# FIITJEE Phase Test (JEE-Advanced)

## PHYSICS, CHEMISTRY & MATHEMATICS

**Pattern - CPT-1** | **QP Code:** | **PAPER - 2**

**Time Allotted: 3 Hours** **Maximum Marks: 183**

- 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** 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.
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 Only One Part.

**(i)** **Part-A (01-07) –** Contains seven (07) multiple choice questions which have **One or More** 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.

**(ii)** **Part-A (08-14) –** Contains seven (07) multiple choice questions which have ONLY ONE CORRECT answer Each question carries **+3 marks** for correct answer and **-1 marks** for wrong answer.

**(iii)** **Part-A (15-18) -** This section contains Two paragraphs. Based on each paragraph, there are Two multiple choice questions. Each question has only one correct answer and carries **+3 marks** for the correct answer and **-1 marks** for wrong answer.

**Name of the Candidate :**_____

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

**Enrolment Number :**_____

**BATCH – Two Yr CRP(2022) X&A Lot_PT-III**

# SECTION-1 : PHYSICS

## PART – A

### (Multi Correct Choice Type)

This section contains 7 **multiple choice questions.** Each question has four choices (A), (B), (C) and (D) out of which **ONE OR MORE** may be correct.

1. A wave pulse in a horizontal string is represented by a function $y(x,t) = \frac{6}{2+(x-3t)^2}$

(c. g .s system) then

(A) wave is propagating along '+x' axis (B) amplitude of the wave is 4 cm

(C) velocity of the wave is 3 cm/sec (D) amplitude of wave is 6 cm

1. **AC**

2. Two waves travelling in opposite directions produce a standing wave. The individual wave functions are given by $y_1 = 4\sin(3x - 2t)$ and $y_2 = 4\sin(3x + 2t)$ cm, where x and y are in cm

(A) The maximum displacement of the motion at $x = \frac{3\pi}{4}$ cm is 4 cm.

(B) The maximum displacement of the motion at $t = \frac{\pi}{6}$ sec is $4\sqrt{2}$ cm.

(C) Nodes are formed at x values given by 0, $\pi/3$, $2\pi/3$, $\pi$, $4\pi/3$, ……..

(D) Antinodes are formed at x values given by $\pi/6$, $\pi/2$, $5\pi/6$, $7\pi/6$, …….

2. **CD**

3. $C_v$ and $C_p$ denote the molar specific heat capacities of a gas at constant volume and constant pressure respectively. Then

(A) $C_P - C_V$ is larger for a diatomic ideal gas than for a monatomic ideal gas

(B) $C_P + C_V$ is larger for a diatomic ideal gas than for a monatomic ideal gas

(C) $C_P / C_V$ is larger for a diatomic ideal gas than for a monatomic ideal gas

(D) $C_P . C_V$ is larger for a diatomic ideal gas than for a monatomic ideal gas

3. **BD**

4. In case of earth:

(A) Potential is minimum at the centre of earth

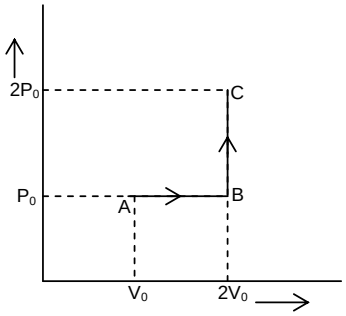
(B) Potential is same, both at centre and infinity but not zero

(C) Potential is zero, both at centre and infinity

(D) Field is zero, both at centre and infinity

4. **AD**

5. One mole of an ideal monoatomic gas is taken from A to C along the path ABC. The temperature of the gas at A is $T_0$. For the process ABC (where R is gas constant)




