FIITJEE COMMON TEST

PHYSICS, CHEMISTRY & MATHEMATICS

CODE:

Time Allotted: 3 Hours **Maximum Marks: 192**

- 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 Section.
3. **Section-I** is Physics, Section-**II** is Chemistry and Section-**III** is Mathematics.
4. Each section is further divided into two parts: Part-**A & Part-B**
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.
2. On the OMR sheet, darken the appropriate bubble with HB pencil 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 – 8)** contains 8 multiple choice questions which have only one correct answer. Each question carries **+3 marks** for correct answer and **– 1 mark** for wrong answer.

PART – A (**09 – 12)** contains **4** Multiple Choice Questions which have **One or More Correct** answer.
For each question in the group **Q. 9 – 12** of **PART – A** you will be awarded
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.

(ii) **Part -B (01 – 06)** contains 6 Numerical based questions, the answer of which maybe positive or negative numbers or decimals (e.g. 6.25, 7.00, -0.33, -.30, 30.27, -127.30) and each question carries **+4 marks** for correct answer and **there will be no negative marking.**

Name of the Candidate :_____

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

Enrolment Number :_____

Section – I (Physics)

PART – A

(Single Correct Choice Type)

This section contains 8 **multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct.**

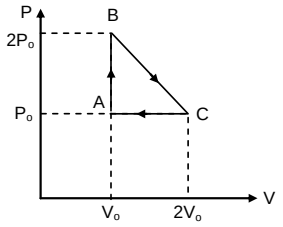
1. To which one of the following factors is the internal energy of an ideal gas unrelated:
   (A) temperature of the gas (B) thermal conductivity of the gas
   (C) density of the gas (D) mean molecular speed of the gas

1. **B**

2. When an ideal diatomic gas is heated at constant pressure, the fraction of the heat energy supplied which increases the internal energy of the gas is:
   (A) 2/5 (B) 3/5
   (C) 3/7 (D) 5/7

2. **D**

3. If the temperature of the state A is T_A then the maximum temperature in whole cycle of the given figure, will be
   (A) $\frac{9}{4}T_A$ (B) $\frac{9}{2}T_A$
   (C) $4T_A$ (D) none of these



3. **A**

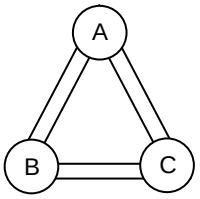
4 Two mole of argon are mixed with one mole of hydrogen, then C_p/C_v for the mixture is nearly
   (A) 1.2 (B) 1.3
   (C) 1.4 (D) 1.5

4. **D**

5. 840 J of heat is required to raise the temperature of 2 g moles of an ideal gas from 20°C to 40°C at constant pressure. The amount of heat required to raise the temperature of the same gas from 40°C to 60°C at constant volume is (take R = 8.4 J g.mole^{-1} k^{-1})
   (A) 504 J (B) 420 J
   (C) 840 J (D) 630 J

5. **A**

6. Three metallic blocks A, B and C have masses m, m and 2m respectively. Specific heat of A, B and C are C, 2C and C respectively. Initial temperature of A, B and C are 10°C, 5°C and 5°C respectively. Now the blocks are connected by 3-identical rods as shown. Find the final temperature of block A on Celsius scale (Neglect any heat loss due to radiation).
   (A) 2 (B) 4
   (C) 6 (D) 8



6. **C**

7. An ideal gas is taken from the state A (pressure P, volume V) to the state B (pressure P/2, volume 2V) along a straight line path in the P - V diagram. Select the correct statement(s) from the following:
   (A) The work done by the gas in the process A to B exceeds the work that would be done by it if the system were taken from A to B along an isotherm
   (B) In the T - V diagram, the path AB becomes a part of a parabola
   (C) In the P - T diagram, the path AB becomes a part of a hyperbola
   (D) In going from A to B, the temperature T of the gas first increases to a maximum value and then decreases.

7. **A**

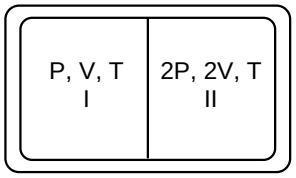
8. If the surface temperature of the sun were to remain constant and its radius becomes double then the temperature of planet will be
(A) 2 times of the initial temperature of the planet.
(B) $\sqrt{2}$ times of the initial temperature of the planet.
(C) 4 times of the initial temperature of the planet.
(D) 16 times of the initial temperature of the planet.

