VMC Vidyamandir Classes SINCE 1986

IIT JEE | MEDICAL | FOUNDATION

CODE A

JEE Main - 3 | JEE 2024

Date: 06/10/2022 **Maximum Marks: 300**

Timing: 04:00 PM to 07:00 PM

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 **5 Numerical Value Type Questions**. The answer to each question is a **NUMERICAL VALUE**. For each question, enter the correct numerical value of the answer. If the answer is a decimal numerical value, then round-off the value to TWO decimal places. If the answer is an Integer value, then do not add zero in the decimal places. *In the OMR, do not bubble the ⊕ sign for positive values. However, for negative values, ⊖ sign should be bubbled*. (Example: 6, 81, 1.50, 3.25, 0.08)
5. 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. Rough work is to be done on the space provided for this purpose in the Test Booklet only.
7. 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**.
8. **Do not fold or make any stray mark on the Answer Sheet (OMR).**

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.

Name of the Candidate (In CAPITALS) : _____

Roll Number : _____

OMR Bar Code Number : _____

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

Syllabus

Physics: Motion in Two Dimensions, Dynamics of a Particle (Section 1 to 3)
Chemistry: Periodic classification, Chemical Bonding-1 & 2 (only Section 2)
Mathematics: Trigonometry, Sequence and Series

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. An aeroplane is flying horizontally at a height of 490 m with a velocity of 150 ms^{-1}. A bag containing food is to be dropped to the jawans on the ground. How far from them (along horizontal) should the bag be dropped so that it directly reaches them? [Take $g = 9.8\ m/s^2$]

(A) 1000 *m* **(B)** 1500 *m*

(C) 750 *m* **(D)** 2000 *m*

2. A block is placed on a weighing machine lying on the floor of an elevator. If the elevator is accelerating upwards at $2\ m/s^2$, the reading of the machine is 120 *N*. What is the reading of machine if elevator is accelerating downwards at $2\ m/s^2$?

(A) 120 *N* **(B)** 100 *N* **(C)** 80 *N* **(D)** 180 *N*

3. The path of one projectile as seen by an observer on another projectile is :

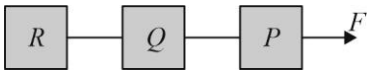
(A) Straight line **(B)** Parabola **(C)** Ellipse **(D)** Circle

4. An electric fan has blades of length 30 *cm* as measured from the axis of rotation. If the fan is rotating at 1200 rpm, the acceleration of a point on the tip of the blade is about:

(A) $1600\ m\,s^{-2}$ **(B)** $4740\ m\,s^{-2}$

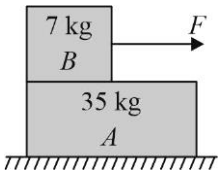
(C) $2370\ m\,s^{-2}$ **(D)** $5055\ m\,s^{-2}$

5. Three equal masses *P*, *Q* and *R* are pulled with a constant force *F*. They are connected to each other with strings. The ratio of the tension between *PQ* and *QR* is:



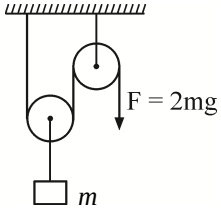
(A) 1 : 1 **(B)** 2 : 1 **(C)** 1 : 2 **(D)** 3 : 1

6. Block A of mass 35 *kg* is resting on a frictionless floor. Another block *B* of mass 7 *kg* is resting on it as shown in the figure. The coefficient of static friction between the blocks is 0.5 while kinetic friction is 0.4. If a force of 100 *N* is applied to block *B*, the acceleration of block *A* will be : $(g = 10\ m\,s^{-2})$



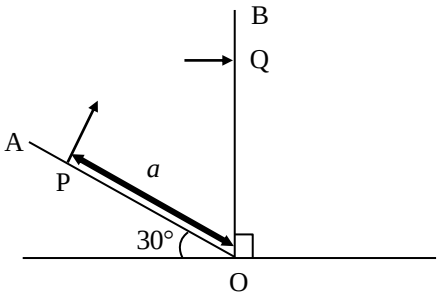
(A) $0.8\ m\,s^{-2}$ **(B)** $2.4\ m\,s^{-2}$ **(C)** $0.4\ m\,s^{-2}$ **(D)** $4.4\ m\,s^{-2}$

