

## 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 – NWC123E1R+E1W\_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  $\vec{A} = 2\hat{i} + 3\hat{j}$  and  $\vec{B} = 2\hat{i} - 3\hat{j} + \hat{k}$  then

(A)  $\vec{A} \cdot \vec{B} = -5$

(B)  $\vec{A} \cdot \vec{B} = 5$

(C)  $|\vec{A} \times \vec{B}| = \sqrt{157}$

(D)  $|\vec{A} \times \vec{B}| = -\sqrt{157}$

1. **AC**

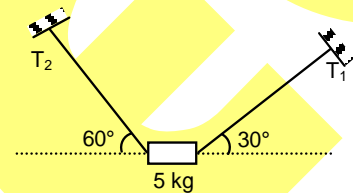
2. A body of mass 5 kg is suspended by the strings making angles  $60^\circ$  and  $30^\circ$  with the horizontal as shown in the figure ( $g = 10 \text{ ms}^{-2}$ ). Then

(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. 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

3. **BD**

4. A particle of mass  $m$  moves along a curve  $y = x^2$ . When particle has x-co-ordinate as  $\frac{1}{2}$  and x-component of velocity as 4 m/s then.

(A) the position coordinate of particle are  $(\frac{1}{2}, \frac{1}{4})$

(B) the velocity of particle will be along the line  $4x - 4y - 1 = 0$ .

(C) the magnitude of velocity at that instant is  $4\sqrt{2} \text{ m/s}$

(D) none of the above.

4. **AC**

5. The force exerted by the floor of an elevator on the foot of a person standing there is more than the weight of the person if the elevator is

(A) going up and slowing down

(B) going up and speeding up

(C) going down and slowing down

(D) going down and speeding up.

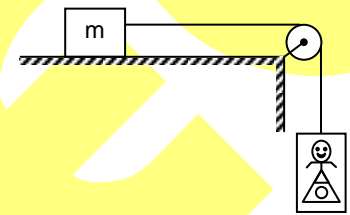
5. **BC**

6. A man who can swim at a speed  $v$  relative to the water wants to cross a river of width  $d$ , flowing with a speed  $u$ . The point opposite him across the river is P.
- (A) The minimum time in which he can cross the river is  $\frac{d}{v}$ .
- (B) He can reach the point P in time  $\frac{d}{v}$ .
- (C) He can reach the point P in time  $\frac{d}{\sqrt{v^2 - u^2}}$
- (D) He cannot reach P if  $u > v$ .

6. **ACD**

7. In the figure, a man of true mass  $M$  is standing on a weighing machine placed in a cabin. The cabin is joined by a string with a body of mass  $m$ . Assuming no friction, and negligible mass of cabin and weighing machine, choose the correct option(s).

- (A) Measured mass of man is  $\frac{Mm}{(M+m)}$
- (B) Acceleration of man is  $\frac{mg}{(M+m)}$
- (C) Acceleration of man is  $\frac{Mg}{(M+m)}$
- (D) Measured mass of man is  $M$ .



7. **AC**

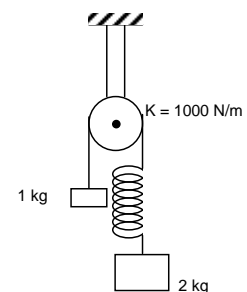
**(Single Correct Choice Type)**

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. 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)  $Ka^2$

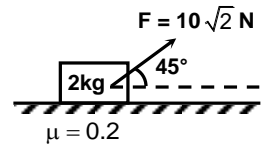
8. **C**

9. 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



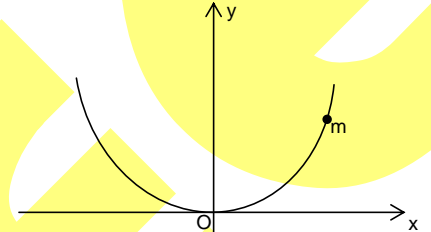
9. **D**

10. A force  $F = 10\sqrt{2}$  N acts at an angle of  $45^\circ$  above the horizontal on a 2kg block placed on a rough horizontal surface. The coefficient of friction between the block and surface is 0.2. Find the work done by the force  $F$  on the block in 5s. Initially the block is at rest. [Take  $g = 10\text{m/s}^2$ ]
- (A) 250 J (B) 2500 J  
(C) 500 J (D) 50 J