(A) Heat absorbed by the gas is $\frac{11}{12}RT_0$

(B) Heat absorbed by the gas is $\frac{11}{2}RT_0$

(C) Work done by the gas = $RT_0$

(D) Change in internal energy of gas is $\frac{9}{2}RT_0$

5. **BCD**

6. A coin is placed on a horizontal platform which undergoes horizontal simple harmonic motion about a mean position O. The coin does not slip on the platform. The force of friction acting on the coin is F.
(A) F is always directed towards O
(B) F is directed towards O when the coin is moving away from O and away from O when the coin moves towards
(C) F = 0 when the coin and platform cone to rest momentarily at the extreme position of the harmonic motion
(D) F is maximum when the coin and platform come to rest momentarily at the extreme position of the harmonic motion

6. **AD**

7. A vibrating string produces 2 beats per seconds when sounded with a turning fork of frequency 256 Hz. increasing the tension in the string produces 3 beats per second. The initial frequency of the string may have been
(A) 253 Hz (B) 254 Hz
(C) 258 Hz (D) 259 Hz

7. **BC**

## (Single Correct Choice Type)

This section contains **7 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct.**

8. A binary star system consists of two stars A and B which have time periods $T_A$ and $T_B$, radii $R_A$ and $R_B$ and masses $M_A$ and $M_B$. Then :
(A) if $T_A > T_B$ then $R_A > R_B$ (B) if $T_A > T_B$ then $M_A > M_B$
(C) $\left(\frac{T_A}{T_B}\right)^2 = \left(\frac{R_A}{R_B}\right)^3$ (D) $T_A = T_B$

8. **D**

9. A monoatomic ideal gas, initially at temperature $T_1$, is enclosed in a cylinder fitted with a frictionless piston. The gas is allowed to expand adiabatically to a temperature $T_2$ by releasing the piston. If $L_1$ and $L_2$ are the lengths of gas column before and after expansion respectively, then $T_1/T_2$ is given by
(A) $\left(\frac{L_1}{L_2}\right)^{2/3}$ (B) $\frac{L_1}{L_2}$ (C) $\frac{L_2}{L_1}$ (D) $\left(\frac{L_2}{L_1}\right)^{2/3}$

9. **D**

10. Two particles move parallel to x axis about the origin with same amplitude a and frequency W. At a certain instant they are found at a distance a/3 from the origin on opposite sides but their velocities are in the same direction. What is the phase difference between the two.
(A) $\cos^{-1}\left(\frac{7}{9}\right)$ (B) $\cos^{-1}\left(\frac{5}{9}\right)$ (C) $\cos^{-1}\left(\frac{4}{9}\right)$ (D) $\cos^{-1}\left(\frac{1}{9}\right)$

10. **A**

11. A Sinusoidal wave traveling in the positive direction on stretched string has amplitude 20 cm wavelength 1.0 m and wave velocity 5.0 m/s. At x = 0 and t = 0 it is given that y = 0 and $\frac{\delta y}{\delta t} < 0$. Find the wave function y(x, t).

(A) $y(x,t) = (0.02)\sin\left\{\left(2\pi m^{-1}\right)x + \left(10\pi \sec^{-1}\right)t\right\} m$

(B) $y(x,t) = (0.02)\sin\left\{\left(10\pi \sec^{-1}\right)t + \left(2\pi m^{-1}\right)x\right\} m$

(C) $y(x,t) = (0.02)\sin\left\{\left(2\pi m^{-1}\right)x - \left(10\pi \sec^{-1}\right)t\right\} m$

(D) $y(x,t) = (0.02)\sin\left\{\left(\pi m^{-1}\right)x + \left(5\pi \sec^{-1}\right)t\right\} m$

11. **C**

12. Two liquids A and B are at $32^0$C and $24^0$C when mixed in equal masses the temperature of the mixture is found to be $28^0$C. Their specific heats are in the ratio of

(A) 3 : 2 (B) 2 : 3

(C) 1 : 1 (D) 4 : 3

12. **C**

13. A monoatomic gas expands at constant pressure on heating. The percentage of heat supplied that increases the internal energy of the gas and that is involved in the expansion is

