries a current 2 A, when 3.4 V battery is connected across it. The mass of uniform metallic wire is $8.92 \times 10^{-3}$ kg, density is $8.92 \times 10^3$ kg/m³ and resistivity is $1.7 \times 10^{-8}$ Ω–m. The length of wire is :**

    a) l = 6.8 m       b) l = 5 m

    c) l = 100 m       d) l = 10 m

12) **A solenoid of 1200 turns is wound uniformly in a single layer on a glass tube 2 m long and 0.2 m diameter. The magnetic intensity at the center of the solenoid when a current of 2 A flows through it is.**

    a) $1.2 \times 10^3$ A m$^{-1}$     b) $1$ A m$^{-1}$

    c) $2.4 \times 10^3$ A m$^{-1}$     d) $2.4 \times 10^{-3}$ A m$^{-1}$

13) **An object of mass 8 kg is hanging from one end of a uniform rod CD of mass 2 kg and length 1 m pivoted at its end C on a vertical wall as shown in figure. It is supported by a cable AB such that the system is in equilibrium. The tension in the cable is : (Take g = 10 m/s²)**
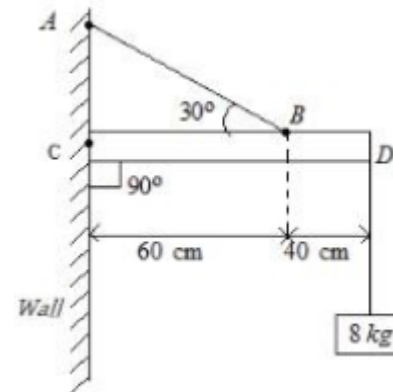


    a) 30 N            b) 240 N

    c) 300 N           d) 90 N

14) **A parallel plate capacitor has plate area 40 cm² and plates separation 2 mm. The space between the plates is filled with a dielectric medium of a thickness 1 mm and dielectric constant 5. The capacitance of the system is :**

    a) $\frac{10}{3}\varepsilon_0 F$     b) $10\,\varepsilon_0$ F

    c) $24\,\varepsilon_0$ F            d) $\frac{3}{10}\varepsilon_0 F$

15) **Electron beam used in an electron microscope, when accelerated by a voltage of 20 kV has a de-Broglie wavelength of $\lambda_0$. If the voltage is increased to 40 kV, then the de-Broglie wavelength associated with the electron beam would be :**

a) $\frac{\lambda_0}{\sqrt{2}}$   b) $\frac{\lambda_0}{2}$

c) $9\,\lambda_0$   d) $3\,\lambda_0$

16) **T is the time period of simple pendulum on the earth's surface. Its time period becomes x T when taken to a height R (equal to earth's radius) above the earth's surface. Then, the value of x will be**

a) $\frac{1}{4}$   b) 2

c) 4   d) $\frac{1}{2}$

17) **In Young's double slits experiment, the position of 5th bright fringe from the central maximum is 5 cm. The distance between slits and screen is 1 m and wavelength of used monochromatic liight is 600 nm. The separation between the slits is:**

a) $48\ \mu m$   b) $36\ \mu m$

c) $60\ \mu m$   d) $12\ \mu m$

18) **A car travels a distance of 'x' with speed $v_1$ and then same distance 'x' with speed $v_2$ in the same direction. The average speed of the car is**

a) $\frac{v_1 v_2}{2(v_1+v_2)}$   b) $\frac{v_1+v_2}{2}$

c) $\frac{2\,v_1 v_2}{v_1+v_2}$   d) $\frac{2x}{v_1+v_2}$

19) **A bowl filled with very hot soup cools from 98°C to 86°C in 2 minutes when the room temperature is 22°C. How long it will take to cool from 75°C to 69°C**

a) 1 minute   b) 0.5 minute

c) 2 minute   d) 1.4 minute

20) **An electromagnetic wave is transporting energy in the negative z direction. At a certain point and certain time the direction of electric field of the wave is along positive y direction. What will be the direction of the magnetic field of the wave at that point and instant?**

a) Positive direction of x   b) Negative direction of y

c) Positive direction of z   d) Negative direction of x

21) **A uniform electric field of 10 N/C is created between two parallel charged plates (as shown in figure). An electron enters the field symmetrically between the plates with a kinetic energy 0.5 eV. The length of each plate is 10 cm. The angle ($\theta$) of deviation of the path of electron as it comes out of the field is _____ (in degree).**



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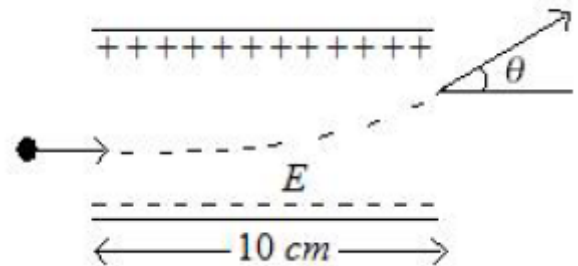
22) **A ray of light is incident from air on a glass plate having thickness $\sqrt{3}$ cm and refractive index $\sqrt{2}$. The angle of incidence of a ray is equal to the critical angle for glass-air interface. The lateral displacement of the ray when it passes through the plate is _____ $\times 10^{-2}$ cm. (given sin 15° = 0.26)**

