FIITJEE COMMON TEST – 7

PHYSICS, CHEMISTRY & MATHEMATICS

CODE:

Time Allotted: 3 Hours **Maximum Marks: 186**

- 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-C**
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 Three Parts.

(i) **Part-A (01 – 05)** contains 5 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 (**06 – 13)** contains 8 Multiple Choice Questions which have **One or More Correct** answer.
For each question in the group **Q. 6 – 13** 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.

(iii) **Part-C (01 – 05)** contains 5 Numerical based questions with single digit integer as answer, ranging from 0 to 9 and each question carries **+3 marks** for correct answer. There is no negative marking.

Name of the Candidate : _____

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

Enrolment Number : _____

BATCHES – NWCM822O1S, NWCM2022X1R, NWCM2022Y1R, NWCM2022A1R, NWCM2022A2R, NWCM2022A1W, NWCM2022A2W, NWCM2022A3W, NWCM2022A4W, NWCM2022X1W, NWCM2022Y1W, NWCM2022Z1W, NWCM2022XA1W, NWCM2022XA2W, PANINI2022-XI 1, PANINI2022-XI 2, & PANINI2022-G 1

PART – I: PHYSICS

SECTION – A

(Single Correct Choice Type)

This section contains **5 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct.**

1. A geostationary satellite is orbiting the earth at a height of 6 R above the surface of earth, R being the radius of earth. The time period of another satellite at a height of 2.5 R from the surface of earth is

   (A) $6/\sqrt{2}$ hr (B) 10 Hr (C) 6 hr (D) $6\sqrt{2}$ hr

1. **D**

2. If θ is the angle with horizontal with which a projectile must be fired to escape from earth's gravitational pull then

   (A) $0^o \le \theta < 45^o$ (B) $0^o \le \theta \le 180^o$ (C) $\theta = 90^o$ (D) $\theta = 45^o$

2. **B**

3. If a tunnel is dug along the diameter of the earth and a body is dropped into it, them the time taken by it to cross the tunnel once is (R = radius of earth)

   (A) $2\pi\sqrt{\frac{R}{g}}$ (B) $\pi\sqrt{\frac{R}{g}}$ (C) $2\pi\sqrt{\frac{g}{R}}$ (D) $\pi\sqrt{\frac{g}{R}}$

3. **B**

4. An artificial satellite is revolving close to the earth. Its orbital velocity depends upon

   (A) the radius of earth (B) the orbital radius
   (C) the mass of earth (D) the mass of satellite

4. **B**

5. Two masses 'm' and '2m' initially 100 m apart start moving towards each other. The velocity of the centre of mass is

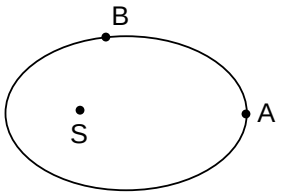
   (A) zero (B) $\frac{m\frac{dx_1}{dt} + 2m\frac{dx_2}{dt}}{3m}$ (C) $\frac{2m\frac{dx_1}{dt} + m\frac{dx_2}{dt}}{3m}$ (D) none of these

5. **A**

(Multi Correct Choice Type)

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

6. A planet is moving round the sun in an elliptical orbit as shown. As the planet moves from A to B
   (A) its kinetic energy will decrease
   (B) its potential energy will remain unchanged
   (C) its angular momentum about centre of sun will remain unchanged
   (D) its speed is minimum at A



6. **CD**

7. A simple pendulum has a time period T_1 when on earth's surface and T_2 when taken to a height R above the earth's surface. R is the radius of the earth. The value of T_2/T_1 is

   (A) 1 (B) $\sqrt{2}$ (C) 4 (D) 2

7. **D**

8. Inside a uniform spherical shell:
(A) potential is zero (B) field is zero
(C) potential is constant (D) field is constant

8. **BC**

9. If a body is projected with speed lesser than escape velocity:
(A) the body can reach a certain height and may fall down following a straight line path
(B) the body can reach a certain height and may fall down following a parabolic path
(C) the body may orbit the earth in a circular orbit
(D) the body may orbit the earth in an elliptic orbit

9. **ABCD**

10. Which of the following statements are correct about a planet rotating around the sun in an elliptic orbit:
(A) its mechanical energy is constant (B) its angular momentum is constant
(C) its areal velocity is constant (D) its time period is proportional to r^3

