

PHYSICS, CHEMISTRY & MATHEMATICS

Pattern - 1

QP Code:

TEST - 1

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 **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 (01-06)** – 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-A (07-12)** – 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 option(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-B (01-06)** 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

(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**.

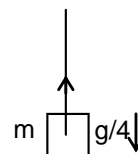
1. Given the $\vec{A} + \vec{B} = \vec{C}$ and that \vec{C} is \perp to \vec{A} . Further if $|\vec{A}| = |\vec{C}|$, then what is the angle between \vec{A} and \vec{B}

(A) $\frac{\pi}{4}$ radian (B) $\frac{\pi}{2}$ radian (C) $\frac{3\pi}{4}$ radian (D) π radian

1. **C**

2. The work done by tension in lowering down a block of mass = m kg through a distance 'd' is

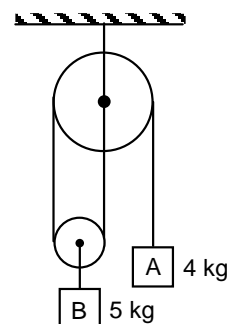
(A) $mg \frac{d}{4}$ (B) $3mg \frac{d}{4}$
 (C) $-3mg \frac{d}{4}$ (D) mgd



2. **C**

3. The acceleration of the blocks (A) and (B) respectively in situation shown in the figure is: (pulleys & strings are massless)

(A) $\frac{2g}{7}$ downward, $\frac{g}{7}$ upward
 (B) $\frac{2g}{3}$ downward, $\frac{g}{3}$ upward
 (C) $\frac{10g}{13}$ downward, $\frac{5g}{13}$ upward
 (D) none of these



3. **A**

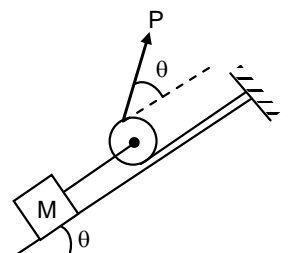
4. The resultant of $\vec{A} + \vec{B}$ is \vec{R}_1 . On reversing the vector \vec{B} , the resultant becomes \vec{R}_2 , what is the value of $R_1^2 + R_2^2$

(A) $A^2 + B^2$ (B) $A^2 - B^2$ (C) $2(A^2 + B^2)$ (D) $2(A^2 - B^2)$

4. **C**

5. What should be the minimum force P to be applied to the string so that block of mass m just begins to move up the frictionless plane?

(A) $\frac{Mg \tan \theta}{2}$ (B) $\frac{Mg \cot \theta}{2}$
 (C) $\frac{Mg \cos \theta}{1 + \sin \theta}$ (D) none of these



5. **A**

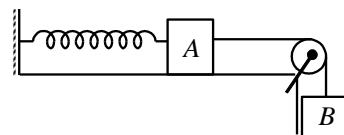
6. A body is moving in a circle at a uniform speed v . The magnitude of the change in velocity when the radius vector describes an angle 60° is
- (A) v (B) $\frac{v}{2}$ (C) $\frac{\sqrt{3}}{2}v$ (D) $\frac{v}{3}$

6. **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.

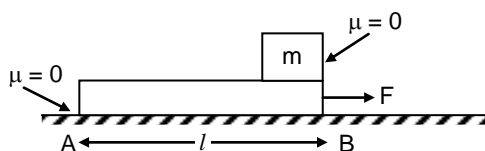
7. In the adjoining figure block A is of mass m and block B is of mass $2m$. The spring has a force constant k . All the surfaces are smooth and the system is released from rest with spring unstretched



- (A) The maximum extension of the spring is $\frac{4mg}{k}$
- (B) The speed of block A when extension in spring is $\frac{2mg}{k}$, is $2g\sqrt{\frac{2m}{3k}}$
- (C) Net acceleration of block B when the extension in the spring is maximum, is $\frac{2}{3}g$.
- (D) Tension in the thread for extension of $\frac{2mg}{k}$ in spring is mg .

