

PHYSICS, CHEMISTRY & MATHEMATICS

Pattern - CPT-1

QP Code:

Test - 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.
- (i) **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 (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 : _____

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. The potential energy U for a force field \vec{F} is such that $U = -kxy$, where k is a constant
- (A) $\vec{F} = ky\hat{i} + kx\hat{j}$
 (B) $\vec{F} = kx\hat{i} + ky\hat{j}$
 (C) the force \vec{F} is a conservative force
 (D) The force \vec{F} is a non conservative force

1. **AC**

2. Kinetic energy of a particle moving in a straight line is proportional to the time t . The magnitude of the force acting on the particle is
- (A) directly proportional to the speed of the particle
 (B) inversely proportional to \sqrt{t}
 (C) inversely proportional to the speed of the particle
 (D) directly proportional to \sqrt{t}

2. **BC**

3. The potential energy ϕ in joule of a particle of mass 1 kg moving in the $x - y$ plane, obeys the law $\phi = 3x + 4y$, where (x,y) are the coordinate of the particle in metre. If the particle is at rest at $(6,4)$ at time $t = 0$, then
- (A) the particle has constant acceleration
 (B) the work done by the external forces from position of rest of the particle to the instant of the particle crossing x axis is 25 J
 (C) the speed of the a particle when it crosses the y axis is 10 ms^{-1}
 (D) the coordinates of the particle at time $t = 4\text{s}$ are $(-18, -28)$

3. **ABCD**

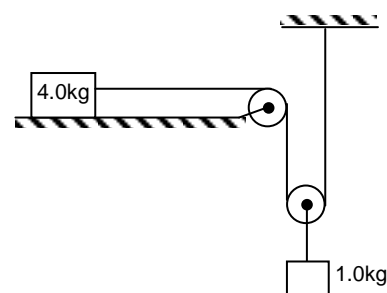
4. A particle is moving with kinetic energy K , straight up an inclined plane of inclination α , the coefficient of friction being μ . The work done against friction before the particle comes to rest is:

(A) $\frac{K\mu \cos \alpha}{\sin \alpha + \mu \cos \alpha}$ (B) $\frac{K \cos \alpha}{\sin \alpha + \mu \cos \alpha}$ (C) $\frac{K}{\sin \alpha + \mu \cos \alpha}$ (D) $\frac{K}{g(\sin \alpha + \mu \cos \alpha)}$

4. **A**

5. Considering the situation shown in the figure. The block of mass 1.0 kg is released from rest and it is found to have a speed of 0.3 m/s^{-1} after it has descended through a distance of 1 m. Which of the following statements are correct?

- (A) Loss in gravitational potential energy is 10J
 (B) kinetic energy of 1kg block is 0.045 J
 (C) 4 kg block travels a distance of 2 m to acquire a velocity of 0.6 ms^{-1}
 (D) Work done against friction is $80 \mu\text{J}$ where μ is coefficient of kinetic friction



5. **ABCD**

6. A particle of mass m moves on x -axis in a conservative force field where the potential energy U varies with position coordinate x as $U = U_0(1 - \cos ax)$, U_0 and a are positive constants. The following statement is true regarding its motion
- (A) the acceleration is constant
 (B) the kinetic energy is constant
 (C) the acceleration is directed along the position vector
 (D) the acceleration is directed opposite to the position vector

6. **D**

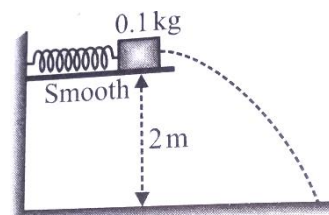
7. A 0.1 kg block is pressed against a horizontal spring fixed at one end to compress the spring through 5 cm. The spring constant is 100 N/m. The ground is 2 m below the spring. Which of the following is/are correct?

(A) When released, block shall have a kinetic energy of $\frac{1}{8}$ J.

(B) The initial horizontal velocity of the block is $\sqrt{\frac{5}{2}}$ m/s.

(C) The block shall reach the ground in $\sqrt{\frac{2}{5}}$ sec.

(D) The block will hit the ground at a horizontal distance of 1 metre from the free end of the spring.



7. **ABCD**

(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**.

