

PHYSICS, CHEMISTRY & MATHEMATICS

QP Code:

Test- 11

Time Allotted: 3 Hours

Maximum Marks: 198

- 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 **Three Parts: Part-A, B & Part-C** 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 Three Parts.

- (i) **Part-A (01-06)** – Contains seven (06) 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: -2 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 **-2 marks**, as a wrong option is also darkened.
- (ii) **Part-B (07-12)** contains Six (06) Numerical based questions with single digit integer as answer, ranging from 0 to 9 (both inclusive) and each question carries **+3 marks** for correct answer and **-1 marks** for wrong answer.
- (iii) **Part-C (13-18)** contains Six (06) 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 **+4 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 6 **multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONE OR MORE** may be correct.

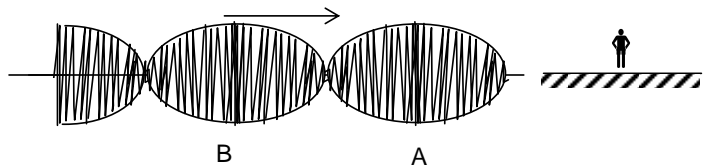
1. $Y(x,t) = \frac{0.8}{\left[(4x+5t)^2+5\right]}$ represents a moving pulse where x and y are in metres and in t

second. Then

- (A) pulse is moving in positive x-direction (B) in 2 s it will travel a distance of 2.5 m
(C) its maximum displacement is 0.16 m (D) it is a symmetric pulse

1. **BCD**

2. Two tuning fork is vibrated Simultaneously having frequency 254 Hz and 258 Hz .The pattern of vibration Of pressure is shown in the figure as a function of x.



A gentleman standing along x axis detect the phenomena

- (A) The phenomenon is beats and having beat time period 0.25 sec.
(B) The time taken by the pattern lying between A and B takes 0.25 sec to cross the gentleman.
(C) Some time he detect maximum intense sound and some time very low intense sound.
(D) The beat frequency observed by gentleman will be 4 Hz.

2. **BCD**

3. Two waves travelling in opposite directions produce a standing wave. The individual wave functions are given by $y_1 = 4 \sin(3x - 2t)$ and $y_2 = 4 \sin(3x + 2t)$ cm, where x and y are in cm

- (A) The maximum displacement of the motion at $x = \frac{3\pi}{4}$ cm is 4 cm.
(B) The maximum displacement of the motion at $t = \frac{\pi}{6}$ sec is $4\sqrt{2}$ cm.
(C) Nodes are formed at x values given by $0, \pi/3, 2\pi/3, \pi, 4\pi/3, \dots$
(D) Antinodes are formed at x values given by $\pi/6, \pi/2, 5\pi/6, 7\pi/6, \dots$

3. **CD**

4. A vibrating string produces 2 beats per seconds when sounded with a tuning fork of frequency 256 Hz. increasing the tension in the string produces 3 beats per second. The initial frequency of the string may have been

- (A) 253 Hz (B) 254 Hz
(C) 258 Hz (D) 259 Hz

4. **BC**

5. One end of a string of length L is tied to ceiling of lift accelerating upwards with an acceleration 3g. The other end of the string is free. The linear mass density of string varies linearly from original zero to λ from bottom to top. Then correct statement for wave travelling in string

- (A) Wave speed is increasing as it travels from bottom to top.
(B) Acceleration of wave on string is uniform.
(C) Time taken by pulse to reach from bottom to top will be $\sqrt{2L/g}$
(D) None of the above

5. **ABC**

6. A plane wave $y = A \sin \left\{ \omega \left(t - \frac{x}{v} \right) \right\}$ undergo a normal incidence on a plane boundary separating medium M_1 and M_2 and splits into a reflected and transmitted wave having speeds v_1 and v_2 then
- (A) for all values of v_1 and v_2 the phase of transmitted wave is same as that of incident wave.
- (B) for all values of v_1 and v_2 the phase of reflected wave is same as that of incident wave.
- (C) the phase of transmitted wave depends upon v_1 and v_2 .
- (D) the phase of reflected wave depends upon v_1 and v_2 .
6. **AD**

