

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 : _____

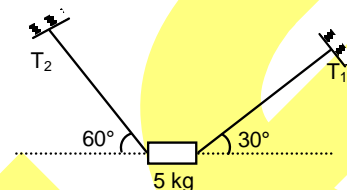
SECTION-1 : PHYSICS

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 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) $T_2 = 25\sqrt{3} \text{ N}$



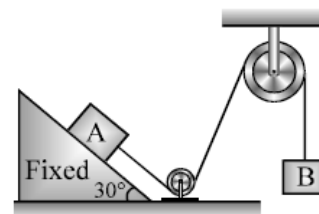
1. **AD**
2. At time $t = 0$, car moving along a straight line has a velocity of 16 m/s. It slows down with an acceleration of $-0.5t \text{ m/s}^2$, where t is in second. Mark the correct statement(s)
- (A) The direction of velocity changes at $t = 8 \text{ sec}$
 (B) The distance travelled in 4 sec is 58.67 m
 (C) The distance travelled by the particle in 10 sec is 94 m
 (D) The velocity at $t_4 = 10 \text{ sec}$ is - 9 m/s

2. **ABCD**

3. 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.

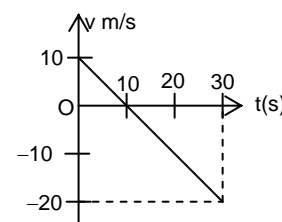
3. **AD**

4. 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 $3g/4$



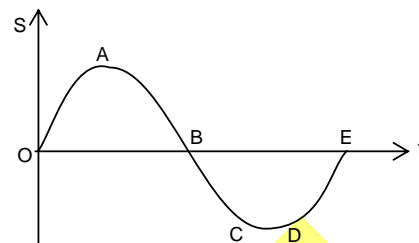
4. **BD**

5. 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.



5. **AD**

6. 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

6. **ACD**

7. 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.

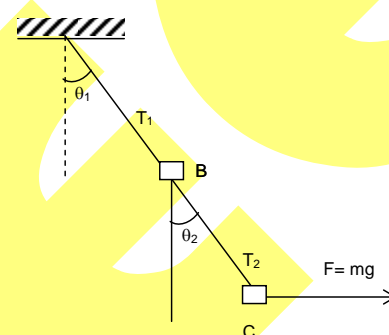
(A) $\tan\theta_1 = 1/2$

(B) $\tan\theta_2 = 1$

(C) $T_1 = \sqrt{5} mg$

(D)

$T_2 = \sqrt{2} mg$



7. **ABCD**

(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. 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) $\sqrt{41}$

8. **B**

9. A particle is thrown from ground level with an initial velocity $4\hat{i} + 3\hat{j}$. Its range on horizontal ground is (The origin is taken at point of projection, x – axis along the ground and y – axis perpendicular to the ground) $g = 10 \text{ m/s}^2$

(A) 1.2 m

(B) 2.4 m

(C) 4.8 m

(D) 3.6 m

9. **B**

10. A vector of magnitude a is turned through angle θ . The magnitude of change in the vector is given by

(A) $|2a \sin\theta|$

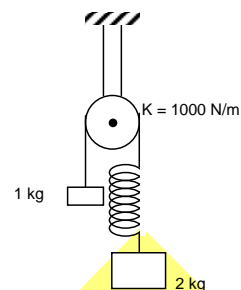
(B) $|2a \sin(\theta/2)|$

(C) $\left| \frac{a}{2} \sin\theta \right|$

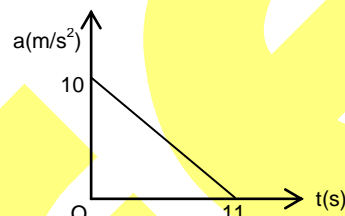
(D) $\left| \frac{a}{2} \sin\left(\frac{\theta}{2}\right) \right|$

