

**CLASSROOM CONTACT PROGRAMME**

(Academic Session : 2020 - 2021)

JEE(Advanced)

UNIT TEST

04-10-2020

JEE(Main + Advanced) : NURTURE COURSE [PHASE : S, I(A), I, II, III, IV(A) & IV]**PAPER-1**

Time : 3 Hours

Maximum Marks : 183



READ THE INSTRUCTIONS CAREFULLY**GENERAL :**

1. This sealed booklet is your Question Paper. Do not break the seal till you are told to do so.
2. Use the Optical Response sheet (ORS) provided separately for answering the questions.
3. Blank spaces are provided within this booklet for rough work.
4. Write your name, form number and sign in the space provided on the back cover of this booklet.
5. After breaking the seal of the booklet, verify that the booklet contains **24** pages and that all the **18** questions in each subject and along with the options are legible. If not, contact the invigilator for replacement of the booklet.
6. You are allowed to take away the Question Paper at the end of the examination.

OPTICAL RESPONSE SHEET :

7. The ORS will be collected by the invigilator at the end of the examination.
8. Do not tamper with or mutilate the ORS. **Do not use the ORS for rough work.**
9. Write your name, form number and sign with pen in the space provided for this purpose on the ORS. **Do not write any of these details anywhere else on the ORS.** Darken the appropriate bubble under each digit of your form number.

DARKENING THE BUBBLES ON THE ORS :

10. Use a **BLACK BALL POINT PEN** to darken the bubbles on the ORS.
11. Darken the bubble  **COMPLETELY.**
12. The correct way of darkening a bubble is as : 
13. The ORS is machine-gradable. Ensure that the bubbles are darkened in the correct way.
14. Darken the bubbles **ONLY IF** you are sure of the answer. There is **NO WAY** to erase or "un-darken" a darkened bubble.
15. Take **$g = 10 \text{ m/s}^2$** unless otherwise stated.

DO NOT BREAK THE SEALS WITHOUT BEING INSTRUCTED TO DO SO BY THE INVIGILATOR

Please see the last page of this booklet for rest of the instructions

SOME USEFUL CONSTANTS

Atomic No. : H = 1, B = 5, C = 6, N = 7, O = 8, F = 9, Al = 13, P = 15, S = 16,
Cl = 17, Br = 35, Xe = 54, Ce = 58

Atomic masses : H = 1, Li = 7, B = 11, C = 12, N = 14, O = 16, F = 19, Na = 23, Mg = 24,
Al = 27, P = 31, S = 32, Cl = 35.5, Ca = 40, Fe = 56, Br = 80, I = 127,
Xe = 131, Ba = 137, Ce = 140, Cu = 63.5, Ne = 20, K = 39, Mn = 55

Space for Rough Work

HAVE CONTROL → HAVE PATIENCE → HAVE CONFIDENCE ⇒ 100% SUCCESS

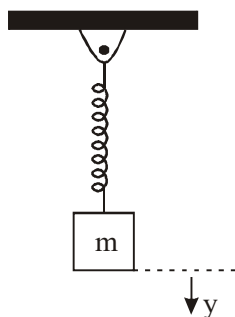
BEWARE OF NEGATIVE MARKING

PART-1 : PHYSICS

SECTION-I(i) : (Maximum Marks: 28)

- This section contains **SEVEN** questions.
- Each question has **FOUR** options for correct answer(s). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct option(s).
- For each question, choose the correct option(s) to answer the question.
- Answer to each question will be evaluated according to the following marking scheme:
Full Marks : +4 If only (all) the correct option(s) is (are) chosen.
Partial Marks : +3 If all the four options are correct but **ONLY** three options are chosen.
Partial Marks : +2 If three or more options are correct but **ONLY** two options are chosen, both of which are correct options.
Partial Marks : +1 If two or more options are correct but **ONLY** one option is chosen and it is a correct option.
Zero Marks : 0 If none of the options is chosen (i.e. the question is unanswered).
Negative Marks : -2 In all other cases.
- **For Example :** If first, third and fourth are the **ONLY** three correct options for a question with second option being an incorrect option; selecting only all the three correct options will result in +4 marks. Selecting only two of the three correct options (e.g. the first and fourth options), without selecting any incorrect option (second option in this case), will result in +2 marks. Selecting only one of the three correct options (either first or third or fourth option), without selecting any incorrect option (second option in this case), will result in +1 marks. Selecting any incorrect option(s) (second option in this case), with or without selection of any correct option(s) will result in -2 marks.