7. In the shown mass pulley system, pulleys and strings are massless. One end of the string is pulled by the force *F* = 2mg. The acceleration of the block will be:



(A) *g*/2 **(B)** 0 **(C)** g **(D)** 3*g*

8. A particle is projected from point *P* with velocity *u* along a direction perpendicular to plane *OA*. The particle strikes wall *OB* perpendicularly at *Q*. Time of flight from *P* to *Q* is :



(A) $\frac{u}{g}$ **(B)** $\frac{u\sqrt{3}}{g}$

(C) $\frac{u}{2g}$ **(D)** $\frac{\sqrt{3}u}{2g}$

9. The maximum range of a rifle bullet on level groud is 6000 *m*. The maximum range when it is projected up an incline of 30° is:

(A) 4000 *m* **(B)** 2000 *m*

(C) 6000 *m* **(D)** 1000 *m*

10. A ball is projected with velocity *u* at right angle to the inclined plane which is inclined at angle α with the horizontal. The distance '*x*' along the inclined plane that it will travel before again striking it is:

(A) $\frac{2u^2}{g}\cos\alpha$ **(B)** $\frac{2u^2}{g}\tan\alpha$ **(C)** $\frac{2u^2}{g}\frac{\tan\alpha}{\cos\alpha}$ **(D)** $\frac{2u^2}{g}\frac{\tan\alpha}{\sin\alpha}$

11. A body has an initial velocity of 3 *m/s* and has a constant acceleration of 1 m/sec^2 normal to the direction of the initial velocity. Then, its velocity 4 seconds after the start, is:

(A) 7 *m/s* along the direction of initial velocity

(B) 7 *m/s* along the normal to the direction of initial velcoity

(C) 7 *m/s* mid-way between the two directions

(D) 5 *m/s* at an angle of $\tan^{-1}(4/3)$ with the direction of initial velocity

12. A boy aims at a bird from a point at a horizontal distance of 100 *m*. The gun can impart a velocity of 500 *m/s* to the bullet. At what height above the bird must he aim his gun in order to hit? (Take $g = 10\ m/s^2$)

(A) 10 *cm* **(B)** 20 *cm* **(C)** 40 *cm* **(D)** 80 *cm*

13. A projectile moves from the ground such that its horizontal displacement is $x = kt$ and vertical displacement is $y = kt(1-\alpha t)$, where *k* and α are constants and *t* is time. Find out its total time of flight (*T*) and maximum height attained $(y_{max.})$:

(A) $T = \alpha,\ y_{max.} = \frac{k}{2\alpha}$ **(B)** $T = \frac{1}{\alpha},\ y_{max.} = \frac{2k}{\alpha}$

(C) $T = \frac{1}{\alpha},\ y_{max.} = \frac{k}{6\alpha}$ **(D)** $T = \frac{1}{\alpha},\ y_{max.} = \frac{k}{4\alpha}$

14. A uniform metal chain is placed on a rough table such that one end of it hangs down over the edge of the table. When one-third of its length hangs over the edge, the chain starts sliding. Then, the coefficient of static friction is:

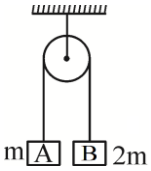
(A) $\frac{3}{4}$ **(B)** $\frac{1}{4}$ **(C)** $\frac{2}{3}$ **(D)** $\frac{1}{2}$

15. A car is moving horizontally along a straight line with constant speed 30 *m/s*. A projectile is to be fired from the moving cart in such a way that it will return to the cart after the cart has moved 80 m. At what speed (relative to the cart) must the projectile be fired? (Take $g = 10\ m/s^2$)

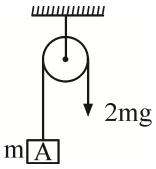
(A) $5\sqrt{8}$ *m/s* **(B)** $10\sqrt{8}$ *m/s* **(C)** $\frac{40}{3}$ *m/s* **(D)** $\frac{4}{3}$ *m/s*

16. In which of the following cases the magnitude of acceleration of the block A will be maximum : (Neglect friction, mass of pulley and string)

