PHYSICS WALLAH

JEE MAIN 2026

SESSION-01

Date: 21-01-2026

Shift-01

SECTION-I (PHYSICS)

Single Correct Type Questions

1. A light wave described by

$E = 60\left[\sin\left(3\times10^{15}\right)t + \sin\left(12\times10^{15}\right)t\right]$

(in SI units) falls on a metal surface of work function 2.8 eV. The maximum kinetic energy of ejected photoelectron is (approximately) ____eV.

($h = 6.6\times10^{-34}$ J.s. and $e = 1.6\times10^{-19}C$)

(1) 3.8 (2) 6.0
(3) 5.1 (4) 7.8

2. A gas based geyser heats water flowing at the rate of 5.0 litres per minute from 27°C to 87°C. The rate of consumption of the gas is _____ g/s.

(Take heat of combustion of gas $= 5.0\times10^4$ J / g)

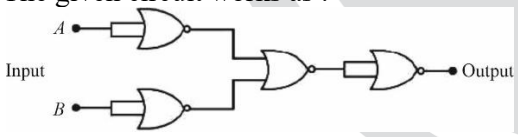
specific heat capacity of water $= 4200$ J / kg.°C

(1) 4.2
(2) 2.1
(3) 0.21
(4) 0.42

3. In an experiment the values of two spring constants were measured as $k_1 = (10\pm0.2)$ N / m and $k_2 = (20\pm0.3)$ N / m . If these springs are connected in parallel, then the percentage error in equivalent spring constant is :

(1) 1.33%
(2) 2.33%
(3) 1.67%
(4) 2.67%

4. The given circuit works as :

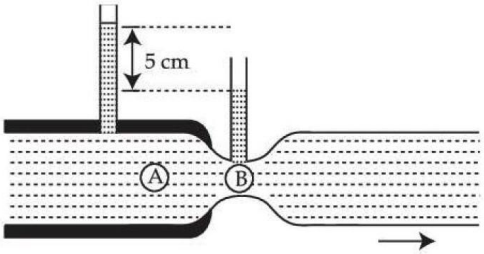


(1) AND gate
(2) NAND gate
(3) OR gate
(4) NOR gate

5. Two strings (*A*, *B*) having linear densities $\mu_A = 2\times10^{-4}$ kg/m and, $\mu_B = 4\times10^{-4}$ kg/m and lengths $L_A = 2.5$ m and $L_B = 1.5$ m respectively are joined. Free ends of *A* and *B* are tied to two rigid supports *C* and *D*, respectively creating a tension of 500 N in the wire. Two identical pulses, sent from *C* and *D* ends, take time t_1 and t_2 , respectively, to reach the joint. The ratio t_1 / t_2 is :

(1) 1.18
(2) 1.67
(3) 1.90
(4) 1.08

6. Water flows through a horizontal tube as shown in the figure. The difference in height between the water columns in vertical tubes is 5 cm and the area of cross-sections at *A* and *B* are 6 cm^2 and 3 cm^2 respectively. The rate of flow will be ____ cm^3 / s . (take $g = 10$ m/s^2)



(1) $200\sqrt{3}$ (2) $\frac{200}{\sqrt{3}}$
(3) $200\sqrt{6}$ (4) $100\sqrt{3}$

7. A point charge of 10^{-8}C is placed at origin. The work done in moving a point charge 2μC from point $A(4,4,2)$m to $B(2,2,1)$m is ____ *J*.

($\frac{1}{4\pi\epsilon_0} = 9\times10^9$ in SI units)

(1) 45×10^{-6} (2) 30×10^{-6}
(3) 0 (4) 15×10^{-6}

8. The electric field in a plane electromagnetic wave is given by :

$E_y = 69\sin\left[0.6\times10^3 x - 1.8\times10^{11}t\right]$ V/m

The expression for magnetic field associated with this electromagnetic wave is _____ *T*.

(1) $B_y = 2.3\times10^{-7}\sin\left[0.6\times10^3 x - 1.8\times10^{11}t\right]$

(2) $B_z = 2.3\times10^{-7}\sin\left[0.6\times10^3 x + 1.8\times10^{11}t\right]$

(3) $B_y = 69\sin\left[0.6\times10^3 x + 1.8\times10^{11}t\right]$

(4) $B_z = 2.3\times10^{-7}\sin\left[0.6\times10^3 x - 1.8\times10^{11}t\right]$

9. A parallel plate capacitor has capacitance *C*, when there is vacuum within the parallel plates. A sheet having thickness $\left(\frac{1}{3}\right)^{rd}$ of the separation between the plates and relative permittivity *K* is introduced between the plates. The new capacitance of the system is :

(1) $\frac{3KC}{2K+1}$ (2) $\frac{3CK^2}{(2K+1)^2}$
(3) $\frac{CK}{2+K}$ (4) $\frac{4KC}{3K-1}$

10. Consider a modified Bernoulli equation.

$$\left(P+\frac{A}{Bt^2}\right)+\rho g(h+Bt)+\frac{1}{2}\rho V^2 = \text{ constant}$$

If t has the dimension of time then the dimensions of A and B are _____ , _____ respectively.

