

PHYSICS, CHEMISTRY & MATHEMATICS

Pattern - 2

QP Code: 100050

Common
TEST - 2

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 Six (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 to **Two decimal places** (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

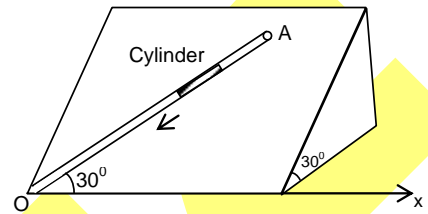
PART – A

(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. An inclined plane makes an angle 30° with the horizontal. A groove (OA) of length = 5m cut in the plane makes an angle 30° with OX. A short smooth cylinder is free to slide down under the influence of gravity. The time taken by the cylinder to reach from A to O is ($g = 10 \text{ m/s}^{-2}$)

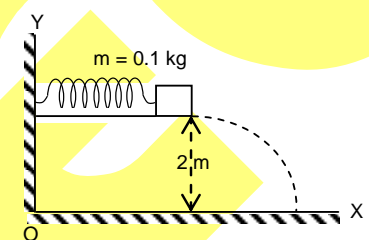
(A) 4s
(B) 2s
(C) 3s
(D) 1s



2. A small block of mass 0.1 kg is pressed against a horizontal spring fixed at one end to compress the spring through 5.0 cm as shown. The spring constant is 100 N/m. When released the block moves horizontally till it leaves the spring. It will hit the ground 2 m below the spring. (Take $g = 10 \text{ m/s}^2$)

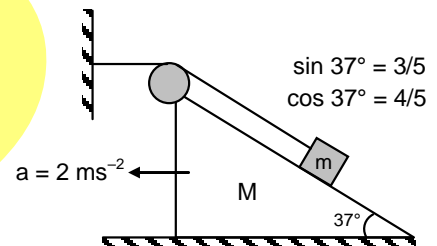
(A) at a horizontal distance of 1 m from free end of the spring.
(B) at a horizontal distance of 2 m from free end of the spring.

(C) vertically below the edge on which the mass is resting.
(D) at a horizontal distance $\sqrt{2}$ m from free end of spring.



3. As shown in the figure, if acceleration of M with respect to ground is 2 ms^{-2} , then

(A) Acceleration of m with respect to M is 5 ms^{-2}
(B) Acceleration of m with respect to ground is 5 ms^{-2}
(C) Acceleration of m with respect to M is 2 ms^{-2}
(D) Acceleration of m with respect to ground is 10 ms^{-2}



4. A bob is suspended from a crane by a cable of length $\ell = 5 \text{ m}$. The crane and the bob are moving at a constant speed v_0 . The crane is stopped by a bumper and the bob on the cable swings out an angle of 60° . The approximate initial speed v_0 is ($g = 9.8 \text{ m/s}^2$)

(A) 10 m/s
(B) 7 m/s
(C) 4 m/s
(D) 2 m/s

Space For Rough Work

5. Two identical particles A and B, each of mass m , are interconnected by a spring of stiffness k . If the particle B experiences a force F and the elongation of the spring is x , the acceleration of particle B relative to particle A is equal to



- (A) $\frac{F}{2m}$ (B) $\frac{F - kx}{m}$ (C) $\frac{F - 2kx}{m}$ (D) $\frac{kx}{m}$

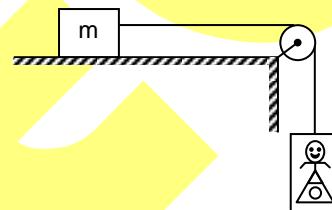
6. A bullet loses 19% of its kinetic energy when it passes through an obstacle. The percentage change in its speed is

- (A) reduced by 10% (B) reduced by 19%
(C) reduced by 9.5% (D) reduced by 11%

(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.