)

23) **An LCR series circuit of capacitance 62.5 nF and resistance of 50 $\Omega$, is connected to an A.C. source of frequency 2.0 kHz. For maximum value of amplitude of current in circuit, the value of inductance is _____ mH.**

**(Take $\pi^2$ = 10)**

)

24) As shown in the figure, in an experiment to determine Young's modulus of a wire, the extension-load curve is plotted. The curve is a straight line passing through the origin and makes an angle of 45° with the load axis. The length of wire is 62.8 cm and its diameter is 4 mm. The Young's modulus is found to be $x \times 10^4$ Nm$^{-2}$. The value of x is



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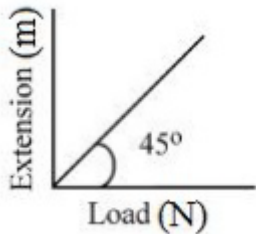
25) The wavelength of the radiation emitted is $\lambda_0$ when an electron jumps from the second excited state to the first excited state of hydrogen atom. If the electron jumps from the third excited state to the second orbit of the hydrogen atom, the 20 wavelength of the radiation emitted will be $\frac{20}{x}\lambda_0$. The value of x is _____.
)

26) An object of mass 'm' initially at rest on a smooth horizontal plane starts moving under the action of force F = 2N. In the process of its linear motion, the angle θ (as shown in figure) between the direction of force and horizontal varies as θ = kx, where k is a constant and x is the distance covered by the object from its initial position. The expression of kinetic energy of the object will be $E = \frac{n}{k}\sin\theta$. The value of n is



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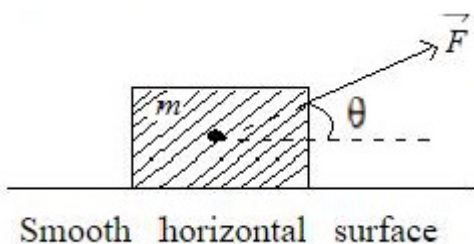
27) If $\vec{P} = 3\hat{i} + \sqrt{3}\hat{j} + 2\hat{k}$ and $\vec{Q} + 4\hat{i} + \sqrt{3}\hat{j} + 2.5\hat{k}$ then. Then unit vector in the direction of $\vec{P} \times \vec{Q}$ is $\frac{1}{x}\left(\sqrt{3}i + \hat{j} - 2\sqrt{3}\hat{k}\right)$. The value of x is
)

28) In the given circuit, the equivalent resistance between the terminal A and B is _____ Ω.



)
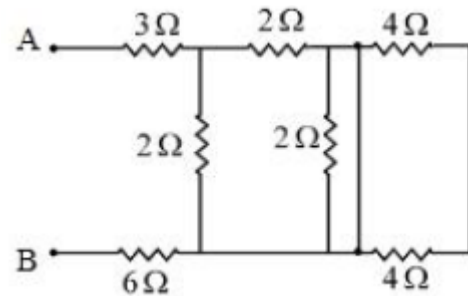
29) The distance between two consecutive points with phase difference of 60° in a wave of frequency 500 Hz is 6.0 m. The velocity with which wave is traveling is _____ km/s
)

30) $I_{CM}$ is the moment of inertia of a circular disc about an axis (CM) passing through its center and perpendicular to the plane of disc. $I_{AB}$ is it's moment of inertia about an axis AB perpendicular to plane and parallel to axis CM at a distance from center. Where R is the radius of the disc. The ratio of $I_{AB}$ and $I_{CM}$ is x : 9. The value of x is _____.



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CHEMISTRY
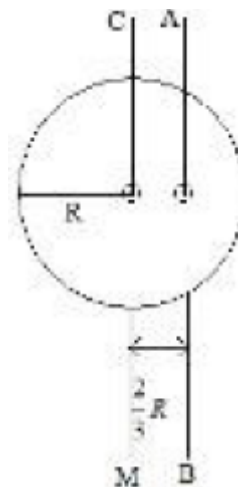
31) **The correct order in aqueous medium of basic strength in case of methyl substituted amines is:**

a) $Me_3N > Me_2NH > MeNH_2 > NH_3$

b) $Me_2NH > Me_3N > MeNH_2 > NH_3$

c) $NH_3 > Me_3N > MeNH_2 > Me_2NH$

d) $Me_2NH > MeNH_2 > Me_3N > NH_3$

32) **Inert gases have positive electron gain enthalpy. Its correct order is**

a) He < Xe < Kr < Ne

b) He < Ne < Kr < Xe

c) He < Kr < Xe < Ne

d) Xe < Kr < Ne < He

33) **In the cumene to phenol preparation in presence of air, the intermediate is**