(1) $\left[ML^0\ T^{-1}\right]$ and $\left[M^0LT\right]$

(2) $\left[ML^0\ T^{-2}\right]$ and $\left[M^0LT^{-1}\right]$

(3) $\left[ML^0\ T^{-2}\right]$ and $\left[M^0LT^{-2}\right]$

(4) $\left[ML^0\ T^{-1}\right]$ and $\left[M^0LT^{-1}\right]$

11. An aluminium and a steel rod having same lengths and cross-sections are joined to make total length of 120 cm at 30°C. The coefficient of linear expansion of aluminium and steel are $24\times10^{-6}/^\circ C$ and $1.2\times10^{-5}/^\circ C$, respectively. The length of this composite rod when its temperature is raised to 100°C, is _____ cm.

(1) 120.03 (2) 120.20

(3) 120.15 (4) 120.06

12. Initially a satellite of 100 kg is in a circular orbit of radius $1.5R_E$. This satellite can be moved to a circular orbit of radius $3R_E$ by supplying $\alpha\times10^6$ J of energy. The value of α is _____.

(Take Radius of Earth $R_E = 6\times10^6$ m and g = 10 m/s^2)

(1) 500 (2) 150

(3) 100 (4) 1000

13. A 4 kg mass moves under the influence of a force $\vec{F}=\left(4t^3\hat{i}-3t\,\hat{j}\right)$N where t is the time in second.

If mass starts from origin at t = 0, the velocity and position after t = 2s will be : (in SI units)

(1) $\left(\vec{v}=4\hat{i}-\frac{3}{2}\hat{j}\right),\left(\vec{r}=\frac{6}{5}\hat{i}-\hat{j}\right)$

(2) $\left(\vec{v}=3\hat{i}+\frac{3}{2}\hat{j}\right),\left(\vec{r}=\frac{6}{5}\hat{i}+\hat{j}\right)$

(3) $\left(\vec{v}=4\hat{i}+\frac{5}{2}\hat{j}\right),\left(\vec{r}=\frac{8}{5}\hat{i}+2\hat{j}\right)$

(4) $\left(\vec{v}=4\hat{i}-\frac{3}{2}\hat{j}\right),\left(\vec{r}=\frac{8}{5}\hat{i}-\hat{j}\right)$

14. If an alpha particle with energy 7.7 MeV is bombarded on a thin gold foil, the closest distance from nucleus it can reach is ____ m. (Atomic number of gold = 79 and $\frac{1}{4\pi\epsilon_o}=9\times10^9$ in SI units)

(1) 2.95×10^{-14} (2) 3.85×10^{-16}

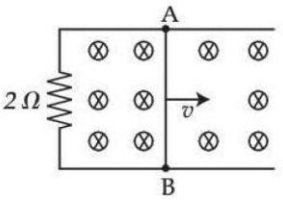
(3) 2.95×10^{-16} (4) 3.85×10^{-14}

15. In a double slit experiment the distance between the slits is 0.1 cm and the screen is placed at 50 cm from the slit's plane. When one slit is covered with a transparent sheet having thickness t and refractive index $n(=1.5)$, the central fringe shifts by 0.2 cm. The value of t is ____ cm.

(1) 6.0×10^{-3} (2) 5.0×10^{-3}

(3) 8×10^{-4} (4) 5.6×10^{-4}

16. A 1 m long metal rod AB completes the circuit as shown in figure. The area of circuit is perpendicular to the magnetic field of 0.10 T. If the resistance of the total circuit is 2Ω then the force needed to move the rod towards right with constant speed (v) of 1.5 m/s is _____ N.



(1) 7.5×10^{-3} (2) 5.7×10^{-2}

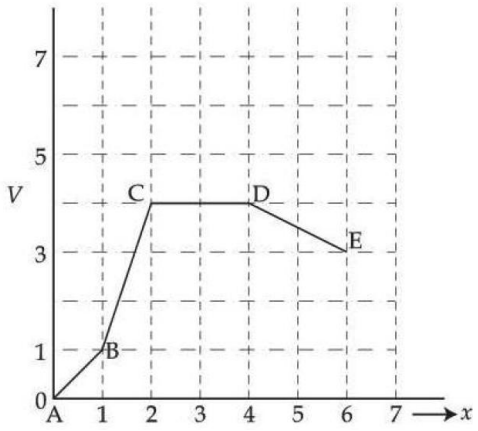
(3) 5.7×10^{-3} (4) 7.5×10^{-2}

17. A conducting circular loop of area 1.0 m^2 is placed perpendicular to a magnetic field which varies as $B=\sin(100t)$ Tesla. If the resistance of the loop is 100Ω, then the average thermal energy dissipated in the loop in one period is _____ J.

