NEW STANDARD ACADEMY

Test Type : Review Test - 1 **25-11-24**

Do not open this Test Booklet until you are asked to do so.

JEE(MAIN): 12th Undergoing/Pass Students

Read carefully the Instructions on the Back Cover of this Test Booklet.

Important Instructions :

1. Immediately fill in the form number on this page of the Test Booklet with Blue/Black Ball Point Pen. Use of pencil is strictly prohibited.
2. The candidates should not write their Form Number anywhere else (except in the specified space) on the Test Booklet/Answer Sheet.
3. The Test Booklet consists of 90 questions.
4. There are three parts in the question paper 1,2,3 consisting of Physics, Chemistry and Mathematics having 30 questions in each subject and each subject having Two sections. (i) Section-I contains 20 multiple choice questions with only one correct option. Marking scheme : +4 for correct answer, 0 if not attempted and –1 in all other cases. (ii) Section-II contains 10 Numerical Value Type questions. Attempt any 5 questions. First 5 attempted questions will be considered for marking. Marking scheme : +4 for correct answer, 0 if not attempted and –1 in all other cases.
5. Use Blue/Black Ball Point Pen only for writting particulars/marking responses on Side –1 and Side–2 of the Answer Sheet. Use of pencil is strictly prohibited.
6. No candidate is allowed to carry any textual material, printed or written, bits of papers, mobile phone any electronic device etc, except the Identity Card inside the examination hall/room.
7. Rough work is to be done on the space provided for this purpose in the Test Booklet only.
8. On completion of the test, the candidate must hand over the Answer Sheet to the invigilator on duty in the Room/ Hall. However, the candidate are allowed to take away this Test Booklet with them.

Name of the Candidate(In Capitals) _____

Date of Examintation _____

Candidate`s Signature:_____ Invigilator`s Signature: _____

PART-1 : PHYSICS

SECTION-I : (Maximum Marks: 80)

This section contains **20 questions**. Each question has 4 options for correct answer. Multiple-Choice Questions (MCQs) **Only one option is correct**. For each question, marks will be awarded as follows:

Full Marks : +4 If correct answer is selected.

Zero Marks : 0 If none of the option is selected.

Negative Marks : –1 If wrong option is selected.

1. The value of sin (480°) is :-

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

2. For $10^{\left(\frac{ax}{t}+4\right)}$ find dimensional formula of a, where x is length and t is time.

(A) $[M^0LT^{-1}]$ (B) $[M^0L^{-1}T^1]$

(C) $[M^0L^{1/2}T^{-1}]$ (D) $[MLT^{-1}]$

3. If the angle between the unit vectors $\hat{a}$ and $\hat{b}$ is 60°, then $|\hat{a}-\hat{b}|$ is :-

(A) 0 (B) 1

(C) 2 (D) 4

4. A ball of 2kg is dropped from a building of height 20 metres. If wind applies a constant horizontal force of 8N on the ball, the horizontal range of the ball will be :

(A) 4m (B) 8m

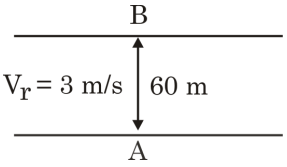
(C) 16m (D) 2m

5. Displacement of a particle is given by $x = 6t^2 - 24t$, where t is in second then velocity will be zero at :-

(A) t = 0 (B) t = 1 sec

(C) t = 2 sec (D) t = 4 sec

6. A man is crossing a river flowing with velocity of 3 m/s. He reaches a point directly across the river at a distance of 60 m in 15 sec. His velocity in still water should be :



(A) 12 m/s (B) 13 m/s (C) 5 m/s (D) 10 m/s

7. A train moving with a speed of 120 km/hr needs to be slowed down for repairing. First, it is slowed down uniformly to 30 km/hr, then it runs at that speed for some time and finally it is accelerated uniformly to its original speed of 120 km/hr. If the distances covered during retardation, uniform motion and acceleration are 3 km, 5 km and 2 km respectively then total time lost in the above journey is :-

(A) 4 min (B) 5 min (C) 7 min (D) 9 min

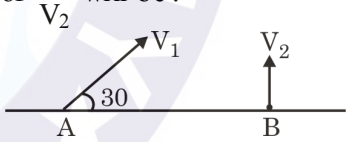
8. If A and B are projected simultaneously such that they collide at the highest point of particle 1 The value of $\frac{V_1}{V_2}$ will be :

