

PHYSICS, CHEMISTRY & MATHEMATICS

QP Code: 100065

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 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 : _____

BATCHES – NWCM224C1R, NWCM224C2R, NWCM224C1W, NWCM224C2W, NWCM224C3W, PANINI224-C1, PANINI224-C2

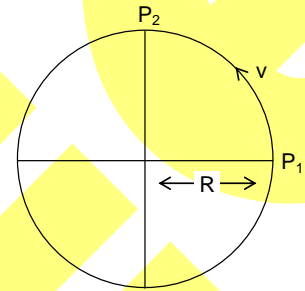
SECTION-1 : PHYSICS**PART – A****(Single Correct Choice Type)**

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 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
 (A) 10 m/s (B) 7 m/s (C) $7\sqrt{2}$ m/s (D) 8.5 m/s

2. Figure below shows a body of mass M moving with the uniform speed on a circular path of radius R. What is the change in acceleration in going from P_1 to P_2

- (A) Zero (B) $v^2 / 2R$
 (C) $2v^2 / R$ (D) $\frac{v^2}{R} \times \sqrt{2}$



3. Given the $\vec{A} + \vec{B} = \vec{C}$ and that \vec{C} is \perp to \vec{A} . Further if $|\vec{A}| = |\vec{C}|$, then what is the angle between \vec{A} and \vec{B}

- (A) $\frac{\pi}{4}$ radian (B) $\frac{\pi}{2}$ radian (C) $\frac{3\pi}{4}$ radian (D) π radian

4. The relation between time t and distance x moved by a particle is $t = \alpha x^2 + \beta x$ where α and β are constants. The retardation is (if v represents velocity)

- (A) $2\alpha v^3$ (B) $2\beta v^3$ (C) $2\alpha\beta v^3$ (D) $2\beta^2 v^3$

5. If $\vec{A} = \hat{i} + 2\hat{j} + 2\hat{k}$ and $\vec{B} = 3\hat{i} + 6\hat{j} + 2\hat{k}$, then the vector in the direction of \vec{A} and having same magnitude as $|\vec{B}|$, is

- (A) $\frac{7}{3}(\hat{i} + \hat{j} + 2\hat{k})$ (B) $7(\hat{i} + 2\hat{j} + 2\hat{k})$ (C) $\frac{3}{7}(\hat{i} + 2\hat{j} + 2\hat{k})$ (D) $\frac{7}{3}(\hat{i} + 2\hat{j} + 2\hat{k})$

6. A man has to hold his umbrella at 30° with the vertical to keep himself dry. He, then runs at a speed of 10 m/s leaving umbrella behind and finds the raindrops to be hitting him vertically. Speed of the raindrop with respect to the earth is

- (A) 10m/s (B) $20\sqrt{3}$ m/s (C) 20m/s (D) $10\sqrt{3}$ m/s

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. Two particles are projected from the same point with same speed u at angles of projection α and β from horizontal strike the horizontal ground. The maximum heights attained by projectiles is h_1 and h_2 respectively, R is the range for both and t_1 and t_2 are their time of flights respectively then:

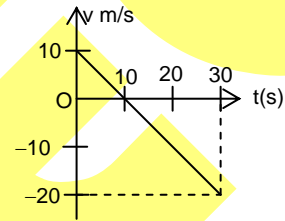
(A) $\alpha + \beta = \frac{\pi}{2}$ (B) $R = 4\sqrt{h_1 h_2}$ (C) $\frac{t_1}{t_2} = \tan \alpha$ (D) $\tan \alpha = \sqrt{h_1 / h_2}$

8. 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) $|\vec{A} \times \vec{B}| = -\sqrt{157}$

9. 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 at $t = 30$ s.
 (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.



10. A particle moves along positive branch of the curve, $y = \frac{x}{2}$, where $x = \frac{t^3}{3}$, x and y are measured in metres and t in seconds, then

- (A) The velocity of particle at $t = 1$ s is $\hat{i} + \frac{1}{2}\hat{j}$
 (B) The velocity of particle at $t = 1$ s is $\frac{1}{2}\hat{i} + \hat{j}$
 (C) The acceleration of particle at $t = 1$ s is $2\hat{i} + \hat{j}$
 (D) The acceleration of particle at $t = 2$ s is $\hat{i} + 2\hat{j}$

11. A projectile have the same range R for two angles of projections. If T_1 and T_2 be the times of flight in the two cases, then

(A) $T_1 T_2 \propto R$ (B) $T_1 T_2 \propto R^2$ (C) $\frac{T_1}{T_2} = \tan \theta$ (D) $\frac{T_1}{T_2} = \cot \theta$

Here θ is the angle of projection corresponding to T_1 .