8. **B**

(Multi Correct Choice Type)

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

9. A partition divides a container having insulated walls into two compartments I and II. The same gas fills the two compartments whose initial parameters are given. The partition is a conducting wall which can move freely without friction. Which of the following statements is/are correct, with reference to the final equilibrium position?



(A) The pressure in the two compartments are equal.
(B) Volume of compartment I is $\frac{3V}{5}$.
(C) Volume of compartment II is $\frac{12V}{5}$.
(D) Final pressure in compartment I is $\frac{5P}{3}$.

9. **ABCD**

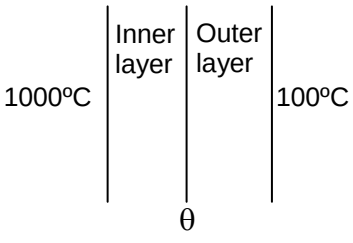
10. A mixture of two diatomic gases X and Y is enclosed in a container at constant temperature. The molecular weight of X is 16 times that of Y and mass of the gas X is 2 times that of Y. Then
(A) The average molecular kinetic energy of X equals that of Y
(B) The r.m.s. molecular speed of translation of X is 1/4th that of Y.
(C) The pressure exerted by X is 1/8th that by Y.
(D) The pressure exerted by X is 8 times that by Y.

10. **ABC**

11. Two bodies A and B have thermal emissivities of 0.01 and 0.81 respectively. The outer surface areas of the two bodies are equal. The two bodies emit total radiant power at the same rate. The wavelength λ_B corresponding to maximum spectral radiancy in the radiation from B to shifted from the wavelength corresponding to maximum spectral radiancy in the radiation from A by 1 μm. If the temperature of A is 5802 K,
(A) The temperature of B is 1934 K (B) $\lambda_B = 1.5\ \mu m$
(C) The temperature of B is 1160 K (D) The temperature of B is 2901 K

11. **AB**

12. The temperature drop through a two layers furnace wall is 900ºC. Each layer is of equal area of cross-section. Which of the following actions will result in lowering the temperature θ of the interface?



(A) by increasing the thermal conductivity of outer layer.
(B) by increasing the thermal conductivity of inner layer.
(C) by increasing thickness of outer layer.
(D) by increasing thickness of inner layer.

12. **AD**

PART – B
(Numerical Based)

This section contains 06 Numerical based questions, the answer of which maybe positive or negative numbers or decimals (e.g. 6.25, 7.00, -0.33, -.30, 30.27, -127.30)

1. 2 kg of ice at –20°C is mixed with 5 kg of water at 20°C in an insulating vessel having negligible heat capacity. Calculate the final mass of water (in Kg) remaining in the container. It is given that the specific heats of water and ice are 1 kcal/kg/°C and 0.5 kcal/kg/°C respectively, while the latent heat of fusion of ice is 80 kcal/kg

1. **6**

2. A certain sample of monoatomic ideal gas is subject to a thermodynamic process in which V and T are related as $V^2 = kT$ (k is constant). If the molar specific heat of the gas in this process is nR then find the value of 'n'.

2. **2**

3. The specific heat capacity of mono-atomic ideal gas for thermodynamic process $P = \alpha v^2$, is equal to $\frac{11R}{K}$. Where α and K are positive constant and R is gas constant. Find the value of 'K'.

3. **6**

4. A steel rod with a cross-sectional area of 150 mm^2 is stretched between two fixed points. The tensile load at 20°C is 5000 N. If stress at –20° is $k127\times10^6 N/m^2$ find the value of 'k'.. (assume α = 11.7μm/m°C and Y = 200 GN/m^2)

4. **1**

5. When the temperature of a copper coin is raised by 80°C its diameter increase by 0.2%. The coefficient of linear expansion of copper is $K \times 10^{-4}$/°C

5. **0.25**

6. Heat is transferred to a heat engine from a furnace at a rate of 80 mW. If the rate of heat rejection is 50 mW, then percentage efficiency of the engine is

