

PHYSICS, CHEMISTRY & MATHEMATICS

Pattern - CPT-1

QP Code:

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.
- (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 : _____

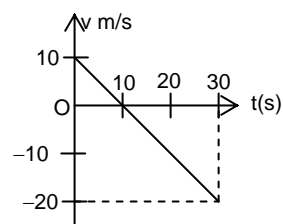
SECTION-1 : PHYSICS

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 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
 (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.

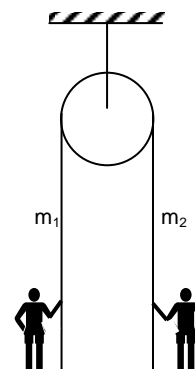


1. **AD**

2. A particle of mass 'M' is attached to a light string of length ' ℓ ' the other end of which is fixed. Initially the string is kept horizontal and the particle is given an upward velocity 'u'. The particle is just able to complete a circle.
- (A) the string becomes slack when the particle reaches its highest point.
 (B) the velocity of the particle becomes $\sqrt{g\ell}$ at the highest point.
 (C) the velocity of the ball at the initial position is $\sqrt{4g\ell}$.
 (D) the particle never passes again through the initial position.

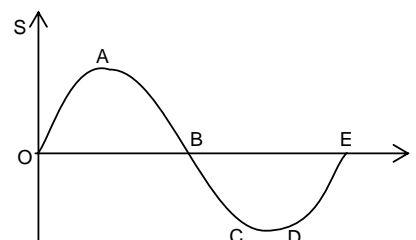
2. **AB**

3. Two men of unequal masses hold on to the two sections of a light rope passing over a smooth light pulley. Which of the following are possible
- (A) The lighter man is stationary while the heavier man slides with some acceleration
 (B) The heavier man is stationary while the lighter man climbs with some acceleration
 (C) The two men slide with the same acceleration in the same direction
 (D) The two men slide with acceleration of the same magnitude in opposite direction



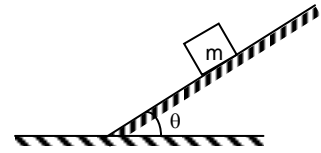
3. **ABD**

4. A particle has a rectilinear motion and the figure gives its displacement as a function of time. Which of the following statements are true with respect to the motion.
- (A) in motion between 0 to A, the velocity is positive and acceleration is negative
 (B) between A and B, the velocity and acceleration are positive
 (C) between B and C, the velocity is negative and acceleration is positive
 (D) between D and E, the acceleration is positive



4. **ACD**

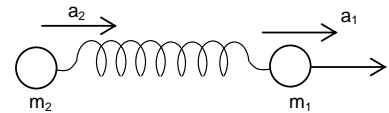
5. A block is stationary relative to a moving inclined plane. No other information is given. The frictional force on the block can be
 (A) zero (B) downward
 (C) upward (D) $>mg$



5. **ABCD**

6. 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



6. **ABCD**

7. If $\vec{A} = 2\hat{i} + 3\hat{j}$ and $\vec{B} = 2\hat{i} - 3\hat{j} + \hat{k}$ then

- (A) $\vec{A} \cdot \vec{B} = -5$ (B) $\vec{A} \cdot \vec{B} = 5$
 (C) $|\vec{A} \times \vec{B}| = \sqrt{157}$ (D) $|\vec{A} \times \vec{B}| = -\sqrt{157}$

7. **AC**

(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 car is moving on circular path of radius 100 m such that its speed is increasing at the rate of 5 m/s^2 . At $t = 0$ it starts from rest. The radial acceleration of car at the instant it makes one complete round trip
 (A) $10\pi \text{ m/s}^2$ (B) $20\pi \text{ m/s}^2$
 (C) $\pi/20 \text{ m/s}^2$ (D) $\pi/10 \text{ m/s}^2$

8. **B**

9. The vector $\vec{B} = 5\hat{i} + 2\hat{j} - x\hat{k}$ is perpendicular to the vector $\vec{A} = 3\hat{i} + \hat{j} + 2\hat{k}$ for x equals to
 (A) 1 (B) 4.7
 (C) 6.3 (D) 8.5

