VMC Vidyamandir Classes SINCE 1986
IIT JEE | MEDICAL | FOUNDATION

CODE A

JEE Main-4 | JEE-2024

Date: 09/10/2023 **Maximum Marks: 300**

Timing: 4:00 PM to 7:00 PM **Duration : 3.0 Hours**

General Instructions

1. The test is of **3 hours** duration and the maximum marks is **300.**
2. The question paper consists of **3 Parts** (Part I: **Physics**, Part II: **Chemistry**, Part III: **Mathematics**). Each Part has **two** sections (Section 1 & Section 2).
3. **Section 1** contains **20 Multiple Choice Questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE CHOICE** is correct.
4. **Section 2 contains 10 Numerical Value Type Questions Out of which ONLY 5 (any) questions have to be attempted. You will NOT be allowed to attempt the sixth question. If you wish to attempt any other question apart from the five already attempted, then you will have to delete any one response from the five previously answered and then proceed to answer the new one.**
   The answer to each question should be **rounded off to the nearest integer**.
5. No candidate is allowed to carry any textual material, printed or written, bits of papers, pager, mobile phone, any electronic device, etc. inside the examination room/hall.
6. On completion of the test, the candidate must hand over the Answer Sheet to the **Invigilator** on duty in the Room/Hall. **However, the candidates are allowed to take away this Test Booklet with them**.

Marking Scheme

1. **Section – 1:** +4 for correct answer, –1 (negative marking) for incorrect answer, 0 for all other cases.
2. **Section – 2:** +4 for correct answer, –1 (negative marking) for incorrect answer, 0 for all other cases.

Syllabus:

Physics: EMI, AC Circuits, EM Waves, Magnetism and Matter

Chemistry : Organic Concepts, OCOC -1, II & III

Mathematics: IC-1, IC – 2, DC - 2, Statistics

Name of the Candidate (In CAPITALS) : _____

Roll Number : _____

OMR Bar Code Number : _____

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

PART I : PHYSICS	MARKS: 100

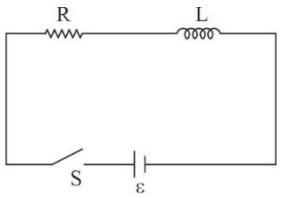
SECTION-1

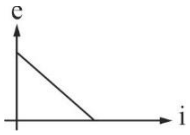
This section contains 20 Multiple Choice Questions. Each question has 4 choices (A), (B), (C) and (D), out of which ONLY ONE CHOICE is correct.

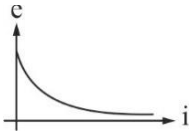
1. A magnet hung at 45° with magnetic meridian makes an angle of 60° with the horizontal. The actual value of the angle of dip is:

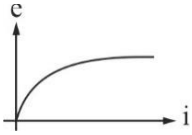
(A) $\tan^{-1}\left(\sqrt{\frac{3}{2}}\right)$ **(B)** $\tan^{-1}(\sqrt{6})$ **(C)** $\tan^{-1}\left(\sqrt{\frac{2}{3}}\right)$ **(D)** $\tan^{-1}\left(\sqrt{\frac{1}{2}}\right)$

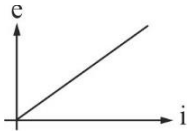
2. In an L-R circuit connected to a battery of constant e.m.f E, switch S is closed at time $t = 0$. If e denotes the induced e.m.f. across inductor and i the current in the circuit at any time t, then which of the following graphs shows the variation of e with i.



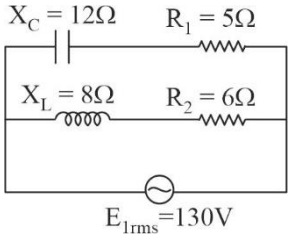
(A) 

(B) 

(C) 

(D) 

3. Power delivered by the ac source in the circuit shown (in Watts) is:



(A) 500 **(B)** 1014 **(C)** 1514 **(D)** 2013

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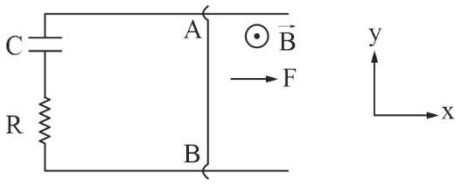
4. A conducting rod *AB* (length *l*) moves parallel to *x*-axis in the *x*-*y* plane. A uniform magnetic field *B* pointing normally out of the plane exists throughout the region. A force *F* acts perpendicular to the rod, so that the rod moves with uniform velocity *v*. The force *F* is given by (neglect resistance of all the connecting wires).



(A) $\frac{vB^2l^2}{R}e^{-t/RC}$ **(B)** $\frac{vB^2l^2}{R}$

(C) $\frac{vB^2l^2}{R}(1-e^{-t/RC})$ **(D)** $\frac{vB^2l^2}{R}(1-e^{-2t/RC})$

5. In an electromagnetic wave the electric field vector and magnetic field vector are given as $\vec{E} = E_0\hat{j}$ and $\vec{B} = B_0\hat{i}$ respectively. The direction of propagation of electromagnetic wave is along:

(A) $\hat{j}$ **(B)** $(-\hat{k})$ **(C)** $(\hat{k})$ **(D)** $(-\hat{j})$

6. Choose the wrong statement.

(A) The rms voltage across the inductor can be greater than the rms voltage of the source in an *LCR* circuit.