(A) 1

(B) 2

(C) $\frac{1}{2}$

(D) cannot be determined



9. A projectile is fired horizontally from an inclined plane (of inclination 45° with horizontal) with speed = 50 m/s. If g = 10 m/s^2, the range measured along the incline is -

(A) 500 m (B) $500\sqrt{2}$ m

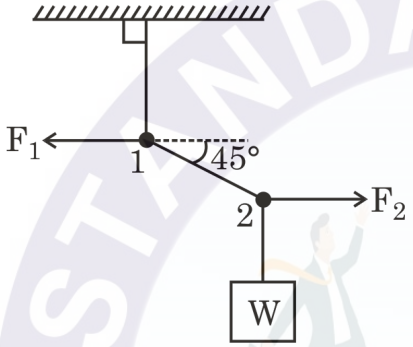
(C) $200\sqrt{2}$m (D) none of these

10. The velocity of a particle in a x-y plane is given by $v = 3t\hat{i} + 4t\hat{j}$. The distance travelled by the particle in 4 sec will be :-

(A) 20 m (B) 40 m

(C) 46 m (D) 50 m

11. In the figure the tension in the string between 1 and 2 is 60 N. Find the magnitude of horizontal force $\vec{F}_1$ and $\vec{F}_2$ that must be applied to hold the system in the position shown.



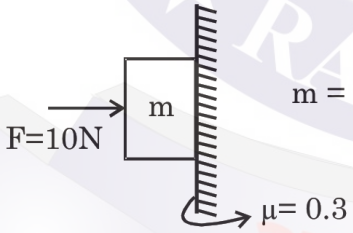
(A) $|\vec{F_1}| = |\vec{F_2}| = 40\sqrt{2}\,N$

(B) $|\vec{F_1}| = |\vec{F_2}| = 30\sqrt{2}\,N$

(C) $|\vec{F_1}| = |\vec{F_2}| = 10\sqrt{2}\,N$

(D) $|\vec{F_1}| = |\vec{F_2}| = 20\sqrt{2}\,N$

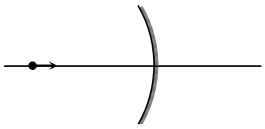
12. Find the friction force acting between block and the wall.



(A) 4 N (B) 5 N

(C) 7 N (D) 3 N

13. A point object is moving along the principle axis of a concave mirror at rest of focal length 30cm with speed 5m/s towards the mirror. Find the speed of image of object when object is at a distance 60cm from mirror.



(A) 5m/s away from mirror

(B) 5m/s towards the mirror

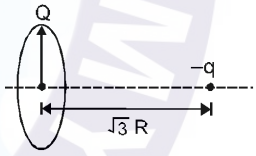
(C) 10m/s away from mirror

(D) 10m/s towards the mirror

14. A rod of length 10 cm lies along the principal axis of a concave mirror of focal length 10 cm in such a way that its end closer to the pole is 20 cm away from the mirror. The length of the image is

(A) 2.5 cm (B) 5 cm (C) 10 cm (D) 15 cm

15. A point charge having charge '-q and mass 'm is released at rest on the axis of a uniformly charged fix ring of total charge Q and radius 'R' from a distance $\sqrt{3}$ R. Find out its velocity when it reaches to centre of ring.



(A) $v = \sqrt{\frac{Qq}{2\pi\epsilon_0 mR}}$ (B) $v = \sqrt{\frac{Qq}{4\sqrt{3}\pi\epsilon_0 mR}}$

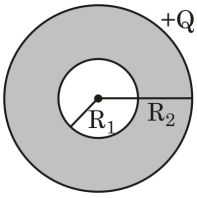
(C) $v = \sqrt{\frac{Qq}{8\pi\epsilon_0 mR}}$ (D) $v = \sqrt{\frac{Qq}{4\pi\epsilon_0 mR}}$

16. Consider a circle of radius R. A point charge lies at a distance a' from its center and on its axis such that $R = a\sqrt{3}$. If electric flux passing through the circle is ϕ then the magnitude of the point charge is :-

(A) $\sqrt{3}\varepsilon_0\phi$ (B) $2\varepsilon_0\phi$

(C) $4\varepsilon_0\phi/\sqrt{3}$ (D) $4\varepsilon_0\phi$

17. Figure shows a thick metallic sphere. If it is given a charge +Q, then electric field will be present in the region :-



(A) $r < R_1$ only

(B) $r > R_1$ and $R_1 < r < R_2$

(C) $r \geqslant R_2$ only

(D) $r \leqslant R_2$

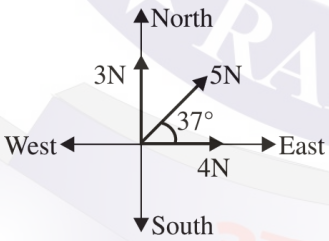
18. A mass 6×10^{24} kg (= mass of earth) is to be compressed in a sphere in such a way that the escape velocity from its surface is 3×10^8m/s (equal to that of light). What should be the radius of the sphere?

