PHYSICS **MAX.MARKS: 100**

SECTION – I
(SINGLE CORRECT ANSWER TYPE)

This section contains 20 multiple choice questions. Each question has 4 options (1), (2), (3) and (4) for its answer, out of which **ONLY ONE** option can be correct.

Marking scheme: +4 for correct answer, 0 if not attempted and -1 if not correct.

1. The rms value of the emf given by E(in volt) = $8\sin(\omega t)+6\cos(\omega t)$ is

   1) $5\sqrt{2}\ V$ 2) $7\sqrt{2}\ V$ 3) $10\ V$ 4) $10\sqrt{2}\ V$

2. A ball is spun with angular acceleration $\alpha = 6t^2 - 2t$ where t is in second and α is in $rads^{-2}$. At $t = 0$, he ball has angular velocity of $10\ rads^{-1}$ and angular position of 4 rad. The most appropriate expression for the angular position of the ball is

   A) $\frac{3}{2}t^4 - t^2 + 10t$ B) $\frac{t^4}{2} - \frac{t^3}{3} + 10t + 4$ C) $\frac{2t^4}{3} - \frac{t^3}{6} + 10t + 12$ D) $2t^4 - \frac{t^3}{2} + 5t + 4$

3. A block of mass 2 kg moving on a horizontal surface with speed of $4\ ms^{-1}$ enters a rough surface ranging from $x = 0.5\ m$ to $x = 1.5\ m$. The retarding force in this range of rough surface is related to distance by $F = -kx$ where $k = 12\ Nm^{-1}$. The speed of the block as it just crosses the rough surface will be

   A) zero B) $1.5\ ms^{-1}$ C) $2.0\ ms^{-1}$ D) $2.5\ ms^{-1}$

4. A current is made of two components given by $i_1 = 4\sqrt{2}\sin\omega t(A)$ and i_2 = 3A. A hot wire ammeter measures the current as –

   A) 3A B) $4\sqrt{2}$ C)7A D) 5A

5. Water falls from a 40 m high dam at the rate of $9\times10^4\ kg$ per hour. Fifty percentage of gravitational potential energy can be converted into electrical energy. Using this hydro electric energy number of 100 W lamps that can be lit is
   (Take $g = 10\ ms^{-2}$)

   A) 25 B) 50 C) 100 D) 18

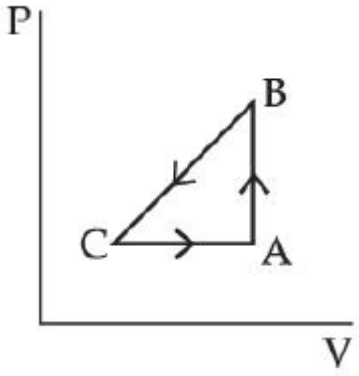
6. Two objects of equal masses placed at certain distance from each other attracts each other with a force of F. If one-third mass of one object is transferred to the other object, then the new force will be

   A) $\frac{2}{9}F$ B) $\frac{16}{9}F$ C) $\frac{8}{9}F$ D) F

7. A charged particle is released form rest in a region of steady and uniform electric and magnetic field which are parallel to each other. The particle will move in –

A) straight line B) circle C) helix D) cycloid

8. A sample of an ideal gas is taken through the cyclic process ABCA as shown in figure. It absorbs, 40 J of heat during the part AB, no heat during BC and rejects 60 J of heat during CA. A work of 50 J is done on the gas during the part BC. The internal energy of the gas at A is 1560 J. The work done by the gas during the part CA is



A) 20 J B) 30 J C) -30 J D) -60 J

9. What will be the effect on the root mean square velocity of oxygen molecules if the temperature is doubled and oxygen molecule dissociates into atomic oxygen?

A) The velocity of atomic oxygen remains same

B) The velocity of atomic oxygen doubles

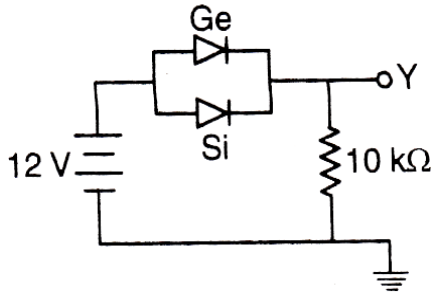
C) The velocity of atomic oxygen becomes half

D) The velocity of atomic oxygen becomes four times

10. If the series limit wavelength of Lyman series for hydrogen atom is 912 Å, then the series limit wavelength for Balmer series of hydrogen atom is –

A) 912 Å B) 1824 Å C) 3648 Å D) 456 Å

11. Two junction diodes one of Germanium (Ge) and other of silicon (Si) are connected as shown in figure to a battery of emf 12 V and a load resistance $10\ k\Omega$. The germanium diode conducts at 0.3 V and silicon diode at 0.7 V. When a current flows in the circuit, the potential of terminal Y will be



A)12 V B)11 V C)11.3 V D)11.7 V

12. The space inside a straight current carrying solenoid is filled with a magnetic material having magnetic susceptibility equal to 1.2×10^{-5}. What is fractional increase in the magnetic field inside solenoid with respect to air as medium inside the solenoid ?

