

PHYSICS, CHEMISTRY & MATHEMATICS

Pattern - CPT-1

QP Code:

PAPER - 1

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. Each **Section** is further divided into **Two Parts: Part-A & B** in the 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 HB pencil for each character of your Enrolment No. and write in ink your Name, Test Centre and other details at the designated places.
3. OMR sheet contains alphabets, numerals & special characters for marking answers.

C. Marking Scheme For All Two Parts.

- (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 (08-13)** – Contains six (06) multiple choice questions which have ONLY ONE CORRECT answer. Each question carries **+3 marks** for correct answer and **-1 marks** for wrong answer.
- (ii) **Part-B (01-05)** contains five (05) Numerical based questions, the answer of which maybe positive or negative numbers or decimals (e.g. 6.25, 7.00, -0.33, -.30, 30.27, -127.30) and each question carries **+3 marks** for correct answer and **there will be no negative marking**.

Name of the Candidate : _____

Batch : _____ Date of Examination : _____

Enrolment Number : _____

SECTION-1 : PHYSICS

PART – A

(Multi Correct Choice Type)

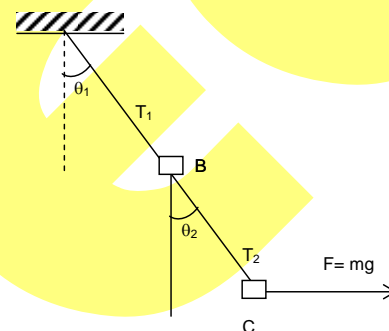
This section contains 7 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which **ONE OR MORE** may be correct.

1. A block of weight 9.8N is placed on a table. The table surface exerts an upward force of 10 N on the block. Assume $g = 9.8 \text{ m/s}^2$
- (A) The block exerts a force of 10N on the table
 (B) The block exerts a force of 19.8 N on the table
 (C) The block exerts a force of 9.8N on the table
 (D) The block has an upward acceleration

1. **AD**

2. Two blocks B and C in the figure have mass m each. The strings AB and BC are light, having tensions T_1 and T_2 respectively. The system is in equilibrium with a constant horizontal force mg acting on C.

- (A) $\tan \theta_1 = 1/2$
 (B) $\tan \theta_2 = 1$
 (C) $T_1 = \sqrt{5} mg$
 (D) $T_2 = \sqrt{2} mg$



2. **ABCD**

3. It $\vec{A} = \sqrt{3}\hat{i} + \hat{j}$
 & $\vec{B} = \sqrt{3}\hat{i} - \hat{j}$

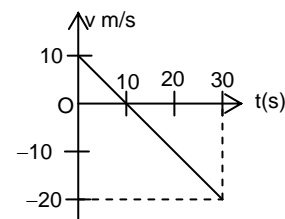
and angle between \vec{A} & \vec{B} is θ then

- (A) $\theta = 60^\circ$
 (B) $\theta = 90^\circ$
 (C) $\vec{A} \cdot \vec{B}$
 (D) Component of \vec{A} along $\vec{B} = 1$

3. **AD**

4. 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.



4. **AD**

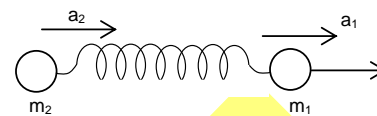
5. A spring connects two particles m_1 and m_2 horizontal force F acts on m_1 shown in figure. When the elongation of the spring is x then

(A) $a_2 = \frac{kx}{m_2}$

(B) $a_1 = \frac{F - kx}{m_1}$

(C) $F = m_1 a_1 + m_2 a_2$

- (D) $a_1 = a_2 = \frac{F}{m_1 + m_2}$ at the maximum elongation of spring



5. **ABCD**

6. A particle of mass 'M' is attached to a light string of length ' ℓ ' the other end of which is fixed. Initially the string is kept horizontal and the particle is given an upward velocity 'u'. The particle is just able to complete a circle.

(A) the string becomes slack when the particle reaches its highest point.

(B) the velocity of the particle becomes $\sqrt{g\ell}$ at the highest point.

(C) the velocity of the ball at the initial position is $\sqrt{4g\ell}$.

(D) the particle never passes again through the initial position.

6. **AB**

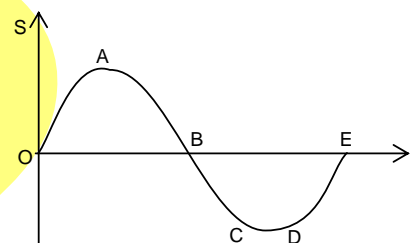
7. A particle has a rectilinear motion and the figure gives its displacement as a function of time. Which of the following statements are true with respect to the motion.

