VMC Vidyamandir Classes SINCE 1986
IIT JEE | MEDICAL | FOUNDATION

CODE A

JEE Advanced Home Practice Test -1 | Paper -2 | JEE 2024

Date: 20/04/2024 **Maximum Marks: 198**

Duration : 3.0 Hours

General Instructions

1. The question paper consists of 3 Subject (Subject I: **Physics**, Subject II: **Chemistry**, Subject III: **Mathematics**). Each Part has **THREE** sections (Section 1, Section 2 & Section 3).
2. **Section 1** contains **SIX (06)** questions. The answer to each question is a **SINGLE DIGIT INTEGER** ranging from 0 to 9 (both inclusive).
3. **Section 2** contains **SIX (06)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct answer(s).
4. **Section 3** contains **SIX (06)** questions. The answer to each question is a **NUMERICAL VALUE.** For each question, enter the correct numerical value of the answer. If the answer is a decimal numerical value, then round-off the value to TWO decimal places. If the answer is an Integer value, then do not add zero in the decimal places. *In the OMR, do not bubble the ⊕ sign for positive values. However, for negative values, ⊖ sign should be bubbled*. (Example: 6, 81, 1.50, 3.25, 0.08)
5. For answering a question, an ANSWER SHEET (OMR SHEET) is provided separately. Please fill your **Test Code, Roll No.** and **Group** properly in the space given in the ANSWER SHEET.

Name of the Candidate (In CAPITALS) : _____

Roll Number : _____

OMR Bar Code Number : _____

Candidate's Signature : _____ **Invigilator's Signature** _____

MARKING SCHEME

SECTION-1

- This section contains **SIX (06)** questions. The answer to each question is a **SINGLE DIGIT INTEGER** ranging from 0 to 9 (both inclusive).
- For each question, choose the option corresponding to the correct answer.
- Answer to each question will be evaluated according to the following marking scheme:

Full Marks	:	+3 If ONLY the correct integer is entered;
Zero Marks	:	0 If none of the options is chosen (i.e., the question is unanswered);
Negative Marks	:	–1 In all other cases.

SECTION-2

- This section contains **SIX (06)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct answer(s).
- For each question, choose the option(s) corresponding to (all) the correct answer(s).
- Answer to each question will be evaluated according to the following marking scheme:

Full Marks	:	+4 If only (all) the correct option(s) is(are) chosen;
Partial Marks	:	+3 If all the four options are correct but ONLY three options are chosen;
Partial Marks	:	+2 If three or more options are correct but ONLY two options are chosen, both of which are correct;
Partial Marks	:	+1 If two or more options are correct but ONLY one option is chosen, both of which are correct;
Zero Marks	:	0 If unanswered;
Negative Marks	:	–2 In all other cases.

SECTION-3

- This section contains **SIX (06)** questions. The answer to each question is a **NUMERICAL VALUE.**
- For each question, enter the correct **NUMERICAL VALUE** of the answer. If the answer is a decimal numerical value, then round-off the value to **TWO** decimal places. If the answer is an Integer value, then do not add zero in the decimal places. *In the OMR, do not bubble the ⊕ sign for positive values. However, for negative values, ⊖ sign should be bubbled*. (Example: 6, 81, 1.50, 3.25, 0.08)
- Answer to each question will be evaluated according to the following marking scheme:

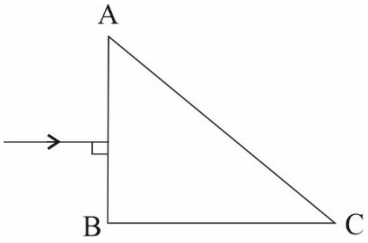
Full Marks	:	+4 If ONLY the correct numerical value is entered;
Zero Marks	:	0 In all other cases.

SUBJECT I : PHYSICS 66 MARKS

SECTION-1

This section contains **SIX (06)** questions. The answer to each question is a **SINGLE DIGIT INTEGER** ranging from 0 to 9 (both inclusive).

1. In the given figure ABC is a right-angled isosceles prism kept in air. A ray of light is incident on it normally as shown in figure. Refractive index of the prism is varying with time t as $\mu = 1 + 0.4t$, here t is in seconds. The angular velocity of the emergent ray at time $t = 1$ sec is _____ rad/sec.



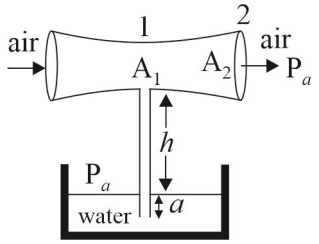
2. A suction device is arranged as shown in figure. The flow rate of air through the main pipe for which water suction will begin for the following data is Q.