A) 1.2×10^{-5} B) 1.2×10^{-3} C) 1.8×10^{-3} D) 2.4×10^{-5}

13. Two parallel, long wires are kept 0.20 m apart in vacuum, each carrying current of x A in the same direction. If the force of attraction per meter of each wire is $2\times10^{-6}N$, then the value of x is approximately.

A) 1 B) 2.4 C) 1.4 D) 2

14. Two sounding bodies producing progressive waves given by $y_1=4\sin(400\pi t)$ and $y_2=3\sin(404\pi t)$, where t is in seconds, are situated near the ears of a person. The person will hear

1) 2 beats per second with intensity ratio $\frac{4}{3}$ between maxima and minima.

2) 2 beats per second with intensity ratio 49 between maxima and minima.

3) 4 beats per second with intensity ratio 7 between maxima and minima.

4) 4 beats per second with intensity ratio $\frac{4}{3}$ between maxima and minima.

15. An EM wave propagating in x-direction has a wavelength of 8 mm. The electric field vibrating y-direction has maximum magnitude of $60\,Vm^{-1}$. Choose the correct equations for electric and magnetic fields if the EM wave is propagating in vacuum.

A) $E_y=60\sin\left[\frac{\pi}{4}\times10^3\left(x-3\times10^8t\right)\right]\hat{j}\,Vm^{-1}$, $B_z=2\sin\left[\frac{\pi}{4}\times10^3\left(x-3\times10^8t\right)\right]\hat{k}\,T$

B) $E_y=60\sin\left[\frac{\pi}{4}\times10^3\left(x-3\times10^8t\right)\right]\hat{j}\,Vm^{-1}$, $B_z=2\times10^{-7}\sin\left[\frac{\pi}{4}\times10^3\left(x-3\times10^8t\right)\right]\hat{k}\,T$

C) $E_y = 2\times10^{-7}\sin\left[\frac{\pi}{4}\times10^3\left(x-3\times10^8 t\right)\right]\hat{j}\,Vm^{-1}, B_z = 60\sin\left[\frac{\pi}{4}\times10^3\left(x-3\times10^8 t\right)\right]\hat{k}\,T$

D) $E_y = 2\times10^{-7}\sin\left[\frac{\pi}{4}\times10^4\left(x-4\times10^8 t\right)\right]\hat{j}\,Vm^{-1}, B_z = 60\sin\left[\frac{\pi}{4}\times10^4\left(x-4\times10^8 t\right)\right]\hat{k}\,T$

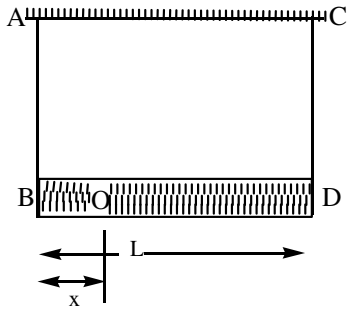
16. In young's double slit experiment performed using a monochromatic light of wavelength λ, when a glass plate $(\mu = 1.5)$ of thickness $x\lambda$ is introduced in the path of the one of the interfering beams, the intensity at the position where the central maximum occurred previously remains unchanged. The value of x will be

A) 3 B) 2 C) 1.5 D) 0.5

17. Let K_1 and K_2 be the maximum kinetic energies of photo-electrons emitted when two monochromatic beams of wavelength λ_1 and λ_2, respectively are incident on a metallic surface. If $\lambda_1 = 3\lambda_2$ then

A) $K_1 > \frac{K_2}{3}$ B) $K_1 < \frac{K_2}{3}$ C) $K_1 = \frac{K_2}{3}$ D) $K_2 = \frac{K_1}{3}$

18. A massless rod is suspended by two identical strings AB and CD of equal length. A block of mass m is suspended from point O such that BO is equal to 'x'. Further, it is observed that the frequency of 1st harmonic (fundamental frequency) in AB is equal to 2nd harmonic frequency in CD. Then, length of BO is



A) L/5 B) 4L/5 C) 3L/4 D) L/4

19. A solid sphere of mass M, radius R and having moment of inertia about an axis passing through the centre of mass I, is recast into a disc of thickness t, whose moment of inertia about an axis passing through its edge and perpendicular to its plane remains I. Then, radius of the disc will be

A) $\frac{2R}{\sqrt{15}}$ B) $R\sqrt{\frac{2}{15}}$ C) $\frac{4R}{\sqrt{15}}$ D) $\frac{R}{4}$

20. A system of binary stars of masses m_A and m_B are moving in circular orbits of radii r_A and r_B respectively. If T_A and T_B are the time periods of revolution of masses m_A and m_B respectively, then

A) $\frac{T_A}{T_B}=\left(\frac{r_A}{r_B}\right)^{3/2}$ B) $T_A > T_B \left(if\ r_A > r_B\right)$

