FIITJEE INTERNAL Phase Test

PHYSICS, CHEMISTRY & MATHEMATICS

QP CODE: 100795 | **RIT – V**

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.

Forthcoming Exam – FTRE on 06th Oct. 2024.

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-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.**

(iv) **Part-B** (07-10) This section contains Two paragraphs. Each paragraph having TWO questions Numerical answer type with answer XXXX.XX**.** For each question, enter the correct numerical value. If the numerical value has more than two decimal places, **truncate/round-off** the value to **TWO** decimal places. Each question carries **+3 marks** for the correct answer. **There is no negative marking.**

Name of the Candidate: _____

Batch: _____ **Date of Examination:** _____

Enrolment Number: _____

BATCHES – C – XII

*** 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)

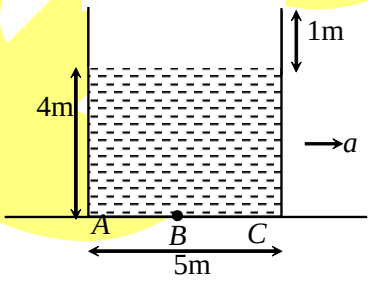
This section contains **4 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct.**

1. A standing wave is created in a string which is represented by $y = 6 \sin(100\pi t) \cos(5\pi x)$. If mass per unit length of string is 100 g/m. Then tension in the thread is

(F) 20 N (T) 100 N

(R) 10 N (E) 40 N

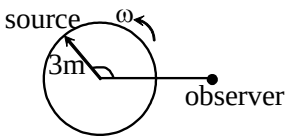
2. A cubical open vessel of side 5m filled with liquid upto a height of 4m is accelerated with an acceleration *a*. The minimum value of *a* so that pressure at mid point of AC is equals to atmospheric is



(F) g (T) $2g$

(R) $g/2$ (E) $2g/5$

3. A source is moving on a circle of radius 3 m with constant angular velocity $\omega = 5$ rad/s. If the observer is at a distance 5 m from the centre of circle, the time interval between maximum and minimum frequency received by the observer is



(F) $\frac{\pi}{5}$ (T) $\frac{2}{5}\cos^{-1}\left(\frac{3}{4}\right)$

(R) $\frac{2}{5}\cos^{-1}\left(\frac{3}{5}\right)$ (E) $\frac{2}{5}\sin^{-1}\left(\frac{3}{5}\right)$

4. A spherical object of mass 1 kg and radius 1 m is falling vertically downward inside a viscous liquid in a gravity free space. At a certain instant the velocity of the sphere is 2 m/s. If the coefficient of viscosity of the liquid is $\frac{1}{18\pi}$ N-S/m^2, then velocity of ball will become 0.5 m/s after a time

(F) ln 4 s (T) 2 ln 4 s

(R) 3 ln 4 s (E) 2 ln 2 s

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. A large wooden plate of area 10 m^2 floating on the surface of a river is made to move horizontally with a speed of 2 m/s by applying a tangential force. River is 1 m deep and the water in contact with the bed is stationary. Then choose correct statements.

(Coefficient of viscosity of water = 10^{-3} N-s/m^2)

(F) velocity gradient is $2s^{-1}$.

(T) velocity gradient is $1s^{-1}$

(R) force required to keep the plate moving with constant speed is 0.02 N.

(E) force required to keep the plate moving with constant speed is 0.01 N.

6. A sound wave of frequency ν travels horizontally to the right. It is reflected from a large vertical plane surface moving to the left with a speed V. The speed of sound in the medium is c.

(F) the number of wave pulse striking the surface per second is $\frac{\nu(c+V)}{c}$

(T) the wavelength of the reflected wave is $\frac{c(c-V)}{\nu(c+V)}$

(R) the frequency of the reflected wave is $\frac{\nu(c+V)}{(c-V)}$

(E) the number of beats heard by a stationary listener to the left of the reflecting surface is $\frac{vV}{c-V}$

7. An object is floating in a liquid, kept in a container. The container is placed in a lift. Choose the correct option(s)

(F) Buoyant force increases as lift accelerates up.