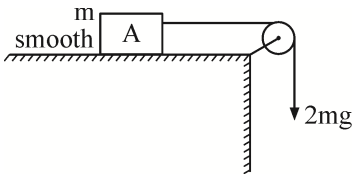
(A)



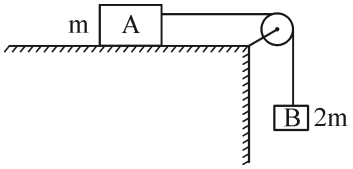
(B)



(C)



(D)



17. A projectile is given an initial velocity of $\hat{i}+2\hat{j}$. Here *x*-axis is horizontal and *y*-axis is vertically upwards. The cartesian equation of its path is: $(g=10\ m/s^2)$

(A) $y=2x-5x^2$ **(B)** $y=x-5x^2$ **(C)** $4y=2x-5x^2$ **(D)** $y=2x-25x^2$

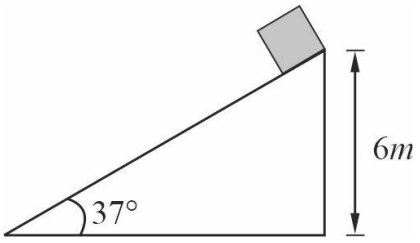
18. A particle is projected from the ground at an angle of 60° with horizontal with speed $u=20\ m/s$. The radius of curvature of the path of the particle, when its velocity makes an angle of 30° with horizontal is: $(g=10\ m/s^2)$

(A) 10.6 *m* **(B)** 12.8 *m* **(C)** 15.4 *m* **(D)** 24.2 *m*

19. A projectile is thrown into space so as to have the maximum possible horizontal range equal to 400 *m*. Taking the point of projection as the origin, *x*-axis as horizontal and *y*-axis as vertically upwards, the co-ordinates of the point where the velocity of the projectile is minimum are:

(A) (400, 100) **(B)** (200, 100) **(C)** (400, 200) **(D)** (200, 200)

20. A block of mass $m=1kg$ is released from the top of a rough inclined plane. The coefficient of friction between block and inclined plane is $\mu=0.5$. Find the speed of block when it reaches the bottom of incline. $(g=10\ m/s^2)$



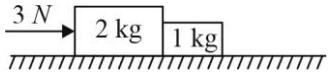
(A) $2\sqrt{15}\ m/s$ **(B)** $2\sqrt{10}\ m/s$ **(C)** $2\sqrt{20}\ m/s$ **(D)** $\sqrt{10}\ m/s$

SPACE FOR ROUGH WORK

SECTION-2

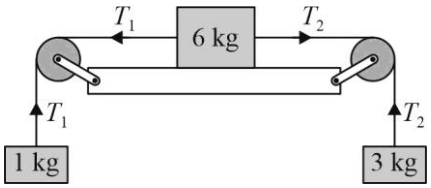
This Section contains Five (05) Numerical Value Type Questions. The answer to each question is a **NUMERICAL VALUE**. For each question, enter the correct numerical value of the answer. If the answer is a decimal numerical value, then round-off the value to TWO decimal places. If the answer is an Integer value, then do not add zero in the decimal places. *In the OMR, do not bubble the ⊕ sign for positive values. However, for negative values, Θ sign should be bubbled*. (Example: 6, 81, 1.50, 3.25, 0.08)

1. Two blocks of 2 *kg* and 1 *kg* are in contact on a frictionless table. If a force of 3N is applied on 2 *kg* block, then the force of contact between the two blocks will be _____ (in Newtons).



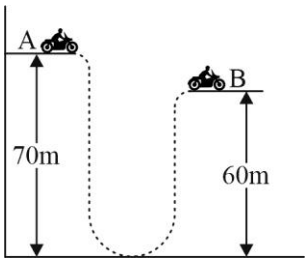
2. A ball of mass 10 *g* moving perpendicular to the plane of the wall strikes it and rebounds in the same line with the same velocity. If the average force experienced by the wall is 5.4 N s, the velocity (in *m/s*) of the ball is_____ . Given that ball was in contact with wall for 0.1 *s*.