(A) 75%, 25% (B) 25%, 75%

(C) 60%, 40% (D) 40%, 60%

13. **D**

14. A box weighs 196 N on a spring balance at the north pole. Its weight recorded on the same balance if it is shifted to the equator is close to (Take g = 10 $ms^{-2}$ at the north pole and the radius of the earth = 6400 km)

(A) 194.66 N (B) 194.32 N

(C) 195.32 N (D) 195.66 N

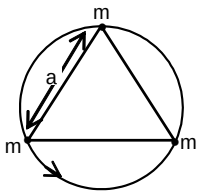
14. **C**

## (Paragraph Type)

This section contains **2 paragraphs**. Based upon the paragraphs **2 multiple choice questions** have to be answered. Each of these questions has 4 choices (A), (B), (C) and (D) out of which **ONLY ONE** is correct.

### Paragraph for Question no. 15 to 16

If the three identical particles are kept at the vertices of an equilateral triangle as shown and move on a circumcircle due to the mutual gravitational forces of attraction, then




15. Kinetic energy of the system would be

(A) $\frac{GM^2}{a}$ (B) $\frac{GM^2}{2a}$ (C) $\frac{3GM^2}{2a}$ (D) none of these

15. **C**

16. Total energy of the system would be

(A) zero (B) $\frac{3Gm^2}{2a}$ (C) $-\frac{3Gm^2}{2a}$ (D) none of these

16. **C**

**Paragraph for Question no. 17 to 18**

The volume of n moles of an ideal gas with degree of freedom f is varied according to the law $V = \frac{a}{T}$ where a is a constant.

17. The amount of heat received by the gas in this process if the gas temperature is increased by $\Delta T$ is

(A) $n\left[\frac{f}{2}-1\right]R\Delta T$ (B) $n\left[\frac{f}{2}+1\right]R\Delta T$

(C) $n[f+2]R\Delta T$ (D) $n\left[\frac{f}{2}+2\right]R\Delta T$

17. **A**

18. The molar specific heat of the gas at constant pressure is

(A) $\left(\frac{f}{2}+1\right)R$ (B) $\left(\frac{f}{2}+2\right)R$

(C) $\frac{5}{2}R$ (D) $\left(\frac{f}{2}-2\right)R$

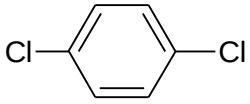
18. **A**

# SECTION-2 : CHEMITRY

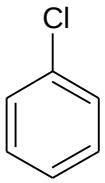
## PART – A

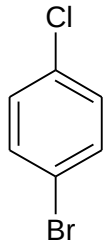
### (Multi Correct Choice Type)

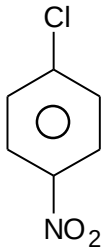
This section contains 7 **multiple choice questions.** Each question has four choices (A), (B), (C) and (D) out of which **ONE OR MORE** may be correct.

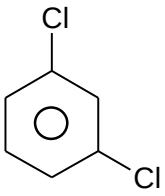
1. Which of the following compound(s) is/are more reactive than 

towards EAS reaction?

(A) 


(B) 

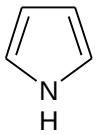

(C) 


(D) 

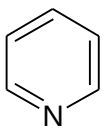

1. ABD

2. The functional isomer(s) of which of the following compound(s) can be more acidic than the parent compound(s)?
(A) $CH_2 = CH - CH = CH_2$ (B) $CH_3CHO$
(C) $CH_3CH_2N(CH_3)_2$ (D) $CH_3CH_2OCH_3$

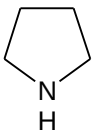
2. ABD

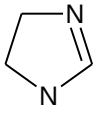
3. Which of the following compound(s) ia/are more basic than 

?

