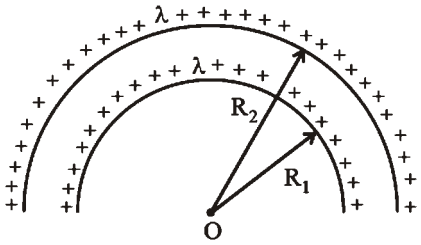
3S INSTITUTE
JEE ADVANCED | JEE MAIN | NEET | OLYMPIADS | MHT-CET | FOUNDATION

24-January-2023 (Evening Batch) : JEE Main Paper

PHYSICS **Section - A (Single Correct Answer)**

1. The electric potential at the centre of two concentric half rings of radii R_1 and R_2, having same linear charge density λ is



(A) $\frac{2\lambda}{\epsilon_0}$ (B) $\frac{\lambda}{2\epsilon_0}$ (C) $\frac{\lambda}{4\epsilon_0}$ (D) $\frac{\lambda}{\epsilon_0}$

2. Let γ_1 be the ratio of molar specific heat at constant pressure and molar specific heat at constant volume of a monoatomic gas and γ_2 be the similar ratio of diatomic gas. Considering the diatomic gas molecule as a rigid rotator, the ratio, γ_1/γ_2 is

(A) 27/35 (B) 35/27 (C) 25/21 (D) 21/25

3. An α-particle, a proton and an electron have the same kinetic energy. Which one of the following is correct in case of their De-Broglie wavelength:

(A) $\lambda_\alpha > \lambda_p > \lambda_e$ (B) $\lambda_\alpha < \lambda_p < \lambda_e$

(C) $\lambda_\alpha = \lambda_p = \lambda_e$ (D) $\lambda_\alpha > \lambda_p < \lambda_e$

4. If the distance of the earth from Sun is 1.5×10^6 km. Then the distance of an imaginary planet from Sun, if its period of revolution is 2.83 years is:

(A) 6×10^7 km (B) 6×10^6 km (C) 3×10^6 km (D) 3×10^7 km

5. Match List I with List II

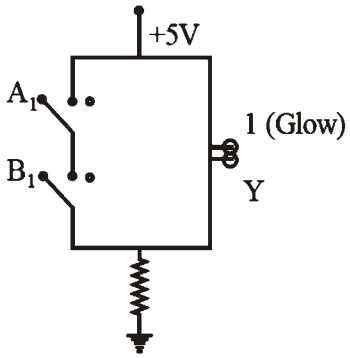
List-I		List-II	
A.	AM Broadcast	I.	88 - 108 MHz
B.	FM Broadcast	II.	540 - 1600 kHz
C.	Television	III.	3.7 - 4.2 GHz
D.	Satellite Communication	IV.	54MHz - 590MHz

Choose the correct answer from the options given below:

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

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

6. The logic gate equivalent to the given circuit diagram is :



(A) OR (B) NAND (C) NOR (D) AND

7. A long solenoid is formed by winding 70 turns cm^{-1}. If 2.0 A current flows, then the magnetic field produced inside the solenoid is _____. ($\mu_0 = 4\pi \times 10^{-7}$ TmA^{-1})

(A) 1232×10^{-4} T (B) 176×10^{-4} T (C) 352×10^{-4} T (D) 88×10^{-4} T

8. Given below are two statements:

Statement I: Acceleration due to earth's gravity decreases as you go 'up' or 'down' from earth's surface.

Statement II: Acceleration due to earth's gravity is same at a height 'h' and depth 'd' from earth's surface, if h = d.

In the light of above statements, choose the most appropriate answer form the options given below

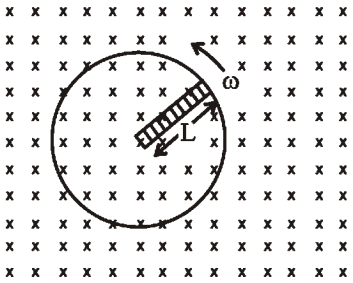
(A) Statement I is incorrect but statement II is correct

(B) Both Statement I and Statement II are incorrect

(C) Statement I is correct but statement II is incorrect

(D) Both Statement I and II are correct

9. A metallic rod of length 'L' is rotated with an angular speed of ¡¥fçi¦ normal to a uniform magnetic field 'B' about an axis passing through one end of rod as shown in figure. The induced emf will be :



(A) $\frac{1}{4}B^2L\omega$ (B) $\frac{1}{4}BL^2\omega$ (C) $\frac{1}{2}BL^2\omega$ (D) $\frac{1}{2}B^2L^2\omega$

10. When a beam of white light is allowed to pass through convex lens parallel to principal axis, the different colours of light converge at different point on the principle axis after refraction. This is called :

(A) Scattering (B) Chromatic aberration

(C) Spherical aberration (D) Polarisation

11. The frequency (ν) of an oscillating liquid drop may depend upon radius (r) of the drop, density (ρ) of liquid and the surface tension (s) of the liquid as : $\nu = r^a \rho^b s^c$. The values of a, b and c respectively are

