VMC Vidyamandir Classes SINCE 1986
IIT JEE | MEDICAL | FOUNDATION

CODE A

JEE Main Home Practice Test - 5 | JEE - 2025

Date: 9/01/2024 **Maximum Marks: 300**

Timing: 10:00 AM to 1:00 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: Full Syllabus
Chemistry: Full Syllabus
Mathematics: Full Syllabus

Name of the Candidate (In CAPITALS) : _____

Roll Number : _____

OMR Bar Code Number : _____

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

PART - I : PHYSICS 100 MARKS

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. In a series LCR resonance circuit, if we change the resistance only, from higher to lower value:

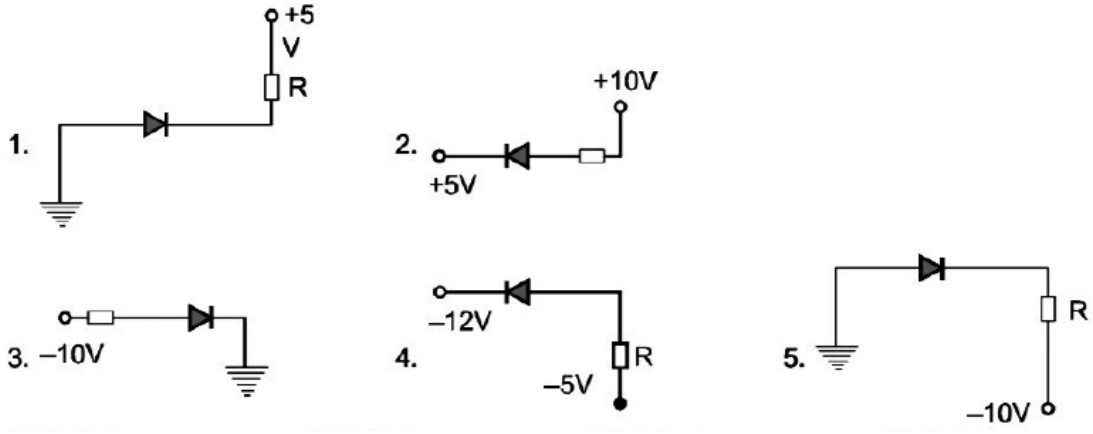
(A) The resonance frequency will decrease

(B) The quality factor will decrease

(C) The quality factor and the resonance frequency will remain constant

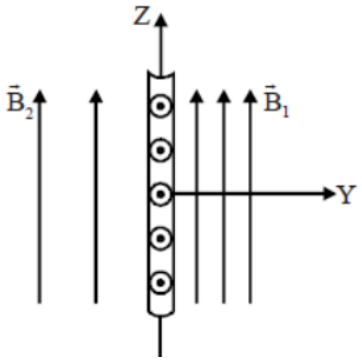
(D) The bandwidth of the resonance circuit will decrease

2. In the given figure, which of the diodes are forward biased?



(A) 1, 2, 3 **(B)** 2, 4, 5 **(C)** 1, 3, 4 **(D)** 2, 3, 4

3. Figure shows a thin metal sheet in the plane $y = 0$, for which the current of constant density flows in the positive x-direction. It is placed in a constant homogeneous magnetic field of value $= (0, 0, B_0)$. As a result of superposition of magnetic fields in region $y > 0$, the net magnetic field is $B_1 = (0, 0, B_1)$ and in $y < 0$ is $B_2 = (0, 0, B_2)$ where $B_1 > B_2$. Specify the correct statement:



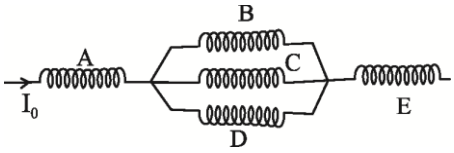
(A) $B_0 = \frac{(B_1 - B_2)}{2}$ **(B)** $B_0 = \frac{(B_1 + B_2)}{2}$ **(C)** $B_0 = B_1 + B_2$ **(D)** $B_0 = B_1 - B_2$

Space for Rought Work

4. An AC source rated 440 V 50 Hz is connected to a resistor. The time taken by the current to change from its maximum to the rms value is:

(A) 0.25 ms **(B)** 25 ms **(C)** 2.5 ms **(D)** 2.5 s

5. Five identical long solenoids *A, B, C, D* and *E* are connected to each other as shown in the figure. If the magnetic field at the centre of *A* is 3*T*, the field at the centre of *C* would be: (Assume that the magnetic field is confined within the volume of the respective solenoid.)



(A) 6*T* **(B)** 12*T* **(C)** 1*T* **(D)** 9*T*

6. A plane electromagnetic wave of frequency 200 MH is travelling in vacuum along the *x*-direction. At a particular point in space and time, $\vec{B} = 3.0 \times 10^{-8} \hat{k} T$.

(where $\hat{k}$ is the unit vector along the *z*-direction). What is $\vec{E}$ at this point? (speed of light $c = 3 \times 10^8 \, m/s$).