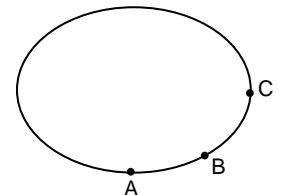
10. **C**
11. A bead of mass  $m$  is located on parabolic wire with its axis vertical and vertex at the origin as shown in figure and whose equation is  $x^2 = 4ay$ . The wire frame is fixed and bead can slide on it without friction. The bead is released from the point  $y = 4a$  on the wire frame from rest. The tangential acceleration of the bead when it reaches the position given by  $y = a$  is

- (A)  $\frac{g}{2}$  (B)  $\frac{\sqrt{3}}{2}g$   
(C)  $\frac{g}{\sqrt{2}}$  (D)  $\frac{g}{\sqrt{5}}$

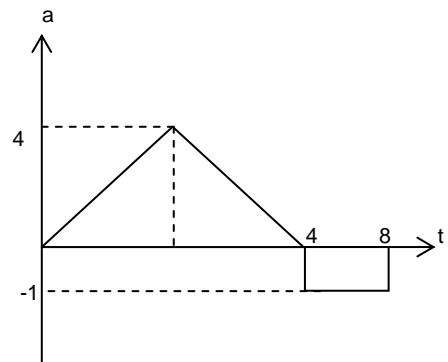


11. **C**
12. A ball is projected with velocity  $v_0$  at an angle  $\theta$  with the ground. The time after which the velocity of the ball is perpendicular to its initial direction of motion is
- (A)  $\frac{v_0}{g\cos\theta}$  (B)  $\frac{v_0}{g\sin\theta}$  (C)  $\frac{v_0}{g}\tan\theta$  (D)  $\frac{v_0}{g}\cot\theta$

12. **B**
13. A particle is moving on an elliptical path as shown, speed of the particle is constant. Its acceleration is minimum at
- (A) A (B) B  
(C) C (D) same everywhere



13. **A**
14. The acceleration time graph of a particle is shown in the figure. What is the velocity of particle at  $t = 8\text{sec}$ , if initial velocity of particle is  $3\text{m/s}$
- (A) 4 m/s (B) 5  
(C) 6 m/s (D) 7



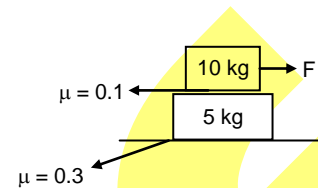
14. **D**

**(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**

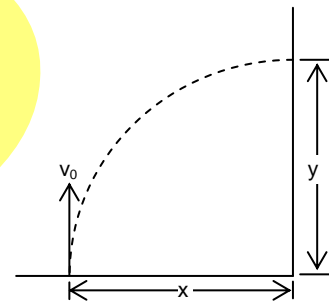
For the arrangement of two blocks shown in figure a force  $F$  is applied on the top block as shown in figure. (take  $g = 10 \text{ m/s}^2$ )