10. **B**

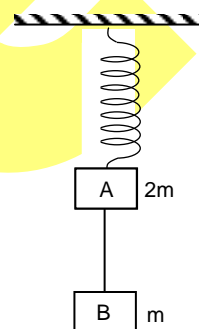
11. In the arrangement shown in the figure pulley is light and smooth. The extension in the spring ($g=10\text{m/s}^2$)
- (A) 1.3 cm (B) 1 cm
(C) 1.67 cm (D) 2 cm



11. **C**
12. A particle starts from rest. Its a-t graph is as shown in the figure. The maximum speed of the particle will be
- (A) 110 m/s
(B) 55 m/s
(C) 550 m/s
(D) 660 m/s



12. **B**
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 and they are in equilibrium. 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) $\frac{g}{2}, \frac{g}{2}$



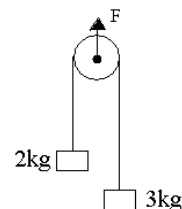
13. **B**

PART – B (Numerical based)

1. A particle has displacement of 12 m towards east and 5 m towards north then 6 m vertically upward. The sum of these displacements in metres is:

1. **14.32**

2. The pulley is light and frictionless. The thread is light and inextensible. The force F is such that the acceleration of 3kg block is zero. The acceleration of the pulley in S.I units is:

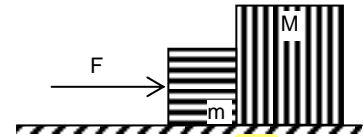


2. **2.50**

3. If $\vec{A} = 4\hat{i} - 2\hat{j} + 6\hat{k}$ and $\vec{B} = -\hat{i} + 2\hat{j} + 3\hat{k}$, find the $\frac{\vec{A} \cdot \vec{B}}{2}$.

3. **5**

4. Two blocks of mass $m = 1\text{kg}$ and $M = 2\text{kg}$ are in contact on a frictionless table. A horizontal force $F(=3\text{N})$ is applied to m . The force (In N) of contact between the blocks will be



4. **2**
5. A block is moving on an inclined plane making an angle 45° with the horizontal and the coefficient of friction is μ . The force required to just push it up the inclined plane is 3 times the force required to just prevent it from sliding down. If we define $N = 10 \mu$, then N is
5. **5**

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.

- Which of the following(s) is/are correct statement?
(A) The heats of hydration of the dipositive alkaline earth metal ions decrease with an increase in their ionic size.
(B) NaNO_3 forms Na_2O on heating.
(C) Hydration of alkali metal ions is less than that of IIA group.
(D) Alkaline earth metal ions, because of their larger charge to size ratio, exert a much stronger electrostatic attraction on the oxygen of water molecule surrounding them, when compared to alkali metal ions.
1. ACD
- Select the incorrect statements:
(A) On dilution, pH of an acid generally increases
(B) pH of a solution formed by mixing equimolar quantities of HCOOH and HCl will be less than that of a similar solution formed from HCOOH and HCOONa
(C) K_{sp} of a sparingly soluble salt increases with increase in concentration of ions
(D) pH cannot be more than 14
2. CD
- Identify the correct statements about BF_3 and PF_3
(A) Hybridisation of central atom is same in both the molecules
(B) Both have resonating structures
(C) Both have double bond character
(D) Both have different type of π bonding
3. BCD
- Which of the following statements is/are correct?
(A) LiHCO_3 does not exist in the solid state.
(B) Potassium superoxide is paramagnetic in nature.
(C) Solubility of Ba(OH)_2 in water is more than the solubility of Mg(OH)_2 .
(D) Li_2CO_3 is more stable than Rb_2CO_3 .
4. ABC
- The time required for an electron to make one complete revolution around nucleus of H-atom in a higher orbit n_2 is 8 times to that of a lower orbit n_1 . Therefore n_1 and n_2 are
(A) 1 and 2
(B) 2 and 3
(C) 2 and 4
(D) 3 and 6
5. ACD

6. Select the correct statement(s) regarding $3P_y$ orbital:
 (A) total no. of nodes are 2
 (B) the number of radial node(s) = number of angular node(s)
 (C) quantum number n , l and m for orbital may be 3, 1 and -1 respectively
 (D) the magnetic quantum number may have a positive value