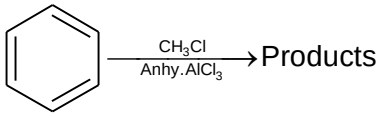
(A) 


(B) 

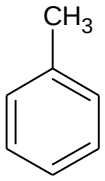

(C) 

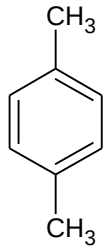

(D) 

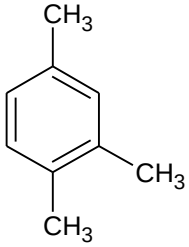

3. ABCD

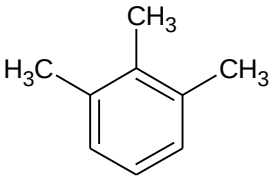
4. 


The product(s) of above reaction can be

(A) 

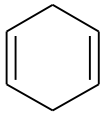
(B) 

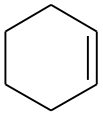
(C) 

(D) 

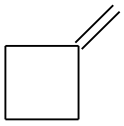
4. ABCD

5. Which of the following produce(s) a single product on acidified permanganate oxidation?

(A) 

(B) 

(C) $CH_3CH_2CH = CHCH_2CH_3$

(D) 

5. ABC

6. Choose the correct statement(s) regarding the positional isomer of 3-pentanol?
(A) One position isomer contains a chiral carbon atom.
(B) One position isomer is obtained by reductive ozonolysis of 1-pentene
(C) The highest boiling position isomer contains primary alcoholic group
(D) One position isomer contains a $3^o$-carbon atom

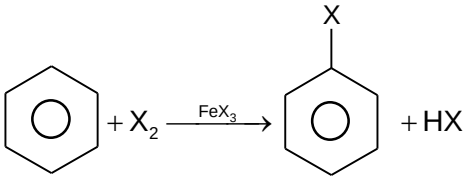
6. AC

7. Which of the following compound(s) react(s) with $NaNH_2$?
(A) $CH_3C \equiv CH$ (B) $CH_3CH_2C \equiv CCH_2CH_3$
(C) $HC \equiv CH$ (D) $CH_3C \equiv CCH_3$

7. ABCD

## (Single Correct Choice Type)

This section contains **7 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct.**

8. 

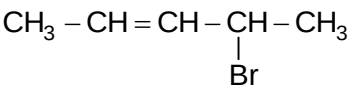
The rate of above reaction will be maximum if $X_2$ is
(A) $F_2$ (B) $Cl_2$
(C) $Br_2$ (D) $I_2$

8. B

9. $CH_3 - CH = CH - CH_2 - CH_3 + NBS \xrightarrow{h\nu} \text{Major product}(P)$

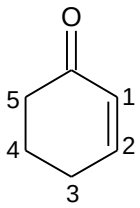
In above reaction, (P) is

(A) $CH_2 = CH - \underset{\displaystyle Br}{\underset{|}{CH}} - CH_2 - CH_3$ (B) $CH_2 = CH - CH_2 - \underset{\displaystyle Br}{\underset{|}{CH}} - CH_3$

(C) 

(D) $Br - CH_2 - CH = CH - CH_2 - CH_3$

9. C

10. 

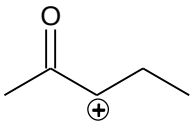
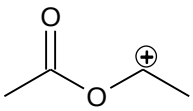
Which carbon is above compound holds the most acidic hydrogen?

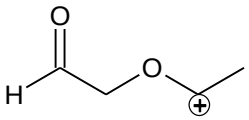
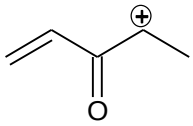
(A) 4 (B) 3

(C) 5 (D) 1

10. B

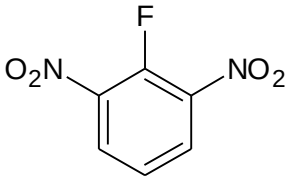
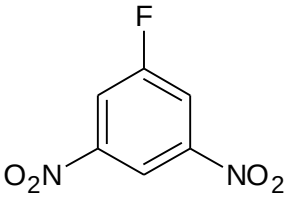
11. The most stable cation out of the following is

