

**PHYSICS, CHEMISTRY & MATHEMATICS****QP CODE: 100734-0****Paper – 1****Time Allotted: 3 Hours****Maximum Marks: 180**

- Please read the instructions carefully. You are allotted 5 minutes specifically for this purpose.
- You are not allowed to leave the Examination Hall before the end of the test.

**INSTRUCTIONS**

**Caution: Question Paper CODE as given above MUST be correctly marked in the answer OMR sheet before attempting the paper. Wrong CODE or no CODE will give wrong results.**

**A. General Instructions**

1. Attempt ALL the questions. Answers have to be marked on the OMR sheets.
2. This question paper contains **Three Sections**.
3. **Section-I** is Physics, **Section-II** is Chemistry and **Section-III** is Mathematics.
4. All the section can be filled in **PART-A & B** of OMR.
5. Rough spaces are provided for rough work inside the question paper. No additional sheets will be provided for rough work.
6. Blank Papers, clip boards, log tables, slide rule, calculator, cellular phones, pagers and electronic devices, in any form, are not allowed.

**B. Filling of OMR Sheet**

1. Ensure matching of OMR sheet with the Question paper before you start marking your answers on OMR sheet.
- \* In multiple choice questions the options are given as F,T,R & E which correspond to the options A,B,C & D respectively in the OMR sheet.**
2. On the OMR sheet, darken the appropriate bubble with **Blue/Black Ball Point Pen** for each character of your Enrolment No. and write in ink your Name, Test Centre and other details at the designated places.
  3. OMR sheet contains alphabets, numerals & special characters for marking answers.

**C. Marking Scheme For All Two Parts.**

- (i) **Part-A (01-04)** – Contains Four (04) multiple choice questions which have ONLY ONE CORRECT answer Each question carries **+3 marks** for correct answer and **-1 marks** for wrong answer.
- (ii) **PART-A (05–07)** contains (3) Multiple Choice Questions which have One or More Than One Correct answer.  
*Full Marks: +4* If only the bubble(s) corresponding to all the correct options(s) is (are) darkened.  
*Partial Marks: +1* For darkening a bubble corresponding to **each correct option**, provided NO incorrect option is darkened.  
*Zero Marks: 0* If none of the bubbles is darkened.  
**Negative Marks: –1 In all other cases.**  
For example, if (A), (C) and (D) are all the correct options for a question, darkening all these three will result in **+4 marks**; darkening only (A) and (D) will result in **+2 marks**; and darkening (A) and (B) will result in **-1 marks**, as a wrong option is also darkened.
- (iii) **Part-A (08-11)** – This section contains Four (04) Matching List Sets. Each set has **ONE** Multiple Choice Question. Each set has **TWO** lists: **List-I** and **List-II**. **List-I** has **Four** entries (P), (Q), (R) and (S) and **List-II** has **Five** entries (1), (2), (3), (4) and (5). **FOUR** options are given in each Multiple Choice Question based on **List-I** and **List-II** and **ONLY ONE** of these four options satisfies the condition asked in the Multiple Choice Question. Each question carries **+3 Marks** for correct answer and **-1 marks** for wrong answer.
- (iii) **Part-B (01-06)** This section contains **SIX (06)** questions. The answer to each question is a **NON-NEGATIVE INTEGER**. For each question, enter the correct integer corresponding to the answer. Each question carries **+4 marks** for correct answer. **There is no negative marking.**

Name of the Candidate: \_\_\_\_\_

Batch: \_\_\_\_\_ Date of Examination: \_\_\_\_\_

Enrolment Number: \_\_\_\_\_

**Forthcoming  
Exam – FTRE on  
15th Sept. 2024.****BATCHES – Two Year CRP426 Batches – PT – 1 (SET-A)**

- \* In multiple choice questions the options are given as F,T,R & E which correspond to the options A,B,C & D respectively in the OMR sheet.

## SECTION – I: PHYSICS

### (PART – A)

(Single Correct Answer Type)

This section contains 4 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE** is correct.

1. At a given instant, an observer stationary on the ground sees a package falling with speed  $v_1$  at some angle with the vertical. A pilot flying at a constant horizontal speed relative to the ground sees the package falling vertically with a speed  $v_2$  at the same instant. What is the speed of the pilot relative to the ground?

(F)  $v_1 + v_2$

(T)  $v_1 - v_2$

(R)  $\sqrt{v_1^2 - v_2^2}$

(E)  $\sqrt{v_1^2 + v_2^2}$

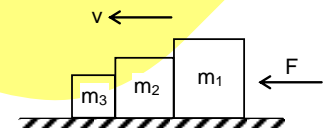
2. Three blocks ( $m_1$ ,  $m_2$  &  $m_3$ ) are slid at constant velocity across a rough surface as shown. The coefficient of kinetic friction between each block and the surface is  $\mu$ . What would be the force due to  $m_1$  on  $m_2$ ?

