VMC Vidyamandir Classes SINCE 1986
IIT JEE | MEDICAL | FOUNDATION

CODE A

JEE Advanced Home Practice Test -5 | Paper -1 | JEE 2024

Date: 3/05/2024 **Maximum Marks: 180**

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 **four** sections (Section 1, Section 2, Section 3, Section 4).

2. **Section 1** contains **4 Multiple Choice Questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE CHOICE** is correct.

   Section 2 contains **THREE (03) Paragraphs.** There are **TWO (02)** questions corresponding to each Paragraph. 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, Θ sign should be bubbled*. (Example: 6, 81, 1.50, 3.25, 0.08).

   Section 3 contains **SIX (06) Multiple Correct Answers Type Questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONE OR MORE THAN ONE CHOICE** is correct.

   Section 4 contains **THREE (03)** Questions. The answer to each question is a **NON-NEGATIVE INTEGER**. For each question, enter the correct integer corresponding to the answer.

3. 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 | (Maximum Marks: 12)

- This section contains **FOUR (04)** Multiple Choice Questions. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE CHOICE** is correct.
- Answer to each question will be evaluated according to the following marking scheme:

Full Marks: +3 If only (all) the correct option(s) is(are) chosen
Zero Mark: 0 if none of the options is chosen (i.e. the question is unanswered)
Negative Marks: –1 In all other cases.

SECTION - 2 | (Maximum Marks: 12)

- This section contains **THREE (03)** Paragraphs. There are **TWO (02)** questions corresponding to each Paragraph. 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: +2 If **ONLY** the correct numerical value is entered at the designated place.
Zero Marks: 0 In all other cases.

SECTION – 3 | (Maximum Marks: 24)

- This section consists of **SIX (06)** Questions. Each question has **FOUR** options. **ONE OR MORE THAN ONE** of these four option(s) is(are) 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 and both of which are correct
Partial Marks: +1 If two or more options are correct but ONLY one option is chosen, and it is a correct option
Zero Mark: 0 if none of the options is chosen (i.e. the question is unanswered)
Negative Marks: –2 In all other cases.

SECTION - 4 | (Maximum Marks: 12)

- This section contains **THREE (03)** Questions. The answer to each question is a NON-NEGATIVE INTEGER. For each question, enter the correct integer corresponding to the answer.
- Answer to each question will be evaluated according to the following marking scheme:

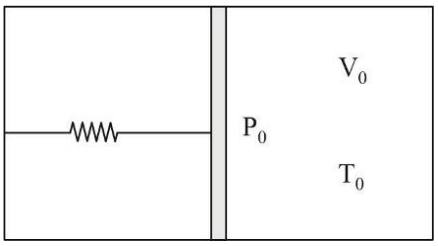
Full Marks: +4 If **ONLY** the correct integer is entered.
Zero Marks: 0 In all other cases.

SUBJECT I : PHYSICS 60 MARKS

SECTION 1

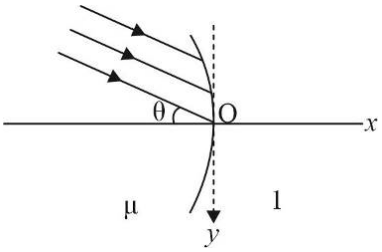
This section contains 04 Multiple Choice Questions. Each question has 4 choices (A), (B), (C) and (D), out of which ONLY ONE CHOICE is correct.

1. A container has a tight-fitting movable piston which can slide without friction. The compartment containing spring has vacuum and to the right of the piston there is one mole of diatomic gas. $P_0, V_0 \& T_0$ are pressure, volume and temperature of gas in equilibrium. Now vacuum is slowly created in the right compartment also so that finally the piston touches the right wall and spring is relaxed. Find molar specific heat of the gas for this process.



(A) $\frac{P_0V_0}{T_0}$ **(B)** $2\frac{P_0V_0}{T_0}$ **(C)** $3\frac{P_0V_0}{T_0}$ **(D)** $\frac{P_0V_0}{2T_0}$

2. A spherical surface of radius R separates air from a medium of refractive index μ. Parallel beam of light is incident, from medium side making a small angle θ with the principal axis. Find the co-ordinates of the point where the beam will focus.



