

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 : _____

SECTION-1 : PHYSICS

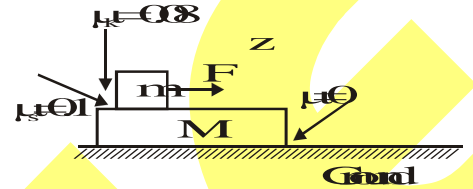
PART – A

(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. In the figure, if $F = 4 \text{ N}$, $m = 2 \text{ kg}$, $M = 4 \text{ kg}$ then

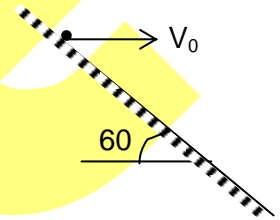
- (A) The acceleration of m w.r.t. ground is $\frac{2}{3} \text{ m/s}^2$
 (B) The acceleration of m w.r.t. ground is 1.2 m/s^2
 (C) Acceleration of M is 0.4 m/s^2
 (D) Acceleration of m w.r.t. ground is $\frac{2}{3} \text{ m/s}^2$



1. **BC**

2. A ball is projected horizontally from an inclined plane with a velocity v_0 as shown in the figure. It will strike the plane after a time

- (A) $\frac{v_0}{\sqrt{3g}}$ (B) $\frac{2v_0}{\sqrt{3g}}$
 (C) $\frac{v_0}{g}$ (D) $2\sqrt{3} \frac{v_0}{g}$



2. **D**

3. A particle moves along positive branch of the curve $y = \frac{x}{2}$ where $x = \frac{t^3}{3}$, x and y are measured in metres and t in seconds, then:

- (A) The velocity of particle at $t = 1 \text{ s}$ is $\hat{i} + \frac{1}{2}\hat{j}$
 (B) The velocity of particle at $t = 1 \text{ s}$ is $\frac{1}{2}\hat{i} + \hat{j}$
 (C) The acceleration of particle at $t = 1 \text{ s}$ is $2\hat{i} + \hat{j}$
 (D) The acceleration of particle at $t = 2 \text{ s}$ is $\hat{i} + 2\hat{j}$

3. **AC**

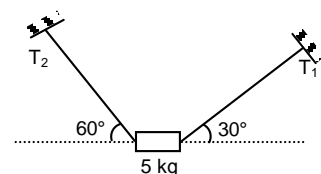
4. A bus starts from rest with an acceleration of 1 m/s^2 . A car which is 48 m behind the bus is moving with a uniform velocity of 10 m/s . the time at which of passenger of car can jump into the bus.

- (A) 6.4 s (B) 8 s
 (C) 12 s (D) 12.4 s

4. **BC**

5. 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

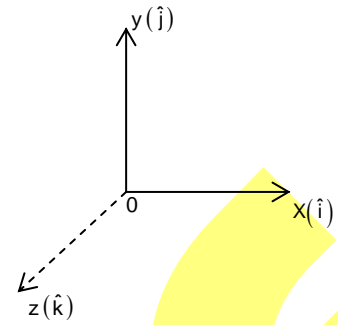
- (A) $T_1 = 25 \text{ N}$
 (B) $T_2 = 25 \text{ N}$
 (C) $T_1 = 25\sqrt{3} \text{ N}$
 (D) $T_2 = 25\sqrt{3} \text{ N}$



5. **AD**

6. A particle is projected from origin with velocity $\vec{u} = (\hat{i} + \hat{j} + \sqrt{2}\hat{k})$ m/s. Horizontal surface lies in X – Y plane, then (take $g = 10$ m/sec²)

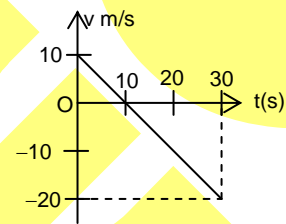
- (A) Time of flight = $\frac{\sqrt{2}}{5}$ sec
 (B) horizontal range = $\frac{2}{5}$ m
 (C) Maximum height = $\frac{1}{10}$ m
 (D) Maximum height = $\frac{1}{5}$ m



6. **ABC**

7. The velocity-time graph for a particle moving on a straight line is shown in figure.

- (A) the particle has constant acceleration
 (B) the particle has never turned around
 (C) the particle has zero displacement
 (D) the average speed in the interval 0 to 10 s is the same as the average speed in the interval 10 s to 20 s.