(F)  $F - (m_2 - m_3)g\mu$

(T)  $(m_2 + m_3)g\mu$

(R)  $m_1g\mu - (m_2 + m_3)g\mu$

(E)  $(m_1 + m_2 + m_3)g\mu$



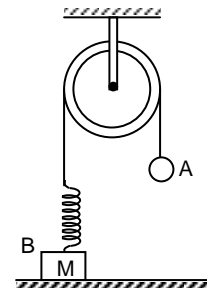
3. In the figure, the ball A is released from rest, when the spring is at its natural (unstretched) length. For the block B of mass M to leave contact with ground at some stage, the minimum mass of A must be

(F)  $2M$

(T)  $M$

(R)  $M/2$

(E)  $M/4$



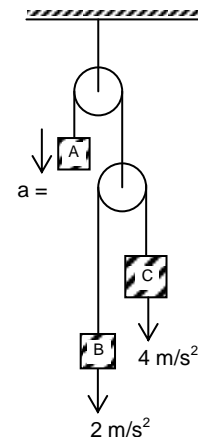
4. In the figure shown acceleration of block B & C is  $2 \text{ m/s}^2$  &  $4 \text{ m/s}^2$  as shown in figure. Then acceleration of block A will be

(F)  $3 \text{ m/s}^2$  upwards

(T)  $3 \text{ m/s}^2$  downwards

(R)  $6 \text{ m/s}^2$  upwards

(E)  $6 \text{ m/s}^2$  downwards

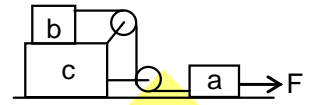


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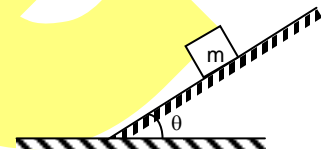
**(One or More Than One Options Correct Type)**

This section contains **3 multiple choice questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONE or MORE THAN ONE is correct**.

5. Three blocks a, b, and c of masses 10 kg, 10 kg and 20 kg are arranged as shown in figure. All the surfaces are frictionless and string is inextensible. Pulleys are light. A constant force  $F = 20 \text{ N}$  is applied on block a as shown. Pulleys and string are light. Part of the string connecting both pulleys is vertical and part of the strings connecting pulleys with masses  $m_1$  and  $m_2$  are horizontal.



- (F) Acceleration of mass blocks a, b and c is  $0.5 \text{ m/s}^2$ .  
 (T) Acceleration of mass block b is  $1 \text{ m/s}^2$ .  
 (R) Tension in the string is 10 N.  
 (E) Acceleration of mass block c is 0.5
6. Choose the correct option(s)  
 (F) If only conservative forces act on a particle, the kinetic energy stays constant.  
 (T) If the net force acting on an object is zero, then the object is at rest.  
 (R) If net mechanical work is done on a body, the velocity body must change.  
 (E) If net mechanical work is done on a body, the speed of body must change.
7. A block is stationary relative to a moving inclined plane. No other information is given. The frictional force on the block can be  
 (F) zero  
 (R) upward  
 (T) downward  
 (E)  $>mg$

**(Matching List Sets)**

This section contains **FOUR (04) Matching List Sets**. Each set has **ONE** Multiple Choice Question. Each set has **TWO** lists: **List-I** and **List-II**. **List-I** has **Four** entries (P), (Q), (R) and (S) and **List-II** has **Five** entries (1), (2), (3), (4) and (5). **FOUR** options are given in each Multiple Choice Question based on **List-I** and **List-II** and **ONLY ONE** of these four options satisfies the condition asked in the Multiple Choice Question.

8. A ball is attached to a string and moves in vertical circle. There is no resistive force. Match the column-I to column-II.

List – I		List – II	
(P)	Minimum	(1)	Tension in the string when ball is at the lowest point.
(Q)	Maximum	(2)	Tension in the string when ball is at the highest point.
(R)	Towards the centre	(3)	The angle between tension and weight of ball when string becomes horizontal.
(S)	Perpendicular	(4)	The direction of tension in the string
		(5)	Magnitude of tangential acceleration when string becomes horizontal.
		(6)	Magnitude of centripetal acceleration when string becomes horizontal.

(F)  $P \rightarrow 2, Q \rightarrow 1, R \rightarrow 6, S \rightarrow 3,4$

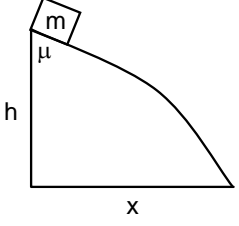
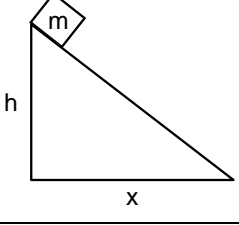
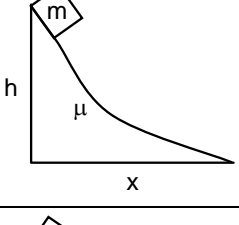
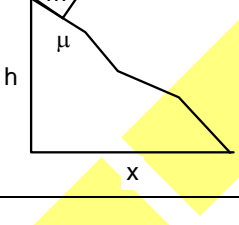
(T)  $P \rightarrow 5, Q \rightarrow 3, R \rightarrow 4,6, S \rightarrow 2$

(R)  $P \rightarrow 2, Q \rightarrow 1,5, R \rightarrow 4,6, S \rightarrow 3$

(E)  $P \rightarrow 2, Q \rightarrow 1,5, R \rightarrow 4, S \rightarrow 6$

Space For Rough Work

9. List-I gives the information about different surfaces on which a block of mass  $m$  slides. In each situation the block starts sliding from rest and always remains contact with the surface. Then match the situations in list-I with the statements in list-II.