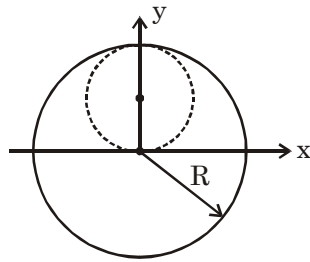
1. A block suspended from a spring at natural length and is free to move vertically in the y-direction. Mark the **CORRECT** statement(s) :-



- (A) Mass is released when $y = 0$; the maximum value of y reached by the mass m is $2mg/k$
 (B) Mass is released when $y = 0$; the maximum value of y reached by the mass m is mg/k
 (C) Due to air resistance the mass settles down into an equilibrium position y_{eq} , the mechanical energy loss is $\frac{1}{2}(m^2g^2/k)$
 (D) Due to air resistance the mass settles down into an equilibrium position y_{eq} , the mechanical energy lost is (m^2g^2/k)

Space for Rough Work

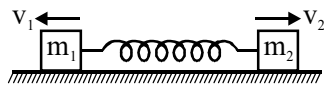
2. A lamina is made by removing a disc of diameter R from a uniform disc of radius R and mass m .



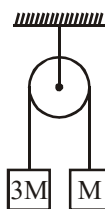
- (A) Mass of remaing lamina is $m/2$ (B) mass of remaining lamina is $\frac{3m}{4}$
- (C) the y-coordinate of COM is $-\frac{R}{6}$ (D) x-coordinate of COM of lamina is zero.
3. Consider a head on elastic collision, between two bodies. Which of the following statement is **CORRECT** :-
- (A) Kinetic energy is conserved during the collision.
 (B) Linear momentum is conserved during the collision.
 (C) Mechanical energy is conserved during the collision.
 (D) Only conservative forces act during the collision.

Space for Rough Work

4. Two blocks of mass m_1 & m_2 are connected by a spring in its natural length having spring constant k and are placed on a smooth surface. Block m_1 and m_2 are given velocities v_1 and v_2 as shown in figure. Choose **CORRECT** statements :-



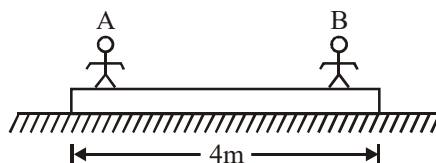
- (A) Momentum of the system of m_1 & m_2 in the ground frame is conserved
 (B) Momentum of the system of m_1 & m_2 in the frame attached to center of mass of m_1 & m_2 is always zero
 (C) The term $\frac{1}{2}(m_1 + m_2) v_c^2$ is always constant, where v_c is velocity of center of mass of m_1 & m_2
 (D) Kinetic energy in center of mass frame remains constant
5. Two blocks of mass M and $3M$ are connected by a light cord which passes over a light frictionless pulley as shown in the figure. The blocks are released from rest and are at the same height at $t = 0$.



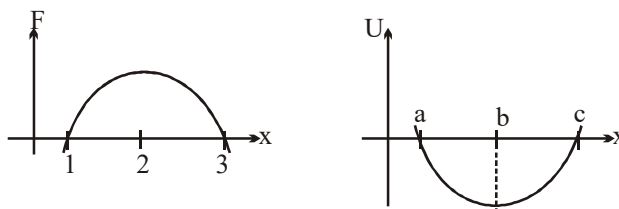
- (A) Tension in string connecting masses is $\frac{3Mg}{4}$
 (B) The acceleration of both masses is $\frac{g}{2}$ in magnitude
 (C) The centre of mass accelerates down.
 (D) The net force on system having M and $3M$ is zero.

Space for Rough Work

6. In the arrangement shown two men A and B of mass 50kg and 60 kg respectively are standing on the ends of a plank of mass 90 kg. Plank is kept on a smooth plane. Now man starts moving and exchange their positions on the plank. Then



- (A) The distance moved by centre of mass of the system A + B + plank is 20 cm
 (B) The distance moved by plank is 20 cm
 (C) The distance moved by man A with respect to ground is 420cm
 (D) The distance moved by man B with respect to ground is 600 cm.
7. A particle is subjected to a conservative force as seen in the graphs, which of the following are **CORRECT**.



- (A) Particle is in stable equilibrium at point 3 and b.
 (B) Particle is in neutral equilibrium at point b and 2.
 (C) No power is delivered by the force to the particle at 1,3, and b.
 (D) Particle has maximum kinetic energy at position b.