12. A particle is projected at an angle $\theta = 30^\circ$ with the horizontal, with a velocity of 10 m/s then

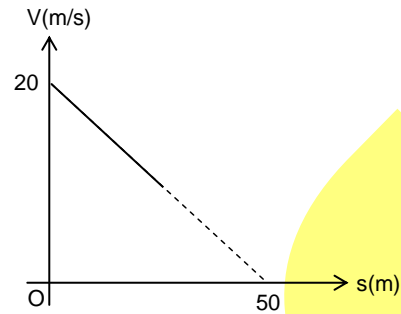
- (A) After 2 s the velocity of particle makes an angle of 60° with initial velocity vector
 (B) At 1 s the velocity of particle makes an angle of 60° with initial velocity vector
 (C) The magnitude of velocity of particle after 1 s is 10 m/s
 (D) The magnitude of velocity of particle after 1 s is 5 m/s

Space For Rough Work

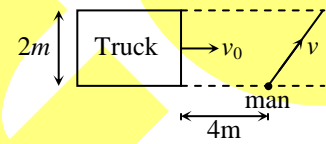
PART – B

(Numerical based)

1. Referring to v–s diagram, find magnitude of acceleration of the particle when its velocity becomes half of the initial velocity

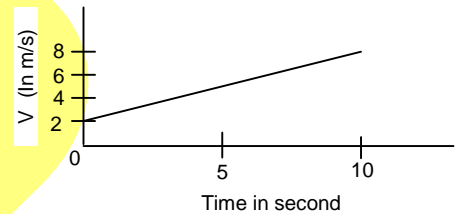


2. A 2m wide truck is moving with a uniform speed $v_0 = 8$ m/s along a straight horizontal road. A pedestrian starts to cross the road with a uniform speed v when the truck is 4 m away from him. The minimum value of velocity so that he can cross the road safely is v then the value of $\frac{\sqrt{5}}{2} v$ is

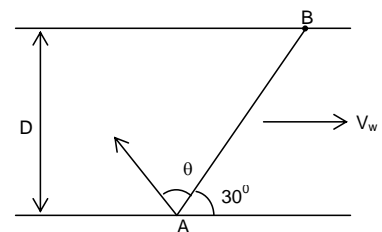


3. If the sum of two unit vectors is a unit vector, find the magnitude of their difference.
4. If $\vec{A} \cdot \vec{B} = |\vec{A} \times \vec{B}|$ and $|\vec{A}|$ & $|\vec{B}|$ are $\frac{1}{\sqrt{2}}$ and 3 respectively, determine $|\vec{C}| = |\vec{A} \times \vec{B}|$.

5. Figure shows the graph of velocity versus time for a particle going along the X-axis. The distance travelled in 0 to 10 sec is $(N \times 10)$. Find 'N'.



6. Two ports A and B are separated by a river of width D . Water in the river flows with speed V_w . A boat crosses the river from port A to port B. The speed of the boat relative to water is V_B . Given $V_w = \sqrt{3} V_B$. if at angle $\theta = \frac{\pi}{n}$ (in radian) with AB in which the boat should start relative to water so that it moves along AB, then find the value of 'n'



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**.