$A_2 = 4A_1,\ A_1 = 4cm^2;$

$h = \frac{15}{8}m,\ a = 20cm,\ g = 10\,m/s^2,$

$\rho_{air} = 1\,kg/m^3,\ \rho_{water} = 1000\,kg/m^3$

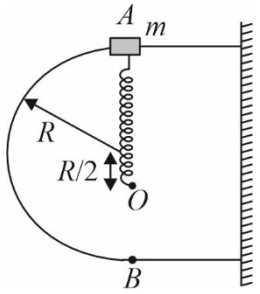
Pressure at section-2 is atmospheric pressure $P_a\left(760mm\ Hg\right)$.



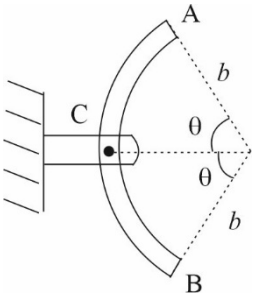
The flow rate Q is $\frac{n}{100}m^3/s$. The value of n is _____.

3. The space between two concentric conducting hollow spheres of radii a and $b\left(a<b\right)$ is filled with a homogenous poorly conducting medium. The capacitance of a such a system equals C. This capacitor is charged by connecting an external voltage source between the two spheres. The potential difference between the spheres, when disconnected from the external source decreases n fold during interval τ. The resistivity of the medium is $\frac{x\pi ab\tau}{\left(b-a\right)C\log_e n}$, where the value of x is _____.

4. A bead of mass m is tied at one end of a spring of spring constant $\frac{mg}{R}$ and unstretched length $\frac{R}{2}$ and other end to fixed point O. The smooth semi-circular wire frame of radius R is fixed in vertical plane. Bead can slide on wireframe without any friction and spring can also rotate freely about fixed point O. The bead is gently pushed from position A with negligible speed. The normal reaction between bead and wire just before it reaches the lowest point is n mg, where n is _____.



5. A uniform rod AB is bent in the shape of an arc of circle. The angular acceleration of the rod immediately after it is released from rest will be $\frac{g}{kb}$. The value of k is _____.

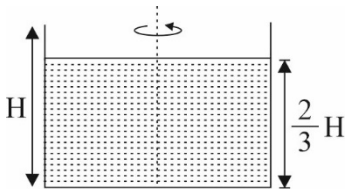


6. For a gas sample containing N_0 number of molecules the speed distribution is given by $N_V = \left[B - A(V-1)^2\right]T$, where T is in Kelvin and A and B are positive constants ($A > B$). Average velocity V_{avg} of the sample at temperature T_0 is given by $\frac{(n+1)BT_0}{nN_0}\left[\frac{B}{A}\right]^{1/2}$, where value of n is_____.

SECTION-2

This section contains **SIX (06)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct answer(s).

7. A circular cylinder of radius R and height H is filled with water to a height $\frac{2}{3}H$. It starts rotating about its axis with constantly increasing angular speed. Choose the correct alternatives.



(A) At all speeds, shape of the free surface is parabolloid

(B) The free surface touches first the brim of cylinder and then the base of the cylinder

(C) The free surface cannot touch the base without spilling water

(D) The free surface touches the brim as well as base at the same instant

8. A projectile is thrown from a point O on the ground at an angle 45° from the vertical and with a speed $5\sqrt{2}\,m/s$. The projectile at the highest point of its trajectory splits into two equal parts. One part falls vertically down to the ground 0.5 seconds after the splitting. The acceleration due to gravity $g = 10\,m/s^2$. Choose the correct options.

(A) Both parts reach the ground together

(B) The linear momentum of the system of two parts remain conserved till both are in air

(C) The separation between the points where the two masses fall on ground is 5 m

(D) The separation between the points where the two masses fall on ground is 7.5 m

9. A beam of light parallel of main optical axis falls on a converging lens of focal length $f_1 = 20\,cm$. Behind the lens, coaxially at some distance L, is a diverging lens of focal length $f_2 = -20\,cm$. After passing through the diverging lens, the light focuses at a point $'A'$ $5\,cm$ behind the lens. The position of lens is then interchanged. Choose the correct options.