(A) $\left(-\frac{3}{2},-\frac{1}{2},\frac{1}{2}\right)$ (B) $\left(\frac{3}{2},-\frac{1}{2},\frac{1}{2}\right)$

(C) $\left(\frac{3}{2},\frac{1}{2},-\frac{1}{2}\right)$ (D) $\left(-\frac{3}{2},\frac{1}{2},\frac{1}{2}\right)$

12. A body of mass 200g is tied to a spring of spring constant 12.5 N/m, while the other end of spring is fixed at point O. If the body moves about O in a circular path on a smooth horizontal surface with constant angular speed 5 rad/s, then the ratio of extension in the spring to its natural length will be :

(A) 1 : 2 (B) 1 : 1 (C) 2 : 3 (D) 2 : 5

13. A cell of emf 90 V is connected across series combination of two resistors each of 100Ω resistance. A voltmeter of resistance 400Ω is used to measure the potential difference across each resistor. The reading of the voltmeter will be :

(A) 40 V (B) 45 V (C) 80 V (D) 90 V

14. The electric field and magnetic field components of an electromagnetic wave going through vacuum is described by

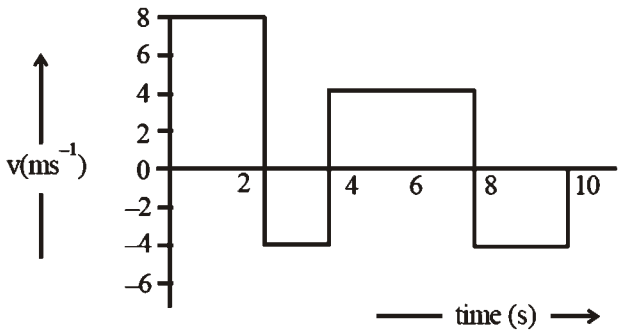
$E_x = E_0 \sin(kz - \omega t)$

$B_y = B_0 \sin(kz - \omega t)$

Then the correct relation between E_0 and B_0 is given by

(A) $kE_0 = \omega B_0$ (B) $E_0 B_0 = \omega k$ (C) $\omega E_0 = kB_0$ (D) $E_0 = kB_0$

15. The velocity time graph of a body moving in a straight line is shown in figure.



The ratio of displacement to distance travelled by the body in time 0 to 10s is

(A) 1 : 1 (B) 1 : 4 (C) 1 : 2 (D) 1 : 3

16. Given below are two statements: one is labelled as

Assertion A and the other is labelled as **Reason R**

Assertion A: Steel is used in the construction of buildings and bridges.

Reason R: Steel is more elastic and its elastic limit is high.

In the light of above statements, choose the most appropriate answer from the options given below

(A) Both **A** and **R** are correct but **R** is **NOT** the correct explanation of **A**

(B) **A** is not correct but **R** is correct

(C) Both **A** and **R** are correct and **R** is the correct explanation of **A**

(D) **A** is correct but **R** is not correct

17. Given below are two statements: one is labelled as

Assertion A and the other is labelled as **Reason R**.

Assertion A: A pendulum clock when taken to Mount Everest becomes fast.

Reason R: The value of g (acceleration due to gravity) is less at Mount Everest than its value on the surface of earth.

In the light of the above statements, choose the most appropriate answer from the options given below

(A) Both **A** and **R** are correct but **R** is **NOT** the correct explanation of **A**

(B) Both **A** and **R** are correct and **R** is the correct explanation of **A**

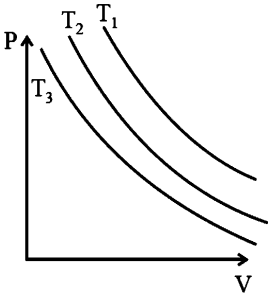
(C) **A** is not correct but **R** is correct

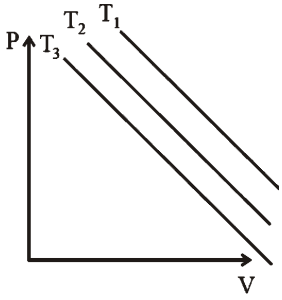
(D) **A** is correct but **R** is not correct

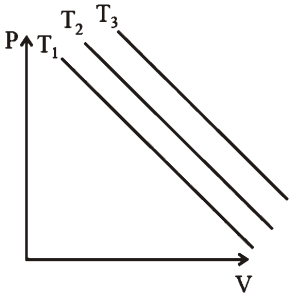
18. A photon is emitted in transition from n = 4 to n = 1 level in hydrogen atom. The corresponding wavelength for this transition is (given, $h = 4 \times 10^{-15}$ eVs) :

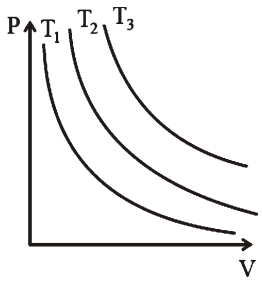
(A) 94.1 nm (B) 941 nm (C) 97.4 nm (D) 99.3 nm

