

PHYSICS, CHEMISTRY & MATHEMATICS

Pattern - CPT-2

QP CODE: 100179

PAPER - 1

Time Allotted: 3 Hours

Maximum Marks: 186

- 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 & B** 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 All Two Parts.

- (i) **Part-A (01-04)** – Contains Six (04) 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 (05–12)** contains (8) Multiple Choice Questions which have **One or More Than One 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.
- (iii) **Part-B (01-06)** contains six (06) 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. **There is no negative marking.**

Name of the Candidate : _____

Batch : _____ Date of Examination : _____

Enrolment Number : _____

SECTION – I : PHYSICS

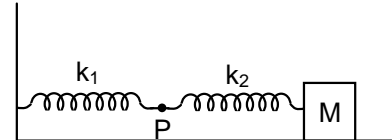
(PART – A)

(Single Correct Answer Type)

This section contains **4 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct**.

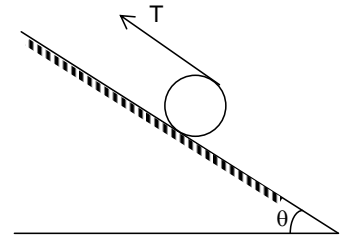
1. Two SHM's are represented by $y_1 = 10 \sin(3\pi t + \pi/4)$ and $y_2 = 5 \sin(3\pi t) + 5\sqrt{3} \cos(3\pi t)$, the ratio of their amplitudes is
 (A) 1 : 2 (B) $5 : \sqrt{7}$ (C) 2 : 1 (D) 1 : 1

2. The mass M shown in the figure oscillates in simple harmonic motion with amplitude A. The amplitude of the point P is



- (A) $\frac{k_1 A}{k_2}$ (B) $\frac{k_2 A}{k_1}$
 (C) $\frac{k_1 A}{k_1 + k_2}$ (D) $\frac{k_2 A}{k_1 + k_2}$

3. A sphere kept on a rough inclined plane is in equilibrium by a string wrapped over it. If angle of inclination is θ , the tension in string will be equal to



- (A) $mg \sin \theta$ (B) $2 mg \sin \theta$
 (C) $\frac{mg \sin \theta}{2}$ (D) None

4. The moment of inertia of a sphere of mass M and radius R about an axis passing through its centre is $\frac{2}{5} MR^2$. The radius of gyration of the sphere about a parallel axis to the above and tangent to the sphere is

- (A) $\frac{7}{5} R$ (B) $\frac{3}{5} R$ (C) $\left(\sqrt{\frac{7}{5}}\right) R$ (D) $\left(\sqrt{\frac{3}{5}}\right) R$

Space For Rough Work

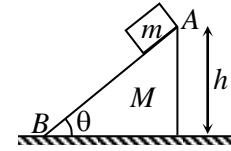
(One or More Than One Options Correct Type)

This section contains **8 multiple choice questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONE or MORE THAN ONE is correct**.

5. A particle performing simple harmonic motion undergoes initial displacement of $A/2$ (where A is the amplitude of simple harmonic motion) in 1 s. At $t = 0$, the particle may be at the extreme position or mean position. The time period of the simple harmonic motion can be
 (A) 6 s (B) 2.4 s (C) 12 s (D) 1.2 s
6. A coin is placed on a horizontal platform, which undergoes vertical simple harmonic motion of angular frequency ω . The amplitude of oscillation is gradually increased. The coin will leave contact with the platform for the first time
 (A) at the highest position of the platform (B) at the mean position of the platform.
 (C) for an amplitude of g/ω^2 (D) for an amplitude of $\sqrt{g/\omega}$.
7. A metal wire of length L area of cross section A and young's modulus Y is stretched by a variable force F such that F is always slightly greater than the elastic forces of resistance in the wire when the elongation of the wire is l .
 (A) the work done by F is $\frac{YA l^2}{2L}$
 (B) the work done by F is $\frac{YA l^2}{L}$
 (C) the elastic potential energy stored in the wire is $\frac{YA l^2}{2L}$
 (D) the elastic potential energy stored in the wire is $\frac{YA l^2}{L}$
8. A coin is placed on a horizontal platform which undergoes horizontal simple harmonic motion about a mean position O . The coin does not slip on the platform. The force of friction acting on the coin is F .
 (A) F is always directed towards O
 (B) F is directed towards O when the coin is moving away from O and away from O when the coin moves towards
 (C) $F = 0$ when the coin and platform come to rest momentarily at the extreme position of the harmonic motion
 (D) F is maximum when the coin and platform come to rest momentarily at the extreme position of the harmonic motion
9. A particle of mass m is projected with a velocity v making an angle θ with horizontal. The magnitude of angular momentum of the projectile about the point of projection when the particle is at its maximum height ' H ' is proportional to
 (A) $V^{3/2}$ (B) V^3 (C) $H^{3/2}$ (D) H^3