(A) The value of L is $16\,cm$

(B) The value of L is $80/3\,cm$

(C) Point A is shifted by $40\,cm$ after the lenses are interchanged

(D) Point A is shifted by $125/3\,cm$ after the lenses are interchanged

10. In an *X*-ray tube, the voltage applied is $20kV$. The energy required to remove an electron from *L* shell of target metal is 19.9 *keV*. In the *X*-rays emitted by the tube,

(A) minimum wavelength will be 0.62 Å

(B) energy of the characteristic *x*-rays will be equal to or less than 19.9 *keV*

(C) $L_\alpha X-$ ray may be emitted

(D) $L_\alpha X-$ ray will have energy 19.9 *keV*

11. Two conducting spheres of radii *r* and 2*r* are placed at very large separation. Each sphere possesses charge *Q*. These spheres are connected with a conducting wire of resistance *R*. Then, which of the following options are true?

(A) Initial current is $\dfrac{Q}{8\pi\varepsilon_0 rR}$

(B) Initial current is $\dfrac{Q}{4\pi\varepsilon_0 rR}$

(C) Current reduces to half the initial current after time $8\pi\varepsilon_0 rR\ln 2$

(D) Current reduces to half the initial current after time $\dfrac{8\pi\varepsilon_0 rR\ln 2}{3}$

12. Initial acceleration of a particle moving in a straight line is a_0 and initial velocity is zero. The acceleration reduces continuously and smoothly to half in every t_0 seconds. The terminal velocity of the particle is:

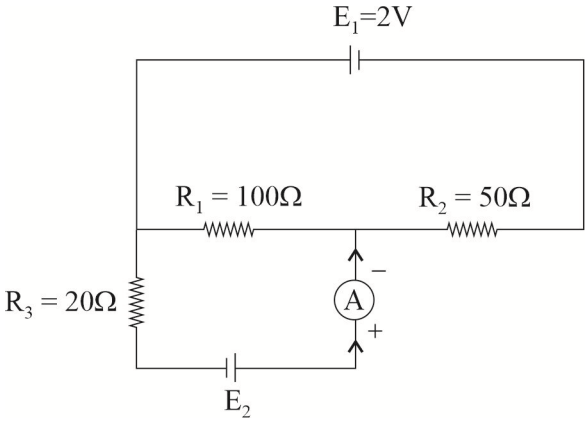
(A) $\dfrac{a_0 t_0}{\ln(3)}$ **(B)** $\dfrac{2a_0 t_0}{\ln(2)}$ **(C)** $\dfrac{a_0 t_0}{\ln(2)}$ **(D)** $\dfrac{a_0 t_0}{3\ln(2)}$

SECTION-3

This section contains **SIX (06)** questions. The answer to each question is a **NUMERICAL VALUE.** For each question, enter the correct numerical value of the answer. If the answer is a decimal numerical value, then round-off the value to TWO decimal places. If the answer is an Integer value, then do not add zero in the decimal places. *In the OMR, do not bubble the ⊕ sign for positive values. However, for negative values, ⊖ sign should be bubbled*.
(Example: 6, 81, 1.50, 3.25, 0.08).

13. In a circuit, a metal filament lamp is connected in series with an inductor of inductance LH, across a 220V AC source of angular frequency 60 rad/s. The power consumed by the lamp is 560 W, while the voltage drop across it is 140 V. Assume that there is no capacitive load in the circuit. Take rms values of the voltage. The value of L is $\sqrt{k}H$, where k is _____.

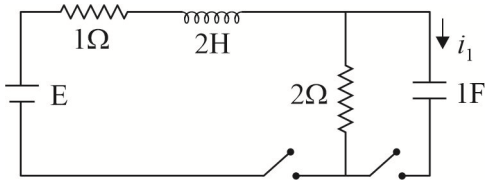
14. The ammeter reading is $50mA$. The magnitude of emf E_2 is _____ volt.
(Neglect internal resistance of cells and ammeter)



15. The length of a cylinder is measured with the help of vernier callipers whose smallest division on main scale is 0.5 mm and nine divisions of the main scale are equal to 10 divisions of vernier scale. It is observed that 78^{th} division of main scale coincides with sixth division of the vernier scale. What is the length (in cm) of the cylinder?

16. The distance between two stars of masses $3M$ and $6M$ is R. Both the stars orbit around their common centre of mass in circular orbits. The ratio of areal velocity of $3M$ star to $6M$ star is n. The value of n is _____.

17. For the circuit shown, both switches are closed simultaneously at $t = 0$. The capacitor is initially charged. The current in the capacitor at any time t is $i_1 = 2e^{-t}$, then the value of E is_____ volt.