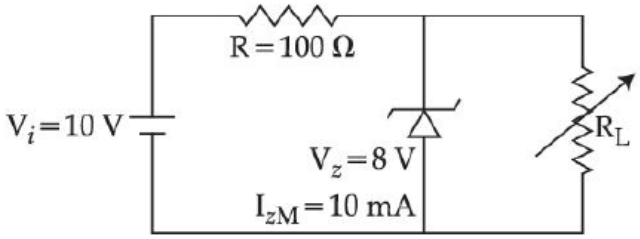
C) $T_A > T_B \left(if\ m_A > m_B\right)$ D) $T_A = T_B$

SECTION-II
(NUMERICAL VALUE ANSWER TYPE)

This section contains 10 questions. The answer to each question is a Numerical value. If the Answer in the decimals, **Mark nearest Integer only. Have to Answer any 5 only out of 10 questions** and question will be evaluated according to the following marking scheme:
Marking scheme: +4 for correct answer, -1 in all other cases.

21. A student in the laboratory measures thickness of a wire using screw gauge. The readings are 1.22 mm, 1.23 mm, 1.19 mm and 1.20 mm. The percentage error is $\frac{x}{121}\%$. The value of x is _____

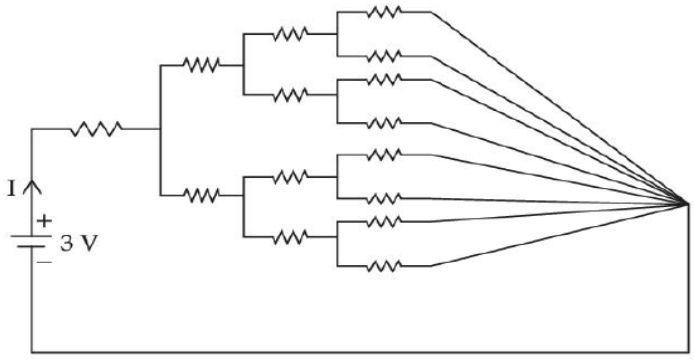
22. A zener of breakdown voltage $V_Z = 8V$ and maximum zener current, $I_{ZM} = 10\,mA$ is subjected to an input voltage $V_i = 10V$ with series resistance $R = 100\,\Omega$. In the given circuit R_L represents the variable load resistance. The ratio of maximum and minimum value of R_L is _____



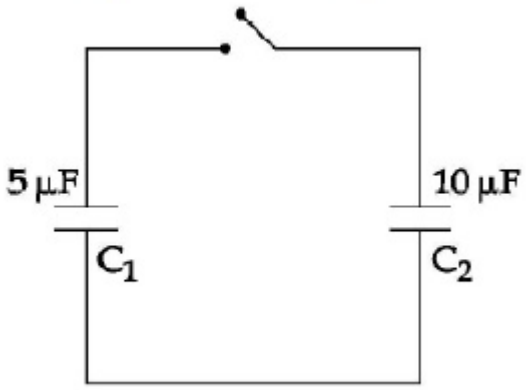
23. In a Young's double slit experiment, an angular width of the fringe is 0.35^0 on a screen placed at 2m away for particular wavelength of 450 nm. The angular width of the fringe, when whole system is immersed in a medium of refractive index 7/5, is $\frac{1}{\alpha}$. The value of α is _____

24. A 60W monochromatic point source radiating equally in all directions in vacuum. The amplitude of electric field in S.I units at a distance of 2m from the source is…

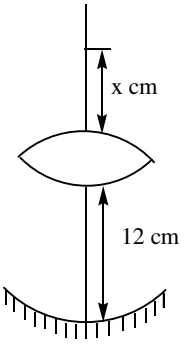
25. All resistances in figure are 1Ω each. The value of current 'I' is $\frac{a}{5}A$. The value of a is



26. A capacitor C_1 of capacitance $5\,\mu F$ is charged to a potential of 30 V using a battery. The battery is then removed and the charged capacitor is connected to an uncharged capacitor C_2 of capacitance $10\,\mu F$ as shown in figure. When the switch is closed charge flows between the capacitors. At equilibrium, the charge on the capacitor C_2 is _____ μC.

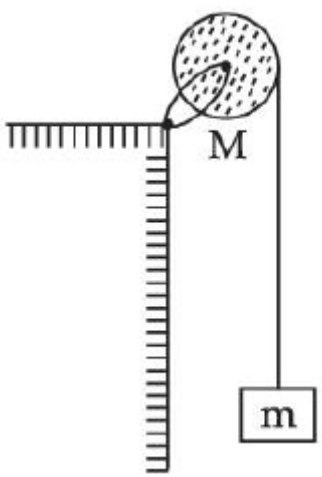


27. A convex lens of focal length 40 cm is held coaxially 12 cm above a concave mirror of focal length 18 cm. An object held *x* cm above the lens gives rise to an image coincident with it. The *x* is equal to

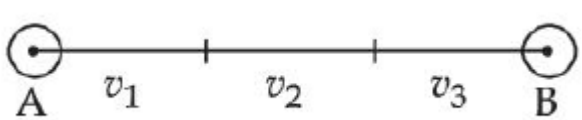


28. A liquid of density 750 kgm^{-3} flows smoothly through a horizontal pipe that tapers in cross-sectional area from $A_1 = 1.2 \times 10^{-2} m^2$ to $A_2 = \frac{A_1}{2}$. The pressure difference between the wide and narrow sections of the pipe is 4500 Pa. The rate of flow of liquid is _____ $\times 10^{-3}\ m^3 s^{-1}$.

