

PHYSICS, CHEMISTRY & MATHEMATICS

Pattern - 1

QP Code:

TEST - 1

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 seven (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 (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 : _____

BATCHES – All 2123 batches (X & A – lot)

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**.

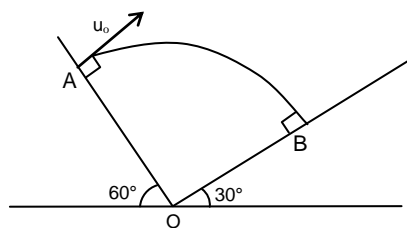
1. A stone is projected with initial velocity $u = 2\sqrt{2}$ m/s at an angle $\alpha = 45^\circ$ with the horizontal, find the angular velocity in rad/sec (in nearest integer) of the stone with respect to the point of projection, when it is at its maximum height. (take $g = 10$ m/s²)
 (A) 1 (B) 2
 (C) 3 (D) 4

1. **B**

2. The ratio of radii of curvature at the point of projection and highest point for maximum horizontal range is:
 (A) 1 (B) $2\sqrt{2}$ (C) $\frac{1}{2}$ (D) $\frac{1}{\sqrt{2}}$

2. **B**

3. A projectile is thrown from one inclined plane in a direction perpendicular for this plane. It is observed that this projectile hits the other incline plane perpendicular to that plane, then find the ratio $\frac{OA}{OB}$.



- (A) $2\sqrt{3}$ (B) $\frac{1}{2\sqrt{3}}$ (C) $\sqrt{3}$ (D) $\frac{1}{\sqrt{3}}$

3. **C**

4. A vector of constant 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) $\left| \frac{a}{2} \sin\left(\frac{\theta}{2}\right) \right|$

4. **B**

5. A projectile is throw horizontally from a big tower with a speed of 20 ms⁻¹. If $g = 10$ ms⁻², the speed of the projectile after 5 second will be nearly,
 (A) 39 ms⁻¹ (B) 48 ms⁻¹ (C) 54 ms⁻¹ (D) 61 ms⁻¹

5. **C**

6. The angle made by vector $\hat{i} + 2\hat{j} - 2\hat{k}$ with the y axis is
 (A) $\cos^{-1} \frac{1}{3}$ (B) $\cos^{-1} \left(-\frac{2}{3}\right)$ (C) $\cos^{-1} \left(\frac{2}{3}\right)$ (D) $\sin^{-1} \left(\frac{1}{3}\right)$

6. **C**

(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. Which are the physical quantities?
 (A) Speed of light
 (B) Mass of Sun
 (C) The thinking capabilities of human mind
 (D) RAM of a computer

7. **ABD**

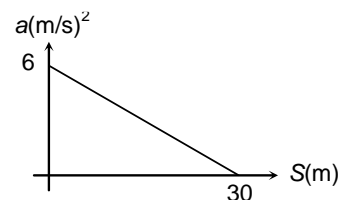
8. The magnitude of component of a vector may be
 (A) greater than the magnitude of that vector.
 (B) equal to the magnitude of that vector.
 (C) smaller than the magnitude of that vector.
 (D) zero

8. **ABCD**

9. Which of the following statement is/are correct?
 (A) Average speed of a particle in a given time period is never less than magnitude of average velocity
 (B) It is possible to have situations in which $\left| \frac{d\vec{v}}{dt} \right| \neq 0$, but $\frac{d|\vec{v}|}{dt} = 0$
 (C) It is possible to have situations in which $\frac{d|\vec{v}|}{dt} \neq 0$ but $\left| \frac{d\vec{v}}{dt} \right| = 0$
 (D) It is possible that the average velocity of a particle is zero in a time interval but the instantaneous velocity is never zero in the interval

9. **ABD**

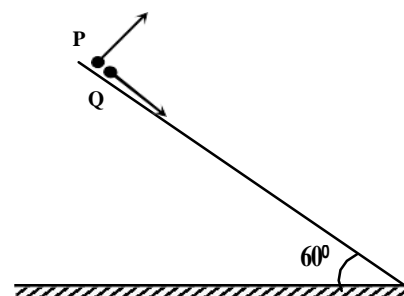
10. A train starts from rest at $S = 0$ and is subjected to acceleration as shown
 (A) Change in velocity at the end of 10 m displacement is 50 m/s.
 (B) Velocity of the train for $S = 10$ m is 10 m/s.



- (C) The maximum velocity attained by train is not greater than 14 m/s
 (D) The maximum velocity of the train is between 15 m/s and 16 m/s.