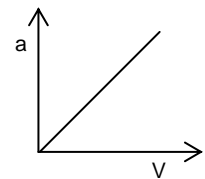
7. **AD**

(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 acceleration-velocity graph of a particle moving in a straight line is as shown in figure. Then slope of velocity-displacement graph

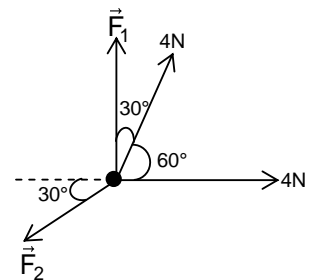
- (A) increases linearly
 (B) decreases linearly
 (C) is constant
 (D) increases parabolically



8. **C**

9. An object is in equilibrium under four concurrent forces in the direction shown in figure. the magnitude of \vec{F}_1 and \vec{F}_2 are

- (A) $0N, 4\sqrt{3}N$
 (B) $4\sqrt{3}N, 0N$
 (C) $4\sqrt{3}N, 4\sqrt{3}N$
 (D) $0, N, 0N$



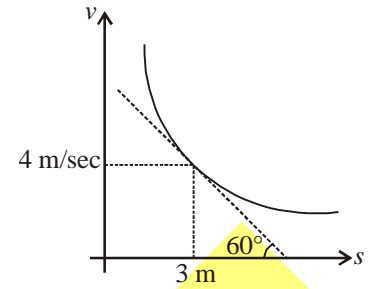
9. **A**

10. 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) $\frac{v_0}{gt_0}$

10. **A**

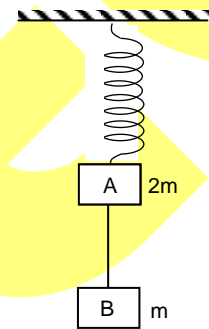
11. A particle is moving along a straight line its velocity–displacement graph is shown in figure. What is the magnitude of acceleration when its displacement is 3 m.
- (A) $4\sqrt{3} \text{ m/sec}^2$
 (B) $3\sqrt{3} \text{ m/sec}^2$
 (C) $\sqrt{3} \text{ m/sec}^2$
 (D) $2\sqrt{3} \text{ m/sec}^2$



11. **A**
12. A particle starts its motion from rest and moves with constant acceleration for time t_1 and then it retards with constant rate for time t_2 until it comes to rest. Then the ratio of maximum speed and average speed during the complete motion will be
- (A) 2 : 1 (B) 1 : 2 (C) $t_1 : t_2$ (D) $t_2 : t_1$

12. **A**

13. Two blocks A and B of masses $2m$ and m respectively, are connected by a massless and inextensible string. The whole system is suspended by a massless spring as shown in the figure. the magnitude of acceleration of A and B, immediately after the string is cut are respectively,



(A) $g, \frac{g}{2}$

(B) $\frac{g}{2}, g$

(C) g, g

(D) $\frac{g}{2}, \frac{g}{2}$

13. **B**

14. If the initial velocity of a particle is $\vec{u} = \hat{i} + \hat{k} \text{ m/s}$ and acceleration $\vec{a} = 2\hat{j} \text{ m/s}^2$, the velocity of the particle after one second is

(A) 4 m/s

(B) $\sqrt{6} \text{ m/s}$

(C) $2\sqrt{2} \text{ m/s}$

(D) 1 m/s

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

When a force \vec{F} acts at a point P, at position \vec{r} from the origin O, torque of this force about O is defined as $\vec{\tau} = \vec{r} \times \vec{F}$. It is a vector quantity having its direction perpendicular to both \vec{r} and \vec{F} according to the rule of cross product.

15. Find the torque of a force $\vec{F} = \hat{i} + 2\hat{j} - 3\hat{k}$ about a point O. The position vector of point of application of force about O is $\vec{r} = 2\hat{i} + 3\hat{j} - \hat{k}$

(A) $-7\hat{i} + 5\hat{j} + \hat{k}$

(B) $3\hat{i} + 5\hat{j} - 4\hat{k}$

(C) $2\hat{i} + 6\hat{j} + 3\hat{k}$

(D) None of these.