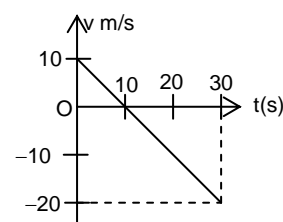
7. **ABC**

8. In the figure, a small block is kept on m , then
- (A) The acceleration of m w.r.t. ground is $\frac{F}{m}$
- (B) The acceleration of m w.r.t. ground is zero
- (C) The time taken by m to separate from M is $\sqrt{\frac{2\ell m}{F}}$
- (D) The time taken by m to separate from M is $\sqrt{\frac{2\ell M}{F}}$



8. **AC**

9. 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 at $t = 30$ s.
- (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.

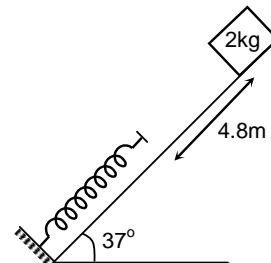


9. **AD**

10. A man has to hold his umbrella at 30° with the vertical to keep himself dry. He, then runs at a speed of 10 m/s leaving umbrella behind and finds the raindrops to be hitting him vertically. Speed of the raindrop with respect to the earth is
 (A) 10m/s (B) $20\sqrt{3}$ m/s (C) 20m/s (D) $10\sqrt{3}$ m/s

10. **C**

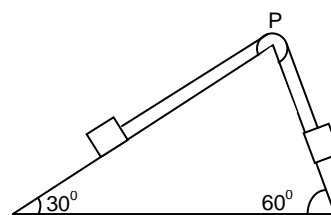
11. Figure shows a massless spring fixed at the bottom end of an inclined of inclination 37° ($\tan 37^\circ = 3/4$). A small block of mass 2 kg start slipping down the incline from a point 4.8 m away from free end of spring. The block compresses the spring by 20 cm, stops momentarily and then rebounds through a distance 1 m up the inclined, then ($g = 10 \text{ m/s}^2$)



- (A) coefficient of friction between block and inclined is 0.5.
 (B) coefficient of friction between block and inclined is 0.75.
 (C) value of spring constant is 1000 N/m.
 (D) value of spring constant is 2000 N/m.

11. **AC**

12. Two blocks of masses $m_1 = 3\text{kg}$ and $m_2 = \frac{1}{\sqrt{3}} \text{ kg}$ are connected by a light inextensible string which passes over a smooth pulley. The blocks rest on the inclined smooth planes of a wedge and the pulley is fixed to the top of the wedge. The planes of the wedge supporting m_1 and m_2 are inclined at 30° and 60° respectively, with the horizontal. then
 (A) acceleration of masses will be 2.79 m/s^2
 (B) tension in the string will be 4.2N
 (C) acceleration of masses will be 2.39 m/s^2
 (D) tension in the string will be 6.6N



12. **AD**

PART – B (Numerical based)

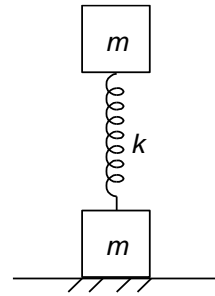
1. A particle of mass m is moving in a circular path of constant radius $r(1\text{m})$ such that it's centripetal acceleration a_c is varying with time t as $a_c = k^2rt^2$, where k is a constant, then power delivered to the particle by the forces acting on it at $t = 5 \text{ sec}$. (take $mk^2 = 1 \text{ unit}$)

1. **5**

2. If $\vec{A} \cdot \vec{B} = |\vec{A} \times \vec{B}|$ and $|\vec{A}|$ & $|\vec{B}|$ are $\frac{1}{\sqrt{2}}$ and 3 respectively, determine $|\vec{C}| = |\vec{A} \times \vec{B}|$.

2. **1.5**

3. A system consists of two identical slabs each of mass m linked by compressed weightless spring of stiffness k as shown in Figure. The slabs are also connected by a thread, which is burnt at a certain moment. If the value of $\Delta \ell$ the initial compression of spring, the lower slab will bounce up after the thread is burned through is $\frac{xmg}{k}$, then find the value of 'x'.