(A) $0.9\, j \frac{V}{m}$ **(B)** $0.9 k \frac{V}{m}$ **(C)** $9.0\, j \frac{V}{m}$ **(D)** $0.6 k \frac{V}{m}$

7. A particle is travelling 16 times as fast as an electron. Assuming the ratio of the de-Broglie wavelength of the particle to that of the electron is 1:2, the mass of the particle is:

(A) $\frac{1}{16}$ times of mass of e^- **(B)** $\frac{1}{6}$ times of mass of e^-

(C) $\frac{1}{8}$ times of mass of e^- **(D)** 8 times the mass of e^-

8. At ordinary temperature the molecules of an ideal gas have only translational and rotational energy. At high temperature, they may also have vibrational energy. As a result of this, at high temperature:

(A) $C_V < \frac{3R}{2}$ for monoatomic gas **(B)** $C_V > \frac{3R}{2}$ for monoatomic gas

(C) $C_V < \frac{5R}{2}$ for Diatomic gas **(D)** $C_V > \frac{5R}{2}$ for Diatomic gas

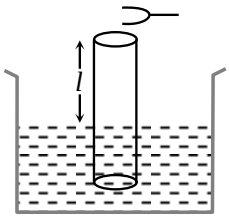
Space for Rought Work

9. Your friend is having an eyesight problem, she is not able to see clearly a distant uniform window mesh and it appear to her as non-uniform and distorted. The doctor diagnosed the problem as:

(A) Myopia and hypermetropia **(B)** Astigmatism

(C) Myopia with astigmatism **(D)** Presbyopia with astigmatism

10. A tuning fork of known frequency is held at the open end of a long tube, which is dipped into water as shown. The tuning fork of frequency 165 Hz resonates with air column, when air column is vibrating in 1st and 3rd harmonic with air column lengths l_1 = (50 $\pm$ 0.5) cm and l_2 = (150 $\pm$ 0.1) cm respectively. The speed of sound in air column is:



(A) (320 $\pm$ 1.98) m/s **(B)** (330 $\pm$ 1.98) m/s

(C) (320 $\pm$ 0.99) m/s **(D)** (330 $\pm$ 0.99) m/s

11. An oil drop of radius 2 mm with a density of 3 $g\,cm^{-3}$ is held stationary under a constant electric field $3.55\times10^{5}\,V\,m^{-1}$ in Millikan's oil drop experiment. What will be its acceleration if the $\vec{E}$ is reversed?

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

12. The time period of a satellite in a circular orbit of radius *R* is *T*. The period of another satellite in a circular orbit of radius 9 *R* is:

(A) $3T$ **(B)** $9T$ **(C)** $8\,T$ **(D)** $12T$

13. A loop of flexible wire of irregular shape carrying current is placed in an external magnetic field. Identify the effect of the field on the wire:

(A) Loop assumes a circular shape with its plane parallel to field

(B) Shape of the loop remains unchanged

(C) Wire gets stretched to become straight

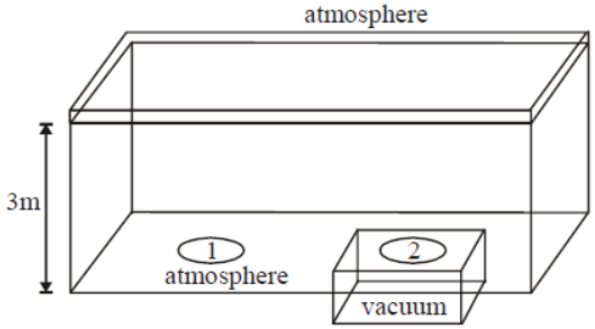
(D) Loop assumes circular shape with its plane normal to the field

Space for Rought Work

14. In Young' double –slit arrangement, slits are separated by a gap of 1.0 mm and the screen is placed at a distance of 1 m from them. The distance between the first and the third bright fringe formed when the slits are illuminated by monochromtic light of 5890 Å is:

(A) $1178\times10^{-6}m$ **(B)** $1178\times10^{-9}m$ **(C)** $5890\times10^{-7}m$ **(D)** $1178\times10^{-12}m$

15. Two identical discs sit at the bottom of a 3m pool of water whose surface is exposed to atmospheric pressure. The first disc acts as a plug to seal the drain as shown. The second disc covers a container containing nearly a perfect vacuum. If each disc has an area of $1m^2$, what is the approximate difference in the force necessary to open the discs ? (Note : 1atm = 101,300 Pa)

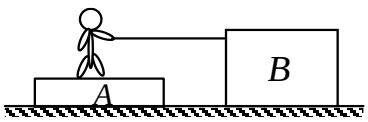


(A) There is no difference **(B)** 3000 N
(C) 101,300 N **(D)** 101,3000 N

16. A body of mass m accelerates uniformly from rest to v_1 in time t_1. As a function of time t, the instantaneous power delivered to the body is:

(A) $\frac{mv_1t}{t_1}$ **(B)** $\frac{mv_1^2t}{t_1}$ **(C)** $\frac{mv_1t^2}{t_1}$ **(D)** $\frac{mv_1^2t^2}{t_1^2}$