(T) Buoyant force decreases as lift accelerates up.

(R) Buoyant force remains constant as lift accelerates.

(E) The fraction of solid submerged into liquid does not change.

Space For Rough Work

(PART – B)

(Non – Negative Integer)

1. A wire of length 1.5 m under tension emits a fundamental note of frequency 120 Hz. What would be its fundamental frequency if the length is increased by half under the same tension (in Hz).

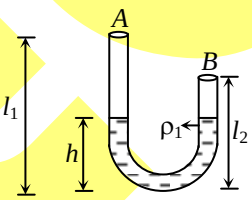
2. When a 60 N stone is attached to a scale and submerged in water, the scale reads 40 N, find the specific gravity of the stone.

3. The vibration of a string of length 60 cm fixed at both ends are represented by the equation

$$y = 4\sin\frac{\pi x}{15}\cos(96\pi t)$$

where x and y are in cm and t is in seconds. What is the velocity of the particle at x = 7.5 cm and t = 0.25 s?

4. A U-tube having uniform cross-section but unequal arm lengths l_1 and l_2 ($< l_1$) has same liquid of density ρ_1 filled in it upto a height h as shown in figure. Another liquid of density $\rho_2 = (\rho_1/2)$ is poured in arm A. Both liquids are immiscible. What length of the second liquid should be poured in A so that first overtone of A is in unison with fundamental tone of B. (Take l_1 = 5 m, l_2 = 1 m and h = 0.5 m)



5. Two wires are fixed on a sonometer. Their tensions are in the ratio 8 : 1, the lengths in the ratio 36 : 35, the diameters in the ratio 4 : 1, the densities in the ratio 1 : 2. Find the frequency of beats if the note of higher pitch has a frequency of 360 Hz.

6. A source and a detector move away from each other each with a speed of 10 m/sec. If the detector detects a frequency of 1950 Hz coming from source, The original frequency of source is 517 × f_0. Find out 'f_0'. [Speed of sound in air = 340 m/sec (in Hz)]

Space For Rough Work

(PART – B)

This section contains Two paragraphs. Each paragraph having TWO questions Numerical answer type with answer XXXX.XX. For each question, enter the correct numerical value. If the numerical value has more than two decimal places, **truncate/round-off** the value to **TWO** decimal places.

Paragraph for Question no. 7 to 8

An incident wave $y = A\sin\left(ax + bt + \frac{\pi}{2}\right)$ is reflected by a rigid obstacle at x = 0 which reduces intensity of reflected wave to 64% of incident wave Due to superposition, the resulting wave consists of a standing wave and a traveling wave, which is given by $Y = -dA\sin ax \cdot \sin bt + cA\cos(bt + ax)$ where A, a, b, c are positive constants.

7. Amplitude of reflected wave is xA. The value of 'x'_____.

8. Value of c is_____.

Paragraph for Question no. 9 to 10

A glass capillary of length 0.11 m is sealed at the upper end and having internal diameter 2×10^{-5}m. The capillary is immersed vertically into a liquid very slowly of surface tension 5.0×10^{-2} N/m in such a way that the liquid level inside and outside the capillary becomes same.

Answer the following questions based on the above statement. (atmospheric pressure $P_0 = 1.01 \times 10^5$ N/m, angle of contact zero)

9. To what length has the capillary to be immersed so that the liquid level inside and outside the capillary becomes same (in m)?

10. The radius of meniscus inside tube is n × 10^{-5} m. The value of 'n' is_____.

Space For Rough Work

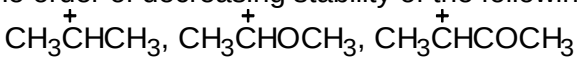
SECTION – II : CHEMISTRY

(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.**

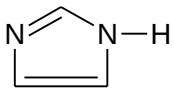
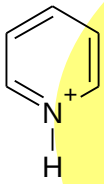
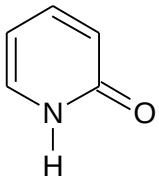
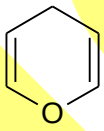
1. The order of decreasing stability of the following cations is