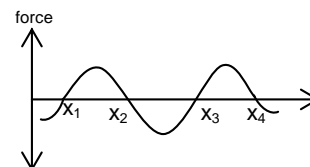
7. In the figure, a man of true mass M is standing on a weighing machine placed in a cabin. The cabin is joined by a string with a body of mass m . Assuming no friction, and negligible mass of cabin and weighing machine, the measured mass of man is (normal force between the man and the machine is proportional to the mass)



- (A) Measured mass of man is $\frac{Mm}{(M+m)}$ (B) Acceleration of man is $\frac{mg}{(M+m)}$
(C) Acceleration of man is $\frac{Mg}{(M+m)}$ (D) Measured mass of man is M .

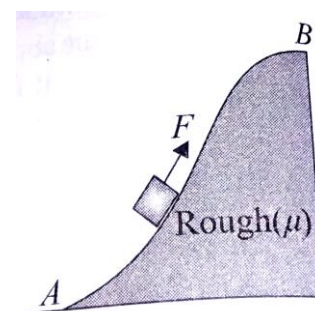
8. A curve between force and displacement is drawn for a particle moving in x axis only conservative forces are acting

- (A) At x_1 & x_3 particle in stable equilibrium
(B) At x_1 & x_3 particle in unstable equilibrium
(C) At x_2 & x_4 particle in stable equilibrium
(D) At x_2 & x_4 particle in unstable equilibrium



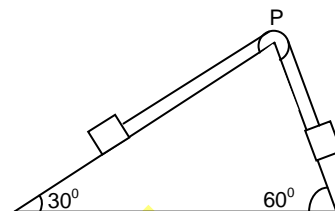
9. A body of mass M was slowly hauled up the rough hill by a force F which at each point was directed along a tangent to the hill. Work done by the force

- (A) is independent of shape of trajectory.
(B) depends upon vertical component of displacement but independent of horizontal component.
(C) depends upon both horizontal and vertical components of displacement.
(D) does not depend upon coefficient of friction.



Space For Rough Work

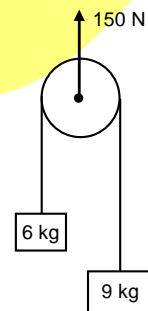
10. Two blocks of masses $m_1 = 3\text{kg}$ and $m_2 = \frac{1}{\sqrt{3}}\text{kg}$ are connected by a light inextensible string which passes over a smooth pulley. The blocks rest on the inclined smooth planes of a wedge and the pulley is fixed to the top of the wedge. The planes of the wedge supporting 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



11. 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 $s = 4P/9m^{1/2}t^{3/2}$

12. As situation shown in figure, choose the correct option(s) (take $g = 10\text{ m/s}^2$ downward)

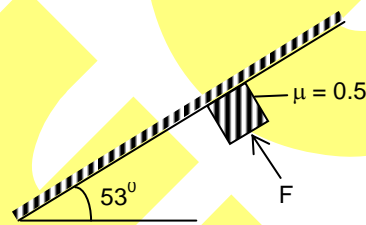
- (A) the acceleration of pulley is $\frac{5}{6}\text{ m/s}^2$ upward.
 (B) the acceleration of pulley is $\frac{5}{12}\text{ m/s}^2$ upward.
 (C) the acceleration of pulley is 0 .
 (D) tension in the string which connects the masses is 75 N .



PART – B (Numerical based)

1. Potential energy of a particle moving along x-axis is given by $U = \frac{x^3}{3} - \frac{9x^2}{2} + 20x$. Find out position of stable equilibrium state.

Space For Rough Work

2. A uniform chain of length ℓ and mass m overhangs a smooth table with its two third part lying on the table. If the kinetic energy of the chain as it completely slips off the table is $\frac{2}{x}mgl$, then find the value of 'x'.
3. A particle hanging by a light string of length l is projected horizontally from its lowest point with velocity $= \sqrt{\frac{7gl}{2}}$, The string slacks after swinging through an angle $k\pi$ then $k =$
4. A particle of mass m is fixed to one end of a light rigid rod of length ℓ and rotated in a vertical circular path about its other end. The minimum speed of particle at its lowest point is \sqrt{KgL} . Find the value of K .
5. In the figure shown the minimum value of F (in newton) to be applied perpendicular to the inclined so that the block of mass 10 kg does not slides and remains in contact with inclined plane is
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6. 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).