(A) 9 mm (B) 8 mm (C) 7 mm (D) 6 mm

19. 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 9R is :

(A) 9 T (B) 27 T (C) 12 T (D) 3 T

20. For shown situation, what will be the magnitude of minimum force in newton that can be applied in any direction so that the resultant force is along east direction?



(A) 15 (B) 6

(C) 5 (D) None of these

SECTION-II : (Maximum Marks: 20)

This section contains 10 questions Candidates have to attempt any 5 questions out of 10. If more than 5 questions are attempted, then only first 5 attempted questions will be evaluated.

The answer to each question is a **Numerical Value.**

For each question, enter the correct integer value (In case of non integer value, the answer should be rounded off to the nearest Integer).

Answer to each question will be evaluated according to the following marking scheme:

Full Marks : +4 If correct answer is entered.

Zero Marks : 0 If the question is unanswered.

Negative Marks : 1 If wrong answer is entered.

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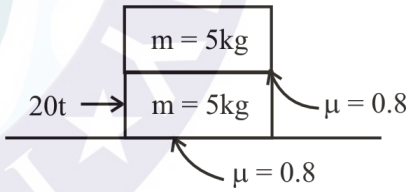
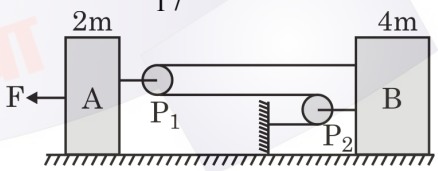
1. Two forces $\vec{F}_1 = 2\hat{i} + 3\hat{j}$ newton and $\vec{F}_2 = 3\hat{i} + 4\hat{j}$ newton act on a body moving from (2, 3)m to (1, 4)m then find magnitude of work done by net force in joule (work done = $\vec{F} \cdot \vec{S}$).

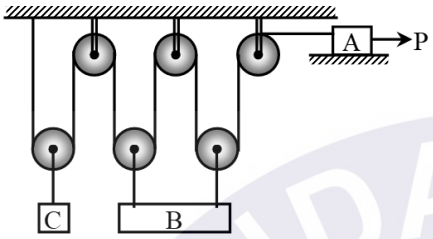
2. In the given figure a force of magnitude 20t is applied on the lower block, where t is time in sec. Coefficient of static friction between contact surfaces is 0.8. For what value of t, upper block begin to slip relative to lower block?



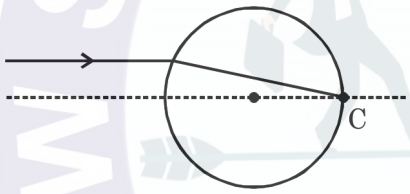
3. The acceleration of the block B in the figure, assuming the surfaces and the pulleys P_1 and P_2 are all smooth and pulleys and string are light is $\frac{3F}{xm}$ then value of $\frac{x}{17}$ is :-



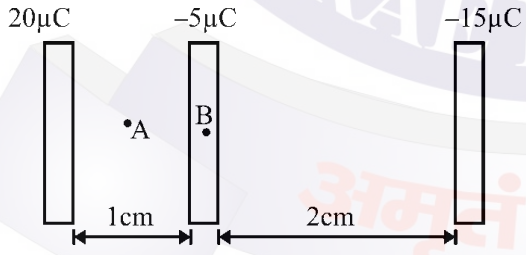
4. Three blocks A, B and C of mass m each are arranged in pulley mass system as shown. Coefficient of friction between block A and horizontal surface is equal to 0.5 and a force P acts on 'A' in the direction shown. The value of P/mg so that block 'C' doesn't move is :-



5. A spherical ball of transparent material has a refractive index μ. A narrow beam of light is aimed as shown. The value of refractive index so that light is focussed at point C on the opposite end of the diameter, is :-