(1) 2π (2) π^2

(3) π (4) $\frac{\pi}{2}$

18. Potential energy (V) versus distance (x) is given by the graph. Rank various regions as per the magnitudes of the force (F) acting on a particle from high to low.



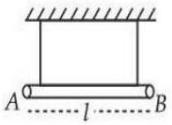
(1) $F_{BC} > F_{CD} > F_{DE} > F_{AB}$

(2) $F_{CD} > F_{AB} > F_{BC} > F_{DE}$

(3) $F_{CD} > F_{DE} > F_{AB} > F_{BC}$

(4) $F_{BC} > F_{AB} > F_{DE} > F_{CD}$

19. A uniform rod of mass m and length l suspended by means of two identical inextensible light strings as shown in figure. Tension in one string immediately after the other string is cut, is. (g acceleration due to gravity)



(1) $mg/3$ (2) mg
(3) $mg/2$ (4) $mg/4$

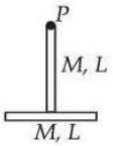
20. A current carrying solenoid is placed vertically and a particle of mass m with charge Q is released from rest. The particle moves along the axis of solenoid. If g is acceleration due to gravity then the acceleration (a) of the charged particle will satisfy :

(1) $a = 0$ (2) $0 < a < g$
(3) $a = g$ (4) $a > g$

Integer Type Questions

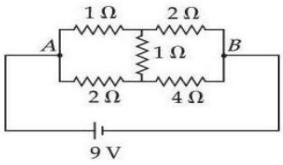
21. In a microscope the objective is having focal length $f_o = 2$ cm and eye-piece is having focal length $f_e = 4$ cm. The tube length is 32 cm. The magnification produced by this microscope for normal adjustment is _____.

22. Two identical thin rods of mass M kg and length L m are connected as shown in figure. Moment of inertia of the combined rod system about an axis passing through point P and perpendicular to the plane of the rods is $\frac{x}{12}ML^2$ kg m^2. The value of x is _____.



23. A collimated beam of light of diameter 2 mm is propagating along x-axis. The beam is required to be expanded in a collimated beam of diameter 14 mm using a system of two convex lenses. If first lens has focal length 40 mm , then the focal length of second lens is _____ mm.

24. The heat generated in 1 minute between points A and B in the given circuit, when a battery of 9 V with internal resistance of 1Ω is connected across these points is _____ J.



25. 10 mole of oxygen is heated at constant volume from 30°C to 40°C. The change in the internal energy of the gas is ____cal. (The molecular specific heat of oxygen at constant pressure, $C_P = 7\text{cal/mol.°C}$ and $R = 2\text{cal./mol.°C}$.)

SECTION-II (CHEMISTRY)

Single Correct Type Questions

26. Given below are two statements :

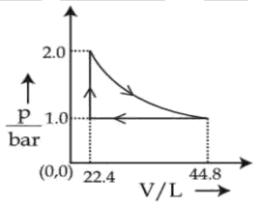
Statement I: When an electric discharge is passed through gaseous hydrogen, the hydrogen molecules dissociate and the energetically excited hydrogen atoms produce electromagnetic radiation of discrete frequencies.

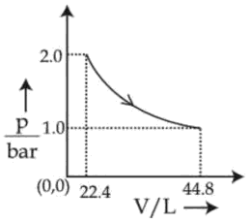
Statement II: The frequency of second line of Balmer series obtained from He^+ is equal to that of first line of Lyman series obtained from hydrogen atom.

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

(1) Statement I is true but Statement II is false
(2) Statement I is false but Statement II is true
(3) Both Statement I and Statement II are true
(4) Both Statement I and Statement II are false

27. Which of the following graphs between pressure 'p' versus volume 'V' represents the maximum work done?

(1)


(2)


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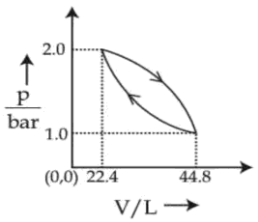
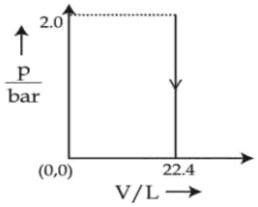


(4)


28. Given below are two statements:

Statement I: Among $\left[Cu(NH_3)_4\right]^{2+}$, $[Ni(en)_3]^{2+}$, $\left[Ni(NH_3)_6\right]^{2+}$ and $\left[Mn(H_2O)_6\right]^{2+}$, $\left[Mn(H_2O)_6\right]^{2+}$ has the maximum number of unpaired electrons.