6. **ABCD**

7. Which of the molecule/s is/are tetrahedral?
 (A) HIO_4 (B) H_2CrO_4
 (C) CH_4 (D) SF_4

7. **ABC**

(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. Which of the following electronic transition in hydrogen atom is accompanied with emission of six different type of photons?
 (A) $n = 3 \rightarrow n = 1$ (B) $n = 4 \rightarrow n = 1$
 (C) $n = 2 \rightarrow n = 5$ (D) $n = 3 \rightarrow n = 6$

8. **B**

9. The half-life of a zero order reaction is 10 sec. How many seconds is required for 75% completion of the reaction?
 (A) 10 (B) 20
 (C) 15 (D) 5

9. **C**

10. Which of the following solutions display common ion effect?
 (A) $\text{HCl} + \text{NH}_2\text{OH}$ (B) $\text{HCl} + \text{KSH}$
 (C) $\text{KCN} + \text{HNO}_2$ (D) $\text{H}_2\text{S} + \text{Na}_2\text{SO}_4$

10. **B**

11. The aqueous solution of which of the following compound decolourizes red litmus paper?
 (A) Na_2O (B) Mg_3N_2
 (C) KO_2 (D) CaC_2

11. **C**

12. What is the orbital angular momentum of the valence electron of calcium?
 (A) zero (B) $\frac{2h}{\pi}$
 (C) $\frac{h}{2\pi}$ (D) $\frac{h}{\sqrt{2}\pi}$

12. **A**

13. Which of the following compound contains maximum percentage of covalent character?
 (A) AlF_3 (B) AlCl_3
 (C) AlBr_3 (D) AlI_3

13. D

PART – B
(Numerical based)

1. The formula of a fluoride of manganese ($Z = 25$) is MnF_x . The spin-only magnetic moment of the fluoride is $\sqrt{15}$ B.M. What is the value of 'x'?

1. 4

2. How many antibonding electron(s) is/are present in a molecule of dinitrogen gas according to molecular orbital theory?

2. 4

3. 'X' is a non-metal which forms the oxy-acid H_3XO_4 . The successive ionization constants i.e. K_{a_1} , K_{a_2} and K_{a_3} of the acid are respectively 10^{-2} , 10^{-3} and 10^{-5} at $25^\circ C$. What will be the pH of 0.1 M solution of the salt Na_2HXO_4 ?

3. 4

4. How many lone pair(s) of electrons is/are present on xenon in XeF_2 ?

4. 3

5. In a reaction involving one reactant and one product, the activation energy of the forward reaction is 6 kJ mole. What will be the activation energy of backward reaction in kJ unit if the heat of reaction is 3 kJ.

5. 3

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. Let $f(x) = \begin{cases} x^2 - 4x + 3, & x < 3 \\ x - 4, & x \geq 3 \end{cases}$ and $g(x) = \begin{cases} x - 3, & x < 4 \\ x^2 + 2x + 2, & x \geq 4 \end{cases}$ then, which of the

following is/are true?

(A) $(f + g)(3.5) = 0$

(B) $f(g(3)) = 3$

(C) $(fg)(2) = 1$

(D) $(f - g)(4) = 0$

1. ABC

2. If $f(x) = \begin{cases} -x - \frac{\pi}{2}, & x \leq -\frac{\pi}{2} \\ -\cos x, & -\frac{\pi}{2} < x \leq 0, \text{ then} \\ x - 1, & 0 < x \leq 1 \\ \ln x, & x > 1 \end{cases}$