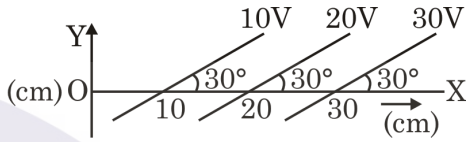


6. Three large thick conducting sheets are placed parallel to each other as shown, charge on plates are 20 μC, –5 μC and – 15 μC and separation between them is 1 cm and 2 cm respectively. Find the ratio of electric field at B to that of electric field at A, $\left[\frac{E_B}{E_A}\right]$:-



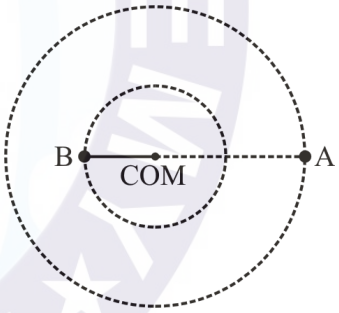
7. There are 8 drops of a conducting fluid. Each has radius r and they are charged to potential 1 volt They are then combined to form a bigger drop. Find potential of big drop in volt.

8. Equipotential surfaces are shown in the following figure. Then corresponding electric field strength is $n \times 10^2$ V/m. Find n.



9. An artificial satellite moving in a circular orbit around the earth has a total energy (K.E. + P.E.) E_0 The ratio of its P.E to the total energy is :

10. Figure shows a binary star system revolving about their COM. The masses of star A & B are 15×10^{30} kg and 45×10^{30} kg respectively. Find the ratio of area swept by star A to area swept by star B in a common time interval.



PART-2 : CHEMISTRY

SECTION-I : (Maximum Marks: 80)

This section contains **20 questions**. Each question has 4 options for correct answer. Multiple-Choice Questions (MCQs) **Only one option is correct**. For each question, marks will be awarded as follows:

Full Marks : +4 If correct answer is selected.

Zero Marks : 0 If none of the option is selected.

Negative Marks : –1 If wrong option is selected.

1. A sample of carbon contains 95% by mole C^{12} and 5% by mole C^{14} isotopes. The average number of neutrons per atom is :

(A) 12.5

(B) 12.1

(C) 6.05

(D) 6.1

2. Find $[VD]_{mix}$ of a gaseous mixture of O_3 and O_2. Molar ratio of O_3 to O_2 is 1 : 2

(A) $\frac{56}{6}$ (B) $\frac{112}{3}$

(C) $\frac{224}{3}$ (D) $\frac{56}{3}$

3. A mixture of H_2 & O_2 having total volume 55 ml is sparked in an Eudiometry tube & contraction of 45 ml is observed after cooling. What can be composition of reacting mixture?

(A) 30 ml H_2 & 25 ml O_2

(B) 10 ml H_2 & 45 ml O_2

(C) 35 ml H_2 & 20 ml O_2

(D) None

4. Which among the following species has unequal bond lengths?

(A) BF_4^-

(B) XeF_4

(C) SF_4

(D) SiF_4

5. Among the following, the set of parameters that represents path function, is :

(A) q + w
(B) q
(C) w
(D) H-TS

(1) A and D
(2) B,C and D
(3) B and C
(4) A,B and C

6. Vapour pressure of solution containing 6gm non volatile solute in 180 gm of water is 20 torr. If 1 mole of water is further added into the solution so that vapour pressure increases by 0.02 torr. Calculate vapour pressure of pure water.

(A) 20.22 torr

(B) 20.02 torr

(C) 19.78 torr

(D) 19.88 torr

7. For a gaseous reaction

$CH_3CHO(g) \xrightarrow{\Delta} CO(g) + CH_4(g)$

initial pressure is 80 mm of Hg and total pressure at the end of 20 minutes is 120 mm of Hg. The rate constant of the reaction assuming first order kinetic is :-

(A) 3.465×10^{-2} min^{-1}

(B) 34.65 min^{-1}

(C) 3.465 min^{-1}

(D) 0.3465 min^{-1}

8. During an adiabatic process, the pressure of a gas is found to be proportional to the cube of its absolute temperature. The ratio of C_P/C_V for the gas is :-

(A) 3/2 (B) 7/5

(C) 5/3 (D) 4/3

9. Change in entropy is negative for

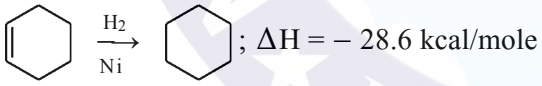
(A) Bromine (l)→Bromine (g)