Space For Rough Work

10. A block of mass m is resting at point A on a wedge of mass M which is kept on a smooth surface as shown in figure. Now the block is set free to move. After some time the block reaches point B with respect to wedge. Then



- (A) momentum of block-wedge system remains conserved in horizontal direction.
 (B) momentum of black-wedge system remains conserved in vertical direction.
 (C) displacement of wedge till this moment will be $\frac{mh \cot \theta}{M + m}$.
 (D) displacement of wedge till this moment will be $\frac{mh \tan \theta}{M + m}$.
11. A particle moves on a straight line with a uniform velocity. Its angular momentum
 (A) is always zero
 (B) is zero about a point on the straight line
 (C) is not zero about a point away from the straight line
 (D) about any given point remains constant
12. A solid sphere is executing rolling with slipping motion on a rough horizontal surface
 (A) the frictional force will always perform a negative work on the sphere
 (B) the work done by friction cannot be zero
 (C) the angular momentum of the sphere is conserved about its centre of mass
 (D) the angular momentum of the sphere is conserved about point of contact

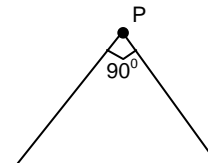
(PART – B)

(Integer Type)

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**.

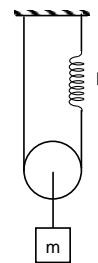
1. A system of two identical rods (L shaped) of mass m , length L . System rest on a peg p as shown in the fig period of

oscillations $T = 2\pi\sqrt{\frac{n\sqrt{2} L}{3g}}$ then $n = ?$



Space For Rough Work

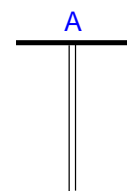
2. Figure below shows a massless pulley, a spring of constant $K = 250 \text{ N/m}$ and a mass 1 kg . On displacing the mass slightly, find its frequency (approximate) of its vertical oscillation



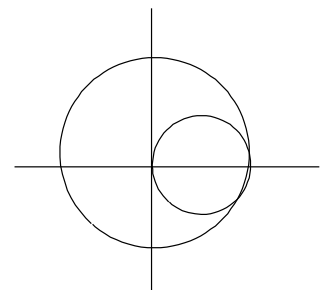
3. Three particles, each of mass m , are situated at the vertices of an equilateral triangle of side length a . The only forces acting on the particles are their mutual gravitational forces. It is desired that each particle moves in a circle while maintaining the original mutual separation a . Find the initial velocity that should be given to each particle. (take $a = \frac{GM}{16}$)

4. A mass of 20 kg moving with a speed of 10 m/s collides with another stationary mass of 5 kg . As a result of the collision, the two masses stick together. The KE of the composite mass is $N \times 100$. Find the value of 'N'.

5. A physical pendulum consists of two sticks each 1 m long and having same mass. Sticks are joint together as shown in Fig. Pendulum's period of oscillation about a pin inserted through Point A is $\frac{\pi}{n} \text{ sec}$.



6. A uniform disc of surface mass density (σ) exists in space. Its radius is R . A small disc of radius $\left(\frac{R}{2}\right)$ is cut from it as shown in the figure. The moment of inertia (I) about axis perpendicular to plane of figure and passing through the centre of disc of radius 'R' is $\frac{3}{k} \sigma \pi R^4$. Find the value of k .



Space For Rough Work

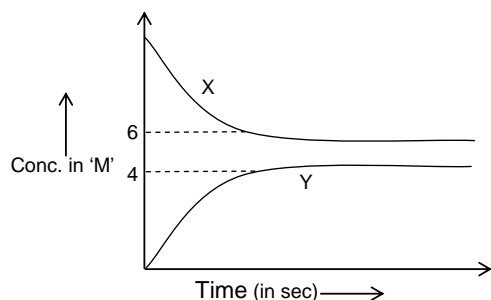
SECTION – II : CHEMISTRY

(PART – A)

(Single Correct Answer Type)

This section contains 4 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE** is correct.