6. **37.5**

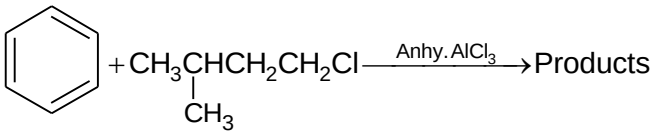
space for rough work

Section – II (Chemistry)

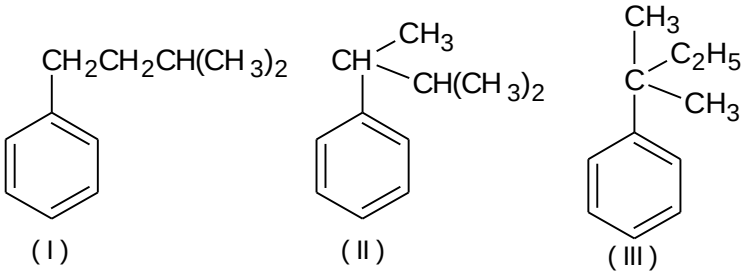
PART – A

(Single Correct Choice Type)

This section contains 8 **multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct.**

1. 

The products are



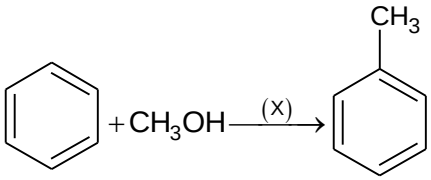
(I) (II) (III)

Which product is formed at the lowest temperature?

(A) I (B) II

(C) III (D) All are formed at any temperature

1. A

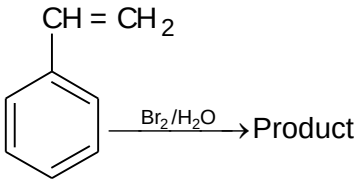
2. 

Most suitable catalyst in above reaction is

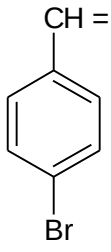
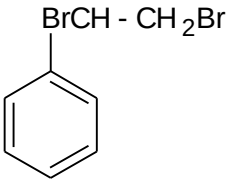
(A) BF_3 (B) $AlCl_3$

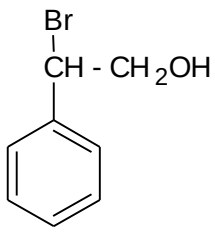
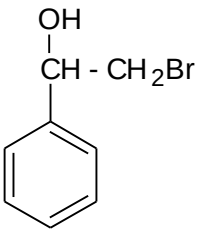
(C) $NaOCH_3$ (D) conc. H_2SO_4 at low temperature

2. A

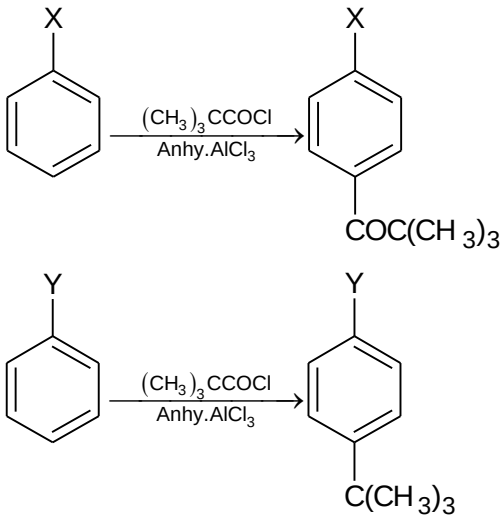
3. 

The major product of above reaction is:

(A)  (B) 

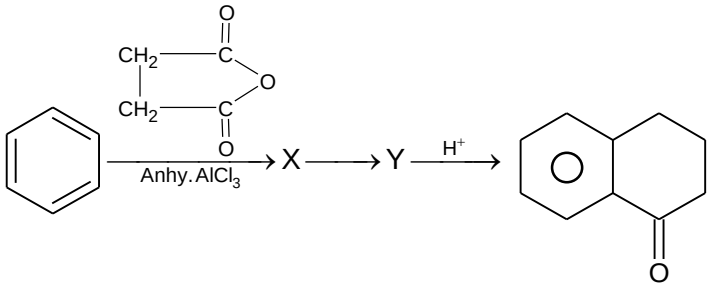
(C)  (D) 

3. D

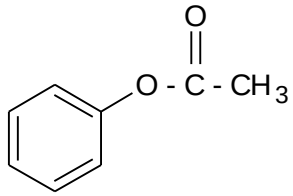
4. 