(B) $C(s) + H_2O(g) \rightarrow CO(g) + H_{2(g)}$

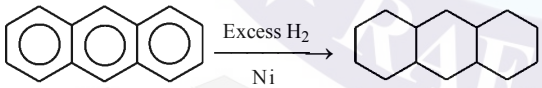
(C) N_2(g, 10 atm)→N_2(g, 1 atm)

(D) Fe (1 mol, 400 K)→Fe (1 mol, 300 K)

10. Given



; $\Delta H = -28.6$ kcal/mole



Anthracene $\Delta H = -116.2$ kcal/mol

Calculate the resonance energy of Anthracene

(A) $-84\frac{kcal}{mol}$ (B) $-100\frac{kcal}{mol}$

(C) $-110\frac{kcal}{mol}$ (D) $-116\frac{kcal}{mol}$

11. Find the maximum number of electrons that can be filled in P shell

(A) 6 (B) 2 (C) 72 (D) 50

12. ${}_xA^y$ & ${}_pB^q$ are isobars. While ${}_mC^n$ is isotone with ${}_xA^y$

Select the correct option

(A) y = (n m) (B) n = q x + m

(C) x = p (D) (y x) = (q p)

13. In the formation of $X^{+2}_{(g)}$ from $X^{+}_{(g)}$, 4 eV energy is absorbed, which would be equal to :

(A) $\Delta H_{e.g}$ of $X^{+}_{(g)}$ (B) IE of $X^{+2}_{(g)}$

(C) IE of $X_{(g)}$ (D) $\Delta H_{e.g}$ of $X^{+2}_{(g)}$

14. Which of the following order is **CORRECT** for indicate property ?

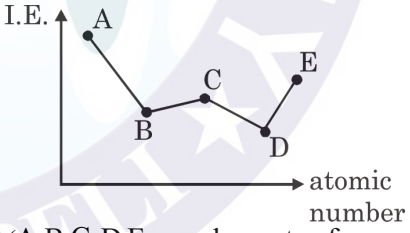
(A) C > Si > Ge > Sn > Pb (Ionization energy)

(B) S > O > Se > Te (Electron gain enthalpy)

(C) $SiO_2 > Al_2O_3 > MgO$ (Basic character)

(D) $Cl_2O_7 > N_2O_5 > P_4O_{10}$ (acidic character)

15. Carefully observe the following graph.



(A,B,C,D,E are elements of one group)

The above graph is correct for which group of periodic table.

(A) Group : 1 (B) Group : 14

(C) Group : 13 (D) Group : 15

16. Which of the following species is planar and polar ?

(A) SO_3 (B) $POCl_3$

(C) NH_2^- (D) SO_3^{-2}

17. For molecule $CF_2(CH_3)_2$ maximum atoms that can be present in the same plane

(A) 7 (B) 5

(C) 3 (D) 9

18. Due to hydrogen bonding, which of the following molecule do not form ring either in their monomeric form or dimeric form ?

(A) CH_3COOH

(B) Salicylic aldehyde

(C) C_6H_5OH

(D) $CCl_3CHO.H_2O$

19. Amongst the following the acid having $-O-O-$ bond is

(A) $H_2S_2O_3$ (B) $H_2S_2O_5$

(C) $H_2S_2O_6$ (D) $H_2S_2O_8$

20. Which of the following option is not correct against mentioned properties :

(A) $IO_4^- > IO_3^- > IO_2^-$ (I–O bond order)

(B) $NH_3 > NF_3$ (Boiling point)

(C) $\dot{N}O_2 > \dot{C}H_3 > \dot{C}lO_2$ (Bond angle)

(D) 2D silicate > 3D silicate > pyrosilicate (number of shared oxygen)

SECTION-II : (Maximum Marks: 20)

This section contains 10 questions Candidates have to attempt any 5 questions out of 10. If more than 5 questions are attempted, then only first 5 attempted questions will be evaluated.

The answer to each question is a **Numerical Value.**

For each question, enter the correct integer value (In case of non-integer value, the answer should be rounded off to the nearest Integer).

Answer to each question will be evaluated according to the following marking scheme:

Full Marks : +4 If correct answer is entered.

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Negative Marks : 1 If wrong answer is entered.