19. In an Isothermal change, the change in pressure and volume of a gas can be represented for three different temperature; $T_3 > T_2 > T_1$ as :

(A) 

(B) 

(C) 

(D) 

20. If two vectors $\vec{P} = \hat{i} + 2m\hat{j} + m\hat{k}$ and $\vec{Q} = 4\hat{i} - 2\hat{j} + m\hat{k}$ are perpendicular to each other. Then, the value of m will be :

(A) 1 (B) – 1 (C) – 3 (D) 2

SECTION - B

21. A uniform solid cylinder with radius R and length L has moment of inertia I_1, about the axis of cylinder. A concentric solid cylinder of radius $R' = \frac{R}{2}$ and length $L' = \frac{L}{2}$ is caned out of the original cylinder. If I_2 is the moment of inertia of the carved out portion ot the cylinder then $\frac{I_1}{I_2} =$ _____

(Both I_1 and I_2 are about the axis of the cylinder)

22. A mass m attached to free end of a spring executes SHM with a period of 1s. If the mass is increased by 3 kg the period of oscillation increases by one second, the value of mass m is _____ kg.

23. The energy released per fission of nucleus of ^{240}X is 200 MeV. The energy released if all the atoms in 120g of pure ^{240}X undergo fission is _____ $\times 10^{25}$ MeV. (Given $N_A = 6 \times 10^{23}$)

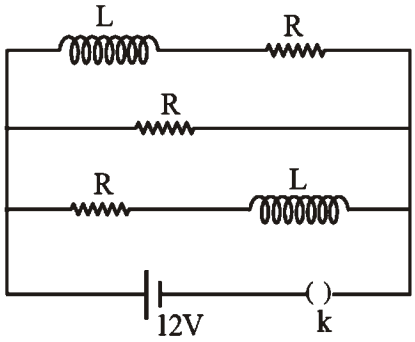
24. A parallel plate capacitor with air between the plate has a capacitance of 15pF. The separation between the plate becomes twice and the space between them is filled with a medium of dielectric constant 3.5. Then the capacitance becomes $\frac{x}{4}$ pF. The value of x is _____.

25. A body of mass 1 kg begins to move under the action of a time dependent force $\vec{F} = \left(t\hat{i} + 3t^2\hat{j}\right)$N. where $\hat{i}$ and $\hat{j}$ are the unit vectors along x and y axis. The power developed by above force, at the time t = 2s. will be _____W.

26. If a copper wire is stretched to increase its length by 20° %. The percentage increase in resistance of the wire is _____ %.

27. A single turn current loop in the shape of a right angle triangle with sides 5 cm, 12 cm, 13 cm is carrying a current of 2A. The loop is in a uniform magnetic field of magnitude 0.75 T whose direction is parallel to the current in the 13 cm side of the loop. The magnitude of the magnetic force on the 5 cm side will be $\frac{x}{130}$N. The value of x is _____.

28. Three identical resistors with resistance R = 12Ω and two identical inductors with sell inductance L = 5 mH are connected to an ideal battery with emf of 12 V as shown in figure. The current through the battery long after the switch has been closed will be_____A.

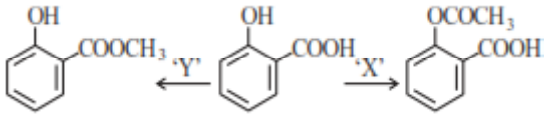


29. A convex lens of refractive index 1.5 and focal length 18 cm in air is immersed in water. The change in focal length of the lens will be_____cm. (Given refractive index of water = 4/3)

30. A Spherical ball of radius 1mm and density 10.5 g/cc is dropped in glycerine of coefficient of viscosity 9.8 poise and density 1.5 g/cc. Viscous force on the ball when it attains constant velocity is 3696×10^{-x} N. The value of x is (Given, g = 9.8 m/s^2 and $\pi = \frac{22}{7}$)

CHEMISTRY Section - A (Single Correct Answer)

31. In a reaction,



reagents 'X' and 'Y' respectively are

(A) $(CH_3CO)_2O/H^+$ and CH_3OH/H^+, Δ (B) $(CH_3CO)_2O/H^+$ and $(CH_3CO)_2O/H^+$

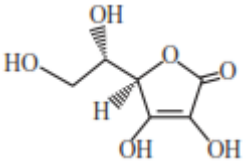
(C) CH_3OH/H^+, Δ and CH_3OH/H^+, Δ (D) CH_3OH/H^+, Δ and $(CH_3CO)_2O/H^+$

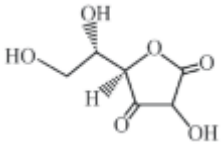
32. The correct order of bond enthalpy (kJ mol^{-1}) is

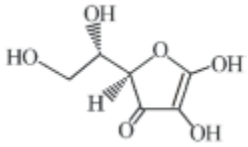
(A) Si – Si > C – C > Sn – Sn > Ge – Ge (B) Si – Si > C – C > Ge – Ge > Sn – Sn

