

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 : _____

BATCHES – NWCM123D1R,D1W & PANINI123-D1_PT1

SECTION-1 : PHYSICS

PART – A

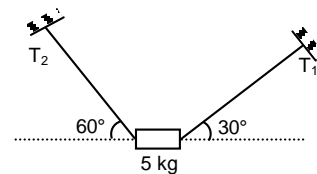
(Multi Correct Choice Type)

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. If the kinetic energy of a body is directly proportional to time 't', the magnitude of the force acting on the body is
 (A) directly proportional to \sqrt{t}
 (B) inversely proportional to \sqrt{t}
 (C) directly proportional to the speed of the body
 (D) inversely proportional to the speed of the body

1. **BD**

2. A body of mass 5 kg is suspended by the strings making angles 60° and 30° with the horizontal as shown in the figure ($g = 10 \text{ ms}^{-2}$). Then
 (A) $T_1 = 25 \text{ N}$
 (B) $T_2 = 25 \text{ N}$
 (C) $T_1 = 25\sqrt{3} \text{ N}$
 (D) $T_2 = 25\sqrt{3} \text{ N}$



2. **AD**

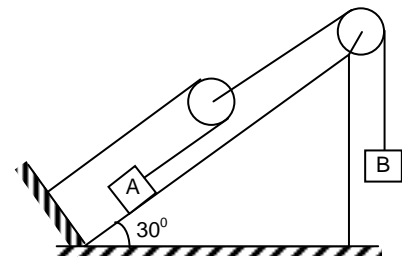
3. In case of projectile motion if two projectiles A and B are projected with same speed at angles θ and $(90 - \theta)$ respectively to the horizontal. If H_A , H_B denotes maximum height and T_A , T_B are time of flight of A and B respectively, Then
 (A) H_A must be less than H_B
 (B) T_A must be less than T_B
 (C) $\frac{H_A}{H_B} = \left(\frac{T_A}{T_B}\right)^2$
 (D) $R_A = R_B$

3. **CD**

4. In the system shown in figure $m_B = 4\text{kg}$ and $m_A = 2\text{kg}$. The pulleys are massless and friction is absent everywhere. The

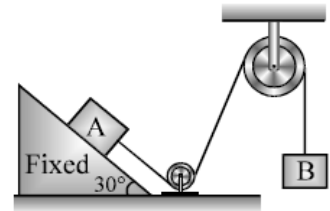
acceleration of block A is: $g = 10 \text{ m/s}^2$

- (A) $\frac{10}{3} \text{ m/s}^2$
 (B) $\frac{20}{3} \text{ m/s}^2$
 (C) 2 m/s^2
 (D) 4 m/s^2



4. **A**

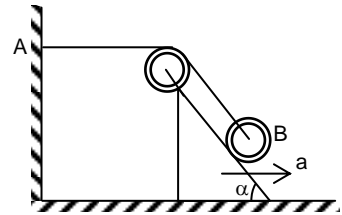
5. Two blocks A and B of equal mass m are connected through a massless string and arranged as shown in figure. Friction is absent everywhere. When the system is released from rest.



- (A) Tension in the string is $mg/2$
 (B) Tension in the string is $mg/4$
 (C) Acceleration of A is $g/2$
 (D) Acceleration of A is $3g/4$

5. **BD**

6. A weightless inextensible rope rests on a stationary wedge forming an angle α with the horizontal. One end of the rope is fixed to the wall at point A. A small load is attached to the rope at point B. The wedge starts moving to the right with a constant acceleration a . The magnitude of acceleration of the load is given by:



- (A) a (B) $2a \sin \frac{\alpha}{2}$
 (C) $a \sin \alpha$ (D) $g \sin \alpha$

6. **B**

7. If the external forces acting on a mass have zero resultant, then the mass
 (A) must not move (B) must not accelerate
 (C) may move (D) may accelerate

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. When a spring is stretched by a distance x , it exerts a force, given by $F = -(5x + 16x^3)$ N.