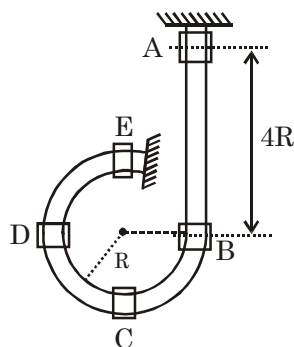
Space for Rough Work

SECTION-I(ii) : (Maximum Marks : 18)

- This section contains **SIX** questions of matching type.
- This section contains **Two** tables (each having 3 columns and 4 rows)
- Based on each table, there are **THREE** questions
- Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is correct
- For each question, darken the bubble corresponding to the correct option in the ORS.
- For each question, marks will be awarded in one of the following categories :
Full Marks : +3 If only the bubble corresponding to the correct option is darkened.
Zero Marks : 0 If none of the bubbles is darkened.
Negative Marks : -1 In all other cases

Answer Q.8, Q.9 and Q.10 by appropriately matching the information given in the three columns of the following table.

A particle is released from rest from point A such that it slides along the vertical pole of length $4R$ and along the circular frame of radius R as shown below. All of the surfaces are smooth.



	Column-1 Speed of particle	Column-2 Magnitude of Normal reaction	Column-3 Tangential acceleration
	(I) $\sqrt{6gR}$	(i) $5mg$	(P) 0
	(II) $\sqrt{8gR}$	(ii) 8 mg	(Q) $\frac{g}{2}$
	(III) $\sqrt{10gR}$	(iii) $9mg$	(R) $\frac{g}{3}$
	(IV) $\sqrt{12gR}$	(iv) 11 mg	(S) g
8.	At point C (A) (III) (iii) (P)	(B) (I) (iii) (S)	(C) (III) (iv) (S) (D) (III) (iv) (P)
9.	At point D (A) (II) (ii) (S)	(B) (II) (i) (S)	(C) (II) (iii) (Q) (D) (II) (ii) (P)
10.	At point E (A) (II) (ii) (S)	(B) (I) (iii) (P)	(C) (I) (i) (P) (D) (II) (i) (S)

Space for Rough Work

Answer Q.11, Q.12 and Q.13 by appropriately matching the information given in the three columns of the following table.

Two blocks of mass m_1 and m_2 are placed on a smooth horizontal floor. The initial velocity of m_1 and m_2 are \vec{v}_1 and \vec{v}_2 respectively.



Column-1
Speed of m_2
after collision

Column-2
Loss in KE
of system after
collision

Column-3
Maximum potential
energy of deformation
during collision

(I) $2\sqrt{2} \text{ m/s}$

(i) $\frac{4}{3} \text{ J}$

(P) $\frac{4}{3} \text{ J}$

(II) 2 m/s

(ii) $\frac{2}{3} \text{ J}$

(Q) 8 J

(III) $\sqrt{5} \text{ m/s}$

(iii) 1 J

(R) $\frac{2}{3} \text{ J}$

(IV) $\frac{4}{3} \text{ m/s}$

(iv) 0 J

(S) 1 J

11. If $m_1 = m_2 = 2 \text{ kg}$, $v_1 = 2\hat{i} \text{ m/s}$, $v_2 = -2\hat{i} \text{ m/s}$ and collision is elastic in nature.

(A) (II) (iv) (Q) (B) (III) (iv) (P) (C) (III) (iv) (S) (D) (II) (iii) (S)

12. If $m_1 = 2 \text{ kg}$ and $m_2 = 4 \text{ kg}$, $\vec{v}_1 = 2\hat{i} \text{ m/s}$ and $\vec{v}_2 = 1\hat{i} \text{ m/s}$ and collision is perfectly inelastic.

(A) (II) (iv) (P) (B) (IV) (ii) (R) (C) (II) (iv) (S) (D) (IV) (ii) (P)

13. If $m_1 = 2 \text{ kg}$ and $m_2 = 1 \text{ kg}$, $\vec{v}_1 = 2\hat{i} \text{ m/s}$, $\vec{v}_2 = 2\hat{j} \text{ m/s}$ and collision is inelastic with $e = \frac{1}{2}$. The line of collision is along the x-axis :-

(A) (II) (iv) (R) (B) (IV) (ii) (Q) (C) (I) (iii) (P) (D) (IV) (ii) (R)

Space for Rough Work

SECTION-II : (Maximum Marks: 15)

- This section contains **FIVE** questions.
- The answer to each question is a **NUMERICAL VALUE**.
- For each question, enter the correct numerical value (in decimal notation, truncated/rounded-off to the **second decimal place**; e.g. 6.25, 7.00, -0.33, -.30, 30.27, -127.30, if answer is 11.36777..... then both 11.36 and 11.37 will be correct) by darkening the corresponding bubbles in the ORS.

For Example : If answer is -77.25, 5.2 then fill the bubbles as follows.