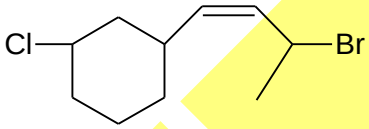
(I) (II) (III)

(F) III > II > I
(T) I > II > III
(R) II > I > III
(E) I > III > II

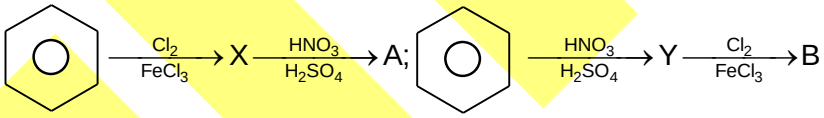
2. Identify the compound which is not aromatic:

(F) 
(T) 
(R) 
(E) 

3. How many stereisomers are possible for following molecule?



(F) 4
(T) 8
(R) 12
(E) 16

4. 

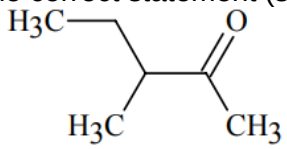
A and B are
(F) identical
(T) position isomers
(R) geometrical
(E) chain isomers

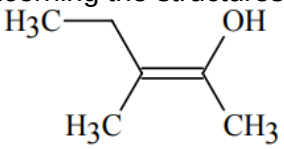
Space For Rough Work

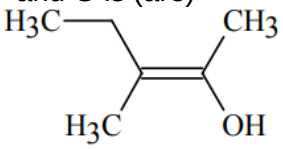
(One or More Than One Options Correct Type)

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. The correct statement (s) concerning the structures E, F and G is (are)


(E)

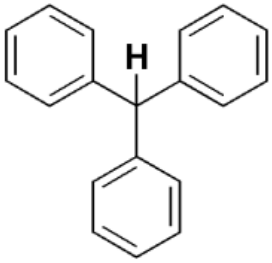

(F)

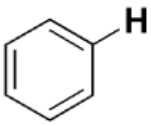

(G)

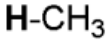
(F) E, F and G are resonance structures (T) E, F and E, G are tautomers
(R) F and G are geometrical isomers (E) F and G are diasteromers

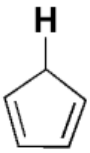
6. Dipole moment is shown by
(F) 1, 4-dichlorobenzene (T) cis-1, 2-dichloroethene
(R) trans-1, 2-dichloroethene (E) trans-1, 2-dichloro-2-pentene

7. With respect to the compounds I-V, choose the correct statement(s).


I


II


III

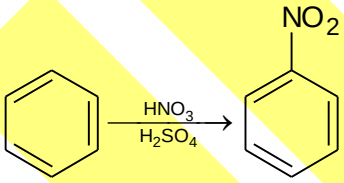

IV


V

(F) The acidity of compound I is due to delocalization in the conjugate base.
(T) The conjugate base of compound IV is aromatic.
(R) Compound II becomes more acidic, when it has a -NO_2 substituent.
(E) Compound I, II & IV are aromatic

(PART – B)

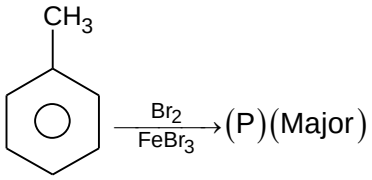
(Non – Negative Integer)

1. 

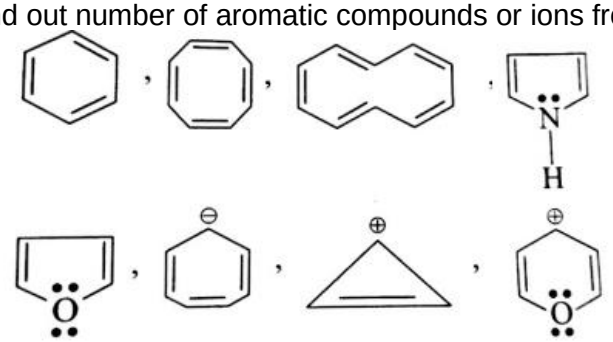
In the above reaction, 3.9 g of benzene on nitration gives 4.92 g of nitrobenzene. The percentage yield of nitrobenzene in the above reaction is _____%
(Round off to the nearest integer), (Atomic mass: C = 12.0 u, H : 1.0 u, O : 16.0u, N : 14.0u)