15. **A**

16. If \vec{F} be a force acting on a particle having the position vector \vec{r} and $\vec{\tau}$ be the torque of this force about the origin then

(A) $\vec{r} \cdot \vec{\tau} = 0$ and $\vec{F} \cdot \vec{\tau} = 0$

(B) $\vec{r} \cdot \vec{\tau} \neq 0$, $\vec{F} \cdot \vec{\tau} = 0$

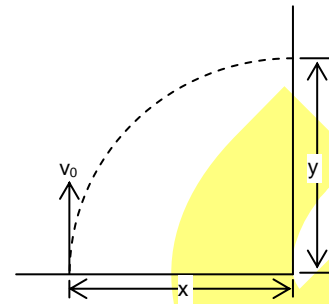
(C) $\vec{r} \cdot \vec{\tau} \neq 0$ and $\vec{F} \cdot \vec{\tau} \neq 0$

(D) $\vec{r} \cdot \vec{\tau} = 0$ and $\vec{F} \cdot \vec{\tau} \neq 0$

16. A

Paragraph for Question no. 17 to 18

A particle is projected vertically with velocity v_0 wind is blowing and is providing a constant horizontal acceleration a_0 . There is a vertical wall at some distance from point of projection. If particle strikes the vertical wall perpendicularly then calculate,



17. The time taken by the particle to hit the wall is

(A) v_0/g

(B) $2v_0/g$

(C) $3v_0/g$

(D) $v_0/2g$

17. A

18. Horizontal component of velocity with which particle strikes the vertical wall is

(A) $\frac{a_0 v_0}{g}$

(B) $\frac{2a_0 v_0}{g}$

(C) $\frac{3a_0 v_0}{g}$

(D) $\frac{a_0 v_0}{2g}$

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 statement(s) is/are correct for oxygen atom? (At. No. = 8)
 - (A) It contains four electrons with $l = 0$ and $m = 0$
 - (B) It contains one unpaired electron in the 2p sub-shell
 - (C) It attains a half-filled electron configuration by losing one electron
 - (D) One of its isotope contains 9 protons

1. AC

2. In which of the following reaction(s) the equivalent mass and molecular mass of the acid(s) is/are identical?
 - (A) $\text{NaOH} + \text{H}_2\text{SO}_4 \longrightarrow \text{NaHSO}_4 + \text{H}_2\text{O}$
 - (B) $2\text{KOH} + \text{H}_3\text{PO}_4 \longrightarrow \text{K}_2\text{HPO}_4 + 2\text{H}_2\text{O}$
 - (C) $\text{LiOH} + \text{H}_3\text{PO}_2 \longrightarrow \text{LiH}_2\text{PO}_2 + \text{H}_2\text{O}$
 - (D) $\text{Ca}(\text{OH})_2 + \text{H}_3\text{PO}_3 \longrightarrow \text{CaHPO}_3 + 2\text{H}_2\text{O}$

2. AC

3. Which of the following molecule(s) do/does not follow the Octet rule?
 - (A) SF_4
 - (B) CF_4
 - (C) SiF_4
 - (D) BF_3

3. AD

4. The dipole moment of which of the following substance(s) is/are higher than that of CO_2 ?
 - (A) HCl
 - (B) SCl_2
 - (C) BeCl_2
 - (D) PF_3

4. ABD

5. Which of the following electronic transition(s) in hydrogen atom take(s) place in visible region of the spectrum?
 - (A) $n = 2 \rightarrow n = 1$
 - (B) $n = 3 \rightarrow n = 2$
 - (C) $n = 4 \rightarrow n = 2$
 - (D) $n = 4 \rightarrow n = 3$

5. BC

6. Which of the following property/properties of hydrogen peroxide is/are greater or higher than that of water?
 - (A) Boiling point
 - (B) Acidic strength
 - (C) Thermal stability
 - (D) Oxidizing nature

6. ABD

7. Which of the following characteristic(s) about magnesium atom is/are correct?
 - (A) $I.E_2 > I.E_1$
 - (B) $r_{\text{Mg}^+} > r_{\text{Mg}^{2+}}$
 - (C) Number of electrons with $l = 0$ is same as the number of electrons with $l = 1$
 - (D) It contains six electrons with $s = +\frac{1}{2}$

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**.