In above reaction
(A) X is a stronger activating group than Y
(B) X is a weaker activating group than Y
(C) X and Y are equally activating
(D) X and Y are both deactivating and X is less deactivating than Y

4. A

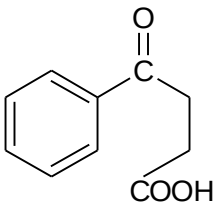
5. 

Choose correct statement

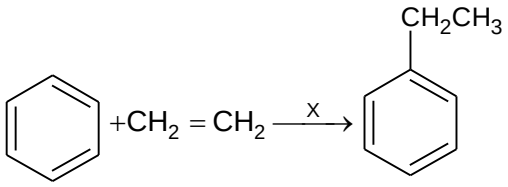
(A) X is 

(B) Y contains no oxygen atoms

(C) X is reduced to Y

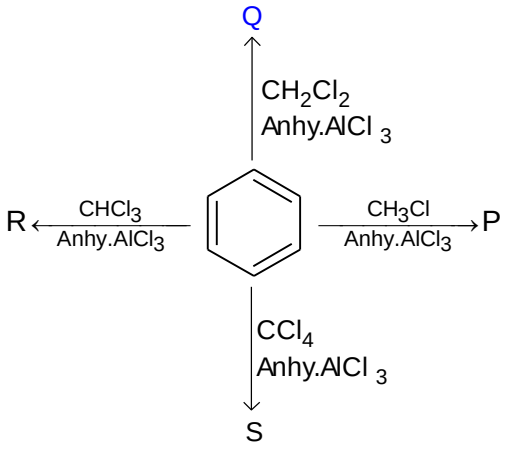
(D) Y is 

5. C

6. 

For better product yield 'X' should be
(A) HF
(B) HCl
(C) HBr
(D) HI

6. A

7. 

The heaviest product in above reaction is

(A) P (B) Q

(C) R (D) S

7. C

8. Which order is correct regarding the EAS reactivity of the substances with benzene?

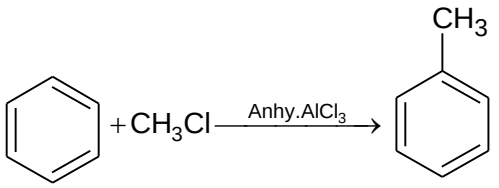
(A) CH_3Cl > t-C_4H_9Cl (for alkylation) (B) ICl > I_2(for iodination)

(C) BrCl > Cl_2(for chlorination) (D) KNO_2 > NO_2BF_4(for nitration)

8. B

(Multi Correct Choice Type)

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

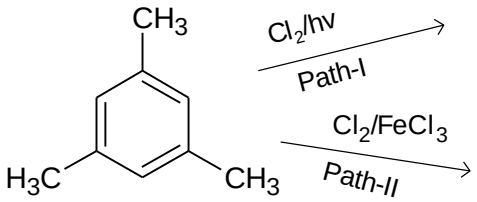
9. 

Which can be used as solvents for above reaction?

(A) Nitrobenzene (B) Phenol

(C) Benzoic acid (D) Toluene

9. AC

10. 

Correct statements(s) is/are

(A) Both steps will produce monochloro products

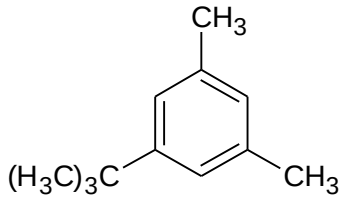
(B) The primary carbon atoms are attacked by chlorine free radicals

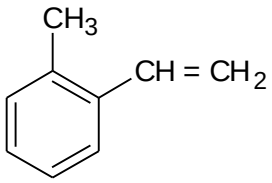
(C) In path-II., Cl^- ions are present in reaction mixture

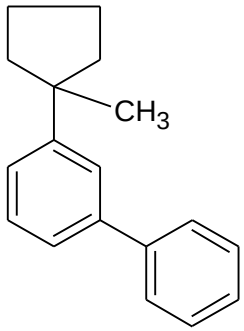
(D) The number of steps in path-I is greater than that of path-II