18. A solid receives heat by radiation over its surface at the rate of 4 kW. The heat convection rate from the surface of solid to the surrounding is 5.2 kW, and heat is generated at a rate of 1.7 kW over the volume of the solid. The rate of change of the average temperature of the solid is $0.5°Cs^{-1}$. The heat capacity of the solid is _____. (In appropriate SI unit)

SUBJECT II : CHEMISTRY 66 MARKS

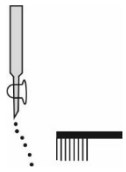
SECTION-1

This section contains **SIX (06)** questions. The answer to each question is a **SINGLE DIGIT INTEGER** ranging from 0 to 9 (both inclusive).

1. The 1st, 2nd and 3rd ionization enthalpies I_1, I_2 and I_3 of three elements with atomic number n, $n+1$ and $n+2$ where $n < 6$ are tabulated below. What is the value of n?

Atomic No.	Element	I.E	I.E	I.E (Kcal/mol)
n	P	98	735	1100
n+1	Q	176	347	1850
n+2	R	396	530	905

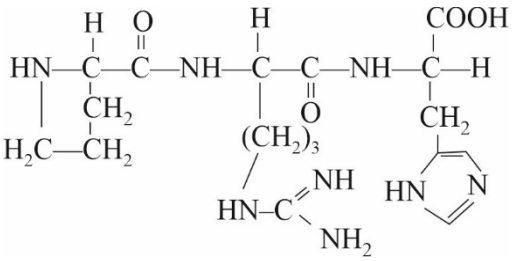
2. Consider the following compounds in the liquid form:
S_2, CS_2, CH_2Cl_2, NH_3, H_2O_2, C_6H_6, C_6H_5Cl, $p\text{-}C_6H_4(OH)_2$, $p\text{-}C_6H_4(Cl)_2$. When a charged comb is brought near their flowing stream, how many of them show deflection as per the following figure?



3. A mixture containing 0.05 mole of $K_2Cr_2O_7$ and 0.02 mole of $KMnO_4$ was treated with excess of KI in acidic medium. The liberated iodine required 1.0 L of $Na_2S_2O_3$ solution for titration. Concentration of $Na_2S_2O_3$ solution was $x \times 10^{-1}$. Value of *x* is _____.

4. An acidified solution of potassium chromate was layered with an equal volume of amyl alcohol. When it was shaken after the addition of 1 mL of 3% H_2O_2, a blue alcohol layer was obtained. The blue color is due to the formation of a chromium (VI) compound 'X'. What is the number of oxygen atoms which are in –1 oxidation state in CrO_5.

5. The structure of a peptide is given below:



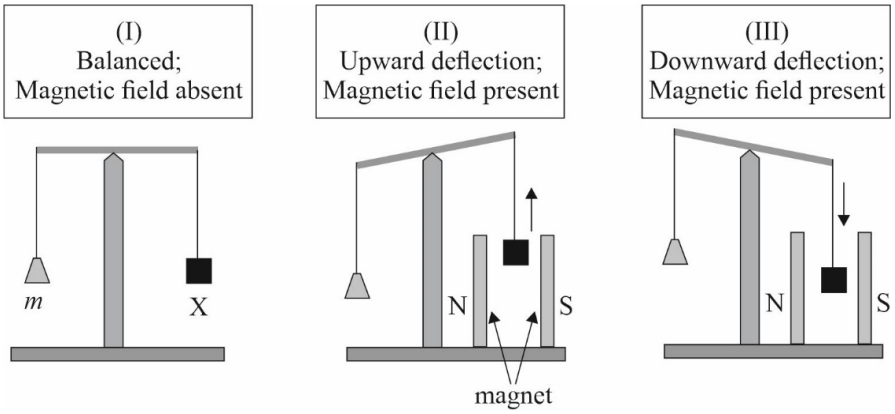
If the absolute values of the net charge of the peptide at pH = 2, pH = 7, and pH = 12 are $|z_1|$, $|z_2|$ and $|z_3|$ respectively, then what is $|z_1|+|z_2|+|z_3|$?

6. An organic compound $C_8H_8O_2$ do not rotates plane-polarized light. It produces yellow color with NaOI solution. What is the total number of the possible isomers for this compound?

SECTION-2

This section contains **SIX (06)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct answer(s).

7. In an experiment, *m* grams of a compound X (gas/liquid/solid) taken in a container is loaded in a balance as shown in figure I below. In the presence of a magnetic field, the pan with X is either deflected upwards (figure II), or deflected downwards (figure III), depending on the compound X. Identify the correct statements(s).