a)
b)
c)
d)
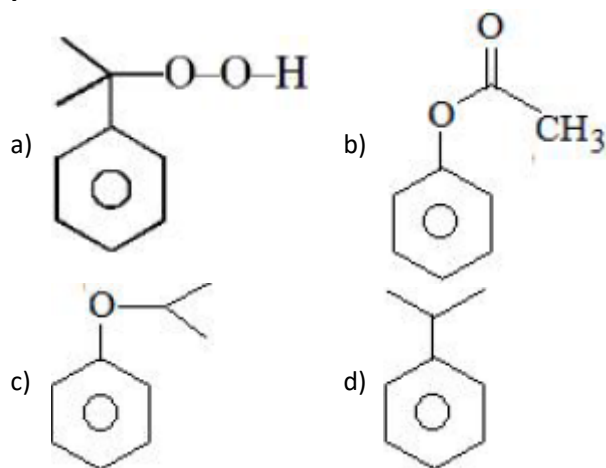
34) **Which of the following statements is incorrect for antibiotics?**

An antibiotic is a synthetic substance

a) produced as a structural analogue of naturally occurring antibiotic

b) An antibiotic should promote the growth or survival of microorganisms

c) An antibiotic should be effective in low concentrations.

d) An antibiotic must be a product of metabolism.

35) The variation of the rate of an enzyme catalyzed reaction with substrate concentration is correctly represented by graph
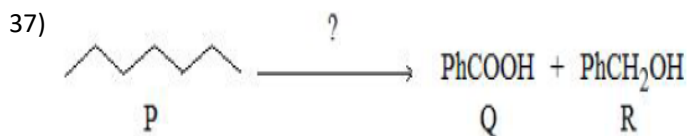
(a)

(b)

(c)

(d)
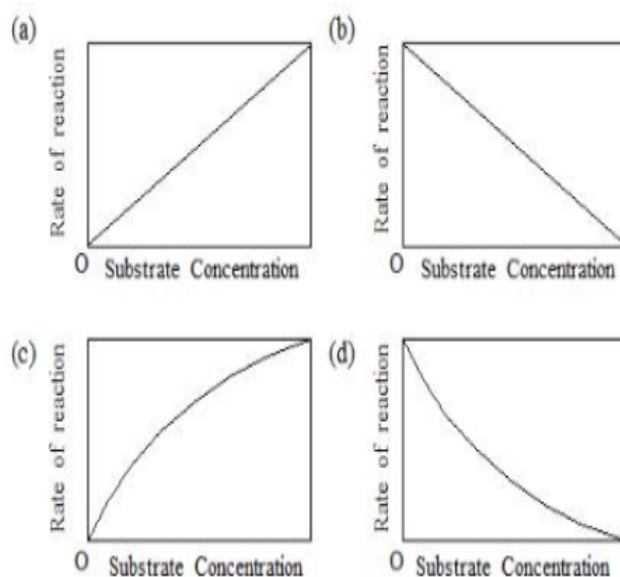
a) a

b) d

c) c

d) b

36) Match List I with List II

|   | List I<br><br>Elements |   | List II<br><br>Colour imparted to the flame |
|---|---|---|---|
| a. | K | i. | Brick Red |
| b. | Ca | ii. | Violet |
| c. | Sr | iii. | Apple Green |
| d. | Bs | iv. | Crimson Red |

Choose the correct answer from the options given below:

a) A-II, B-IV, C-I, D-III

b) A-II, B-I. C-IV, D-III

c) A-IV, B-III, C-II, D-I

d) A-II, B-I, C-III, D-IV

**37)**



The correct sequence of reagents for the preparation of Q and R is:

a) (i) $CrO_2Cl_2$, $H_3O^+$; (ii) $Cr_2O_3$, 770 K, 20 atm; (iii) NaOH, (iv) $H_3O^+$

b) (i) $KMnO_4$, $OH^-$: (u) $Mo_2O_3$, $\Delta$; (ii) NaOH, (iv) $H_2O^+$

c) (i) $Cr_2O3$, 770 K, 20 atm; (ii) $CrO_2Cl_2$, $H_2O^+$; (iii) NaOH; (iv) $H_3O^+$

d) (i) $Mo_2O_3$, $\Delta$; (ii) $CrO_2Cl_2$, $H_3O^+$; (iii) NaOH, (v) $H_3O^+$

**38)** Compound A reacts with $NH_4Cl$ and forms a compound B. Compound B reacts with $H_2O$ and excess of $CO_2$ to form compound C which on passing through or reaction with saturated NaCl solution forms sodium hydrogen carbonate. Compound A. B and C, are respectively.