10. **ABC**

11. An orbiting satellite will escape if:
(A) its speed is increased by 41%
(B) its speed in the orbit is made $\left(\sqrt{1.5}\right)$ times of its initial value
(C) its kinetic energy is doubled
(D) it stop moving in the orbit

11. **AC**

12. Which of the following is true for a satellite in an orbit:
(A) it is a freely falling body
(B) its speed is constant
(C) its surfers no acceleration
(D) it does not require energy for its motion in the orbit

12. **ABD**

13. In case of an orbiting satellite if the radius of orbit is decreased:
(A) its KE decreases (B) its PE decreases
(C) Its ME decreases (D) its speed decreases

13. **BC**

SECTION – C
(Integer Type)

This section contains **5 questions**. The answer to each question is a **single-digit integer**, ranging from 0 to 9. The correct digit below the question number in the ORS is to be bubbled.

1. A satellite is revolving round the earth in a circular orbit of radius "r" and velocity V_o. A body is projected from the satellite in forward direction with relative velocity $V_{rel} = \left(\frac{\sqrt{5}}{4} - 1\right)V_o$.

If ratio of minimum and maximum distances from earth's centre during subsequent motion of the particle is K, then value of 10 K will be?

1. **6**

2. Three particles, each of mass m, are situated at the vertices of an equilateral triangle of side length a. The only forces acting on the particles are their mutual gravitational forces. It is desired that each particle moves in a circle while maintaining the original mutual separation a. Find the initial velocity that should be given to each particle. $\left(\text{take a} = \frac{GM}{16}\right)$

2. **4**

3. A rocket is fired form the earth to the moon. The distance between the earth and the moon is r and the mass of the earth is 81 times the mass of the moon. The gravitational force on the rocket will be zero, when its distance from the moon is μr. Find the value of '10μ'.

3. **1**

4. A satellite is moving in a circular orbit around earth at a height R above earth surface (R being radius of earth). It's velocity should be increased to K times its initial orbital speed value, so as to make it escape from earth gravitational pull and reach infinity. Find the value of "K x K"

4. **2**

5. If the mass of the planet that has a satellite whose time period is T and orbital radius r is $\frac{K\pi^2 r^3}{4GT^2}$, then the value of 'K' is

5. **1**

PART – II: CHEMISTRY

SECTION – A

(Single Correct Choice Type)

This section contains **5 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct.**

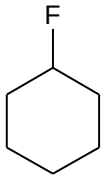
1. In which molecule the ethyl group exerts the strongest +I effect?
   (A) C_2H_5Cl (B) $C_2H_5NO_2$
   (C) $C_2H_5CH_3$ (D) C_2H_5OH

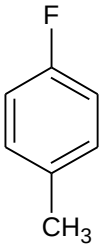
1. B

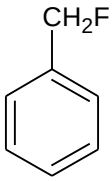
2. The functional isomer of which molecules are associated with intermolecular hydrogen bonds?
   (A) $CH_3CH_2CH_2OH$ (B) $CH_3CH_2OCH_3$
   (C) CH_3CH_2COOH (D) $CH_3C \equiv CCH_3$

2. B

3. In which compound fluorine exhibits –I as well as +R effect?

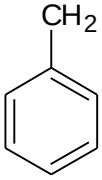
   (A) $CH_3CH = CH - CH_2 - F$ (B) 

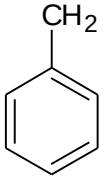
   (C) 

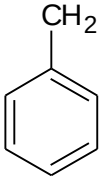
   (D) 

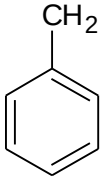
3. C

4. Which of the following molecule can form the most stable benzylic free radical?

   (A) 

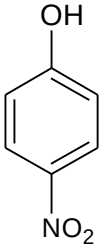
   (B) 

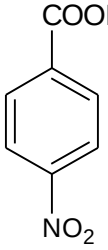
   (C) 

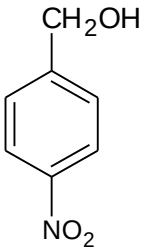
   (D) 

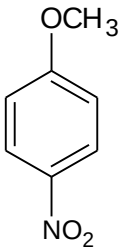
4. A

5. Which of the following molecule contains the strongest acidic hydrogen atom?

   (A) 

   (B) 

(C) 

(D) 

5. B

(Multi Correct Choice Type)

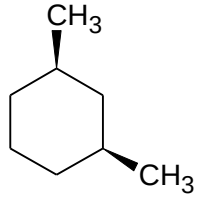
This section contains **8 multiple choice questions.** Each question has four choices (A), (B), (C) and (D) out of which **ONE OR MORE** may be correct.