The work done, when the spring is stretched from 0.1m to 0.2m is

- (A) 8.1×10^{-2} J (B) 12.2×10^{-2} J
 (C) 8.1×10^{-1} J (D) 12.2×10^{-1} J

8. **A**

9. A particle moves on a rough horizontal ground with some initial velocity v_0 . If $\frac{3}{4}$ th of its K.E. is lost in friction in time t_0 , the coefficient of friction between the particle and the ground is

- (A) $\frac{v_0}{2gt_0}$ (B) $\frac{v_0}{4gt_0}$ (C) $\frac{3v_0}{4gt_0}$ (D) $\frac{v_0}{gt_0}$

9. **A**

10. A boat which has a speed of 5 km/h in still water crosses a river of width 1 km along the shortest possible path in 15 min. The velocity of the river water in km/h is

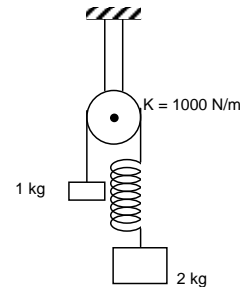
- (A) 1 (B) 3
 (C) 4 (D) $\sqrt{41}$

10. **B**

11. A force $F = -k(y\hat{i} + x\hat{j})$ where k is a positive constant acts on a particle moving in the xy plane. Starting from the origin, the particle is taken along the positive x axis to the point $(a, 0)$ and then parallel to the y axis to the point (a, a) . The total work done by the force F on the particle is
- (A) $-2Ka^2$ (B) $2Ka^2$
(C) $-Ka^2$ (D) Ka^2

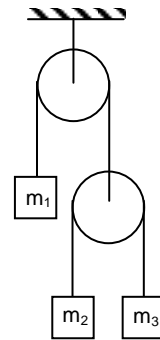
11. C

12. In the arrangement shown in the figure pulley is light and smooth. The extension in the spring ($g=10\text{m/s}^2$)
- (A) 1.3cm (B) 1 cm
(C) 1.67 cm (D) 2 cm



12. D

13. In the arrangement, shown below pulleys are massless and frictionless and threads are inextensible, block of mass m_1 will remain at rest if
- (A) $\frac{4}{m_1} = \frac{1}{m_2} + \frac{1}{m_3}$ (B) $m_1 = m_2 = m_3$
(C) $\frac{1}{m_1} = \frac{1}{m_2} + \frac{1}{m_3}$ (D) $\frac{1}{m_3} = \frac{2}{m_2} + \frac{3}{m_1}$



13. A

14. A vector of magnitude a is turned through angle θ . The magnitude of change in the vector is given by
- (A) $|2a \sin\theta|$ (B) $|2a \sin(\theta/2)|$
(C) $\left|\frac{a}{2} \sin\theta\right|$ (D) $\left|\frac{a}{2} \sin\left(\frac{\theta}{2}\right)\right|$

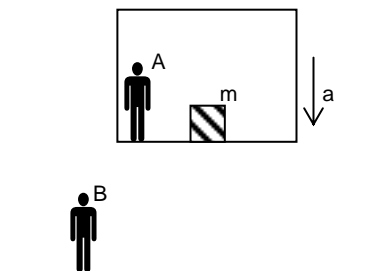
14. B

(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

A block of mass m is kept in an elevator which starts moving downward with an acceleration a as shown in figure. The block is observed by two observers A and B for a time interval t_0 .



15. The observer B finds that the work done by gravity on the block is

- (A) $\frac{1}{2}mg^2t_0^2$
 (B) $-\frac{1}{2}mg^2t_0^2$
 (C) $\frac{1}{2}mgat_0^2$
 (D) $-\frac{1}{2}mgat_0^2$

15. **C**

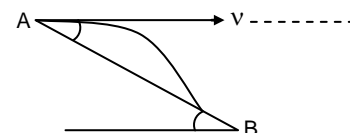
16. The observer A finds that the work done by Pseudo force on the block is

- (A) zero
 (B) $-ma^2t_0$
 (C) ma^2t_0
 (D) $-mgat_0$

16. **A**

Paragraph for Question no. 17 to 18

A particle is projected horizontally with a speed $v = 5 \text{ ms}^{-1}$ from the top of a plane inclined at an angle $\theta = 37^\circ$ to the horizontal as shown in figure.