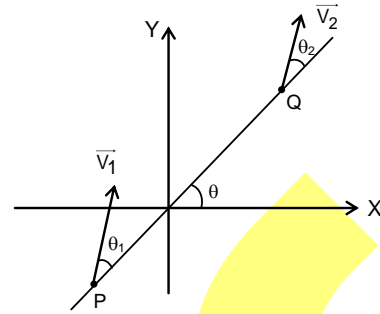
List-I		List-II	
(P)		(1)	Workdone by friction = $-\mu mg x$
(Q)		(2)	Workdone by friction < $-\mu mg x$
(R)		(3)	Workdone by friction > $-\mu mg x$
(S)		(4)	Workdone by gravity = $mgh$
		(5)	Workdone by normal reaction = 0

The correct option is:

- (F)  $P \rightarrow 3,4,5$  ;  $Q \rightarrow 2,4$  ;  $R \rightarrow 2,3,5$  ;  $S \rightarrow 1,4,5$   
 (T)  $P \rightarrow 3,4,5$  ;  $Q \rightarrow 1,4,5$  ;  $R \rightarrow 2,4,5$  ;  $S \rightarrow 1,4,5$   
 (R)  $P \rightarrow 1,3,4$  ;  $Q \rightarrow 2,3,4$  ;  $R \rightarrow 2,5$  ;  $S \rightarrow 1,3,4$   
 (E)  $P \rightarrow 1,3,4$  ;  $Q \rightarrow 2,4,5$  ;  $R \rightarrow 2,4,5$  ;  $S \rightarrow 2,3,5$

Space For Rough Work

10. Two particle P and Q moving with velocities  $\vec{V}_1$  and  $\vec{V}_2$  in the direction as shown in fig. From figure answer the given questions.



List-I		List-II	
(P)	Magnitude of relative velocity of P with respect to Q.	(1)	$ \vec{V}_2 \cos(\theta_2 + \theta) - \vec{V}_1 \cos(\theta_1 + \theta) $
(Q)	Magnitude of velocity of P relative to Q along the line joining them	(2)	$ \vec{V}_2 \cos \theta_2 - \vec{V}_1 \cos \theta_1 $
(R)	Magnitude of velocity of P relative to Q along x-axis	(3)	$ \vec{V}_1 - \vec{V}_2 $
(S)	Magnitude to velocity of P relative to Q along Y-axis	(4)	$ \vec{V}_2 \sin(\theta_2 + \theta) - \vec{V}_1 \sin(\theta_1 + \theta) $
		(5)	$ \vec{V}_2 - \vec{V}_1 $

The correct option is:

(F) P  $\rightarrow$  3,5 ; Q  $\rightarrow$  2 ; R  $\rightarrow$  1 ; S  $\rightarrow$  4

(T) P  $\rightarrow$  2,5 ; Q  $\rightarrow$  3 ; R  $\rightarrow$  4 ; S  $\rightarrow$  1

(R) P  $\rightarrow$  3,4 ; Q  $\rightarrow$  3 ; R  $\rightarrow$  2 ; S  $\rightarrow$  1

(E) P  $\rightarrow$  3,5 ; Q  $\rightarrow$  1 ; R  $\rightarrow$  3 ; S  $\rightarrow$  2

11. A man can swim at a speed of 3 km/h in still water. He wants to cross a 500 m wide river flowing at 2 km/h. He keeps himself always at an angle to  $120^\circ$  with river flow while swimming. Then

List-I		List-II	
(P)	Time taken to cross the river is .....hr	(1)	$\frac{1}{6\sqrt{3}}$
(Q)	Magnitude of velocity of the swimmer with respect to the observer on the bank ..... km/hr	(2)	$\frac{1}{3\sqrt{3}}$
(R)	Drift of the man along river flow on reaching the opposite bank is ..... km	(3)	$\sqrt{7}$
(S)	For an observer on the bank, he moves in direction making angle $\theta$ with river flow.	(4)	$\theta = \tan^{-1}(3\sqrt{3})$
		(5)	$\theta = \tan^{-1}(\sqrt{3})$

The correct option is:

(F) P  $\rightarrow$  3 ; Q  $\rightarrow$  4 ; R  $\rightarrow$  1 ; S  $\rightarrow$  2

(T) P  $\rightarrow$  3 ; Q  $\rightarrow$  1 ; R  $\rightarrow$  4 ; S  $\rightarrow$  2

(R) P  $\rightarrow$  2 ; Q  $\rightarrow$  3 ; R  $\rightarrow$  4 ; S  $\rightarrow$  1

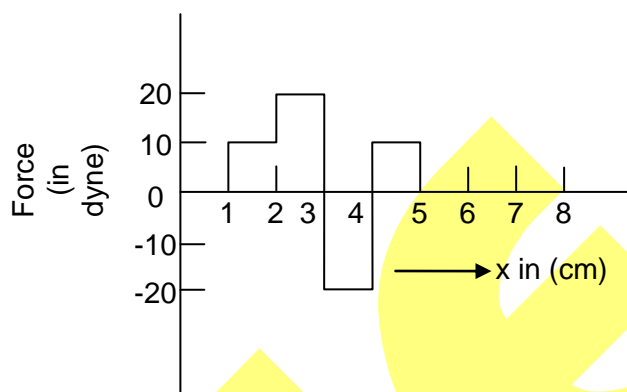
(E) P  $\rightarrow$  2 ; Q  $\rightarrow$  3 ; R  $\rightarrow$  1 ; S  $\rightarrow$  4

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## (PART – B)

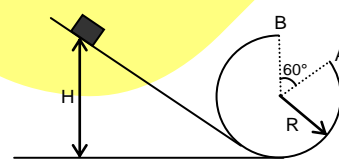
(Non – Negative Integer)

1. The relationship between force and position is shown in figure (in one dimensional case). The work done by the force in displacing a body from  $x = 1$  cm to  $x = 5$  cm is \_\_\_\_\_ (in ergs).