Space For Rough Work

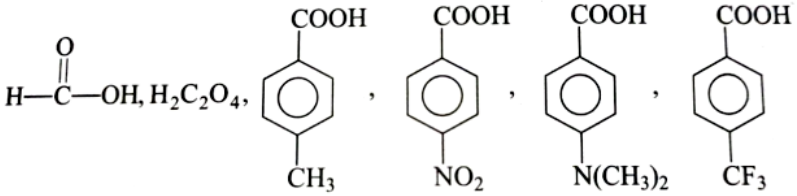
2. In the given reaction; number of bromo groups present in the major product(P) is



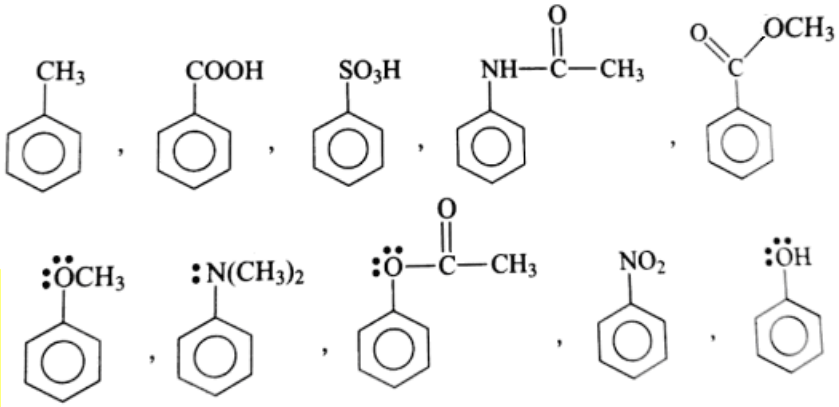
3. Find out number of aromatic compounds or ions from following:



4. Find out number of compounds which are more acidic than benzoic acid, from the following



5. Examine the structural formulas shown below and find out how many compounds undergo electrophilic nitration more rapidly than flouro benzene.



6. Find out number of structural isomers possible for C_6H_{14}.

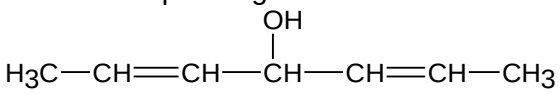
Space For Rough Work

(PART – B)

This section contains Two paragraphs. Each paragraph having TWO questions Numerical answer type with answer XXXX.XX. For each question, enter the correct numerical value. If the numerical value has more than two decimal places, **truncate/round-off** the value to **TWO** decimal places.

Paragraph for Question no. 7 to 8

If 'x' = Number of geometrical isomers and
'y' = Number of optical active isomers
For the compound given below



Then

7. The value of x is_____

8. The value of y is_____

Paragraph for Question no. 9 to 10

Delocalisation of electrons takes place in alternate single and multiple bonds involving carbon atoms. Delocalisation may also occur in a conjugated system involving carbon atom and atoms other than the carbon. There are also examples in which pi orbital and p orbital (vacant or half-filled or filled) overlap. Thus delocalisation is of the following types:

(i) delocalisation by π, π overlap
(ii) delocalisation by π, p overlap

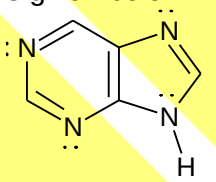
Delocalisation makes system stable. More is the number of resonating structures more will be the stability of the system.

9.

1, 4-pentadiene	1, 3-butadiene	1, 3, 5-hexatriene	Benzene	Naphthalene	Furan	1, 3-pentadiene
I	II	III	IV	V	VI	VII

If given compounds which can undergo delocatlisation is 'x' then value of 1.26x will be?

