

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 – NWCMPA122A1_PT1

SECTION-1 : PHYSICS

PART – A

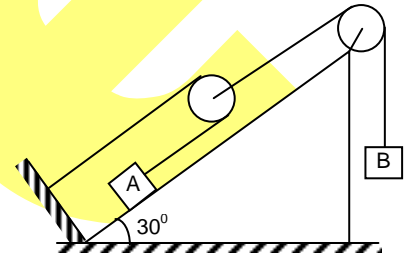
(Multi Correct Choice Type)

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. 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) $R_A = R_B$

1. **CD**

2. 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) 2m/s^2
 (D) 4m/s^2
2. **A**
3. 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) $|\vec{A} \times \vec{B}| = -\sqrt{157}$

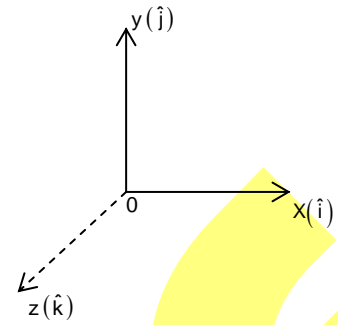
3. **AC**

4. 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 $u > v$.

4. **ACD**

5. 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



5. **ABC**

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. 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.

7. **BD**

(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**.

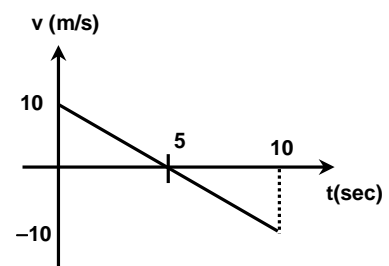
8. An object of mass m is hanging by a string from the ceiling of an elevator. The elevator is moving upward but slowing down. What is the tension in the string?

- (A) less than mg
 (B) exactly mg
 (C) greater than mg
 (D) zero

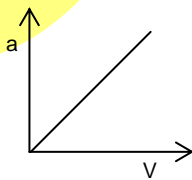
8. **A**

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. The vector $\vec{B} = 5\hat{i} + 2\hat{j} - x\hat{k}$ is perpendicular to the vector $\vec{A} = 3\hat{i} + \hat{j} + 2\hat{k}$ for x equals to
 (A) 1 (B) 4.7
 (C) 6.3 (D) 8.5
10. **D**
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. If the sum of two unit vectors is also equal to a unit vector, then find the square of magnitude of their difference:
 (A) 1 (B) 2 (C) 3 (D) 4
12. **C**
13. 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
- 
13. **C**
14. A person walking at the rate of 3km/hour, the rain appears to fall vertically when he increase his to speed 6 km/hr it appears to meet him at angle of 45° with vertical. The speed of rain is
 (A) $3\sqrt{2}$ km/hr (B) $\frac{3}{\sqrt{2}}$ km/hr
 (C) $6\sqrt{2}$ km/hr (D) $2\sqrt{3}$ km/hr
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

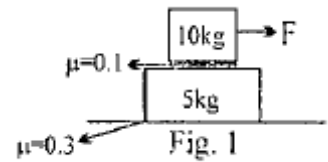
When a force \vec{F} acts at a point P, at position \vec{r} from the origin O, torque of this force about O is defined as $\vec{\tau} = \vec{r} \times \vec{F}$. It is a vector quantity having its direction perpendicular to both \vec{r} and \vec{F} according to the rule of cross product.

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

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



17. 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
17. **A**
18. The acceleration of 10 kg block when $F = 30 \text{ N}$
 (A) 2 m/s^2 (B) 3 m/s^2
 (C) 1 m/s^2 (D) None of these
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. The pH of the aqueous solution(s) of which of the following salt(s) does not change upon dilution?
 (A) CH_3COONa (B) NaCl
 (C) $\text{CH}_3\text{COONH}_4$ (D) KCN

1. **BC**

2. $2\text{KClO}_3(\text{s}) \rightleftharpoons 2\text{KCl}(\text{s}) + 3\text{O}_2(\text{g}); \Delta H = +ve$
 The product yield of above reaction increases by
 (A) increasing temperature (B) adding more KClO_3
 (C) removing KCl (D) decreasing pressure