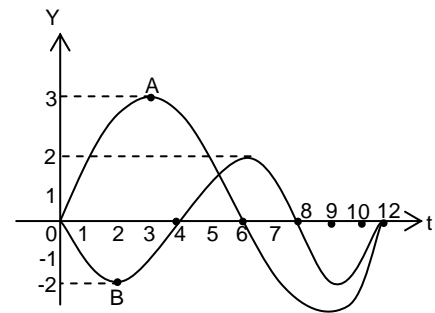
PART – B

Integer Answer Type

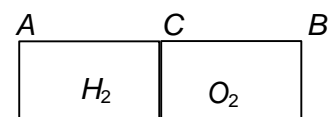
This section contains **6 questions**. The answer to each of the questions is a single digit integer, ranging from **0 to 9**.

7. The displacement Vs time graph for two waves A and B which travel along the same string are shown in figure.

Determine the ratio of their Intensity $\frac{I_A}{I_B}$



7. **1**
8. A bus is moving towards a huge wall with a velocity of 5 m/s. The driver sounds a horn of frequency 200Hz. The frequency of the beats heard by a passenger of the bus will be (In Hz) nearly (velocity of sound in air = 338 m/s)
8. **6**
9. Sound waves of frequency 16 kHz are emitted by two coherent point sources of sound placed 2 m apart at the centre of a circular train track of radius $1000/\pi$ meter. Find the number of maxima per second observed by person riding the train running at a speed of 36 km/h. [velocity of sound in air 320 m/s]
9. **2**
10. An organ pipe P_1 closed at one end vibrating in its first overtone and another pipe P_2 open at the both ends vibrating in its third overtone are in resonance with a given tuning fork. The ratio of the length of P_1 to that of P_2 is $\frac{3}{n}$ then $n = ?$
10. **8**
11. AB is a cylinder of length 1 m fitted with a thin flexible diaphragm C at the middle and two other thin flexible diaphragms A and B at the ends. The portions AC and BC contain hydrogen and oxygen.
- The diaphragms A and B are set in vibrations of same frequency. If the minimum frequency of these vibrations for which the diaphragm C is a node under the conditions given is $550X$ find the value of X (the velocity of sound in hydrogen is 1100 m/sec and in oxygen 300 m/sec)?



11. **3**

12. Three sources of same Intensity and frequencies $f-1, f, f+1$ are emitting waves simultaneously. The number of beats heard by the observer will be.

12. **2**

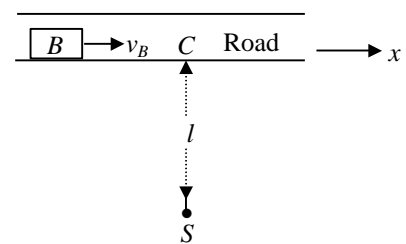
PART – C (Numerical based)

This section contains **6 questions**, numerical based questions, (answer of which maybe positive or negative numbers or decimals).

1. S_1 and S_2 are two loudspeakers with the same frequency of 165 Hz and their individual intensity at P is 1.6×10^{-3} and $2.5 \times 10^{-3} \text{ w/m}^2$ respectively. Where P is a point at a distance 4 m from S_1 and 3m from S_2 . If they vibrate in same phase the intensity at P when S_1 and S_2 both are on S_1 and S_2 on is $\chi \times 10^{-4} \text{ w/m}^2$. Find χ . (take velocity of sound = 330 m/s).