17. In adjacent figure, a boy on a horizontal platform *A*, kept on a smooth horizontal surface, holds a rope attached to a box *B*. Boy pulls the rope with a constant force of 50 N. The co-efficient of friction between boy and platform is 0.5. (Mass of boy = 80 kg, mass of platform 120kg, mass of box = 100 kg)



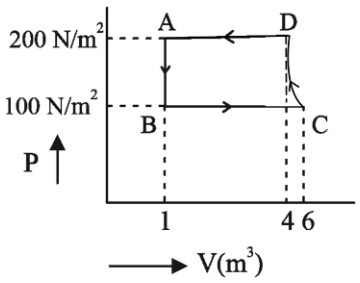
(A) Velocity of platform relative to box after 4 s is 3 m/s
(B) Velocity of boy relative to platform after 4 s is 2 m/s
(C) Friction force between boy and platform is 40 N
(D) Friction force between boy and platform is 50 N

Space for Rought Work

18. Imagine that the electron in a hydrogen atom is replaced by a muon (μ). The mass of a muon particle is n times that of an electron and the charge is equal to the charge of an electron. The ionization potential of this hydrogen atom will be:

(A) 27.2 neV **(B)** 13.6 neV **(C)** 331.2 neV **(D)** 416.2 neV

19. The P-V diagram of diatomic ideal gas system going under cyclic process is shown in the figure. The work done during the adiabatic process *CD* is (use $\gamma = 1.4$).



(A) 200 J

(B) $-500\,\text{J}$

(C) $-400\,J$

(D) $400\,J$

20. A particle is thrown with a speed of 12 m/s at an angle 60° with the horizontal. The time interval between the moments when its speed is 10 m/s is: (g = 10 m/s^2)

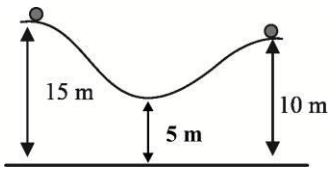
(A) 1.0 s **(B)** 1.2 s **(C)** 1.4 s **(D)** 1.6 s

Space for Rought Work

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**.

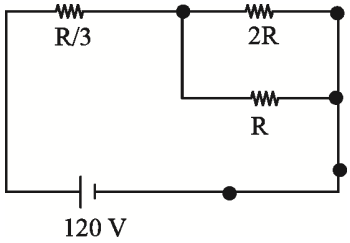
1. As shown in the figure, a particle of mass 10 kg is placed at point *A*. When the particle is slightly displaced to its right, it starts moving and reaches point *B*. The speed of the particle at *B* is _____ m/s. (Take $g = 10\,m/s^2$).



2. A uniform rod of length $\ell = 1\,\text{m}$ is free to move and rotate in gravity-free space. When an impulse is given to one end of the rod, perpendicular to its length, its centre of mass moves with velocity v = 1 m/s. What will be its angular velocity (in rad/s) about its centre of mass?

3. An object is thrown between two tall buildings 180 *m* from each other. The object is thrown horizontally from a window 55 *m* above ground from one building through a window 10.9 *m* above ground in the other building. Find out the speed of projection. (use g = 9.8 m/s^2)

4. The voltage across the R resistor in the given circuit is _____ volt.

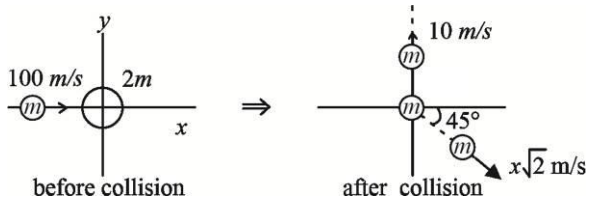


5. Two separate wires *A* and *B* are stretched by 2 mm and 6 mm respectively, when they are subjected to a force of 20 N. Assume that both the wires are made up of the same material and the radius of wire *B* is 4 times that of the radius of wire *A*. The length of the wires *A* and *B* are in the ratio of $a:b$. Then a/b can be expressed as $\frac{1}{x}$ where *x* is_____.

Space for Rought Work

6. A bullet of mass 0.1 kg is fired on a wooden block to pierce through it, but it stops after moving a distance of *x* cm into it. If the velocity of the bullet before hitting the wood is 10 m/s and it slows down with uniform deceleration, due to effective retarding force of 10 N, the value of '*x*' to the nearest integer is_____.

7. A ball of mass m moving with a velocity 10 m/s along the x-axis, hits another ball of mass 2 m which is at rest. After the collision, the first ball comes to rest while the second ball disintegrates into two equal pieces. One-piece starts moving along the y-axis with a speed of 10 m/s. The second piece starts moving at an angle of 45° with respect to the *x*-axis with speed $x\sqrt{2}$ m/s. The configuration of piece after collision is shown in the figure below. The value of x to the nearest integer is_____.



8. A positively charged particle starts at rest 25cm from a second positively charged particle which is held stationary throughout the experiment. The first particle is released and accelerates directly away from the second particle. When the first particle has moved 25cm, it has reached a velocity of $10\sqrt{2}$ m/s. What is the maximum velocity (in m/s) that the first particle will reach?