29. A uniform disc with mass M = 4 kg and radius R = 10 cm is mounted on a fixed horizontal axle as shown in figure. A block with mass m = 2kg hangs from a massless cord that is wrapped around the rim of the disc. During the fall of the block, the cord does not slip and there is no friction at the axle. The tension in the cord is _____ N.



30. A car covers AB distance with first one-third at velocity $v_1\ ms^{-1}$, second one-third at $v_2 ms^{-1}$ and last one-third at $v_3\ ms^{-1}$. If If $v_3 = 3v_1, v_2 = 2v_1$ and $v_1 = 11\,ms^{-1}$ then the average velocity of the car is _____ ms^{-1}.



CHEMISTRY **MAX.MARKS: 100**

SECTION – I
(SINGLE CORRECT ANSWER TYPE)

This section contains 20 multiple choice questions. Each question has 4 options (1), (2), (3) and (4) for its answer, out of which **ONLY ONE** option can be correct.

Marking scheme: +4 for correct answer, 0 if not attempted and -1 if not correct.

31. Compound A contains 8.7% Hydrogen, 74% Carbon and 17.3% Nitrogen. The molecular formula of the compound is,

Given : Atomic masses of C, H and N are 12, 1 and 14 amu respectively.

The molar mass of the compound A is 162 g mol^{-1}.

A) $C_4H_6N_2$ B) C_2H_3N C) C_5H_7N D) $C_{10}H_{14}N_2$

32. Consider the following statements:

(A) The principal quantum number 'n' is a positive integer with values of 'n' = 1, 2, 3, ……

(B) The azimuthal quantum number $'l'$ for a given 'n' (principal quantum number) can have values as $'l'$ = 0, 1, 2, ….. n

(C) Magnetic orbital quantum number $'m_l'$ for a particular $'l'$ (azimuthal quantum number) has $(2l+1)$ values

(D) For $\pm 1/2$ are the two possible electron spin states

(E) For $l = 5,$ there will be a total of 9 orbitals

Which of the above statements are correct ?

A) (A), (B) and (C) B) (A), (C), (D) and (E)

C) (A), (C) and (D) D) (A), (B), (C) and (D)

33. In the structure of $SF_4,$ the lone pair of electrons on S is in.

A) equatorial position and there are two lone pair – bond pair repulsions at 90^0

B) equatorial position and there are three lone pair – bond pair repulsion at 90^0

C) axial position and there are three lone pair – bond pair repulsion at 90^0

D) axial position and there are two lone pair – bond pair repulsion at 90^0

34. The pH of a buffer solution changes from 6.20 to 6.17 when 0.003 mole of acid is added to 500 mL of the buffer. The buffer capacity of the system is, therefore,

A) 0.1 B) 0.3 C) 0.2 D) 0.4

35. Mole fraction of a non electrolyte in aqueous solution is 0.07. If K_f is 1.86° mol^{-1} kg, depression in f.p, ΔT_f is,

A) 0.26° B) 1.86° C) 0.13° D) 7.78°

36. Match List-I with List-II.

	List-I (Oxide)		List-II (Nature)
(A)	Cl_2O_7	(I)	Amphoteric
(B)	Na_2O	(II)	Basic
(C)	Al_2O_3	(III)	Neutral
(D)	N_2O	(IV)	Acidic

Choose the correct answer from the options given below:

A) (A) – (IV), (B) – (III), (C) – (I), (D) – (II)

B) (A) – (IV), (B) – (II), (C) – (I), (D) – (III)

C) (A) – (II), (B) – (IV), (C) – (III), (D) – (I)

D) (A) – (I), (B) – (II), (C) – (III), (D) – (IV)