1. Find (O O) bond enthalpy in H_2O_2 (kJ/mol)

Given : $\Delta H_f(H_2O_2, l) = 200$ kJ/mol

$\Delta H_f(H_2O, l) = 285$ kJ/mol

$\Delta H_{vap.}(H_2O_2, l) = 60$ kJ/mol

$\Delta H_{vap}(H_2O, l) = 40$ kJ/mol

$\Delta H_{atomisation}(O_2, g) = 300$ kJ/mol

Fill your answer as sum of digits (excluding decimal places) till you get the single digit answer.

2. Calculate ΔG (in bar-L) when a definite mass of a monoatomic ideal gas at 1 bar & 27°C is expanded adiabatically against vaccum from 10 L to 20 L ($\ln 2 = 0.7$)

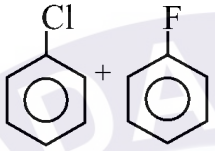
3. FeO crystallize according rock salt structure, where O^{-2} is equivalent to $Cl^{\ominus}$ ion. Due to some crystal defect, lattice becomes $Fe_{0.75}O$. Find number of effective Fe^{+2} ions per unit cell.

4. 62 g ethylene glycol is dissolved in 500 gram water. The solution is placed in a refrigerator maintained at a temperature of 263 K. What amount of ice (in grams) will separate out at this temperature? (K_f water = 1.86 K molality $^{-1}$)

5. If ratio of molarity and molality for 40%, (w/w) aqueous solution of NaOH having density 2 gm/cc is x : 1, then find out value of 5x/3 :

6. Find number of the pair of compounds in which intermolecular interaction energy is dependent on the inverse cube of distance between the molecules is :

(i) $H_2O + H_2O$ (ii) $CCl_4 + C_6H_6$

(iii) $CHCl_3 + CHCl_3$ (iv) 

(v) $K^+ + I^-$ (vi) He + Ne

7. Find the total number of compound(s), which is/are repelled by magnetic field

K_2O_2 , KO_2 , O_2, $NO[BF_4]$, KCN, Na_2C_2

8. For the mineral Hemimorphite, $Zn_x(OH)_2Si_4O_{14}$. Find out the value of 'x'.

9. Which out of the following options are incorrect ? According to the mentioned properties.

(i) LiCl < NaCl < KCl < RbCl (% covalent character)

(ii) Maximum covalency of halogen including F which can be achieved is 7.

(iii) IP_1 of ion M^{+2} > EA_1 of M^{+3} .

(IP = ionisation potential, EA = electron affinity)

(iv) S > Se > Te > O (order of EA)

(v) Li < Be < B < C (order of electronegativity)

(vi) Mg^{+2} < Na < F^- (order of ionic size)

(vii) $Li^+ > Na^+ > K^+$ (order of hydrated size)

(viii) NaCl > $MgCl_2$ > $AlCl_3$ (order of lattice energy)

10. In aqueous solution, how many of the following oxides can change colour of red litmus paper ?

BaO, Cl_2O_7, SO_2, SrO, Rb_2O, P_4O_{10}, SiO_2

PART-3 : MATHEMATICS

SECTION-I : (Maximum Marks: 80)

This section contains **20 questions**. Each question ha 4 options for correct answer. Multiple-Choic Questions (MCQs) **Only one option is correct**. Fo each question, marks will be awarded as follows:

Full Marks : +4 If correct answer is selected.

Zero Marks : 0 If none of the option is selected.

Negative Marks : 1 If wrong option is selected.

1. If n(U) = 600, n(A) = 100, n(B) = 200 and $n(A \cap B) = 50$, then $n(\bar{A} \cap \bar{B})$ is -

(U is universal set and A and B are subsets of U)

(A) 300

(B) 350

(C) 250

(D) 200

2. If $a + b + c > \frac{9c}{4}$ and quadratic equation $ax^2 + 2bx - 5c = 0$ has non-real roots, then -

(A) $a > 0, c > 0$

(B) $a > 0, c < 0$

(C) $a < 0, c < 0$

(D) $a < 0, c > 0$

3. If the equation x^2 kx 7 = 0 and $x^2 - 6x - (k + 1) = 0$ have a common roots then find the sum of uncommon roots is equal to-

