

PHYSICS, CHEMISTRY & MATHEMATICS

Pattern - CPT-1

QP Code: 100105

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 to **Two decimal places** (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 : _____

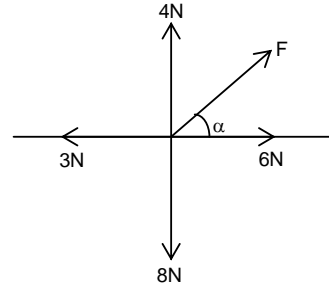
BATCHES – NWCMPB223A1-A2 & NWCMPD223A1_PT1

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.

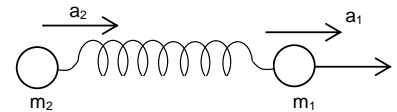
1. Five concurrent forces are acting on a body. For the body to remain in equilibrium under these five forces:

- (A) $F = 10 \text{ N}$
 (B) $F = 5 \text{ N}$
 (C) $90^\circ < \alpha < 180^\circ$
 (D) $180^\circ < \alpha < 270^\circ$



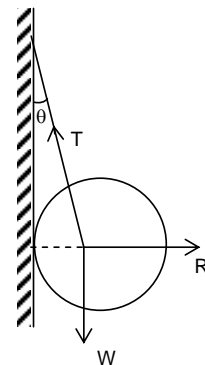
2. A spring connects two particles m_1 and m_2 horizontal force F acts on m_1 shown in figure. When the elongation of the spring is x then

- (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



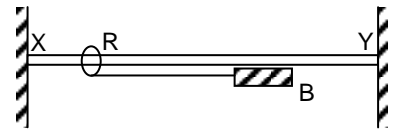
3. A metallic sphere is hung by a string fixed to a wall. The forces acting on the sphere are shown in figure. Which of the following statement is correct

- (A) $\vec{R} + \vec{T} + \vec{W} = 0$
 (B) $T^2 = R^2 + W^2$
 (C) $T = R + W$
 (D) $R = W \tan \theta$



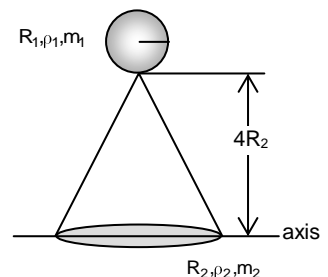
Space For Rough Work

4. The ring R in the arrangement shown can slide along a smooth, fixed, horizontal rod XY. It is attached to the block B by a light string. The block is released from rest, with the string horizontal.



- (A) One point in the string will have only vertical motion
 (B) R and B will always have momenta of same magnitude
 (C) When the string becomes vertical, the speeds of R and B will be inversely proportional to their masses.
 (D) R will lose contact with the rod at some point
5. Which of the following is incorrect about kinetic friction?
 (A) Always acts in opposite direction of the applied force
 (B) Kinetic friction has a range between 0 to μN
 (C) Direction of friction is always opposite to direction of velocity
 (D) It may increase speed

6. A solid cone and solid sphere are arranged as shown in the figure. The centre of mass is:



- (A) at $3R$ distance from the centre of solid cone if $m_1 = m_2 = m$ and $R_1 = R_2 = R$
 (B) at $2R$ from centre of mass of solid cone if $\rho_1 = \rho_2$ and $R_1 = R_2 = R$
 (C) If $\rho_1 = 2\rho_2$, $R_1 = R_2 = R$ then distance from the centre of solid cone is $\frac{11R}{3}$
 (D) (A) and (B) both

7. An automobile of mass m accelerates, starting from rest, while the engine supplies constant power P

- (A) The velocity is given as a function of time by $v = 2Pt/m^{1/2}$
 (B) The position is given as a function of time by $s = 8P/9m^{1/2} t^{3/2}$
 (C) The velocity is given as a function of time by $v = Pt/m^{1/2}$
 (D) The position is given as a function of time by $s = 4P/9m^{1/2} t^{3/2}$

(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 ball is projected with velocity v_0 at an angle θ with the ground. The time after which the velocity of the ball is perpendicular to its initial direction of motion is

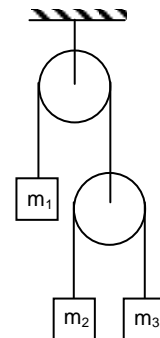
- (A) $\frac{v_0}{g \cos \theta}$ (B) $\frac{v_0}{g \sin \theta}$ (C) $\frac{v_0}{g} \tan \theta$ (D) $\frac{v_0}{g} \cot \theta$