17. How far from the point of projection will the particle strike the plane?

- (A) 75 m
 (B) $\frac{65}{16}$ m
 (C) $\frac{75}{16}$ m
 (D) $\frac{85}{9}$ m

17. **C**

18. Find the time taken by the particle to hit the plane

- (A) $\frac{3}{4}$ s
 (B) 3 s
 (C) 4 s
 (D) $\frac{4}{3}$ s

18. **A**

SECTION-2 : CHEMISTRY

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 concentration term(s) do/does not depend on temperature?
 (A) Molarity (B) Molality
 (C) Formality (D) Normality

1. B

2. For which of the following ions, the number of spectral lines for a particular electron transition from one orbit to another, produces more lines as compared to H-atom?
 (A) H⁻ (B) He⁺
 (C) Li⁺ (D) Be³⁺

2. AC

3. The dipole moment(s) of which of the following molecule(s) is/are higher than that of XeF₄?
 (A) BF₃ (B) NF₃
 (C) SF₄ (D) SF₆

3. BC

4. The bond dissociation energy of which of the following molecule(s) increases by removing electrons?
 (A) O₂ (B) N₂
 (C) F₂ (D) Li₂

4. AC

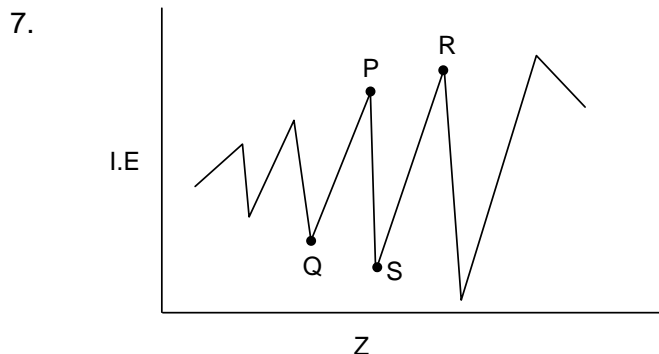
5. The van der Waal's equation for one mole of a real gas is given below:

$$\left(P + \frac{a}{V^2}\right)(V - b) = RT$$
 What change(s) is/are observed in the equation if the pressure is increased?
 (A) The equation reduces to P(V – b) = RT
 (B) 'a' is neglected and is assumed to be zero
 (C) PV becomes less than RT
 (D) 'b' is taken to be zero

5. AB

6. Which of the following is/are linear molecules?
 (A) BeCl₂ (B) CO₂
 (C) SnCl₂ (D) XeF₂

6. ABD



The ionization energies of representative elements has been plotted against their atomic numbers. Which point(s) in the curve represent(s) the correct element(s)?

- (A) 'Q' represents an alkali metal (B) 'P' represents an inert-gas
(C) 'R' represents a non-metal (D) 'S' represents a metal

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. Which quantum number may have the lowest value for the unpaired electrons of nitrogen?
(A) Principal quantum number (B) Azimuthal quantum number
(C) Magnetic quantum number (D) Spin quantum number

8. C

9. Which of the following molecule has the highest lattice energy?
[Assume the coordination number and Madelung constant for the compounds have same values]
(A) CaO (B) MgO
(C) Al₂O₃ (D) BaO

9. C

10. Under which of the following condition, the density of an ideal gas has maximum value?
(A) 3 atm and 400 K (B) 4 atm and 800 K
(C) 1 atm and 100 K (D) 2 atm and 400 K

10. C

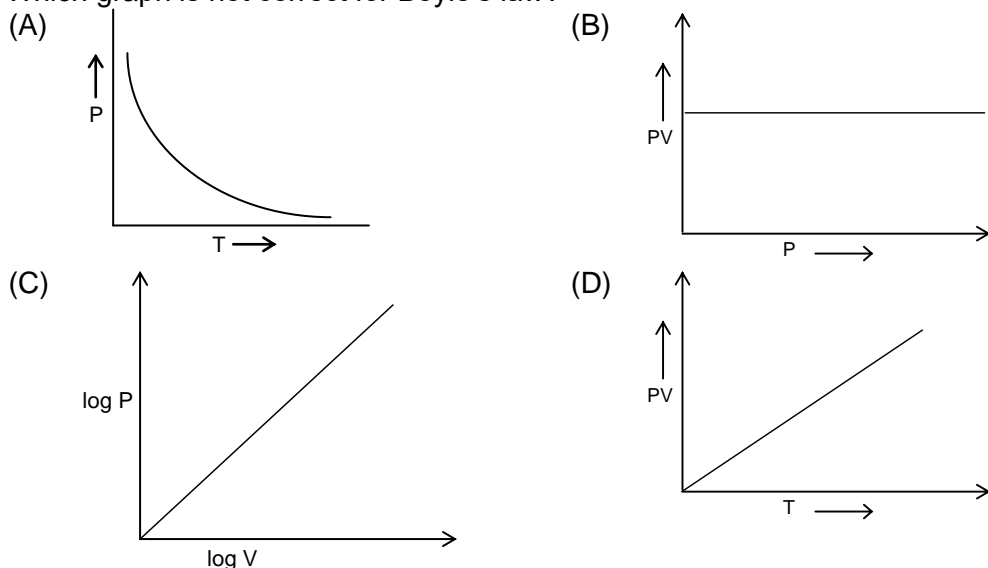
11. If the radius of the first orbit of hydrogen atom is a_0 , what will be the difference in the radii of third and second orbit of hydrogen atom?
(A) $2a_0$ (B) a_0
(C) $5a_0$ (D) $4a_0$