Statement II: The number of pairs among $\left\{[NiCl_4]^{2-}, [Ni(CO)_4]\right\}$, $\left\{[NiCl_4]^{2-}, [Ni(CN)_4]^{2-}\right\}$ and $\left\{[Ni(CO)_4], [Ni(CN)_4]^{2-}\right\}$ that contain only diamagnetic species is two.

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

(1) Statement I is true but Statement II is false
(2) Both Statement I and Statement II are false
(3) Statement I is false but Statement II is true
(4) Both Statement I and Statement II are true

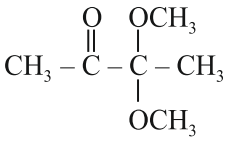
29. 14.0 g of calcium metal is allowed to react with excess HCl at 1.0 atm pressure and 273 K.

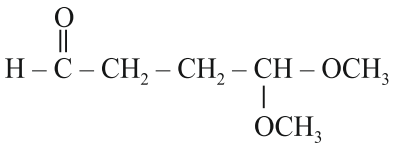
Which of the following statements is incorrect?

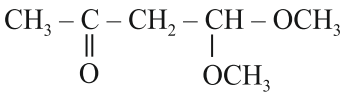
[Given: Molar mass in $gmol^{-1}$ of $Ca-40$, $Cl-35.5$, $H-1$]

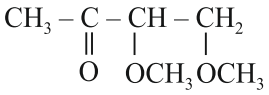
(1) 0.35 mol of H_2 gas is evolved.
(2) The limiting reagent is calcium metal.
(3) 33.3 g of $CaCl_2$ is produced.
(4) 7.84 L of H_2 gas is evolved.

30. An organic compound "P" of molecular formula $C_6H_{12}O_3$ gives positive Iodoform test but negative Tollen's test. When "P" is treated with dilute acid, it produces "Q". "Q" gives positive Tollen's test and also iodoform test. The structure of "P" is :

(1) 

(2) 

(3) 

(4) 

31. A hydrocarbon 'P' (C_4H_8) on reaction with HCl gives an optically active compound 'Q' (C_4H_9Cl) which on reaction with one mole of ammonia gives compound 'R' $(C_4H_{11}N)$. 'R' on diazotization followed by hydrolysis gives 'S'. Identify P, Q, R and S.

(1) $P = CH_3-\underset{}{\overset{}{\triangle}}$,
$Q = Cl-CH_2-\underset{}{\overset{}{\triangle}}$,
$R = H_2N-CH_2-\underset{}{\overset{}{\triangle}}$,
$S =$ 

(2) $P = CH_3-CH=CH-CH_3$,
$Q = CH_3-CH_2-\underset{\underset{Cl}{|}}{CH}-CH_3$,
$R = CH_3-CH_2-\underset{\underset{NH_2}{|}}{CH}-CH_3$,
$S = CH_3-CH_2-\underset{\underset{OH}{|}}{CH}-CH_3$

(3) $P = CH_3-CH_2-CH=CH_2$,
$Q = CH_3-CH_2-\underset{\underset{Cl}{|}}{CH_2}-CH_2$,
$R = CH_3-CH_2-CH_2-\underset{\underset{CH_3}{|}}{NH}$,
$S = CH_3-CH_2-\underset{\underset{CH_3}{|}}{\underset{\underset{OH}{|}}{CH}}$

(4) $P = CH_3-CH=CH-CH_3$,
$Q = CH_3-CH_2-CH_2-CH_2-Cl$,
$R = CH_3-CH_2-CH_2-\underset{\underset{NH_2}{|}}{CH_2}$,
$S = CH_3-CH_2-\underset{\underset{OH}{|}}{\underset{\underset{CH_2}{|}}{CH_2}}$

32. Identify the correct statements.

A. Arginine and Tryptophan are essential amino acids.
B. Histidine does not contain heterocyclic ring in its structure.
C. Proline is a six membered cyclic ring amino acid.
D. Glycine does not have chiral centre.
E. Cysteine has characteristic feature of side chain as $MeS-CH_2-CH_2-$.