Space For Rough Work

9. If a man of mass M jumps to the ground from a height h and his centre of mass moves a distance x in the time taken by him to come to rest after hitting the ground, the average force acting on him by the ground is approximately:
- (A) $\frac{Mgh}{x} + Mg$ (B) $\frac{Mgx}{h} + Mg$
 (C) $Mg\left(\frac{h}{x}\right)^2 + Mg$ (D) $Mg\left(\frac{x}{h}\right)^2 + Mg$
10. The velocity of a particle of mass 3 kg varies with time as $\vec{v} = (2t^2\hat{i} + 3\hat{j}) \text{ m/s}$, [t is in second]. Then find out change in the linear momentum of the ball in $0 \rightarrow 4 \text{ sec}$.
- (A) $96\hat{i} \text{ Kg.m/sec}$ (B) $105[\hat{i} + \hat{j}] \text{ Kg.m/sec}$
 (C) $48\hat{i} \text{ Kg.m/sec}$ (D) $36\hat{i} \text{ Kg.m/sec}$
11. A ball of mass 2 kg hits a floor with a speed of 4 m/s at an angle of 60° with the normal. If $(e=1/2)$; then the change in kinetic energy of the ball is
- (A) -6J (B) -12J
 (C) -9J (D) -3J
12. 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) $\left|\frac{a}{2} \sin\left(\frac{\theta}{2}\right)\right|$

13. In the arrangement, shown below pulleys are massless and frictionless and threads are inextensible, block of mass m_1 will remain at rest if

- (A) $\frac{4}{m_1} = \frac{1}{m_2} + \frac{1}{m_3}$ (B) $m_1 = m_2 = m_3$
 (C) $\frac{1}{m_1} = \frac{1}{m_2} + \frac{1}{m_3}$ (D) $\frac{1}{m_3} = \frac{2}{m_2} + \frac{3}{m_1}$

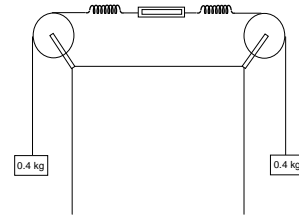


PART – B (Numerical based)

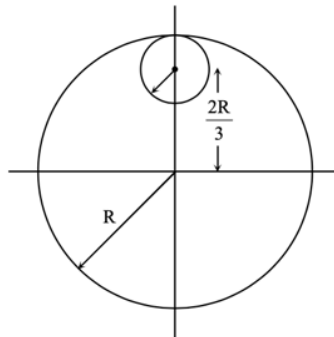
1. A spring of force constant K is cut into two pieces such that one piece is double the length of the other, then find out the force constant of the longer piece ($K = 6 \text{ N/m}$) in N/m .

Space For Rough Work

2. In the Figure given below, what is the reading of the balance (in Newton)? (Take $g = 10 \text{ N kg}^{-1}$)



3. A block of mass 1 kg lies on a horizontal surface in a truck. The coefficient of static friction between the block and the surface is 0.6. If the acceleration of the truck is 5 m/s^2 , then what frictional force acting on the block (in newton).
4. If $\vec{A} + \vec{B} = \vec{C}$ & $A + B = C$ then find angle between \vec{A} & \vec{B}
5. From a uniform circular disc of radius R and mass $9M$, a small disc of radius $\frac{R}{3}$ is removed as shown in the figure. The moment of inertia of the remaining disc about an axis perpendicular to the plane of the larger disc and passing through centre of disc is KMR^2 . Find K .



Space For Rough Work

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. Which of the following solution(s) behave(s) as buffer?
 (A) $\text{HCOOH} + \text{HCOOK}$ (B) $\text{NaH}_2\text{PO}_4 + \text{Na}_2\text{HPO}_4$
 (C) $\text{H}_2\text{SO}_4 + \text{NaHSO}_4$ (D) $\text{H}_2\text{CO}_3 + \text{NaHCO}_3$

2. $\text{H}_2\text{O}_2 + \text{H}^+ + \text{I}^- \longrightarrow \text{I}_2 + \text{H}_2\text{O}$

On investigation of the above reaction, the following results were obtained.

Initial conc. of reactant in M			Initial rate of formation of I_2 in $\text{mol dm}^{-3} \text{s}^{-1}$
$[\text{H}_2\text{O}_2]$	$[\text{I}^-]$	$[\text{H}^+]$	
0.01	0.01	0.30	2×10^{-6}
0.03	0.01	0.30	6×10^{-6}
0.03	0.02	0.10	1.2×10^{-5}
0.03	0.02	0.20	1.2×10^{-5}

Choose the correct statement(s)