3. **3**
4. A particle starts with initial velocity 10 m/s along positive x direction with an acceleration 5 m/s^2 along negative x direction. Find the displacement (in meters) of the particle in 5 seconds.
4. **-12.5**
5. If the sum of two unit vectors is a unit vector, find the magnitude of their difference.
5. **1.73**
6. A locomotive of mass m starts moving so that its speed varies according to the law $v = a\sqrt{S}$ where a is a constant and S is the distance covered. If the total work performed by all the forces, which are acting on the locomotive during the first t seconds after the beginning of motion is $\frac{ma^2t^2}{x}$, then find the value 'x'.
6. **8**

SECTION-2 : CHEMISTRY

PART – A

(Single Correct Choice Type)

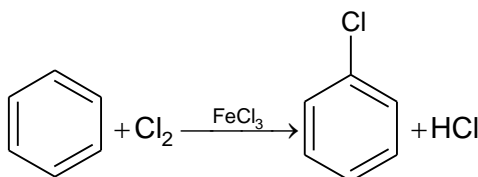
This section contains **6 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct**.

1. Geometrical isomerism is not displayed by
 (A) $\text{CH}_3\text{CH}=\text{CH}-\text{CH}=\text{CHCH}_3$ (B) $\text{H}_2\text{C}=\text{CH}-\text{CH}=\text{CH}-\text{CH}=\text{CH}_2$
 (C) $(\text{CH}_3)_2\text{C}=\text{CH}-\text{CH}_2-\text{CH}=\text{CH}_2$ (D) $\text{CH}_3\text{CH}=\text{CHCH}_2\text{CH}_2\text{CH}_3$

1. C

2. In which of the following reaction decolourisation of Cl_2 takes place?

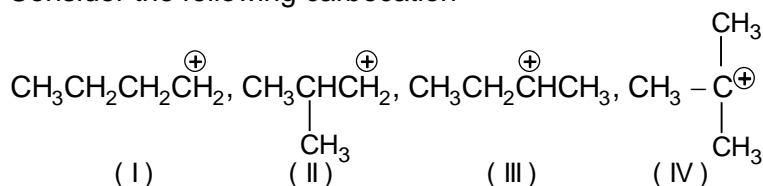
- (A) $\text{CH}_4 + \text{Cl}_2 \xrightarrow{h\nu} \text{CH}_3\text{Cl} + \text{HCl}$
 (B) $\text{CH}_2=\text{CH}_2 + \text{Cl}_2 \xrightarrow{\text{CCl}_4} \text{Cl}-\text{CH}=\text{CH}-\text{Cl}$
 (C)



- (D) All are correct

2. D

3. Consider the following carbocation

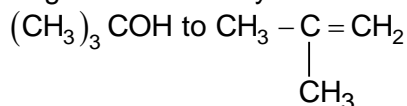


Choose correct statement

- (A) The charge density is the highest in carbocation(IV)
 (B) Hybridization of all carbon atoms in (III) is sp^2
 (C) If the chloride of all the carbocations undergo ionization, maximum amount of (IV) will be formed as compared to other carbocations.
 (D) (I) can form the lowest number of hyperconjugation structure.

3. C

4. Which reagent cannot dehydrate?

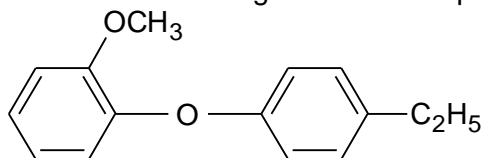


- (A) $\text{Cu}/300^\circ\text{C}$ (B) $\text{Conc. H}_2\text{SO}_4/\Delta$
 (C) $\text{Anhy ZnCl}_2/\text{Conc. HCl}$ (D) $\text{Conc. H}_3\text{PO}_4/\Delta$

4. C

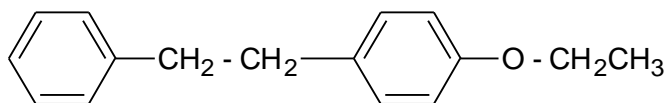
5. Which ether forms the largest number of products when treated with excess of HI?