2. **AD**

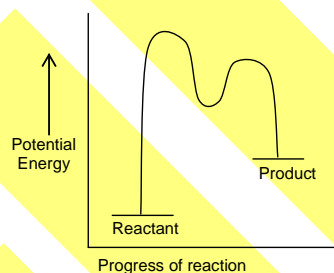
3. The energy of first orbit of hydrogen atom is identical to the energy of
 (A) second orbit of He^+ (B) fourth orbit of Li^{2+}
 (C) fourth orbit of Be^{3+} (D) third orbit of He^+

3. **AC**

4. Which of the following molecule(s) contain(s) covalent bonds of different bond lengths?
 (A) PCl_5 (B) SF_4
 (C) SF_6 (D) XeF_4

4. **AB**

5.



Which of the following statement(s) is/are correct for the reaction which energy profile is given above?

- (A) It is an endothermic reaction (B) A catalyst may be used for the reaction
 (C) It completes in a single step (D) A reaction intermediate is formed

5. **ABD**

6. Which of the following expression(s) is/are correct?
 (A) $K_p = K_x [P]^{\Delta n}$
 [K_x = Equilibrium constant expressed with mole fractions of the reacting species]
 (B) $K_p = K_c [RT]^{\Delta n}$
 (C) $K_p = K_n \left(\frac{P}{n}\right)^{\Delta n}$
 [n = Total moles at equilibrium]
 [K_n = Equilibrium constant expressed with moles of reacting species]
 (D) $K_p = K_x [RT]^{\Delta n}$

6. **ABC**

7. Which of the following relation(s) is/are correct for a reaction at equilibrium?

(A) $\Delta G^0 = -RT \ln K_{eq}$

(B) $\alpha = \frac{D-d}{(n-1)d}$

(C) $\Delta G = 0$

(D) $\log K_{eq} = \log A - \frac{\Delta H}{2.303R} \times \frac{1}{T}$

7. **ABCD**

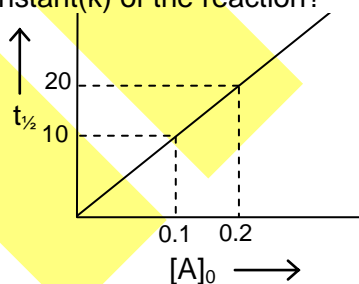
(Single Correct Choice Type)

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. An element (X) belongs to nitrogen family (Gr-15). What should be the minimum bond angle of XH_3 molecule?
 (A) 107° (B) 90°
 (C) 45° (D) 104°

8. **B**

9. The variation of $t_{1/2}$ and initial concentration $[A]_0$ of a reaction is given as follows. What is the rate constant (k) of the reaction?



(A) $5 \times 10^{-2} \text{ mol}^{-1} \text{ L sec}^{-1}$
 (C) $5 \times 10^{-2} \text{ mol L}^{-1} \text{ sec}^{-1}$

(B) $5 \times 10^{-3} \text{ mol}^{-1} \text{ L sec}^{-1}$
 (D) $5 \times 10^{-3} \text{ mol L}^{-1} \text{ sec}^{-1}$

9. **D**

10. $X(g) \rightleftharpoons Y(g)$

80% (mole - mole) of 'X' undergoes complete reaction in a one litre container at equilibrium according to above reaction. How many moles of 'X' should be added at equilibrium so that the concentration of 'Y' becomes 0.9 M?