1. **1**

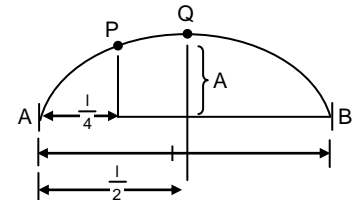
2. A bus B is moving with a velocity v_B in the positive x-direction along a road as shown in the figure. A shooter 'S' is at a distance l from the road. He has a detector which can detect signals only of frequency 1500Hz. The bus blows horn of frequency 1000 Hz. When the detector detects a signal the shooter immediately shoots towards the road along SC and the bullet hits the bus. Find the value of 'n' if the velocity of the bullet is $34n$ (velocity of sound in air is $v = 340 \text{ m/s}$



and $\frac{v_B}{v} = \frac{2}{3\sqrt{3}}$)

2. **4**

3. A string vibrates with one loop between the fixed points A and B. The ratio of maximum velocities of Q and P is



3. **1.41**

4. At $t = 0$, a transverse wave pulse travelling in negative x-direction with speed 2 m/s in wire is given by $y = 4/x^2$ given that $x \neq 0$ then transverse velocity of particle at $x = 2 \text{ m}$ and $t = 2 \text{ s}$, in (cm/s)is

4. **-7.41**

5. The frequency of a sonometer wire is 100 Hz. When the weights producing the tensions are completely immersed in water the frequency becomes 80 Hz and on immersing the weights in a certain liquid the frequency becomes 60 Hz. The specific gravity of the liquid is.

5. **1.77**

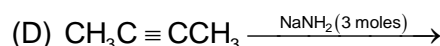
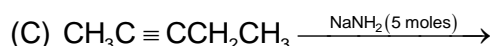
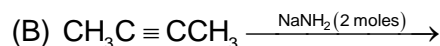
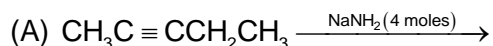
6. The power of sound from a speaker is raised from 10 mW to 500 mW. What is the power increased in (decibel) dB as compared to initial original power. ($\log 50 = 1.69$)

6. **16.9**

SECTION-2 : CHEMISTRY**PART – A****(Multi Correct Choice Type)**

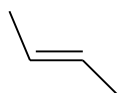
This section contains 6 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which **ONE OR MORE** may be correct.

1. Which of the following alkynes should react with the given amount of NaNH_2 to form sodium salts?

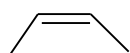


1. ACD

- 2.



(I)



(II)

Choose the correct properties

(A) Boiling point: II > I

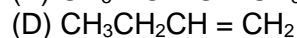
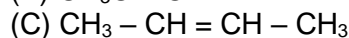
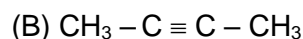
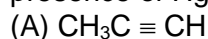
(B) Melting point: I > II

(C) Solubility in polar solvent: II > I

(D) Reactivity towards hydrogenation reaction: II > I

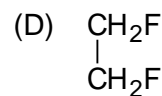
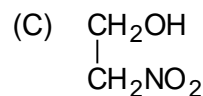
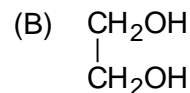
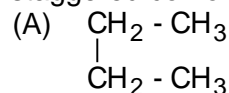
2. ABCD

3. Which of the following compound(s) form carbonyl compounds upon reaction with H_2O in presence of Hg^{2+} ?



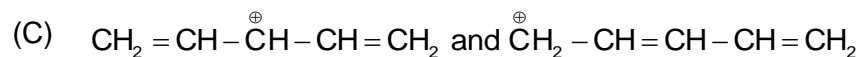
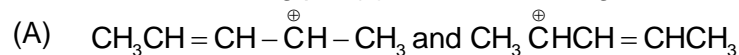
3. AB

4. For which of the following compound(s) the gauche conformer is more stable than the staggered conformer?



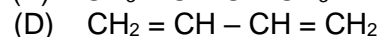
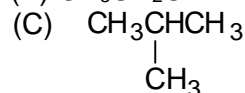
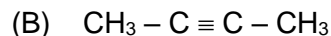
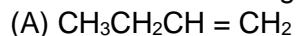
4. BCD