9. A bird can fly in air at a constant speed *v*. There is a wind of speed v_1 blowing from the North. The bird has to move in the East-West direction? What is its speed (in m/s) with respect to the Earth? Take: v_1= 18 km/hr, v = 13ms^{-1}.

10. A particle performs simple harmonic motion with a period of 2 second. The time taken by the particle to cover a displacement equal to $\frac{1}{\sqrt{2}}$ times of its amplitude from the mean position is $\left(\frac{1}{a}\right)s$. The value of '*a*' to the nearest integer is_____.

Space for Rought Work

PART - II : CHEMISTRY 100 MARKS

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 first ionization potential in electron volts of nitrogen and oxygen atoms are respectively given by :

(A) 14.6, 13.6 **(B)** 13.6, 14.6 **(C)** 13.6, 13.6 **(D)** 14.6, 14.6

2. Match Column I with Column II :

Column I (Chemicals)		Column II (Use)	
I.	N_2H_4 / glycol / KOH	**P.**	Clemmensen reduction
II.	Zn-Hg/Conc. HCl	**Q.**	Wolff-Kishner reduction
III.	OsO_4	**R.**	Vicinal glycol to carbonyl compounds
IV.	HIO_4	**S.**	Alkene to vicinal diols

(A) I – Q; II – P; III – S; IV – R **(B)** I – Q; II – R; III – S; IV – S

(C) I – S; II – P; III – Q; IV – R **(D)** I – S; II – R; III – P; IV – Q

3. Which of the following is incorrect regarding the properties of carbohydrates?

(A) Carbohydrates with a hemiacetal unit at one end exhibit mutarotation

(B) Sucrose is a reducing sugar

(C) Glucose and mannose both produce the same osazone

(D) Fructose responds to Tollen's test

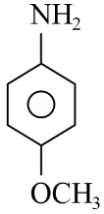
4. Which of the following does not show geometrical isomerism:

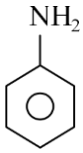
(A) $CH_3-CH=CH-CH_3$ **(B)** $CH_3-CH_2-CH=CH_2$

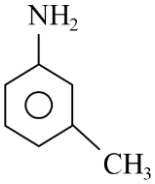
(C) $CH_3-\underset{\displaystyle Cl}{\underset{|}{C}}=CH-CH_3$ **(D)** $ClHC=CH-CH_2-CH_3$

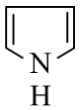
Space for Rought Work

5. Which of the following is least basic in nature?

(A) 

(B) 

(C) 

(D) 

6. How many number of isomeric 1° amines of the formula $C_4H_{11}N$ will give positive Hinsberg reagent test?

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

7. Match List I with List II. Select the correct answer using the codes given below the list.

List-I		List-II	
(a)	NH_4^+	(i)	sp^3d^3
(b)	PCl_5	(ii)	sp^3d
(c)	SF_6	(iii)	sp^3
(d)	IF_6	(iv)	sp^3d^2

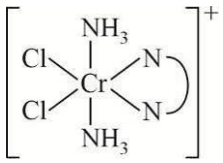
(A) a-iii, b-ii, c-iv, d-i **(B)** a-i, b-ii, c-iii, d-iv

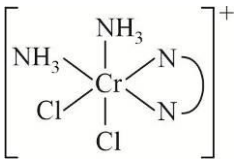
(C) a-ii, b-iii, c-i, d-iv **(D)** a-iv, b-i, c-ii, d-iii

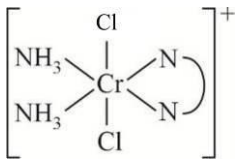
8. In an alkaline solution, sodium nitroprusside gives a violet colour with :

(A) S^{2-} **(B)** SO_3^{2-} **(C)** SO_4^{2-} **(D)** NO_2^-

9. Select correct structure of the optically active isomer of $[Cr(NH_3)_2Cl_2(en)]^+$:

(A) 

(B) 

(C) 

(D) None of these

Space for Rought Work

10. Match the items given in column I with that given in column II

Column I		Column II	
I.	Nucleotide	**P.**	Linkage in carbohydrates
II.	Peptide linkage	**Q.**	Linkage in proteins
III.	Glycoside linkage	**R.**	A sugar and heterocyclic base combination
IV.	Nucleoside	**S.**	The monomeric unit in nucleic acids

(A) I – S; II – Q; III – P; IV – R **(B)** I – Q; II – P; III – S; IV – R

(C) I – P; II – S; III – R; IV – Q **(D)** I – S; II – R; III – Q; IV – P

11. Among the oxo-acids of chlorine, the correct order of acid strength is :

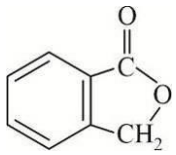
(A) $HClO_4 < HClO < HClO_2 < HClO_3$ **(B)** $HClO_3 < HClO_2 < HClO_4 < HClO$

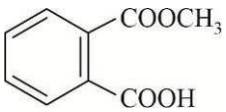
(C) $HClO_4 > HClO_3 > HClO_2 > HClO$ **(D)** $HClO_4 < HClO_3 < HClO_2 < HClO$

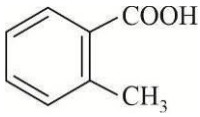
12. Maximum number of electrons having $l = 2$ in a Fe^{+2} ion is :

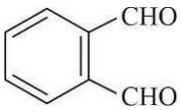
(A) 5 **(B)** 4 **(C)** 3 **(D)** 6

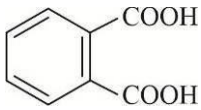
13. Which of the following compound on reaction with conc. NaOH followed by acidification gives following lactone ?