10. The purine heterocyclic compound which occurs mainly in the structure of DNA, structure of purine is given below:



(Purine)

If number of 'N' atoms having localized lone pair of electron in purine = x
If number of sp^2 hybridised carbon in purine = y
If number of hydrogen in purine = z
Then the value of $\frac{x+y+z}{7}$ is

Space For Rough Work

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. Consider the ellipse $\frac{x^2}{3}+\frac{y^2}{1}=1$. Let P, Q, R, S be four points on this ellipse such that the normals drawn at these four points are concurrent at the point (2, 2), then the centre of the conic (apart from the given ellipse) on which these four points lie is

(F) (0, 0) (T) (3, 1)

(R) (3, –1) (E) (–1, 3)

2. Tangents are drawn from the point P (3, 4) to the ellipse $\frac{x^2}{9}+\frac{y^2}{4}=1$ touching the ellipse at points A and B, then the orthocenter of the triangle PAB is

(F) $\left(5,\frac{8}{7}\right)$ (T) $\left(\frac{7}{2},\frac{25}{8}\right)$

(R) $\left(\frac{11}{5},\frac{8}{5}\right)$ (E) $\left(\frac{8}{25},\frac{7}{5}\right)$

3. A variable point P on the ellipse of eccentricity e is joined to the foci S and S'. Then the locus of the in-centre of the triangle PSS' is an ellipse whose eccentricity is

(F) $\sqrt{\frac{2e+1}{1+e}}$ (T) $\sqrt{\frac{2e}{2+e}}$

(R) $\sqrt{\frac{2e}{1+e}}$ (E) $\sqrt{\frac{2e}{1+2e}}$

4. A hyperbola with equation $\frac{(x-1)^2}{16}-\frac{(y+2)^2}{9}=1$ is given. A triangle is formed with two vertices as the focus of the hyperbola and third vertex lies on hyperbola. The locus of centroid of the triangle is:

(F) $16(x-1)^2-9(y+2)^2=16$ (T) $9(x-1)^2-16(y+2)^2=16$

(R) $9(x-1)^2+16(y+2)^2=169$ (E) $16(x-1)^2+9(y+2)^2=16$

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. An ellipse intersects the hyperbola $2x^2 - 2y^2 = 1$ orthogonally. The eccentricity of the ellipse is reciprocal to that of the hyperbola. If the axes of the ellipse are along the co – ordinate axes, then

(F) equation of ellipse is $x^2 + 2y^2 = 2$ (T) foci of ellipse are $(\pm 1, 0)$

(R) equation of ellipse is $x^2 + 2y^2 = 4$ (E) foci of ellipse are $\left(\pm\sqrt{2}, 0\right)$

6. Consider two straight lines, each of which is tangent to both the circle $x^2 + y^2 = \frac{1}{2}$ and the parabola $y^2 = 4x$. Let these lines intersect at the point Q. Consider the ellipse whose center is at the origin O (0, 0) and whose semi – major axis is OQ. If the length of the minor axis of this ellipse is $\sqrt{2}$, then which of the following statement(s) is (are) TRUE?

(F) For the ellipse, the eccentricity is $\frac{1}{\sqrt{2}}$ and the length of the latus rectum is 1

(T) For the ellipse, the eccentricity is $\frac{1}{2}$ and the length of the latus rectum is $\frac{1}{2}$

(R) The area of the region bounded by the ellipse between the lines $x = \frac{1}{\sqrt{2}}$ and $x = 1$ is

$$\frac{1}{4\sqrt{2}}(\pi - 2)$$

(E) The area of the region bounded by the ellipse between the lines $x = \frac{1}{\sqrt{2}}$ and $x = 1$ is

$$\frac{1}{16}(\pi - 2)$$

7. Let a and b be positive real numbers such that $a > 1$ and $b < a$. Let P be a point in the first quadrant that lies on the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$. Suppose the tangent to the hyperbola at P passes through the point (1, 0), and suppose the normal to the hyperbola at P cuts off equal intercepts on the coordinate axes. Let Δ denote the area of the triangle formed by the tangent at P, the normal at P and the x – axis. If e denotes the eccentricity of the hyperbola, then which of the following statement is/are TRUE?