+									
0	0	0	0	0	0	0	0	0	0
1	1	1	1	1	1	1	1	1	1
2	2	2	2	2	2	2	2	2	2
3	3	3	3	3	3	3	3	3	3
4	4	4	4	4	4	4	4	4	4
5	5	5	5	5	5	5	5	5	5
6	6	6	6	6	6	6	6	6	6
7	7	7	7	7	7	7	7	7	7
8	8	8	8	8	8	8	8	8	8
9	9	9	9	9	9	9	9	9	9

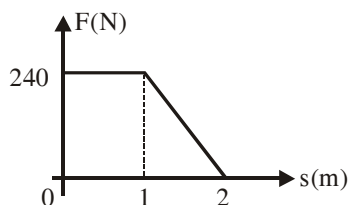
-									
0	0	0	0	0	0	0	0	0	0
1	1	1	1	1	1	1	1	1	1
2	2	2	2	2	2	2	2	2	2
3	3	3	3	3	3	3	3	3	3
4	4	4	4	4	4	4	4	4	4
5	5	5	5	5	5	5	5	5	5
6	6	6	6	6	6	6	6	6	6
7	7	7	7	7	7	7	7	7	7
8	8	8	8	8	8	8	8	8	8
9	9	9	9	9	9	9	9	9	9

- Answer to each question will be evaluated according to the following marking scheme:
Full Marks : +3 If **ONLY** the correct numerical value is entered as answer.
Zero Marks : 0 In all other cases.

- Block A of mass 0.50 kg initially travelling towards right at 4.00 m/s on a frictionless horizontal track collides elastically with another block B of mass 1.50 kg initially at rest. If the collision is head on, find magnitude of momentum in SI units of the block B after the collision.

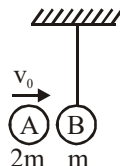


- A block of mass 45 kg resting on a horizontal surface is acted upon by a force F which varies as shown in the figure. If the coefficient of friction between the block and surface is 0.2, find the displacement (in m) when the block will come to rest.



Space for Rough Work

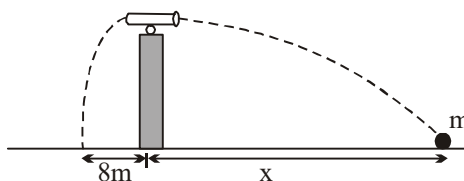
3. A sphere A of mass 2kg moving with velocity v_0 collide with bob of mass 1kg as shown in the figure. value of tension at which string of pendulum break is 40N. If length of pendulum is 30cm, then find the maximum value of v_0 in m/s so that string does not break. Coefficient of restitution is $\frac{1}{2}$.



4. Two blocks each of mass 2kg moving with velocities as shown in figure. Find maximum compression (in cm) of spring, if $k = 100 \text{ N/m}$.



5. A cannon of mass $M = 200 \text{ kg}$ is positioned at the top of a narrow wall as shown. It fires a ball of mass $m = 2 \text{ kg}$ horizontally across a plane. Unfortunately the gunners forgot to lock the frictionless wheels of the cannon and it immediately rolls backwards off the wall, landing a distance 8 m from the wall as shown. Neglecting air friction, at what distance x (in meters) from the base of the wall does the ball land ?



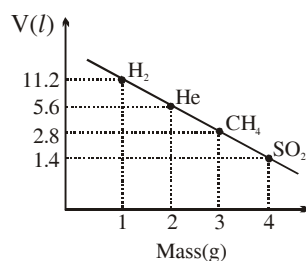
Space for Rough Work

PART-2 : CHEMISTRY**SECTION-I(i) : (Maximum Marks: 28)**

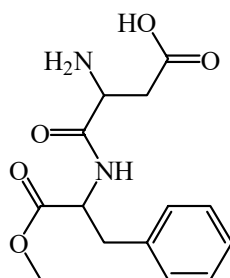
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 - **For Example :** If first, third and fourth are the **ONLY** three correct options for a question with second option being an incorrect option; selecting only all the three correct options will result in +4 marks. Selecting only two of the three correct options (e.g. the first and fourth options), without selecting any incorrect option (second option in this case), will result in +2 marks. Selecting only one of the three correct options (either first or third or fourth option), without selecting any incorrect option (second option in this case), will result in +1 marks. Selecting any incorrect option(s) (second option in this case), with or without selection of any correct option(s) will result in -2 marks.
-
1. Select the **CORRECT** statements about ClO_2^+ .
(A) Cationic part of solid $\text{Cl}_2\text{O}_6(\text{s})$
(B) Nature of π bond(s) present is $3\text{d}\pi\text{-}2\text{p}\pi$ & $3\text{p}\pi\text{-}2\text{p}\pi$
(C) Total lone pairs of electrons are five
(D) Hybridisation of Cl is sp^2
 2. 50 ml, 1M Sn^{2+} oxidised to Sn^{x+} by 10 ml, 2M MnO_4^- solution in acidic medium completely. Select the incorrect option(s) -
(A) Value of $x = 4$
(B) 0.1 gram equivalent of MnO_4^- consumed
(C) 100 gram equivalent of Sn^{2+} consumed
(D) Value of $(x + 2) = 4$

Space for Rough Work

3. At 1 atm and 273°C following is graphical representation of volume occupied by different gases. Which is not correctly matched ?