9. **D**

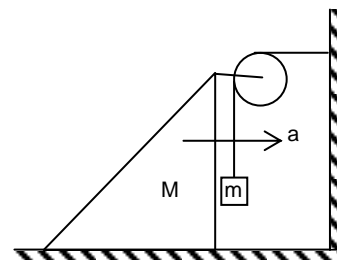
10. A particle moving in the positive x -direction has initial velocity v_0 . The particle undergoes retardation kv^2 , where v is its instantaneous velocity. The velocity of the particle as a function of time is given by

- (A) $v = v_0/(1 + kv_0 t)$ (B) $v = \frac{2v_0}{1 + kt}$
 (C) $v = \frac{v_0}{kt}$ (D) $v = \frac{v_0}{(1 + k^2 v_0^2 t)}$

10. **A**

11. If wedge is moving with acceleration a as shown in the figure then value of net force on m is

(A) ma (B) $\sqrt{2} ma$
 (C) mg (D) zero



11. **B**

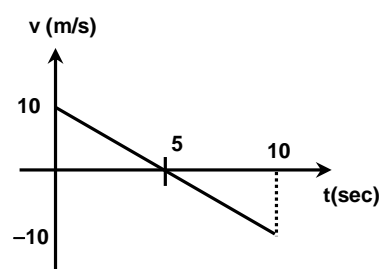
12. An object of mass m is hanging by a string from the ceiling of an elevator. The elevator is moving upward but slowing down. What is the tension in the string

(A) less than mg (B) exactly mg
 (C) greater than mg (D) zero

12. **A**

13. Velocity-time graph of a particle moving in a straight line is shown in the figure. Mass of the particle is 2 kg. Work done by all the forces acting on the particle in time interval $t = 0$ to $t = 10$ sec is

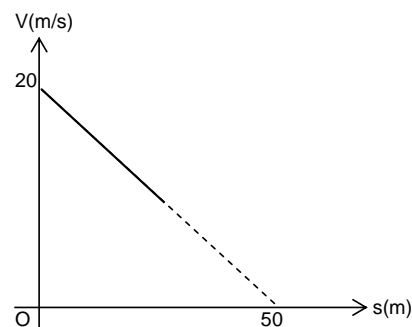
(A) 300 J (B) - 300 J
 (C) zero (D) - 400 J



13. **C**

PART – B (Numerical based)

1. Referring to $v - s$ diagram, the magnitude of acceleration of the particle when its velocity becomes half of the initial velocity is $5x$. Find the value of ' x '.



1. **0.80**

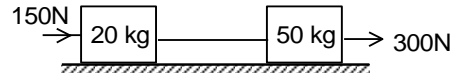
2. Power supplied to a particle of mass 2 kg varies with time as $P = \frac{3t^2}{2}$ W. Here t in second. If velocity of particle at $t = 0$ is $v = 0$. The velocity (in m/sec) of the particle at time $t = 2$ sec is $5x$, then find the value of ' x '.

2. **0.40**

3. A ball is projected in upward direction with a speed of 20 m/s. Find the distance (in meter) travelled by it in last second of its ascending motion ($g = 10 \text{ m/s}^2$)

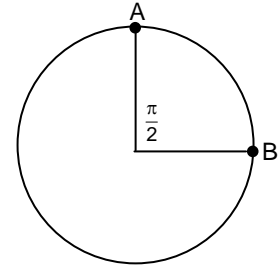
3. **5**

4. Two blocks of masses 20 kg and 50 kg are lying on a horizontal floor (coefficient of friction $\mu = 0.5$). Initially string is stretched and blocks are at rest. Now two forces 300 N and 150 N are applied on two blocks as shown in figure. What is the acceleration (m/s^2) of 20 kg block?



4. **2.50**

5. A particle is moving in a circular path of radius 1 metre. Under the action of centripetal force. The speed $\frac{\pi}{\sqrt{2}}$ m/s of the particle is constant. Find the average velocity (in m/s) between A and B.