3. Three masses of 1 kg, 6 *kg* and 3 *kg* are connected to each other with threads and are placed on a table as shown in figure.



What is the acceleration (in m/s^2) with which the system is moving? (Take $g = 10\ m\,s^{-2}$)

4. A motorcyclist is trying to jump across a path as shown by driving horizontally off a cliff *A* at a speed of 5 $m\,s^{-1}$. Ignore air resistance and take $g = 10\ m\,s^{-2}$. The speed (in *m*/s) with which he touches the peak *B* is _____ .



5. If the equation for the angular displacement of a particle moving on a circular path is given by:

$$\theta = 2t^3 + 0.5$$

where θ is in radian and *t* in second, then the angular velocity (in rad/s) of the particle at *t* = 2*s* is ____ .

SPACE FOR ROUGH 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. Given below are two statements: one is labelled as Assertion A and, the other is labelled as Reason R.

Assertion A : According to modern periodic law, the physical and chemical properties of the elements are periodic functions of their atomic numbers.

Reason R : The periodic variation in electronic configuration determine the physical and chemical properties of elements and their compounds.

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

(A) Both A and R are correct, and R is correct explanation of A

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

(C) A is correct but R is not correct

(D) A is not correct but R is correct

2. Which of the following is/are correct for hypothetical element with atomic number 120?

(a) Its IUPAC name is unbinilium

(b) Its symbol is Unn

(c) It is an alkaline earth element

(d) Its predicted electronic configuration will be $[Og]8s^2$

Choose the correct answer from the options given below.

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

3. **Match List I with List II.**

	List-I		**List-II**
(P)	Same values of electron gain enthalpies	**(I)**	N and Cl
(Q)	Same values of electronegativity on Pauling scale	**(II)**	Ar and Kr
(R)	Form amphoteric oxide	**(III)**	Al and As
(S)	Same chemical reactivity	**(IV)**	K and Rb

Choose the correct answer from the options given below.

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

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

4. Given below are two statements.

Statement-I : For alkali metals reactivity increases down the group.

Statement-II : For halogens, reactivity decreases down the group.

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

(A) Both Statement-I and Statement-II are true

(B) Both Statement-I and Statement-II are false

(C) Statement-I is true but Statement-II is false

(D) Statement-I is false but Statement-II is true

SPACE FOR ROUGH WORK

5. **Match List I with List II.**

	List-I		**List-II**
(P)	Order of ionization enthalpy	**(I)**	Be > B
(Q)	Order of electron gain enthalpy	**(II)**	O < S
(R)	Order of valence	**(III)**	N > P
(S)	Order of ability to form $p\pi - p\pi$ multiple bond to itself	**(IV)**	I < Xe

Choose the correct answer from the options given below.

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

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

6. **Match List I with List II.**

	List-I		**List-II**
(P)	p-Block elements	**(I)**	Two columns
(Q)	d-Block elements	**(II)**	Six columns
(R)	s-Block elements	**(III)**	Group 3 to 12
(S)	f-Block elements	**(IV)**	Two rows of elements at the bottom of the periodic table, having group number 3

Choose the correct answer from the options given below.

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

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

7. Considering the elements F, Cl, O and N, the correct order of their chemical reactivity in terms of oxidizing property is:

(A) F > Cl > N > O **(B)** Cl > F > N > O **(C)** F > O > Cl > N **(D)** Cl > O > F > N

8. Given below are two statements.

Statement-I : Lithium differs in many respects from the sodium.

Statement-II : Lithium shows many similarity with the magnesium.

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

(A) Both Statement-I and Statement-II are true

(B) Both Statement-I and Statement-II are false

(C) Statement-I is true but Statement-II is false

(D) Statement-I is false but Statement-II is true

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

Assertion A : First ionization enthalpy of Al is less than Ga.

Reason R : In a group ionization enthalpy increases on moving downward.

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

(A) Both A and R are correct, and R is correct explanation of A

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

(C) A is correct but R is not correct

(D) A is not correct but R is correct

10. You will notice from the modern periodic table that Mendeleev's name has been immortalized by naming the element with atomic number Z, as Mendelevium. Which of the following is/are correct for this element?