(A) in motion between 0 to A, the velocity is positive and acceleration is negative

(B) between A and B, the velocity and acceleration are positive

(C) between B and C, the velocity is negative and acceleration is positive

(D) between D and E, the acceleration is positive



7. **ACD**

(Single Correct Choice Type)

This section contains **6 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct**.

8. An object moves with the constant acceleration \vec{a} . Which of the following expression is also constant?

(A) $\frac{d|\vec{v}|}{dt}$

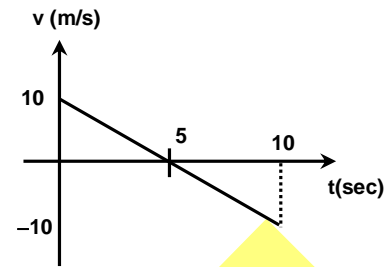
(B) $\left| \frac{d\vec{v}}{dt} \right|$

(C) $\frac{d(v^2)}{dt}$

(D) $\frac{d\left(\frac{\vec{v}}{|\vec{v}|}\right)}{dt}$

8. **B**

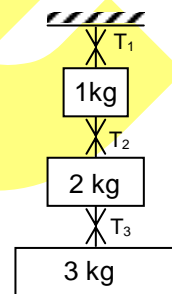
9. Velocity-time graph of a particle moving in a straight line is shown in the figure. Mass of the particle is 2 kg. Work done by all the forces acting on the particle in time interval $t = 0$ to $t = 10$ sec is
- (A) 300 J
(B) - 300 J
(C) zero
(D) - 400 J



9. **C**
10. A ball is attached to a string and moves in a vertical circle. The string is always taut and there are absolutely no resistive forces. Which of the following statements is correct?
- (A) the net force on the ball is always vertical.
(B) the net force on the ball is always perpendicular to the velocity vector of the ball.
(C) the net force on the ball is always towards centre.
(D) the tension in the string is greatest when the ball is at its lowest point.

10. **D**

11. In the system shown in the adjoining figure, the tension T_2 is
- (A) g
(B) $2g$
(C) $5g$
(D) $6g$



11. **C**

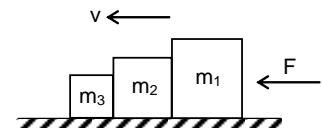
12. A point moves in xy plane according to equation $x = at$, $y = at(1-bt)$ where a and b are positive constants and t is time. The instant at which velocity vector is at $\pi/4$ with acceleration vector is given by

- (A) $\frac{1}{a}$
(B) $\frac{1}{b}$
(C) $\frac{1}{a} + \frac{1}{b}$
(D) $\frac{a+b}{a^2+b^2}$

12. **B**

13. Three blocks (m_1 , m_2 & m_3) are slid at constant velocity across a rough surface as shown. The coefficient of kinetic friction between each block and the surface is μ . What would be the force due to m_1 on m_2 ?

- (A) $F - (m_2 - m_3)g\mu$
(B) $(m_2 + m_3)g\mu$
(C) $m_1g\mu - (m_2 + m_3)g\mu$
(D) $(m_1 + m_2 + m_3)g\mu$



13. **B**

PART – B
(Numerical based)

1. A particle moves along the y-axis of a coordinate system, with a force component $F_y = (2\text{N/m})y$ acting on it. As the particle moves from the origin to $y = 3$ m, how much work (in Joule) done on it by the force?

1. **9**

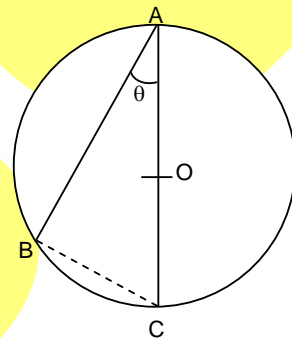
2. If $\vec{A} = 4\hat{i} - 2\hat{j} + 6\hat{k}$ and $\vec{B} = -\hat{i} + 2\hat{j} + 3\hat{k}$, $\frac{\vec{A} \cdot \vec{B}}{2}$ is equal to $2n$. Find the value of 'n'.

2. **2.50**

3. A passenger is standing 20 m behind from a bus. The bus begins to move with constant acceleration 0.9 m/s^2 . To catch the bus, the passenger runs at a constant speed v towards the bus. What must be the minimum speed (in m/s) of the passenger so that he may catch the bus?