15. When  $F = 2\text{N}$ , the frictional force between 5 kg block and ground is  
 (A) 2 N (B) 0  
 (C) 8 N (D) 10 N
15. **A**
16. The acceleration of 10 kg block when  $F = 30 \text{ N}$   
 (A)  $2 \text{ m/s}^2$  (B)  $3 \text{ m/s}^2$   
 (C)  $1 \text{ m/s}^2$  (D) None of these
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.  $\text{NaOH} + \text{H}_2\text{SO}_4 \longrightarrow \text{NaHSO}_4 + \text{H}_2\text{O}$   
The correct statement(s) regarding above reaction is/are  
(A) the n-factor of  $\text{H}_2\text{SO}_4$  is one  
(B) one mole of  $\text{H}_2\text{SO}_4$  can be completely neutralized by one mole of  $\text{NaOH}$   
(C) it is a redox reaction  
(D) the oxidation number of sulphur in the product is +6
1. AD
2. Which of the following species do/does not contain electrons in their antibonding molecular orbital(s)?  
(A)  $\text{H}_2^+$  (B)  $\text{H}_2^-$   
(C)  $\text{H}_2^{2+}$  (D)  $\text{He}_2$
2. AC
3. Which of the following ion(s) contain(s) unpaired electrons in atomic orbital(s) or molecular orbital(s)?  
(A)  $\text{Mg}^+$  (B)  $\text{O}_2^{2+}$   
(C)  $\text{N}_2$  (D)  $\text{Fe}^{3+}$
3. AD
4. Which of the following is/are linear molecules?  
(A)  $\text{BeCl}_2$  (B)  $\text{CO}_2$   
(C)  $\text{SnCl}_2$  (D)  $\text{XeF}_2$
4. ABD
5. The electronegativity of which atom(s) is/are higher than that of nitrogen?  
(A) F (B) O  
(C) C (D) Si
5. AB
6. Which of the following minimum number of quantum number(s) is/are required to represent a vacant atomic orbital?  
(A) Principal quantum number (B) Azimuthal quantum number  
(C) Magnetic quantum number (D) Spin quantum number
6. ABC
7. Under high pressure, the van der Waal's equation for one mole of gas can be written as:  
(A)  $P(V-b) = RT$  (B)  $Z = 1 + \frac{Pb}{RT}$   
(C)  $PV > RT$  (D)  $P + \frac{a}{V^2} = 0$

7. ABC

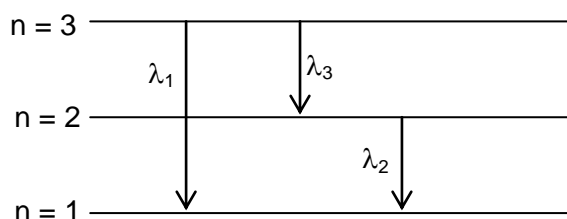
**(Single Correct Choice Type)**

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. Elements of which of the following groups of periodic table do not form hydrides?  
(A) Groups 7, 8, 9 (B) Group 13  
(C) Groups 15, 16, 17 (D) Group 14.
8. A
9. A metal 'M' readily forms water soluble sulphate and water insoluble hydroxide,  $M(OH)_2$ . Its oxide, MO, is amphoteric, hard and possess high melting point. The hydroxide is also amphoteric in nature. The alkaline earth metal, 'M' must be  
(A) Be (B) Mg  
(C) Ca (D) Ba
9. A
10. For a '3p' electron, the orbital angular momentum is  
(A)  $\sqrt{6} h/2\pi$  (B)  $\sqrt{2} h/2\pi$   
(C)  $h/2\pi$  (D)  $2h/2\pi$
10. B
11. Which have the same number of s-electron as the d-electron in  $Fe^{2+}$   
(A) Li (B) Na  
(C) N (D) P
11. D
12. The molecules of a gas A travel 4 times faster than the molecules of gas B at the same temperature. The ratio of molecular weights ( $M_A/M_B$ ) will be  
(A) 1/16 (B) 4  
(C) 1/4 (D) 16
12. A
13. If 1 litre of a gas A at 600 mm and 0.5 litre of gas B at 800 mm are taken in a 2 litre bulb. The resulting pressure is  
(A) 1500 mm (B) 1000 mm  
(C) 2000 mm (D) 500 mm
13. D
14. Calculate the mass in gm of 2N molecules of  $CO_2$   
(A) 22 gm (B) 44 gm  
(C) 88 gm (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**

Electronic transitions between the orbits of hydrogen atoms are displayed in the above figure. The transitions results in the emission of three different photons having different wavelengths.