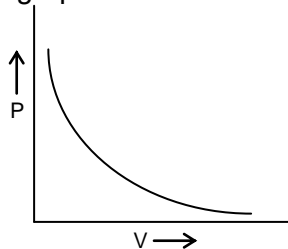
8. Which of the following molecule displays $p_\pi - p_\pi$ back bonding?

- (A) CCl_4 (B) BF_3
(C) NF_3 (D) PCl_5

8. B

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

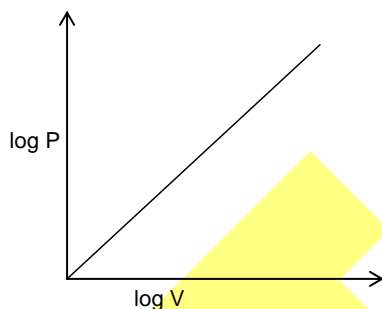
(A)



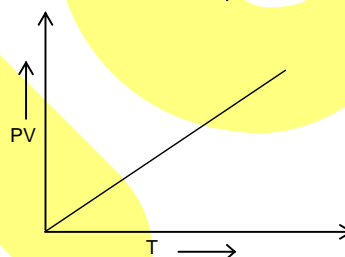
(B)



(C)



(D)



9. C

10. Which of the following compound is formed on the surface of lime water, if it is kept under air for some time?

- (A) CaCO_3 (B) Ca_3N_2
(C) CaO (D) CaS

10. A

11. A 4.5 g sample of pyrolusite (containing MnO_2) was dissolved in 400 mL of 0.5 M HCl. After complete reaction, the excess acid required one liter of 0.1 M NaOH for complete neutralization. What mass % of MnO_2 was present in the sample? (Mol. mass of $\text{MnO}_2 = 87$)

- (A) 94.19% (B) 95.12%
(C) 96.66% (D) 98.12%

11. C

12. If the uncertainty in position (Δx) of an electron in a hydrogen atom is zero, then which of the following statement is correct?

- (A) The exact velocity of the electron can be determined.
(B) The exact momentum of the electron can be determined.
(C) The exact location of the electron can be determined.
(D) None of these is correct

12. C

13. Which of the following molecule is most covalent according to Fajan's rule?
 (A) MgCl_2 (B) AlCl_3
 (C) MgBr_2 (D) AlBr_3
13. D
14. Which of the following releases a neutral gas when reacts with water?
 (A) CaS (B) Mg_3N_2
 (C) KO_2 (D) None of these
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 values of van der Waal's constants a and b of four gases are given as follows:

Gases	'a' in $\text{atm L}^2 \text{mol}^{-2}$	'b' in L mol^{-1}
P	733	0.4
Q	890	0.6
R	720	0.5
S	680	0.3

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

15. Which gas has the strongest intermolecular force of attraction?
 (A) P (B) Q
 (C) R (D) S
15. B
16. Which of the following gas can be easily liquefied?
 (A) P (B) Q
 (C) R (D) S
16. D

Paragraph for Question no. 17 to 18

The values of successive ionization energies in eV unit of the following non-transition elements other than inert gases are given below.

Elements	I.E_1	I.E_2	I.E_3	I.E_4
P	1219	1590	1704	1892
Q	2212	2133	4128	6120
R	2619	2861	4016	5139
S	3021	3316	3429	3625

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

17. If the elements are present in the second period successively with 'R' in group-15, which element will be present in group-17?
 (A) P (B) Q
 (C) S (D) Unpredictable
17. C

18. If all the elements are placed in group-17, which will be the most electronegative element?
- (A) P (B) Q
(C) R (D) S
18. D

FIITJEE

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 θ is angle between $x - y + 1 = 0$ and $ax + y = 5$, $a \in I$ where $\sin\theta = \frac{3}{5}$, then $a =$
 - (A) 3
 - (B) 5
 - (C) -7
 - (D) $-\frac{1}{7}$

1. CD

2. If $a^2 + 16b^2 - 8ab - c^2 = 0$ then point of concurrency of $ax + by + c = 0$ is
 - (A) (1, -4)
 - (B) (-1, 4)
 - (C) (1, 4)
 - (D) None

2. AB

3. If the equation $px^2 + (2 - q)xy + 3y^2 - 6qx + 30y + 6q = 0$ represents a circle, then the value of p and q , are
 - (A) $p = 3$
 - (B) $p = 2$
 - (C) $q = 3$
 - (D) $q = 2$