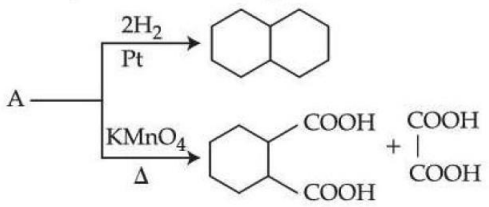
Choose the correct answer from the options given below :

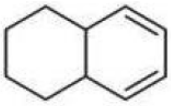
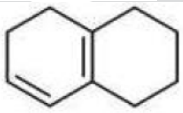
(1) C and D Only (2) C and E Only
(3) A and D Only (4) B and E Only

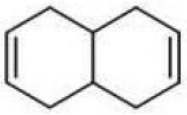
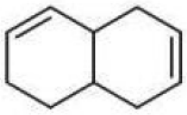
33. Elements P and Q form two types of non-volatile, non-ionizable compounds PQ and PQ_2. When 1 g of PQ is dissolved in 50 g of solvent 'A', ΔT_b was 1.176 K while when 1 g of PQ_2 is dissolved in 50 g of solvent ' A′, ΔT_b was 0.689 K. (K_b of 'A' $= 5\ K\ kg\ mol^{-1}$). The molar masses of elements P and Q (in $gmol^{-1}$) respectively, are :

(1) 60, 25
(2) 25, 60
(3) 65, 145
(4) 70, 110

34. Identify A in the following reaction.



(1)  (2) 

(3)  (4) 

35. Given below are two statements :
Statement I: The number of species among $SF_4, NH_4^+, [NiCl_4]^{2-}, XeF_4, [PtCl_4]^{2-}, SeF_4$ and $[Ni(CN)_4]^{2-}$, that have tetrahedral geometry is 3.
Statement II: In the set $[NO_2, BeH_2, BF_3, AlCl_3]$, all the molecules have incomplete octet around central atom.
In the light of the above statements, choose the correct answer from the options given below:

(1) Both Statement I and Statement II are true
(2) Statement I is true but Statement II is false
(3) Both Statement I and Statement II are false
(4) Statement I is false but Statement II is true

36. Which of the following represents the correct trend for the mentioned property?

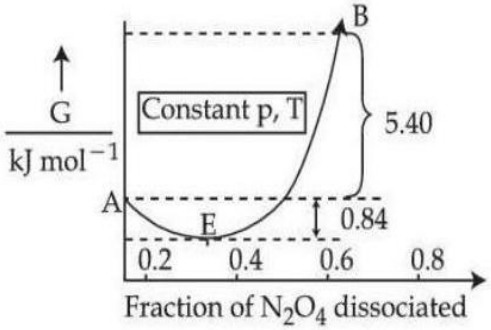
A. $F > P > S > B$ - First Ionization Energy
B. $Cl > F > S > P$ - Electron Affinity
C. $K > Al > Mg > B$ - Metallic character
D. $K_2O > Na_2O > MgO > Al_2O_3$ - Basic character

Choose the correct answer from the options given below :

(1) A, B and D only (2) A and B only
(3) A, B, C and D (4) B and C only

37. For the reaction, $N_2O_4 \rightleftharpoons 2NO_2$, graph is plotted as shown below. Identify correct statements.

A. Standard free energy change for the reaction is $-5.40\ kJ\ mol^{-1}$.
B. As $\Delta G^{\ominus}$ in graph is positive, N_2O_4 will not dissociate into NO_2 at all.
C. Reverse reaction will go to completion.
D. When 1 mole of N_2O_4 changes into equilibrium mixture, value of $\Delta G^{\ominus} = -0.84\ kJ\ mol^{-1}$
E. When 2 mole of NO_2 changes into equilibrium mixture, $\Delta G^{\ominus}$ for equilibrium mixture is $-6.24\ kJ\ mol^{-1}$.



Choose the correct answer from the options given below :

(1) D and E only (2) C and E only
(3) B and C only (4) A and D only

38. Consider the following reactions.

$PbCl_2 + K_2CrO_4 \rightarrow A + 2KCl$
(Hot solution)
$A + NaOH \rightleftharpoons B + Na_2CrO_4$
$PbSO_4 + 4CH_3COONH_4 \rightarrow (NH_4)_2SO_4 + X$

In the above reactions, A, B and X are respectively.

(1) $Na_2[Pb(OH)_2]$, $PbCrO_4$ and $[Pb(NH_3)_4]SO_4$
(2) $Na_2[Pb(OH)_2]$, $PbCrO_4$ and $(NH_4)_2[Pb(CH_3COO)_4]$
(3) $PbCrO_4$, $Na_2[Pb(OH)_4]$ and $(NH_4)_2[Pb(CH_3COO)_4]$
(4) $PbCrO_4$, $Na_2[Pb(OH)_4]$ and $[Pb(NH_3)_4]SO_4$

39. In Carius method, 0.75 g of an organic compound gave 1.2 g of barium sulphate, find percentage of sulphur (molar mass 32 $g\ mol^{-1}$). Molar mass of barium sulphate is 233 $g\ mol^{-1}$.

(1) 21.97% (2) 16.48%
(3) 4.55% (4) 10.30%

40. Given below are two statements :

Statement I: The number of pairs among $[SiO_2, CO_2], [SnO, SnO_2], [PbO, PbO_2]$ and $[GeO, GeO_2]$, which contain oxides that are both amphoteric is 2.