- (A) The rate equation for the reaction is $\text{Rate} = k[\text{H}_2\text{O}_2][\text{I}^-]$.
 (B) The reaction is zero order with respect to acid.
 (C) The reaction is termolecular.
 (D) The rate constant is $2 \times 10^{-1} \text{ mol}^{-2} \text{ dm}^6 \text{ s}^{-1}$.
3. Which of the following property/properties is/are correct for Chromium ($Z = 24$) atom?
 (A) It contains nine electrons with particular spin quantum number and fifteen electrons with another spin quantum number.
 (B) Its total spin value is ± 3 .
 (C) It is paramagnetic in ground state.
 (D) When supplied with energy equivalent to its I.E_1 , the electron is removed from the 4s orbital.
4. Which of the following compound(s) is/are more covalent than NaCl according to Fajan's rule?
 (A) KCl (B) CuCl
 (C) MgBr_2 (D) NaBr
5. The solubility of AgCl in water is x g/L. Addition of which of the following substance decreases its solubility?
 (A) AgNO_3 (B) NaCl
 (C) NH_4OH (D) KCN

Space For Rough Work

6. $\text{CaCO}_3(\text{s}) \rightleftharpoons \text{CaO}(\text{s}) + \text{CO}_2(\text{g}); \Delta H > 0$
Which of the following factor(s) can favour the decomposition of CaCO_3 in the above reaction?
(A) Increasing temperature
(B) Decreasing pressure
(C) Increasing the volume of reaction vessel
(D) Adding CaCO_3
7. In which of the following compound(s) sulphur show(s) negative oxidation state?
(A) NH_2SH (B) $\text{K}_2\text{S}_2\text{O}_8$
(C) FeS_2 (D) H_2S

(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 characteristic of a chemical reaction decreases by increasing temperature?
(A) Temperature coefficient (B) Half-life period
(C) Rate constant (D) Activation energy
9. The incorrect statement for I_3^- ion is :
(A) The central iodine atom undergoes sp^3d hybridization
(B) It is a linear ion.
(C) The central atom contains no lone pair.
(D) The electron in the hybridized d-orbital, forms sigma bond.
10. How many gram of magnesium metal can be completely dissolved in 400 mL of 0.5 N HCl solution?
(A) 2.4 g (B) 1.2 g
(C) 4.8 g (D) 1.8 g
11. $\text{HCN}(\text{aq}) \rightleftharpoons \text{H}^+(\text{aq}) + \text{CN}^-(\text{aq})$
Which of the following characteristic of the above system increases by increasing temperature?
(A) K_a (B) $\text{p}K_a$
(C) pH (D) K_b of CN^-
12. Which of the following molecule does not display pi-bond resonance?
(A) CO_2 (B) N_2O_5
(C) SO_3 (D) SiO_2

Space For Rough Work

13. Which of the following contains maximum number of atoms?
(A) 4 gram of sodium (B) 2 gram of helium
(C) 8 gram of magnesium (D) 6 gram of aluminum

PART – B
(Numerical based)

1. The rate of effusion of an unknown gas is four times that of SO_2 . What is the molecular mass of the unknown gas?
2. The solubility product of a salt MX is 16×10^{-4} . What is the molarity of its saturated solution in decimal form?
3. $\text{X(g)} \rightleftharpoons \text{Y(g)} + \text{Z(g)}$
In the above reaction the molecular mass of X is 140 and that of the equilibrium mixture is 100. What is the degree of dissociation of X(g) ?
4. If the average oxidation number of nitrogen in NH_4NO_3 is $+x$, then the value of 'x' is :
5. K_{a_1} and K_{a_2} of a dibasic acid H_2XO_3 are respectively 10^{-6} and 10^{-10} . What is the pH of 0.1 M NaHXO_3 solution?

Space For Rough Work

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 $f(x) = x + \sqrt{x^2}$ is a function from $\mathbb{R} \rightarrow \mathbb{R}$, then $f(x)$ is
 (A) injective (B) surjective
 (C) Many One (D) Into

2. Let $f(x) = \begin{cases} 1 + \frac{2x}{\lambda}, & 0 \leq x < 1 \\ \lambda x, & 1 \leq x < 2 \end{cases}$ if $\lim_{x \rightarrow 1} f(x)$ exists, then λ is
 (A) -2 (B) -1
 (C) 1 (D) 2

3. If $f(x) = \begin{cases} -4 \sin x + \cos x & \text{for } x \leq -\frac{\pi}{2} \\ a \sin x + b & \text{for } -\frac{\pi}{2} < x < \frac{\pi}{2} \\ \cos x + 2 & \text{for } x \geq \frac{\pi}{2} \end{cases}$ is continuous then:
 (A) $a = -1$ (B) $b = 3$
 (C) $a = 1$ (D) $b = -3$

4. The function $f(x) = \frac{\tan \pi[x - \pi]}{1 + [x]^2}$ where $[.] = \text{GIV}$. Which of the following are true for $f(x)$
 (A) Continuous everywhere
 (B) Differentiable everywhere
 (C) $f'(x)$ is continuous everywhere
 (D) neither continuous nor differentiable at $x = \pm 1$