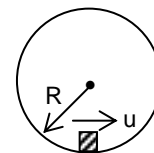
8. A particle is given an initial speed u inside a smooth spherical shell of radius $R = 1$ m that it is just able to complete the circle. Acceleration of the particle when its velocity is vertical is

(A) $g\sqrt{10}$

(B) g

(C) $g\sqrt{2}$

(D) $g\sqrt{6}$



8. **A**

9. A bullet is fired normally on an immovable wooden plank. It loses 25% of its kinetic energy in penetrating a thickness x of the plank. What is the total thickness penetrated by the bullet?

(A) $2x$

(B) $4x$

(C) $6x$

(D) $5x$

9. **B**

10. The relation between the displacement x and the time t for a body of mass 2kg moving under the action of a force is given by $x = \frac{t^3}{3}$, where x is in meters and t is in seconds. The work done by the body in the 1st 2 seconds is

(A) 1.6J

(B) 16J

(C) 160J

(D) 1600 J

10. **B**

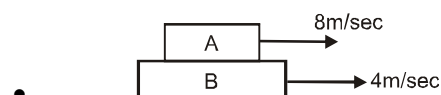
11. A pump motor is used to deliver water at a certain rate from a given pipe. To obtain 'n' times water from the same pipe in the same time, by what amount the power of the motor should be increased?
 (A) n^2 times (B) n^3 times
 (C) n times (D) $n^{3/2}$ times
11. **B**
12. Under the action of a force, a 3kg body moves such that $x = t^2/2$ where position x is in meter and t is in second. The work done by the force in first 3 second is
 (A) 13.5J (B) 27J
 (C) 81J (D) 109 J
12. **A**
13. A stone tied to a string of length L is whirled in a vertical circle with the other end of the string at the centre. At a certain instant of time, the stone is at its lowest position and has a speed u. The magnitude of the change in its velocity as it reaches a position where the string is horizontal is:
 (A) $\sqrt{u^2 - 2gL}$ (B) $\sqrt{2gL}$ (C) $\sqrt{u^2 - gL}$ (D) $\sqrt{2(u^2 - gL)}$
13. **D**

PART – B
(Numerical based)

1. A particle of mass m is moving in a circular path of constant radius r(0.5 m) such that its 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 $t = 5$ sec. (take $mk^2 = 1$ unit)

1. **2.50**

2. Block A of mass 1 kg is placed on the rough surface of block B of mass 3 kg. Block B is placed on smooth horizontal surface. Blocks are given the velocities as shown. Find net work done (in Joule) by the frictional force.



2. **-6**

3. If an ideal linear spring is stretched by x then energy stored in it is E and when it is stretched by a further 1.5 x then energy stored adds a further nE. Find the value of 'n'.

3. **5.25**

4. A pump motor delivers water at a certain rate. The power of the motor is to be increased to obtain twice amount of water from the same pipe and in the same time. The power of the motor has to be increased by how many time (in integer)?

4. **8**

5. A nail is located at a certain distance vertically below the point of suspension of a simple pendulum. The pendulum bob is released from a position when the string makes 60° with vertical and it moves in vertical circular motion. Calculate the distance (in cm) of nail from point of suspension such that the bob will just perform revolutions with nail as centre. The length of pendulum is given as 10 cm.

5. **8**

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 show amphoteric behaviour?
(A) $Zn(OH)_2$ (B) BeO
(C) Al_2O_3 (D) $Pb(OH)_2$
1. ABCD
2. Chlorine atom does not differ from chloride ion in the number of which of the following?
(A) Electrons (B) Size
(C) Protons (D) Neutrons
2. CD
3. Which of the following substance(s) is/are thermally less stable than $CaCO_3$?
(A) $BeCO_3$ (B) $MgCO_3$
(C) $SrCO_3$ (D) $BaCO_3$
3. AB
4. Which of the following statement is correct regarding H_2O_2 ?
(A) it has open book like structure
(B) it is both an oxidizing as well as reducing agent
(C) it is a bleaching agent
(D) it acts as only oxidizing agent
4. ABC
5. Which of the following properties of compounds is correctly matched?
(A) Hydration energy: $Li^+ > Na^+ > K^+ > Rb^+ > Cs^+$
(B) Solubility in water: $LiOH < NaOH < KOH < RbOH < CsOH$
(C) Lattice energy: $RbF < KF < NaF < LiF$
(D) Thermal Stability: $RbH < KH < NaH < LiH$
5. ABCD
6. An atom contains 2, 8, 14 and 2 electrons respectively in K, L, M and N orbits. Which of the following statement(s) is/are correct for the atom?
(A) it is a d-block element
(B) it contains eight electrons with $\ell = 0$
(C) It's spin magnetic moment is $2\sqrt{6}$ B.M
(D) it has 5 unpaired electrons.
6. ABC
7. Highly pure dilute solution of sodium in liquid ammonia:
(A) Shows blue colour
(B) Exhibits electrical conductivity
(C) Shows reducing properties
(D) Shows oxidizing properties
7. ABC