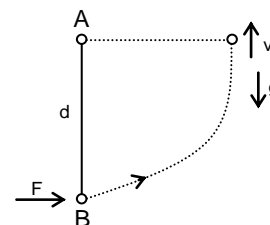


2. A block of mass 'M' = 2 kg rests on the top of a smooth horizontal fixed table top, resting inside a rail car, which is moving with a constant velocity  $V_0 = 2$  m/s over a horizontal track. A person P riding in the car pushes the block with a horizontal force  $F = 1$  N in the direction of velocity for a time 't' = 2 sec. Then at the end of this interval, the kinetic energy (in J) of the block as assessed by P is less than that computed by another person Q standing at rest on the ground by a value of \_\_\_\_\_ Joule.

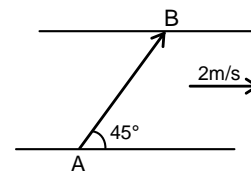
3. A small particle slides from height  $H = 45$  cm as shown and then loops inside the vertical loop of radius  $R$  from where a section of angle  $\theta = 60^\circ$  has been removed. If  $R = (1/N)$  meter, such that after losing contact at A and flying through the air, the particle will reach at the point B. Find N. Neglect friction everywhere.



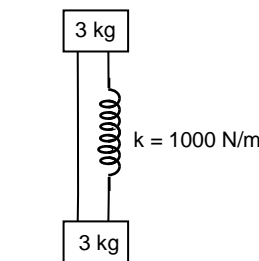
4. A particle B of mass 5 kg is attached to a frictionless pivot, A, by a thread of length  $d = 0.2$  m so that B hangs freely. At some instant of time a strong wind begins to apply a constant horizontal force  $F = 100$  N on B, as a result it rotates about A in a vertical plane. Find the speed (in m/s) of B at the instant when the string is horizontal.



5. A man wants to reach point B on the other bank of a river flowing at a speed 2 m/s as shown in the figure. If minimum speed of man relative to water is  $V$ , then  $\sqrt{2} V = ?$  (m/s)



6. A system consists of two identical cubes, each of mass 3 kg, linked together by a compressed weightless spring of force constant  $1000 \text{ Nm}^{-1}$ . The cubes are also connected by a thread which is burnt at a certain moment. At what minimum value of initial compression  $x_0$  (in cm) of the spring will the lower cube bounce up after the thread is burnt ( $g = 10 \text{ m/s}^2$ )?



Space For Rough Work

- \* In multiple choice questions the options are given as F,T,R & E which correspond to the options A,B,C & D respectively in the OMR sheet.

## **SECTION – II: CHEMISTRY**

### **(PART – A)**

#### **(Single Correct Answer Type)**

This section contains 4 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE** is correct.

- The chemical properties of group-1 elements down to the third period have similar chemical properties. This is due to their  
 (F) alkaline nature of aqueous solution (T) same shielding constant( $\sigma$ )  
 (R) identical electronic configuration (E) soft nature in solid state
- In the molecules, the order of lone pair – lone pair repulsion is  
 (F)  $N_2 > N_2H_2 > N_2H_4$  (T)  $N_2H_4 > N_2H_2 > N_2$   
 (R)  $N_2 > N_2H_4 > N_2H_2$  (E)  $N_2H_4 > N_2 > N_2H_2$
- An ideal gas exerts 0.2 atm pressure in a container of volume V and temperature T. Due to accident the container was dented and temperature of the gas increased. The pressure after accident increased to 1.6 atm. Therefore the volume percentage of dent and increase in temperature are  
 (F) 10% dent and temperature increases to two times  
 (T) 30% dent and temperature increases to three times  
 (R) 25% dent and temperature increases to two times  
 (E) 20% dent and temperature increases to two times
- $BF_3$  is an electron deficient compound and  $NH_3$  has one lone pair. So when they react an addition product(P) is formed. In (P)  
 (F) one  $sp^2$ -hybridized orbital of boron overlaps with one  $sp^3$ -orbital of nitrogen  
 (T) one  $sp^3$ -orbital of N overlaps with one 2p orbital of boron  
 (R) two  $sp^3$  orbitals of N overlaps with two  $sp^2$ -orbitals of B  
 (E) two  $sp^3$  orbitals of N overlaps with one vacant orbital of boron

#### **(One or More Than One Options Correct Type)**

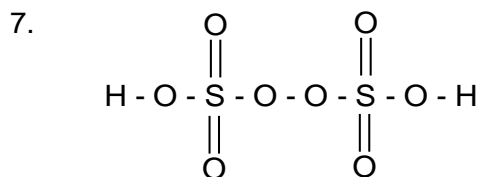
This section contains 3 multiple choice questions. Each question has 4 choices (A), (B), (C) and (D), out of which **ONE** or **MORE THAN ONE** is correct.

- The expression,  $PV_m = RT - \frac{a}{V_m}$  can be applied to gases which ( $V_m$  is molar volume)  
 (F) show negative deviation from ideal behaviour  
 (T) shows maximum dip in the curve of Z vs P graph  
 (R) follows only Boyle temperature  
 (E) Z at the maximum dip (of Z vs P graph) is less than one

*Space For Rough Work*



6. Which properties of the solution of Na in liquid  $\text{NH}_3$  is/are greater than the solution of Na in water?  
 (F) Reducing agent (T) Conductivity of solution  
 (R) oxidation number of sodium (E) Evolution of gas



- The correct statement(s) for the above substance is/are  
 (F) oxygen shows oxidation number of -2 and -1  
 (T) the oxidation number of sulphur is +6  
 (R) polar and non-polar covalent bonds are present  
 (E) for hybridization sulphur uses three p-orbitals

**(Matching List Sets)**

This section contains **FOUR (04)** Matching List Sets. Each set has **ONE** Multiple Choice Question. Each set has **TWO** lists: **List-I** and **List-II**. **List-I** has **Four** entries (P), (Q), (R) and (S) and **List-II** has **Five** entries (1), (2), (3), (4) and (5). **FOUR** options are given in each Multiple Choice Question based on **List-I** and **List-II** and **ONLY ONE** of these four options satisfies the condition asked in the Multiple Choice Question.