(B) In a circuit containing a capacitor and an *AC* source the current is zero at the instant the source voltage is maximum

(C) An *AC* source is connected to a capacitor. The rms current in the circuit gets increased if a dielectric slab is inserted into the capacitor

(D) At resonance of *LCR* series circuit with *AC* source, reading of voltmeter across all individual elements will be same

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7. Two bar magnets oscillate in a horizontal plane in earth's magnetic field with time periods of 3*s* and 4*s* respectively. If their moments of inertia are in the ratio of 3 : 2 then the ratio of their magnetic moments will be:

(A) 2 : 1 **(B)** 8 : 3 **(C)** 1 :3 **(D)** 27 : 16

8. For a plane electromagnetic wave, the magnetic field at a point *x* and time *t* is $\vec{B}(x,t)=\left[1.2\times10^{-7}\ \sin\left(0.5\times10^{3}x+1.5\times10^{11}t\right)k\right]T$. The instantaneous electric field $\vec{E}$ corresponding to $\vec{B}$ is : $\left(speed\ of\ light\ c=3\times10^{8}\ ms^{-1}\right)$

(A) $\vec{E}(x,\ t)=\left[36\sin\left(0.5\times10^{3}x+1.5\times10^{11}t\right)k\right]\frac{V}{m}$

(B) $\vec{E}(x,\ t)=\left[-36\sin\left(0.5\times10^{3}x+1.5\times10^{11}t\right)j\right]\frac{V}{m}$

(C) $\vec{E}(x,\ t)=\left[36\sin\left(1\times10^{3}x+1.5\times10^{11}t\right)\hat{i}\right]\frac{V}{m}$

(D) $\vec{E}(x,\ t)=\left[36\sin\left(1\times10^{3}x+0.5\times10^{11}t\right)j\right]\frac{V}{m}$

9. A small square loop of side $'a'$ and one turn is placed inside a larger square loop of side b and one turn $(b>>a)$. The two loops are coplanar with their centres coinciding. If *a* current *I* is passed in the square loop of side $'a'$, then the flux through the bigger loop is :

(A) $\frac{\mu_0}{4\pi}\frac{8\sqrt{2}}{b}I$ **(B)** $\frac{\mu_0}{4\pi}\frac{8\sqrt{2}}{a}I$ **(C)** $\frac{\mu_0}{4\pi}8\sqrt{2}\frac{b^2}{a}I$ **(D)** $\frac{\mu_0}{4\pi}8\sqrt{2}\frac{a^2}{b}I$

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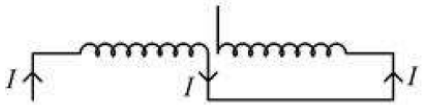
10. Two coils of self-inductance L_1 and L_2 are connected in series combination having mutual inductance of the coils as *M*. The equivalent inductance of the combination will be:

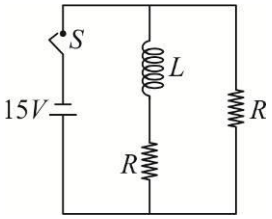


(A) $\frac{1}{L_1}+\frac{1}{L_2}+\frac{1}{M}$ **(B)** L_1+L_2+M **(C)** L_1+L_2+2M **(D)** L_1+L_2-2M

11. An alternating current is given by the equation $i = i_1 \sin \omega t + i_2$. The rms current will be :

(A) $\frac{1}{2}\left(i_1^2+i_2^2\right)^{1/2}$ **(B)** $\frac{1}{\sqrt{2}}\left(i_1+i_2\right)^2$ **(C)** $\left(\frac{i_1^2}{2}+i_2^2\right)^{1/2}$ **(D)** $\left(i_1^2+\frac{i_2^2}{2}\right)^{1/2}$

12. In the figure shown, a circuit contains two identical resistors with resistance $R = 5\ \Omega$ and an inductance with *L* = 2 *mH*. An ideal battery of 15 *V* is connected in the circuit. What will be the current through the battery long after the switch is closed?



(A) 6 *A* **(B)** 3 *A*

(C) 7.5 *A* **(D)** 5.5 *A*

13. Match List-I with List-II

	List-I		List-II
(a)	Gamma rays	**(i)**	Diagnostic tool in medicine
(b)	X-rays	**(ii)**	Destroys cancer cells
(c)	Microwave	**(iii)**	Communication, Radar
(d)	Radio wave	**(iv)**	Used in TV communication system

Choose the correct answer from the options given below:

(A) (a)-(iii), (b)-(ii), (c)-(i), (d)-(iv) **(B)** (a)-(ii), (b)-(i), (c)-(iii), (d)-(iv)

(C) (a)-(ii), (b)-(iv), (c)-(iii), (d)-(i) **(D)** (a)-(iii), (b)-(i), (c)-(ii), (d)-(iv)