5. **2**

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. The particles of which radiation(s) has/have constant charge to mass ratio irrespective of their source of formation?
 (A) Cathode ray (B) Anode ray
 (C) Alpha ray (D) X-ray

1. **ACD**

2. Which of the following element(s) has/have higher I.E₁ than sodium?
 (A) Li (B) Mg
 (C) K (D) Al

2. **ABD**

3. The correct statement(s) regarding SF₆ molecule is/are
 (A) it is an octahedral molecule
 (B) sulphur undergoes sp³d² hybridization
 (C) it's dipole moment is zero
 (D) all the S – F bonds do not have identical bond length

3. **ABC**

4. Which of the following contains nitrogen atom(s) in positive oxidation state(s)?
 (A) NH₄Cl (B) HNO₃
 (C) N₂O₃ (D) NO₂BF₄

4. **BCD**

5. Which of the following relation(s) is/are correct for an ideal gas?
 (A) PV = nRT (B) Z = 1
 (C) $C_{rms} = \sqrt{\frac{3RT}{M}}$ (D) Translational kinetic energy = $\frac{3}{2}nRT$

5. **ABCD**

6. For which of the following atom(s), there is larger difference between I.E₂ to I.E₃ as compared to I.E₁ and I.E₂?
 (A) Al (B) Mg
 (C) Be (D) Na

6. **BC**

7. Which of the following atom(s) contain(s) half-filled electron configuration?
 (A) N(Z = 7) (B) Mn(Z = 25)
 (C) S(Z = 16) (D) Ni(Z = 28)

7. **AB**

(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. In which of the following molecule the lone pair of the central atom is the most penetrated towards its nucleus or strongly attracted by the nucleus?

(A) NH_3 (B) PH_3
(C) AsH_3 (D) BiH_3

8. **D**

9. In which of the following option, the second ionization energy is given in the correct order.

(A) $\text{B} > \text{Be}$ (B) $\text{N} > \text{O}$
(C) $\text{Mg} > \text{Na}$ (D) $\text{C} > \text{O}$

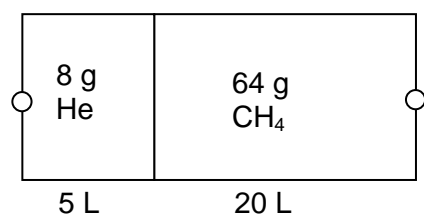
9. **A**

10. 0.98g of a polybasic acid(mol.mass = 98) requires 30 mL of 0.5 M $\text{Ba}(\text{OH})_2$ for complete neutralization. What is the basicity of the acid?

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

10. **C**

11.



In the above arrangement the 5 L container contains He and the 20 L container contains CH_4 at constant temperature. What will be the rate of effusion of He to CH_4 through the two identical orifices?

(A) 2 : 1 (B) 4 : 1
(C) 1 : 1 (D) 1 : 2

11. **B**

12. How many covalent bonds are present in SO_4^{2-} ion?

(A) 4 (B) 6
(C) 8 (D) 7

12. **B**

13. Which of the following contains the strongest B – F bond?

(A) BF_3 (B) BF_4^-
(C) HBF_4 (D) KBF_4

13. **A**

PART – B
(Numerical based)

1. A vessel contains 600 mL of 0.4 M solution of NaOH. On heating, 560 mL of water was evaporated. What is the molarity of the remaining solution?
1. 6
2. One litre aqueous solution of HCl contains 36.5 g of HCl. What is the molarity of the solution?
2. 1
3. If the simplest ratio of the relative rate of effusion of H_2 to O_2 , under identical condition, is expressed as $x : y$, the value of $(x + y)$ is:
3. 5
4. The number of completely filled antibonding molecular orbitals of O_2^- ion is:
4. 3
5. How many moles of dioxygen gas can completely oxidize 0.8 g of dihydrogen into water?
5. 0.2