(A) 

(B) 

(C) 

(D) 

Space for Rought Work

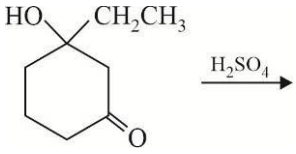
14. A 100 mL flask contained H_2 at 200 Torr, and a 200 mL flask contained He at 100 Torr. The two flask were then connected so that each gas filled their combined volume. Assuming no change in temperature, total pressure is:

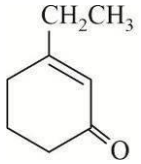
(A) 300 Torr **(B)** 66.66 Torr **(C)** 150 Torr **(D)** 133.33 Torr

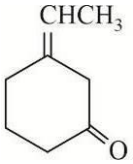
15. Which of the following elements has the least ionization potential?

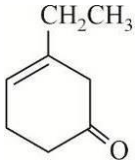
(A) Lithium **(B)** Cesium **(C)** Magnesium **(D)** Calcium

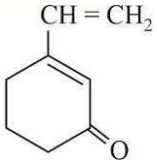
16. The major product of the following reaction is :



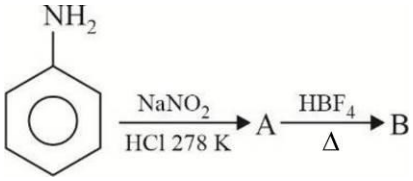
(A)


(B)


(C)


(D)


17. In the chemical reaction.



The compound A and B are respectively

(A) Nitrobenzene and fluorobenzene

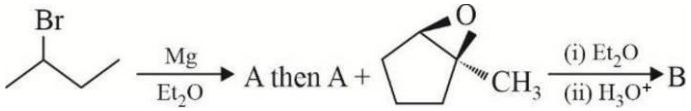
(B) Phenol and benzene

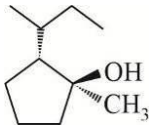
(C) Benzene diazonium chloride and fluorobenzene

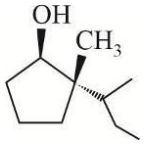
(D) Nitrobenzene and chlorobenzene

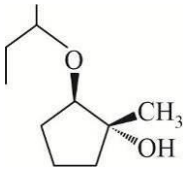
Space for Rought Work

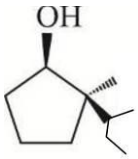
18. What is the major product B of the given reaction?



(A) 

(B) 

(C) 

(D) 

19. Complete hydrolysis of cellulose gives :

(A) D-fructose **(B)** D-ribose **(C)** D-glucose **(D)** L-glucose

20. Match the various sequences with the appropriate orders:

Sequence		Order	
I.	$Na^+Mg^{2+}Al^{3+}$	**a.**	Increasing size of ion in gaseous state
II.	$F^-O^{2-}N^{3-}$	**b.**	Decreasing size of ion in gaseous state
III.	00^-O^{2-}	**c.**	Increasing size of ions in aqueous state
IV.	N F O(IE_2)	**d.**	Decreasing size of ions in aqueous state
		e.	Increasing order of IE_2
		f.	Decreasing order of electron affinity

(A) I-(b), II-(c), III-(e), IV-(f) **(B)** I-(c), II-(b), III-(a), IV-(f)

(C) I-(b,c), II-(a), III-(a,f), IV-(e) **(D)** I-(d), II-(c), III-(a), IV-(e)

Space for Rought Work

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. A certain substance 'A' tetramerises in water to the extent of 80%. A solution of 2.5 g of A in 100 g of water lowers the freezing point by 0.3°C. The molar mass of A is_____.
Given K_f (Water) = 1.86 K-Kg/ mol

2. The number of unpaired electrons present in $[NiF_6]^{2-}$ is _____.

3. Find the number of species having fractional bond order ?
N_2^+, N_2^-, O_2, O_2^+, F_2, B_2, C_2^+, CN^-, NO^+

4. 0.092 g of a compound (A) with the molecular formula $C_3H_8O_3$ on reaction with an excess of CH_3MgI gives 67 mL of methane at STP. The number of active hydrogen atoms present in a molecule of the compound (A) is : [Given : Atomic masses : C : 12.0 u, H : 1.0 u, O : 16.0 u]

5. Acrylonitrile, C_3H_3N, is the starting material for the production of a kind of synthetic fibre (acrylics). It can be made from propylene, C_3H_6, by reaction with nitric oxide, NO as
$C_3H_6(g) + NO(g) \rightarrow C_3H_3N(g) + H_2O(g) + N_2(g)$ (Unbalanced)
x kilograms acrylonitrile is obtained from 420 kg of propylene and excess NO, then value of x/53 is:

Space for Rought Work

6. Rate of reaction $A + B \rightarrow P$ is given as a function of different initial concentrations of A and B

S.No.	{A} (M)	{B} (M)	{Rate} (M/ min.)
1.	0.01	0.01	0.005
2.	0.02	0.01	0.010
3.	0.01	0.02	0.005

The overall order of the reaction is _____.