(A) $\left(\frac{R\theta}{\mu-1}, \frac{R}{\mu-1}\right)$ **(B)** $\left(\frac{\mu R\theta}{\mu-1}, \frac{R}{\mu-1}\right)$

(C) $\left(\frac{R}{\mu-1}, \frac{\mu R\theta}{\mu-1}\right)$ **(D)** $\left(\frac{R}{\mu-1}, \frac{R\theta}{\mu^2-1}\right)$

3. Calculate the pressure caused by gravitational compression inside the earth, at a distance '*r*' from its centre. Take *M* as mass and *R* as radius of earth respectively.

(A) $\frac{GM^2}{4\pi R^4}\left(1-\frac{r^2}{R^2}\right)$ **(B)** $\frac{3GM^2}{8\pi R^4}\left(1-\frac{r^2}{R^2}\right)$

(C) $\frac{3}{2}\frac{GM^2}{\pi R^4}\left(1-\frac{r^2}{R^2}\right)$ **(D)** $\frac{GM^2}{2\pi R^4}\left(1-\frac{r^2}{R^2}\right)$

4. A student performs an experiment for determination of $g\left(=\frac{4\pi^2\ell}{T^2}\right)$, using a second's pendulum with $\ell \approx 1m$ and he commits an error of $\Delta\ell$. For T he takes the time of n oscillations with the stop watch of least count ΔT and he commits a human error of 0.1sec. For which of the following data, the measurement of g will be most accurate?

	$\Delta\ell$	ΔT	n	Amplitude of oscillation
(A)	5mm	0.2sec	10	5mm
(B)	5mm	0.2sec	20	5mm
(C)	5mm	0.1sec	20	1mm
(D)	1mm	0.1sec	50	1mm

SECTION-2

This Section contains **THREE (03) Paragraphs.** There are **TWO (02)** questions corresponding to each Paragraph. 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)

PARAGRAPH FOR Q-5 & 6

A square plate of mass M and edge a is released from rest with its corner C vertically above A. It rotates about A until its corner B strikes the floor, and then rotates about B. The floor is sufficiently rough to prevent slipping and the impact at B is perfectly plastic. ω_0 denotes the angular speed of cube just before B strikes the floor. (Motion of plate is in x-y plane only) [M = 5 kg, $a = 0.5m$, $g = 10\ m/s^2$]

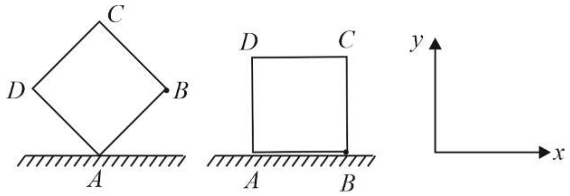


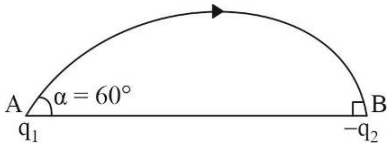
Fig-(a) Fig-(b)

5. The value of ω_0^2 [in $(rad/s)^2$] is_____.

6. The angular speed of plate after B strikes the floor is $K\omega_0$. Value of K is_____.

PARAGRAPH FOR Q-7 & 8

Two point charges $+q_1$ & $-q_2$ are placed at A & B respectively (at large distance). An electric line of force emerges from q_1 making an angle $\alpha = 60°$ with line AB and terminates at $-q_2$ at angle 90°.

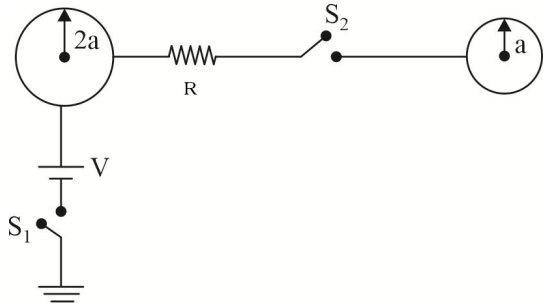


7. $\left|\frac{q_1}{q_2}\right|$ is _____.