Statement II: BF_3 is an electron deficient molecule, can act as a Lewis acid, forms adduct with NH_3 and has a trigonal planar geometry.

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

(1) Statement I is true but Statement II is false
(2) Both Statement I and Statement II are true
(3) Statement I is false but Statement II is true
(4) Both Statement I and Statement II are false

41. 80 mL of a hydrocarbon on mixing with 264 mL of oxygen in a closed U-tube undergoes complete combustion. The residual gases after cooling to 273 K occupy 224 mL. When the system is treated with KOH solution, the volume decreases to 64 mL. The formula of the hydrocarbon is:

(1) C_2H_4 (2) C_2H_2
(3) C_2H_6 (4) C_4H_{10}

42. An organic compound (P) on treatment with aqueous ammonia under hot condition forms compound (Q) which on heating with Br_2 and KOH forms compound (R) having molecular formula C_6H_7N . Names of P, Q and R respectively are.

(1) Benzoic acid, 4-methylbenzamide, 4-methylaniline
(2) Benzoic acid, benzamide, aniline
(3) Toluic acid, methylbenzamide, 2-methylaniline
(4) Phenylethanoic acid, phenylethanamide, benzamine

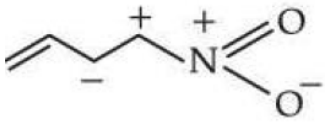
43. Identify correct statements from the following :

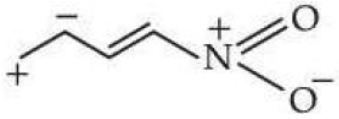
A. Propanal and propanone are functional isomers.
B. Ethoxyethane and methoxypropane are metamers.
C. But-2-ene shows optical isomerism.
D. But-1-ene and but-2-ene are functional isomers.
E. Pentane and 2, 2-dimethyl propane are chain isomers.

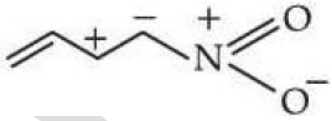
Choose the correct answer from the options given below :

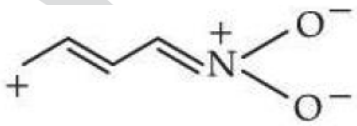
(1) C, D and E only
(2) A, B and E only
(3) A, B and C only
(4) B, C and D only

44. From the following, the least stable structure is :

(1) 

(2) 

(3) 

(4) 

45. MnO_4^{2-}, in acidic medium, disproportionates to:

(1) MnO_4^- and MnO_2
(2) MnO_4^- and MnO
(3) Mn_2O_7 and MnO
(4) Mn_2O_7 and MnO_2

Integer Type Questions

46. Consider the following reactions :

$$NaCl + K_2Cr_2O_7 + H_2SO_4 \rightarrow A + KHSO_4 + NaHSO_4 + H_2O$$

$$A + NaOH \rightarrow B + NaCl + H_2O$$

$$B + H_2SO_4 + H_2O_2 \rightarrow C + Na_2SO_4 + H_2O$$

In the product 'C', 'X' is the number of O_2^{2-} units, 'Y' is the total number oxygen atoms present and 'Z' is the oxidation state of Cr . The value of $X + Y + Z$ is _____.

47. The pH and conductance of a weak acid (HX) was found to be 5 and 4×10^{-5} S , respectively. The conductance was measured under standard condition using a cell where the electrode plates having a surface area of 1 cm^2 were at a distance of 15 cm apart. The value of the limiting molar conductivity is ___ $Sm^2\ mol^{-1}$. (nearest integer)
(Given: degree of dissociation of the weak acid $(\alpha) \ll 1$)

48. Us the following data:

Substance	$\frac{\Delta_f H^{\ominus}(500\ K)}{kJmol^{-1}}$	$\frac{S^{\ominus}(500\ K)}{JK^{-1}\ mol^{-1}}$
$AB(g)$	32	222
$A_2(g)$	6	146
$B_2(g)$	x	280

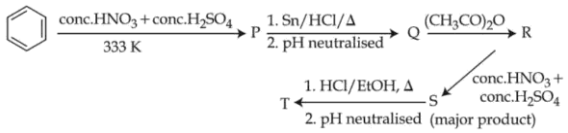
One mole each of $A_2(g)$ and $B_2(g)$ are taken in a 1 L closed flask and allowed to establish the equilibrium at 500 K.