(F) $1 < e < \sqrt{2}$ (T) $\sqrt{2} < e < 2$

(R) $\Delta = a^4$ (E) $\Delta = b^4$

Space For Rough Work

(PART – B)

(Non – Negative Integer)

1. Let a, b and λ be positive real numbers. Suppose P is an end point of the latus rectum of the parabola $y^2 = 4\lambda x$, and suppose the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ passes through the point P. If the tangents to the parabola and the ellipse at the point P are perpendicular to each other, then the eccentricity of the ellipse is $\frac{1}{\sqrt{k}}$ then k is

2. Consider a branch of the hyperbola $x^2 - 2y^2 - 2\sqrt{2}x - 4\sqrt{2}y - 6 = 0$ with vertex at the point A. Let B be one of the end points of its latus rectum. If C is the focus of the hyperbola nearest to the point A, then the area of the triangle ABC is $\sqrt{\frac{k}{2}} - 1$ then k is

3. We have 21 identical balls, which needs to be distributed among 3 Boys A, B, C. Such that A always gets even number of balls. Number of possible ways of doing this is

4. A man wants to distribute 101 coins of a rupee each, among his 3 sons with the condition that no one receives more money than the combined total of other two. The number of ways of doing this is

5. The number of 7 digit numbers whose sum of the digits equals 10 and which is formed by using the digits 1, 2 and 3 only is

6. Find the number of integral solutions of $x + y + z \le 29$ such that $x > 0, y > 1, z > 2$.

Space For Rough Work

(PART – B)

This section contains Two paragraphs. Each paragraph having TWO questions Numerical answer type with answer XXXX.XX. For each question, enter the correct numerical value. If the numerical value has more than two decimal places, **truncate/round-off** the value to **TWO** decimal places.

Paragraph for Question no. 7 to 8

Number of ways to put n-letters into any n-envelopes such that no letter goes in its own envelope is given by $D_n = (n!)\left(\frac{1}{2!} - \frac{1}{3!} + \frac{1}{4!} - \frac{1}{5!} + \ldots + \frac{(-1)^n}{n!}\right)$.

7. If A, B, C, D each have four houses then number of ways in which they can enter these houses so that none of them enter their own house is

8. If A has two houses whereas B, C, D have one house each then number of ways in which they can enter these houses such that no one enters their own house is

Paragraph for Question no. 9 to 10

Let $F_1(x_1, 0)$ and $F_2(x_2, 0)$, for $x_1 < 0$ and $x_2 > 0$, be the foci of the ellipse $\frac{x^2}{9} + \frac{y^2}{8} = 1$. Suppose a parabola having vertex at the origin and focus at F_2 intersects the ellipse at point M in the first quadrant and at point N in the fourth quadrant.

9. The orthocentre of the triangle F_1MN is $\left(-\frac{k}{10}, 0\right)$, then k is

10. If the tangents to the ellipse at M and N meet at R and the normal to the parabola at M meets the x – axis at Q, then the ratio of area of the triangle MQR to area of the quadrilateral MF_1NF_2 is $k:8$, then k is

Space For Rough Work

FIITJEE INTERNAL TEST

BATCHES – C-XII

RIT – V

Code : 100795

ANSWERS

Physics

PART – A

1.	E	2.	T	3.	R	4.	R
5.	FR	6.	FTR	7.	FE		

PART – B

1.	80	2.	3	3.	0	4.	2
5.	10	6.	4	7.	0.8	8.	0.2
9.	0.01	10.	1				

Chemistry

PART – A

1.	R	2.	E	3.	E	4.	T
5.	TRE	6.	TE	7.	FTR		

PART – B

1.	80	2.	1	3.	5	4.	4
5.	6	6.	5	7.	3	8.	2
9.	7.56	10.	1.71				

Mathematics

PART – A

1.	R	2.	R	3.	R	4.	T
5.	FT	6.	FR	7.	FE		

PART – B

1.	2	2.	3	3.	132	4.	1275
5.	77	6.	2600	7.	9	8.	42
9.	9	10.	5				