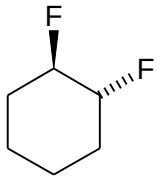
---

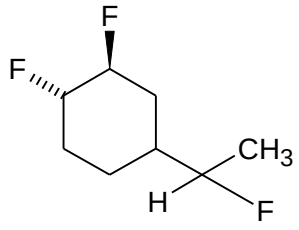
6. The $p^{K_{a_1}}$ values of which of the following molecule(s) is/are higher than that of $CH_3CH_2CH_3$?
   (A) CH_4 (B) C_2H_6
   (C) C_4H_{10} (D) C_5H_{12}

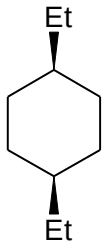
6. CD

7. The geometrical isomer(s) of which of the following molecules show(s) optical isomerism?

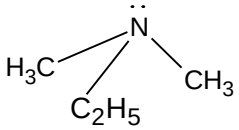
(A) 

(B) 

(C) 

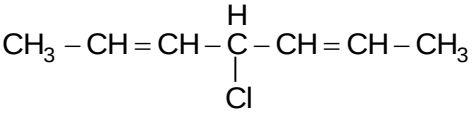
(D) 

7. AC

8. 

The correct statement(s) regarding above compound is/are
(A) the boiling points of its functional isomer are higher than that of it
(B) it is most basic isomer in gaseous state with formula $C_4H_{11}N$
(C) it is more soluble in water than its other isomer
(D) it can form salt with HCl

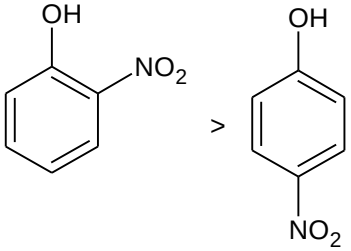
8. ABD

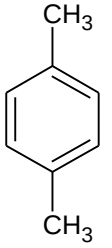
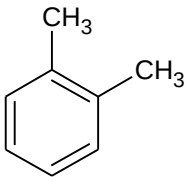
9. 

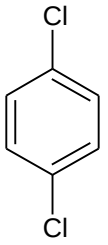
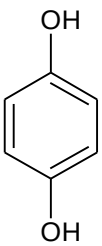
The correct statement(s) about the above compound is/are
(A) Total number of geometrical isomers for the compound is three.
(B) One of the geometrical isomers shows optical isomerism making the total number of stereoisomers to four.
(C) one of it's positional isomer can contain chlorine in vinylic position
(D) some of it's isomers can contain a triple bond in terminal or internal positions

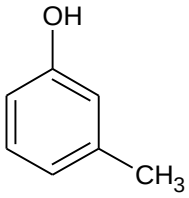
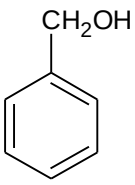
9. ABCD

10. Which contain(s) correct order of physical properties of the isomers?

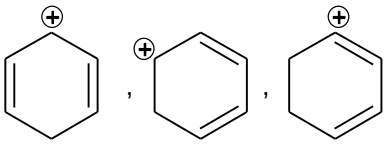
(A) Boiling point:  >

(B) Melting point:  > 

(C) Dipole moment:  = 

(D) Acidic strength:  > 

10. BD

11. 

(I) (II) (III)

Correct statement(s) regarding above carbocations is/are

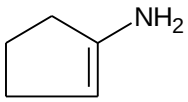
(A) Stability order – II > I > III

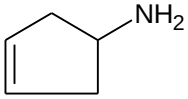
(B) % s-orbital character of carbon carrying positive charge – III > II > I

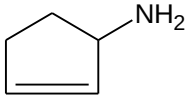
(C) number of resonating structures – II > I > III

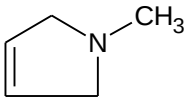
(D) number of hyperconjugation structures – I > III > II