5. Which of the following pair(s) is/are resonating structures?



5. BC

6. Which of the following compounds can decolourise bromine water?

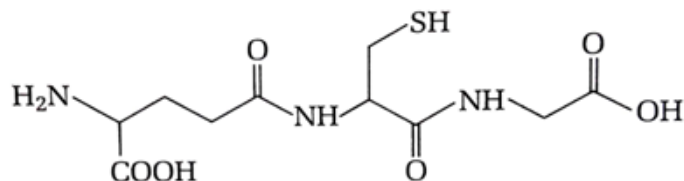


6. ABD

PART – B
Integer Answer Type

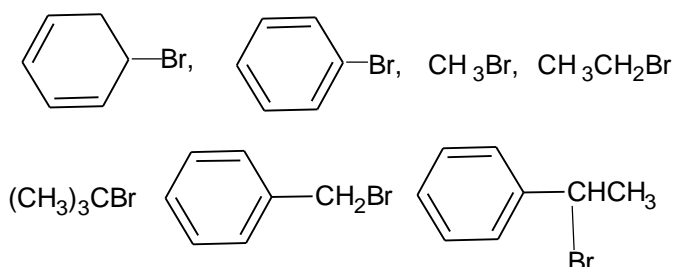
This section contains **6 questions**. The answer to each of the questions is a single digit integer, ranging from **0 to 9**.

7. How many stereogenic centres are there in the following naturally occurring antioxidant ? (glutathione)



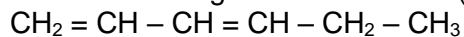
7. 2

8. How many of the following would give E¹ reactions easily (considering alkyl halides can undergo E¹ on addition of suitable reagent)?



8. 3

9. The number of geometrical isomer(s) formed by the following compound is:



9. 2

10. $\text{CH}_4 \xrightarrow[\text{h}\nu]{\text{Cl}_2(\text{excess})} \text{P} + \text{Q} + \text{R} + \text{S}$

The molecular mass of the product(s) formed follows the order: $\text{P} < \text{Q} < \text{R} < \text{S}$.

How many product(s) has/have zero dipole moment?

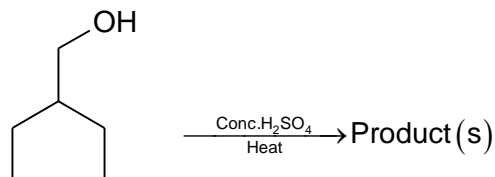
10. 1

11. $\text{CH}_3\text{CH}_2\underset{\text{Cl}}{\text{CH}}\text{CH}_3 \xrightarrow[\text{E}_2 \text{ reaction}]{\text{Alcoholic KOH}/\Delta} \text{Product(s)}$

How many product(s) is /are formed in the above reaction? (consider stereoisomers)

11. 3

- 12.



How many cyclohexene(s) is/are formed in the above reaction?

12. 1

PART – C

(Numerical based)

This section contains **6 questions**, numerical based questions, (answer of which maybe positive or negative numbers or decimals).

13. Number of distinct monochlorinated products, (including stereoisomers) are x obtained when the alkane shown below is heated in the presence of Cl_2 . Find value of $x/2$?



13. 0.5

14. Number of distinct monochlorinated products, (including stereoisomers) x obtained when the alkane shown below is heated in the presence of Cl_2 . Find value of $x/5$?