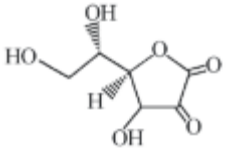
(C) C – C > Si – Si > Sn – Sn > Ge – Ge (D) C – C > Si – Si > Ge – Ge > Sn – Sn

33. All structures given below are of vitamin C. Most stable of them is :

(A) 

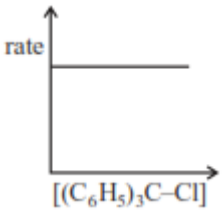
(B) 

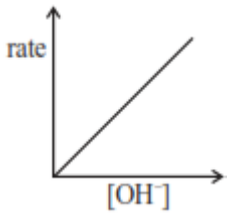
(C) 

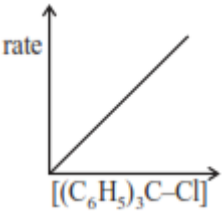
(D) 

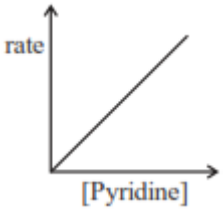
34. The graph which represents the following reaction is

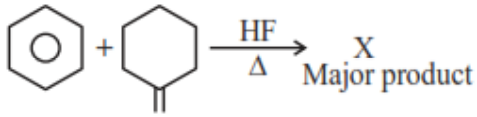
$$(C_6H_5)_3C-Cl \xrightarrow[\text{Pyridine}]{OH^-} (C_6H_5)_3C-OH$$

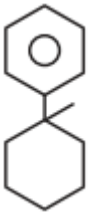
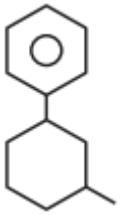
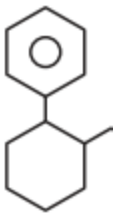
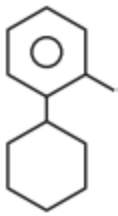
(A) 

(B) 

(C) 

(D) 

35. 'X' is : 

(A)  (B)  (C)  (D) 

36. The complex cation which has two isomers is :

(A) $[Co(H_2O)_6]^{3+}$ (B) $[Co(NH_3)_5Cl]^{2+}$ (C) $[Co(NH_3)_5NO_2]^{2+}$ (D) $[Co(NH_3)_5Cl]^{+}$

37. Given below are two statements :

Statement I : Sulphanilic acid gives esterification test for carboxyl group.

Statement II : Sulphanilic acid gives red colour in Lassigne's test for extra element detection.

In the light of the above statements, choose the most appropriate answer from the options given below.

(A) Statement I is correct but Statement II is incorrect.

(B) Both Statement I and Statement II are incorrect.

(C) Both Statement I and Statement II are correct.

(D) Statement I is incorrect but Statement II is correct.

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

Assertion (A) : Gypsum is used for making fireproof wall boards.

Reason (R) : Gypsum is unstable at high temperatures.

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

(A) Both (A) and (R) are correct but (R) is not the correct explanation of (A).

(B) (A) is correct but (R) is not correct.

(C) (A) is not correct but (R) is correct.

(D) Both (A) and (R) are correct and (R) is the correct explanation of (A).

39. Which element is not present in Nessler's reagent ?

(A) Mercury (B) Potassium (C) Iodine (D) Oxygen

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

Assertion (A) : α-halocarboxylic acid on reaction with dil. NH_3 gives good yield of α-amino carboxylic acid whereas the yield of amines is very low when prepared from alkyl halides.

Reason (R) : Amino acids exist in zwitter ion form in aqueous medium.

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

(A) Both (A) and (R) are correct and (R) is the correct explanation of (A).

(B) Both (A) and (R) are correct but (R) is not the correct explanation of (A).

(C) (A) is correct but (R) is not correct.

(D) (A) is not correct but (R) is correct.

41. The industrial activity held least responsible for global warming is :

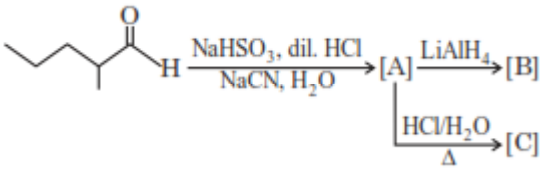
(A) manufacturing of cement

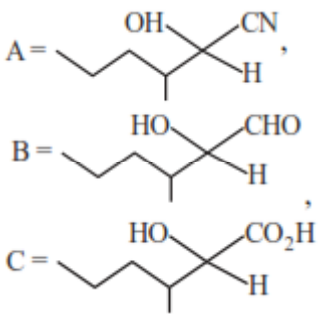
(B) steel manufacturing

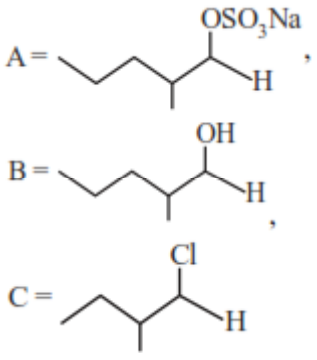
(C) electricity generation in thermal power plants