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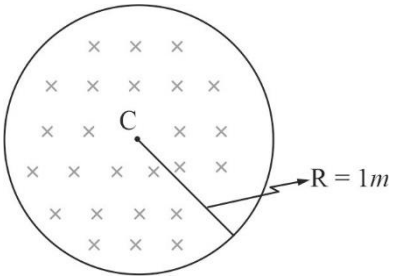
14. A transformer operating at primary voltage 8 kV and secondary voltage 80 V serves a load of 80 kW. Assuming the transformer to be ideal with purely resistive load and working on unity power factor, the ratio of number of loops in primary and secondary coils is:

(A) $100:1$ **(B)** $10:1$ **(C)** $1:100$ **(D)** $1:10$

15. The magnetic field of earth at the equator is approximately $6\times10^{-5}T$. The radius of earth is $6.4\times10^{6}\,m$. Then the dipole moment of the earth will be nearly of the order of :

(A) $1.5\times10^{23}Am^2$ **(B)** $1.5\times10^{20}Am^2$ **(C)** $2\times10^{23}Am^2$ **(D)** $2\times10^{20}Am^2$

16. A circular region of radius 1 *m* has magnetic field passing through it as shown in figure. The magnetic field varies with time as $B=2t^2T$, find the magnitude of induced electric field at a distance of 1/2 *m* from *C* at time *t* = 2sec.



(A) 1 N/C **(B)** 2 N/C **(C)** 3 N/C **(D)** 4 N/C

17. A paramagnetic material has $10^{28}\,atoms/m^3$. Its magnetic susceptibility at temperature 350 *K* is 2.5×10^{-4}. Its susceptibility at 250*K* is:

(A) 4×10^{-4} **(B)** 3×10^{-4} **(C)** 2.5×10^{-4} **(D)** 3.5×10^{-4}

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18. Which is the correct ascending order of wavelengths?

(A) $\lambda_{\text{visible}} < \lambda_{\text{infrared}} < \lambda_{\text{gamma-ray}} < \lambda_{\text{microwave}}$

(B) $\lambda_{\text{gamma-ray}} < \lambda_{\text{X-ray}} < \lambda_{\text{visible}} < \lambda_{\text{AM Radio}}$

(C) $\lambda_{\text{X-ray}} < \lambda_{\text{gamma-ray}} < \lambda_{\text{visible}} < \lambda_{\text{AM Radio}}$

(D) $\lambda_{\text{AM Radio}} < \lambda_{\text{visible}} < \lambda_{\text{gamma-ray}} < \lambda_{\text{X-ray}}$

19. Given below are two statements: one is labelled as **Assertion A** and the other is labelled as **Reason R**

Assertion A: Electromagnets are made of soft iron.

Reason R: Soft iron has high permeability and low retentivity.

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

(A) A is correct but R is not correct

(B) A is not correct but R is correct

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

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

20. In an oscillating *LC* circuit the maximum charge on the capacitor is *Q*. The charge on the capacitor when the energy in capacitor is twice the energy in inductor is:

(A) Q/2 **(B)** $\frac{\sqrt{2}}{\sqrt{3}}Q$ **(C)** $Q/\sqrt{2}$ **(D)** Q

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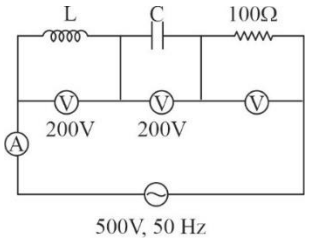
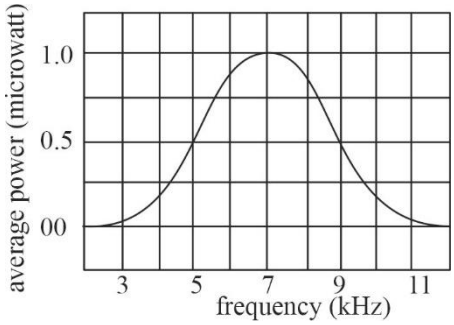
SECTION-2

Section 2 contains 10 Numerical Value Type Questions Out of which ONLY 5 (any) questions have to be attempted.
The answer to each question should be **rounded off to the nearest integer**.

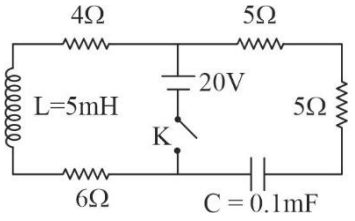
1. The ratio of readings of A.C. voltmeter across the resistance and A.C. ammeter in the circuit is *'n'* volt per ampere then *n* is equal to _____.



2. The plot given below is of the average power delivered to an LRC circuit versus frequency of the source. Resistance of circuit is 100Ω. Capacitive reactance of circuit at resonance (in Ω) is _____.



3. In the circuit shown, the key (K) is closed at $t = 0$. Current through the key at time $t = 10^{-3}\ln 2$ is p/2 Ampere. Then p = _____.



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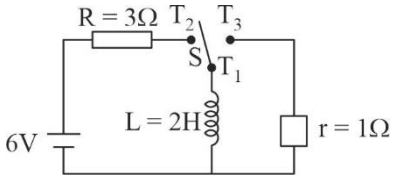
4. *AC* voltage $V(t)=10\sin\omega t$ of frequency 50 Hz is applied to a parallel plate capacitor. The separation between the plates is 8.85 mm and the area is $\frac{10}{\pi}\,m^2$. The amplitude of the oscillating displacement current for the applied *AC* voltage is $x\,\mu A$. Find *x*. $\left\{\varepsilon_0=8.85\times10^{-12}\,\frac{C^2}{Nm^2}\right\}$

5. Consider an electrical circuit containing a two way switch $'S'$. Initially *S* is open and then T_1 is connected to T_2. As the current in $R=3\Omega$ attains a maximum value of steady state level, T_1 is disconnected from T_2 and immediately connected to T_3. Find the total energy loss (in J) in 1Ω resistor.