8. Match the Lists.

List – I		List – II	
(P)	$\text{NH}_3$	(1)	Dipole moment is zero
(Q)	$\text{CS}_2$	(2)	Central atom contains no lone pair
(R)	CO	(3)	Sigma bonds are formed by unhybridized orbitals
(S)	$\text{H}_2\text{S}$	(4)	Lone pair and bond pair moment reinforce each other
		(5)	Contains three covalent bonds

The correct option is:

- (F) (P)  $\rightarrow$  (3), (Q)  $\rightarrow$  (2), (R)  $\rightarrow$  (4), (S)  $\rightarrow$  (5)  
 (T) (P)  $\rightarrow$  (4), (Q)  $\rightarrow$  (1), (R)  $\rightarrow$  (5), (S)  $\rightarrow$  (3)  
 (R) (P)  $\rightarrow$  (4), (Q)  $\rightarrow$  (2), (R)  $\rightarrow$  (1), (S)  $\rightarrow$  (5)  
 (E) (P)  $\rightarrow$  (3), (Q)  $\rightarrow$  (1), (R)  $\rightarrow$  (5), (S)  $\rightarrow$  (3)

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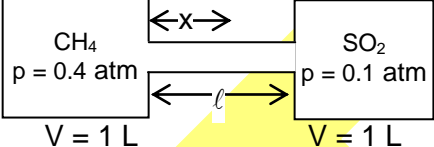
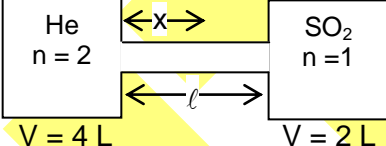
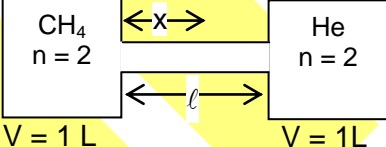
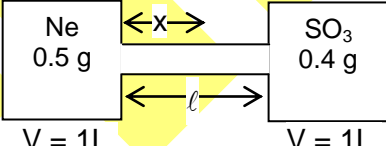
9. Match the Lists.

List - I		List - II	
(P)	Cr(Z = 24)	(1)	It contains six electrons with $\ell = 2$ in +3 oxidation state
(Q)	Mn(Z = 25)	(2)	It contains same number of unpaired electrons in +1 and +3 oxidation state
(R)	Fe(Z = 26)	(3)	It attains a half-filled electronic configuration in +2 oxidation state
(S)	Co(Z = 27)	(4)	It contains six unpaired electrons in zero oxidation state
		(5)	It attains a half-filled electronic configuration in +1 oxidation state

The correct option is:

(F) (P)  $\rightarrow$  (2), (Q)  $\rightarrow$  (4), (R)  $\rightarrow$  (1), (S)  $\rightarrow$  (5)(T) (P)  $\rightarrow$  (5), (Q)  $\rightarrow$  (3), (R)  $\rightarrow$  (4), (S)  $\rightarrow$  (2)(R) (P)  $\rightarrow$  (4), (Q)  $\rightarrow$  (3), (R)  $\rightarrow$  (2), (S)  $\rightarrow$  (1)(E) (P)  $\rightarrow$  (2), (Q)  $\rightarrow$  (3), (R)  $\rightarrow$  (4), (S)  $\rightarrow$  (1)

10. In each case two containers are connected by a pipe of length ' $\ell$ ' cm. The containers contain ideal gases under different conditions. The gases effuse through the pipe in opposite directions. One of the gas effuses by  $x$  cm, find relation between  $x$  and  $\ell$ .

List - I		List - II	
(P)	At constant temperature 	(1)	$x = \left(\frac{10}{11}\right)\ell$
(Q)	At constant temperature 	(2)	$x = \left(\frac{4}{5}\right)\ell$
(R)	At constant temperature 	(3)	$x = \left(\frac{8}{9}\right)\ell$
(S)	At constant temperature 	(4)	$x = \left(\frac{1}{3}\right)\ell$
		(5)	$x = \left(\frac{6}{7}\right)\ell$

The correct option is:

(F) (P)  $\rightarrow$  (1), (Q)  $\rightarrow$  (2), (R)  $\rightarrow$  (3), (S)  $\rightarrow$  (4)(T) (P)  $\rightarrow$  (3), (Q)  $\rightarrow$  (2), (R)  $\rightarrow$  (4), (S)  $\rightarrow$  (1)(R) (P)  $\rightarrow$  (4), (Q)  $\rightarrow$  (2), (R)  $\rightarrow$  (1), (S)  $\rightarrow$  (3)(E) (P)  $\rightarrow$  (5), (Q)  $\rightarrow$  (2), (R)  $\rightarrow$  (1), (S)  $\rightarrow$  (3)

Space For Rough Work

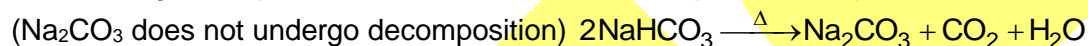
11. Match the lists.