a) $Ca(OH)_2$, $NH_4^{\oplus}$, $(NH_4)_2CO_3$

b) $Ca(OH)_2$, $NH_3$, $NH_4HCO_3$

c) $CaCl_2$, $NH_3$, $NH_4HCO_3$
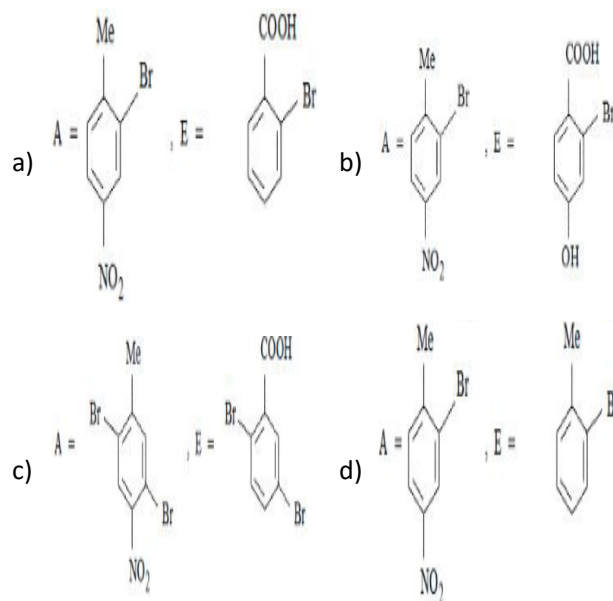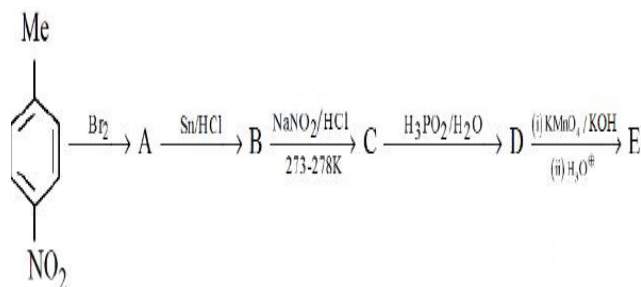
d) $CaCl_2$, $NH_4^{\oplus}$, $(NH_4)_2CO_3$

**39)** The radius of the 2$^{nd}$ orbit of $Li^{2+}$ is x. The expected radius of the 3$^{rd}$ orbit of $Be^{3+}$ is

a) $\frac{9}{4}x$

b) $\frac{27}{16}x$

c) $\frac{16}{27}x$

d) $\frac{4}{9}x$

**40)** The compound which will have the lowest rate towards nucleophilic aromatic substitution on treatment with $OH^-$ is



a)

b)

c)

d)
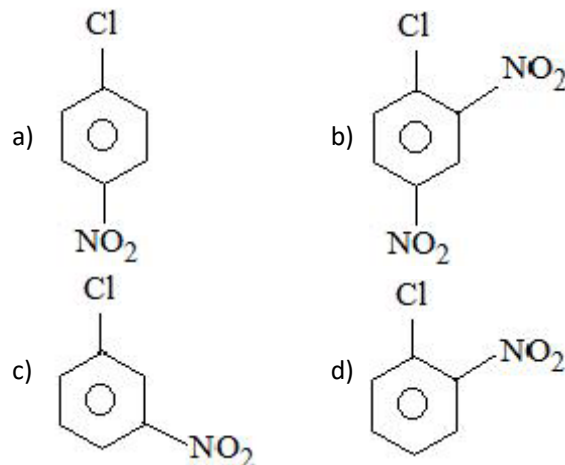
**41)** Identify the product formed (A and E)



a) A =  , E = 

b) A =  , E = 

c) A =  , E = 

d) A =  , E = 

**42)** Reaction of thionyl chloride with white phosphorus forms a compound [A], which on hydrolysis gives [B], a dibasic acid. [A] and [B] are respectively

a) $PCl_3$ and $H_3PO_3$

b) $P_4O_6$ and $H_3PO_3$

c) $PCl_5$ and $H_3PO_4$

d) $POCl_3$ and $H_3PO_4$

43) Given below are two statements: one is labelled as **Assertion A** and the other is labelled as **Reason R:**

**Assertion A :** Acetal Ketal is stable in basic medium.

**Reason R**: The high leaving tendency of alkoxide ion gives the stability to ketal in basic medium.

In the light of the above statements, choose the correct answer from the options given below:

a) Both A and R are true but R is NOT the correct explanation of A

b) Both A and R are true and R is the correct explanation of A

c) A is false but R is true

d) A is true but R is false

44) **25 volume' hydrogen peroxide means**

a) 1 L marketed solution contains 75 g of $H_2O_2$.

b) 100 mL marketed solution contains 25 g of $H_2O_2$.

c) 1 L marketed solution contains 250 g of $H_2O_2$

d) 1 L marketed solution contains 25 g of $H_2O_2$

45) **Which one of the following reactions does not occur during extraction of copper?**

a) $CaO + SiO_2 \rightarrow CaSiO_3$

b) $2\,FeS + 3\,O2 \rightarrow 2\,FeO + 2\,SO_2$

c) $2\,Cu_2S + 3\,O_2 \rightarrow Cu_2O + 2\,SO_2$

d) $FeO + SiO_2 \rightarrow FeSiO_3$

46) **A cubic solid is made up of two elements X and Y Atoms of X are present on every alternate corner and one at the center of cube. Y is at $\frac{1}{3}rd$ of the total faces. The empirical formula of the compound is**

a) $X_2Y_{1.5}$

b) $XY_{2.5}$

c) $X_3Y_2$

d) $X_{1.5}Y_2$

47) Match the List-I with List-II:

|     | List I Cations | | List II Group reagents |
| --- | --- | --- | --- |
| a. | $Pb^{2+}, Cu^{2+}$ | i. | $H_2S$ gas in presence of dilute HCl |
| b. | $Al^{3+}, Fe^{3+}$ | ii. | $(NH_4)_2CO_3$ in presence of $NH_4OH$ |
| c. | $Co^{2+}, Ni^{2+}$ | iii. | $NH_4OH$ in presence of $NH_4Cl$ |
| d. | $Ba^{2+}, Ca^{2+}$ | iv. | $H_2S$ in presence of $NH_4OH$ |