6. A square coil of side 8.0 cm and 20 turns is rotated about its vertical axis with an angular speed of 50 rad s^{-1} in a uniform horizontal magnetic field of $3.0\times10^{-2}T$. The maximum emf induced the coil will be _____ $\times10^{-3}$ volt (rounded off to the nearest integer).

7. Magnetic flux (in weber) in a closed circuit of resistance 2Ω varies with time $t(s)$ as $\phi=8t^2-10t+5$. The magnitude of the induced current at $t=0.5$ s will be _____ A.

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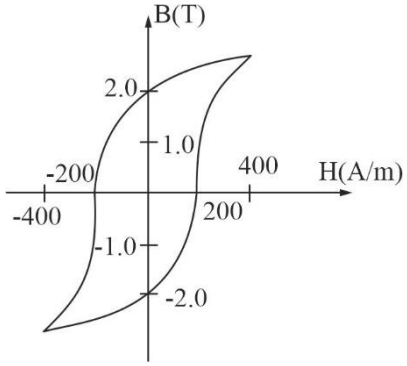
8. The B-H curve for a ferromagnet is shown in the figure. The ferromagnet is placed inside a long solenoid with 100 turns/m. The current that should be passed in the solenoid to demagnetize the ferromagnet completely is _____ A.



9. The electromagnetic waves travel in a medium at a speed of $1.5\times10^{8} m/s$. The relative permeability of the medium is 1.0. The relative permittivity of the medium will be_____.

10. A direct current of 4 A and an alternating current of peak value 4 A flow through resistance of 3Ω and 2Ω respectively. The ratio of heat produced in the two resistances in same interval of long period of time will be *x* : 1. Find *x*.

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PART II : CHEMISTRY	MARKS: 100

SECTION-1

This section contains 20 Multiple Choice Questions. Each question has 4 choices (A), (B), (C) and (D), out of which ONLY ONE CHOICE is correct.

1. Which of following statement is correct?

(A) Ethanol is known as Wood Spirit

(B) Sugar in molasses is converted to glucose and fructose in presence of enzyme, Zymase

(C) Methanol is used as solvent in paints

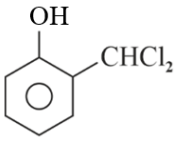
(D) All of above

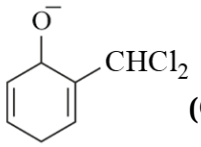
2. Which of the following is correct IUPAC name of Phenetole?

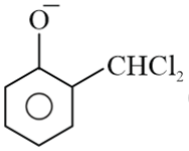
(A) Methoxy Benzene **(B)** Ethoxy Benzene

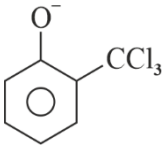
(C) Benzene-1, 2-diol **(D)** Benzene-1, 3-diol

3. Which intermediate is formed on reaction of Phenol with $CHCl_3$/KOH.

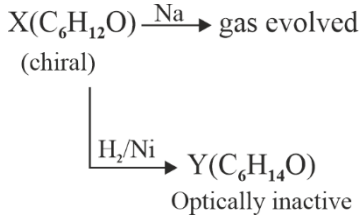
(A) 

(B) 

(C) 

(D) 

4. Consider the following reaction:



(A) Only 'X' gives yellow solid with $NaOH/I_2$.

(B) Both X and 'Y' form immediate turbidity with HCl in the presence of anh. $ZnCl_2$.

(C) Both 'X' and 'Y' decolourises the colour of acidic $KMnO_4$ solution.

(D) Dehydrogenation takes place when 'Y' is heated with Cu at 300°C.

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5. $CH_3-CH=CH-CH_2CH_2CN \xrightarrow[2.H_2O]{1.\ AlH(isoBu)_2} X$

(A) n-hexane

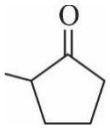
(B) $CH_3-CH_2-CH_2-CH_2CH_2CHO$

(C) $CH_3-CH=CH-CH_2-CH_2-CHO$

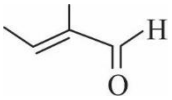
(D) $CH_3-\overset{\overset{O}{\|}}{C}-CH_2-CH_2-CH_2-COOH$

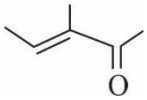
6. Identify X in the following reaction:

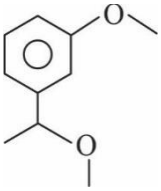
$$X \xrightarrow[H_2O]{NaOCl} CH_3-CH=\overset{CH_3}{\overset{|}{C}}-\overset{O}{\overset{\|}{C}}-OH$$

(A) 

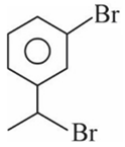
(B) 