7. For reaction, $2Fe^{3+}(aq.) + 2I^{-}(aq) \longrightarrow 2Fe^{2+}(aq) + I_2(s)$, $E^0_{cell} = 0.236\,V$ at 268 K. The standard Gibbs energy of the cell reaction is –a kJ/mol. The value of a is _____ (Round off to the nearest integer). [Take Faraday's constant F = 96500 C]

8. Consider the given bond enthalpies.

$C-H = 414\,kJ,\ H-Cl = 431\,kJ,\ Cl-Cl = 243\,kJ,\ C-Cl = 331\ kJ$

$CH_4(g) + 4Cl_2(g) \rightarrow CCl_4(g) + 4HCl(g)$, if enthalpy change for the reaction is $\Delta_r H$ then value of $\frac{-\Delta_r H}{10}$ is:

9. A buffer solution was prepared by dissolving 0.05 mol formic acid and 0.06 mol sodium formate in enough water to make 1.0 L of solution. K_a for formic acid is 1.80×10^{-4}. Calculate the pH of the solution. (Round off to the nearest integer) (log 1.8 = 0.256)

10. 10 mL gaseous C_4H_x requires exactly 55 mL O_2 for complete combustion. What is the value of x.

Space for Rought Work

PART - III : MATHEMATICS 100 MARKS

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. Let $f(x)$ be defined on $[-2,2]$ and is given by $f(x)=\begin{cases}-1 & -2\le x<0\\ x-1 & 0\le x\le 2\end{cases}$ and $g(x)=f(|x|)+|f(x)|$. Then $g(x)$ is equal to:

(A) $\begin{cases}-x & -2\le x<0\\ 0 & 0\le x<1\\ x-1 & 1\le x\le 2\end{cases}$ **(B)** $\begin{cases}-x & -2\le x<0\\ 0 & 0\le x<1\\ 2(x-1) & 1\le x\le 2\end{cases}$

(C) $\begin{cases}-x & -2\le x<0\\ x-1 & 0\le x\le 2\end{cases}$ **(D)** None of these

2. If in x,y,z the system of linear equations $(\sin 3\theta)x-y+z=0;\ (\cos 2\theta)x+4y+3z=0;$ $2x+7y+7z=0$ has non-zero solution, then $\theta=$

(A) $n\pi$ **(B)** $2n\pi\pm\frac{\pi}{6}$ **(C)** $n\pi+\frac{\pi}{3}$ **(D)** $\frac{n\pi}{2}$

3. If α is the root of equation $z^n+2z^{n-1}+3z^{n-2}+12-18z=0$ which lies inside $|z|=1$, then:

(A) $|\alpha|>\frac{2}{3}$ **(B)** $|\alpha|<\frac{2}{3}$ **(C)** $|\alpha|=\frac{2}{3}$ **(D)** None of these

4. $a_1+(1-a_1)a_2+(1-a_1)(1-a_2)a_3+...+(1-a_1)(1-a_2)(1-a_3)...(1-a_{n-1})a_n=?$

(A) $\prod_{i=1}^{n}(1-a_i)$ **(B)** $1+\sum_{i=1}^{n}(1-a_i)$ **(C)** $1-\sum_{i=1}^{n}(1-a_i)$ **(D)** $1+\sum_{i=1}^{n}(1-a_i)$

Space for Rought Work

5. The equation of a straight line passing through (1, 2) and having intercept of length 3 between the straight line $3x+4y=24$ and $3x+4y=12$ is:

(A) $7x+24y-55=0$ **(B)** $24x+7y-38=0$

(C) $24x-7y-10=0$ **(D)** $7x-24y+41=0$

6. If $0\le x<2;-1\le y<1$ and $1\le z<3$, ([ ]) denotes the greatest integer function) then the maximum value of determinant $\Delta=\begin{vmatrix}[x+1] & [y] & [z]\\ [x] & [y]+1 & [z]\\ [x] & [y] & [z]+1\end{vmatrix}$ is:

(A) 2 **(B)** 6 **(C)** 4 **(D)** None of these

7. On the interval $J=[-2,2]$, the function $f(x)=\begin{cases}(x+1)e^{-\left(\frac{1}{|x|}+\frac{1}{x}\right)} & x\neq 0\\ 0 & x=0\end{cases}$:

(A) Is continuous for all $x\in J$

(B) is differentiable for all $x\in J$

(C) Assumes all intermediate values from $f(-2)$ to $f(2)$

(D) None to these

8. If $\hat{a}.\hat{b}=0$, where $\hat{a}$ and $\hat{b}$ are unit vectors and the unit vector $\hat{c}$ is inclined at an angle θ to both $\hat{a}$ and $\hat{b}$. If $\hat{c}=m\hat{a}+n\hat{b}+p\left(\hat{a}\times\hat{b}\right)$; where, $m,n,p\in R$, then:

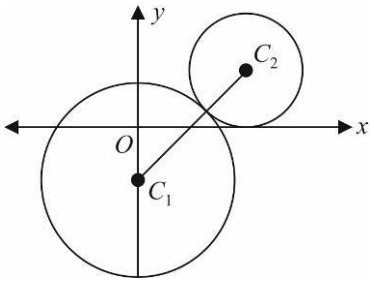
(A) $-\frac{\pi}{4}\le\theta\le\frac{\pi}{4}$ **(B)** $\frac{\pi}{4}\le\theta\le\frac{3\pi}{4}$ **(C)** $0\le\theta\le\frac{\pi}{4}$ **(D)** $0\le\theta\le\frac{3\pi}{4}$

9. Three digit numbers in which the middle one is a perfect square are formed using the digits 1 to 9. Their sum is:

(A) 134055 **(B)** 270540 **(C)** 170055 **(D)** None of these

Space for Rought Work

10. In the given figure, the equation of the large circle is $x^2+y^2+4y-5=0$ and the distance between centres is 4. Then the equation of smaller circle is:



(A) $\left(x-\sqrt{7}\right)^2+\left(y-1\right)^2=1$ **(B)** $\left(x+\sqrt{7}\right)^2+\left(y-1\right)^2=1$

(C) $x^2+y^2=2\sqrt{7}x+2y$ **(D)** None of these

11. If f is twice differentiable such that $f''(x)=-f(x); f'(x)=g(x); h'(x)=\left[f(x)\right]^2+\left[g(x)\right]^2$ and $h(0)=2, h(1)=4$, then the equation $y=h(x)$ represents:

(A) A parabola with latus rectum 2 **(B)** A parabola with latus rectum 4

(C) A parabola with latus rectum 8 **(D)** None of these

12. If $[x]$ denotes the integral part of x and $k=\sin^{-1}\left(\frac{1+t^2}{2t}\right)>0$, then number of values of α for which the equation $\left(x-[k]\right)\left(x+\alpha\right)-1$ has integral roots:

(A) 1 **(B)** 2 **(C)** 4 **(D)** None of these

13. $\int\frac{e^{x^2}(2x+x^3)}{\left(3+x^2\right)^2}dx$ is equal to:

(A) $\frac{e^{x^2}}{\left(3+x^2\right)}+c$ **(B)** $\frac{1}{8}\frac{e^{x^2}}{\left(3+x^2\right)}+c$ **(C)** $\frac{1}{4}\frac{e^{x^2}}{\left(3+x^2\right)}+c$ **(D)** $\frac{1}{2}\frac{e^{x^2}}{\left(3+x^2\right)}+c$

14. The differential equation for all family of lines which are at a unit distance from the origin is:

(A) $\left(y-x\frac{dy}{dx}\right)^2=1-\left(\frac{dy}{dx}\right)^2$ **(B)** $\left(y+x\frac{dy}{dx}\right)^2=1+\left(\frac{dy}{dx}\right)^2$

(C) $\left(y-x\frac{dy}{dx}\right)^2=1+\left(\frac{dy}{dx}\right)^2$ **(D)** $\left(y+x\frac{dy}{dx}\right)^2=1-\left(\frac{dy}{dx}\right)^2$

Space for Rought Work

15. Domain of real values function $\frac{(x!)\left(\sin^{-1}\frac{x}{1000}+\cos^{-1}\frac{x}{1000}\right)}{\sqrt{1000x^2-999\{x\}^2-990[x]^2-50x+60}}$ (where, [ ] denotes the greatest integer function and { } is fractional part of x) is:

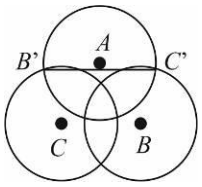
(A) $I^+-\{2,3\}$ **(B)** $\{0,1\}\cup\{4,5,6,....,1000\}$

(C) $\{0,1,2,....,1000\}$ **(D)** None of these

16. The value of the $\lim\limits_{x\to 0}\frac{\cos(\sin x)-\cos x}{x^4}$ equals to:

(A) $\frac{1}{5}$ **(B)** $\frac{1}{6}$ **(C)** $\frac{1}{4}$ **(D)** $\frac{1}{2}$

17. Circles with centers A, B and C each have radius r, where $1<r<2$. The distance between each pair of centers is 2. If B' is the point of intersection of circle A and circle C which is outside circle B, and if C' is the point of intersection of circle A and circle B which is outside circle C. Then length $B'C'$ equals:



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

Space for Rought Work

18. If *n* is an odd positive integer and a, b, c are distinct then the number of distinct terms in the expansion of $(a+b+c)^n + (a-b-c)^n$ are:

(A) $\left(\frac{n+1}{2}\right)^2$ **(B)** $\frac{(n+1)^2}{2}$ **(C)** $\frac{(n+1)(n+2)}{4}$ **(D)** None of these

19. If $E(\theta) = \begin{bmatrix} \cos^2\theta & \cos\theta\sin\theta \\ \cos\theta\sin\theta & \sin^2\theta \end{bmatrix}$ and θ and ϕ differ by an odd multiple of $\frac{\pi}{2}$. Then $E(\theta)E(\phi)$ is:

(A) A null matrix **(B)** A unit matrix

(C) A diagonal matrix **(D)** None of these

20. Let A_r, r = 1, 2, 3, ……, be the points on the number line such that OA_1, OA_2, OA_3, …… are in GP, where O is the origin, and the common ratio of the GP be a positive proper fraction. Let M_r be the middle point of the line segment A_rA_{r+1}. Then the value of $\sum_{r=1}^{\infty} OM_r$ is equal to

(A) $\frac{OA_1(OSA_1 - OA_2)}{2(OA_1 + OA_2)}$ **(B)** $\frac{OA_1(OA_1 - OA_2)}{2(OA_1 + OA_2)}$

(C) $\frac{OA_1}{2(OA_1 - OA_2)}$ **(D)** ∞

Space for Rought Work

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. Let the set $A=\{1,2,3,5,6,10,15,30\}$ and x_1, x_2, x_3 be natural numbers. Let n = the number of possible ordered triplets (x_1, x_2, x_3), such that $x_1x_2x_3 \in A$, then $\frac{n}{8}=$ _____ .

2. If $f(x)=ae^{2x}+be^{x}+cx$ satisfies the conditions $f(0)=-1$, $f'(\log 2)=31$, $\int_0^{\log 4}(f(x)-cx)dx=\frac{39}{2}$, then $|c|$ is _____.

3. *A, B, C* are respectively the points (1, 2), (4, 2), (4, 5). If T_1, T_2 are the points of trisection of the line segment *AC* and S_1, S_2 are the points of trisection of the line segment *BC*, twice the area of the quadrilateral $T_1S_1S_2T_2$ is _____.

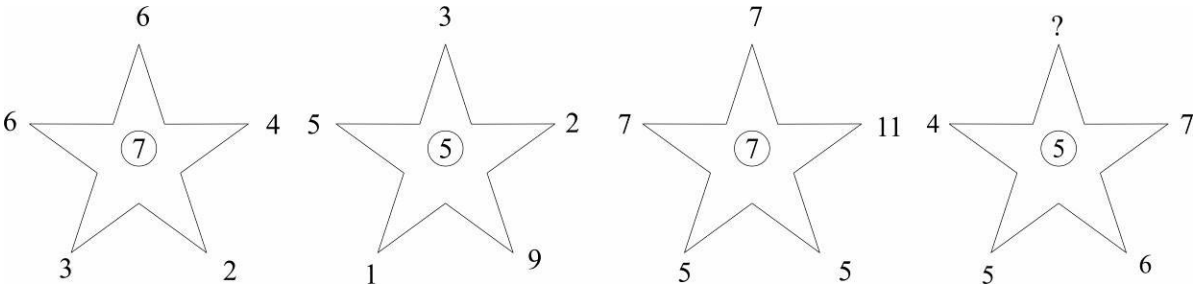
4. In a triangle PQR, let $\vec{a}=\overrightarrow{QR}$, $\vec{b}=\overrightarrow{RP}$ and $\vec{c}=\overrightarrow{PQ}$. If $|\vec{a}|=3$, $|\vec{b}|=4$ *and* $\frac{\vec{a}.(\vec{c}-\vec{b})}{\vec{c}.(\vec{a}-\vec{b})}=\frac{|\vec{a}|}{|\vec{a}|+|\vec{b}|}$, then the value of $|\vec{a}\times\vec{b}|^2$ is _____

5. If n and x are two real numbers, then $e^{2ni\cot^{-1}x}.\left(\frac{xi+1}{xi-1}\right)^n$ is equal to _____.

Space for Rought Work

6. If $\int \frac{\cos 4x+1}{\cot x-\tan x}dx = A\cos 4x + B$, then 16 |A| _____.

7. Find the missing number?



8. The mean and the variance of five observations are 4 and 5.20, respectively. If three of the observations are 3, 4 and 4; then the absolute value of the difference of the other two observations, is:

9. Let A is 3 × 3 matrix and $A=\left(a_{ij}\right)_{3\times 3}$. If for every column matrix X, if X^1. A.X = 0 and a_{23} = –2009 then a_{32} = _____

10. A farmer F_1 has a land in the shape of a triangle with vertices at P(0, 0), Q(1, 1) and R(2, 0). From this land, a neighbouring farmer F_2 takes away the region which lies between the side PQ and a curve of the form $y = x^n$ ($n > 1$). If the area of the region taken away by the farmer F_2 is exactly 30% of the area ΔPQR, then the value of n is _____

Space for Rought Work

••• End of JEE Main Home Practice Test - 5 [JEE - 2024] •••