8. The maximum value of angle α (in degree) at which a line emitted from q_1 terminates on charge q_2 is _____.

PARAGRAPH FOR Q-9 & 10

In the figure two neutral spherical conductors of radii 2a and a are separated by a large distance. Initially, switch S_1 is kept closed and S_2 is open. Now S_1 is opened and S_2 is closed at $t = 0$.



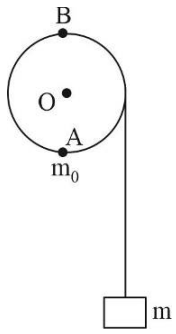
9. If the rate of fall in potential of the conductor of radius 2a as a function of time is $\frac{V}{(8\pi \in_0 a)R} e^{-\frac{Kt}{8\pi\epsilon_0 aR}}$ then K is _____.

10. If heat dissipated after S_2 is closed is $\frac{\alpha}{3}\pi\varepsilon_0 a V^2$ then α is _____.

SECTION-3

This section consists of 6 Multiple Correct Answers Type Questions. Each question has 4 choices (A), (B), (C) and (D), out of which **ONE OR MORE THAN ONE CHOICE** is correct.

11. A uniform disc shaped massless pulley is free to rotate about a fixed horizontal axis passing through O. A point mass m_0 is attached at A as shown in the figure. If the system is released from rest as shown in the figure, then choose the correct options:



(A) If $m_0 = \sqrt{2}m$, m_0 will fail to cross point B

(B) In no case m_0 can reach the top point with zero speed

(C) If $m_0 = \sqrt{2}m$, m_0 will reach point B with zero speed

(D) Whatever be the value of m_0 it will never reach point B

12. Curved surface of a very long hollow cylinder of radius R is uniformly charged with surface charge density σ. At the centre of this cylinder a small insulating ring of radius r mass m and charge q is coaxially placed. The arrangement is in gravity free space. If the cylinder is now made to rotate with angular velocity ω_0 about its axis, then choose the correct options:

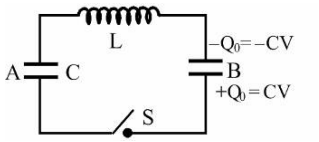
(A) The ring will acquire angular velocity $\omega = \frac{\mu_0 \sigma R q \omega_0}{2m}$

(B) The direction of angular velocity of the ring will be same as of cylinder

(C) The direction of angular velocity of the ring will be opposite to cylinder

(D) The ring will acquire angular velocity $\omega = \frac{2\mu_0 \sigma R q \omega_0}{m}$

13. An inductor and two capacitors are connected in the circuit as shown in the figure. Initially capacitor A has no charge and capacitor B has CV charge. Assume circuit has no resistance at all. At $t = 0$ switch S is closed, then choose the correct statements.



[Given $LC = \frac{2}{\pi^2 \times 10^4}\sec^2$ & $CV = 100\ mC$]

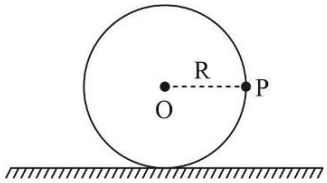
(A) when current in the circuit is maximum, charge on each capacitor is same

(B) when current in the circuit is maximum, charge on capacitor A is twice the charge on capacitor B

(C) $q = 50\ (1 + \cos 100\ \pi t)\ mC$, where q is the charge on capacitor B at time t

(D) $q = 50(1 - \cos 100\ \pi t)\ mC$, where q is the charge on capacitor B at time t

14. A point mass $m = 1$kg is attached to a point P on the circumference of a uniform ring of mass $M = 3$kg and radius $R = 2m$. The ring is placed on a horizontal surface and is released from rest with line OP in horizontal position. Friction is large enough to prevent sliding. Immediately after the ring is released, which of the following is(are) correct?