11. C

12. Which of the following molecule displays $p_\pi - p_\pi$ back bonding?
(A) CCl₄ (B) BF₃
(C) NF₃ (D) PCl₅

12. B

13. Which graph is not correct for Boyle's law?



13. C

14. Which of the following molecule has the highest value of dipole moment?

- (A) CO_2 (B) BeF_2
(C) NF_3 (D) BF_3

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

The successive values of ionization energies of four representative elements in eV unit is given as follows:

Elements	I.E ₁	I.E ₂	I.E ₃	I.E ₄	I.E ₅	I.E ₆	I.E ₇	I.E ₈	I.E ₉
P	4	10	12	16	18	20	1060	2010	4115
Q	2	6	8	11	2120	3850	5016	7180	8920
R	6	8	13	15	19	2018	3180	5120	6910
S	8	11	14	16	20	22	26	3120	4109

Answer the following questions on the basis of above write up.

15. Choose the correct statement regarding the element P, Q, R and S if they are placed in the third period of the periodic table?

- (A) 'Q' will be the smallest atom
(B) Electron affinity of 'R' will be higher than that of 'P'
(C) 'S' can form the maximum number of covalent bonds with hydrogen
(D) 'R' can form a maximum of five covalent bonds with chlorine or oxygen

15. D

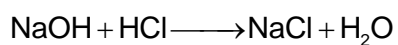
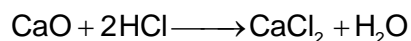
16. The formula of the oxide of which element is given correctly, assuming that they are present in the third period of periodic table

- (A) P_2O_5 (B) S_2O_7
(C) QO_4 (D) R_3O_4

16. B

Paragraph for Question no. 17 to 18

A 15 g mixture of NaCl and CaO was dissolved in 2.5 L of 0.2 M HCl solution. After complete reaction, the reaction mixture consumed 200 mL of 0.5 M NaOH solution for neutralization of the excess acid(HCl).



Answer the following questions on the basis of above write up.

17. How much NaCl is present in the mixture?
(A) 3.8 g (B) 0.6 mole
(C) 0.4 equivalent (D) None
17. A
18. What is the percentage purity of the mixture?
(A) 30.88 (B) 25.34
(C) 69.12 (D) 74.66
18. D

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. If A(2, -3) and B(-2, 1) are two vertices of a triangle and third vertex moves on the line $2x + 3y = 9$, then the locus of the centroid of the triangle passes through the point

(A) (2, -1)	(B) (-1, 1)
(C) (2, -2)	(D) (1, 1)

1. AB

2. If the equation of base of an equilateral triangle is $2x - y = 1$ and the vertex is (-1, 2), and the length of the side of the triangle is a, then the value of $\frac{3a^2}{4}$ cannot be

(A) 1	(B) 2
(C) 3	(D) 5

2. ABC

3. Consider circles $C_1 = x^2 + y^2 - 2x - 4y - 4 = 0$, $C_2 = x^2 + y^2 + 2x + 4y + 4 = 0$ and Line $L = x + 2y + 2 = 0$ then

(A) L is radical axis of C_1 and C_2	(B) L is common tangent of C_1 & C_2
(C) L is common chord of C_1 and C_2	(D) L is perpendicular to the line joining centers of C_1 & C_2

3. ACD

4. If $\cos \alpha = \frac{3}{5}$ and $\cos \beta = \frac{5}{13}$ then

(A) $\cos(\alpha + \beta) = \frac{33}{65}$	(B) $\sin(\alpha + \beta) = \frac{56}{65}$
(C) $\sin^2\left(\frac{\alpha - \beta}{2}\right) = \frac{1}{65}$	(D) $\cos(\alpha - \beta) = \frac{63}{65}$