(A)



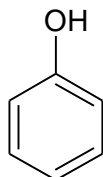
(B) $\text{CH}_3\text{OC}_2\text{H}_5$

(C)



(D) $\text{CH}_3\text{CH}_2\text{OCH}_2\text{CH}_3$

5. B



6. An alkane is formed when phenol

(A) NaOH

(C) $\text{CH}_3\text{Cl}/\text{Anhy. AlCl}_3$

reacts with

(B) CH_3MgBr

(D) Zn dust/ Δ

6. B

(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.

7. Which of the following reactions of alkanes take(s) place with cleavage of C – C bond?

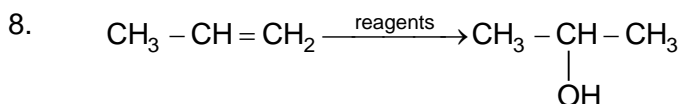
(A) Nitration

(B) Chlorination

(C) Pyrolysis

(D) Bromination

7. AC



The reagent(s) which can be used in above reaction is/are

(A) $\text{H}_2\text{O}/\text{H}^+$

(B) $\frac{\text{Hg}(\text{OCOCH}_3)_2, \text{H}_2\text{O}}{\text{NaBH}_4}$

(C) $\frac{\text{B}_2\text{H}_6, \text{THF}}{\text{NaOH}, \text{H}_2\text{O}_2}$

(D) $\text{Cl}_2/\text{H}_2\text{O}$

8. AB

9. $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3$ and $\text{CH}_3\text{CH}_2\text{C} \equiv \text{CH}$ can be distinguished by

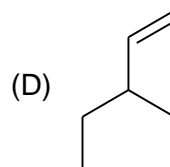
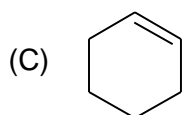
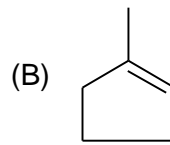
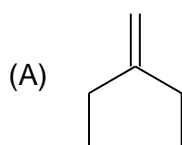
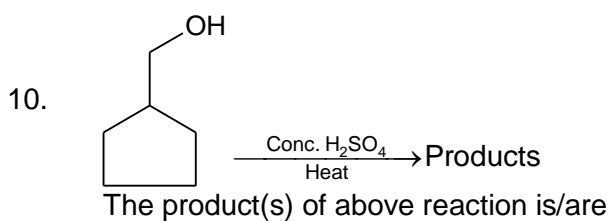
(A) Br_2/CCl_4

(B) $\text{NH}_4\text{OH}/\text{AgNO}_3$

(C) H_2/Ni

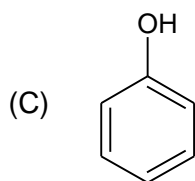
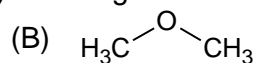
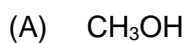
(D) $\text{H}_2\text{O}/\text{H}^+$

9. AB



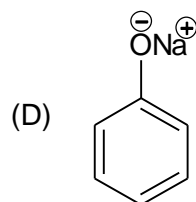
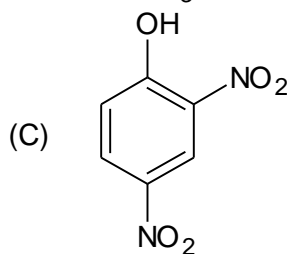
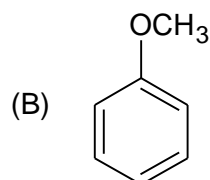
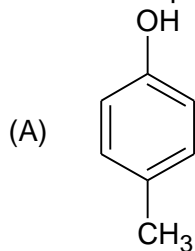
10. ABC