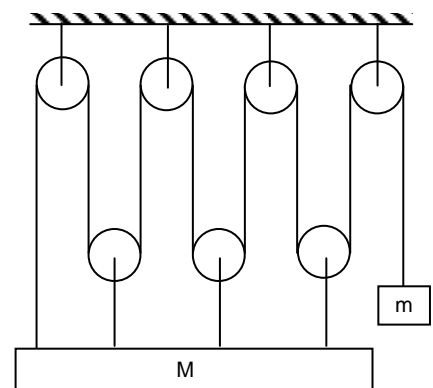
3. **6**

4. A bead is free to slide down on a smooth wire tightly stretched between point A and B on a vertical circle of radius 10 m. Find the time taken (in s) by the bead to reach the point B, if the bead slide from rest from the highest point A on the circle. (take $g = 10 \text{ m/s}^2$)



4. **2**

5. The system as shown in figure is in equilibrium. The ratio of $\frac{M}{m}$ is $5n$. Find the value of 'n'.



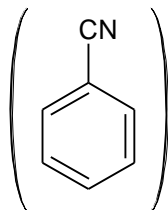
5. **1.40**

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. Cyanobenzene () has

(A) 7 sigma and 4 pi bonds	(B) 7 sigma and 5 pi bonds
(C) 12 sigma and 6 pi bonds	(D) 13 sigma and 5 pi bonds

1. D

2. If temperature of a gas is raised, which of the following would be true?

(A) Fraction of the molecules possessing most probable velocity will increase	(B) Fraction of the molecules possessing most probable velocity will decrease
(C) Fraction possessing very low velocity will decrease	(D) Fraction possessing very high velocity will increase

2. BCD

3. Equal weights of carbon dioxide and Nitrous oxide are kept in two identical vessels maintained at same temperature. Which property has the same magnitude for both the gases?

(A) Density	(B) Average kinetic energy
(C) V_{rms}	(D) Rate of diffusion

3. ABCD

4. Which of the following has non-zero dipole moment?

(A) NH_3	(B) CH_4
(C) NF_3	(D) CF_4

4. AC

5. In which of the following reaction(s) the equivalent mass and molecular mass of the acid(s) is/are identical?

(A) $NaOH + H_2SO_4 \longrightarrow NaHSO_4 + H_2O$	(B) $2KOH + H_3PO_4 \longrightarrow K_2HPO_4 + 2H_2O$
(C) $LiOH + H_3PO_2 \longrightarrow LiH_2PO_2 + H_2O$	(D) $Ca(OH)_2 + H_3PO_3 \longrightarrow CaHPO_3 + 2H_2O$

5. AC

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. Select the correct statement(s) regarding $3P_y$ orbital :
- (A) Total number of nodes are 2
 (B) Number of maxima in the curve $4\pi r^2 R^2$ vs r is one
 (C) Quantum number n, l and m for orbital may be 3, 1, -1 respectively
 (D) The magnetic quantum number may have a positive value

7. ACD

(Single Correct Choice Type)

This section contains **6 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct**.

8. According to Hund's rule, the electronic configuration of a stable atom like nitrogen should have
- (A) maximum spin value
 (B) maximum number of unpaired electrons
 (C) maximum exchange energy
 (D) all are correct

8. D

9. Which of the following contains one mole atoms?
- (A) 17 g of NH_3
 (B) 14 g of CO
 (C) 64 g of SO_2
 (D) 4.4 g of CO_2

9. B

10. Which of the following is a gr-16 element?
- (A) P
 (B) S
 (C) Br
 (D) Ar

10. B

11. How many covalent bonds are present in SO_4^{2-} ion?
- (A) 4
 (B) 6
 (C) 8
 (D) 7

11. B

12. Which of the following atomic orbital contains maximum number of radial nodes?
- (A) 4s
 (B) 4p
 (C) 4d
 (D) 4f

12. A

13. Which of the following two orbitals can form π -bonds?
- (A) 3s and 3p
 (B) $2p_x$ and $2p_y$
 (C) $2p_z$ and $2p_z$
 (D) $2p_x$ and $3p_y$

13. C

PART – B
(Numerical based)