List – I		List – II	
(P)	$\text{Na}_2\text{CO}_3(\text{aq})$	(1)	Evolves $\text{CO}_2$ gas on normal heating
(Q)	$\text{KO}_2(\text{s})$	(2)	Evolves $\text{O}_2$ gas and another gas on strong heating
(R)	$\text{NaHCO}_3(\text{s})$	(3)	Evolves $\text{CO}_2$ when reacts with $\text{Cl}_2$
(S)	$\text{NaNO}_3(\text{s})$	(4)	Forms a sulphate salt when reacts with sulphur
		(5)	Paramagnetic substance

The correct option is:

(F) (P)  $\rightarrow$  (1), (Q)  $\rightarrow$  (5), (R)  $\rightarrow$  (3), (S)  $\rightarrow$  (4)(T) (P)  $\rightarrow$  (1), (Q)  $\rightarrow$  (2), (R)  $\rightarrow$  (3), (S)  $\rightarrow$  (4)(R) (P)  $\rightarrow$  (3), (Q)  $\rightarrow$  (4), (R)  $\rightarrow$  (5), (S)  $\rightarrow$  (2)(E) (P)  $\rightarrow$  (3), (Q)  $\rightarrow$  (5), (R)  $\rightarrow$  (1), (S)  $\rightarrow$  (2)**(PART – B)****(Non – Negative Integer)**

1. When 13.1 g of a mixture containing  $\text{NaHCO}_3$  and  $\text{Na}_2\text{CO}_3$  is heated,  $\text{NaHCO}_3$  decomposes and the gas ( $\text{CO}_2$ ) is produced. The gas ( $\text{CO}_2$ ) measures 1.12 litre at STP. How much  $\text{Na}_2\text{CO}_3$  in gram is present in the container after complete decomposition of  $\text{NaHCO}_3$ ?



2. The separation between two iodine atoms in  $\text{BI}_3$  molecule is  $3.6 \overset{\circ}{\text{A}}$ . What is the bond length of  $\text{BI}_3$  in  $\overset{\circ}{\text{A}}$  unit? [Assume  $\cos 30^\circ = 0.9$ ]
3. If x, y and z are respectively the coordination number of beryllium chloride in solid, gas and aqueous state respectively, what is the value of (x + y + z)?
4.  $\text{I}_2 + 2\text{S}_2\text{O}_3^{2-} \longrightarrow 2\text{I}^- + \text{S}_4\text{O}_6^{2-}$   
How much gram of  $\text{I}_2$  is consumed by 1.2 litre of 5 M  $\text{S}_2\text{O}_3^{2-}$  solution?  
[Atomic wt. of I = 127 g mol<sup>-1</sup>]
5. What is the most probable velocity of ozone ( $\text{O}_3$ ) in m s<sup>-1</sup> unit at 1920 K?  
[Given: R = 8 JK<sup>-1</sup>mol<sup>-1</sup>]
6. The electronic configuration of an atom is  $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^3$   
If x = the number of electrons present in orbital(s) which has(ve) two radial nodes and one angular node.  
y = the number of electrons present in orbital(s) which has(ve) two angular nodes and zero radial node and  
z = the number of electrons present in the orbitals which has only radial node and no angular node,  
then the value of (x + y + z) is

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- \* In multiple choice questions the options are given as F,T,R & E which correspond to the options A,B,C & D respectively in the OMR sheet.

## SECTION – III: MATHEMATICS

### (PART – A)

(Single Correct Answer Type)

This section contains 4 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE** is correct.

1. The ratio  $\frac{\sin \frac{2\pi}{7} + \sin \frac{4\pi}{7} - \sin \frac{6\pi}{7}}{\sin \frac{\pi}{7} \sin \frac{3\pi}{7} \sin \frac{5\pi}{7}}$  is equal to:
- (F)  $\frac{1}{4}$  (T) 1  
(R) 2 (E) 4
2. A line passes through (2, 2) and cuts a triangle of area 9 square units from the first quadrant. The sum of all possible values for the slope of such a line, is:
- (F) -2.5 (T) -2  
(R) -1.5 (E) -1
3. The equation of a line inclined at an angle  $\frac{\pi}{4}$  from the positive x – axis, such that the two circles  $x^2 + y^2 = 4$  and  $x^2 + y^2 - 10x - 14y + 65 = 0$  intercept equal lengths on it, is:
- (F)  $2x - 2y - 3 = 0$  (T)  $2x - 2y + 3 = 0$   
(R)  $x - y + 6 = 0$  (E)  $x - y - 6 = 0$
4. Sum of radii of all the circles touching the coordinate axes and the line  $3x + 4y = 12$ , is:
- (F) 6 (T) 3  
(R) 12 (E) 5

*Space For Rough Work*

**(One or More Than One Options Correct Type)**

This section contains **3 multiple choice questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONE or MORE THAN ONE is correct**.