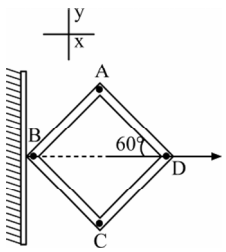
(A) Angular acceleration of the ring will be $\frac{5}{8} rad/s^2$

(B) Normal from horizontal surface will be $\frac{155}{4} N$

(C) Friction will be $5N$

(D) Friction will be $12N$

15. $ABCD$ is a wire frame of identical wires hinged at points A, B, C and D in which point D is given velocity v as shown in figure. Choose the correct statement(s).



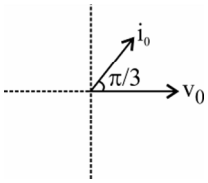
(A) Velocity of point A along x-axis will be $v/2$

(B) Speed of point A will be v

(C) Speed of point A along x-axis will be $2v$

(D) Velocity of point A will be equal to velocity of point C

16. For an LCR series circuit phasors of current i and applied voltage $v = v_0 \sin \omega t$ are shown in diagram at $t = 0$. Which of the following is(are) correct?



(A) At $t = \frac{\pi}{2\omega}$, instantaneous power supplied by source is negative

(B) From $t > 0$ to $t < \frac{2\pi}{3\omega}$ average power supplied by source is positive

(C) At $t = \frac{5\pi}{6\omega}$, instantaneous power supplied by source is negative

(D) If ω is increased slightly, angle between the two phasors decreases

SECTION - 4

This section contains **THREE (03)** Questions. The answer to each question is a **NON-NEGATIVE INTEGER**. For each question, enter the correct integer corresponding to the answer.

17. A hydrogen like atom (atomic number Z) is in a higher excited state of quantum number 6. The excited atom can make a transition to the first excited state by successively emitting two photons of energies 10.2 eV and 17.0 eV respectively. Determine the value of Z. (Ionization energy of H-atom is 13.6 eV.)

18. Water rises to a height h in a glass capillary tube lowered vertically into a container of depth $l (l >> h)$. When the capillary is out of water, the maximum length of water column that the capillary can support without leaking is mh, where m is _____.

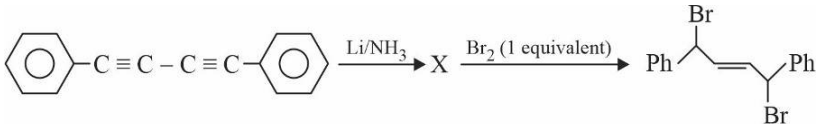
19. One end of a rod of length 20 cm is inserted in a furnace at 800 K. The sides of the rod are covered with an insulating material and the other end emits radiation like a black body. The temperature of this end is 750 K in the steady state. The temperature of the surrounding air is 300 K. Assume radiation to be the only important mode of energy transfer between the surrounding and the open end of the rod, Then the thermal conductivity of the rod is _____ $W m^{-1} k^{-1}$ (Stefan constant $\sigma = 6.0 \times 10^{-8} W / m^2 \cdot K^{-4}$. Take emissivity of the open end $e = 1$) (Round off to nearest integer)

SUBJECT I : CHEMISTRY — 60 MARKS

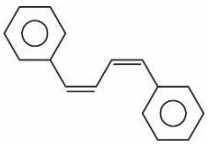
SECTION 1

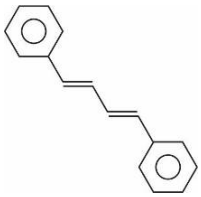
This section contains 04 Multiple Choice Questions. Each question has 4 choices (A), (B), (C) and (D), out of which ONLY ONE CHOICE is correct.

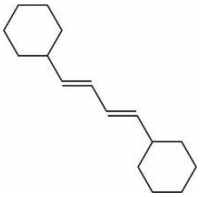
1.

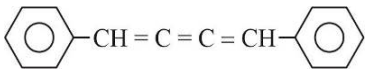


What will be structure of X?