3. AD

4. If the lines $x - 2y - 6 = 0$, $3x + y - 4 = 0$ and $\lambda x + 4y + \lambda^2 = 0$ are concurrent, then:
 - (A) $\lambda = 2$
 - (B) $\lambda = -3$
 - (C) $\lambda = 4$
 - (D) $\lambda = -4$

4. AD

5. $||x - 1| - 1| = 3$ then x is
 - (A) -1
 - (B) 5
 - (C) 3
 - (D) -3

5. BD

6. $\sec\theta + \tan\theta = 2$ then
 - (A) $\tan\theta = \frac{3}{4}$
 - (B) $\sec\theta = \frac{1}{2}$
 - (C) $\tan\theta = \frac{1}{2}$
 - (D) $\sec\theta = 2$

6. AC

7. If $x^2 + y^2 + 2kx + 5y + 4k = 0$ and $x^2 + y^2 + kx + 2y + 2k = 0$ intersect orthogonally then k equal to
 - (A) 1
 - (B) 3
 - (C) 5
 - (D) None

7. AC

(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 reflection of the point (4, -13) in the line $5x + y + 6 = 0$ is
 (A) (-1, -14) (B) (3, 4)
 (C) (0, 0) (D) (1, 2)
8. A
9. Locus of point of intersection of lines $x \cos \theta + y \sin \theta = 2$ and $x \sin \theta - y \cos \theta = 1$ is
 (A) $x^2 + y^2 = 3$ (B) $x^2 + y^2 = 5$
 (C) $x^2 + y^2 = 9$ (D) None
9. B
10. $\frac{dy}{dx}$ for $x^2 + y^2 = 1$ is
 (A) $-\frac{x}{y}$ (B) $\frac{x}{y}$
 (C) $\frac{y}{x}$ (D) $-\frac{y}{x}$
10. A
11. If $y = (\sec x)^5$ then $\frac{dy}{dx}$ at $x = \frac{\pi}{4}$ is
 (A) $10\sqrt{2}$ (B) $20\sqrt{2}$
 (C) $30\sqrt{2}$ (D) None
11. B
12. The point of concurrency of $(2+k)x + (1+k)y = 5 + 7k$ is.
 (A) (2,9) (B) (-2,9)
 (C) (-3,9) (D) None of these
12. B
13. If $\tan x = \frac{2}{3}$, $\tan y = \frac{1}{5}$ then $x + y$ is
 (A) $\frac{\pi}{4}$ (B) $\frac{\pi}{3}$
 (C) $\frac{\pi}{2}$ (D) None of these
13. A
14. If $x + 2y = 5$ is tangent to the circle $x^2 + y^2 = 5$, then equation of normal at their point of contact is
 (A) $2x + y = 5$ (B) $2x - y = 0$
 (C) $x + 2y = 0$ (D) None of these
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

Consider a variable line 'L' which passes through the point of intersection 'P' of the lines $L_1: 3x + 4y - 12 = 0$ and $L_2: x + 2y - 5 = 0$ meeting the coordinate axes at points A and B

15. Point of intersection of L_1 and L_2 is
- (A) (1, 1) (B) $(2, \frac{3}{2})$
(C) (8, 2) (D) None of these
15. B
16. Locus of the middle point of the segment AB has the equation
- (A) $3x + 4y = 4xy$ (B) $3x + 4y = 3xy$
(C) $4x + 3y = 4xy$ (D) $4x + 3y = 3xy$

16. A

Paragraph for Question no. 17 to 18

Consider the circle $x^2 + y^2 = 10$. Tangent are drawn to the circle from $P(4, 2)$. The tangents touch the circle at Q and R.

17. The angle between the tangents is
- (A) $\frac{\pi}{6}$ (B) $\frac{\pi}{4}$
(C) $\frac{\pi}{3}$ (D) $\frac{\pi}{2}$
17. D
18. The equation of circum circle of triangle PQR is
- (A) $x^2 + y^2 + 4x + 2y = 0$ (B) $x^2 + y^2 - 4x - 2y = 0$
(C) $x^2 + y^2 - 4x + 2y = 0$ (D) None of these

18. B

ANSWERS

SECTION-1 : PHYSICS

PART – A

Paper – 2 : CHEMISTRY

PART – A

FIITJEE

SECTION - 3 : MATHEMATICS
PART - A