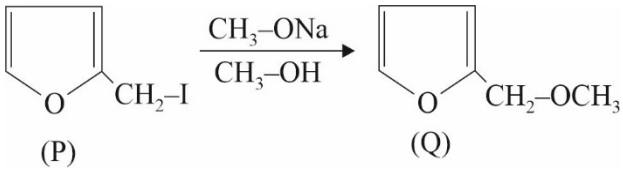
(A) If X is $KO_2(\ell)$, deflection of the pan is downwards

(B) If X is $K_4[Fe(CN)_6](s)$, deflection of the pan is upwards

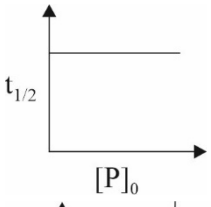
(C) If X is $B_2(\ell)$, deflection of the pan is downwards

(D) If X is NaCl(s), deflection of the pan is downwards

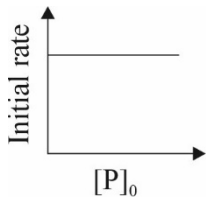
8. Which of the following plots is (are) correct for the given reaction? ($[P]_0$ is the initial concentration of P)



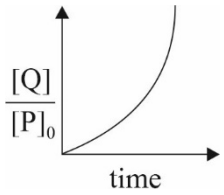
(A)



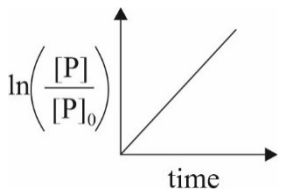
(B)



(C)



(D)



9. Select which is associated during the extraction of iron in blast furnace:

(A) Iron formed in furnace melt below its melting point due to the presence of impurities.

(B) CO_2 formed by combustion of C, reacts with excess coke in furnace and produces CO

(C) Fe_2O_3 is reduced by Al and produces melted iron

(D) Lime stone is decomposed to CaO which combines with impurity of SiO_2 in ore

10. Select the correct statement(s):

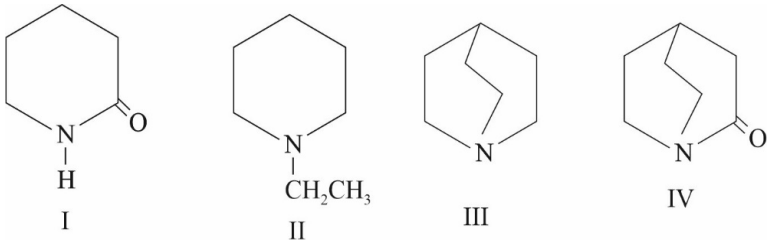
(A) When Al is added to potassium hydroxide solution, hydrogen gas is evolved

(B) H_2SiF_6 is formed when silica reacts with hydrogen fluoride followed by hydrolysis

(C) Phosphine gas is formed when red phosphorus is heated with NaOH

(D) $(NH_4)_2SO_4 \cdot FeSO_4 \cdot 6H_2O$ is called alums

11. Consider the following four compounds I, II, III and IV.



Choose the correct statement(s)

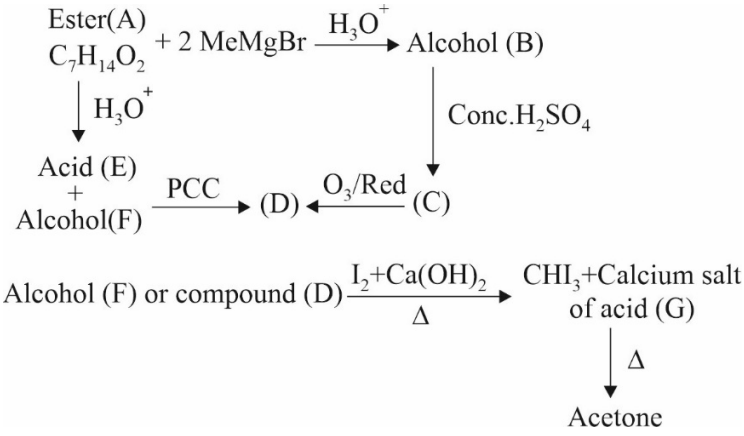
(A) The order of basicity is III > II > IV > I

(B) The magnitude of difference of pK_b between I and II is more than that between III and IV

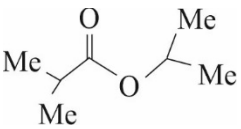
(C) Resonance affect is more in I than in IV

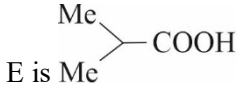
(D) Steric effect makes compound IV more basic than III

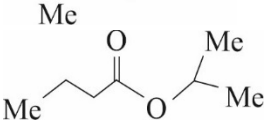
12. Consider the following transformation of a compound A.