37. Among the following species identify the isostructural pairs: NF_3, NO_3^-, BF_3, H_3O^+, HN_3

A) $[NF_3, NO_3^-]$ and $[BF_3, H_3O^+]$ B) $[NF_3, HN_3]$ and $[NO_3^-, BF_3]$

C) $[NF_3, H_3O^+]$ and $[NO_3^-, BF_3]$ D) $[NF_3, H_3O^+]$ and $[HN_3, BF_3]$

32. Zieglar-Natta catalyst is-

A) R_3Al B) $TiCl_4$ C) $R_3Al + TiCl_4$ D) $R_3B + TiCl_2$

39. Among the following, basic oxide is

A) SO_3 B) SiO_2 C) CaO D) Al_2O_3

40. Maltose is made up of

A) α –D-glucose B) D-fructose

C) α–D-Glucose and β–D-glucose D) Glucose and fructose

41. Which of the following oxoacids of sulphur contains "S" in two different oxidation states ?

A) $H_2S_2O_3$ B) $H_2S_2O_6$ C) $H_2S_2O_7$ D) $H_2S_2O_8$

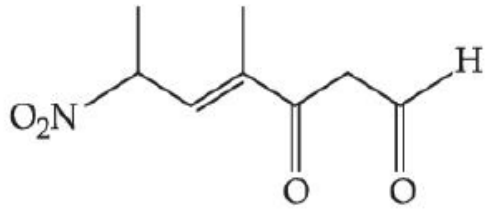
42. Given the following reaction at equilibrium $N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)}$. Some inert gas is added at constant Volume predict which of the following facts will be affected?

A) More of $NH_{3(g)}$ is produced B) less of $NH_{3(g)}$ is produced

C) No affect on the degree of advancement of the reaction at equilibrium

D) K_P of the reaction is increased

43. The correct IUPAC name of the following compound is

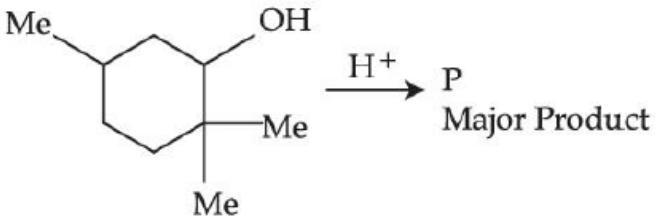


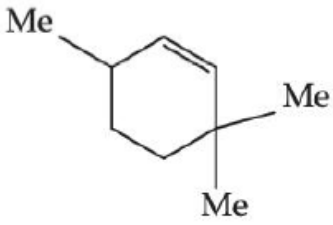
A) 4-methyl-2-nitro-5-oxohept-3-enal B) 4-methyl-5-oxo-2-nitrohept-3-enal

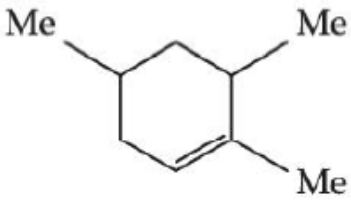
C) 4-methyl-6-nitro-3-oxohept-4-enal D) 6-formyl-4-methyl-2-nitrohex-3-enal

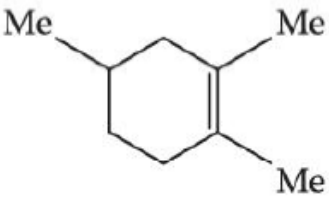
44. The major product (P) of the given reaction is

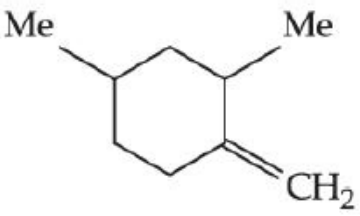
(where, Me is $-CH_3$)



A) 

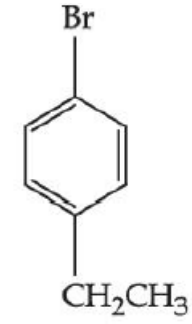
B) 

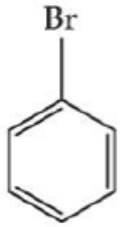
C) 

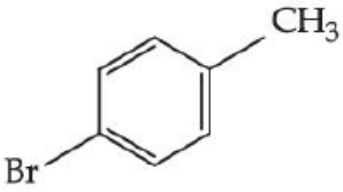
D) 

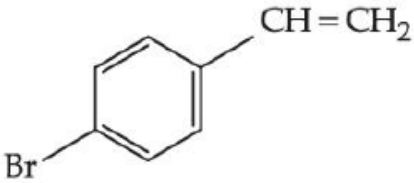
45. $A \xrightarrow[(ii)\ CN^-]{(i)\ Cl_2, \Delta} \xrightarrow[(iii)\ H_2O/H^+]{}$ 4-Bromophenyl acetic acid

In the above reaction 'A' is

A) 

B) 

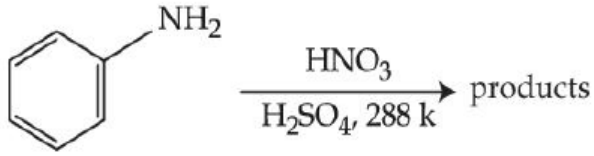
C) 

D) 