(a) Its IUPAC symbol is Unu **(b)** It is an actinoid element

(c) It is a radioactive element **(d)** It is representative element

(e) American scientist Glenn T. Seaborg is its discoverer

Choose the correct answer from the options given below.

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

11. According to Lewis theory, which of the following is/are correct for ozone molecule?

(a) It possess both bond pair and lone pair electrons

(b) All O atoms has same formal charge

(c) It has two types of O – O bond length

(d) All O atoms has same number of lone pairs

Choose the correct answer from the options given below.

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

12. The length of a true carbon to oxygen double bond (C = O) is 121 pm and true carbon to oxygen triple bond (C ≡ O) is 110 pm. The experimentally determined carbon to oxygen bond length in CO_2 is:

(A) 121 pm **(B)** 110 pm

(C) Both 121 and 110 pm **(D)** 115 pm

13. Which of the following is correct representation of direction of dipole moment of carbon monoxide by a student of chemistry using crossed arrow $(+\longrightarrow)$?

(A) The cross is on carbon and arrow head on oxygen

(B) The cross is on oxygen and arrow head on carbon

(C) The cross on less electronegative element and arrow head on more electronegative element

(D) The cross on more electropositive element and arrow head on less electropositive element

14. Which of the following is/are correct for NF_3 and ClF_3 ?

(a) Both are trigonal pyramidal in shape

(b) Both have same percent p-character in hybrid orbital

(c) Both have one type of bond length

(d) Both have same value of net dipole moment (μ)

(e) Both have same valence of central atom

Choose the correct answer from the options given below.

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

15. Which of the following is correct for ClO_2^-, ClO_3^- and ClO_4^-?

(a) All have expanded octet.

(b) All have same Cl – O bond order.

(c) All possess $d\pi - p\pi$ (pi-bond) covalent bonds.

(d) All have same O – Cl – O bond angle.

(e) In all, valence atomic orbitals of central atom has same number of nodes.

Choose the correct answer from the options given below.

(A) Only a and e **(B)** Only a, c and e

(C) Only a, c and d **(D)** a, b, c, d and e

16. Which of the following has nodal plane?

(A) Sigma bond **(B)** pi-bond **(C)** Ionic bond **(D)** Electrovalent bond

17. **Match List I with List II.**

	List-I		**List-II**
(P)	SF_4	**(I)**	Rectangular
(Q)	XeF_4	**(II)**	See-saw
(R)	CF_4	**(III)**	Tetrahedral
(S)	C_2F_4	**(IV)**	Square planar

Choose the correct answer from the options given below.

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

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

18. Given below are two statements.

Statement-I : Resonance stabilizes the molecule as the energy of the resonance hybrid is less than the energy of any single canonical structure.

Statement-II : Whenever a single Lewis structure cannot describe a molecule accurately, a number of structures with similar energy, position of nuclei, bonding and non-bonding pairs of electrons are taken as the canonical structures of the hybrid.

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

(A) Both Statement-I and Statement-II are true

(B) Both Statement-I and Statement-II are false

(C) Statement-I is true but Statement-II is false

(D) Statement-I is false but Statement-II is true

19. **Match List I with List II.**

	List-I		**List-II**
(P)	CH_3-CH_3	**(I)**	Planar
(Q)	$CH_2=CH_2$	**(II)**	Non planar
(R)	$CH_2=C=CH_2$	**(III)**	Most electronegative C atom
(S)	$HC\equiv C-CH=CH_2$	**(IV)**	180° (C – C – C bond angle)
		(V)	120° (H – C – H bond angle)

Choose the correct answer from the options given below.

(A) P-I; Q-II, V; R-I, IV; S-I, III

(B) P-II, V; Q-I, V; R-II, III, IV; S-I, III, IV, V

(C) P-II; Q-I, V; R-II, III, IV, V; S-I, III, IV, V

(D) P-I, III; Q-I, V; R-I, IV, V; S-II, V

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

Assertion A : Hybrid orbitals are polycentric.

Reason R : Hybrid orbitals are formed by combination of atomic orbitals of combining atoms.