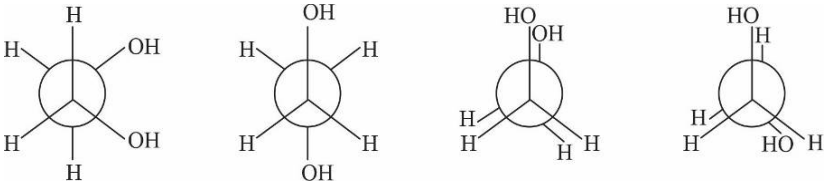
(A) 

(B) 

(C) 

(D) 

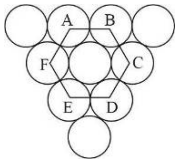
2. Which of the following is least and most stable conformer respectively as compared to its other conformers?



I. II. III. IV.

(A) I and II **(B)** III and II **(C)** III and I **(D)** IV and I

3. The percentage packing efficiency of the two-dimensional arrangement of spheres for plane ABCDEF shown below is :



(A) 90.64% **(B)** 74.05% **(C)** 68.02% **(D)** 78.54%

4. Which of the following statements is(are) true for $[Cu(NO_2)_6]^{4-}$ and $[Fe(H_2O)_6]^{3+}$?

I. Both are outer orbital complexes

II. Both are inner orbital complexes with magnetic moment equal to 1.73 B.M.

III. The former complex is paramagnetic with one unpaired electron while later one is paramagnetic with five unpaired electrons

IV. The former is outer orbital complex and later is inner orbital complexes respectively

(A) I only **(B)** II and III **(C)** I and III **(D)** IV only

SECTION-2

This Section contains **THREE (03) Paragraphs.** There are **TWO (02)** questions corresponding to each Paragraph. 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)

PARAGRAPH FOR Q-5 & 6

$$(A) \xrightarrow[250°C]{Al_2O_3} (B) \xrightarrow[\text{Demercuration}]{\text{Oxymercuration}} (C) \xrightarrow[150°C]{Al_2O_3} (B) \xrightarrow[\text{(ii) } H_2O_2,\ OH^-]{\text{(i) } B_2H_6} (A)$$

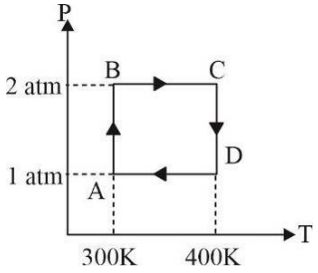
In the above reaction sequence (A) and (C) are isomers. Molecular formula of B is C_5H_{10}, which can also be obtained from the product of the reaction with CH_3CH_2MgBr and $(CH_3)_2CO$ and followed by acidification.

5. If the IUPAC name of A is. x-Methylbutan-y-ol. The value of $(x + y)$ is:

6. Number of β hydrogen atoms in the molecular structure of C is:

PARAGRAPH FOR Q-7 & 8

One mole of Helium gas undergoes a reversible cyclic process ABCDA as shown in the figure. Assuming gas to be ideal, answer the following questions



7. What is the value of 'q' (in calories) for the overall cyclic process : (take ln 2 = 0.7)

8. The value of ΔH for the process $A \rightarrow C$ is_____cal. (Take R = 2 Cal/mol K)

PARAGRAPH FOR Q-9 & 10

The pressure of two pure liquids A and B which forms an ideal solution are 400 mm Hg and 800 mm Hg respectively at temperature T. A liquid containing 3 : 1 molar composition of A and B is present in a cylinder closed by a piston so that the pressure can be varied.

The solution is slowly vaporized at temperature T by decreasing the applied pressure starting with a pressure of 760 mm Hg. A pressure gauge (in mm of Hg) is connected which gives the reading of pressure applied.

9. The minimum reading of pressure Gauge at which only liquid phase exists is _____.

10. The maximum reading of pressure Gauge at which only vapour phase exists is _____.

SECTION-3

This section consists of 6 Multiple Correct Answers Type Questions. Each question has 4 choices (A), (B), (C) and (D), out of which **ONE OR MORE THAN ONE CHOICE** is correct.