(A) 2 (B) 2

(C) 6 (D) 6

4. Let invertible function $f(x)$ satisfies $e^{f(x)} + f(x) = \ell nx$, then $\ell n(f^{-1}(1))$ is-

(A) e

(B) e – 1

(C) e + 1

(D) 1

5. If $f(x) = \frac{(484)^{x-1}}{(484)^x + 22}$, then $f\left(\frac{1}{45}\right) + f\left(\frac{2}{45}\right) + f\left(\frac{3}{45}\right) + \ldots + f\left(\frac{44}{45}\right)$ is equal to

(A) 44 (B) 22

(C) 1/11 (D) 1/22

6. The sum $\sum_{n=1}^{\infty} \tan^{-1} \frac{3}{n^2 + n - 1}$ is equal to -

(A) $\frac{\pi}{2}$

(B) $\pi + \tan^{-1} 3$

(C) $\frac{\pi}{2} + \tan^{-1} 3$

(D) $\tan^{-1} 3$

7. If $\log_2 \sin x - \log_2 \cos x - \log_2(1 - \tan^2 x) = -1$, the number of solutions of the equation for $x \in [0, 2\pi)$ are -

(A) 1 (B) 2

(C) 3 (D) 4

8. If $\sum_{r=1}^{n} T_r = n(n^2 - 1)$, then $\sum_{r=2}^{\infty} \frac{1}{T_r}$ equal to -

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

9. Match List-I with List-II and select the correct answer using the code given below the list.

List-I		List-II	
(A)	$\tan 16^\circ \tan 42^\circ \tan 44^\circ \tan 45^\circ \tan 76^\circ$ is equal to	(I)	0
(B)	$\left(1 \quad \cot \frac{\pi}{10}\right)\left(1 \quad \cot \frac{3\pi}{20}\right)$ is equal to	(II)	$\frac{3}{4}$
(C)	$\prod_{k=1}^{15} \sin\left(\frac{k\pi}{10}\right)$ is equal to	(III)	2
(D)	$\cos^2 65^\circ + \cos^2 55^\circ + \cos 65^\circ \cos 55^\circ$ is equal to	(IV)	1

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

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

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

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

10. Number of terms common to the two sequences 17,21,25,...,417 and 16,21,26,....,466 is

(A) 19 (B) 20

(C) 21 (D) 22

11. If $\lim_{x \to \infty} \left(\frac{x^3 + 1}{x^2 + 1} / (ax + b)\right) = 2$ then

(A) a = 1 b = 1 (B) a = 1 b = 2

(C) a = 1 b = 2 (D) none of these

12. Let $f(x) = \begin{cases} \frac{\sin 2x \quad 2\tan x}{\ell n(1+x^3)} & , \quad x \neq 0 \\ k & , \quad x = 0 \end{cases}$

If $f(x)$ is continuous at x = 0 then the value of k, is

(A) 1 (B) 1 (C) 2 (D) 2

13. If $f(x) = \left|\left(x + \frac{1}{2}\right)[x]\right|$, $x \in [-2,2]$, then-
(where [.] denotes greatest integer function)

(A) $f(x)$ is discontinuous at 4 points and not differentiable at 4 points

(B) $f(x)$ is discontinuous at 3 points and not differentiable at 4 points

(C) $f(x)$ is discontinuous at 4 points and not differentiable at 5 points

(D) $f(x)$ is discontinuous at 5 points and not differentiable at 5 points

14. If $f(x) = \begin{cases} \frac{1-\sin x}{(\pi-2x)^2} \cdot \frac{\log \sin x}{\log(1+\pi^2-4\pi x+4x^2)}, & x \neq \frac{\pi}{2} \\ k, & x = \frac{\pi}{2} \end{cases}$
is continuous at $x = \pi/2$, then k is :

(A) $-\frac{1}{16}$ (B) $-\frac{1}{32}$

(C) $-\frac{1}{64}$ (D) $-\frac{1}{128}$

15. Let $g : R \longrightarrow R$ be given by $g(x) = e^{2x} + 3x + \sin x + 1$. If g^{-1} is the inverse function of g, then find the value of $\frac{1}{(g^{-1})'(2)}$.

(A) 6 (B) 1/6

(C) 5 (D) 1/5

16. Let x and y be real numbers such that $\frac{\sin x}{\sin y} = 3$ and $\frac{\cos x}{\cos y} = \frac{1}{2}$. The value of $\frac{\sin 2x}{\sin 2y} + \frac{\cos 2x}{\cos 2y}$ can be expressed in the form $\frac{p}{q}$, where p and q are relatively prime positive integers. Find p + q.