4. BCD

5. The circles $x^2 + y^2 = 1$ and $x^2 + y^2 = 2x$

(A) intersect in two distinct points	(B) intersect on the line $x = \frac{1}{2}$
(C) intersect in the points $\left(\frac{1}{2}, \frac{\sqrt{3}}{2}\right)$ and $\left(\frac{1}{2}, -\frac{\sqrt{3}}{2}\right)$	
(D) have no common tangent	

5. ABC

6. The inequation, $(x - 1)^1(x - 2)^2(x - 3)^3(x - 4)^4 < 0$ has

(A) no positive integral solutions	(B) no negative integral solutions
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(C) $x \in (1, 3)$

(D) no integral solution

6. ABD

7. The real solutions of the equation $x^2 - 3|x| + 2 = 0$ are

(A) 1

(B) -1

(C) 2

(D) -2

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 value of $6(\sin^6 \theta + \cos^6 \theta) - 9(\sin^4 \theta + \cos^4 \theta) + 4$ is:

(A) -3

(B) 0

(C) 1

(D) 3

8. C

9. Let C be the circle with centre at (1, 1) and radius = 1. If T is the circle centred at (0, y) passing through origin and touching the circle C externally, then the radius of T is equal to:

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

(B) $\frac{1}{4}$

(C) $\frac{\sqrt{3}}{\sqrt{2}}$

(D) None

9. B

10. The equation of the common chord of the circles $x^2 + y^2 + 2x + 3y + 1 = 0$ and $x^2 + y^2 + 4x + 3y + 2 = 0$ is

(A) $x = -\frac{1}{2}$

(B) $x = \frac{1}{2}$

(C) $y = -\frac{1}{2}$

(D) $y = \frac{1}{2}$

10. A

11. A ray of light along $x + \sqrt{3}y = \sqrt{3}$ gets reflected upon reaching x - axis, the equation of the reflected ray is:

(A) $\sqrt{3}y = x - \sqrt{3}$

(B) $y = \sqrt{3}x - \sqrt{3}$

(C) $\sqrt{3}y = x - 1$

(D) $y = x + \sqrt{3}$

11. A

12. If $P = (1, 0)$, $Q = (-1, 0)$ and $R = (2, 0)$ are three given points, then the locus of a point S satisfying the relation $SQ^2 + SR^2 = 2SP^2$ is:

(A) a straight line parallel to x - axis

(B) a circle through origin

(C) a circle with centre at the origin

(D) a straight line parallel to y - axis

12. D

13. If $90^\circ < A < 180^\circ$ and $\sin A = \frac{4}{5}$, then $\tan\left(\frac{A}{2}\right)$ is equal to:
 (A) 2 (B) 3
 (C) 4 (D) 5
13. **A**
14. The number of common tangents to the circle $x^2 + y^2 = 4$ and $x^2 + y^2 - 6x - 8y = 24$ is:
 (A) 1 (B) 2
 (C) 3 (D) 4
14. **A**

(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 $\cos \alpha + \cos \beta = m$ and $\sin \alpha + \sin \beta = n$ then answer the following questions

15. Value of $\sin(\alpha + \beta) =$
 (A) $\frac{m^2 - n^2}{m^2 + n^2}$ (B) $\frac{n^2 - m^2}{m^2 + n^2}$
 (C) $\frac{2mn}{m^2 + n^2}$ (D) $\frac{2mn}{m^2 - n^2}$
15. **C**
16. Value of $\tan\left(\frac{\alpha + \beta}{2}\right) =$
 (A) $\frac{n}{m}$ (B) $\frac{m}{n}$
 (C) $\frac{n+m}{2}$ (D) $\frac{n-m}{2}$
16. **A**

Paragraph for Question no. 17 to 18

Given $P_N = \sin^N \theta + \cos^N \theta$ where $N \in$ whole number and $\theta \in$ Real numbers.

17. If $P_1 = m$, then the value of $2[1 - P_4]$ is
 (A) $(m-1)^2$ (B) $(m^2-1)^2$
 (C) $(m+1)^2$ (D) $(m^2+1)^2$
17. **B**
18. Value of $2P_2 + 7 =$
 (A) 0 (B) 6
 (C) 9 (D) 15

18. C

ANSWERS

SECTION-1 : PHYSICS

PART – A

Paper – 2 : CHEMISTRY

PART – A

SECTION – 3 : MATHEMATICS
PART – A