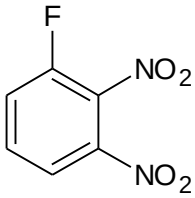
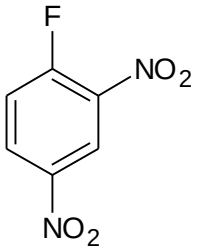
(A)  (B) 

(C)  (D) 

11. C

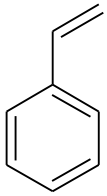
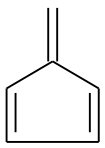
12. Which contains the shortest C – F bond?

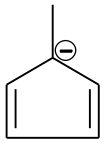
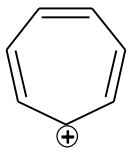
(A)  (B) 

(C)  (D) 

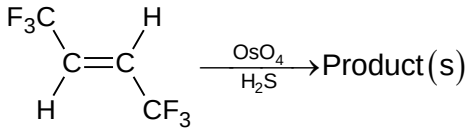
12. B

13. Which is not an aromatic compound?

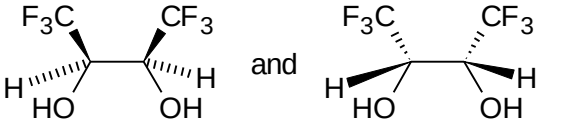
(A)  (B) 

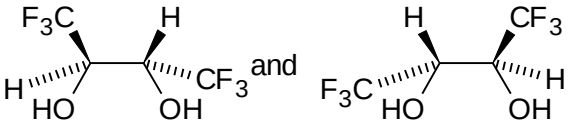
(C)  (D) 

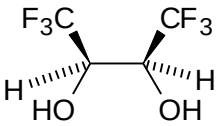
13. B

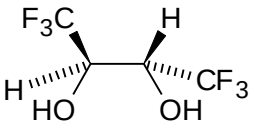
14. 

Product(s) of above reaction is/are

(A) 

(B) 

(C) 

(D) 

14. B

## (Paragraph Type)

This section contains **2 paragraphs**. Based upon the paragraphs **2 multiple choice questions** have to be answered. Each of these questions has 4 choices (A), (B), (C) and (D) out of which **ONLY ONE** is correct.

### Paragraph for Question no. 15 to 16

$$(P)\xrightarrow[CCl_4]{Cl_2}(Q)\xrightarrow[Heat]{Alc.KOH}(R)+(S)$$

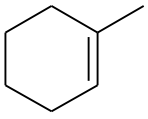
(R) and (S) are dienes, which respond to the following reactions.

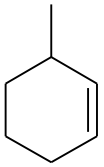
$$(R)\xrightarrow[Zn/H_2O]{O_3}But\tan-1,4-diol+CH_3-\overset{\overset{O}{\|}}{C}-CHO$$

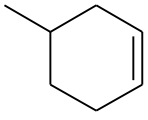
$$(S)\xrightarrow[Zn/H_2O]{O_3}CHO-\overset{\overset{O}{\|}}{C}-CH_2-CH_2-CH_2-CHO+HCHO$$

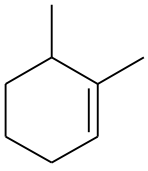
Answer the following questions on the basis of above reactions?

15. Which of the following is (P)?

(A) 

(B) 

(C) 

(D) 

15. **A**

16. How many asymmetric carbon atom(s) is/are present in (Q)?

(A) 3 (B) 2

(C) 1 (D) Zero

16. **B**

## Paragraph for Question no. 17 to 18

Consider the following reactions

$$CH_3CH_2C\equiv CH \xrightarrow[(ii)\ C_2H_5Br]{(i)\ NaNH_2} (P)$$

$$(P) \xrightarrow[\text{Liquid } NH_3]{Na} (Q) \xrightarrow[\text{Cold}]{MnO_4^-/OH^-} (S)+(T)$$

$$(P) \xrightarrow[\text{Quinoline}]{Pd/BaSO_4} (R) \xrightarrow[2.H_2O/H^+]{1.CF_3COOOH} (S)+(T)$$