1. One litre aqueous solution of HCl contains 36.5 g of HCl. What is the molarity of the solution?

1. 1

2. If the simplest ratio of the relative rate of effusion of H_2 to O_2 , under identical condition, is expressed as $x : y$, the value of $(x + y)$ is:
2. 5
3. How many element(s) is/are present in the shortest period of the periodic table?
3. 2
4. The velocity of gas molecules in a given sample are given below in $cm\ s^{-1}$ unit?
4, 3, 2, 1, 3, 5, 3, 2, 4, 3, 7, 3
What is the most probable velocity of the gas in $cm\ s^{-1}$ unit?
4. 3
5. The root mean square velocity of an ideal gas is $4.6\ ms^{-1}$ at 400 K. What will be its r.m.s velocity in ms^{-1} unit if the temperature is raised at 1600 K?
5. 9.2

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 $y = \sin^2 x$ then $\frac{dy}{dx}$ is equal to
 (A) $3 \sin^3 x$ (B) $2 \sin x$
 (C) $\sin 2x$ (D) $2 \sin x \cdot \cos x$
1. CD
2. The equation of straight line equally inclined to the axes and equidistant from the point (1, -2) and (3, 4) is
 (A) $x + y = 3$ (B) $x - y + 1 = 0$
 (C) $y - x = 2$ (D) $y - x + 1 = 0$
2. AD
3. If (1,2), (2,3) lies on same side of $x - y + a = 0$ then 'a' can be
 (A) 1 (B) 3
 (C) 4 (D) 5
3. BCD
4. If $2 \sin^2 \theta + \sin^2 2\theta = 2$ then $\sin^2 \theta$ equal to
 (A) 1 (B) $\frac{1}{2}$
 (C) $\frac{1}{3}$ (D) $\frac{1}{4}$
4. AB
5. If distance between $(x, x+1)$ and $(5,6)$ is $5\sqrt{2}$, then x is equal to
 (A) 0 (B) 5
 (C) 10 (D) 15
5. AC
6. If $ax^2 - 6xy + y^2 + bx + cy + d = 0$ is pair of lines whose slopes are m and m^2 then a is /are
 (A) $a = -8$ (B) $a = 8$
 (C) $a = 27$ (D) $a = -27$
6. BD
7. $\int 5 \sin^4 x \cos x dx$ is equal to
 (A) $\sin^3 x - \cos^2 x \sin^3 x + c$ (B) $\sin^2 x - \cos^3 x \sin^2 x + c$
 (C) $\sin^5 x + c$ (D) $\sin^4 x + c$
7. AC

(Single Correct Choice Type)

This section contains **6 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct**.

8. Equation of chord of circle $x^2 + y^2 + 4x + 2y - 20 = 0$ with mid point $(-1, 1)$ is
 (A) $x + 2y = 1$ (B) $x + 3y = 2$
 (C) $2x + 3y = 1$ (D) None
8. A
9. If $\log_a x = 0.3$ and $\log_a 3 = 0.4$, then $\log_3 x$ is :
 (A) 0.12 (B) 0.7
 (C) $\frac{3}{4}$ (D) $\frac{4}{3}$
9. C
10. Solution of the equation $|x + 4| > |2x - 3|$ is
 (A) $\left(-\frac{1}{3}, 7\right)$ (B) $\left(-7, \frac{1}{3}\right)$
 (C) $\left(-4, \frac{1}{3}\right)$ (D) $\left(\frac{1}{3}, 4\right)$
10. A
11. The equation of the normal to the circle $x^2 + y^2 - 4x + 4y - 17 = 0$ which passes through $(1, 1)$ is $3x + y - k = 0$, Find k.
 (A) 4 (B) 1
 (C) 2 (D) None of these
11. A
12. $\frac{\cos \theta}{\sin(90 + \theta)} + \frac{\sin(-\theta)}{\sin(180 + \theta)}$ is
 (A) 0 (B) 1
 (C) 2 (D) None of these
12. C
13. If $x + y + z = \pi$, $\tan x \tan y = 2$, $\tan x + \tan y + \tan z = 6$, then $\tan z =$
 (A) 1 (B) 2 (C) 3 (D) None
13. C

PART – B
(Numerical based)