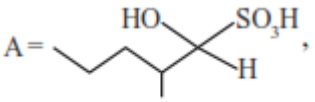
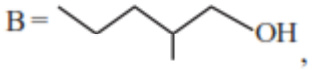
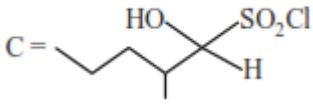
(D) industrial production of urea

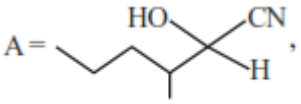
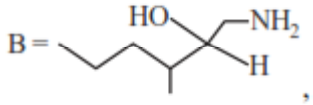
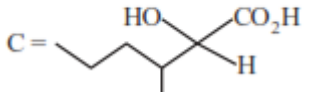
42. The structures of major products A, B and C in the following reaction are sequence.



(A) 

(B) 

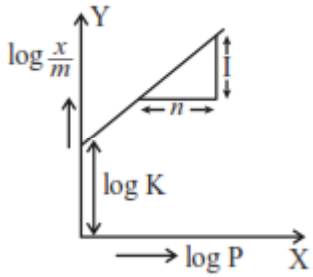
(C) A =  , B =  , C = 

(D) A =  , B =  , C = 

43. Given below are two statements : one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A) : Cu^{2+} in water is more stable than Cu^{+}.
Reason (R) : Enthalpy of hydration for Cu^{2+} is much less than that of Cu^{+}.
In the light of the above statements, choose the correct answer from the options given below.
(A) Both (A) and (R) are correct and (R) is the correct explanation of (A).
(B) (A) is correct but (R) is not correct.
(C) (A) is not correct but (R) is correct.
(D) Both (A) and (R) are correct but (R) is not the correct explanation of (A).

44. The starting material for convenient preparation of deuterated hydrogen peroxide (D_2O_2) in laboratory is
(A) $K_2S_2O_8$ (B) 2-ethylanthraquinol
(C) BaO_2 (D) BaO

45. In figure, a straight line is given for Freundrich Adsorption (y = 3x + 2.505). The value of $\frac{1}{n}$ and log K are respectively.



(A) 0.3 and log 2.505 (B) 0.3 and 0.7033 (C) 3 and 2.505 (D) 3 and 0.7033

46. Given below are two statements : one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A) : An aqueous solution of KOH when for volumetric analysis, its concentration should be checked before the use.
Reason (R) : On aging, KOH solution absorbs atmospheric CO_2.
In the light of the above statements, choose the correct answer from the options given below.
(A) (A) is not correct but (R) is correct
(B) Both (A) and (R) are correct but (R) is not the correct explanation of (A)
(C) Both (A) and (R) are correct and (R) is the correct explanation of (A)
(D) (A) is correct but (R) is not correct

47. Which one of the following sets of ions represents a collection of isoelectronic species ?
[**Given :** Atomic No. : F = 9 , Cl = 17, Na = 11, Mg = 12, Al = 13, K = 19, Ca = 20, Sc = 21]
(A) Li^{+}, Na^{+}, Mg^{2+}, Ca^{2+} (B) Ba^{2+}, Sr^{2+}, K^{+}, Ca^{2+}
(C) N^{3-}, O^{2-}, F^{-}, S^{2-} (D) K^{+}, Cl^{-}, Ca^{2+}, Sc^{3+}

48. The effect of addition of helium gas to the follo-wing reaction in equilibrium state, is :

$$PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$$

(A) the equilibrium will shift in the forward direction and more of Cl_2 and PCl_3 gases will be produced.

(B) the equilibrium will go backward due to suppression of dissociation of PCl_5.

(C) helium will deactivate PCl_5 and reaction will stop.

(D) addition of helium will not affect the equilibrium.

49. For electron gain enthalpies of the elements denoted as $\Delta_{eg}H$, the incorrect option is :

(A) $\Delta_{eg}H$ (Cl) < $\Delta_{eg}H$ (F) (B) $\Delta_{eg}H$ (Se) < $\Delta_{eg}H$ (S)

(C) $\Delta_{eg}H$ (I) < $\Delta_{eg}H$ (At) (D) $\Delta_{eg}H$ (Te) < $\Delta_{eg}H$ (Po)

50. O–O bond length in H_2O_2 is X than the O–O bond length in F_2O_2. The O–H bond length in H_2O_2 is Y than that of the O–F bond in F_2O_2.

Choose the correct option for X and Y from the given below.

(A) X – shorter, Y – shorter (B) X – shorter, Y – longer

(C) X – longer, Y – longer (D) X – longer, Y – shorter

SECTION - B

51. 0.3 g of ethane undergoes combustion at 27°C in a bomb calorimeter. The temperature of calori-meter system (including the water) is found to rise by 0.5°C. The heat evolved during combustion of ethane at constant pressure is _____kJ mol^{-1}.