(A) 0.0125
 (C) 0.125

(B) 1.25
 (D) 0.215

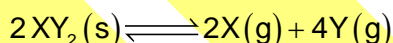
10. **C**
11. What type of hydrogen is produced in hydrogen torch?
 (A) Molecular hydrogen (B) Atomic hydrogen
 (C) Nascent hydrogen (D) Ortho hydrogen
11. **B**
12. Which of the following two substances can be distinguished by heating?
 (A) CaCO_3 and MgCO_3 (B) LiNO_3 and NaNO_3
 (C) $\text{Ba}(\text{NO}_3)_2$ and $\text{Ca}(\text{NO}_3)_2$ (D) NaHCO_3 and $\text{Mg}(\text{HCO}_3)_2$
12. **B**
13. Which of the following quantum number is different for the unpaired electrons of nitrogen?
 (A) Principal quantum number (B) Azimuthal quantum number
 (C) Magnetic quantum number (D) Spin quantum number
13. **C**
14. Which of the following compound contains sp^3 -hybridized central atom?
 (A) BF_3 (B) NF_3
 (C) ClF_3 (D) AlF_3
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

For equilibria involving solid species, the value of K_C or K_P remains unchanged by changing the amount of the solid substance. Consider a reversible reaction which contains a solid species:



The value of K_C for the above equilibrium is 64×10^{-6} at a particular temperature.

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

15. If a one litre container contains 2 moles each of X and Y at the equilibrium temperature, then the reaction will
 (A) proceed from left to right (B) proceed from right to left
 (C) be at equilibrium (D) none of these is correct
15. **B**
16. If the partial pressure of 'Y' at equilibrium is increased in such a manner that at the new equilibrium the partial pressure becomes double, it will cause the equilibrium partial pressure of 'X' to change to
 (A) four times of its original value (B) $\frac{1}{4}$ times of its original value
 (C) $\frac{1}{16}$ times of its original value (D) 16 times of its original value

16. **B****Paragraph for Question no. 17 to 18**

AgOH is a sparingly soluble salt. The equilibrium $\text{AgOH} \rightleftharpoons \text{Ag}^+(\text{aq}) + \text{OH}^-(\text{aq})$ exists if it is dissolved in water. The solubility product of AgOH is the product of ionic concentrations of Ag^+ and OH^- in a saturated solution. The solubility product (K_{sp}) of AgOH is 4×10^{-4} .

Answer the following questions on the basis of above write up. [$\log 2 = 0.3010$]

17. What is the molarity of the saturated solution of AgOH?
(A) 0.4 M (B) 0.2 M
(C) 0.02 M (D) 0.04 M

17. **C**

18. What is the minimum pH necessary to cause precipitation of AgOH from a 0.4 M AgNO_3 solution?
(A) 6 (B) 3
(C) 8 (D) 11

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. $D = [-1, 1]$ is the domain of the following functions, state which of them are injective.

(A) $f(x) = x^2$

(B) $g(x) = x^3$

(C) $h(x) = \sin 2x$

(D) $k(x) = \sin\left(\frac{\pi x}{2}\right)$

1. BD

2. If $f(x) = \frac{x^2}{x^2+1}$ then

(A) Domain of $f(x) = \mathbb{R}^+$

(B) Domain of $f(x) = \mathbb{R}$

(C) Range of $f(x) = [0, 1)$

(D) Range of $f(x) = \mathbb{R}$

2. BC

3. Which is/are correct?

(A) $\lim_{x \rightarrow 0} \frac{\sin x - x}{x^3} = -\frac{1}{6}$

(B) $\lim_{x \rightarrow 0} \frac{\sin x - x}{x^3} = \frac{1}{6}$

(C) $\lim_{x \rightarrow 0} (1+x)^{\frac{2}{x}} = e$

(D) $\lim_{x \rightarrow 0} (1+x)^{\frac{2}{x}} = e^2$

3. AD

4. If $f(x) = \sqrt{\frac{x-1}{x-2}} + \sqrt{\frac{x-2}{x-3}}$ is defined for

(A) $x \in (-\infty, 1]$

(B) $x \in (3, \infty)$

(C) $x \in (-\infty, 0]$

(D) $x \in [5, \infty)$

4. ABCD

5. Which is/are correct?

(A) Range of $f(x) = \frac{1}{3+\sin x}$ is $\left[\frac{1}{4}, 1\right]$

(B) Range of $f(x) = \frac{1}{3+\sin x}$ is $\left[\frac{1}{4}, \frac{1}{2}\right]$