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

(A) Both A and R are correct, and R is correct explanation of A

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

(C) A is correct but R is not correct

(D) Both A and R are incorrect

SPACE FOR ROUGH WORK

SECTION-2

This Section contains Five (05) Numerical Value Type Questions. The answer to each question is a **NUMERICAL VALUE**. For each question, enter the correct numerical value of the answer. If the answer is a decimal numerical value, then round-off the value to TWO decimal places. If the answer is an Integer value, then do not add zero in the decimal places. *In the OMR, do not bubble the ⊕ sign for positive values. However, for negative values, Θ sign should be bubbled*. (Example: 6, 81, 1.50, 3.25, 0.08)

1. Considering maximum valence of oxygen and chlorine in oxide Cl_xO_y. Find the value of sum of x and y.

2. Consider the following elements.

$_8O$, $_9F$, $_{16}S$, $_{17}Cl$, $_{34}Se$, $_{35}Br$, $_{52}Te$, $_{84}Po$, $_{53}I$, $_{85}At$

Determine the number of proton of the element having least negative value of electron gain enthalpy.

3. How many 90°, F – S – F bond angles are present in SF_6?

4. How many of the following has expanded octet?

SCl_2, SF_4, ClF_3, XeF_2, XeF_4, SO_2, XeO_3, SO_2Cl_2, I_3^-, IF_3^{2-}

5. Find the number of compounds having all ionic, covalent and coordinate bonds.

NaCN, KNO_3, $NaBF_4$, KI_3, NH_4Cl, O_3, CO, Hg_2Cl_2

SPACE FOR ROUGH 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. The sum of the series: $\frac{1}{1.4}+\frac{1}{4.7}+\frac{1}{7.10}+.....$ upto ∞ terms, is:

(A) $\frac{1}{3}$ **(B)** $\frac{1}{2}$ **(C)** $\frac{1}{4}$ **(D)** $\frac{1}{5}$

2. $\sum_{r=1}^{120}\frac{1}{\sqrt{r+1}+\sqrt{r}}$ is equal to:

(A) 10 **(B)** 9 **(C)** 1 **(D)** 5

3. Let $t_n = n\cdot(n!)$. Then $\sum_{n=1}^{20} t_n$ is equal to:

(A) $19!-1$ **(B)** $21!+1$ **(C)** $21!-1$ **(D)** $20!-1$

4. Let $f(x)=x^4+\frac{9}{x^4}$ $(x\neq 0)$ then the minimum value of $f(x)$ is:

(A) 2 **(B)** 4 **(C)** 6 **(D)** 8

5. The simplified value of $\frac{\sin 2x+\sin 3x+\sin 4x}{\cos 2x+\cos 3x+\cos 4x}$ is:

(A) $\tan x$ **(B)** $\tan 2x$ **(C)** $\tan 3x$ **(D)** $\tan 4x$

6. If $\frac{x}{\sin\theta}=\frac{y}{\sin\left(\theta+\frac{2\pi}{3}\right)}=\frac{z}{\sin\left(\theta-\frac{2\pi}{3}\right)}$, then $x+y+z$ is equal to:

(A) –1 **(B)** 1 **(C)** 0 **(D)** 2

7. If a, b, c are non-zero numbers in H.P., then $\frac{1}{a}-bc,\ \frac{1}{b}-ca,\ \frac{1}{c}-ab$ are in:

(A) A.P. **(B)** G.P. **(C)** H.P. **(D)** G.P. & H.P. both

8. If the sum of *n* terms of a sequence is given by $\frac{n(n+1)(n+2)}{6}$, then the n^{th} term of the sequence is:

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

9. If T_m and T_n denotes the m^{th} and n^{th} terms of an H.P. respectively, such that $T_m = n, T_n = m,$ then which of the following is equal to 1?