(Nearest integer)

[Given : The heat capacity of the calorimeter system is 20 kJ K^{-1}, R = 8.3 JK^{-1} mol^{-1}.

Assume ideal gas behaviour.

Atomic mass of C and H are 12 and 1 g mol^{-1} respectively]

52. Among following compounds, the number of those present in copper matte is _____.

A. $CuCO_3$ B. Cu_2S C. Cu_2O

D. FeO

53. Among the following, the number of tranquilizer/s is/are _____.

A. Chloroliazepoxide B. Veronal C. Valium D. Salvarsan

54. $A \rightarrow B$

The above reaction is of zero order. Half life of this reaction is 50 min. The time taken for the concentration of A to reduce to one-fourth of its initial value is _____ min. (Nearest integer)

55. 20% of acetic acid is dissociated when its 5 g is added to 500 mL of water. The depression in freezing point of such water is _____ × 10^{-3} °C.

Atomic mass of C, H and O are 12, 1 and 16 a.m.u. respectively.

[**Given :** Molal depression constant and density of water are 1.86 K kg mol^{-1} and 1 g cm^{-3} respectively]

56. The molality of a 10% (v/v) solution of di-bromine solution in CCl_4 (carbon tetrachloride) is 'x'.

x = _____ × 10^{-2} M. (Nearest integer)

[**Given :** molar mass of Br_2 = 160 g mol^{-1}

atomic mass of C = 12 g mol^{-1}

atomic mass of Cl = 35.5 g mol^{-1}

density of dibromine = 3.2 g cm^{-3}

density of CCl_4 = 1.6 g cm^{-3}]

57. 1×10^{-5} M $AgNO_3$ is added to 1 L of saturated solution of AgBr. The conductivity of this solution at 298 K is _____ $\times 10^{-8}$ S m^{-1}.

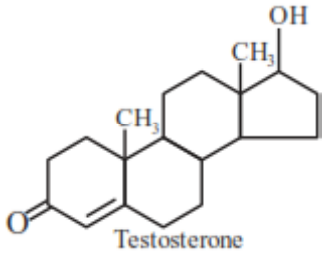
[**Given :** $K_{sp}(AgBr) = 4.9 \times 10^{-13}$ at 298 K

$\lambda^{o}_{Ag^+} = 6 \times 10^{-3}$ Sm^2 mol^{-1}

$\lambda^{o}_{Br^-} = 8 \times 10^{-3}$ Sm^2 mol^{-1}

$\lambda^{o}_{NO_3^-} = 7 \times 10^{-3}$ Sm^2 mol^{-1}]

58. Testosterone, which is a steroidal hormone, has the following structure.



Testosterone

The total number of asymmetric carbon atom/s in testosterone is _____.

59. The spin only magnetic moment of $[Mn(H_2O)_6]^{2+}$ complexes is _____ B.M.
(Nearest integer)
[**Given :** Atomic no. of Mn is 25]

60. A metal M crystallizes into two lattices : face centred cubic (fcc) and body centred cubic (bcc) with unit cell edge length of 2.0 and 2.5 Å respectively. The ratio of densities of lattices fcc to bcc for the metal M is _____.
(Nearest integer)

MATHEMATICS Section - A (Single Correct Answer)

61. Let the six numbers $a_1, a_2, a_3, a_4, a_5, a_6$ be in A.P. and $a_1 + a_3 = 10$. If the mean of these six numbers is $\frac{19}{2}$ and their variance is σ^2, then $8\sigma^2$ is equal to

(A) 220 (B) 210 (C) 200 (D) 105

62. Let f(x) be a function such that $f(x + y) = f(x) \cdot f(y)$ for all $x, y \in N$. If $f(1) = 3$ and $\sum_{k=1}^{n} f(k) = 3279$, then the value of n is

(A) 6 (B) 8 (C) 7 (D) 9

63. The number of real solutions of the equation $3\left(x^2 + \frac{1}{x^2}\right) - 2\left(x + \frac{1}{x}\right) + 5 = 0$, is

(A) 4 (B) 0 (C) 3 (D) 2

64. If $f(x) = \frac{2^{2x}}{2^{2x} + 2}$, $x \in R$, then $f\left(\frac{1}{2023}\right) + f\left(\frac{2}{2023}\right) + ... + f\left(\frac{2022}{2023}\right)$ is equal to

(A) 2011 (B) 1010 (C) 2010 (D) 1011

65. If $f(x) = x^3 - x^2 f'(1) + xf''(2) - f'''(3), \ x \in R,$ then

(A) $3f(1) + f(2) = f(3)$ (B) $f(3) - f(2) = f(1)$

(C) $2f(0) - f(1) + f(3) = f(2)$ (D) $f(1) + f(2) + f(3) = f(0)$

66. The number of integers, greater than 7000 that can be formed, using the digits 3, 5, 6, 7, 8 without repetition, is

(A) 120 (B) 168 (C) 220 (D) 48

67. If the system of equations

$x + 2y + 3z = 3$

$4x + 3y - 4z = 4$

$8x + 4y - \lambda z = 9 + \mu$

has infinitely many solutions, then the ordered pair (λ, μ) is equal to

(A) $\left(\frac{72}{5}, \frac{21}{5}\right)$ (B) $\left(\frac{-72}{5}, \frac{-21}{5}\right)$ (C) $\left(\frac{72}{5}, \frac{-21}{5}\right)$ (D) $\left(\frac{-72}{5}, \frac{21}{5}\right)$