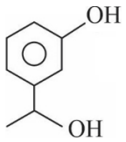
(C) 

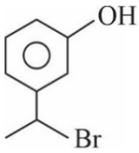
(D) 

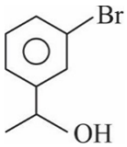
7.  $\xrightarrow[HBr,\ \Delta]{Conc.}$ P

Identify P:

(A) 

(B) 

(C) 

(D) 

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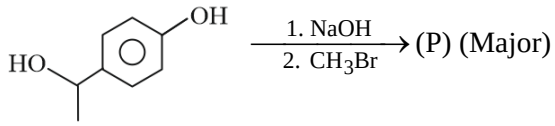
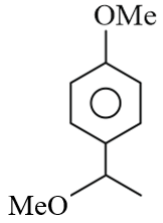
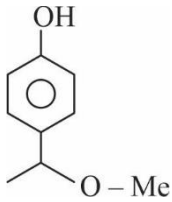
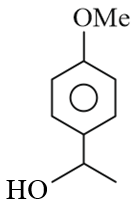
8. 

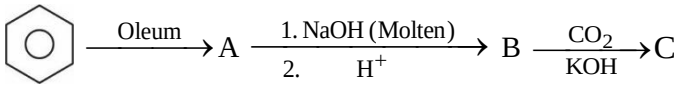
Identify major product (P) in above reaction.

(A) 

(B) 

(C) 

(D) 

9. 

Product C is:

(A) Salicylic acid **(B)** Phthalic acid **(C)** Salicaldehyde **(D)** Acetyl Salicyclic acid

10. **Assertion:** C – O – C bond angle in dimethyl ether is less than 109°-28'.

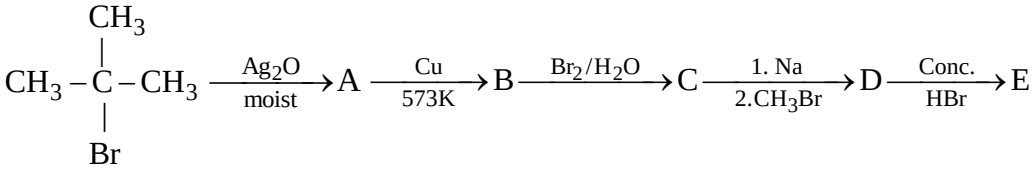
Reason: According to VSEPR theory, $\ell p - \ell p$ repulsion is more than $\ell p - bp$ repulsion.

(A) Both Assertion and Reason are correct and reason is correct explanation of Assertion.

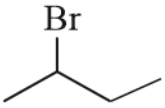
(B) Both Assertion and Reason are correct and reason is not correct explanation of Assertion.

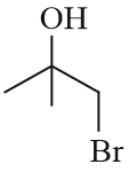
(C) Assertion is correct and reason is wrong

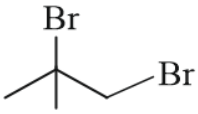
(D) Assertion is wrong and reason is correct.

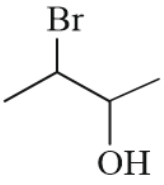
11. 

Product E is:

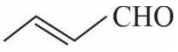
(A) 

(B) 

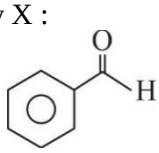
(C) 

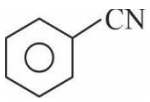
(D) 

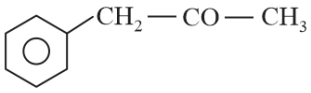
SPACE FOR ROUGH WORK

12. $X \xrightarrow[2.\ H_2O]{1.\ AlH(isoBu)_2} A \xrightarrow[dil\ NaOH]{CH_3CHO} Ph$ 

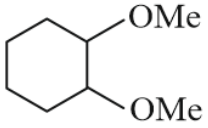
Identify X :

(A) 

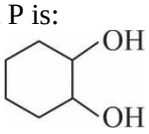
(B) 

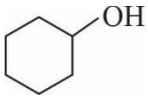
(C) 

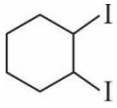
(D) Both A & B

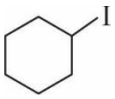
13.  $\xrightarrow[HI\ excess]{conc.}$ P

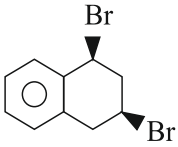
Product P is:

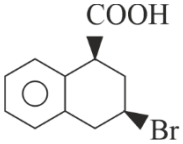
(A) 

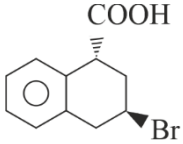
(B) 

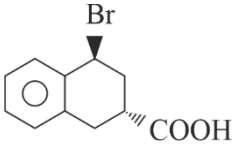
(C) 

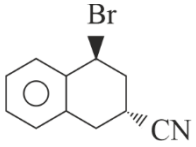
(D) 

14.  $\xrightarrow[2.\ H_3O^+]{1.\ 1eq\ KCN}$ P. Product P is:

(A) 

(B) 

(C) 

(D) 