17. (Q) and (R) are a pair of
(A) chain isomers (B) Geometrical isomers
(C) Position isomers (D) Optical isomers

17. **B**

18. (S) and (T) are
(A) dihydroxy compounds (B) epoxy compounds
(C) aldehydes (D) ketones

18. **A**

# SECTION-3 : MATHEMATICS

## PART – A
### (Multi Correct Choice Type)

This section contains 7 **multiple choice questions.** Each question has four choices (A), (B), (C) and (D) out of which **ONE OR MORE** may be correct.

1. The number of 5 letter words formed with the letters of the word CALCULUS is divisible by
(A) 2 (B) 3
(C) 5 (D) 7

1. ABC

1. Case – I : All five letters are different = 5!
Case – II : Two letters are same and remaining are different.
$${}^3C_1 \times {}^4C_3 \times \frac{5!}{2!} = 720$$
Case – III: Two alike, two other alike and remaining different
$${}^3C_2 \times {}^3C_1 \times \frac{5!}{2!2!} = 270$$
Total number of words = 1110

2. If $\left(1^2 - t_1\right) + \left(2^2 - t_2\right) + \left(3^2 - t_3\right) + \ldots + \left(n^2 - t_n\right) = \frac{1}{3} \cdot n \cdot \left(n^2 - 1\right)$ then
(A) $t_n = \frac{n}{2}$ (B) $t_n = n$
(C) $t_1 + t_2 + \ldots + t_n = \frac{n(n+1)}{2}$ (D) $t_1 + t_2 + \ldots + t_n = \frac{n(n+1)}{4}$

2. B, C

2. $1^2 + 2^2 + \ldots + n^2 - s_n = \frac{1}{3} \cdot n \cdot \left(n^2 - 1\right)$
$$\therefore t_1 + t_2 + \ldots + t_n = s_n = \frac{n(n+1)}{3}\left[\frac{2n+1-2n+2}{2}\right]$$
Now $t_n = s_n - s_{n-1} = \frac{n(n+1)}{2} - \frac{(n-1)n}{2} = n$

3. If $\left(9 + \sqrt{80}\right)^n = I + f$ where I, n are integers and 0 < f < 1, then :
(A) I is an odd integer (B) I is an even integer
(C) (I + f) (1 – f) = 1 (D) 1 – f = $\left(9 - \sqrt{80}\right)^n$

3. A,C,D

4. In the expansion of $\left(x + y + z\right)^{25}$
(A) every term is of the form ${}^{25}C_r \cdot {}^{r}C_k \cdot x^{25-r} \cdot y^{r-k} \cdot z^k$
(B) the coefficient of $x^8 y^9 z^9$ is 0
(C) the number of terms is 325
(D) none of these

4. AB

5. If $t_n$ be the $n^{th}$ term of the series $1+3+7+15+.....$, then

(A) $t_5+1=32$ (B) $t_7=2^7+1$

(C) $t_{10}=2^{10}-1$ (D) $t_{100}=2^{50}+1$

5. AC

6. Six boys and six girls sit along a line alternately in x ways; and along a circle (again alternately) in y ways,

(A) y = 6 ! 5 ! (B) y = 7 ! 6 !

(C) x = 12y (D) x = 42y.