68. The value of $\left(\frac{1+\sin\frac{2\pi}{9}+i\cos\frac{2\pi}{9}}{1+\sin\frac{2\pi}{9}-i\cos\frac{2\pi}{9}}\right)^3$ is

(A) $\frac{-1}{2}(1-i\sqrt{3})$ (B) $\frac{1}{2}(1-i\sqrt{3})$ (C) $\frac{-1}{2}(\sqrt{3}-i)$ (D) $\frac{1}{2}(\sqrt{3}+i)$

69. The equations of the sides AB and AC of a triangle ABC are

$(\lambda + 1)x + \lambda y = 4$ and $\lambda x + (1 - \lambda)y + \lambda = 0$

respectively. Its vertex A is on the y-axis and its orthocentre is (1, 2). The length of the tangent from the point C to the part of the parabola $y^2 = 6x$ in the first quadrant is

(A) $\sqrt{6}$ (B) $2\sqrt{2}$ (C) 2 (D) 4

70. The set of all values of 'a' for which $\lim\limits_{x\to a}([x-5]-[2x+2]) = 0,$ where $[\propto]$ denotes the greater integer less than or equal to $\propto$ is equal to

(A) (–7.5, –6.5) (B) (–7.5, –6.5] (C) [–7.5, –6.5] (D) [– 7.5, –6.5)

71. If $({}^{30}C_1)^2 + 2({}^{30}C_2)^2 + 3({}^{30}C_1)^2 + \ldots\ldots + 30({}^{30}C_{30})^2 = \frac{\alpha 60!}{(30!)^2}$, then α is equal to

(A) 30 (B) 60 (C) 15 (D) 10

72. Let the plane containing the line of intersection of the planes

P1 : $x + (\lambda + 4)y + z = 1$ and

P2 : $2x + y + z = 2$ pass through the points (0, 1, 0) and (1, 0, 1). Then the distance of the point $(2\lambda, \lambda, -\lambda)$ from the plane P2 is

(A) $5\sqrt{6}$ (B) $4\sqrt{6}$ (C) $2\sqrt{6}$ (D) $3\sqrt{6}$

73. Let $\vec{\alpha} = 4\hat{i} + 3\hat{j} + 5\hat{j}$ and $\vec{\beta} = \hat{i} + 2\hat{j} - 4\hat{k}$. Let $\vec{\beta}_1$ be parallel to $\vec{\alpha}$ and $\vec{\beta}_2$ be perpendiculat to $\vec{\alpha}$. If $\vec{\beta} = \vec{\beta}_1 + \vec{\beta}_2$, then the value of $5\vec{\beta}_2 \cdot (\hat{i} + \hat{j} + \hat{k})$ is

(A) 6 (B) 11 (C) 7 (D) 9

74. The locus of the mid points of the chords of the circle $C_1 : (x-4)^2 + (y-5)^2 = 4$ which subtend an angle θ_i at the centre of the circle C_1, is a circle of radius r_i. If $\theta_1 = \frac{\pi}{3}$, $\theta_3 = \frac{2\pi}{3}$ & $r_1^2 = r_2^2 + r_3^2$, then θ_2 is equal to

(A) $\frac{\pi}{4}$ (B) $\frac{3\pi}{4}$ (C) $\frac{\pi}{6}$ (D) $\frac{\pi}{2}$

75. If the foot of the perpendicular drawn from (1, 9, 7) to the line passing through the point (3, 2, 1) and parallel to the planes $x + 2y + z = 0$ and $3y - z = 3$ is (α, β, γ), then $\alpha + \beta + \gamma$ is equal to

(A) –1 (B) 3

(C) 1 (D) 5

76. Let $y = y(x)$ be the solution of the differential equation $(x^2 - 3y^2)dx + 3xy\,dy = 0$, $y(1) = 1$. Then $6y^2(e)$ is equal to

(A) $3e^2$ (B) e^2 (C) $2e^2$ (D) $\frac{3e^2}{2}$

77. Let p and q be two statements.

Then $\sim(p \wedge (p \Rightarrow \sim q))$ is equivalent to

(A) $p \vee (p \wedge (\sim q))$ (B) $p \vee ((\sim p) \wedge q)$ (C) $(\sim p) \vee q$ (D) $p \vee (p \wedge q)$

78. The number of square matrices of order 5 with entries from the set {0, 1}, such that the sum of all the elements in each row is 1 and the sum of all the elements in each column is also 1, is