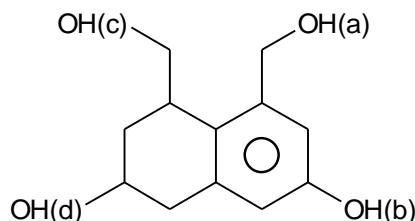
1.



What is the equilibrium constant K_c of the reaction $X(g) \rightleftharpoons 2Y(g)$ according to above figure?

- (A) $\frac{3}{2}$ (B) $\frac{2}{3}$ (C) $\frac{8}{3}$ (D) $\frac{3}{8}$

2.



Arrange the OH groups of the above compound in decreasing order of tendency to remove hydrogen as H^+ ?

- (A) $a > b > d > c$ (B) $b > a > d > c$
 (C) $b > a > c > d$ (D) $a > b > c > d$

3.

The pH of water at room temperature is same as the pH of aqueous solution of

- (A) NH_4Cl (B) $FeSO_4$ (C) KBr (D) $NaCN$

4.

For which of the following reaction, the half-life decreases by increasing temperature?

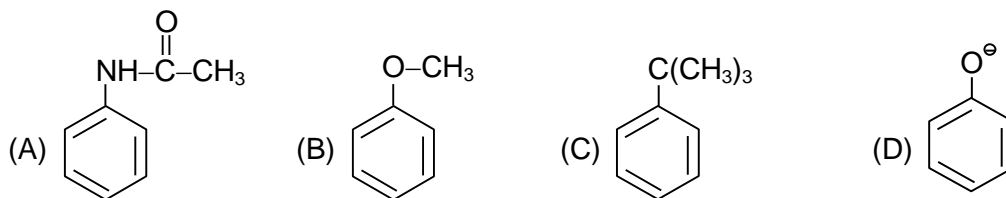
- (A) Zero order (B) First order
 (C) Second order (D) All are correct

Space For Rough Work

(One or More Than One Options Correct Type)

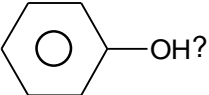
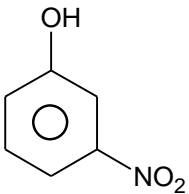
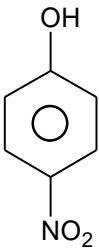
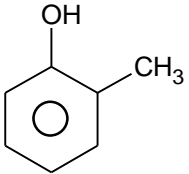
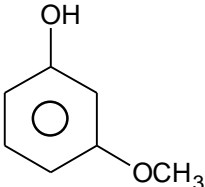
This section contains **8 multiple choice questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONE or MORE THAN ONE is correct**.

5. Which of the following solutions can form buffer?
 (A) $\text{CH}_3\text{COOH} + \text{CH}_3\text{COONa}$ (B) $\text{NH}_4\text{OH} + \text{NH}_4\text{Cl}$
 (C) $\text{HCl} + \text{NaCl}$ (D) $\text{KOH} + \text{KCl}$
6. Which of the following substituent shows +R effect on benzene ring?



7. $\text{H}_2\text{O} + \text{H}_2\text{O} \rightleftharpoons \text{H}_3\text{O}^+ (\text{aq}) + \text{OH}^- (\text{aq})$
 Choose correct statements
 (A) $K_w = 1 \times 10^{-14}$ at 25°C (B) $\text{pH} < 7$ at 80°C
 (C) $[\text{H}_3\text{O}^+] = [\text{OH}^-]$ at all temperature (D) $\alpha < 1$ at 25°C
8. K_{a_1} and K_{a_2} are the ionization constants of H_2CO_3 at 25°C . Choose correct statements:
 (A) $K_{a_1} > K_{a_2}$ (B) $\text{p}^{K_{a_1}} > \text{p}^{K_{a_2}}$
 (C) pH of $0.1 \text{ M NaHCO}_3 = \frac{\text{p}^{K_{a_1}} + \text{p}^{K_{a_2}}}{2}$ (D) $K_a(\text{H}_2\text{CO}_3) \times K_b(\text{HCO}_3^-) = 10^{-14}$
9. $2\text{NO}(\text{g}) + \text{O}_2(\text{g}) \longrightarrow 2\text{NO}_2(\text{g})$
 Rate of above reaction is equal to
 (A) $-\frac{d[\text{O}_2]}{dt}$ (B) $\frac{1}{2} \frac{d[\text{NO}_2]}{dt}$ (C) $-2 \frac{d[\text{NO}]}{dt}$ (D) $-\frac{1}{2} \frac{d[\text{NO}_2]}{dt}$
10. Which of the following electronic effect(s) is/are observed in the following molecule?
 $\text{CH}_3 - \text{CH}_2 - \text{OH}$
 (A) +I effect (B) -I effect
 (C) +R effect (D) -R effect