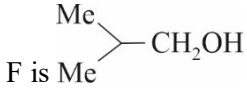


The structural formula of compound is:

(A) A is 

(B) E is 

(C) A is 

(D) F is 

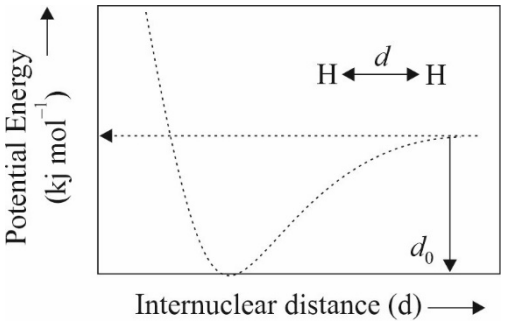
SECTION-3

This section contains **SIX (06)** questions. The answer to each question is a **NUMERICAL VALUE.** For each question, enter the correct numerical value of the answer. If the answer is a decimal numerical value, then round-off the value to TWO decimal places. If the answer is an Integer value, then do not add zero in the decimal places. *In the OMR, do not bubble the ⊕ sign for positive values. However, for negative values, ⊖ sign should be bubbled*.
(Example: 6, 81, 1.50, 3.25, 0.08).

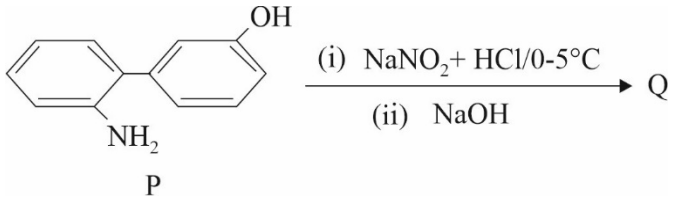
13. A solution of weak acid was titrated with base NaOH. The equivalence point was reached when 36.12 mL of 0.1 M NaOH have been added. Now, 18.06 mL of 0.1 M HCl was added to the titrated solution, the pH was found to be 5.0. The pK_a of acid is _____.

14. Vapour pressure of solution containing 6 g of a non-volatile solute in 180 g water is 20 torr. If 1mole of water is further added, then vapour pressure increases by 0.02 torr. The molar mass (in g/mol) of the non-volatile solute is _____.

15. The figure below is the plot of potential energy versus internuclear distance (d) of H_2 molecule in the electronic ground state. The value of the net potential energy E_0 is $-87\times10^{-x}\,J/mol$, for $d = d_0$ at which the electron-electron repulsion and the nucleus-nucleus repulsion energies are absent? As reference, the potential energy of H atom is taken as zero when its electron and the nucleus are infinitely far apart. Find the value of *x*? Use Avogadro constant as $6.023\times10^{23}\,mol^{-1}$.



16. Consider the reaction sequence from P and Q shown below. The overall yield of the major product Q from P is 75%. What is the amount in grams of Q obtained from 18.5 mL of P?
(Use density of P = 1.00 g mL^{-1}; Molar mass of C = 12.0, H = 1.0, O = 16.0 and N = 14.0g mol^{-1})



17. Calculate $\Delta S_{univ}\,(\text{in J/K})$ for the chemical reaction:

$C(\text{Graphite}) + 2H_2(g) \rightarrow CH_4(g);\ \Delta H^{\circ}_{300} = -75.0\text{kJ}$. The standard entropies of C (Graphite), $H_2(g)$ and $CH_4(g)$ are $6.0, 130.6$ and $186.2\ J/K-mol$, respectively.

18. An aqueous solution of a metal bromide $MBr_2\left(0.04M\right)$ is saturated with H_2S. What is the minimum pH at which MS will precipitate? The value of K_{sp} for $MS = 6.0\times10^{-21}$; concentration of saturated $H_2S = 0.1M,\ K_1 = 10^{-7}$ and $K_2 = 1.5\times10^{-13}$ for H_2S.

SUBJECT III : MATHEMATICS 66 MARKS

SECTION-1

This section contains **SIX (06)** questions. The answer to each question is a **SINGLE DIGIT INTEGER** ranging from 0 to 9 (both inclusive).