5. 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) $\tan^{-1} \frac{1}{3}$

Space For Rough Work

6. Which of the functions have domain \mathbb{R}
(A) $x^3 - 6x^2 + 8x + 7$ (B) $3 \sin x + 4 \cos x$
(C) $\tan x$ (D) $\sec x$
7. Point of discontinuity of the function $f(x) = \frac{1 + \cos 5x}{1 - \cos 4x}$
(A) $x = 0$ (B) $x = \frac{\pi}{2}$
(C) π (D) $x = \frac{\pi}{4}$

(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. Find the range of $y = \frac{1}{2 - \sin 3x}$
(A) $\left[\frac{1}{3}, 1\right]$ (B) $\left[\frac{1}{3}, 2\right]$
(C) $\left[\frac{1}{2}, 1\right]$ (D) None
9. If $f(x+1) = x^2 - 3x + 2$, then $f(x)$ is
(A) $x^2 + 5x + 6$ (B) $x^2 - 4x + 6$
(C) $x^2 - 5x + 4$ (D) $x^2 - 5x + 6$
10. If the curves $y = 1 - ax^2$ and $y = x^2$ are orthogonal then 'a' is equal to
(A) $\frac{1}{3}$ (B) $\frac{1}{2}$
(C) $\frac{1}{4}$ (D) none of these
11. If $f(x) = \sin x + \cos x$ and $g(x) = x^2 - 1$ then $g(f(x))$ is
(A) $\sin 2x$ (B) $\sin x$
(C) $\cos x$ (D) $\cos 2x$

Space For Rough Work

12. $f(x) = (x^2 - 1)|x|$ is
(A) even (B) odd
(C) neither even nor odd (D) none
13. $\int \frac{x^2 + \sin^2 x}{1 + x^2} \sec^2 x dx$ is equal to
(A) $\tan x + c$ (B) $\tan x - \tan^{-1} x + c$
(C) $\tan x + \tan^{-1} x + c$ (D) none of these

PART – B
(Numerical based)

1. The slope of the normal to curve $y = x^3 - 4x^2$ at $(2, -1)$ is
2. The equation of the tangent to the curve $y = x + \frac{4}{x^2}$, that is parallel to the $x -$ axis is $y = \lambda$ then λ is equal to
3. If $f, g : \mathbb{R} \rightarrow \mathbb{R}$, $f(x) = (x + 1)^2$, $g(x) = x^2 + 1$ then $(f \circ g)(-3) =$
4. If $f(9) = 9$, $f'(9) = 4$, then find value of $\lim_{x \rightarrow 9} \frac{\sqrt{f(x)} - 3}{\sqrt{x} - 3}$.
5. If $\int_{\pi/6}^{\pi/4} (\tan^2 x + \cot^2 x) dx = \frac{2}{\sqrt{3}} - \frac{\pi}{k}$ then $k =$

Space For Rough Work

FIITJEE INTERNAL TEST

BATCHES: NWCMPB223A1-A2 & NWCMPD223A1

PAPER-1

PHASE TEST – I

PHYSICS, CHEMISTRY & MATHEMATICS

ANSWER KEY

Paper Code
100105

SECTION-1 : PHYSICS

PART – A

- | | | | |
|--------|---------|--------|-------|
| 1. BC | 2. ABCD | 3. ABD | 4. AC |
| 5. ABC | 6. ABC | 7. AB | 8. B |
| 9. A | 10. A | 11. D | 12. B |
| 13. A | | | |

PART – B

- | | | | |
|------|------|------|------|
| 1. 9 | 2. 4 | 3. 5 | 4. 0 |
| 5. 4 | | | |

SECTION – 2 : CHEMISTRY

PART – A

- | | | | |
|--------|--------|---------|--------|
| 1. ABD | 2. AB | 3. ABCD | 4. BCD |
| 5. AB | 6. ABC | 7. CD | 8. B |
| 9. C | 10. A | 11. A | 12. D |
| 13. B | | | |

PART – B

- | | | | |
|------|---------|--------|------|
| 1. 4 | 2. 0.04 | 3. 0.4 | 4. 1 |
| 5. 8 | | | |

SECTION – 3 : MATHEMATICS

PART – A

- | | | | |
|--------|-------|--------|--------|
| 1. CD | 2. BD | 3. AB | 4. ABC |
| 5. ABC | 6. AB | 7. ABC | 8. A |
| 9. D | 10. A | 11. A | 12. A |
| 13. B | | | |

PART – B

- | | | | |
|---------|------|--------|------|
| 1. 0.25 | 2. 3 | 3. 121 | 4. 4 |
| 5. 6 | | | |