(A) $f(x)$ is continuous at $x = \frac{-\pi}{2}$

(B) $f(x)$ is not differentiable at $x = 0$

(C) $f(x)$ is differentiable at $x = 1$

(D) $f(x)$ is differentiable at $x = \frac{-3}{2}$

2. ABCD

3. The angle between the tangents to the curves $y = x^2$ and $x = y^2$ at $(1, 1)$ is

(A) $\cos^{-1} \frac{4}{5}$

(B) $\sin^{-1} \frac{3}{5}$

(C) $\tan^{-1} \frac{3}{4}$

(D) $\tan^{-1} \frac{1}{3}$

3. ABC

4. Let $f(x) = x^4 - 4x^3 + 6x^2 - 4x + 1$, then

(A) f increases on $[1, \infty)$

(B) f decreases on $[1, \infty)$

(C) f has local minima at $x = 1$

(D) f has neither maximum nor minimum

4. AC

5. If $y = \frac{x^4 + x^2 + 1}{x^2 - x + 1}$ such that $\frac{dy}{dx} = ax + b + c$ then

(A) $a = 2$

(B) $b = 1$

(C) $c = 0$

(D) $c \in \mathbb{R}$

5. ABC

6. $\lim_{n \rightarrow \infty} \frac{(2n+1)(n+2)}{(3n-1)(4n-3)}$ is equal to
- (A) $\frac{1}{6}$
- (C) $\frac{3}{18}$

- (B) $\frac{2}{12}$
- (D) $\frac{4}{24}$

6. ABCD

7. If $y = x^4 - 2x^2 + 5$ in $[-2, 2]$ then

- (A) greatest value = 13
(C) least value = 13

- (B) greatest value = 4
(D) least value = 4

7. AD

(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. If $f(x) = \frac{\sin([x]\pi)}{x^2 + x + 1}$, where $[.]$ denotes the greatest integer function, then

- (A) f is one – one
(C) f is constant function

- (B) f is not one – one and non – constant
(D) None of these

8. C

9. The value of $\sqrt{2} \int \frac{\sin x \, dx}{\sin\left(x - \frac{\pi}{4}\right)}$ is:

(A) $x - \log \left| \cos \left(x - \frac{\pi}{4} \right) \right| + c$

(B) $x + \log \left| \cos \left(x - \frac{\pi}{4} \right) \right| + c$

(C) $x - \log \left| \left(x - \frac{\pi}{4} \right) \right| + c$

(D) $x + \log \left| \sin \left(x - \frac{\pi}{4} \right) \right| + c$

9. D

10. If $f(x) = \frac{\tan\left(\frac{\pi}{4} - x\right)}{\cot 2x}$, $\left(x \neq \frac{\pi}{4}\right)$ is continuous at $x = \frac{\pi}{4}$, then the value of $f\left(\frac{\pi}{4}\right)$ is

(A) 1

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

(C) $\frac{1}{3}$

(D) -1

10. B

11. If $y = a \sin x + b \cos x$, then $y^2 + \left(\frac{dy}{dx}\right)^2$ is a

- (A) function of x
(C) function of x and y

- (B) function of y
(D) constant

11. D
12. The curves $4x^2 + 9y^2 = 72$ and $x^2 - y^2 = 5$ at (3, 2)
 (A) touch each other (B) cut orthogonally
 (C) intersect at 45° (D) intersect at 60°
12. B
13. Which of the following functions is periodic with period π ?
 (A) $f(x) = \sin 3x$ (B) $f(x) = |\cos x|$
 (C) $f(x) = [x + \pi]$ (D) $f(x) = x \cos x$
 where $[x]$ means the greatest integer not greater than x .

13. B

PART – B
(Numerical based)