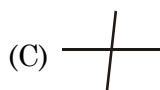
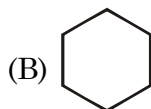
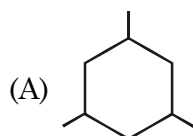


- (A) H₂ (B) He (C) CH₄ (D) SO₂
4. Which functional group(s) is/are present in ASPARTAME -

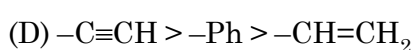
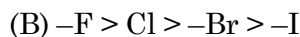
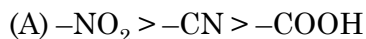


ASPARTAME

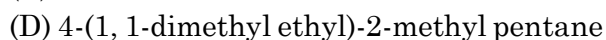
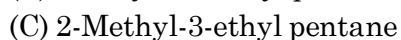
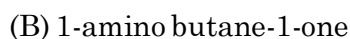
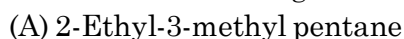
- (A) Carboxylic acid (B) Amide (C) Ether (D) Amine
5. Which of the following contains of 1°, 2° & 3° carbon atoms.



6. Which of the following is the correct order of -I effect :



7. Which of the following is / are **incorrect** IUPAC names



Space for Rough Work

SECTION-I(ii) : (Maximum Marks : 18)

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- This section contains **Two** tables (each having 3 columns and 4 rows)
- Based on each table, there are **THREE** questions
- Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is correct
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Zero Marks : 0 If none of the bubbles is darkened.
Negative Marks : -1 In all other cases

Answer Q.8, Q.9 and Q.10 by appropriately matching the information given in the three columns of the following table.

Column - I Elements	Column - II Electron Affinity (KJ /mol)	Column - III EN (Pauling Scale)
(I) Cl	(A) 140.97	(P) 4.0
(II) P	(B) 328.16	(Q) 3.5
(III) F	(C) 72.03	(R) 2.19
(IV) O	(D) 348.57	(S) 3.16

8. Which is a **CORRECT** match.
 (A) (I), (B), (S) (B) (III), (B), (Q) (C) (II), (C), (R) (D) (IV), (A), (P)
9. Which of the following element will form the H-X bond with maximum polarity
 (X belongs to elements in 1st column)
 (A) (I) (B) (II) (C) (III) (D) (IV)
10. Which of the following elements of 1st column will absorb energy on accepting an electron
 (A) (I), (III) (B) (I)
 (C) (I), (II), (III), (IV) (D) None of these

Space for Rough Work

Answer Q.11, Q.12 and Q.13 by appropriately matching the information given in the three columns of the following table.

Column - I		Column - II	Column - III
I	II \longrightarrow Product		
(i) $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \longrightarrow 2\text{NH}_3(\text{g})$ 5.6g 1g		(P) 0.1 mole excess reagent react	(I) II reactant is limiting reagent
(ii) $\text{C}(\text{s}) + 2\text{H}_2(\text{g}) \longrightarrow \text{CH}_4(\text{g})$ 2.4g 4.54 L, at STP		(Q) $\frac{1}{30}$ mole excess reagent left	(II) II reactant is excess reagent
(iii) $\text{CO}(\text{g}) + \frac{1}{2}\text{O}_2(\text{g}) \longrightarrow \text{CO}_2(\text{g})$ 2.8g 3.2g		(R) 0.05 mole excess reagent react	(III) Both reactant are limiting reagent
(iv) $\text{P}_4(\text{s}) + 3\text{O}_2(\text{g}) \longrightarrow \text{P}_4\text{O}_6(\text{s})$ 6.2g 1.6g		(S) 0.5 gm of excess reagent left	(IV) No limiting reagent concept is applicable with these reactant
11. Select only correct combination -			
(A) (i), (P), (II)	(B) (i), (Q), (I)	(C) (i), (Q), (III)	(D) (i), (R), (I)
12. Select only correct combination -			
(A) (i), (S), (II)	(B) (iii), (R), (I)	(C) (i), (Q), (III)	(D) (ii), (P), (I)
13. Select only correct combination -			
(A) (iv), (Q), (I)	(B) (iii), (R), (I)	(C) (i), (Q), (III)	(D) (iii), (P), (III)

Space for Rough Work

SECTION-II : (Maximum Marks: 15)

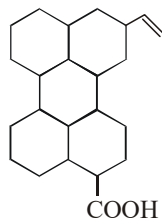
- This section contains **FIVE** questions.
- The answer to each question is a **NUMERICAL VALUE**.
- For each question, enter the correct numerical value (in decimal notation, truncated/rounded-off to the **second decimal place**; e.g. 6.25, 7.00, -0.33, -.30, 30.27, -127.30, if answer is 11.36777..... then both 11.36 and 11.37 will be correct) by darkening the corresponding bubbles in the ORS.