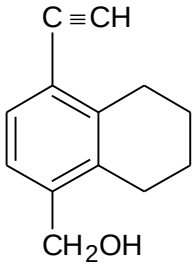
10. ABCD

11. Which compound(s) form dicarboxylic acid(s) on permanganate oxidation?

(A) 

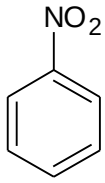
(B) 

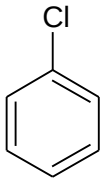
(C) 

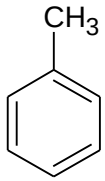
(D) 

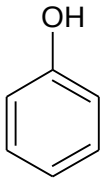
11. AB

12. Which of the following compound(s) is/are more reactive towards NO_2^+ than benzene?

(A) 

(B) 

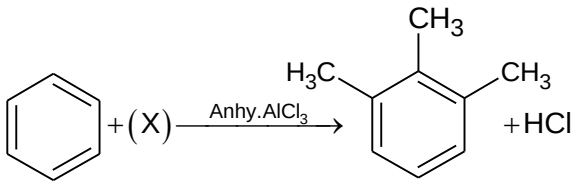
(C) 

(D) 

12. CD

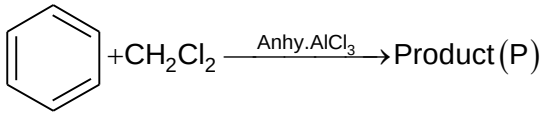
PART – B
(Numerical Based)

This section contains 06 Numerical based questions, the answer of which maybe positive or negative numbers or decimals (e.g. 6.25, 7.00, -0.33, -.30, 30.27, -127.30)

1. 

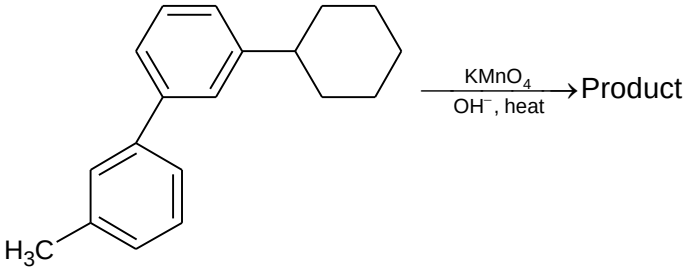
What is the molar mass of (X)?

1. 50.5

2. 

If the mass percent of C, H and Cl in major product(P) respectively are x, y and z. What is the value of (x + y - z)?

2. 100

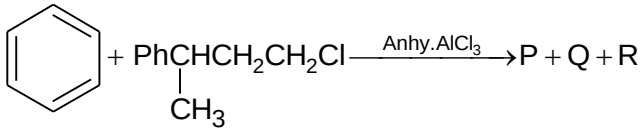
3. 

How many oxygen atom(s) is/are present in the organic product of above reaction?

3. 4

4. The molecular formula of an aromatic compound is C_7H_9N. It is more basic than aniline. It does not form acids upon permanganate oxidation. How many C – N bond(s) is/are present in it?

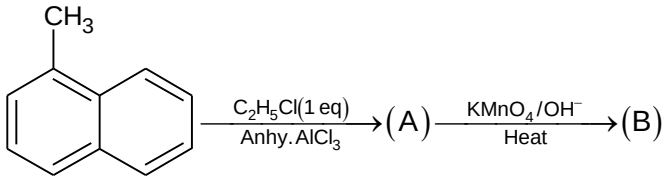
4. 2

5. 

Products	**P**	**Q**	**R**
Number of asymmetric carbon atoms	1	2	1
Number of 3^o carbon atoms	1	2	0

How many maximum number of monochloro products can be formed by R through all possible mechanisms?

5. 10

6. 

(B) is the anion of the heaviest end product of above reaction. What is it's molar mass in g mol^{-1} unit?