Correct match is

a) a-iv, b-ii, c-iii, d-i

b) a-i, b-iii, c-iv, d-ii
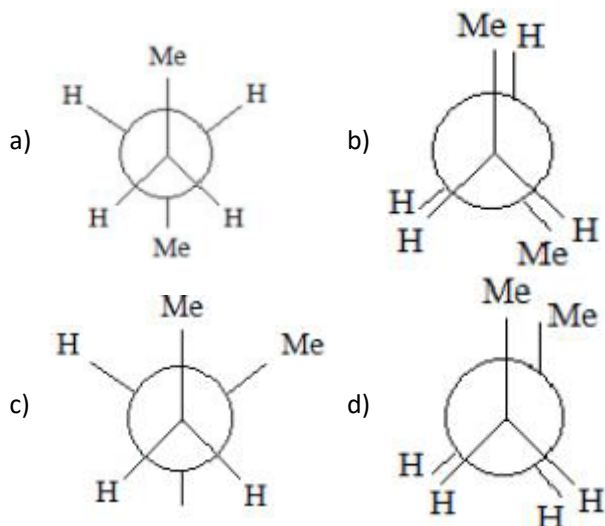
c) a-iii, b-i, c-iv, d-ii

d) a-i, b-iii, c-ii, d-iv

48) **Some reactions of $NO_2$ relevant to photochemical smog formation are**

$$NO_2 \xrightarrow{\text{sunlight}} X + Y$$
$$\downarrow A$$
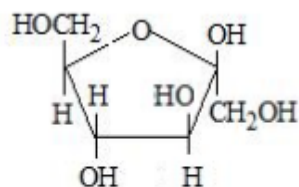$$B$$
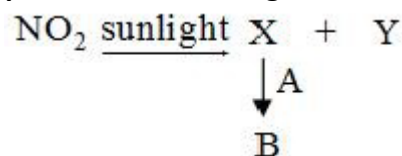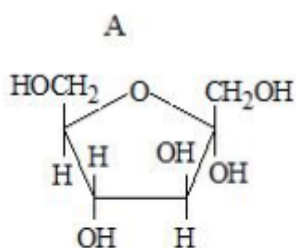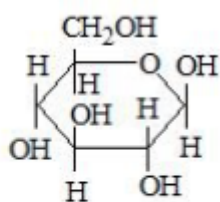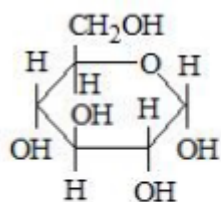
**Identify A, B, X and Y**

a) X = [O], Y = NO, A = $O_2$, B = $O_3$

b) $X = \frac{1}{2}O_2$, Y = $NO_2$, A = $O_3$, B = $O_2$

c) X = $N_2O$, Y = [O], A = $O_3$, B = NO

d) X = NO, Y = [O], A = $O_2$, B = $N_2O_3$

49) **Which of the following conformations will be the most stable?**



a)

b)

c)

d)

50) **Match items of Row I with those of Row II.**

**Row I:**



A

B

C

D

**Row II:**

**(i) α-D-(-)-Fructofuranose**

**(ii) β-D-(-)- Fructofuranose**

**(iii) α-D-(-) Glucopyranose**

**(iv) β-D-(-)- Glucopyranose**

**Correct match is**

a) A - i, B - ii, C - iii, D - iv
b) A - iv, B - iii, C - i, D - ii
c) A - iii, B - iv, C - i, D - ii
d) A - iii, B - iv, C - ii, D - i

51) How many of the following metal ions have similar value of spin only magnetic moment in gaseous state?

(Given: Atomic number V, 23; Cr, 24, Fe, 26; Ni, 28)
$V^{3+}$, $Cr^{3+}$, $Fe^{2+}$, $Ni^{3+}$
)

52) An athlete is given 100 g of glucose ($C_6H_{12}O_6$) for energy. This is equivalent to 1800kJ of energy. The 50% of this energy gained is utilized by the athlete for sports activities at the event. In order to avoid storage of energy, the weight of extra water he would need to perspire is _____ g (Nearest integer)

Assume that there is no other way of consuming stored energy.

Given: The enthalpy of evaporation of water is 45 kJ $mol^{-1}$

Molar mass of C, H & O are 12, 1 and 16 g $mol^{-1}$.