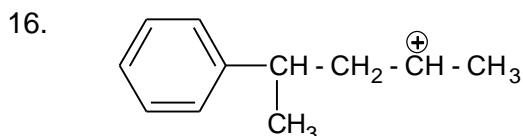


14. 1.6

15. How many of the following compound(s) form(s) precipitate with ammonical silver nitrate (AgNO_3) solution?

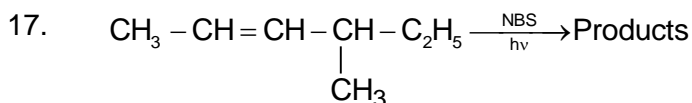
$\text{CH}_2 = \text{CH}_2$, $\text{HC} \equiv \text{CH}$, $\text{CH}_3 - \text{C} \equiv \text{C} - \text{CH}_3$, $\text{CH}_3 - \text{C} \equiv \text{CH}$, $\text{CH}_3\text{CH} = \text{CHCH}_3$, $\text{CH}_3\text{CH}_2\text{C} \equiv \text{CH}$, $\text{PhC} \equiv \text{CH}$, $\text{CH}_3\text{CH}_2\text{CH} = \text{CH}_2$ and $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH} = \text{CH}_2$

15. 4.00



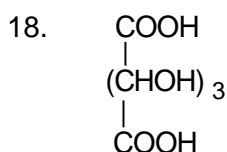
How many maximum number of carbocations is/are formed by rearrangement of the above carbocation? [Consider stereoisomers] (Do not consider the given carbocations as one isomer)

16. 4.00



How many stereoisomer(s) is/are possible by the major product of above reaction? [Consider the product as an isomer]

17. 4.00



No. of meso compound(s) is/are possible for 2, 3, 4-trihydroxypentan-1, 5-dioic acid = x . Find the value of $x/5$?

18. 0.4

SECTION-3 : MATHEMATICS**PART – A****(Multi Correct Choice Type)**

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

1. The equation $(3 + \cos x)^2 = 4 - 2\sin^8 x$ has
 (A) exactly one solution in $x \in (0, 3\pi)$ (B) exactly three solutions
 (C) exactly two solutions $x \in [0, 5\pi)$ (D) infinite solutions

1. AC

2. The solution of the equation $(\tan^2 x - 1)^{-1} = 1 + \cos 2x$ satisfy the inequality $2^{x+1} - 8 > 0$ are
 (A) $x = n\pi - \frac{\pi}{2}, n \in \mathbb{I}$ (B) $x = n\pi + \frac{\pi}{3}$
 (C) $x = n\pi - \frac{\pi}{3}$ (D) None of these

2. BC

3. If H is the orthocenter of an acute angle triangle whose circum – circle is $x^2 + y^2 = 16$, then circumdiameter of ΔHBC is greater than
 (A) 1 (B) 2
 (C) 4 (D) 8

3. ABC

4. In ΔABC , AD, BE and CF are the medians of a ΔABC , then
 $(AD^2 + BE^2 + CF^2) : (BC^2 + CA^2 + AB^2)$ is equal to
 (A) 3 : 4 (B) 3 : 2
 (C) Minimum value of $\frac{3}{8}(\tan^2 \theta + \cot^2 \theta)$ (D) Minimum value of $\frac{1}{3}(\tan^2 \theta + \cot^2 \theta)$

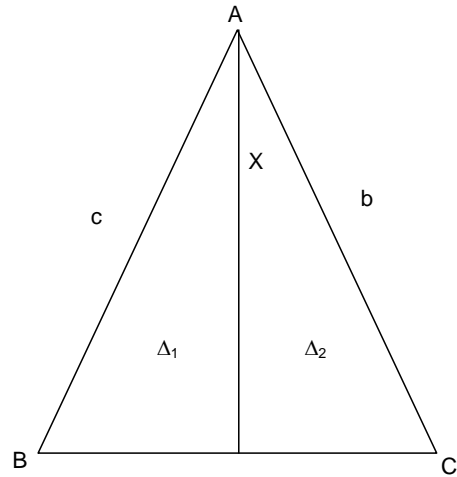
4. AC

5. The sides of a ΔABC satisfy the equation $2a^2 + 4b^2 + c^2 = 4ab + 2ac$. Then
 (A) the triangle is isosceles (B) the triangle is obtuse
 (C) $B = \cos^{-1} \frac{7}{8}$ (D) $A = \cos^{-1} \frac{1}{4}$

5. ACD

6. In a triangle ABC, with usual notations the length of the bisector of internal angle A is

- (A) $\frac{2bc \cos \frac{A}{2}}{b+c}$
 (B) $\frac{2bc \sin \frac{A}{2}}{b+c}$
 (C) $\frac{abc \operatorname{cosec} \frac{A}{2}}{2R(b+c)}$
 (D) none



6. AC

PART – B

Integer Answer Type

This section contains **6 questions**. The answer to each of the questions is a single digit integer, ranging from **0 to 9**.