15. Which of following order is correct?

(a) $C_6H_5\ CH(C_6H_5)\ Br > (C_6H_5)\ CH(CH_3)Br$: S_N1

(b) $C_6H_5\ CH(C_6H_5)\ Br > (C_6H_5)\ CH(CH_3)Br$: S_N2

(c) $C_6H_5\ CH(C_6H_5)\ Br < (C_6H_5)\ CH(CH_3)Br$: S_N1

(d) $C_6H_5\ CH(C_6H_5)\ Br < (C_6H_5)\ CH(CH_3)Br$: S_N2

(A) a, b **(B)** a, d **(C)** b, c **(D)** c, d

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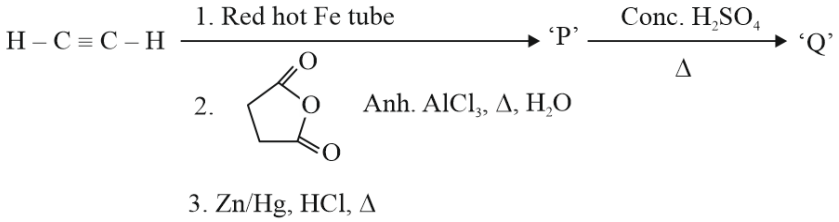
16. Choose the correct option for the following reaction sequence:



(I) Q gives 2, 4 DNP Test

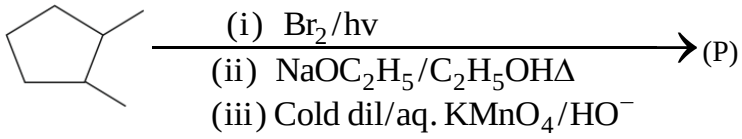
(II) P undergoes intramolecular electrophilic substitution reaction

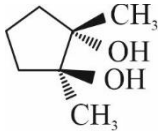
(III) Q gives iodoform reaction

The correct option is:

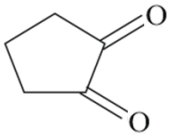
(A) I, II, III **(B)** I, II **(C)** I **(D)** I, III

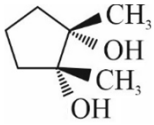
17. Choose the correct option for the following reaction sequence:



(A) The compound 'P' is 

(B) Total 'P' products formed are two.

(C) Compound 'P' on oxidation gives 

(D) Compound 'P' is 

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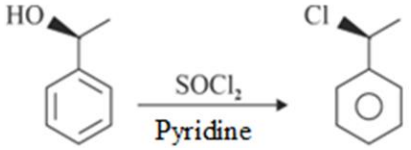
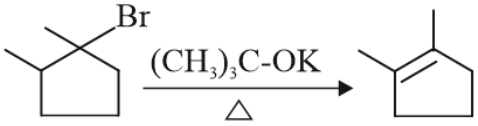
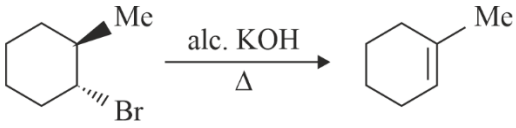
18. Which of the following reaction is incorrect?

(I) 

(II) 

(III) 

(IV) $CH_3-O-CH_2CH_3 \xrightarrow{\text{Conc. HCl}} CH_3Cl + CH_3CH_2OH$

Choose the correct option.

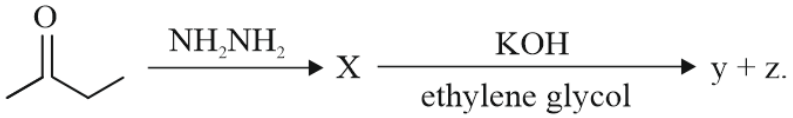
(A) I, II, III, IV **(B)** I, IV **(C)** I, II **(D)** Only I

19. Match with Column-I and Column-II.

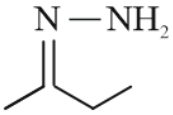
	Column-I		**Column-II**
(I)	Formaldehyde	**(P)**	Nylon-6,6
(II)	Acetaldehyde	**(Q)**	Bakelite
(III)	Benzaldehyde	**(R)**	Perfumery
(IV)	Hexanedioic acid	**(S)**	Drugs

Choose the correct option.

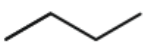
(A)	I → S	II → R	III → P	IV → Q
(B)	I → Q	II → S	III → R	IV → P
(C)	I → S	II → Q	III → R	IV → P
(D)	I → Q	II → S	III → P	IV → Q

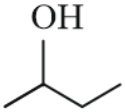
20. 

y and z are respectively.

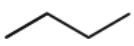
(A) 

and H_2O

(B)  and N_2

(C) 

and NH_3

(D)  and H_2O

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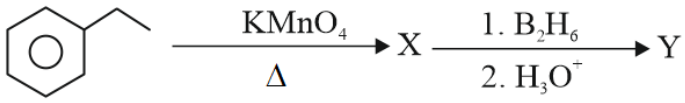
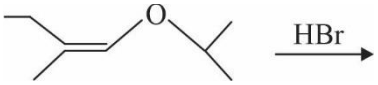
SECTION-2

Section 2 contains 10 Numerical Value Type Questions Out of which ONLY 5 (any) questions have to be attempted.
The answer to each question should be **rounded off to the nearest integer**.