11. Select the correct statements out of the following :

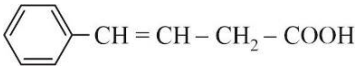
(A) $\beta - D(+)$ glucopyranose is more stable than $\alpha - D(+)$ glucopyranose

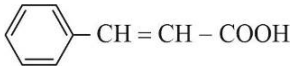
(B) Invert sugar is a laevorotatory

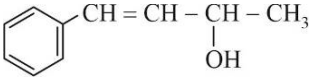
(C) Although fructose is a ketone but it gives positive Tollen's test

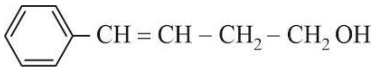
(D) Starch contains α-glycosidic linkage whereas cellulose contains β - glycosidic linkage

12. Compound 'P' $(C_{10}H_{12}O)$ evolves H_2 gas with Na metal. It reacts with Br_2 / CCl_4 to give 'Q' $(C_{10}H_{12}Br_2O)$. With I_2 / NaOH it forms iodoform and an acid 'R' $(C_9H_8O_2)$. 'P' has geometrical and optical isomers. The structures of 'P' and 'R' should be:

(A) 

(B) 

(C) 

(D) 

13. Which of the following are correct statements

(A) Spontaneous adsorption of gases on solid surface is an exothermic process as entropy decreases during adsorption

(B) Formation of micelles takes place when temperature is below Kraft Temperature (T_k) and concentration is above critical micelle concentration (CMC)

(C) A colloid of $Fe(OH)_3$ is prepared by adding a little excess [required to completely precipitate Fe^{3+} ions as $Fe(OH)_3$] of NaOH in $FeCl_3$ solution the particles of this sol will move towards cathode during electrophoresis

(D) According to Hardy-Schulze rule, the coagulation (flocculating) value of Fe^{3+} ion will be more than Ba^{2+} or Na^+

14. One mole of an ideal diatomic gas $(C_v = 5\ cal)$ was transformed from initial 25°C and 1 L to the state when temperature is 100°C and volume 10 L. Then for the process (R = 2 cal/mol-K) (take calories as unit of energy and kelvin as unit for temperature and ΔE is change in internal energy)

(A) $\Delta H = 525$

(B) $\Delta S = 5 \ln \frac{373}{298} + 2 \ln 10$

(C) $\Delta E = 525$

(D) ΔG of the process can not be calculated using given information.

15. Which of the following statements is/are true?

(A) In process of the precipitation of silver from leaching process, Zn acts as reducing agent

(B) In the process of roasting, the copper pyrites is converted into a mixture of Cu_2S & FeS which, in turn, are partially oxidised

(C) Limonite, haematite and magnesite are ores of iron

(D) Tin and lead both are extracted from their ores by carbon reduction

16. $KBr + MnO_2 + H_2SO_4\,(conc.) \longrightarrow KHSO_4 + MnSO_4 + H_2O + [X]$ (unbalanced equation)

(A) Reaction of X with Phenol gives white ppt.

(B) X with $AgNO_3$ solution gives a pale-yellow precipitate which is completely soluble in dilute ammonium hydroxide

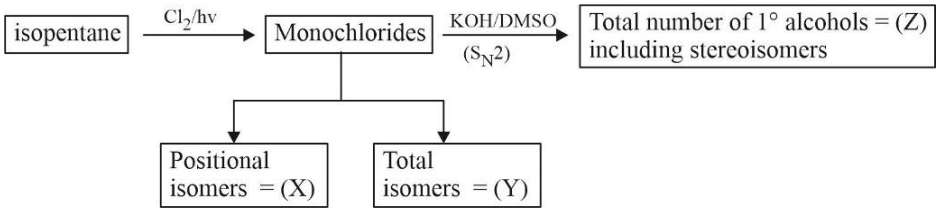
(C) X produces violet colour in organic layer in KI solution

(D) X is liberated when a mixture of KBr, $K_2Cr_2O_7$ and conc. H_2SO_4 is heated

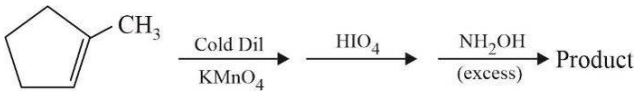
SECTION - 4

This section contains **THREE (03)** Questions. The answer to each question is a **NON-NEGATIVE INTEGER**. For each question, enter the correct integer corresponding to the answer.