(A) T_{mn} **(B)** T_{m+n} **(C)** T_{m+2n} **(D)** T_{m-n}

10. The geometric series $a+ar+ar^2+ar^3+.....\infty$ has a sum of 7 and the terms involving odd powers of *r* has a sum of 3. Then the value of $(a+r)$ equals:

(A) 4/3 **(B)** 10/7 **(C)** 5/2 **(D)** 7/3

11. If the 2nd, 5th and 9th terms of a non-constant A.P. are in G.P., then the common ratio of this G.P. is:

(A) $\frac{4}{3}$ **(B)** 1 **(C)** $\frac{7}{4}$ **(D)** $\frac{8}{5}$

12. The number of solutions of the equation $(\sin x-\pi)(3\cos x+2)=0$ in $[0, 2\pi]$, is :

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

13. If $a_1, a_2, a_3, ...$ are in harmonic progression with $a_1 = 5$ and $a_{10} = 15$. Then, the least positive integer n for which $a_n < 0$, is:

(A) 12 **(B)** 14 **(C)** 15 **(D)** 16

14. The value of expression $\cos 20^\circ \cos 40^\circ \cos 60^\circ \cos 80^\circ$ is:

(A) 1/8 **(B)** 1/4 **(C)** 1/16 **(D)** 1/32

15. The sum of the series $1 + \frac{4}{3} + \frac{7}{3^2} + \frac{10}{3^3} + ...$ to ∞ terms is:

(A) $\frac{35}{4}$ **(B)** $\frac{15}{4}$ **(C)** $\frac{37}{16}$ **(D)** $\frac{35}{16}$

16. The smallest positive value of x satisfying the equation $\frac{\sin x - \sin 7x}{\cos 7x - \cos x} = \tan 6x$, is:

(A) $\frac{\pi}{20}$ **(B)** $\frac{\pi}{15}$ **(C)** $\frac{\pi}{10}$ **(D)** $\frac{\pi}{9}$

17. If $s = \cos^2\alpha + \cos^2\beta$, then the value of $\cos(\alpha+\beta)\cos(\alpha-\beta)$ in terms of 's', is:

(A) $s-1$ **(B)** $\frac{s-1}{s}$ **(C)** s^2 **(D)** $1-s$

18. If $7\tan(\alpha-\beta) = 5\tan(\alpha+\beta)$ then the value of $\frac{\sin 2\alpha}{\sin 2\beta}$ is equal to:

(A) 4 **(B)** 5 **(C)** 6 **(D)** 8

19. Let $a_1, a_2, a_3, a_4, a_5 .....$ are in G.P. with $a_{51} = 25$ and $\sum_{i=1}^{101} a_i = 125$, then the value of $\sum_{i=1}^{101}\left(\frac{1}{a_i}\right)$ equals:

(A) 5 **(B)** $\frac{1}{5}$ **(C)** $\frac{1}{25}$ **(D)** $\frac{1}{125}$

20. If a, b, c are in G.P., x and y be the arithmetic mean between a, b and b, c respectively, then $\left(\frac{a}{x} + \frac{c}{y}\right)$ is equal to:

(A) 2 **(B)** –4 **(C)** 4 **(D)** 6

SECTION-2

This Section contains Five (05) Numerical Value Type Questions. The answer to each question is a **NUMERICAL VALUE**. For each question, enter the correct numerical value of the answer. If the answer is a decimal numerical value, then round-off the value to TWO decimal places. If the answer is an Integer value, then do not add zero in the decimal places. *In the OMR, do not bubble the ⊕ sign for positive values. However, for negative values, Θ sign should be bubbled*. (Example: 6, 81, 1.50, 3.25, 0.08)

1. The sum of first 9 terms of the series $\frac{1^3}{1} + \frac{1^3+2^3}{1+3} + \frac{1^3+2^3+3^3}{1+3+5} + ...$ is _____.

2. The Harmonic mean of the roots of the equation $(5+\sqrt{2})x^2 - (4+\sqrt{5})x + 8 + 2\sqrt{5} = 0$ is _____.

3. The number of terms common of the two A.P.'s 3, 7, 11, …… 407 and 2, 9, 16, …….. 709 is _____.

4. The maximum value of $\sin^6 x + \cos^6 x$ is _____.

5. The sum of the first 10 terms of the series $\frac{7}{2^2 5^2} + \frac{13}{5^2 8^2} + \frac{19}{8^2 11^2} + ...$ is $\frac{m}{n}$ where m, n are coprime natural numbers, then the value of $(n - 12m)$ is _____.

••• End of JEE Main – 3 [JEE - 2024] •••