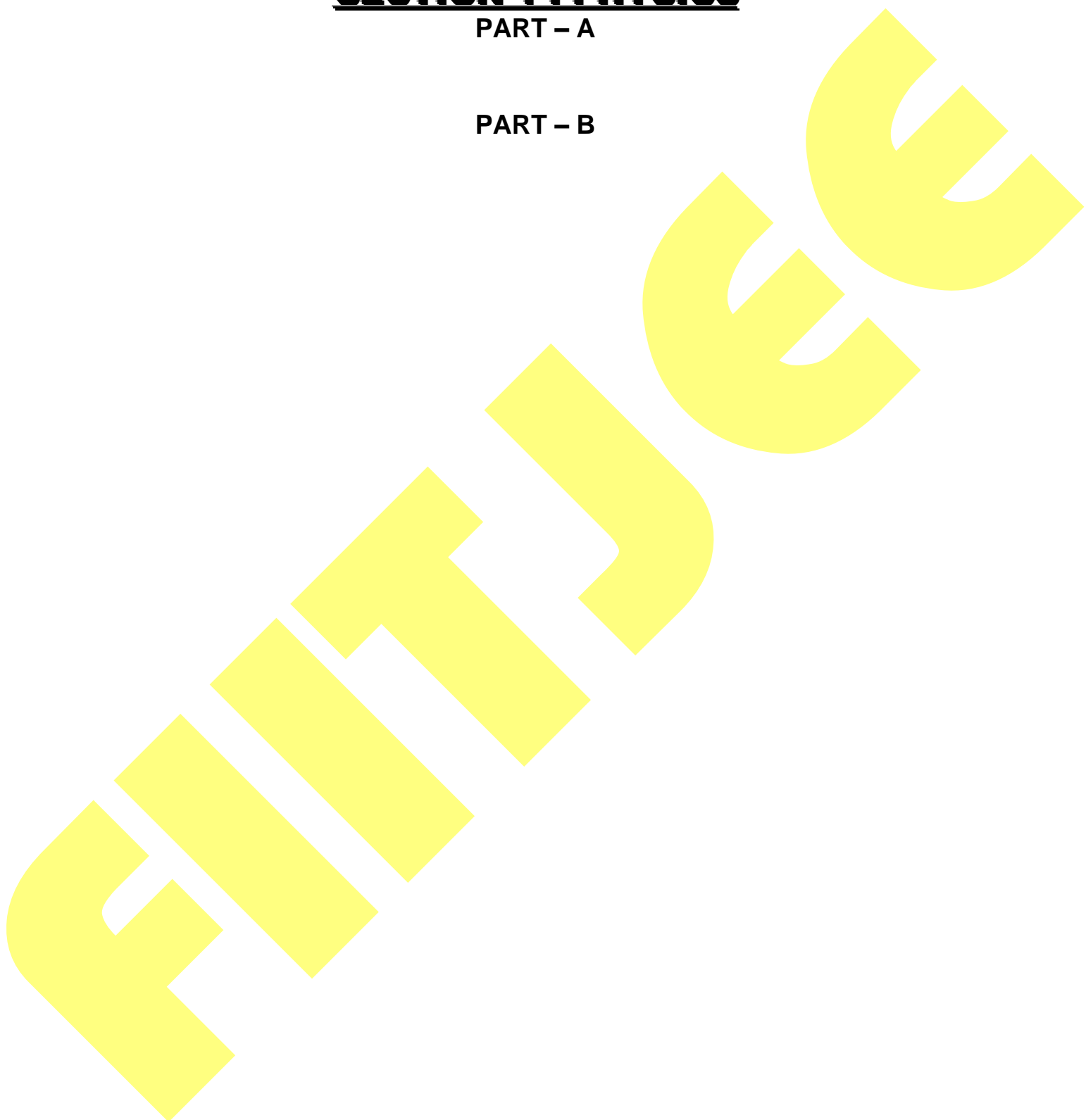
1. The values of x satisfying $\log_{16} x + \log_4 x + \log_2 x = \log_{1/2} \left(\frac{1}{128} \right)$ is
 1. 16
 2. Radius of the circle $(x-4)(x+2) + (y^2 - 16) = 0$ is
 2. 5
 3. $\lim_{x \rightarrow 0} \frac{1+x+x^2-e^x}{x^2} = k$, then k is equal to
 3. 0.5
 4. If $(2, -3)$ lies on $kx^2 - 3y^2 + 2x + y - 2 = 0$ then k is equal to
 4. 7
 5. If x is integer then number of integral solutions of $\frac{x(x-2)(x-5)}{(x-2)} \leq 0$ is
 5. 5

ANSWERS

SECTION-1 : PHYSICS

PART – A

PART – B



PAPER – 1 : CHEMISTRY

PART – A

PART – B



SECTION – 3 : MATHEMATICS

PART – A

PART – B