6. AD

7. If $10!=2^p\times3^q\times5^r\times7^s$, then:

(A) $2q=p$

(B) $pqrs=64$

(C) number of divisors of 10! is 280

(D) number of ways of putting 10! As a product of two natural numbers is 135

7. ABD

## (Single Correct Choice Type)

This section contains **7 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct.**

8. If $\left(1-x+x^2\right)^n=a_0+a_1x+a_2x^2+...+a_{2n}x^{2n}$ then $a_0+a_2+a_4+....+a_{2n}$ is equal to

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

(C) $3^n-\frac{1}{2}$ (D) $3^n+\frac{1}{2}$

8. A

9. The number of six digit number formed using 1, 2, 3, 4, 5, 6, 7 (Repetition not allowed) so that terminal digits are even is

(A) 144 (B) 72

(C) 288 (D) 720

9. D

10. The coefficient of $x^{10}$ in the polynomial $\left(x+{}^{10}C_0\right)\left(x+3\,{}^{10}C_1\right)\left(x+5\,{}^{10}C_2\right)....\left(x+21\,{}^{10}C_{10}\right)$ is

(A) $10.2^{10}$ (B) $10.2^{11}$

(C) $11.2^{10}$ (D) $10.2^9$

10. C

10. ${}^nC_0+3\,{}^nC_1+5\,{}^nC_2+\ldots\ldots+(2n+1)\,{}^nC_n$

$={}^nC_0+{}^nC_1+{}^nC_2+.....+{}^nC_n+2\left({}^nC_1+2\,{}^nC_2+.....+n\,{}^nC_n\right)$

$=2^n+2\cdot n\,2^{n-1}$

Now put n = 10.

11. The number of ways of distributing 1st and 2nd prize each in Maths, Physics and Chemistry and 1st , 2nd, 3rd prize in each of English and Computer Science in the class of 50 students is
(A) $50^2\times49\times48^2$ (B) $50^2\times49^5\times48^2$
(C) $50^5\times49^5\times48^2$ (D) $50\times49^4\times48^2$

11. C
11. $(50\times49)^3.(50\times49\times48)^2$

12. The expression $P(x)=\left(\sqrt{x^5-1}+x\right)^7-\left(\sqrt{x^5-1}-x\right)^7$ is polynomial of degree
(A) 16 (B) 18
(C) 20 (D) 27

12. A
12. Using $(a+b)^7-(a-b)^7$
$=2[{}^7C_1a^6b+{}^7C_3a^4b^3+{}^7C_5a^2b^5+{}^7C_7b^7]$,
We get $P(x)={}^7C_1(x^5-1)^3x+{}^7C_2(x^5-1)^2x^3+{}^7C_3(x^5-1)x^5+{}^7C_7x^7$
Which is a polynomial of degree 16.

13. Let a, b and c be positive real numbers such that a + b + c = 6. Then range of $ab^2c^3$ is
(A) $(0,\infty)$ (B) (0, 1)
(C) (0, 108] (D) (6, 108]

13. C

13. A.M $\geq$ G.M for $\dfrac{a+\frac{b}{2}\cdot2+\frac{c}{3}\cdot3}{3}\geq\left(a\left(\frac{b}{2}\right)^2\left(\frac{c}{3}\right)^3\right)^{1/3}$

$\dfrac{a+\frac{b}{2}\cdot2+\frac{c}{3}\cdot}{6}\geq\left(a\left(\frac{b}{2}\right)^2\left(\frac{c}{3}\right)^3\right)^{1/3}$

$1\geq\left(\dfrac{ab^2c^3}{2^23^3}\right)^{1/3}$

$ab^2c^3\leq108$

(0, 108]

Answer C.

14. a, b, c and d are in H.P, then (ab + bc + cd + da) is equal to
(A) 3ad (B) 4ac
(C) 3ac (D) (a + b)(c + d)

14. A

Sol. Put $a=\dfrac{1}{a_1-3d}$, $b=\dfrac{1}{a_1-d}$, $c=\dfrac{1}{a_1+d}$ and $d=\dfrac{1}{a_1+3d}$