1. If $a_r = \frac{r}{101}$, $r = 1, 2, 3, \ldots$ then the value of

$$\frac{a_1^3}{1-3a_1+3a_1^2}+\frac{a_2^3}{1-3a_2+3a_2^2}+\ldots+\frac{a_{101}^3}{1-3a_{101}+3a_{101}^2}=k,$$ then sum of digit of k is _____.

2. Let E_1, E_2, E_3 be three independent events associated with a random experiment such that $3P\left(E_1 \cap \overline{E}_2 \cap \overline{E}_3\right) = P\left(\overline{E}_1 \cap E_2 \cap \overline{E}_3\right) = 9P\left(\overline{E}_1 \cap \overline{E}_2 \cap E_3\right) = 3P\left(\overline{E}_1 \cap \overline{E}_2 \cup \overline{E}_3\right)$, where $P\left(E_1\right), P\left(E_2\right), P\left(E_3\right) \neq 1$ and $P(A)$ denotes probability of event A.

If absolute value of $\begin{vmatrix} P(E_1) & P(E_2) & P(E_3) \\ P(E_2) & P(E_3) & P(E_1) \\ P(E_3) & P(E_1) & P(E_2) \end{vmatrix} = \frac{a}{b}$, where $a, b \in N$, then find the least value of $(a+b+1)/6$ is _____.

3. If $f\left(x\right) = x^3 - 3x + 1,$ then minimum number of real roots of $f(f(x)) = 0$ is _____.

4. Let $A_n, \left(n \in N\right)$ be a matrix of order $\left(2n-1\right)\times\left(2n-1\right)$, such that $a_{ij} = 0 \;\forall\; i \neq j$ and $a_{ij} = n^2 + i + 1 - 2n \;\forall\; i = j$ where a_{ij} denotes the element of i^{th} row and j^{th} column of A_n. Let $T_n = \left(-1\right)^n \times$ (sum of all the elements of A_n). Then the value of $\left[\frac{\sum_{n=1}^{102} T_n}{520200}\right]$, is _____.

(Where [.] represents the greatest integer function)

5. $\int_{-4}^{-5} e^{(x+5)^2}dx + 3\int_{1/3}^{2/3} e^{9\left(x-\frac{2}{2}\right)^2}dx$ is equals to _____.

6. Let z be those complex number which satisfy $|z+5| \leq 4$ and $z\left(1+i\right)+\bar{z}\left(1-i\right) \geq -10,\ i = \sqrt{-1}$. If the maximum value of $|z+1|^2$ is $a+b\sqrt{2}$ (where $a, b \in N$) and length of latus rectum of curve $ax^2 = 4\left(by^2 + ab\right)$ is L units then L is _____.

SECTION-2

This section contains **SIX (06)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct answer(s).

7. Let $l_1 = \lim\limits_{x\to 0} \dfrac{1}{x^3} \int\limits_0^x \dfrac{t^2 \cdot \left(e^{3t}-1\right)\ln\left(1+2t\right)}{\left(t^3+3\right)\left(1-\cos t\right)} dt$

and $l_2 = \lim\limits_{x\to 0} \dfrac{1}{x}\left(\int\limits_{\frac{\pi}{4}}^{v} \log_{\frac{1}{2}} \sin^2 t\, dt - \int\limits_{\left(\frac{\pi}{4}+x\right)}^{v} \log_{\frac{1}{2}} \sin^2 t\, dt \right)$

Where $\pi < v < 2\pi$. Then which of the following is incorrect?

(A) $9l_1^2 + l_2^2 = 18$ **(B)** $3l_1 + 4l_2 = 8$

(C) $l_1 > 0$ and $l_2 < 0$ **(D)** $l_1 < l_2$

8. A circle of radius 1 touches *x*-axis at *A* and *y*-axis at *B* in first quadrant. A variable line of slope '*m*' through origin meets the circle at *D* and *E*. Then which of the following is/are correct(s)?

(A) Length of chord $DE = \sqrt{\dfrac{8m}{1+m^2}}$

(B) If the length of chord is $\dfrac{4}{\sqrt{5}}$ the inclination can be $\tan^{-1}\left(\dfrac{1}{2}\right)$

(C) If the chord is a diameter, then its slope is 1

(D) If area of ΔDEB is maximum then $m^2 = 1/3$

9. Let $f : R \to R$ is one-one, onto and differentiable function and graph of $y = f(x)$ is symmetrical about the point (4,0), then:

(A) $f^{-1}\left(2020\right) + f^{-1}\left(-2020\right) = 8$ **(B)** $\int\limits_{-2020}^{2028} f\left(x\right) dx = 0$