7. If p_1, p_2 and p_3 are the altitudes of a triangle from vertices A, B and C respectively and Δ is the area of the triangle and $\frac{1}{p_1} + \frac{1}{p_2} - \frac{1}{p_3} = \frac{\lambda ab}{(a+b+c)\Delta} \cos^2 \frac{C}{2}$, then find the value of λ .

7. 2

8. In a ΔABC if the angles A, B, C are in A.P. and $\lambda \cos \frac{A-C}{2} = \frac{a+c}{\sqrt{a^2-ac+c^2}}$, then find the value of λ .

8. 2

9. Let ABC be a triangle with altitudes h_1, h_2, h_3 and inradius r and

$$\frac{h_1+r}{h_1-r} + \frac{h_2+r}{h_2-r} + \frac{h_3+r}{h_3-r} \geq \lambda, \text{ then find the value of } \lambda$$

9. 6

10. In a triangle ABC, if $\sin 10A + \sin 10B + \sin 10C = \lambda \sin 5A \sin 5B \sin 5C$, then find the value of λ .

10. 4

11. If $\tan \beta = \frac{\tan \alpha + \tan \gamma}{1 + \tan \alpha \tan \gamma}$ and $\sin 2\beta = \frac{\sin 2\alpha + \sin 2\gamma}{\lambda + \sin 2\alpha \sin 2\gamma}$, then find the value of λ .

11. 1

12. Find the number of solution of the equation $\cos^{n+1} x - \sin^{n+1} x = 1$ in $[0, 2\pi]$, where n is an odd natural number

12. 1

PART – C
(Numerical based)

This section contains **6 questions**, numerical based questions, (answer of which maybe positive or negative numbers or decimals).

13. Number of value(s) of $x \in [0, 2\pi]$ which satisfies the equation $\sin^2 x + \operatorname{cosec}^2 x = \cos^2 x + \sec^2 x$ is

13. 4.00

14. Number of value(s) of $x \in [0, 4\pi]$ satisfying the equation $\cos x - \tan x = \cot x$ is λ then $\lambda + 1$

14. 1.00

15. With usual notations in ΔABC , let $\angle A = 60^\circ$ and b, c are roots of the equation $x^2 - 2\sqrt{3}x + 1 = 0$. If the value of $\sum (a+b)\cos C$ equals $p + 2\sqrt{q}$, where $p, q \in \mathbb{N}$, then find the value of $(p + q)$.

15. 6.00

16. Let a, b and c be the side lengths of a triangle ABC and assume that $a \leq b$ and $a \leq c$. If $x = \frac{b+c-a}{2}$, then find the minimum value of $\frac{ax}{rR}$, where r and R denotes inradius and circumradius of triangle ABC.

16. 3.00

17. On one bank of a river, there is a tree. On another bank, an observer makes an angle of elevation of 60° at the top of the tree. The angle of elevation of the top of the tree at a distance 20m away from the bank is 30° . The width of the river is λ meter then find λ

17. 10.00

18. In a triangle ABC, if $r_1 + r_3 + r = r_2$, then find the value of $(\sec^2 A + \operatorname{cosec}^2 B - \cot^2 C)$.
[Note: All symbols used have usual meaning in a triangle.]

18. 2.00

ANSWERS

SECTION-1 : PHYSICS

PART – A

PART – B

SECTION – 2 : CHEMISTRY

PART – A

PART – B

SECTION – 3 : MATHEMATICS

PART – A

PART – B