46. The hybridisation of orbitals of N-atom in NO_3^-, NO_2^+ *and* NH_4^+ are respectively:-

A) sp, sp^3, sp^2 B) sp^2, sp^3, sp C) sp, sp^2, sp^3 D) sp^2, sp, sp^3

47. With respect to the following reaction, consider the given statements:



(A) o-Nitroaniline and p-nitroaniline are the predominant products

(B) p-Nitroaniline and m-nitroaniline are the predominant products

(C) HNO_3 acts as an acid

(D) H_2SO_4 acts as an acid

A) (A) and (C) are correct statements B) (A) and (D) are correct statements

C) (B) and (D) are correct statements D) (B) and (C) are correct statements

48. $B \xleftarrow[Lindlar]{H_2} R-C\equiv C-R \xrightarrow{Na,\ liq.\ NH_3} A$

A and B are geometrical isomers :-

A) A is trans, B is cis B) A and B both are cis

C) A and B both are trans D) A is cis, B is trans

49. When sugar 'X' is boiled with dilute H_2SO_4 in alcoholic solution, two isomers 'A' and 'B' are formed. 'A' on oxidation with HNO_3 yields saccharic acid where as 'B' is laevorotatory. The compound 'X' is

A) Maltose B) Sucrose C) Lactose D) Starch

50. The correct name for the complex $[Cr(NH_3)_6]\ [Co(C_2O_4)_3]$ is

A) Hexaamminechromium (III) trioxalatocobalt (III)

B) Hexaamminechromate (III) trioxalatocobaltate (III)

C) Hexaamminechromium (III) trioxalatocobaltate (III)

D) Hexaamminechromate (III) trioxalatocobalt (III)

SECTION-II
(NUMERICAL VALUE ANSWER TYPE)

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51. 100 g of an ideal gas is kept in a cylinder of 416 L volume at 27^0C under 1.5 bar pressure. The molar mass of the gas is _____ g mol^{-1}. (Nearest integer)
(Given : $R = 0.083\ L\ bar\ \ K^{-1}\ mol^{-1}$)

52. For combustion of one mole of magnesium in an open container at 300 K and 1 bar pressure, $\Delta_C H^\odot = -601.70\ kJ\ mol^{-1}$, the magnitude of change in internal energy for the reaction is _____ kJ. (Nearest integer)
(Given : $R = 8.3\ J\ K^{-1}\ mol^{-1}$)

53. The number of radial nodes present in 3p orbital is

54. No. of moles of neutrons present in 36g of H_2O

55. How many liters of water must be added to 1 liter of an aqueous solution of HCl with a P^H of 1 to create an aqueous solution with P^H of 2

56. $\left[Fe(CN)_6\right]^{4-}, \left[Fe(CN)_6\right]^{3-}, \left[Ti(CN)_6\right]^{3-}, \left[Ni(CN)_4\right]^{2-}, \left[Co(CN)_6\right]^{3-}$
Among the given complexes, number of paramagnetic complexes is _____

57. (a) $CoCl_3.4NH_3$ (b) $CoCl_3.5NH_3$ (c) $CoCl_3.6NH_3$ and (d) $CoCl(NO_3)_2.5NH_3$
Number of complex(es) which will exist in cis-trans form is/are _____

58. The complete combustion of 0.492 g of an organic compound containing 'C', 'H' and 'O' gives 0.793 of CO_2 and 0.442 g of H_2O. The percentage of oxygen composition in the organic compound is _____ (nearest integer)

59. When phenol reacts with bromine water, the major product contains number of bromine atom(s).

60. Calculate $\left|\Delta G^0\right|$ (KJ/mol) at 127^0C for a reaction with $K_{eq}=10^5$ (Nearest integer)

MATHEMATICS **MAX.MARKS: 100**

SECTION – I
(SINGLE CORRECT ANSWER TYPE)

This section contains 20 multiple choice questions. Each question has 4 options (1), (2), (3) and (4) for its answer, out of which **ONLY ONE** option can be correct.
Marking scheme: +4 for correct answer, 0 if not attempted and -1 if not correct.

61. Let $R_1=\{(a,b)\in N\times N:|a-b|\le 13\}$ and $R_2=\{(a,b)\in N\times N:|a-b|\ne 13\}$. Then on N :

A) Both R_1 and R_2 are equivalence relations

B) Neither R_1 nor R_2 is an equivalence relation

C) R_1 is an equivalence relation but R_2 is not

D) R_2 is an equivalence relation but R_1 is not

62. Let $f(x)$ be a quadratic polynomial such that $f(-2)+f(3)=0$. If one of the roots of $f(x)=0$ is -1, then the sum of the roots of $f(x)=0$ is equal to :

A) $\frac{11}{3}$ B) $\frac{7}{3}$ C) $\frac{13}{3}$ D) $\frac{14}{3}$

63. The number of ways to distribute 30 identical candies among four children C_1, C_2, C_3 and C_4 so that C_2 receives atleast 4 and atmost 7 candies, C_3 receives atleast 2 and atmost 6 candies, is equal to

A) 205 B) 615 C) 510 D) 430

64. The term independent of x in the expansion of $\left(1-x^2+3x^3\right)\left(\frac{5}{2}x^3-\frac{1}{5x^2}\right)^{11}$, $x\ne 0$ is

A) $\frac{7}{40}$ B) $\frac{33}{200}$ C) $\frac{39}{200}$ D) $\frac{11}{50}$

65. If n arithmetic means are inserted between a and 100 such that the ratio of the first mean to the last mean is 1 : 7 and $a+n=33,$ then the value of n is