For Example : If answer is -77.25, 5.2 then fill the bubbles as follows.

+					-				
●	●	●	●	●	●	●	●	●	
1	1	1	1	1	1	1	1	1	
2	2	2	2	2	2	2	2	2	
3	3	3	3	3	3	3	3	3	
4	4	4	4	4	4	4	4	4	
5	5	5	5	5	5	5	5	5	
6	6	6	6	6	6	6	6	6	
7	7	7	7	7	7	7	7	7	
8	8	8	8	8	8	8	8	8	
9	9	9	9	9	9	9	9	9	

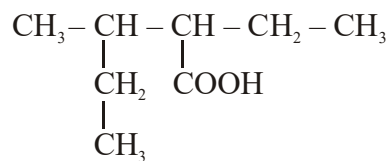
- Answer to each question will be evaluated according to the following marking scheme:
Full Marks : +3 If **ONLY** the correct numerical value is entered as answer.
Zero Marks : 0 In all other cases.

- 4.0g of argon gas has pressure, P and temperature, TK in a vessel. On keeping the vessel at 50°C higher temperature, 0.8g of argon gas escape out maintaining the pressure P. The original temperature was "A" × 10² K. The value of A is
- Double bond equivalent (DBE) of the following compound.



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3. Number of carbon atoms in the principal carbon chain of the given compound in its IUPAC name will be.



4. The number of (P–O–P) linkages present in $\text{P}_4\text{O}_{12}^{4-}$ are :-
5. If $x \rightarrow$ Number of $p_\pi-d_\pi$ bonds in XeO_4 .
 $y \rightarrow$ Number of electrons having $\ell = 2$ in La
 $z \rightarrow$ Difference in effective nuclear charge on C and O

Then value of $\left(\frac{x+y+z}{2}\right)$ is.

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PART-3 : MATHEMATICS**SECTION-I(i) : (Maximum Marks: 28)**

- This section contains **SEVEN** questions.
- Each question has **FOUR** options for correct answer(s). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct option(s).
- For each question, choose the correct option(s) to answer the question.
- Answer to each question will be evaluated according to the following marking scheme:
Full Marks : +4 If only (all) the correct option(s) is (are) chosen.
Partial Marks : +3 If all the four options are correct but **ONLY** three options are chosen.
Partial Marks : +2 If three or more options are correct but **ONLY** two options are chosen, both of which are correct options.
Partial Marks : +1 If two or more options are correct but **ONLY** one option is chosen and it is a correct option.
Zero Marks : 0 If none of the options is chosen (i.e. the question is unanswered).
Negative Marks : -2 In all other cases.
- **For Example** : If first, third and fourth are the **ONLY** three correct options for a question with second option being an incorrect option; selecting only all the three correct options will result in +4 marks. Selecting only two of the three correct options (e.g. the first and fourth options), without selecting any incorrect option (second option in this case), will result in +2 marks. Selecting only one of the three correct options (either first or third or fourth option), without selecting any incorrect option (second option in this case), will result in +1 marks. Selecting any incorrect option(s) (second option in this case), with or without selection of any correct option(s) will result in -2 marks.

-
1. Let S be the set of all $\lambda \in \mathbb{R}$ for which the system of linear equations
- $$\begin{aligned} 2x - y + 2z &= 2 \\ x - 2y + \lambda z &= -4 \\ x + \lambda y + z &= 4 \end{aligned}$$
- has a unique solution. Then which of the following is/are **INCORRECT** ?
- (A) S contains more than two elements (B) S contains finite number of elements
(C) S contains exactly two elements (D) S is a singleton set
2. In a ΔABC , with usual notations, $\frac{a}{3} = \frac{b}{4} = \frac{c}{5}$ then which of the following is/are correct ?
- (A) $\tan B = \frac{4}{3}$ (B) $\cot B = \frac{4}{3}$ (C) $\cos A = \frac{3}{5}$ (D) $\sin A = \frac{3}{5}$
-