)

53) The density of a monobasic strong acid (Molar mass 24.2 g mol) is 121 kg L The volume of its solution required for the complete neutralization of 25 ml of 0.24 M NaOH is _____ × $10^{-2}$ mL (Nearest integer)
)

54) The total number of lone pairs of electrons on oxygen atoms of ozone is __
)

55) In sulphur estimation, 0.471 g of an organic compound gave 1.4439 g of barium sulphate. The percentage of sulphur in the compound is _____ (Nearest Integer)
(Given: Atomic mass Ba: 137 u, S: 32 u, O: 16 u)
)

56) Consider the cell

Pt(s) | $H_2$(g) (1 atm) | $H^+$ (aq. $[H^+]$ = 1) || $Fe^{3+}$ (aq), $Fe^{2+}$ (aq) | Pt(s)
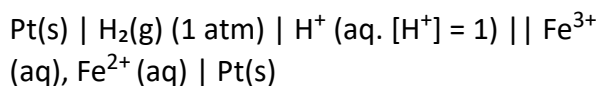
Given $E^\circ_{Fe^{3+}/Fe^{2+}} = 0.771\ V$ and

$E^\circ_{H^+/\frac{1}{2}H_2} = 0\ V$, T = 298 K

If the potential of the cell is 0.712 V, the ratio of concentration of $Fe^{2+}$ to $Fe^{3+}$ is _____ (Nearest integer)
)

57) For the first order reaction A $\rightarrow$ B, the half life is 30 min. The time taken for 75% completion of the reaction is _____ min. (Nearest integer)

Given : log 2 = 0.3010
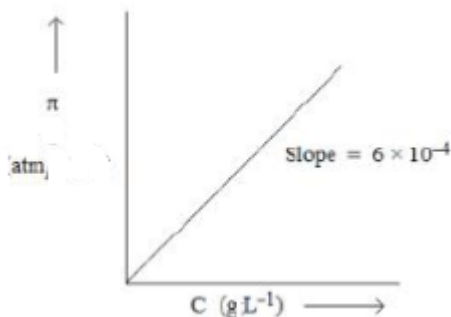
log 3 = 0.4771

log 5 = 0.6989
)

58) The osmotic pressure of solutions of PVC in cyclohexanone at 300 K are plotted on the graph.

The molar mass of PVC is _____ g $mol^{-1}$ (Nearest integer)



(Given: R = 0.083 L atm $K^{-1}$ $mol^{-1}$) (
$\pi$ vs C (g/L) graph with slope $= 6 \times 10^{-4}$
)

59) A litre of buffer solution contains 0.1 mole of each of $NH_3$ and $NH_4Cl$. On the addition of 0.02 mole of HCl by dissolving gaseous HCl, the pH of the solution is found to be _____ $\times 10^{-3}$ (Nearest integer)

[Given: $pK_b(NH_3)$ = 4.745

log 2 = 0.301

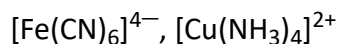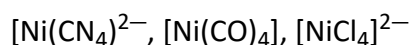log 3 = 0.477

T = 298 K]
)

60) The number of paramagnetic species from the following is

$[Ni(CN_4)]^{2-}$, $[Ni(CO)_4]$, $[NiCl_4]^{2-}$

$[Fe(CN)_6]^{4-}$, $[Cu(NH_3)_4]^{2+}$

$[Fe(CN)_6]^{3-}$ and $[Fe(H_2O)_6]^{2+}$

)

## MATHEMATICS

61) **The distance of the point P (4, 6,-2) from the line passing through the point (-3, 2, 3) and parallel to a line with direction ratios 3, 3,-1 is equal to :**
a) $2\sqrt{3}$        b) 3
c) $\sqrt{14}$        d) $\sqrt{6}$

62) **The mean and variance of the marks obtained by the students in a test are 10 and 4 respectively. Later, the marks of one of the students is increased from 8 to 12. If the new mean of the marks is 10.2, then their new variance is equal to:**

a) 3.96        b) 3.92
c) 4.04        d) 4.08

63) **The statement $(p \wedge (\sim q)) \Rightarrow (p \Rightarrow (\sim q))$ is**

a) *a contradiction*        b) equivalent to $p \vee q$

c) a tautology        d) Equivalent to $(\sim p) \vee (\sim q)$

64) Let $S_1$ and $S_2$ be respectively the sets of all a $\in$ R − {0} for which the system of linear equations

ax + 2ay − 3az = 1

(2a + 1)x + (2a + 3) y + (a + 1) z = 2

(3a + 5)x + (a + 5) y + (a + 2)z = 3

has unique solution and infinitely many solutions. Then

a) $n(S_1)$ = 2 and $S_2$ is an infinite set

b) $S_1$ = R − {0} and $S_2$ = Φ

c) $S_1$ is an infinite set and $n(S_2)$ = 2

d) $S_1$ = and $S_2$ =R − {0}

65) Let x, y, z > 1 and

$$A = \begin{bmatrix} 1 & \log_x y & \log_x z \\ \log_y x & 2 & \log_y z \\ \log_z x & \log_z y & 3 \end{bmatrix}.$$ Then |adj (adj $A^2$)| is equal to