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. If P(1, 2), Q(4, 6), R(5,7) and S(a, b) are the vertices of a parallelogram PQRS, then
 (A) a = 2 (B) a = 3
 (C) b = 3 (D) b = 5
1. AC
2. The slope of the line making an angle of 45° with the line $x - 2y = 3$ is
 (A) 3 (B) -3
 (C) $-\frac{1}{3}$ (D) $\frac{1}{3}$
2. AC
3. If 'a' denotes the slope of a line given by $108x^2 + 31xy + y^2 = 0$, then a =
 (A) -4 (B) 8
 (C) -27 (D) 4
3. AC
4. If (1,2), (2,3) lies on same side of $x - y + a = 0$ then 'a' can be
 (A) 1 (B) 3
 (C) 4 (D) 5
4. BCD
5. If the circle $x^2 + y^2 + 2x + 2ky + 6 = 0$ and $x^2 + y^2 + 2ky + k = 0$ intersect orthogonally, then k is
 (A) 2 (B) -2
 (C) $-\frac{3}{2}$ (D) $\frac{3}{2}$
5. AC
6. If $x = at^2$ and $y = 2at$ then $\frac{dy}{dx}$ is equal to
 (A) $\frac{1}{t}$ (B) t
 (C) $\frac{2a}{y}$ (D) None of these
6. AC

7. If $2\sin^2\theta + \sin^2 2\theta = 2$ then $\sin^2\theta$ equal to
- (A) 1 (B) $\frac{1}{2}$
 (C) $\frac{1}{3}$ (D) $\frac{1}{4}$
7. AB

(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. Solution of the equation $|x + 4| < 3$ is
- (A) $\left(-\frac{1}{3}, 7\right)$ (B) $(-7, -1)$
 (C) $\left(-4, \frac{1}{3}\right)$ (D) $\left(\frac{1}{3}, 4\right)$
8. B
9. Equation of chord of circle $x^2 + y^2 + 4x + 2y - 20 = 0$ with mid point $(-1, 1)$ is
- (A) $x + 2y = 1$ (B) $x + 3y = 2$
 (C) $2x + 3y = 1$ (D) None
9. A
10. If $\log_a x = 0.3$ and $\log_a 3 = 0.4$, then $\log_3 x$ is :
- (A) 0.12 (B) 0.7
 (C) $\frac{3}{4}$ (D) $\frac{4}{3}$
10. C
11. The equation of the normal to the circle $x^2 + y^2 - 4x + 4y - 17 = 0$ which passes through $(1, 1)$ is $3x + y - k = 0$, Find k.
- (A) 4 (B) 1
 (C) 2 (D) None of these
11. A
12. $\frac{\cos\theta}{\sin(90+\theta)} + \frac{\sin(-\theta)}{\sin(180+\theta)}$ is
- (A) 0 (B) 1
 (C) 2 (D) None of these
12. C
13. If $x + 2y = 5$ is tangent to the circle $x^2 + y^2 = 5$, then equation of normal at their point of contact is
- (A) $2x + y = 5$ (B) $2x - y = 0$
 (C) $x + 2y = 0$ (D) None of these
13. B

PART – B
(Numerical based)

1. The values of x satisfying $\log_{16} x + \log_4 x + \log_2 x = \log_{1/2} \left(\frac{1}{128} \right)$ is
1. 16
2. Radius of the circle $(x-4)(x+2) + (y^2 - 16) = 0$ is
2. 5
3. Minimum value of the expression $4 \cos \left(\theta + \frac{\pi}{3} \right) - 3 \sin \left(\theta - \frac{\pi}{6} \right)$ is
3. -7
4. The shortest distance from the line $3x + 4y = 25$ to the circle $x^2 + y^2 = 6x - 8y$ is equal to
4. 1.4
5. If angle between pair of tangents from $(2, 5)$ to $x^2 + y^2 - 2x - 4y + 4 = 0$ is ' θ ' then $\tan \theta$ equal to
5. 0.75

ANSWERS

SECTION-1 : PHYSICS

PART – A

PART – B

PAPER – 1 : CHEMISTRY

PART – A

PART – B

SECTION – 3 : MATHEMATICS

PART – A

PART – B