6. 250

space for rough work

Section – III (Mathematics)

PART – A

(Single Correct Choice Type)

This section contains 8 **multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct.**

1. There are 12 points in a plane of which 5 are collinear. The number of distinct quadrilaterals which can be formed with vertices at these points is:
   (A) 420 (B) $^{7}P_{3}$
   (C) $10\,^{7}C_{3}$ (D) None of these

1. A

2. Integral solutions to $x + y + z + t = 29$, where $x \geq 1$, $y \geq 1$, $z \geq 3$ and $t \geq 0$, are
   (A) $^{26}C_{3}$ (B) $^{26}C_{4}$
   (C) None of these (D) 1300

2. A

3. The number of ways 5 identical balls can be distributed into 3 different boxes so that no box remains empty
   (A) $^{4}C_{2}$ (B) $^{4}C_{3}$
   (C) $^{4}C_{1}$ (D) None of these

3. A

4. If the number of zeroes at the end of 130! Is 2^{n}, then the value of n is _____
   (A) 3 (B) 4
   (C) 5 (D) 6

4. C

5. Number of ways in which 9 different toys be distributed among 4 children belonging to different age groups in such a way that distribution among the 3 elder children is even and the youngest one is to receive one toy more, is:
   (A) $\frac{(5!)^{2}}{8}$ (B) $\frac{9!}{2}$
   (C) $\frac{9!}{3!(2!)^{3}}$ (D) none

5. C

6. The number of different seven digit numbers that can be written using only the three digits 1, 2 and 3 with the condition that the digit 2 occurs twice in each number is
   (A) $^{7}P_{2}.2^{5}$ (B) $^{7}C_{2}.2^{5}$
   (C) $^{7}C_{2}.5^{2}$ (D) $^{7}P_{2}.5^{2}$

6. B

7. Out of 10 white, 9 black and 7 red balls, the number of ways in which selection of one or more balls can be made, is(balls of same color are identical)
   (A) 881 (B) 891

(C) 879 (D) 892

7. C

8. The number of diagonals that can be drawn by joining the vertices of an octagon is
(A) 28 (B) 48
(C) 20 (D) None of these

8. C

(Multi Correct Choice Type)

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

9. The sum of all five digit numbers that can be formed using the digit 1, 2, 3, 4 and 5 (repetition of digits not allowed)
(A) $24 \times 15 \times 1111$ (B) $5 ! \times 15 \times 1111$
(C) $6 !$ (D) 3999960

9. **AD**

10. Triangles can be formed by joining the vertices of a decagon
(A) ${}^{10}C_3$ (B) ${}^{10}C_2$
(C) 120 (D) 90

10. **AC**

11. If P (n, n) denotes the number of permutations of n different things taken all at a time then P (n, n) is also identical to (where $0 \le r \le n$)
(A) $n.P(n-1, n-1)$ (B) $P(n,n-1)$
(C) $r!.P(n,n-r)$ (D) $(n-r)!.P(n,r)$

11. **ABCD**

12. Number of ways in which 200 people can be divided in 100 couples is:
(A) $\frac{(200)!}{2^{100}(100)!}$ (B) $1\times3\times5.....199$
(C) $\left(\frac{101}{2}\right)\left(\frac{102}{2}\right).....\left(\frac{200}{2}\right)$ (D) $\frac{(200)!}{(100)!}$

12. **ABC**

PART – B
(Numerical Based)

This section contains 06 Numerical based questions, the answer of which maybe positive or negative numbers or decimals (e.g. 6.25, 7.00, -0.33, -.30, 30.27, -127.30)

1. If total n 4 lettered words can be formed from the letters of MORADABAD then the value of $\left[\frac{n}{100}\right]$ is (where $[.]$ denotes greatest integer function.

1. 6

2. Out of 6 boys and 4 girls a group of 7 is to be formed. If there are n groups which have boys in majority then number of distinct digits in n is

2. 2

3. The number of words which can be formed taking 4 different letters out of the letters of the word 'ASSASSINATION' is ${}^{6}C_{\alpha}.\alpha!$, then α will be

3. 4

4 The number of flags with three strips in order that can be formed using 2 identical red, 2 identical blue and 2 identical white strips is $30-\lambda$ where λ is

4 6

5. The number of ways of selecting two numbers from the set {1, 2, …,12} whose sum is divisible by 3 is 11k where k is

5. 2

6. In a hockey tournament, a total of 153 matches were played. If each team played one match with every other team, the total number of teams that participated in the tournament were $10+k$ then k equals

6. 8

space for rough work

FIITJEE INTERNAL TEST

BATCHES –

COMMON TEST – VIII

ANSWER KEY

QP Code:

Physics (Section -I)
PART – A
PART – B

Chemistry (Section-II)
PART – A
PART – B

Mathematics (Section -III)
PART – A
PART – B