10. **BC**

11. A particle P is projected at $t = 0$ from a point on the surface of a smooth inclined plane as shown in the figure simultaneously another particle Q is released on the smooth inclined plane from the same position. P and Q collide after $t = 4$ seconds. Then choose the correct Option(s).



- (A) Trajectory of particle P in the frame of Q is parabola during the flight of particle P.
 (B) Speed of projection of P is 20 m/s.
 (C) Relative velocity of Particle P in the frame of Q changes linearly with time during the flight of P.
 (D) Acceleration of particle P in the frame of Q is zero during the flight of P.

11. **C**

12. A point moves with deceleration along the circle of radius R so that at any time its tangential and normal acceleration are equal in magnitude. At the initial moment $t=0$, the velocity of the point is v_0 . The velocity of the point will be

(A) $v = \frac{v_0}{1 + \frac{v_0 t}{R}}$ at t second

(B) $v = v_0 e^{-s/R}$ after displacements

(C) $v = v_0 e^{-sR}$ after displacements

(D) $v = \frac{v_0}{1 - \frac{v_0 t}{R}}$ at t second

12. **AB**

PART – B (Numerical based)

1. The resultant of two vectors A and B is perpendicular to the vector A and its magnitude is equal to half the magnitude of vector B . The angle between A and B is $x \frac{\pi}{6}$. Then the value of 'x' is

1. **5.00**

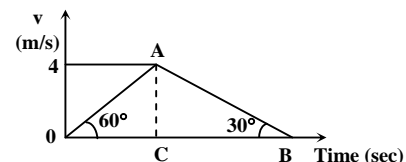
2. Velocity time equation of a particle moving in a straight line is $V = t^2 - 5t + 6$. The distance travelled by the particle in the time interval from $t = 0$ to $t = 4$ sec

2. **5.67 (Range: 5.62 to 5.70)**

3. If $\vec{A} = 2\hat{i} + 3\hat{j} - \hat{k}$ and $\vec{B} = -\hat{i} + 3\hat{j} + 4\hat{k}$, then projection of \vec{A} on \vec{B} will be ?

3. **0.59 (Range: 0.58 to 0.60)**

4. The velocity time graph of a body is shown in the figure. The ratio of the average velocity during the interval OA and AB is



4. **1.00**

5. A particle has an initial velocity of $3\hat{i} + 4\hat{j}$ and an acceleration of $0.4\hat{i} + 0.3\hat{j}$. Its Speed after 10 sec is

5. **9.90 (Range: 9.70 to 10.00)**

6. Twelve persons are initially at the twelve corners of a regular polygon of twelve sides of side $a = 1$ m. Each person now moves with uniform speed $V = 2$ m/s, in such a manner that 1 is always directed towards 2, 2 towards 3, 3 towards 4 and so on. What is the distance travelled by each person before they meet ? (in meters)

6. **7.46 (Range: 7.43 to 7.50)**

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**.

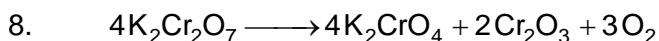
1. $\text{CO}_2 + \text{C} \longrightarrow 2\text{CO}$
What is the equivalent mass of CO_2 in above reaction?
(A) 44 (B) 11
(C) 22 (D) 14.33
1. C
2. What is the ratio of densities of helium to dioxygen ideal gases at STP? $\frac{d_{\text{He}}}{d_{\text{O}_2}} = ?$
(A) 1:8 (B) 1:4
(C) 8:1 (D) 4:1
2. A
3. How many sodium pellets can be neutralized by one litre of 0.4 M HCl solution? [Mass of each NaOH pellet = 2g]
(A) 4 (B) 16
(C) 8 (D) 10
3. C
4. At constant temperature the molecules of an ideal gas move with same
(A) velocity (B) kinetic energy
(C) linear momentum (D) direction
4. B
5. Two litre of FeSO_4 solution is added to a container containing 1.2 litre of 0.4 M acidified KMnO_4 solution. After decolourisation of pink colour, the remaining solution required 400 mL of 4 N acidified $\text{K}_2\text{Cr}_2\text{O}_7$ solution to change the colourless solution to just green. How many moles of Fe^{2+} ions was present in the FeSO_4 solution?
(A) 2 (B) 4
(C) 4.2 (D) 2.4
5. B
6. An ideal gas occupies a volume of 0.1 L when collected over water at 10°C and pressure 0.9 atm. The same gas occupied a volume of 0.08 L at STP in dry condition. What is the aqueous tension of water at 10°C ?
(A) 0.071 atm (B) 0.061 atm
(C) 0.051 atm (D) 0.081 atm
6. A

(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 gas shows positive deviation from ideal behaviour. Which of the following is/are correct for the gas?
- (A) Volume occupied by the gas is greater than that of an ideal gas under constant conditions.
- (B) It is easily compressible than ideal gas under same condition.
- (C) The relation $b = 4V_m$ is applicable to it and also it is applicable for a gas showing negative deviation.
- (D) Temperature should be increased and pressure should be decreased to convert it into ideal gas.