(C) Domain of $f(x) = \frac{1}{3+\sin x}$ is \mathbb{R}

(D) All the above

5. BC

6. For curve $\sqrt{x} + \sqrt{y} = 7$ at P (16, 9)

(A) Length of tangent at P is $\frac{45}{4}$

(B) Length of tangent at P is 15

(C) Length of subnormal at P is 12

(D) Length of subtangent at P is 12

6. BD
7. Let $h(x) = \min\{x, x^2\}$ for every real number x . Then
 (A) h is continuous for all x
 (B) h is differentiable for all x
 (C) $h'(x) = 1$ for all $x > 1$
 (D) h is not differentiable at two values of x

7. **ACD**

(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 $f(x) = 2x^3 - 21x^2 + 36x - 30$, then which one of the following is correct.
 (A) $f(x)$ has local minima at $x = 1$ (B) $f(x)$ has local maxima at $x = 6$
 (C) $f(x)$ has local maxima at $x = 1$ (D) $f(x)$ has no local maxima or minima

8. C

9. $\int \frac{1}{x^2(x^4+1)^{3/4}} dx$ is equal to:

- (A) $\left(1 + \frac{1}{x^4}\right)^{1/4} + c$ (B) $(x^4 + 1)^{1/4} + c$
 (C) $\left(1 - \frac{1}{x^4}\right)^{1/4} + c$ (D) $-\left(1 + \frac{1}{x^4}\right)^{1/4} + c$

9. D

10. Let $f(x) = x^3 + (\lambda + 2)x^2 + 3\lambda x + 5$ then
 (A) $f(x)$ is increasing for $\lambda \in (1, 4)$ (B) $f(x)$ is increasing for $\lambda \in (4, \infty)$
 (C) $f(x)$ is increasing for $\lambda \in (-\infty, 1)$ (D) None of these

10. A

11. $\int_0^1 \sin^{-1} x \, dx =$

- (A) $\frac{\pi}{2} + 1$ (B) $\frac{\pi}{2} - 1$
 (C) $\pi - 1$ (D) None

11. B

12. $\int_0^{\pi/2} e^x \sin x \, dx$ is equal to:

- (A) $\frac{e^{\pi/2} - 1}{2}$ (B) $\frac{e^{\pi/2} + 1}{\sqrt{2}}$
 (C) $\frac{e^{\pi/2} + 1}{2}$ (D) None

12. C
13. Let $f(x) = \int_0^x e^x (x-1)(x-2) dx$. Then f decreases in the interval:
 (A) $(-\infty, -2)$ (B) $(-2, -1)$
 (C) $(1, 2)$ (D) $(2, +\infty)$
13. D
14. $f(x)$ is a cubic polynomial which has local maximum at $x = -1$. If $f(2) = 18$, $f(1) = -1$ and $f'(x)$ has local minimum at $x = 0$, then which of the following is incorrect?
 (A) $f(x)$ is increasing in $(1, 2\sqrt{5})$ (B) $f(x)$ has local minimum at $x = 1$
 (C) $f(0) = 5$ (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

Consider the function $f(x) = 3x^4 + 4x^3 - 12x^2$

15. $y = f(x)$ increases in the interval
 (A) $(-1, 0) \cup (2, \infty)$ (B) $(-\infty, 0) \cup (1, 2)$
 (C) $(-2, 0) \cup (1, \infty)$ (D) None of these
15. C
16. The range of the function $y = f(x)$ is
 (A) $(-\infty, \infty)$ (B) $[-32, \infty)$
 (C) $[0, \infty)$ (D) None of these

16. B

Paragraph for Question no. 17 to 18

If $\lim_{x \rightarrow 0} \frac{x(1 + a \cos x) - b \sin x}{x^3} = 1$ then
 $a, b \in \mathbb{R}$