Space For Rough Work

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**.

- For hydrogen atom, which transition would show shortest wave length?
(A) $n = 3$ to $n = 1$ (B) $n = 4$ to $n = 2$
(C) $n = 5$ to $n = 3$ (D) $n = 4$ to $n = 3$
- The energy of electrons in the excited state of Be^{3+} is -3.45 eV. If the electrons come to the ground state, how many electronic transitions can be made that are formed in the Lyman series
(A) 7 (B) 36
(C) 28 (D) 5
- Consider the following ions: Al^{3+} , Mg^{2+} , S^{2-} , N^{3-}
Which two ions have largest size difference?
(A) Al^{3+} , N^{3-} (B) Mg^{2+} , N^{3-}
(C) Al^{3+} , S^{2-} (D) Mg^{2+} , S^{2-}
- All the products are same when x and y react with water. x and y would be
(A) Ca, CaO (B) Na, NaH
(C) NaOH, Na_2CO_3 (D) Na, K
- Select the pair of species in which both are paramagnetic.
(A) O_3 , NO_2^- (B) N_2 , O_2
(C) O_2 , C_2^+ (D) F_2 , N_2
- Select the compound in which central atom has 2 lone pairs of electrons.
(A) BrF_5 (B) ClF_3
(C) XeF_6 (D) SF_4

(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.

- Temporary hardness of water can be removed by
(A) Boiling (B) Adding $\text{Ca}(\text{OH})_2$
(C) Adding Na_2CO_3 (D) Ion-exchange method

Space For Rough Work

8. Select the correct statement(s)
(A) the number of radial node in 2p orbital is 2
(B) for hydrogen atom, $3d_{xy}$ energy = $3p_x$ energy
(C) Cr^{3+} has lesser number of unpaired electrons than Fe^{2+}
(D) For 3s orbital, orbital angular momentum is zero
[At. No. Cr = 24, Fe = 26]
9. Which of the following statement is / are correct regarding bonding molecular orbitals?
(A) Bonding molecular orbital possess less energy than the atomic orbitals from which they are formed.
(B) Bonding molecular orbitals have lesser electron density between the two nuclei in comparison to anti bonding molecular orbitals
(C) Electrons in bonding molecular contribute to the attraction between atoms
(D) More number of electrons in Bonding Molecular orbitals, higher bond dissociation energy of the chemical bond.
10. Which of the following statement is /are not True for the properties of Li ?
(A) The melting point and boiling point of Li are comparatively higher than that of other alkali metals.
(B) Li forms a nitride Li_3N unlike group 1 metals
(C) Li is much softer than the other group-1 metals
(D) Li^+ ion and its compounds are least hydrated than those of the rest of the group.
11. Which of the following molecules are polar?
(A) I_3^- (B) CH_3Cl
(C) BF_3 (D) PF_3Cl_2
12. Select the correct order for the given property?
(A) $\text{LiH} > \text{NaH} > \text{KH} > \text{RbH}$ (Thermal stability)
(B) $\text{Ag}_2\text{CO}_3 > \text{Li}_2\text{CO}_3 > \text{K}_2\text{CO}_3$ (Covalent character)
(C) $\text{BeCO}_3 > \text{MgCO}_3 > \text{CaCO}_3$ (Ease of decomposition)
(D) $\text{BeF}_2 > \text{MgF}_2 > \text{CaF}_2 > \text{SrF}_2$ (Solubility in water)

PART – B
(Numerical based)

1. Among the following molecules/ions
 BeCl_2 , O_3 , SCl_2 , N_2O , XeF_2 , I_3^-
Calculate the total number of linear molecules/ions where the hybridization of central atoms does not have contribution from the d-orbital(s).
2. Sc^{x+} shows spin only magnetic moment of 1.73 BM. What is value of x?
(At. No. Sc = 21)