7. ACD

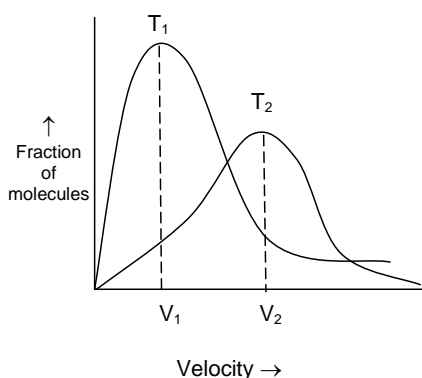


Choose correct statement(s) from the following

- (A) chromium is oxidized as well as reduced
- (B) Two moles of $K_2Cr_2O_7$ produces three moles of atomic oxygen
- (C) The n-factor of O_2 is 4
- (D) It is a decomposition reaction

8. BCD

9.



Choose correct statement(s) from the following?

- (A) $T_2 > T_1$
- (B) $V_1 = \sqrt{\frac{3RT_1}{M}}$
- (C) $V_2 = \sqrt{\frac{2RT_2}{M}}$
- (D) $T_1 > T_2$

9. AC

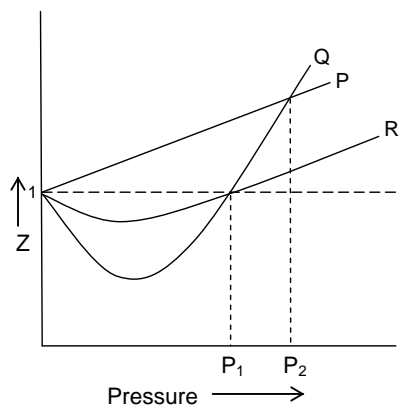
10. 550 mL of 0.2 M HCl solution is required to neutralize 11 g of a mixture of Na_2CO_3 and NaOH with phenolphthalein indicator.

Choose correct statement(s)

- (A) CO_2 gas is evolved in the titration
- (B) 0.4 g of NaOH is present in the mixture
- (C) 0.1 mole of Na_2CO_3 is present in the mixture
- (D) After reaction 0.1 mole of $NaHCO_3$ is present in the solution

10. BCD

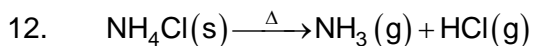
11.



Choose correct statement(s) regarding the behaviour of gases P, Q and R at constant temperature.

- (A) Q and R show ideal behaviour at pressure P_1
 (B) For gases P and Q the van der Waal's equation reduces to $P(V - b) = RT$ more favourably at P_2 than P_1
 (C) At P_1 pressure, gas P is least compressible among the given gases
 (D) All gases show ideal behaviour at P_2

11. ABC



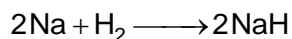
One mole of NH_4Cl

- (A) contains 14 g of nitrogen
 (B) produces 22.4 L of NH_3 at NTP
 (C) Produces 4 mole of HCl
 (D) contains 6 moles of atom

12. ABD

PART – B (Numerical based)

1. In a reaction two moles of Na and one mole of H_2 produces 36 g of sodium hydride(NaH). If the product yield of NaH is x %. What is x?

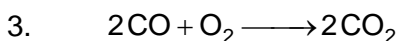


1. 75

320 g SO_2	16 g CH_4
$V = 2 \text{ L}$	$V = 2 \text{ L}$

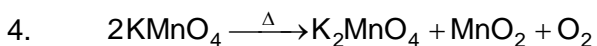
How many times will be the relative rate of effusion of SO_2 greater than CH_4 in above two containers at constant temperature?

2. 2.5



How much gram of CO_2 is produced by complete reaction of 2.8 g CO and 3.2 g O_2 ?