(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. Sodium sulphate is soluble in water whereas barium sulphate is sparingly soluble because
(A) the hydration energy of sodium sulphate is more than its lattice energy
(B) the hydration energy of barium sulphate is more than its lattice energy
(C) the lattice energy has not role to play in solubility
(D) the hydration energy of sodium sulphate is less than its lattice energy
8. A
9. $\text{Mg} + \text{N}_2 \xrightarrow{\Delta} \text{A} \xrightarrow{\text{H}_2\text{O}} \text{B(g)} \uparrow + \text{C}$
basic
- B is
(a) NO_2 (b) N_2O_3
(c) NH_3 (d) N_2H_4
9. C
10. Which of the following gas should be passed through aqueous solution of calcium hydroxide in order to produce a salt which contains atoms that show the following oxidation numbers
+2, -2, +1, -1
(A) CO_2 (B) Cl_2
(C) NO_2 (D) SO_2
10. B
11. Which of the following substance has the highest value of second ionization energy?
(A) Na (B) Mg
(C) Al (D) Ca
11. A
12. Which of the following substance forms a white colour product when reacts with H_2O_2 ?
(A) $\text{K}_2\text{Cr}_2\text{O}_7$ (B) FeSO_4
(C) PbS (D) Na_2SO_4
12. C
13. Which of the following expression regarding the successive ionization enthalpies of Mg is correct?
(A) $\text{I.E}_3 - \text{I.E}_1 > \text{I.E}_2 - \text{I.E}_1$ (B) $\text{I.E}_2 + \text{I.E}_1 > \text{I.E}_3 + \text{I.E}_4$
(C) $\text{I.E}_3 - \text{I.E}_2 > \text{I.E}_3 - \text{I.E}_1$ (D) $\text{I.E}_1 + \text{I.E}_3 > \text{I.E}_4 + \text{I.E}_2$
13. A

PART – B
(Numerical based)

1. An element has its electronic configuration as given $[\text{Ar}]_{18}3d^54s^1$. Predict the group number of the element in the long form of periodic table.
1. 6
2. The dipositive($2+$) ions of how many of the following atoms(s) contain(s) unpaired electrons?
Li, Mg, Fe, Al, Cl, Ca, Zn, Ni, Ti, S, P and Si
2. 8
3. A third period metal(A) reacts with steam to produce a solid residue(B) and H_2 gas. (B) is dissolved in HCl producing an aqueous solution which on crystallization produces $\text{MgCl}_2 \cdot 6\text{H}_2\text{O}$ at a certain temperature. How many atoms are present in the compound(B)?
3. 2
4. Find the maximum number of hydrogen bonds a water molecule can form
4. 4
5. Beryllium chloride exists as a dimer in vapour state
If x = Number of Be – Be bonds in the dimer
 y = Number of ($2c - 2e$) Be – Cl bonds in the dimer
 z = Number of coordinate bonds in the dimer
What is the value of ($x + y + z$)?
5. 6