A) 21 B) 22 C) 23 D) 24

66. A die is rolled 5 times. The probability there are at least two equal numbers among the outcomes obtained is

A) 319/324 B) 49/54 C) 13/18 D) 4/9

67. Let $f:R\to R$ be a differentiable function such that $f\left(\frac{\pi}{4}\right)=\sqrt{2}, f\left(\frac{\pi}{2}\right)=0$ and $f'\left(\frac{\pi}{2}\right)=1$ and let $g(x)=\int_x^{\pi/4}\left(f'(t)\sec t+\tan t\sec t\ f(t)\right)dt$ for $x\in\left[\frac{\pi}{4},\frac{\pi}{2}\right).$ Then $\lim\limits_{x\to\left(\frac{\pi}{2}\right)^-} g(x)$ is equal to

A) 2 B) 3 C) 4 D) –3

68. Let $f:R\to R$ be a continuous function satisfying $f(x)+f(x+k)=n,$ for all $x\in R$ where $k>0$ and n is a positive integer. If $I_1=\int_0^{4nk} f(x)dx$ and $I_2=\int_{-k}^{3k} f(x)\,dx$, then

A) $I_1+2I_2=4nk$ B) $I_1+2I_2=2nk$ C) $I_1+nI_2=4n^2k$ D) $I_1+nI_2=6n^2k$

69. The area of the bounded region enclosed by the curve $y=3-\left|x-\frac{1}{2}\right|-|x+1|$ and the x-axis is

A) $\frac{9}{4}$ B) $\frac{45}{16}$ C) $\frac{27}{8}$ D) $\frac{63}{16}$

70. Let $x=x(y)$ be the solution of the differential equation $2y\,e^{x/y^2}\,dx+\left(y^2-4e^{x/y^2}\right)dy=0$ such that $x(1)=0$. Then, $x(e)$ is equal to

A) $e\log_e(2)$ B) $-e\log_e(2)$ C) $e^2\log_e(2)$ D) $-e^2\log_e(2)$

71. Let the slope of the tangent to a curve $y=f(x)$ at (x,y) be given by $2\tan x(\cos x-y)$. If the curve passes through the point $\left(\frac{\pi}{4},0\right)$, then the value of $\int_0^{\pi/2} y\,dx$ is equal to

A) $\left(2-\sqrt{2}\right)+\frac{\pi}{\sqrt{2}}$ B) $2-\frac{\pi}{\sqrt{2}}$ C) $\left(2+\sqrt{2}\right)+\frac{\pi}{\sqrt{2}}$ D) $2+\frac{\pi}{\sqrt{2}}$

72. Let a triangle be bounded by the lines $L_1 : 2x+5y=10; L_2 : -4x+3y=12$ and the line L_3, which passes through the point P(2, 3), intersects L_2 at A and L_1 at B. If the point P divides the line-segment AB, internally in the rtio 1 : 3, then the area of the triangle is equal to

A) $\frac{110}{13}$ B) $\frac{132}{13}$ C) $\frac{142}{13}$ D) $\frac{151}{13}$

73. Let $a>0, b>0$. Let e and ℓ respectively be the eccentricity and length of the latus rectum of the hyperbola $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$. Let e' and ℓ' respectively be the eccentricity and length of the latus rectum of its conjugate hyperbola. If $e^2=\frac{11}{14}\ell$ and $(e')^2=\frac{11}{8}\ell'$, then the value of $77a+44b$ is equal to

A) 100 B) 110 C) 120 D) 130

74. Let $\vec{a}=\alpha\hat{i}+2\hat{j}-\hat{k}$ and $\vec{b}=-2\hat{i}+\alpha\hat{j}+\hat{k}$, where $\alpha\in R$. If the area of the parallelogram whose adjacent sides are represented by the vectors $\vec{a}$ and $\vec{b}$ is $\sqrt{15(\alpha^2+4)}$, then the value of $2|\vec{a}|^2+(\vec{a}.\vec{b})|\vec{b}|^2$ is equal to

A) 10 B) 7 C) 9 D) 14

75. If vertex of a parabola is $(2,-1)$ and the equation of its directrix is $4x-3y=21$, then the length of its latus rectum is

A) 2 B) 8 C) 12 D) 16

76. If $\cos 1+\cos 2+\cos 3+.....+\cos n=S_n$. That $\lim\limits_{n\to\infty}\frac{S_n}{n}=$

A) 1 B) 2

C) does not exists D) 0

77. The probability that a randomly chosen one-one function from the set $\{a,b,c,d\}$ to the set $\{1,2,3,4,5\}$ satisfies $f(a)+2f(b)-f(c)=f(d)$ is

A) $\frac{1}{24}$ B) $\frac{1}{40}$ C) $\frac{1}{30}$ D) $\frac{1}{20}$

78. The value of $\lim\limits_{n\to\infty}6\tan\left\{\sum_{r=1}^{n}\tan^{-1}\left(\frac{1}{r^2+3r+3}\right)\right\}$ is equal to