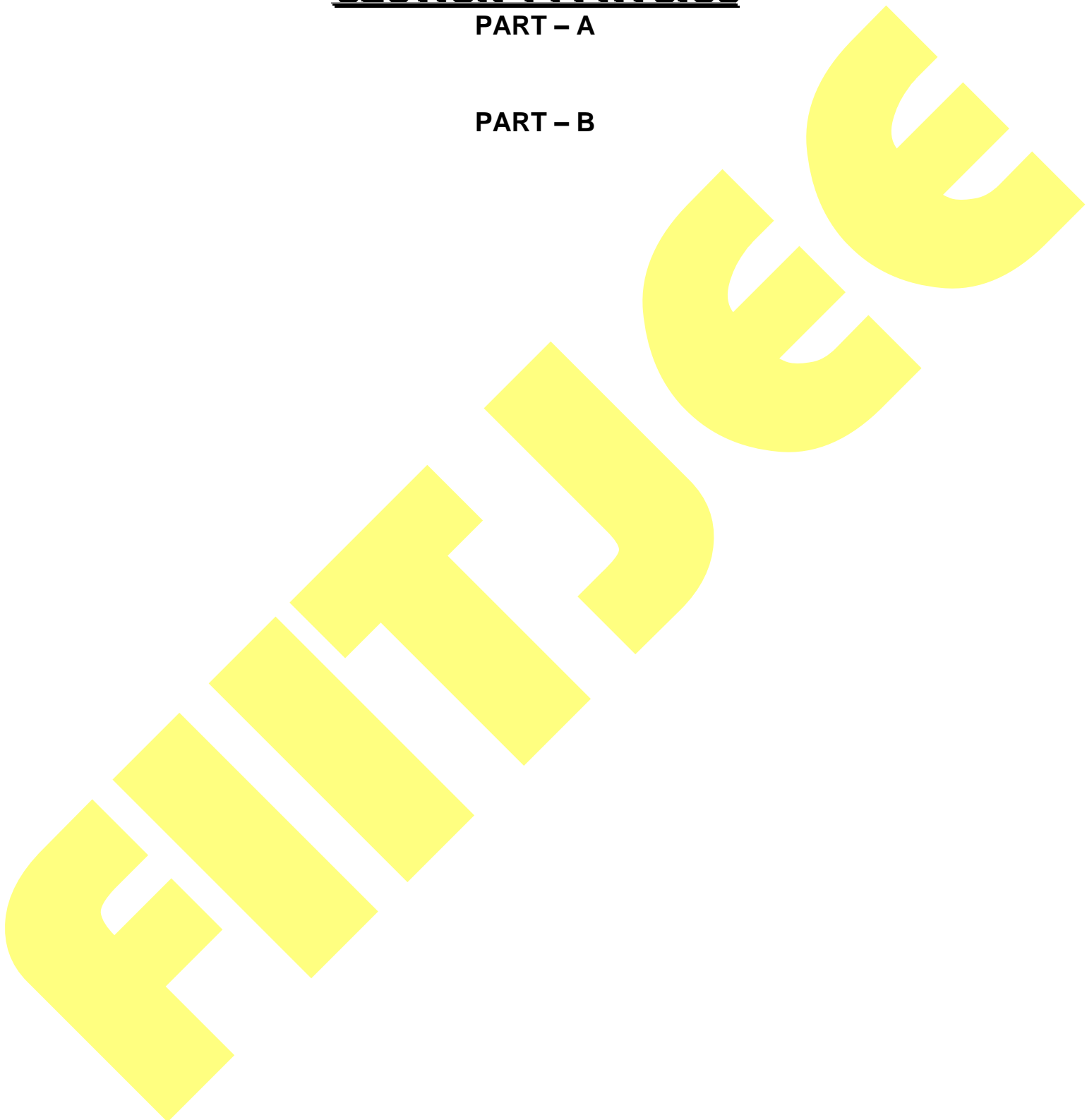
1. If $\lim_{x \rightarrow 0} \frac{\int_0^x \sin t^2 dt}{x^3}$ is $\frac{k}{3}$ then $k =$ _____
1. 1
2. If $f(9) = 9$, $f'(9) = 4$, then find value of $\lim_{x \rightarrow 9} \frac{\sqrt{f(x)} - 3}{\sqrt{x} - 3}$.
2. 4
3. If $\int \frac{2x^2 + 3}{(x^2 - 1)(x^2 + 4)} dx = a \ln \left(\frac{x-1}{x+1} \right) + b \tan^{-1} \frac{x}{2} + C$, then $a + b =$
3. 1
4. $\lim_{x \rightarrow \infty} \left(\frac{x+1}{x-1} \right)^x$ is e^c then $c =$ _____
4. 2
5. The number of real solutions of $x^2 - 3|x| + 2 = 0$ is:
5. 4

ANSWERS

SECTION-1 : PHYSICS

PART – A

PART – B



PAPER – 1 : CHEMISTRY

PART – A

PART – B



SECTION – 3 : MATHEMATICS

PART – A

PART – B