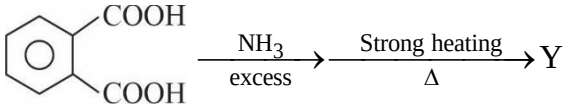
1. 

Maximum number of atoms present in one plane in product (Y) is _____.

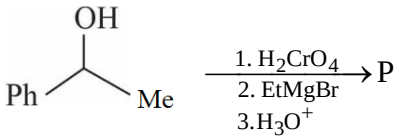
2. In sodalime decarboxylation of RCOONa, NaOH and CaO are used in ratio of x : y.
Sum of x + y is _____.

3. 

Total number of optically Active compounds obtained in above reaction is _____.

4. 

Degree of unsaturation of Y is _____.

5. 

The number of optical isomers of P is _____.

SPACE FOR ROUGH WORK

6. Number of compounds given below which contain CHO group are equal to _____

(a) Aspirin (b) Picric acid

(c) Adipic acid (d) Salicylaldehyde

(e) Phthalic acid (f) Acrolein (g) Cinnamaldehyde

7. Number of sp^2 hybridized carbon in Mesityl oxide is _____.

8. Total number of monohalogenated products formed in the following reaction excluding stereoisomers is/are:

$$\underset{\substack{\text{Smallest Optically}\\\text{Active Alkene}}}{P} \xrightarrow[(2)\,Cl_2/\Delta]{(1)\,H_2/Ni}$$

9. $$o-\text{xylene} \xrightarrow[\Delta]{\text{alk. } KMnO_4} A \xrightarrow{\Delta} B \xrightarrow[H_2SO_4]{\text{Phenol}} C$$

Find the degree of unsaturation in C.

10. How many of the following reacts with both Benzaldehyde and Acetone?

Hydrazine, Fehling's solution, Grignard – Reagent, Tollen's Reagent, 2-4 DNP, $NaOH / I_2$

SPACE FOR ROUGH WORK

PART III : MATHEMATICS	MARKS: 100

SECTION-1

This section contains 20 Multiple Choice Questions. Each question has 4 choices (A), (B), (C) and (D), out of which ONLY ONE CHOICE is correct.

1. The difference between the maximum and minimum value of the function $f(x)=3\sin^4 x-\cos^6 x$ is :

(A) $\frac{3}{2}$ **(B)** $\frac{5}{2}$ **(C)** 3 **(D)** 4

2. A function $y=f(x)$ has a second order derivative $f''(x)=6(x-1)$. If its graph passes through the point (2, 1) and at that point the tangent to the graph is $y=3x-5$, then the function is :

(A) $(x-1)^2$ **(B)** $(x-1)^3$ **(C)** $(x+1)^3$ **(D)** $(x+1)^2$

3. If the subnormal at any point on the curve $y=3^{1-k}\cdot x^k$ is of constant length then *k* equals to :

(A) $\frac{1}{2}$ **(B)** 1 **(C)** 2 **(D)** 0

4. The value of the definite integral $\int\limits_{-(\pi/2)}^{\pi/2}\frac{\cos^2 x}{1+5^x}$ equal to :

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

5. $\int\frac{8x^{43}+13x^{38}}{(x^{13}+x^5+1)^4}dx=$

(A) $\frac{x^{39}}{3(x^{13}+x^5+1)^3}+C$ **(B)** $\frac{x^{39}}{(x^{13}+x^5+1)^3}+C$

(C) $\frac{x^{39}}{5(x^{13}+x^5+1)^5}+C$ **(D)** None of these

SPACE FOR ROUGH WORK

6. If $\int_0^1 e^{-x^2}dx = a$, then $\int_0^1 x^2e^{-x^2}dx$ is equal to :

(A) $\frac{1}{2e}(ea-1)$ **(B)** $\frac{1}{2e}(ea+1)$ **(C)** $\frac{1}{e}(ea-1)$ **(D)** $\frac{1}{e}(ea+1)$

7. Let $f(x)=\begin{cases}a-3x & ; \quad -2\le x<0\\ 4x+3 & ; \quad 0\le x<1\end{cases}$; if $f(x)$ has smallest value at $x=0$, then range of *a*, is:

(A) $(-\infty,3)$ **(B)** $(-\infty,3]$ **(C)** $(3,\infty)$ **(D)** $[3,\infty)$

8. Let $f(x)=\begin{cases}1+\sin x, & x<0\\ x^2-x+1, & x\ge 0\end{cases}$, then:

(A) *f* has a local maximum at $x=0$ **(B)** *f* has a local minimum at $x=0$

(C) *f* is increasing everywhere **(D)** *f* is decreasing everywhere

9. $I=\int \frac{dx}{\sqrt[4]{(x-1)^3(x+2)^5}} = k\sqrt[4]{\frac{x-1}{x+2}}+C$, then '*k*' is equal to:

(A) $\frac{1}{3}$ **(B)** $\frac{2}{3}$ **(C)** $\frac{3}{4}$ **(D)** $\frac{4}{3}$

10. The value of : $\lim\limits_{n\to\infty}\left(\frac{1}{\sqrt{n}\sqrt{n+1}}+\frac{1}{\sqrt{n}\sqrt{n+2}}+\frac{1}{\sqrt{n}\sqrt{n+3}}+....+\frac{1}{\sqrt{n}\sqrt{2n}}\right)$ is:

(A) $\sqrt{2}-1$ **(B)** $2(\sqrt{2}-1)$ **(C)** $\sqrt{2}+1$ **(D)** $2(\sqrt{2}+1)$

SPACE FOR ROUGH WORK

11. The minimum value of the function $f(x)=\int_0^2 e^{|x-t|}dt$ is:

(A) 2 **(B)** $2(e-1)$ **(C)** $2e-1$ **(D)** $e(e-1)$

12. The ages of 40 students in a class are given below:

Age (in years)	12	13	14	15	16	17
Number of students	6	8	5	7	9	5

Find the mean age (years) of the class.