A) 1 B) 2 C) 3 D) 6

79. If $\vec{x}=3\hat{i}-6\hat{j}-\hat{k},\ \vec{y}=\hat{i}+4\hat{j}-3\hat{k},$ and $\vec{z}=3\hat{i}-4\hat{j}-12\hat{k},$ then the magnitude of the scalar projection of $\vec{x}\times\vec{y}$ *on* $\vec{z}$ is:

A) 12 B) 15 C) 14 D) 13

80. If $\cot\alpha=1$ and $\sec\beta=-\frac{5}{3},$ where $\pi<\alpha<\frac{3\pi}{2}$ and $\frac{\pi}{2}<\beta<\pi$, then the value of $\tan(\alpha+\beta)$ and the quadrant in which $\alpha+\beta$ lies, respectively are

A) $-\frac{1}{7}$ and IVth quadrant B) 7 and Ist quadrant

C) -7 and IVth quadrant D) $\frac{1}{7}$ and Ist quadrant

SECTION-II
(NUMERICAL VALUE ANSWER TYPE)

This section contains 10 questions. The answer to each question is a Numerical value. If the Answer in the decimals, **Mark nearest Integer only. Have to Answer any 5 only out of 10 questions** and question will be evaluated according to the following marking scheme:
Marking scheme: +4 for correct answer, -1 in all other cases.

81. Let the image of the point $P(1,2,3)$ in the line $L:\frac{x-6}{3}=\frac{y-1}{2}=\frac{z-2}{3}$ be Q. Let $R(\alpha,\beta,\gamma)$ be a point that divides internally the line segment PQ in the ratio 1 : 3. Then the value of $22(\alpha+\beta+\gamma)$ is equal to _____

82. Suppose a class has 7 students. The average marks of these students in the mathematics examination is 62, and their variance is 20. A student fails in the examination if he/she gets less than 50 marks, then in worst case, the number of students can fail is _____.

83. The number of real solutions of the equation $\log_7(x+2)=6-x$ is

84. Standard deviation of two distributions are same and their arithmetic means are 30 and 25 respectively. If their coefficient of variation is v_1 and v_2, then $6v_1-5v_2$ is equal to

85. If $ax^2+bx+6=0$ does not have two distinct real roots, where $a\in R$, $b\in R$, then the least value of $3a+b$ is m, then $|m|$ is

86. If the system of linear equations $2x-3y=\gamma+5,\ \alpha x+5y=\beta+1,$ where $\alpha,\beta,\gamma\in R$ has infinitely many solutions, then the value of $|9\alpha+3\beta+5\gamma|$ is equal to _____.

87. Let $A=\begin{pmatrix}1+i & 1\\ -i & 0\end{pmatrix}$ where $i=\sqrt{-1}$. Then, the number of elements in the set $\{n\in\{1,2,.....,100\}: A^n=A\}$ is _____.

88. Sum of squares of modulus of all the complex numbers z satisfying $\overline{z}=iz^2+z^2-z$ is equal to ___

89. Let $S=\{1,2,3,4\}$. Then the number of elements in the set $\{f: S\times S\to S: f$ is onto and $f(a,b)=f(b,a)\geq a\ \forall\ (a,b)\in S\times S\}$ is _____

90. The number of divisors of the form $4n+2(n\geq 0)$ of the integer 240 is

Sec: (MODEL-A,B&C)	GTM-17(N)	Date: 15-01-24
Time: 3 HRS	JEE-MAIN	Max. Marks: 300

KEY SHEET

PHYSICS

1	**A**	2	**B**	3	**C**	4	**D**	5	**B**
6	**C**	7	**A**	8	**B**	9	**B**	10	**C**
11	**D**	12	**A**	13	**C**	14	**B**	15	**B**
16	**B**	17	**B**	18	**A**	19	**A**	20	**D**
21	**150**	22	**2**	23	**4**	24	**30**	25	**8**
26	**100**	27	**15**	28	**24**	29	**10**	30	**18**

CHEMISTRY

31	**D**	32	**C**	33	**A**	34	**C**	35	**D**
36	**B**	37	**C**	38	**C**	39	**C**	40	**A**
41	**A**	42	**C**	43	**C**	44	**C**	45	**C**
46	**D**	47	**C**	48	**A**	49	**B**	50	**C**
51	**4**	52	**600**	53	**1**	54	**16**	55	**9**
56	**2**	57	**1**	58	**46**	59	**3**	60	**38**

MATHEMATICS

61	**B**	62	**A**	63	**D**	64	**B**	65	**C**
66	**B**	67	**B**	68	**C**	69	**C**	70	**D**
71	**B**	72	**B**	73	**D**	74	**D**	75	**B**
76	**D**	77	**D**	78	**C**	79	**C**	80	**A**
81	**125**	82	**0**	83	**1**	84	**0**	85	**2**
86	**58**	87	**25**	88	**2**	89	**37**	90	**4**