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

15. The relationship among the wavelengths is:

(A)  $\lambda_1 = \lambda_2 + \lambda_3$

(B)  $\frac{1}{\lambda_1} = \frac{1}{\lambda_2} + \frac{1}{\lambda_3}$

(C)  $\lambda_1 > \lambda_2 > \lambda_3$

(D)  $\lambda_1 = \lambda_2 \times \lambda_3$

15. B

16.  $\lambda_3$  is

(A) greater than  $\lambda_1$

(B) greater than  $\lambda_2$

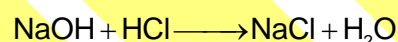
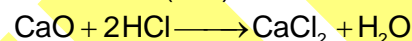
(C) both are correct

(D) none of these

16. C

**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  $f(x) = \log_e(\cos x)$  then
 

(A) $f'\left(\frac{\pi}{4}\right) = -1$	(B) $f(0) = 0$
(C) $f'(0) = 0$	(D) $f\left(\frac{\pi}{2}\right) = 2$
1. ABC
2.  $\cos 20^\circ \cos 40^\circ \cos 80^\circ =$ 

(A) 1	(B) $\left(\frac{1}{8}\right)$
(C) $\frac{1}{4} \cdot \sin 30^\circ$	(D) 2
2. BC
3.  $\left| |x-1| - 1 \right| = 3$  then x is
 

(A) -1	(B) 5
(C) 3	(D) -3
3. BD
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. If  $\sin x + \sin y + \sin z = 3$ ,  $x, y, z \in [0, 2\pi]$ , then
 

(A) $x^2 + y^2 + z^2 - xy - yz - zx = 0$	(B) $x^3 + y^3 - z^3 = \frac{\pi^3}{8}$
(C) $x^3 + y^3 + z^3 = 0$	(D) $x + y + z = 0$
5. AB
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. If the line passing through  $(4, 3)$  and  $(2, k)$  is perpendicular to  $y = 2x + 3$ , then  $k =$   
 (A) 3 (B) 1  
 (C) 4 (D) 7
8. C
9. If  $x = t^2 + 1$  and  $y = 2t + 3$  then locus of  $(x, y)$  is  
 (A)  $y^2 + 6y - 4x + 13 = 0$  (B)  $y^2 - 6y - 4x + 13 = 0$   
 (C)  $y^2 + 6y + 4x + 13 = 0$  (D) None
9. B
10. 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
10. B
11. The number of common tangents to the circle  $x^2 + y^2 = 4$  and  $x^2 + y^2 - 6x - 8y = 24$  is:  
 (A) 3 (B) 1  
 (C) 0 (D) 4
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)  $2x + y = 5$   
 (C)  $x + 2y = 0$

- (B)  $2x - y = 0$   
 (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**

A triangle ABC is given, where vertex A is (1, 1) and the orthocentre is (2, 4). Also sides AB and BC are member of the family of lines  $ax + by + c = 0$ , where a, b, c are in A.P.

15. The vertex B is  
 (A) (2, 1)  
 (C) (-1, 2)

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

15. B

16. The vertex C is  
 (A) (4, 16)  
 (C) (4, -17)

- (B) (17, -4)  
 (D) (-17, 4)