(A) 12 **(B)** 13 **(C)** 14.5 **(D)** 16

13. If $I_1=\int_0^1 \frac{1+x^8}{1+x^4}dx$ and $I_2=\int_0^1 \frac{1+x^9}{1+x^3}dx$, then:

(A) $I_1>1, I_2<1$ **(B)** $I_1<1,\ I_2>1$

(C) $1<I_1<I_2$ **(D)** $I_2<I_1<1$

14. The *x* co-ordinate of the point on the curve $y=\sqrt{x}$ which is closest to the point (2, 1) is:

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

15. The range of the function $f(\theta)=\frac{\sin\theta}{\theta}+\frac{\theta}{\tan\theta}, \theta\in\left(0,\frac{\pi}{2}\right)$ is equal to :

(A) $(0, \infty)$ **(B)** $\left(\frac{1}{\pi},2\right)$ **(C)** $(2,\infty)$ **(D)** $\left(\frac{2}{\pi},2\right)$

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16. $\int_{-20\pi}^{20\pi} |\sin x|[\sin x]\,dx =$ [where [ ] is step function]

(A) –40 **(B)** 40 **(C)** 20 **(D)** –20

17. A student obtained the mean and standard deviation of 100 observations as 40 and 5.1 respectively. It was later found that he had wrongly copied down an observation as 50 instead of 40. The correct mean and standard deviation are:

(A) 39.9, 6 **(B)** 36.4, 5 **(C)** 39.9, 5 **(D)** 39, 5

18. The mean deviation of the numbers 3, 4, 5, 6, 7 is:

(A) 0 **(B)** 1.2 **(C)** 5 **(D)** 25

19. The value of $\lim\limits_{n\to\infty} \frac{1}{\sqrt{n}}\left(1+\frac{1}{\sqrt{2}}+\frac{1}{\sqrt{3}}+\ldots\frac{1}{\sqrt{n}}\right)$ is:

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

20. $\int_0^1 \left(\sqrt[4]{1-x^7}-\sqrt[7]{1-x^4}\right)dx$ is equal to:

(A) $\frac{1}{2}$ **(B)** 1 **(C)** 0 **(D)** 2

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SECTION-2

Section 2 contains 10 Numerical Value Type Questions Out of which ONLY 5 (any) questions have to be attempted.
The answer to each question should be **rounded off to the nearest integer**.

1. If $f(x)=\dfrac{(x-1)(x-2)}{(x-3)(x-4)}$, then number of local extremas for $g(x)$, where $g(x)=f(|x|)$ is _____.

2. Let $y=\{x\}^{[x]}$ then the value of $6\int_0^3 y\,dx$ equals to _____.
(where {.} and [.] denote fractional part and greatest integer function respectively)

3. The value of the definite integral $\int_3^7 \dfrac{\cos x^2}{\cos x^2+\cos(10-x)^2}\,dx$ is _____.

4. For $a>0$, if $I=\int\sqrt{\dfrac{x}{a^3-x^3}}\,dx=A\sin^{-1}\left(\dfrac{x^{3/2}}{B}\right)+C$, where C is any arbitrary constant, then 3A = _____.

5. If $\int_0^1\left(x^{21}+x^{14}+x^7\right)\left(2x^{14}+3x^7+6\right)^{1/7}dx=\dfrac{1}{l}(11)^{m/n}$ were $l,m,n\in N,m$ and n are coprime then $l+m+n$ is equal to _____.

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6. Let A be the area bounded by the curve $y = x|x-3|$, the x-axis and the ordinates $x = -1$ *and* $x = 2$. Then 12A is equal to_____.

7. A polynomial function $P(x)$ of degree 5 with leading coefficient one, increases in the interval $(-\infty,1)$ *and* $(3,\infty)$ and decreases in the interval $(1,3)$. Given that $P(0) = 4$ *and* $P'(2) = 0$. Then the value $P'(6)$ is _____.

8. The value of $\int_{-5}^{5} f(x)dx$, where $f(x) =$ minimum of $(\{x+1\},\{x-1\}), \forall x \in R$ and $\{.\}$ denotes fractional part of *x*, is _____.

9. Area bounded by the curves $y = \left[\frac{x^2}{64} + 2\right]$, $y = x - 1$ and $x = 0$ above the x-axis, is _____. (where [.] denotes the G.I.F)

10. The value of the integral $\int_{-2}^{2} \frac{|x^3 + x|}{\left(e^{x|x|} + 1\right)} dx$ is equal to _____. (where |*x*| : modulus of *x*)

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