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3. The value of determinant $\begin{vmatrix} \log_{10} 100 & \log_{10} 200 & \log_{10} 300 \\ 100 & 200 & 300 \\ a & b & c \end{vmatrix}$ (where $a, b, c \in \mathbb{R}$) doesn't depend on
- (A) a (B) b (C) c (D) none of the above
4. Let A, B, C be the vertices of a triangle. If $\angle BAC = \alpha$, $\angle ABC = \beta$, $\angle ACB = \gamma$ and $\tan \alpha + \tan \beta + \tan \gamma = k \cdot \tan \alpha \cdot \tan \beta \cdot \tan \gamma$ then which of the following is/are **INCORRECT** ?
- (A) k is a prime number (B) k is an odd number
(C) k is a composite number (D) k is an even number
5. If m be the number of common terms in two A.P.'s
1, 4, 7, ... upto 2020 terms
& 9, 16, 23, ... upto 2020 terms
then which of the following is/are **INCORRECT** statement ?
- (A) m is an odd number (B) sum of digits of m is a prime number
(C) m is a four digit number (D) m is a two digit number
6. If equation of a straight line passing through $(1, 1)$ and making an angle of magnitude 45° with the line $y = 2020$ is $ax + by + c = 0$, then which of the following can be true
- (A) $a = 2020, b = -2020, c = 0$ (B) $a = 1, b = -1, c = 0$
(C) $a = 1, b = 1, c = -2$ (D) $a = 1, b = 1, c = 2$
7. Let $A(1, 0), B(0, 1)$ & $C(0, 0)$ be the vertices of a triangle ABC . If (α, α) lies interior of the $\triangle ABC$, then possible value of α is/are
- (A) 0.25 (B) 0.35 (C) 0.45 (D) 0.50

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SECTION-I(ii) : (Maximum Marks : 18)

- This section contains **SIX** questions of matching type.
- This section contains **Two** tables (each having 3 columns and 4 rows)
- Based on each table, there are **THREE** questions
- Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is correct
- For each question, darken the bubble corresponding to the correct option in the ORS.
- For each question, marks will be awarded in one of the following categories :
Full Marks : +3 If only the bubble corresponding to the correct option is darkened.
Zero Marks : 0 If none of the bubbles is darkened.
Negative Marks : -1 In all other cases

Answer Q.8, Q.9 and Q.10 by appropriately matching the information given in the three columns of the following table

Column I contains a quadratic expression $P(x)$.

Column II contains information about product of roots & discriminant of equation $P(x) = 0$ with notations.

$D \rightarrow$ Discriminant

$\alpha, \beta \rightarrow$ Roots of $P(x) = 0$

Column III contains range of $P(x)$

Column I

Column II

Column III

(I) $P(x) = x^2 + 2bx + b^2, b \in \mathbb{R}$

(i) $\alpha\beta > 0$

(P) $[0, \infty)$

(II) $P(x) = x^2 - 2mx + m^2 - 1, m > 1$

(ii) $D = 0$

(Q) $\left[\frac{3}{4}, \infty\right)$

(III) $P(x) = x^2 - 6x + 8$

(iii) $D > 0$

(R) $[-2, \infty)$

(IV) $P(x) = x^2 + x + 1$

(iv) $D < 0$

(S) $[-1, \infty)$

8. Which of the following options is the only **CORRECT** combination ?
 (A) (I) (i) (P) (B) (II) (ii) (S) (C) (II) (iii) (S) (D) (I) (iii) (P)
9. Which of the following options is the only **INCORRECT** combination ?
 (A) (I) (ii) (P) (B) (II) (ii) (S) (C) (III) (i) (S) (D) (III) (iii) (S)
10. Which of the following options is the only **INCORRECT** combination ?
 (A) (III) (i) (S) (B) (III) (iii) (S) (C) (IV) (i) (Q) (D) (IV) (ii) (Q)

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Answer Q.11, Q.12 and Q.13 by appropriately matching the information given in the three columns of the following table

Column 1 contains $f(x)$

Column 2 contains range of $f(x)$

Column 3 contains number of solutions of equation $f(x) = 1$ given $x \in [0, 2\pi)$

Column 1

Column 2

Column 3

(I) $\sin^2 x - 4\sin x + 2$

(i) $[-3, 1]$

(P) 4

(II) $\frac{\cos 3x}{\cos x}$

(ii) $[26, \infty)$

(Q) 0

(III) $\frac{25 + 3\sin x + 4\cos x}{15 - 3\sin x - 4\cos x}$

(iii) $[-1, 7]$

(R) 2

(IV) $\sin^2 x + 25\operatorname{cosec}^2 x$

(iv) $[1, 3]$

(S) 1

11. Which of the following options is the only **CORRECT** combination ?

(A) (IV) (ii) (R) (B) (II) (i) (Q) (C) (III) (iv) (R) (D) (III) (iv) (S)

12. Which of the following options is the only **CORRECT** combination ?

(A) (I) (iii) (Q) (B) (II) (i) (R) (C) (I) (iii) (R) (D) (IV) (ii) (R)

13. Which of the following options is the only **CORRECT** combination ?

(A) (II) (i) (P) (B) (II) (i) (S) (C) (IV) (ii) (P) (D) (IV) (ii) (Q)

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SECTION-II : (Maximum Marks: 15)

- This section contains **FIVE** questions.
- The answer to each question is a **NUMERICAL VALUE**.
- For each question, enter the correct numerical value (in decimal notation, truncated/rounded-off to the **second decimal place**; e.g. 6.25, 7.00, -0.33, -.30, 30.27, -127.30, if answer is 11.36777..... then both 11.36 and 11.37 will be correct) by darkening the corresponding bubbles in the ORS.