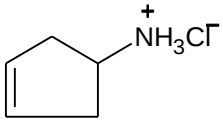
11. AC

12. Which of the following compound(s) is/are more basic than  in non-polar solvent?

(A) 

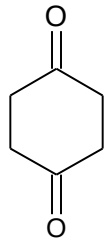
(B) 

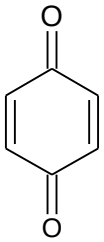
(C) 

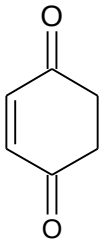
(D) 

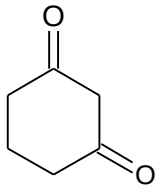
12. ABC

13. Which of the following can exist in more than one form?

(A) 

(B) 

(C) 

(D) 

13. ACD

SECTION – C
(Integer Type)

This section contains **5 questions**. The answer to each question is a **single-digit integer**, ranging from 0 to 9. The correct digit below the question number in the ORS is to be bubbled.

1. (X) is the lowest boiling isomer with formula C_5H_{12}.
   If a = the number of primary hydrogen atoms present in (X)
   and b = the number of primary carbon atoms present in (X)
   then what is $\left(\frac{a+b}{2}\right)$?

1. 8

2. Acids X and Y have same formula $C_5H_{10}O_2$. X is the strongest acid and Y is the most weak acid isomer.
   If a = Number of secondary carbon atoms present in X
   and b = Number of secondary carbon atom present in Y
   What is (a - b)?

2. 3

3. $CH_3 – CH = CH – CH = CH – CH = CH_2$
   How many geometrical isomer(s) is/are possible for the above compound?

3. 4

4. How many functional isomer(s) is/are possible for C_4H_9COOH?

4. 8

5. Compound(X) is the simplest carbon and hydrogen containing compound that shows optical isomerism. If(X) contains n_1 number of carbon atoms and n_2 number of hydrogen atoms. What is the value of $(n_2 – n_1)$?

5. 3

Space for rough work

PART – III: MATHEMATICS

SECTION – A

(Single Correct Choice Type)

This section contains **5 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct.**

1. Let S_n, S_{2n}, S_{3n} are the sum of n, 2n, 3n terms of an arithmetic progression, then $\frac{S_{3n}}{S_{2n}-S_n}$ is equal to

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

   (C) 2 (D) 3

1. D

2. If axes of a hyperbola are along the co-ordinate axes and distances of its one vertex from its foci are 1 and 3, then its equation can be

   (A) $x^2-3y^2=3$ (B) $3x^2-y^2=3$

   (C) $3x^2-y^2+3=0$ (D) None of these

2. B

3. For any $x,y \in R, xy>0$ then the minimum value of $\frac{2x}{y^3}+\frac{x^3y}{3}+\frac{4y^2}{9x^4}$ equals

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

   (C) $3^{\frac{1}{3}}$ (D) 3

3. B

4. Let the major axis of a standard ellipse equals the transverse axis of a standard hyperbola and their director circles have radius equal to 2R and R respectively: If e_1 and e_2 are the eccentricities of the ellipse and hyperbola then the correct relation is:

   (A) $4e_1^2-e_2^2=6$ (B) $e_1^2-4e_2^2=2$

   (C) $4e_2^2-e_1^2=6$ (D) $2e_1^3-e_2^2=4$

4. C

5. If the tangent at the point $P(h,k)$ on the hyperbola $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$ cuts the circle $x^2+y^2=a^2$ at the points $Q(x_1,y_1)$ and $R(x_2,y_2)$ then $\frac{1}{y_1}+\frac{1}{y_2}$ is equal to:

   (A) $\frac{2}{k}$ (B) $\frac{1}{k}$

   (C) $\frac{a}{k}$ (D) $\frac{b}{k}$

5. A

(Multi Correct Choice Type)

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

6. If $\sum_{r=1}^{n} r(r+1)(2r+3) = an^4 + bn^3 + cn^2 + dn + e$, then

(A) $a - b = d - c$ (B) $e = 0$

(C) $a, b - \frac{2}{3}, c - 1$ are in A.P. (D) $\frac{b+d}{a}$ is an integer

6. AB

7. For the series $S = 1 + \frac{(1+2)^2}{1+3} + \frac{(1+2+3)^2}{1+3+5} + \frac{(1+2+3+4)^2}{1+3+5+7} + \ldots$,

(A) the 7th term is 16 (B) the 7th term is 18

(C) the sum of the first 10 terms is $\frac{505}{4}$ (D) the sum of the first 10 terms is $\frac{405}{4}$