Space For Rough Work

3. Consider first ionization energy (IE_1) and second ionization energy (IE_2) of alkali metals (Li to Cs) data as given below [not in order]
Identify which data of ionization energy correspond to IE_2 of Li
Ionization energy (KJ/mole): 375.6, 2650.0, 2420.2, 520.1, 495.7, 4563.0, 7296.0, 418.6, 402.6, 3069.0
4. The number of Radial nodes in $3p_y$ orbital = a
The number of angular nodes in $4d_{xy}$ orbital = b
The number of total nodes in 4s orbital = c
What is value of $a + b + c = ?$
5. The photoelectric emission requires a threshold frequency V_0 for a certain metal
 $\lambda_1 = 2200 \text{ \AA}$ and $\lambda_2 = 1900 \text{ \AA}$ produces electrons with a maximum kinetic energy KE_1 and KE_2 if $KE_2 = 2KE_1$. The value of V_0 in order of 10^{15} sec^{-1} is .
6. Two particles X and Y are in motion. If the wavelength associated with the particle X is $1.6 \times 10^{-8} \text{ m}$ then calculate the wavelength of the particle Y having momentum $1/4^{\text{th}}$ of X in order of 10^{-8} m

Space For Rough Work

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. Family of lines represented by the equation $(\cos \theta + \sin \theta)x + (\cos \theta - \sin \theta)y - 3(3\cos \theta + \sin \theta) = 0$ passed through a fixed point M for all real values of θ . The reflection of M in the line $x - y = 0$ is
 (A) (6, 3) (B) (3, 6)
 (C) (-6, 3) (D) (3, -6)
2. The equation of common tangent to the circle $x^2 + y^2 - 4x - 6y - 12 = 0$ and $x^2 + y^2 + 6x + 18y + 26 = 0$ at their point of contact will be
 (A) $12x + 5y + 19 = 0$ (B) $5x + 12y + 19 = 0$
 (C) $5x - 12y + 19 = 0$ (D) $12x - 5y + 19 = 0$
3. The centre of circle inscribed in a square formed by the lines $x^2 - 8x + 12 = 0$ and $y^2 - 14y + 45 = 0$ will be
 (A) (9, 4) (B) (7, 4)
 (C) (4, 9) (D) (4, 7)
4. The line $4y - 3x + \lambda = 0$ touches the circle $x^2 + y^2 - 4x - 8y - 5 = 0$. The value of λ is
 (A) 29 (B) 10
 (C) -35 (D) none of these
5. Radii of two circles are 4 units and 8 units. Their centres are $(-1, -2)$ and $(2, 2)$ respectively. The length of their external common tangent is
 (A) no external common tangent exists (B) 3 units
 (C) 6 units (D) none of these
6. The locus of the point such that the tangents drawn from it to the circle $x^2 + y^2 - 6x - 8y = 0$ are perpendicular to each other, is
 (A) $x^2 + y^2 - 6x - 8y - 25 = 0$ (B) $x^2 + y^2 + 6x - 8y - 5 = 0$
 (C) $x^2 + y^2 - 6x + 8y - 5 = 0$ (D) $x^2 + y^2 - 6x - 8y + 25 = 0$