11. Which of the following substance(s) react(s) with Grignard's reagent?



11. ACD

12. Which of the following can be the product(s) of electrophilic aromatic substitution(EAS) reactions of phenol?

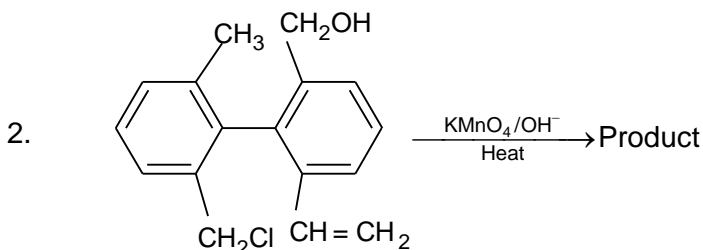


12. AC

PART – B (Numerical based)

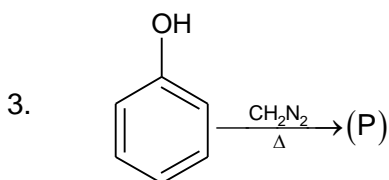
1. How many cyclic structural isomer(s) is/are possible with formula C_5H_{10} ?

1. 5



How many oxygen atom(s) is/are present in the organic product of above reaction?

2. 8



What is the molar mass difference between the reactant(Phenol) and product(P) in $g\ mol^{-1}$ unit in above reaction?

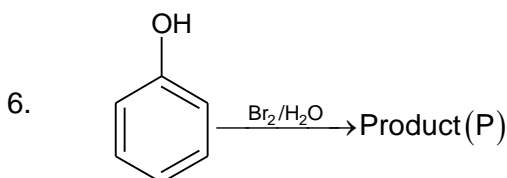
3. 14

4. The molecular formula of a fluorine substituted monocarboxylic acid is $C_5H_9O_2F$. How many total number of hydrogen atom(s) is/are present in the α - and β -carbon atoms of it's most acidic isomer?

4. 3

5. For the compound 2, 3-dichlorobutane
 If x = Total number of optical isomers
 y = Total number of optically active isomers
 z = Number of diastereomer pair
 What is the value of $(x + y + z)$?

5. 7



How many bromine atom(s) is/are present in the product(P) in above reaction?

6. 3

SECTION-3 : MATHEMATICS

PART – A

(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**.

1. The domain of the function $f(x) = \log_x(x+2)$ is
 (A) $(0, \infty)$ (B) $(-2, \infty)$
 (C) $(0, 1) \cup (1, \infty)$ (D) none of these

1. C

2. $\lim_{x \rightarrow \frac{\pi}{3}} \frac{\tan^3 x - 3 \tan x}{\cos\left(x + \frac{\pi}{6}\right)} =$
 (A) 24 (B) -24
 (C) $\frac{1}{24}$ (D) $-\frac{1}{24}$

2. B

3. Let f and g be differentiable function such that $f'(x) = 2g(x)$ and $g'(x) = -f(x)$, and $T(x) = (f(x))^2 - (g(x))^2$. Then $T'(x)$ is equal to
 (A) $T(x)$ (B) 0
 (C) $2f(x)g(x)$ (D) $6f(x)g(x)$

3. D

4. If $f(x) = \begin{cases} x + \alpha, & x < 3 \\ 4, & x = 3 \\ 3x - 5, & x > 3 \end{cases}$ is continuous $x = 3$, then the value of α is
 (A) 1 (B) 2
 (C) 3 (D) No real values of α is possible

4. A

5. Which one of the following functions is continuous for all real x but has at least one point where it is not differentiable?
 (A) $f(x) = \frac{|x|}{x}$ (B) $f(x) = \tan x$
 (C) $f(x) = x^{1/3}$ (D) $f(x) = e^{-x}$

5. C

6. If $f(x)$ and $g(x)$ be two given functions with all real numbers as their domain, then $h(x) = (f(x) + f(-x))(g(x) - g(-x))$. is
- (A) always an odd function
 (B) an odd function only when both the f and g are odd
 (C) an odd function only when f is even and g is odd
 (D) none of these
6. 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.