$A_2(g)+B_2(g) \rightleftharpoons 2AB(g)$

The value of $x(\text{in kJ mol}^{-1})$ is _____. (Nearest integer)

(Given: $\log K = 2.2$ $R = 8.3\ J\ K^{-1}\ mol^{-1}$)

49. Consider the following reaction sequence



The percentage of nitrogen in product 'T' formed is ____ %. (Nearest integer)

(Given molar mass in $gmol^{-1}$ H : 1, C : 12, N : 14, O : 16)

50. Pre-exponential factors of two different reactions of same order are identical. Let activation energy of first reaction exceeds the activation energy of second reaction by $20\ kJ\ mol^{-1}$. If k_1 and k_2 are the rate constants of first and second reaction respectively at 300 K, then $\ln\frac{k_2}{k_1}$ will be _____. (nearest integer) $\left[R = 8.3\ J\ K^{-1}\ mol^{-1}\right]$

SECTION-III (MATHEMATICS)

Single Correct Type Questions

51. Let $f:R\to(0,\infty)$ be a twice differentiable function such that $f(3)=18, f'(3)=0$ and $f''(3)=4$. Then $\lim\limits_{x\to 1}\left(\log_e\left(\frac{f(2+x)}{f(3)}\right)^{\frac{18}{(x-1)^2}}\right)$ is equal to:

(1) 2 (2) 1

(3) 9 (4) 18

52. Let PQ and MN be two straight lines touching the circle $x^2+y^2-4x-6y-3=0$ at the points A and B respectively. Let O be the centre of the circle and $\angle AOB=\pi/3$. Then the locus of the point of intersection of the lines PQ and MN is:

(1) $x^2+y^2-18x-12y-25=0$

(2) $3(x^2+y^2)-12x-18y-25=0$

(3) $3(x^2+y^2)-18x-12y+25=0$

(4) $x^2+y^2-12x-18y-25=0$

53. The value of $\int\limits_{-\pi/6}^{\pi/6}\left(\frac{\pi+4x^{11}}{1-\sin(|x|+\pi/6)}\right)dx$ is equal to:

(1) 6π (2) 2π

(3) 4π (4) 8π

54. Let a point A lie between the parallel lines L_1 and L_2 such that its distances from L_1 and L_2 are 6 and 3 units, respectively. Then the area (in sq. units) of the equilateral triangle ABC, where the points B and C lie on the lines L_1 and L_2, respectively, is :

(1) $12\sqrt{2}$ (2) $15\sqrt{6}$

(3) $21\sqrt{3}$ (4) 27

55. Let the mean and variance of 7 observations $2,4,10,x,12,14,y, x>y$ be 8 and 16 respectively. Two numbers are chosen from $\{1,2,3,x-4,y,5\}$ one after another without replacement, then the probability, that the smaller number among the two chosen numbers is less than 4, is :

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

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

56. The value of $\text{cosec}10^\circ-\sqrt{3}\sec 10^\circ$ is equal to :

(1) 6 (2) 8

(3) 2 (4) 4

57. Let $\vec{a}=-\hat{i}+2\hat{j}+2\hat{k}, \vec{b}=8\hat{i}+7\hat{j}-3\hat{k}$ and $\vec{c}$ be a vector such that $\vec{a}\times\vec{c}=\vec{b}$. If $\vec{c}\cdot(\hat{i}+\hat{j}+\hat{k})=4$, then $|\vec{a}+\vec{c}|^2$ is equal to :

(1) 33 (2) 35

(3) 30 (4) 27

58. Let the foci of a hyperbola coincide with the foci of the ellipse $\frac{x^2}{36}+\frac{y^2}{16}=1$. If the eccentricity of the hyperbola is 5, then the length of its latus rectum is :

(1) 16

(2) $24\sqrt{5}$

(3) 12

(4) $\frac{96}{\sqrt{5}}$

59. If $x^2+x+1=0$, then the value of $\left(x+\frac{1}{x}\right)^4$ $+\left(x^2+\frac{1}{x^2}\right)^4+\left(x^3+\frac{1}{x^3}\right)^4+\ldots+\left(x^{25}+\frac{1}{x^{25}}\right)^4$ is :

(1) 145 (2) 162

(3) 128 (4) 175

60. Let (α,β,γ) be the co-ordinates of the foot of the perpendicular drawn from the point $(5,4,2)$ on the line $\vec{r}=\left(-\hat{i}+3\hat{j}+\hat{k}\right)+\lambda\left(2\hat{i}+3\hat{j}-\hat{k}\right)$.

Then the length of the projection of the vector $\alpha\hat{i}+\beta\hat{j}+\gamma\hat{k}$ on the vector $6\hat{i}+2\hat{j}+3\hat{k}$ is :

(1) 4 (2) $\frac{18}{7}$

(3) 3 (4) $\frac{15}{7}$

61. If the domain of the function $f(x)=\cos^{-1}\left(\frac{2x-5}{11-3x}\right)+\sin^{-1}\left(2x^2-3x+1\right)$ is the interval $[\alpha,\beta]$, then $\alpha+2\beta$ is equal to :