Space For Rough Work

11. Which of the following compound(s) is/are more acidic than ?
- (A) 
- (B) 
- (C) 
- (D) 

12. Which of the following is / are pseudo first order reaction ?
- (A) The alkaline hydrolysis of ethyl acetate
 (B) The inversion of sucrose in the presence of an acid
 (C) The acidic hydrolysis of ethyl acetate
 (D) The decomposition of ammonium nitrite in aqueous solution

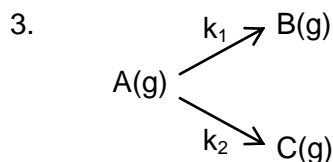
(PART – B)

(Integer Type)

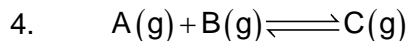
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1. One mole of each of gases SO_3 , NO , NO_2 and SO_2 are taken in a one litre vessel for reaction.
- $$\text{SO}_3(\text{g}) + \text{NO}(\text{g}) \rightleftharpoons \text{SO}_2(\text{g}) + \text{NO}_2(\text{g})$$
- The equilibrium state is attained after 50%(mole) of the reactants undergo reaction. What is the equilibrium constant K_C of the reaction.
2. What is the pH of 0.02 M sugar solution?

Space For Rough Work



In above reaction $k_1 = 40 \times 10^{-2} \text{ hr}^{-1}$ and $k_2 = 8 \times 10^{-2} \text{ hr}^{-1}$. If the product ratio, i.e. $\frac{[\text{B}]}{[\text{C}]}$ is expressed in simple ratio as $x : y$, what is the value of $(x + y)$?



A, B and C have equal partial pressures at above equilibrium which is established at 400 K and 0.6 atm pressure. The equilibrium constant K_P in atm^{-1} unit is:

5. What is the pH of a buffer which contains CH_3COOH and CH_3COONa in the molar ratio of 10 : 1 respectively. [K_a of $\text{CH}_3\text{COOH} = 10^{-5}$]

6. The rate of a reaction is given as

$$\text{Rate} = k[\text{A}]^{0.5}[\text{B}]^{1.5}$$

How many times will the rate of above reaction increase, if the volume of reaction container is reduced to half of it's initial value?

Space For Rough Work

SECTION – III : MATHEMATICS

(PART – A)

(Single Correct Answer Type)

This section contains **4 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct**.

1. If one end of a focal chord AB of the parabola $y^2 = 8x$ is at $A\left(\frac{1}{2}, -2\right)$, then the equation of the tangent to it at B is:
 (A) $2x - y - 24 = 0$ (B) $x - 2y + 8 = 0$
 (C) $2x + y - 24 = 0$ (D) $x + 2y + 8 = 0$
2. If $y = mx + 4$ is a tangent to both the parabolas, $y^2 = 4x$ and $x^2 = 2by$, then b is equal to:
 (A) -32 (B) -128
 (C) -64 (D) 128
3. If the roots of the equation $x^2 + bx + c = 0$ and $x^2 - cx + b = 0$ differ by the same quantity, then the value of $(b + c)$, is:
 (A) 4 (B) 1
 (C) 0 (D) -4
4. The mean and the median of the following ten numbers in increasing order 10, 22, 26, 29, 34, x, 42, 67, 70, y are 42 and 35 respectively, then $\frac{y}{x}$ is equal to
 (A) $\frac{7}{3}$ (B) $\frac{9}{4}$ (C) $\frac{7}{2}$ (D) $\frac{8}{3}$

(One or More Than One Options Correct Type)

This section contains **8 multiple choice questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONE or MORE THAN ONE is correct**.