(C) If $f'\left(-100\right) > 0,$ then roots of $x^2 - f'\left(10\right)x - f'\left(10\right) = 0$ may be non-real

(D) If $f'\left(10\right) = 20$ then $f'\left(-2\right) = 20$

10. Consider the line $L_1 : x = y = z$ and the line $L_2 : 2x + y + z - 1 = 0 = 3x + y + 2z - 2,$ then:

(A) The shortest distance between the two lines is $\dfrac{1}{\sqrt{2}}$

(B) The shortest distance between the two lines is $\sqrt{2}$

(C) Plane containing the line L_2 and parallel to line L_1 is $z - x + 1 = 0$

(D) Perpendicular distance of origin from plane containing line L_2 and parallel to line L_1 is $\dfrac{1}{\sqrt{2}}$

11. The position vectors of the points P and Q are $5\hat{i}+7\hat{j}-2\hat{k}$ and $-3\hat{i}+3\hat{j}+6\hat{k}$ respectively. The vector $\vec{A}=3\hat{i}-\hat{j}+\hat{k}$ passes through the point P and the vector $\vec{B}=-3\hat{i}+2\hat{j}+4\hat{k}$ passes through the point Q. A third vector $2\hat{i}+7\hat{j}-5\hat{k}$ intersects vectors $\vec{A}$ and $\vec{B}$. The position vectors of the points of intersection are:

(A) $2\hat{i}+8\hat{j}-3\hat{k}$ **(B)** $\hat{i}+\hat{j}+2\hat{k}$ **(C)** $2\hat{i}+\hat{j}+2\hat{k}$ **(D)** $\hat{j}+2\hat{k}$

12. Given $(1-x^3)^n=\sum_{k=0}^{n} a_k x^k (1-x)^{3n-2k}$, then the value of 3. $a_{k-1}+a_k$ is:

(A) ${}^{n}C_k\cdot 3^k$ **(B)** ${}^{n+1}C_{k-1}\cdot 3^k$ **(C)** ${}^{n}C_{k-1}\cdot 3^k$ **(D)** ${}^{n+1}C_k\cdot 3^k$

SECTION-3

This section contains **SIX (06)** questions. The answer to each question is a **NUMERICAL VALUE.** For each question, enter the correct numerical value of the answer. If the answer is a decimal numerical value, then round-off the value to TWO decimal places. If the answer is an Integer value, then do not add zero in the decimal places. *In the OMR, do not bubble the ⊕ sign for positive values. However, for negative values, ⊖ sign should be bubbled*.
(Example: 6, 81, 1.50, 3.25, 0.08).

13. Number of non-similar triangles having all the angles in integral degrees is N then number of zero in $N!$ is _____.

14. The term independent of x in $\left(1+x+x^{-2}+x^{-3}\right)^{10}$ is n then the last digit of $(n+2)^n$ is _____.

15. In the equation $A + B + C + D + E = FG$, where FG is the two-digit number whose value is $10F + G$ and A, B, C, D, E, F and G each represent different digits. If FG is as large as possible and a five-digit number is made using A, B, C, D, E, F, G (repetition not allowed) then Probability that number made is divisible by 4 is k then $49k$ _____.

16. Number of roots of the equation $3^{\tan\left(x-\frac{\pi}{4}\right)}-2\left(\frac{1}{9}\right)^{\frac{\sin^2\left(x-\frac{\pi}{4}\right)}{\cos 2x}}+1=0$ in $[0, 4\pi]$ is _____.

17. Let $I_n=\int_0^{\infty} e^{-x}(\sin x)^n dx,\ n\in N,\ n>1$ then $50\times\frac{I_7}{I_5}$ has integral part equals to _____.

18. If x, y and z are real numbers that satisfy the three equations.

$$\begin{cases} \tan(x)+\tan(y)+\tan(z)=6-\left(\cot(x)+\cot(y)+\cot(z)\right) \\ \tan^2(x)+\tan^2(y)+\tan^2(z)=6-\left(\cot^2(x)+\cot^2(y)+\cot^2(z)\right) \\ \tan^3(x)+\tan^3(y)+\tan^3(z)=6-\left(\cot^3(x)+\cot^3(y)+\cot^3(z)\right) \end{cases}$$

Then the value of the expression $\left(\frac{\tan(x)}{\tan(y)}+\frac{\tan(y)}{\tan(z)}+\frac{\tan(z)}{\tan(x)}+3\tan(x)\tan(y)\tan(z)\right)$ is _____.