17. The value of $a =$
 (A) $\frac{-5}{2}$ (B) $\frac{5}{2}$
 (C) $\frac{3}{2}$ (D) $\frac{-3}{2}$

17. A
18. Then $a + b =$
(A) -1 (B) -2
(C) -3 (D) -4
18. D

FIITJEE

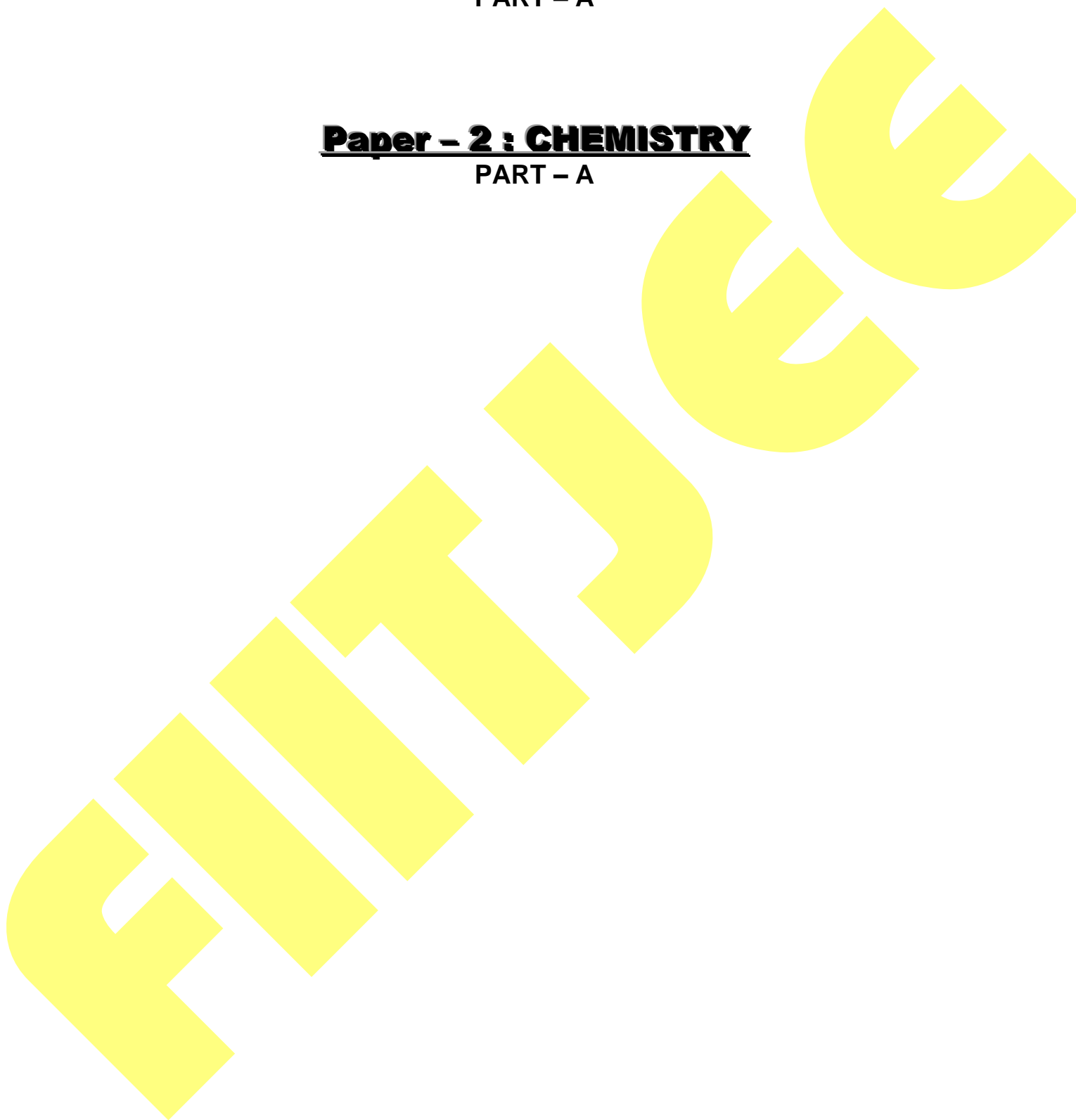
ANSWERS

SECTION-1 : PHYSICS

PART – A

Paper – 2 : CHEMISTRY

PART – A



SECTION - 3 : MATHEMATICS
PART - A