5. If $2^{4a-b} = \log_7(2401)$ and $\log_4(98a + 138b) = 5$, then find the value of the product (ab) .
 (A) $a = 2$ (B) $a = 6$ (C) $ab = 12$ (D) $ab = 36$
6. If the equation $x^3 - 2x^2 + px + 2 = 0$ and $x^3 - 7x^2 + px + d = 0$ have two roots in common. Then, the non - common roots will be
 (A) 3 (B) 2 (C) 7 (D) 4

Space For Rough Work

7. The positive integer 'n' for which $(1+i\sqrt{3})^n$ is real is
 (A) 3 (B) 6
 (C) 12 (D) 18
8. If the equation $cx^2 + bx - 2a = 0$ has no real roots and $a < \frac{b+c}{2}$ then
 (A) $ac < 0$ (B) $a < 0$
 (C) $\frac{c-a}{2} > a$ (D) $\frac{c+2b}{8} > a$
9. Consider equation $x^2 + 2(a-3)x + a - 1 = 0$.
 If roots are real and distinct then value of the parameter "a" is
 (A) $(-\infty, 2)$ (B) $(5, \infty)$
 (C) $(2, 5)$ (D) none of these
10. The parabola $x^2 + 2x - 4y = 0$ has
 (A) vertex = $(-1, -1)$ (B) latus rectum = 4
 (C) focus = $(-1, \frac{3}{4})$ (D) focus = $(0, -\frac{1}{4})$
11. For the parabola $(x-2)^2 + (y-3)^2 = \frac{(3x-y+7)^2}{10}$, which of the following is/are CORRECT?
 (A) The equation of the axis about which the parabola is symmetrical is $x + 3y - 11 = 0$
 (B) The equation of the line along which minimum length of the focal chord occurs is $3x - y + 7 = 0$
 (C) The locus of the point of intersection of perpendicular tangents is $3x - y - 3 = 0$
 (D) The locus of the foot of perpendicular from the focus upon any tangent is $3x - y + 2 = 0$

Space For Rough Work

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12. Let a , b and c be in G.P with common ratio r , where $a \neq 0$. If $3a$, $7b$ and $15c$ are the first three terms of an A.P., then
- (A) $3r = 1$ (B) $3r = 5$
(C) $5r = 1$ (D) $5r = 3$

(PART – B)

(Integer Type)

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**.

1. Sum of 10 terms common to $17, 21, 25, \dots$ and $16, 21, 26$, is k then sum of digits of k is
2. 10^{th} term of the series $2 + 7 + 14 + 23 + 34 + \dots$
3. If $z = \frac{(3+i)(7-i)^2}{3-i}$, then the value of $|z|$ is equal to
4. The minimum length of focal chord of parabola $y^2 = 16x$ is
5. The number of all possible positive integral values of α for which the roots of the quadratic equation $6x^2 - 11x + \alpha = 0$ are rational numbers is
6. The values of x satisfying $\log_{16} x + \log_4 x + \log_2 x = \log_{1/2} \left(\frac{1}{128} \right)$ is

Space For Rough Work

FIITJEE INTERNAL TEST

BATCHES: Two Yr CRP224-E-Lot

PHASE TEST-2: PAPER-1

Code: 100179

JEE ADVANCED LEVEL

ANSWER KEY

ANSWER KEYS

Physics

PART – A

- | | | | |
|-------|--------|---------|---------|
| 1. D | 2. D | 3. C | 4. C |
| 5. AC | 6. AC | 7. AC | 8. AD |
| 9. BC | 10. AC | 11. BCD | 12. ABD |

PART – B

- | | | | |
|---------|-------------------------------|------|------|
| 1. 2 | 2. 5 | 3. 4 | 4. 8 |
| 5. 1.73 | 6. 7.38 (range: 7.31 to 7.40) | | |

Chemistry

PART – A

- | | | | |
|-------|--------|---------|--------|
| 1. C | 2. C | 3. C | 4. D |
| 5. AB | 6. ABD | 7. ABCD | 8. ACD |
| 9. AB | 10. AB | 11. ABD | 12. BC |

PART – B

- | | | | |
|------|------|------|------|
| 1. 9 | 2. 7 | 3. 6 | 4. 5 |
| 5. 4 | 6. 4 | | |

Mathematics

PART – A

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

PART – B

- | | | | |
|------|--------|-------|-------|
| 1. 3 | 2. 119 | 3. 50 | 4. 16 |
| 5. 3 | 6. 16 | | |