3. 4.4



How much litre of O_2 will be formed at STP if one equivalent of KMnO_4 undergoes complete reaction in above equation? [Molar mass of $\text{KMnO}_4 = 158$]

4. 5.6
5. What is the kinetic energy of two moles of an ideal gas at 10^4K in kJ unit?
5. 249.42
6. The root mean square velocity of a diatomic ideal gas is 0.8 ms^{-1} . What will be the rms velocity in ms^{-1} if the temperature is increased eight times and the molecules are dissociated into atoms?
6. 3.2

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. $y = \ln(\sec x + \tan x)$, then $\frac{dy}{dx}$ will be

- (A) $\tan x$
(C) $\tan^2 x$

- (B) $\sec x$
(D) none of these

1. B

2. The value of the indefinite integral $\int \left(x + \frac{1}{x}\right)^2 dx$ will be

(A) $\frac{1}{3} \left(x + \frac{1}{x}\right)^3 + C$

(B) $\frac{x^3}{3} + 2x - \frac{1}{x} + c$

(C) $\frac{x^3}{3} + 2x + \frac{1}{x} + c$

(D) none of these

2. B

3. If $|3x - 2| + 4 = k$ has 2 distinct solutions, then k is

- (A) 3
(C) 6

- (B) 4
(D) 0

3. C

4. The complete set of values of x satisfying the inequality $\frac{x^2 - 1}{2x + 5} < 3$ will be

(A) $\left(-\infty, -\frac{5}{2}\right) \cup (-2, 8)$

(B) $\left(-\infty, -\frac{5}{2}\right) \cup (-2, 7)$

(C) $\left(-\infty, -\frac{5}{2}\right) \cup (-2, 6)$

(D) $\left(-\infty, -\frac{5}{2}\right) \cup (-2, 5)$

4. A

5. The equation of the line passing through the point (1, 2) and perpendicular to the line $x + y + 7 = 0$ will be

- (A) $y - x + 1 = 0$
(C) $y - x + 2 = 0$

- (B) $y - x - 1 = 0$
(D) $y - x - 2 = 0$.

5. B

6. $\lim_{n \rightarrow \infty} \frac{n^4 + 3n^3 + 1}{2n^4 - n^2 + 2}$

(A) 0

(B) ∞

(C) $\frac{1}{2}$

(D) 1

6. C

(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. $x^{\lceil \log_3 x^2 + (\log_3 x)^2 - 10 \rceil} = x^{-2}$ then $x =$

(A) 9

(B) $\frac{1}{81}$

(C) 2

(D) 3

7. AB

8. If $f(x) = \frac{1 - \cos x}{1 + \cos x}$, then which of the following is/are correct

(A) $f'\left(\frac{\pi}{2}\right) = 2$ (B) $f'\left(\frac{\pi}{2}\right) = 0$ (C) $f'\left(\frac{\pi}{3}\right) = \frac{4}{3\sqrt{3}}$ (D) $f'(0) = 0$

8. ACD

9. If $\log_k x \times \log_5 k = \log_x 5$ $k \neq 1, k > 0$, then x is equal to

(A) k (b) $\frac{1}{5}$

(C) 5

(D) none the these

9. BC

10. If the points $(k, 2-2k), (1-k, 2k)$ and $(-k-4, 6-2k)$ be collinear, then the possible values of k is/are

(A) $\frac{1}{2}$ (B) $-\frac{1}{2}$

(C) 1

(D) -1

10. AD

11. 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) $A - B = 9$

11. AC

12. If $(1, 2), (5, 7), (4, 6)$ and (a, b) are vertices of parallelogram then (a, b) can be

(A) $(2, 3)$ (B) $(0, 1)$ (C) $(8, 11)$ (D) $(1, 0)$

12. ABC

PART – B
(Numerical based)

1. $\lim_{x \rightarrow 0} \frac{2 - \sqrt{4 - x}}{3 - \sqrt{9 - x}}$
1. 1.5
2. If $||2x + 3| + 1| = 3$, then the modulus of sum of all possible values of x will be
2. 3
3. The distance between the parallel lines $3x + 4y = 9$ and $6x + 8y = 15$ will be
3. 0.3
4. 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
4. 0.75
5. The number of real solutions of the equation $\log_2(4 \cdot 3^x - 6) - \log_2(9^x - 6) = 1$, will be
5. 1
6. If solution set of x for the inequality, $x \leq \frac{6}{x-5}$ is $(-\infty, a] \cup (b, c]$ then the value of $\frac{c}{a+b}$ will be
6. 1.5

ANSWERS

SECTION-1 : PHYSICS

PART – A

PART – B

SECTION – 2 : CHEMISTRY

PART – A

PART – B

SECTION – 3 : MATHEMATICS

PART – A

PART – B