- 5 Which of the following when simplified, reduces to unity?  
 (F)  $\log_{10} 5 \cdot \log_{10} 20 + (\log_{10} 2)^2$  (T)  $\frac{2\log 2 + \log 3}{\log 48 - \log 4}$   
 (R)  $-\log_5 \log_3 \sqrt[5]{9}$  (E)  $\frac{1}{6} \log_{\frac{\sqrt{3}}{2}} \left( \frac{64}{27} \right)$
- 6 Straight lines  $2x + y = 5$  and  $x - 2y = 3$  intersect at the point A. Point B and C are chosen on these two lines such that  $AB = AC$ . Then the equation of a line BC passing through the point (2, 3) is:  
 (F)  $3x - y - 3 = 0$  (T)  $x + 3y - 11 = 0$   
 (R)  $3x + y - 9 = 0$  (E)  $x - 3y + 7 = 0$
- 7 Tangents PA and PB are drawn to the circle  $S = x^2 + y^2 - 2y - 3 = 0$  from the point P (3, 4). Which of the following alternative(s) is/are correct?  
 (F) The length of tangent from point P (3, 4) with respect to circle  $S = 0$  is  $\sqrt{14}$ .  
 (T) The angle between tangents from P (3, 4) to the circle  $S = 0$  is  $\frac{\pi}{3}$ .  
 (R) The equation of circumcircle of  $\Delta PAB$  is  $x^2 + y^2 - 3x - 5y + 4 = 0$ .  
 (E) The area of quadrilateral PACB is  $3\sqrt{7}$  square units where C is the centre of circle  $S = 0$

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*Space For Rough Work*

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**(Matching List Sets)**

This section contains **FOUR (04)** Matching List Sets. Each set has **ONE** Multiple Choice Question. Each set has **TWO** lists: **List-I** and **List-II**. **List-I** has **Four** entries (P), (Q), (R) and (S) and **List-II** has **Five** entries (1), (2), (3), (4) and (5). **FOUR** options are given in each Multiple Choice Question based on **List-I** and **List-II** and **ONLY ONE** of these four options satisfies the condition asked in the Multiple Choice Question.

8. Match the following List

List - I		List - II	
(P)	For positive real numbers $a (a > 1)$ , let $p_a$ and $q_a$ be the maximum and minimum values of $\log_a(x)$ respectively for $a \leq x \leq 2a$ . If $p_a - q_a = \frac{1}{2}$ , then the value of $a$ is	(1)	2
(Q)	$\sum_{n=1}^{1023} \log_2 \left( 1 + \frac{1}{n} \right)$ is equal to	(2)	4
(R)	If $A = \log_{\sqrt{3}} \left( \sqrt{3\sqrt{3\sqrt{3\sqrt{3}}}} \right)$ , then the value of $\log_{\sqrt{2}}(8A + 1)$ is equal to	(3)	8
(S)	The values of $x$ , which satisfy the equation $\log_2^2(x^2 - x) - 4\log_2(x - 1)\log_2 x = 1$ , is (are)	(4)	10
		(5)	6

The correct option is

(F)  $P \rightarrow (2)$   $Q \rightarrow (4)$   $R \rightarrow (3)$   $S \rightarrow (1)$

(T)  $P \rightarrow (2)$   $Q \rightarrow (5)$   $R \rightarrow (1)$   $S \rightarrow (4)$

(R)  $P \rightarrow (3)$   $Q \rightarrow (1)$   $R \rightarrow (4)$   $S \rightarrow (1)$

(E)  $P \rightarrow (1)$   $Q \rightarrow (5)$   $R \rightarrow (3)$   $S \rightarrow (4)$

9. Match the following List

List - I		List - II	
(P)	If $A = \sin \frac{2\pi}{7} + \sin \frac{4\pi}{7} + \sin \frac{8\pi}{7}$ and $B = \cos \frac{2\pi}{7} + \cos \frac{4\pi}{7} + \cos \frac{8\pi}{7}$ , then $\sqrt{A^2 + B^2}$ is equal to	(1)	1
(Q)	$\frac{\cos 20^\circ + 8 \sin 70^\circ \sin 50^\circ \sin 10^\circ}{\sin^2 80^\circ}$ is equal to	(2)	$\sqrt{2}$
(R)	If $\cos \alpha = \frac{2 \cos \beta - 1}{2 - \cos \beta}$ , then $\tan^2 \frac{\alpha}{2} \cdot \cot^2 \frac{\beta}{2}$ has the value equal to {where $\alpha, \beta \in (0, \pi)$ }	(3)	2
(S)	Exact value of $\cos 20^\circ + 2 \sin^2 55^\circ - \sqrt{2} \sin 65^\circ$ is	(4)	$\sqrt{3}$
		(5)	3

The correct option is

(F)  $P \rightarrow (1)$   $Q \rightarrow (4)$   $R \rightarrow (5)$   $S \rightarrow (3)$

(T)  $P \rightarrow (2)$   $Q \rightarrow (4)$   $R \rightarrow (1)$   $S \rightarrow (1)$

(R)  $P \rightarrow (2)$   $Q \rightarrow (3)$   $R \rightarrow (5)$   $S \rightarrow (1)$

(E)  $P \rightarrow (1)$   $Q \rightarrow (3)$   $R \rightarrow (3)$   $S \rightarrow (4)$

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10. Match the following

List - I		List - II	
(P)	If $m$ and $n$ are positive integer satisfying $1 + \cos 2\theta + \cos 4\theta + \cos 6\theta + \cos 8\theta + \cos 10\theta = \frac{\cos m\theta \cdot \sin n\theta}{\sin \theta}$ , then $(m+n)$ is equal to	(1)	9
(Q)	The minimum value of the expression $\frac{9x^2 \sin^2 x + 4}{x \sin x}$ for $x \in (0, \pi)$ is	(2)	10
(R)	Let $f(x) = 11 - 8\sin x - 2\cos^2 x$ . If the maximum and minimum value of $f(x)$ are denoted by $M$ and $m$ respectively, then $\frac{M+8}{m}$ has the value equal to	(3)	11
(S)	If $\tan 9\theta = \frac{3}{4}$ (where $0 < \theta < \frac{\pi}{18}$ ), then the value of $(3\operatorname{cosec} 3\theta - 4\sec 3\theta)$ is equal to	(4)	12
		(5)	13