7. AC

8. Equation of a tangent passing through (2, 8) to the hyperbola $5x^2 - y^2 = 5$ is:

(A) $3x - y + 2 = 0$ (B) $3x + 4y - 14 = 0$

(C) $23x - 3y - 22 = 0$ (D) $3x - 23y + 178 = 0$

8. AC

9. The co – ordinates of a focus of the hyperbola $9x^2 - 16y^2 + 18x + 32y - 151 = 0$ is

(A) (–1, 1) (B) (6, 1)

(C) (4, 1) (D) (–6, 1)

9. CD

10. Given that x_1, x_3 are roots of the equation $ax^2 - 4x + 1 = 0$ and x_2, x_4 are roots of the equation $bx^2 - 6x + 1 = 0$. If x_1, x_2, x_3, x_4 are in harmonic progression, then

(A) $3a - b = 1$ (B) $a^2 + b^2 = 73$

(C) $2a < 3b$ (D) $\frac{1}{a} > \frac{1}{b}$

10. ABCD

11. If the sum of first three numbers in A.P. is 24 and their product is 440, then S_n can be (S_n denotes sum of first n terms)

(A) $\frac{n}{2}[1 + 5n]$ (B) $\frac{n}{2}[19 - 3n]$

(C) $\frac{n}{2}[25 - 3n]$ (D) $\frac{n}{2}[3n + 7]$

11. CD

12. If the sum of third and ninth term of an arithmetic progression is equal to 8 and sum of its first seven terms is 14, then which of the following is(are) correct?

(A) Ratio of first term and common difference is one

(B) Sum of first term and common difference is zero

(C) Sum of first eleven terms is 44

(D) Absolute value of the difference of first term and common difference is two.

12. BCD

13. If two tangents can be drawn to the different branches of hyperbola $\frac{x^2}{1}-\frac{y^2}{4}=1$ from the point (α,α^2), then

(A) $\alpha\in(-2,0)$ (B) $\alpha\in(0,2)$

(C) $\alpha\in(-\infty,-2)$ (D) $\alpha\in(2,\infty)$

13. CD

SECTION – C
(Integer Type)

This section contains **5 questions**. The answer to each question is a **single-digit integer**, ranging from 0 to 9. The correct digit below the question number in the ORS is to be bubbled.

1. Consider the system of hyperbolas $xy=k, k\in R^+$. Let e_1 be the eccentricity when $k=27$ and e_2 be the eccentricity when $k=81$. Find the value of $|e_2-e_1|$.

1. 0

2. If the sum $\sum_{k=1}^{100}\frac{k}{k^4+k^2+1}$ is equal to $\frac{(1+2+3+...+100)N}{10101}$ then find the value of N.

2. 1

3. If the acute angle between the asymptotes of the hyperbola $x^2-y^2=3$ is $\frac{\pi\lambda}{12}$, then the value of λ is

3. 6

4. Let α_1,β_1 are the roots of $x^2-6x+p=0$ and α_2,β_2 are the roots of $x^2-54x+q=0$. If $\alpha_1,\beta_1,\alpha_2,\beta_2$ form an increasing G.P., then find the value of $\frac{(q-p)}{90}$.

4. 6

5. The sum of infinite terms of the series $\frac{1}{2}+\frac{2}{4}+\frac{3}{8}+\frac{4}{16}+\frac{5}{32}+.....$ is equal to

5. 2

Space for rough work

FIITJEE COMMON TEST – VII

BATCHES – NWCM822O1S, NWCM2022X1R, NWCM2022Y1R, NWCM2022A1R, NWCM2022A2R, NWCM2022A1W, NWCM2022A2W, NWCM2022A3W, NWCM2022A4W, NWCM2022X1W, NWCM2022Y1W, NWCM2022Z1W, NWCM2022XA1W, NWCM2022XA2W, PANINI2022-XI 1, PANINI2022-XI 2, & PANINI2022-G 1

ANSWERS KEY

QP Code:

Physics

SECTION – A

SECTION – C

Chemistry

SECTION – A

SECTION – C

MATHEMATICS

SECTION – A

SECTION – C