a) $4^8$

b) $2^4$

c) $2^8$

d) $6^4$

66) Let x = 2 be a local minima of the function f(x) = $2x^4 − 18x^2 + 8x + 12$, x $\in$ (−4, 4). If M is local maximum value of the function f in (−4, 4), then M =

a) $18\sqrt{6} − \frac{3}{2}$

b) $12\sqrt{6} − \frac{31}{2}$

c) $18\sqrt{6} − \frac{31}{2}$

d) $12\sqrt{6} − \frac{33}{2}$

67) Let $f\left(x\right) = \int \frac{2x}{(x^2+1)(x^2+3)}dx$. If $f\left(3\right) = \frac{1}{2}\left(\log_e 5 − \log_e 6\right)$ ($\log_e 5 − \log_e 6$), then f(4) is equal to

a) $\log_e 17 − \log_e 18$

b) $\frac{1}{2}\left(\log_e 19 − \log_e 17\right)$

c) $\frac{1}{2}\left(\log_e 17 − \log_e 19\right)$

d) $\log_e 19 − \log_e 20$

68) The vector $\vec{a} = -\hat{i} + 2\hat{j} + \hat{k}$ is rotated through a right angle, passing through the y-axis in its way and the resulting vector is $\vec{b}$. Then the projection of $3\vec{a} + \sqrt{2}\vec{b}$ on $\vec{c} = 5\vec{i} + 4\vec{j} + 3\vec{k}$ is

a) $2\sqrt{3}$

b) $3\sqrt{2}$

c) 1

d) $\sqrt{6}$

69) The points of intersection of the line ax + by = 0, (a ≠ b) and the circle $x^2 + y^2 − 2x = 0$ are A (α, 0) and B (1, β). The image of the circle with AB as a diameter in the line x + y + 2 = 0 is:

a) $x^2 + y^2 + 3x + 5y + 8 = 0$

b) $x^2 + y^2 − 5x − 5y + 12 = 0$

c) $x^2 + y^2 + 3x + 3y + 4 = 0$

d) $x^2 + y^2 + 5x + 5y + 12 = 0$

70) Let f : (0, 1) →R be a function defined by $f\left(x\right) = \frac{1}{1-e^{-x}}$ and g(x) = (f(−x) − f(x)).

Consider two statements

(I) g is an increasing function in (0, 1)

(II) g is one-one in (0, 1)

Then,

a) Only (II) is true

b) Both (I) and (II) are true

c) Only (I) is true

d) Neither (1) nor (II) is true

71) Let y(x) = (1 + x) (1 + x²) (1 + x⁴) (1 + x⁸) (1 + x¹⁶). Then y'− y" at x = −1 is equal to :

a) 976

b) 464

c) 496

d) 944

72) Let M be the maximum value of the product of two positive integers when their sum is 66. Let the sample space $S = \left\{x \in Z : x\left(66 − x\right) \geq \frac{5}{9}M\right\}$ and the event

A = {x $\in$ S : x is a multiple of 3). Then P(A) is equal to

a) $\frac{7}{22}$

b) $\frac{15}{44}$

c) $\frac{1}{5}$

d) $\frac{1}{3}$

73) The distance of the point $\left(6, -2\sqrt{2}\right)$ from the common tangent y = mx + c, m > 0. of the curves x = 2y² and x = 1 + y² is:

a) $\frac{14}{3}$

b) $\frac{1}{3}$

c) $5\sqrt{3}$

d) 5

74) **Consider the lines $L_1$ and $L_2$ given by**

$$L_1 = \frac{x-1}{2} = \frac{y-3}{1} = \frac{z-2}{2}$$

$$L_2 = \frac{x-2}{1} = \frac{y-2}{2} = \frac{z-3}{3}$$

**A line $L_3$ having direction ratios 1,–1, –2, intersects $L_1$ and $L_2$ at the points P and Q respectively. Then the length of line segment PQ is**

a) $2\sqrt{6}$      b) 4

c) $3\sqrt{2}$      d) $4\sqrt{3}$

75) **The value of**

$$\lim_{n\to\infty} \frac{1+2-3+4+5-6+...+(3n-2)+(3n-1)-3n}{\sqrt{2n^4+4n+3}-\sqrt{n^4+6n+4}} \text{ is :}$$

a) $\frac{\sqrt{2}+1}{2}$      b) $3\left(\sqrt{2}+1\right)$

c) $\frac{3}{2\sqrt{2}}$      d) $\frac{3}{2}\left(\sqrt{2}+1\right)$

76) **Let y = y(x) be the solution curve of the differential equation**

$$\frac{dy}{dx} = \frac{y}{x}\left(1 + xy^2\left(1 + \log_e x\right)\right), \text{ x > 0, y(1) = }$$

**3. Then $\frac{y^2(x)}{9}$ is equal to :**

a) $\frac{x^2}{7-3x^3\left(2+\log_e x^2\right)}$      b) $\frac{x^2}{5-2x^3\left(2+\log_e x^3\right)}$

c) $\frac{x^2}{3x^3\left(1+\log_e x^2\right)-2}$      d) $\frac{x^2}{2x^3\left(2+\log_e x^3\right)-3}$