The correct option is

(F)  $P \rightarrow (3)$   $Q \rightarrow (2)$   $R \rightarrow (1)$   $S \rightarrow (4)$ (T)  $P \rightarrow (3)$   $Q \rightarrow (4)$   $R \rightarrow (1)$   $S \rightarrow (2)$ (R)  $P \rightarrow (2)$   $Q \rightarrow (4)$   $R \rightarrow (1)$   $S \rightarrow (3)$ (E)  $P \rightarrow (3)$   $Q \rightarrow (1)$   $R \rightarrow (4)$   $S \rightarrow (2)$ 

11. Match the following List

List - I		List - II	
(P)	The expression, $x^{\ln y - \ln z} \cdot y^{\ln z - \ln x} \cdot z^{\ln x - \ln y}$ when simplified reduces to	(1)	$\frac{1}{8}$
(Q)	Let $p = \log_5 \log_5 (3)$ . If $3^{C+5^p} = 45$ , then the value of $C$ equals	(2)	$\frac{1}{4}$
(R)	The real value of $x$ for which the statement $\log_6 9 - \log_9 27 + \log_8 x = \log_{64} x - \log_6 4$ holds true, is	(3)	4
(S)	$\log_{\sqrt{5}} \sin\left(\frac{\pi}{5}\right) \cdot \log_{\sqrt{\sin\frac{\pi}{5}}} 5$ simplifies to	(4)	1
		(5)	2

The correct option is

(F)  $P \rightarrow (3)$   $Q \rightarrow (5)$   $R \rightarrow (1)$   $S \rightarrow (4)$ (T)  $P \rightarrow (4)$   $Q \rightarrow (1)$   $R \rightarrow (2)$   $S \rightarrow (3)$ (R)  $P \rightarrow (3)$   $Q \rightarrow (1)$   $R \rightarrow (2)$   $S \rightarrow (4)$ (E)  $P \rightarrow (4)$   $Q \rightarrow (5)$   $R \rightarrow (1)$   $S \rightarrow (3)$ 

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**(PART – B)****(Non – Negative Integer)**

1. The equation of a line through the mid point of the sides AB and AD of rhombus ABCD, whose one diagonal is  $3x - 4y + 5 = 0$  and one vertex is A (3, 1) is  $ax + by + c = 0$ . Find the absolute value of  $(a + b + c)$  where a, b, c are integers expressed in lowest form.
2. The three vertices of  $\Delta ABC$  are on the circle  $x^2 + y^2 = 5$ . The point (0, 0) is outside the  $\Delta ABC$  and 1 unit away from the nearest side of  $\Delta ABC$ . If the maximum area of the triangle is  $k \cos 72^\circ$ , then find the value of k.
3. One of the diameters of the circle circumscribing the rectangle ABCD in order is  $4y = x + 7$ . If A and B are the points (-3, 4) and (5, 4) respectively, then find the area of the rectangle.
4. If x be a real number in the interval  $\left(0, \frac{\pi}{2}\right)$  such that  $\frac{1}{\sin x \cdot \cos x} + 2 \cot 2x = \frac{1}{2}$  then the value of the expression  $\frac{1}{\sin x \cdot \cos x} - 2 \cot 2x$  is
5. Let P be the point (3, 2). Let Q be the reflection of P about the x – axis. Let R be the reflection of Q about the line  $y = -x$  and let S be the reflection of R through the origin. If PQRS is a convex quadrilateral then the area of PQRS is
6. In any triangle, if  $(\sin A + \sin B + \sin C)(\sin A + \sin B - \sin C) = 3 \sin A \sin B$ , then find the angle C (in degree).

*Space For Rough Work*



# FIITJEE INTERNAL TEST

**BATCHES – Two Year CRP426 Batches**

**Phase Test – 1**

**Code: 100734-0**

**JEE ADVANCED LEVEL**

**ANSWER KEY**

**ANSWER KEYS**

## Physics

### PART – A

- |       |       |        |      |
|-------|-------|--------|------|
| 1. R  | 2. T  | 3. R   | 4. F |
| 5. TR | 6. RE | 7. FTR | 8. R |
| 9. T  | 10. F | 11. E  |      |

### PART – B

- |       |      |      |      |
|-------|------|------|------|
| 1. 20 | 2. 8 | 3. 5 | 4. 2 |
| 5. 2  | 6. 9 |      |      |

## Chemistry

### PART – A

- |        |       |         |      |
|--------|-------|---------|------|
| 1. R   | 2. T  | 3. R    | 4. T |
| 5. FTE | 6. FT | 7. FTRE | 8. T |
| 9. R   | 10. T | 11. E   |      |

### PART – B

- |        |       |       |        |
|--------|-------|-------|--------|
| 1. 10  | 2. 2  | 3. 11 | 4. 762 |
| 5. 800 | 6. 19 |       |        |

## Mathematics

### PART – A

- |        |       |       |      |
|--------|-------|-------|------|
| 1. E   | 2. F  | 3. F  | 4. R |
| 5. FTR | 6. FT | 7. FR | 8. F |
| 9. R   | 10. T | 11. E |      |

### PART – B

- |       |       |       |      |
|-------|-------|-------|------|
| 1. 1  | 2. 8  | 3. 32 | 4. 8 |
| 5. 15 | 6. 60 |       |      |