7. If $\lim_{n \rightarrow \infty} \left(an - \frac{1+n^2}{1+n} \right) = b$, where b is a finite number, then
- (A) $a = 1$ (B) $a = 0$
 (C) $b = 1$ (D) $b = -1$

7. **AC**

8. $D = [-1, 1]$ 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) $k(x) = \sin\left(\frac{\pi x}{2}\right)$

8. **BD**

9. The function $f(x) = \sin^{-1}(\cos x)$ is
- (A) Discontinuous at $x = 0$ (B) continuous at $x = 0$
 (C) Differentiable at $x = 0$ (D) $\lim_{x \rightarrow 0} f(x) = \frac{\pi}{2}$

9. **BD**

10. If $f(x) = \left[x^{-2} \left[x^2 \right] \right]$, $x \neq 0$, then (where $[.]$ denotes GIF)
- (A) $f(x)$ is continuous everywhere
 (B) $f(x)$ is discontinuous at $x = \sqrt{2}$
 (C) $f(x)$ is non-differentiable at $x = 1$
 (D) $f(x)$ is discontinuous at infinitely many points

10. **BCD**

11. Which of the following statement(s) is/are INCORRECT?
- (A) If the graph of $y = f(x)$ has a unique tangent at point $x = a$ then the function $f(x)$ is said to be differentiable at point $x = a$.
- (B) Every function can be expressed uniquely as the sum of an even and an odd function.
- (C) If $f : A \rightarrow B$ is injective and $g : B \rightarrow C$ is surjective, then $g \circ f : A \rightarrow C$ must be bijective.
- (D) The value of $\lim_{x \rightarrow -\infty} \frac{3x-2}{\sqrt{4x^2+1}}$ is $\frac{3}{2}$.

11. **ABCD**

12. The function $f : \mathbb{R} \rightarrow (-1, 1)$ defined by $f(x) = \frac{e^x - e^{-x}}{e^x + e^{-x}}$, then
- (A) $f(x)$ is a non-bijective function
- (B) $f(x)$ is a bijective function
- (C) $f^{-1}(x) = \frac{1}{2} \log \left(\frac{1+x}{1-x} \right)$
- (D) $f(x)$ is many – one onto function

12. **BC**

PART – B
(Numerical based)

1. Let $f(x) = \begin{cases} k, & x = 3 \\ \frac{2x^3 + 3x^2 - 32x + 15}{(x-3)}, & x \neq 3 \end{cases}$. The value of k for which $f(x)$ is continuous for all real values of x , is

1. **40**

2. Let $f(x) = \frac{ax^2 + bx + c}{x+1}$ such that $\lim_{x \rightarrow 0} f(x) = 2$ and $\lim_{x \rightarrow \infty} f(x) = 1$. Find the value of $(a+b+c)$.

2. **3**

3. The domain of the function $f(x) = \frac{\sin^{-1}(x-3)}{\sqrt{9-x^2}}$ is $[\alpha, \beta)$, then $\alpha - \beta$ will be equal to

3. **-1**

4. If fractional part of $\frac{1}{x}$ and x^2 are equal for some $x \in (\sqrt{2}, \sqrt{3})$ then the value of $x^4 - \frac{3}{x}$ is

4. **5**

5. $\lim_{x \rightarrow \infty} \left(\frac{x^2 + 5x + 3}{x^2 + x + 3} \right)^x$ is equal to e^α , then α will be equal to

5. **4**

6. The number of points of discontinuity of $f(x) = [x^2 - 3]$ in $\left[-\frac{1}{2}, 4\right]$ is ([.] is GIF)
6. **15**

ANSWERS

SECTION-1 : PHYSICS

PART – A

PART – B

SECTION – 2 : CHEMISTRY

PART – A

PART – B

SECTION – 3 : MATHEMATICS

PART – A

PART – B