16. D

**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)  $\frac{\pi}{6}$   
 (C)  $\frac{\pi}{3}$

- (B)  $\frac{\pi}{4}$   
 (D)  $\frac{\pi}{2}$

17. D

18. The equation of circum circle of triangle PQR is

- (A)  $x^2 + y^2 + 4x + 2y = 0$   
 (C)  $x^2 + y^2 - 4x + 2y = 0$

- (B)  $x^2 + y^2 - 4x - 2y = 0$   
 (D) None of these

18. B

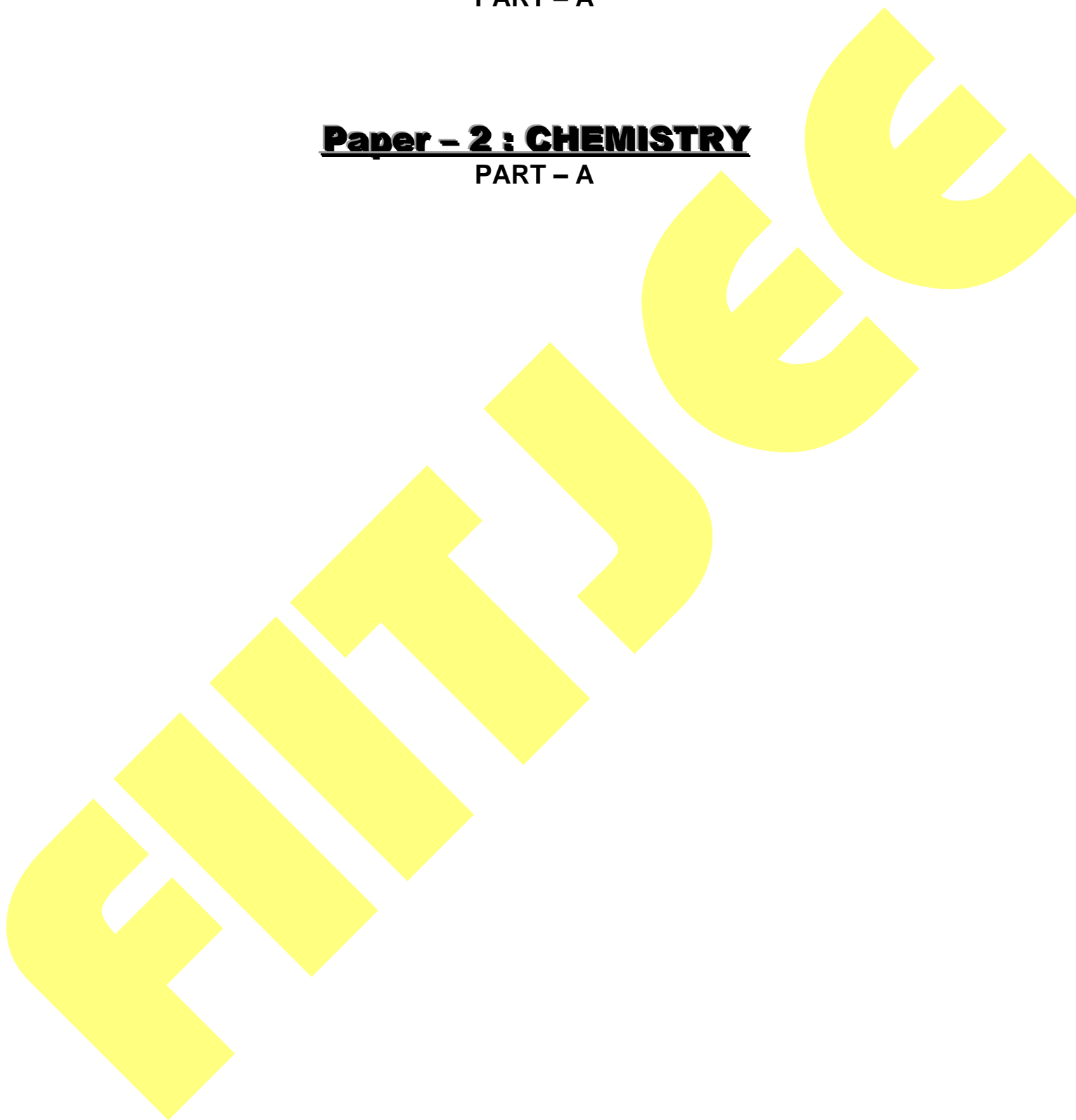
# ANSWERS

## **SECTION-1 : PHYSICS**

PART – A

## **Paper – 2 : CHEMISTRY**

PART – A



**SECTION - 3 : MATHEMATICS**  
**PART - A**