17. Observe the following flow chart and write the sum of the number of X, Y, Z.



18.



Total no. of stereoisomers are formed in the product.

19. How many total isomers including structural isomers and stereoisomers are possible for the complex $[Rh(en)_2(NO_2)(SCN)]^+$?

SUBJECT I : MATHEMATICS 60 MARKS

SECTION 1

This section contains 04 Multiple Choice Questions. Each question has 4 choices (A), (B), (C) and (D), out of which ONLY ONE CHOICE is correct.

1. A(1,0) and B(0,1) are two fixed points on the circle $x^2 + y^2 = 1$. C is a variable point on this circle. As C moves, the locus of the orthocentre of the triangle ABC is

(A) $x^2 + y^2 - 2x - 2y + 1 = 0$ **(B)** $x^2 + y^2 - x - y = 0$

(C) $x^2 + y^2 = 4$ **(D)** $x^2 + y^2 + 2x - 2y + 1 = 0$

2. The area bounded by the curve $y = x^2 - 1$ & the straight line $x + y = 3$ is :

(A) $\frac{9}{2}$ **(B)** 4 **(C)** $\frac{7\sqrt{17}}{2}$ **(D)** $\frac{17\sqrt{17}}{6}$

3. Two cards are drawn one by one without replacement from a deck of 52 cards. The probability that the second card is higher in rank than the first card, is:
(Ranks in increasing order can be taken from Ace to King.)

(A) $\frac{1}{17}$ **(B)** $\frac{8}{17}$ **(C)** $\frac{16}{17}$ **(D)** $\frac{9}{17}$

4. Given, α, β respectively the fifth and the fourth non-real roots of unity, then the value of $(1+\alpha)(1+\beta)(1+\alpha^2)(1+\beta^2)(1+\beta^3)(1+\alpha^4)$ is:

(A) 0 **(B)** $(1+\alpha+\alpha^2)(1-\beta^2)$

(C) $(1+\alpha)(1+\beta+\beta^2)$ **(D)** 1

SECTION-2

This Section contains **THREE (03) Paragraphs.** There are **TWO (02)** questions corresponding to each Paragraph. 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)

PARAGRAPH FOR Q-5 & 6

A JEE aspirant estimates that she will be successful with an 80 percent chance if she studies 10 hours per day, with a 60 percent chance if she studies 7 hours per day and with a 40 percent chance if she studies 4 hours per day. She further believes that she will study 10 hours, 7 hours and 4 hours per day with probabilities 0.1, 0.2 and 0.7, respectively

5. The chance she will be successful, is _____.

6. Given that she is successful, the chance she studied for 4 hours, is _____.

PARAGRAPH FOR Q-7 & 8

The set of equations

$$x - y + 3z = 2$$
$$2x - y + z = 4$$
$$x - 2y + \alpha z = \beta \text{ has}$$

7. Unique solution for $\alpha \neq$

8. Infinite number of solutions for $\alpha + \beta =$

PARAGRAPH FOR Q-9 & 10

Consider a family of lines $(4a+3)x - (a+1)y - (2a+1) = 0$ where $a \in R$.

9. A member of this family with positive gradient making an angle of $\pi/4$ with the line $3x - 4y = 2$, is $y = mx + c$ then the value of $|m| + |c|$ is _____.

10. Minimum area of the triangle which a member of this family with negative gradient can make with the positive coordinate axes, is _____.