77) **If $a_r$ is the coefficient of $x^{10-r}$ in the Binomial expansion of $(1 + x)^{10}$, then**

$$\sum_{r=1}^{10} r^3\left(\frac{a_r}{a_{r-1}}\right)^2 \text{ is equal to}$$

a) 1210      b) 5445

c) 3025      d) 4895

78) **Let $z_1$ = 2 + 3i and $z_2$ = 3 + 4i. The set**

$$S = \{z \in C : |z - z_1|^2 - |z - z_2|^2 = |z_1 - z_2|^2\}$$
**represents a**

a) Straight line with the sum of its intercepts on the coordinate axes equals 14

b) Straight line with the sum of its intercepts on the coordinate axes equals -18

c) hyperbola with eccentricity 2

d) hyperbola with the length of the transverse axis 7

79) **Let $\vec{a}$, $\vec{b}$ and $\vec{c}$ be three non zero vectors such that $\vec{b} \cdot \vec{c} = 0$ and**

$$\vec{a} \times \left(\vec{b} \times \vec{c}\right) = \frac{\vec{b}-\vec{c}}{2}. \text{ If } \vec{d} \text{ be a vector}$$

**such that $\vec{b} \cdot \vec{d} = \vec{a} \cdot \vec{b}$, then**

$$\left(\vec{a} \times \vec{b}\right) \cdot \left(\vec{c} \times \vec{d}\right) \text{ is equal to}$$

a) $\frac{3}{4}$      b) $\frac{1}{4}$

c) $-\frac{1}{4}$      d) $\frac{1}{2}$

80) **The minimum value of the function**

$$f\left(x\right) = \int_0^2 e^{|x-t|}dt \text{ is :}$$

a) 2e - 1      b) 2

c) 2 (e - 1)      d) e (e - 1)

81) Let x and y be distinct integers where $1 \le x \le 25$ and $1 \le y \le 25$. Then, the number of ways of choosing x and y, such that x + y is divided by 5, is

)

82) Let

$$S = \left\{\alpha : \log_2\left(9^{2\alpha-4} + 13\right) - \log_2\left(\frac{5}{2} \cdot 3^{2\alpha-4} + 1\right) = 2\right\}$$

. Then the maximum value of $\beta$ for which the equation

$$x^2 - 2\left(\sum_{\alpha \in s} \alpha\right)^2 x + \sum_{\alpha \in s} \left(\alpha + 1\right)^2 \beta = 0 \text{ has real}$$

roots, is ____

)

83) It the area enclosed by the parabolas $P_1 : 2y = 5x^2$ and $P_2 : x^2 - y + 6 = 0$ is equal to the area enclosed by $P_1$ and $y = \alpha x$, a > 0, then $a^3$ is equal to _____

)

84) Let the equation of the plane passing through the line x − 2y − z − 5 − 0 = x + y + 32 = 5 and parallel to the line x + y + 2z − 7 = 0 = 2x + 3y + z − 2 be ax + by + cz = 65. Then the distance of the point (a, b, c) from the plane 2x + 2y − z +16 = 0 is

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85) The constant term in the expansion of

$$\left(2x + \frac{1}{x^7} + 3x^2\right)^5 \text{ is } \_\_\_\_\_.$$

)

86) The vertices of a hyperbola H are (± 6. 0) and its eccentricity is $\frac{\sqrt{5}}{2}$. Let N be the normal to H at a point in the first quadrant and parallel to the line $\sqrt{2}x + y = 2\sqrt{2}$. If d is the length of the line segment of N between H and the y-axis then $d^2$ is equal to
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87) If the sum of all the solution of
$\tan^{-1}\left(\frac{2x}{1-x^2}\right) + cot^{-1}\left(\frac{1-x^2}{2x}\right) = \frac{\pi}{3}$, -1 < x < 1, x ≠ 0,
is $\alpha - \frac{4}{\sqrt{3}}$, then $\alpha$ is equal to _____
)

88) Let S = {1, 2, 3, 5, 7, 10, 11}. The number of non-empty subsets of S that have the sum of all elements a multiple of 3. is ____
)

89) Let $A_1$, $A_2$, $A_3$ be the three A.P. with the same common difference d and having their first terms as A. $A^{+1}$, $A^{+2}$, respectively. Let a, b, c be the 7th 9th, 17th terms of $A_1$, $A_2$, $A_3$,

respectively such that $\begin{vmatrix} a & 7 & 1 \\ 2b & 17 & 1 \\ c & 17 & 1 \end{vmatrix} + 70 = 0$

If a = 29, then the sum of first 20 terms of an AP whose first term is c-a-b and common difference is $\frac{d}{12}$ is equal to
)

90) For some a, b, c ∈ N, f(x) = ax − 3 and g(x) = $x^b$ + c, x ∈ R. If $(fog)^{-1}(x) = \left(\frac{x-7}{2}\right)^{1/3}$, then (fog) (ac) + (gof) (b) is equal to
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