(A) 225 (B) 120 (C) 150 (D) 125

79. $\int_{\frac{3\sqrt{2}}{4}}^{\frac{3\sqrt{3}}{4}} \frac{48}{\sqrt{9-4x^2}}dx$ is equal to

(A) $\frac{\pi}{3}$ (B) $\frac{\pi}{2}$

(C) $\frac{\pi}{6}$ (D) 2π

80. Let A be a 3×3 matrix such that $|\text{adj}(\text{adj}(\text{adj}A))| = 12^4$. Then $|A^{-1}\,\text{adj}\,A|$ is equal to

(A) $2\sqrt{3}$ (B) $\sqrt{6}$ (C) 12 (D) 1

SECTION - B

81. The urns A, B and C contain 4 red, 6 black; 5 red, 5 black and λ red, 4 black balls respectively. One of the urns is selected at random and a ball is drawn. If the ball drawn is red and the probability that it is drawn from urn C is 0.4 then the square of the length of the side of the largest equilateral triangle, inscribed in the parabola $y^2 = \lambda x$ with one vertex at the vertex of the parabola is

82. If the area of the region bounded by the curves $y^2 - 2y = -x$, $x + y = 0$ is A, then 8A is equal to

83. If $\frac{1^3 + 2^3 + 3^3 + \ldots\ldots \text{upto n terms}}{1\cdot3 + 2\cdot5 + 3\cdot7 + \ldots\ldots \text{upto n terms}} = \frac{9}{5}$, then the value of n is

84. Let f be a differentiable function defined on $\left[0, \frac{\pi}{2}\right]$ such that f(x) > 0 and

$f(x)+\int_0^x f(t)\sqrt{1-(\log_e f(t))^2}\,dt = e,\ \forall x \in \left[0, \frac{\pi}{2}\right]$. Then $\left(6\log_e f\left(\frac{\pi}{6}\right)\right)^2$ is equal to _____.

85. The minimum number of elements that must be added to the relation R — {(a, b), (b, c), (b, d)} on the set {a, b, c, d} so that it is an equivalence relation, is_____.

86. Let $\vec{a}=\hat{i}+2\hat{j}+\lambda\hat{k},\ \vec{b}=3\hat{i}-5\hat{j}-\lambda\hat{k},\ \vec{a}\cdot\vec{c}=7,\ 2\vec{b}\cdot\vec{c}+43=0,\ \vec{a}\times\vec{c}=\vec{b}\times\vec{c}$. Then $|\vec{a}\cdot\vec{b}|$ is equal to

87. Let the sum of the coefficients of the first three terms in the expansion of $\left(x-\frac{3}{x^2}\right)^n,\ x\neq 0,\ n\in N$, be 376. Then the coefficient of x^4 is _____.

88. If the shortest distance between the lines $\frac{x+\sqrt{6}}{2}=\frac{y-\sqrt{6}}{3}=\frac{z-\sqrt{6}}{4}$ and

$\frac{x-\lambda}{3}=\frac{y-2\sqrt{6}}{4}=\frac{z+2\sqrt{6}}{5}$ is 6, then the square of sum of all possible values of λ is

89. Let $S=\{\theta\in[0,\ 2\pi):\ \tan(\pi\cos\theta)+\tan(\pi\sin\theta)=0\}$. Then $\sum_{\theta\in S}\sin^2\left(\theta+\frac{\pi}{4}\right)$ is equal to

90. The equations of the sides AB, BC and CA of a triangle ABC are : 2x + y = 0, x + py = 21a, $(a\neq 0)$ and x – y = 3 respectively. Let P (2, a) be the centroid of ΔABC. Then $(BC)^2$ is equal to

❐ ❐ ❐

24-January-2023 (Evening Batch) : JEE Main Paper

ANSWER KEY

Physics

Single Choice Correct

1.	B	2.	C	3.	B	4.	C	5.	A
6.	B	7.	B	8.	C	9.	C	10.	B
11.	A	12.	C	13.	A	14.	A	15.	D
16.	C	17.	C	18.	A	19.	D	20.	D

Numerical Value

21.	32	22.	1	23.	6	24.	105	25.	100
26.	44	27.	9	28.	3	29.	54	30.	7

Chemistry

Single Choice Correct

31.	D	32.	A	33.	D	34.	B	35.	D
36.	C	37.	B	38.	C	39.	B	40.	D
41.	C	42.	B	43.	A	44.	B	45.	C
46.	A	47.	C	48.	C	49.	C	50.	D

Numerical Value

51.	2	52.	8	53.	3	54.	8	55.	5
56.	2	57.	314	58.	620	59.	85	60.	2

Mathematics

Single Choice Correct

61.	B	62.	C	63.	B	64.	D	65.	C
66.	B	67.	C	68.	C	69.	B	70.	A
71.	C	72.	D	73.	C	74.	D	75.	D
76.	C	77.	C	78.	B	79.	D	80.	A

Numerical Value

81.	432	82.	36	83.	5	84.	27	85.	13
86.	8	87.	405	88.	384	89.	2	90.	122