SECTION-3

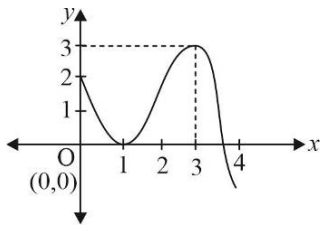
This section consists of 6 Multiple Correct Answers Type Questions. Each question has 4 choices (A), (B), (C) and (D), out of which **ONE OR MORE THAN ONE CHOICE** is correct.

11. Let $A = \begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{bmatrix}$, then:

(A) $A^2 - 4A - 5I_3 = 0$ **(B)** $A^{-1} = \frac{1}{5}(A - 4I_3)$

(C) A^3 is not invertible **(D)** A^2 is invertible

12. The diagram shows the graph of the derivative of a function $f(x)$ for $0 \le x \le 4$ with $f(0) = 0$. Which of the following could be correct statements for $y = f(x)$?



(A) Tangent line to $y = f(x)$ at $x = 0$ makes an angle of $\sec^{-1}\sqrt{5}$ with the x-axis

(B) f is strictly increasing in (0,3)

(C) $x = 1$ is both an inflection point as well as point of local extremum

(D) Number of critical points of $y = f(x)$ is two

13. If A & B are two events such that $P(B) \neq 1$, B^C denotes the event complementary to B, then:

(A) $P(A / B^C) = \frac{P(A) - P(A \cap B)}{1 - P(B)}$

(B) $P(A \cap B) \ge P(A) + P(B) - 1$

(C) $P(A) > < P(A / B)$ according as $P(A / B^C) > < P(A)$

(D) $P(A / B^C) + P(A^C / B^C) = 1$

14. If A and B are 3×3 matrices and $|A|\neq 0,$ then which of the following are true?

(A) $|AB|=0 \Rightarrow |B|=0$ **(B)** $|AB|=0 \Rightarrow B=0$

(C) $|A^{-1}|=|A|^{-1}$ **(D)** $|A+A|=2|A|$

15. For $x\in\left(0,\frac{\pi}{4}\right)$. Let $S_n=\sum_{r=1}^{2n}\sin(\sin^{-1}x^{3r-2}),\ C_n=\sum_{r=1}^{2n}\cos(\cos^{-1}x^{3r-1})$ & $T_n=\sum_{r=1}^{2n}\tan(\tan^{-1}x^{3r})$ where $n\in N$ & $n\geq 3$. Then:

(A) $S_n<C_n<T_n$ **(B)** $S_n>C_n>T_n$

(C) $\lim_{n\to\infty}(S_n+C_n+T_n)=\frac{x}{1-x}$ **(D)** $S_n=C_n+T_n$ *at* $x=2\sin\frac{\pi}{10}$

16. If $|z|=1$ and let $\omega=\frac{(1-z)^2}{1-z^2}, z\neq\pm 1$ then locus of ω is equivalent to:

(A) $|z-2-4i|=|z-2+4i|, z\neq 0$ **(B)** $|z-3+4i|=|z+3+4i|, z\neq 0$

(C) $|z-2|=|z+2|, z\neq 0$ **(D)** $||z-i|-|z+i||=2$

SECTION - 4

This section contains **THREE (03)** Questions. The answer to each question is a NON-NEGATIVE INTEGER. For each question, enter the correct integer corresponding to the answer.

17. Polynomial $P(x)$ contains only terms of odd degree. When $P(x)$ is divided by $(x-3),$ the remainder is 6. If $P(x)$ is divided by (x^2-9) then remainder is $g(x)$. The value of $g(2)$ is:

18. In ΔABC, if $\frac{\sin A}{c\sin B}+\frac{\sin B}{c}+\frac{\sin C}{b}=\frac{c}{ab}+\frac{b}{ac}+\frac{a}{bc}$, the value of angle A is $\frac{n\pi}{6}$, then the value of n is _____ (All symbols used have their usual meanings in a triangle)

19. Let $\overrightarrow{AB}=3\hat{i}-\hat{j},\ \overrightarrow{AC}=2\hat{i}+3\hat{j}$ & $\overrightarrow{DE}=4\hat{i}-2\hat{j}$. The area of the shaded region in the adjacent figure, is _____.