Space For Rough Work

(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. A line passes through the origin and makes an angle of $\pi/4$ with the line $x - y + 1 = 0$.
Then :
(A) equation of the line is $x = 0$
(B) the equation of the line is $y = 0$
(C) the point of intersection of the line with the given line is $(-1, 0)$
(D) the point of intersection of the line with the given line is $(0, 1)$
8. Three vertices of a triangle are A $(4, 3)$, B $(1, -1)$ and C $(7, k)$. Value of k for which area of triangle equals to 10 square units
(A) $\frac{1}{3}$ (B) $\frac{2}{3}$
(C) $\frac{40}{3}$ (D) $\frac{41}{3}$
9. Number of integral coordinate inside the triangle made by the line $x + y = 15$ and coordinate axes is represented by two digit number AB then
(A) $A + B = 10$ (B) $A + B = 9$
(C) $A - B = 8$ (D) $A - B = 9$
10. Coordinates of a point which is at 3 units distance from the point $(1, -3)$ on the line $2x + 3y + 7 = 0$ is/are
(A) $\left(1 + \frac{9}{\sqrt{13}}, 3 - \frac{6}{\sqrt{13}}\right)$ (B) $\left(1 - \frac{9}{\sqrt{13}}, -3 + \frac{6}{\sqrt{13}}\right)$
(C) $\left(1 + \frac{9}{\sqrt{13}}, -3 - \frac{6}{\sqrt{13}}\right)$ (D) $\left(1 - \frac{9}{\sqrt{13}}, 3 - \frac{6}{\sqrt{13}}\right)$
11. The tangent lines to the circle $x^2 + y^2 - 6x + 4y - 12 = 0$ which are parallel to the line $4x + 3y + 5 = 0$ are
(A) $4x + 3y - 31 = 0$ (B) $4x + 3y + 19 = 0$
(C) $4x + 3y - 19 = 0$ (D) $4x + 3y + 31 = 0$
12. For the circles $S_1 \equiv x^2 + y^2 - 4x - 6y - 12 = 0$ and $S_2 \equiv x^2 + y^2 + 6x + 4y - 12 = 0$ & the line $L \equiv x + y = 0$, then which of the following is/are true?
(A) L is common tangent of S_1 and S_2
(B) L is common chord of S_1 and S_2
(C) L is radical axis of S_1 and S_2
(D) L is perpendicular to the line joining centre of S_1 and S_2

Space For Rough Work

PART – B
(Numerical based)

1. Circum-centre of the triangle formed by the lines $x = 0$, $y = 0$ and $x + y = 2$ comes out to be (a, b) then the value of $\frac{4a+5b}{12}$ will be
2. Let x and y be the real numbers satisfying the equation $x^2 - 4x + y^2 + 3 = 0$. If the maximum and minimum values of $(x^2 + y^2)$ are M and m respectively, then the numerical value of $(M - m)$ will be
3. If the two circles $(x - 1)^2 + (y - 3)^2 = r^2$ and $x^2 + y^2 - 8x + 2y + 8 = 0$ intersect in two distinct points, then number of integral values r can take will be
4. If the chord $y = mx + 1$ of the circle $x^2 + y^2 = 1$ subtends an angle of measure 45° at the major segment of the circle, then the value of $|m|$ will be
5. The greatest distance of the point $P(10, 7)$ from the circle $x^2 + y^2 - 4x - 2y - 20 = 0$ is K then $K/3$ is
6. Tangents are drawn to circle $x^2 + y^2 = 12$ at the points where it is meet by the line $5x - 3y - 10 = 0$, then x - coordinate of points of intersection of these tangents is _

Space For Rough Work

QP Code: 10050

ANSWERS

SECTION-1 : PHYSICS

PART – A

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

PART – B

- | | | |
|------|--------|-------------------------------|
| 1. 5 | 2. 4.5 | 3. 0.67 (range: 0.65 to 0.68) |
| 4. 4 | 5. 220 | 6. 5 |

SECTION – 2 : CHEMISTRY

PART – A

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

PART – B

- | | | | |
|-----------------|---------------------------|------------|------|
| 1. 2 | 2. 2 | 3. 7296.00 | 4. 6 |
| 5. 1.11 to 1.20 | 6. 6.4 (range 6.2 to 6.6) | | |

SECTION – 3 : MATHEMATICS

PART – A

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

PART – B

- | | | | |
|---------|------|------|------|
| 1. 0.75 | 2. 8 | 3. 5 | 4. 1 |
| 5. 5 | 6. 6 | | |