(1) 5 (2) 1

(3) 3 (4) 2

62. Let O be the vertex of the parabola $x^2=4y$ and Q be any point on it. Let the locus of the point P, which divides the line segment OQ internally in the ratio $2:3$ be the conic C. Then the equation of the chord of C, which is bisected at the point $(1,2)$, is :

(1) $5x-4y+3=0$

(2) $5x-y-3=0$

(3) $x-2y+3=0$

(4) $4x-5y+6=0$

63. Let $y=y(x)$ be the solution curve of the differential equation $\left(1+x^2\right)dy+\left(y-\tan^{-1}x\right)dx=0, y(0)=1$. Then the value of $y(1)$ is :

(1) $\frac{2}{e^{\pi/4}}+\frac{\pi}{4}-1$ (2) $\frac{4}{e^{\pi/4}}-\frac{\pi}{2}-1$

(3) $\frac{2}{e^{\pi/4}}-\frac{\pi}{4}-1$ (4) $\frac{4}{e^{\pi/4}}+\frac{\pi}{2}-1$

64. The sum of all the roots of the equation $(x-1)^2-5|x-1|+6=0$, is :

(1) 4 (2) 5

(3) 3 (4) 1

65. The number of relations, defined on the set $\{a, b, c, d\}$, which are both reflexive and symmetric, is equal to:

(1) 64 (2) 256

(3) 16 (4) 1024

66. If the coefficient of x in the expansion of $\left(ax^2+bx+c\right)(1-2x)^{26}$ is –56 and the coefficients of x^2 and x^3 are both zero, then $a+b+c$ is equal to :

(1) 1483 (2) 1300

(3) 1500 (4) 1403

67. The area of the region, inside the ellipse $x^2+4y^2=4$ and outside the region bounded by the curves $y=|x|-1$ and $y=1-|x|$, is :

(1) $2\pi-1$ (2) $3(\pi-1)$

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

68. Let $\vec{c}$ and $\vec{d}$ be vectors such that $|\vec{c}+\vec{d}|=\sqrt{29}$ and $\vec{c}\times\left(2\hat{i}+3\hat{j}+4\hat{k}\right)=\left(2\hat{i}+3\hat{j}+4\hat{k}\right)\times\vec{d}$. If $\lambda_1,\lambda_2(\lambda_1>\lambda_2)$ are the possible values of $\left(\vec{c}+\vec{d}\right)\cdot\left(-7\hat{i}+2\hat{j}+3\hat{k}\right)$, then the equation $K^2x^2+\left(K^2-5K+\lambda_1\right)xy+\left(3K+\frac{\lambda_2}{2}\right)y^2-8x+12y+\lambda_2=0$ represents a circle, for K equal to :

(1) –1 (2) 1

(3) 4 (2) 2

69. The number of strictly increasing functions f from the set {1, 2, 3, 4, 5, 6} to the set {1, 2, 3, ….., 9} such that $f(i)\neq i$ for $1\le i\le 6$, is equal to :

(1) 21 (2) 22

(3) 27 (4) 28

70. Let $a_1, a_2, a_3, \ldots$ be a G.P. of increasing positive terms such that $a_2 \cdot a_3 \cdot a_4 = 64$ and $a_1 + a_3 + a_5 = \frac{813}{7}$. Then $a_3 + a_5 + a_7$ is equal to :

(1) 3248 (2) 3244
(3) 3256 (4) 3252

Integer Type Questions

71. Let $a_1 = 1$ and for $n \geq 1, a_{n+1} = \frac{1}{2}a_n + \frac{n^2 - 2n - 1}{n^2(n+1)^2}$.

Then $\left|\sum_{n=1}^{\infty}\left(a_n - \frac{2}{n^2}\right)\right|$ is equal to_____.

72. For some $\alpha, \beta \in R$, let $A = \begin{bmatrix} \alpha & 2 \\ 1 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 1 \\ 1 & \beta \end{bmatrix}$ be such that $A^2 - 4A + 2I = B^2 - 3B + I = O$. Then $\left(\det\left(\text{adj}\left(A^3 - B^3\right)\right)\right)^2$ is equal to _____.

73. $6\int_0^{\pi}\left|(\sin 3x + \sin 2x + \sin x)\right| dx$ is equal to _____.

74. Let $S = \{(m,n) : m, n \in \{1,2,3,\ldots..,50\}\}$. If the number of elements (m,n) in S such that $6^m + 9^n$ is a multiple of 5 is p and the number of elements (m,n) in S such that $m+n$ is a square of a prime number is q , then p + q is equal to _____.

75. Let $f : R \to R$ be a twice differentiable function such that the quadratic equation $f(x)m^2 - 2f'(x)m + f''(x) = 0$ in m , has two equal roots for every $x \in R$. If $f(0) = 1, f'(0) = 2$, and (α, β) is the largest interval in which the function $f(\log_e x - x)$ is increasing, then $\alpha + \beta$ is equal to _____.