For Example : If answer is -77.25, 5.2 then fill the bubbles as follows.

+									
●	●	○	○	○	○	○	○	○	○
①	①	①	①	①	①	①	①	①	①
②	②	②	②	●	②	②	②	②	②
③	③	③	③	③	③	③	③	③	③
④	④	④	④	④	④	④	④	④	④
⑤	⑤	⑤	⑤	⑤	⑤	⑤	⑤	⑤	⑤
⑥	⑥	⑥	⑥	⑥	⑥	⑥	⑥	⑥	⑥
⑦	⑦	●	●	⑦	⑦	⑦	⑦	⑦	⑦
⑧	⑧	⑧	⑧	⑧	⑧	⑧	⑧	⑧	⑧
⑨	⑨	⑨	⑨	⑨	⑨	⑨	⑨	⑨	⑨

-									
●	●	●	○	○	○	○	○	○	○
①	①	①	①	①	①	①	①	①	①
②	②	②	②	●	②	②	②	②	②
③	③	③	③	③	③	③	③	③	③
④	④	④	④	④	④	④	④	④	④
⑤	⑤	⑤	●	⑤	⑤	⑤	⑤	⑤	⑤
⑥	⑥	⑥	⑥	⑥	⑥	⑥	⑥	⑥	⑥
⑦	⑦	⑦	⑦	⑦	⑦	⑦	⑦	⑦	⑦
⑧	⑧	⑧	⑧	⑧	⑧	⑧	⑧	⑧	⑧
⑨	⑨	⑨	⑨	⑨	⑨	⑨	⑨	⑨	⑨

- Answer to each question will be evaluated according to the following marking scheme:
Full Marks : +3 If **ONLY** the correct numerical value is entered as answer.
Zero Marks : 0 In all other cases.

1. Let A(0, 0), B(0, 5) & C(3, 4) be the vertices of a triangle. If H(α , β) be the orthocenter of $\triangle ABC$

and H₁(a, b) be the orthocenter of $\triangle ABH$, then the value of $\frac{a}{b} = \underline{\hspace{2cm}}$

2. If N is the sum of the magnitude of the values of x satisfying $2^{\log_2 x^2} - 3x - 4 = 0$, then the value

of $\frac{1}{N}$ is

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3. If complete set of values of λ for which $|x - 1| + |x - 2| + |x - 3| + |x - 4| = \lambda$ has infinitely many solution is $\{a\}$, then the value of $\frac{1}{a}$ is
4. If $a + 2b + 3c = 4$, where $a, b, c \in \mathbb{R}^+$ and the greatest value of (abc) is M , then the value of $\frac{8}{M}$ is
5. In a ΔABC , with usual notations and m_1, m_2 & m_3 are the lengths of medians through vertex A, B & C respectively, if $n(m_1 + m_2 + m_3) < (n + 1)(a + b + c) < (n + 2)(m_1 + m_2 + m_3)$ (where n is a natural number) then the value of $\frac{1}{n}$ is

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QUESTION PAPER FORMAT AND MARKING SCHEME :

16. The question paper has three parts : Physics, Chemistry and Mathematics.

17. Each part has two sections as detailed in the following table.

Section	Que. Type	No. of Que.	Category-wise Marks for Each Question				Maximum Marks of the section
			Full Marks	Partial Marks	Zero Marks	Negative Marks	
I(i)	One or more correct option(s)	7	+4 If only the bubble(s) corresponding to all the correct option(s) is(are) darkened	+1 For darkening a bubble corresponding to each correct option, provided NO incorrect option darkened	0 If none of the bubbles is darkened	-2 In all other cases	28
I(ii)	Matching Lists Type (Single correct option)	6	+3 If only the bubble corresponding to the correct option is darkened	—	0 If none of the bubbles is darkened	-1 In all other cases	18
II	Numerical Value Type (Up to second decimal place)	5	+3 If only the bubble corresponding to correct answer is darkened	—	0 In all other cases	—	15

NAME OF THE CANDIDATE

FORM NO.

I have read all the instructions and shall abide by them.

Signature of the Candidate

I have verified the identity, name and Form number of the candidate, and that question paper and ORS codes are the same.

Signature of the Invigilator