Solution: a, b, c and d are in H.P,

$\Rightarrow$ $\frac{1}{a},\frac{1}{b},\frac{1}{c},\frac{1}{d}$ are in A.P

$\dfrac{1}{a}=a_1-3d$

$\dfrac{1}{b}=a_1-d$

$\dfrac{1}{c}=a_1+d$

$\dfrac{1}{d}=a_1+3d$

ab + bc + cd

$$\frac{1}{(a_1-3d)(a_1-d)}+\frac{1}{(a_1-d)(a_1+d)}+\frac{1}{(a_1+d)(a_1+3d)}$$

$$\frac{1}{2d}\left[\frac{1}{a_1-3d}-\frac{1}{a_1-d}+\frac{1}{a_1-d}-\frac{1}{a_1+d}+\frac{1}{a_1+d}-\frac{1}{a_1+3d}\right]$$

$$\frac{1}{2d}\left[\frac{6d}{(a_1-3d)(a_1+3d)}\right]=3ad$$

## (Paragraph Type)

This section contains **2 paragraphs**. Based upon the paragraphs **2 multiple choice questions** have to be answered. Each of these questions has 4 choices (A), (B), (C) and (D) out of which **ONLY ONE** is correct.

### Paragraph for Question no. 15 to 16

Sixteen players $S_1, S_2 ... S_{16}$ play in a tournament they are divided into groups at random. Each group consists of two players.

15. The number of ways in which the grouping can be done is

(A) $\frac{16!}{(2!)^8}$ (B) $\frac{16!}{(2!)^8\,8!}$

(C) $\frac{16!}{(2!)^{16}\,8!}$ (D) $\frac{16!}{(4!)^8\,8!}$

15. B

16. The number of ways in which grouping can be done so that $S_1$ and $S_2$ are grouped together is

(A) $\frac{7!}{(2!)^7\,7!}$ (B) $\frac{16!}{(2!)^8}-\frac{14!}{(2!)^7}$

(C) $\frac{14!}{(2!)^7\,7!}$ (D) $\frac{16!}{(2!)^7\,7!}$

16. C

### Paragraph for Question no. 17 to 18

Consider the identity $(1+x)^{6m}=\sum_{r=0}^{6m} {}^{6m}C_r\,.x^r$. By putting different values of x on both sides, we can get summation of several series involving binomial coefficients. For example, by putting $x=\frac{1}{2}$ we get $\sum_{r=0}^{6m} {}^{6m}C_r\,\frac{1}{2^r}=\left(\frac{3}{2}\right)^{6m}$

17. The value of $\sum_{r=0}^{6m} {}^{6m}C_r\,2^{r/2}$ is equal to

(A) $\frac{3^{6m}}{2}$ (B) $\left(1+\sqrt{2}\right)^{3m}$

(C) $\left(3+2\sqrt{2}\right)^{3m}$ (D) None of these

17. C

17. $\sum_{r=0}^{6m} {}^{6m}C_r 2^{r/2}$ put $x = \sqrt{2}$

$= \left(1+\sqrt{2}\right)^{6m} = \left(3+2\sqrt{2}\right)^{3m}$

18. The value of $\sum_{r=0}^{3m} (-1)^r {}^{6m}C_{2r}$ is

(A) $2^{3m}$ (B) 0 if m is odd

(C) $-2^{3m}$ if m is even (D) None of these

18. B

18. $\sum_{r=0}^{3m} (-1)^r {}^{6m}C_{2r} = \left(\sqrt{2}\right)^{6m}\left(\frac{1}{\sqrt{2}}+i\frac{1}{\sqrt{2}}\right)^{6m} + \left(\sqrt{2}\right)^{6m}\left(\frac{1}{\sqrt{2}}-i\frac{1}{\sqrt{2}}\right)^{6m}$

$= 2^{3m}.2\cos\frac{3m\pi}{2} = \begin{cases} 0 & \text{if m is odd} \\ (-1)^{\frac{m}{2}} 2^{3m+1} & \text{if m is even} \end{cases}$

# ANSWERS

## SECTION-1 : PHYSICS

**PART – A**

## SECTION – 2 : CHEMISTRY

**PART – A**

## SECTION – 3 : MATHEMATICS

**PART – A**