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. A line passing through the point $(11, -2)$ and touching the circle $x^2 + y^2 = 25$ is
 (A) $4x + 3y = 38$ (B) $3x + 4y = 25$
 (C) $3x - 4y = 41$ (D) $7x - 24y = 125$
1. B,D
2. The radius of a circle passing through the point $(1,1)$ and touching both the coordinate axes is
 (A) $2 - \sqrt{3}$ (B) $2 - \sqrt{2}$
 (C) $2 + \sqrt{3}$ (D) $2 + \sqrt{2}$
2. B,D
3. Tangents are drawn from a point P on the circle $C: x^2 + y^2 = a^2$ to the circle $C_1: x^2 + y^2 = b^2$. If these tangents cut the circle C at Q and R and if QR is tangent to the circle C_1 then the area of ΔPQR is
 (A) $3\sqrt{3}b^2$ (B) $\frac{3\sqrt{3}}{4}a^2$
 (C) $\frac{3\sqrt{3}}{2}ab$ (D) $2\sqrt{3}ab$
3. A,B,C
4. AB is a chord of length 5 units of the circle $x^2 + y^2 = \frac{25}{2}$. If a point P moves such that $PA = 4$ and $PB = 3$, then the locus of P is a circle of radius
 (A) 1 (B) $\frac{1}{\sqrt{2}}$
 (C) $\frac{5}{\sqrt{2}}$ (D) $\frac{7}{\sqrt{2}}$
4. B,D
5. Equation of tangents drawn from the origin to the circle $x^2 + y^2 - 2rx - 2hy + h^2 = 0$ are;
 (A) $x = 0$ (B) $y = 0$
 (C) $(h^2 - r^2)x - 2rhy = 0$ (D) $(h^2 - r^2)x + 2hxy = 0$
5. A,D
6. If a circle passes through the point $\left(3, \sqrt{\frac{7}{2}}\right)$ and touches $x + y = 1$ and $x - y = 1$, then the centre of the circle is at:
 (A) $(4, 0)$ (B) $(4, 2)$
 (C) $(6, 0)$ (D) $(7, 0)$
6. A,C

7. A Circle (C) is drawn , having centre in 1st quadrant , such that it is touching both axes . Now , another circle is drawn which is touching both axes and circle (C) , then the centre of new circle can lies in
 (A) 1st Quadrant (B) 2nd Quadrant
 (C) 3rd Quadrant (D) 4th Quadrant
7. A,B,C

(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. The lines $3x + 2y = 5$ and $4x + 3y = 7$ are diameters of a circle of area 154 sq. units, then the equation of the circle is
 (A) $x^2 + y^2 + 2x - 2y = 62$ (B) $x^2 + y^2 + 2x - 2y = 47$
 (C) $x^2 + y^2 - 2x - 2y = 47$ (D) $x^2 + y^2 - 2x + 2y = 62$
8. C
9. 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
9. D
10. A circle of radius 2 units passes through (1, 1) and has the line $y + x = 0$ as diameter. The centre of the circle is
 (A) (1, 2) (B) (1, -1)
 (C) (1, 0) (D) (0, 1)
10. B
11. The length of the intercept made by the circle whose diameter is the line joining the end points (-4, 3) and (12, -1) on y-axis is
 (A) $2\sqrt{13}$ (B) $4\sqrt{13}$
 (C) $8\sqrt{13}$ (D) none of these
11. B
12. The tangents to the circle $x^2 + y^2 = 169$ at the points (5, 12) and (-5, -12) are
 (A) parallel (B) at right angle
 (C) inclined at an angle of 45° (D) none of these
12. A
13. If $x^2 + y^2 - 2x - 4y - 11 = 0$ then equation of tangent from P (6, 2) is/are
 (A) $3x - 4y = 18$ (B) $3x + 4y + 30 = 0$
 (C) $3x + 4y = 8$ (D) none of these
13. D

PART – B
(Numerical based)

- 1) 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
 1. 5
2. If $2x - 4y = 9$ and $6x - 12y + 7 = 0$ are common tangents to a circle having radius $\frac{17}{k\sqrt{5}}$ then k is
 2. 6
3. If the tangent at the point P on the circle $x^2 + y^2 + 6x + 6y = 2$ meets the straight line $5x - 2y + 6 = 0$ at a point Q on the y-axis, then the length of PQ is
 3. 5
4. Find the area of the quadrilateral formed by a pair of tangents from the point (4, 5) to the circle $x^2 + y^2 - 4x - 2y - 11 = 0$ and a pair of its radii
 4. 8
5. The centre of circle inscribed in square formed by the lines $x^2 - 8x + 12 = 0$ and $y^2 - 14y + 45 = 0$, is (a,b). Then the value of b-a is
 5. 3

ANSWERS

SECTION-1 : PHYSICS

PART – A

PART – B

SECTION – 2 : CHEMISTRY

PART – A

PART – B

SECTION – 3 : MATHEMATICS

PART – A

PART – B