(A) 105 (B) 106

(C) 107 (D) 108

17. Let f(x) is differentiable function in [2, 5] such that $f(2) = \frac{1}{5}$ and $f(5) = \frac{1}{2}$ then their exists a number x_0, $2 < x_0 < 5$ for which $f'(x_0)$ equals

(A) $\frac{1}{15}$ (B) $\frac{1}{10}$

(C) $\frac{1}{5}$ (D) $\frac{1}{2}$

18. The normal to the curve $y(x\ \ 2)(x\ \ 3) = x + 6$ at the point where the curve intersects the y-axis passes through the point :

(A) $\left(\frac{1}{2}, \frac{1}{3}\right)$

(B) $\left(\frac{1}{2}, \frac{1}{3}\right)$

(C) $\left(\frac{1}{2}, \frac{1}{2}\right)$

(D) $\left(\frac{1}{2}, \frac{1}{2}\right)$

19. Let $f : [0, 2] \longrightarrow R$ be a twice differentiable function such that $f''(x) > 0$, for all $x \in (0, 2)$. If $\phi(x) = f(x) + f(2\ \ x)$, then ϕ is :

(A) decreasing on (0, 2)

(B) decreasing on (0, 1) and increasing on (1, 2)

(C) increasing on (0, 2)

(D) increasing on (0, 1) and decreasing on (1, 2)

20. If f (x) is continuous and differentiable over [2, 5] and $4 \leq f'(x) \leq 3$ for all x in (2, 5) then the greatest possible value of f (5) f (2) is

(A) 7 (B) 9

(C) 15 (D) 21

SECTION-II : (Maximum Marks: 20)

This section contains 10 questions Candidates have to attempt any 5 questions out of 10. If more than 5 questions are attempted, then only first 5 attempted questions will be evaluated.

The answer to each question is a **Numerical Value.**

For each question, enter the correct integer value (In case of non-integer value, the answer should be rounded off to the nearest Integer).

Answer to each question will be evaluated according to the following marking scheme:

Full Marks : +4 If correct answer is entered.

Zero Marks : 0 If the question is unanswered.

Negative Marks : –1 If wrong answer is entered.

1. Let f(x) be a polynomial of degree 3 such that $f(k) = -\frac{2}{k}$ for k = 2, 3, 4, 5. Then the value of 52 – 10 f(10) is equal to :

2. Let $f : R \longrightarrow R$ be defined as $f(x) = x^3 + 2k\,x^2 + (k^2 + 12)\,x - 12$. If f(x) is strictly increasing on R, then the largest value of k is equal to

3. If $\alpha = \sum_{k=1}^{n} k$, $\beta = \frac{\sqrt{10}}{3}\sum_{k=1}^{n} k^2$ and $\gamma = \sum_{k=1}^{n} k^3$ and α, β, γ are in G.P., then the sum of all values of 'n' is

4. Let $S = 1 + 2.2 + 3.2^2 + 4.2^3 + ... + 100.2^{99}$. If sum can be expressed as $a(b)^c + 1$ where a, b, c $\in$ N & b is prime number then value of $\frac{2(c-a)}{b}$ is equal to

5. If α and β are roots of the equation $x^2 - 6x + 12 = 0$ and the value of $(\alpha - 2)^{24} \cdot \frac{(\beta - 6)^8}{\alpha^8} + 1$ is a^b where a and b are natural numbers then the least value of $\frac{(a+b)}{2}$ is equal to

6. The greatest value of expression $\log_{(26+8\sqrt{10})}\left(\cos^2\theta - 6\sin\theta\cos\theta + 3\sin^2\theta + 2\right)$ is 'K', then '4K' is

7. $\lim_{x\to\infty}\left(\sqrt[4]{x^4+3x} - \sqrt[3]{x^3+3}\right)$ is equal to

8. If $f(x) = x^{11} + x^9 - x^7 + x^3 + 1$, then $f(\sin^{-1}(\sin 3)) + f(\tan^{-1}(\tan 3))$ is equal to

9. If function $f(x) = 27x^3 + 2px^2 + qx - 64$ has three real roots and f(x) is bijective function then value of $\frac{p+q}{10}$ is :

10. If the equation $\cot^4 x - 2\operatorname{cosec}^2 x + a^2 - 4a + 6 = 0$ has at least one real solution then the sum of all possible integral values of a is