- The correct order of oxidation state of central atom in following compound/ions is
 (A) $\text{MnCl}_2 < \text{MnO}_4^- < \text{MnO}_4^{2-} < \text{MnO}_2$ (B) $\text{MnO}_4^- < \text{MnO}_2 < \text{MnCl}_2 < \text{MnO}_4^{2-}$
 (C) $\text{MnO}_4^- < \text{MnO}_2 < \text{MnCl}_2 < \text{MnO}_4^{2-}$ (D) $\text{MnCl}_2 < \text{MnO}_2 < \text{MnO}_4^{2-} < \text{MnO}_4^-$
- 36.5% (W/W) HCl has density equal to 1.2 g/mL. The molarity and molality(m) respectively are
 (A) 15.7, 15.7 (B) 12, 12 (C) 15.7, 12 (D) 12, 15.7
- 0.2 mol of HCl and 0.1 mol of barium chloride is dissolved in water to produce a 500 mL solution. The molarity of Cl^- ion is [Assuming BaCl_2 undergoes complete ionization]
 (A) 0.80 M (B) 0.06 M (C) 0.12 M (D) 0.09 M
- Volume of 0.1 M KMnO_4 required to oxidize 100 mL of 0.2 M FeSO_4 in acidic medium is
 (A) 20 mL (B) 40 mL (C) 80 mL (D) 50 mL
- Which of the following pair of gases contain the same number of molecules?
 (A) 16 g O_2 , 14 g N_2 (B) 8 g O_2 , 22 g N_2
 (C) 28 g N_2 , 22 g CO_2 (D) 32 g O_2 , 32 g N_2
- A mixture of helium and argon contains 3 mol of He for every 2 mol of Ar. The partial pressure of argon is
 (A) 2/3 of total pressure (B) 1/3 of the total pressure
 (C) 2/5 of total pressure (D) 1/5 of the total pressure

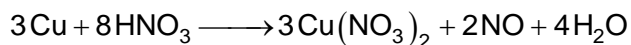
(Multi Correct Choice Type)

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.

- 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.

Space For Rough Work

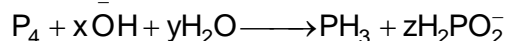
8. Consider the reaction



Select the correct statement

- (A) Cu is reducing agent
 (B) Equivalent mass of HNO_3 is M_0 ($M_0 = \text{Molar mass}$)
 (C) Equivalent mass of HNO_3 in above reaction is $\frac{4M_0}{3}$
 (D) HNO_3 acts as oxidant as well as acid in the above reaction

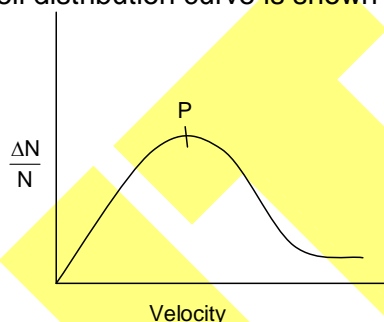
9. Consider the reaction



Which of the following statement(s) is/are correct?

- (A) It is an example of disproportionation reaction
 (B) Coefficient x, y and z are equal
 (C) Equivalent mass of P_4 is 41.33
 (D) Oxidation state of phosphorus in H_2PO_2^- is +1
10. Two gases A & B have critical temperature 35°C and 25°C respectively. Which of the following statements are incorrect?
 (A) A is more easily liquefiable than B
 (B) At 30°C and under very high P, A exists as a liquid and B as a gas
 (C) At 35°C and under very high P both A and B exist as gases
 (D) B has higher boiling point than A

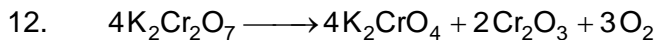
11. Maxwell distribution curve is shown as below



Select the correct statements of the following?

- (A) P represents most probable velocity (u_{mp})
 (B) u_{rms} (root mean square velocity) is less than P
 (C) With increase in temperature fraction of molecules u_{mp} increases
 (D) Fraction of molecules having higher velocity increases if T increases

Space For Rough Work



Choose correct statement(s) from the following

- (A) chromium is oxidized as well as reduced
- (B) Two moles of $\text{K}_2\text{Cr}_2\text{O}_7$ produces three moles of atomic oxygen
- (C) The n-factor of O_2 is 4
- (D) It is a decomposition reaction

PART – B
(Numerical based)

1. How many moles of FeC_2O_4 are required to reduce 2 mol of KMnO_4 in acidic medium?

2.

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

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

3. 5.3 g of M_2CO_3 is dissolved in 150 mL of 1 N HCl. Unused acid required 100 mL of 0.5 N NaOH. The equivalent mass of M is

4. The normality of 10 mL of a '20 V H_2O_2 ' is

5. Oxidation state of carbon in C_3O_2 is x, then x is

6. The temperature of a gas sample is increased from 60° to 100°C . By what factor must the pressure be changed if volume is to be kept constant?

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. If $||x-1|-1| \geq 1$, then
 (A) $x \in (-\infty, -1] \cup [3, \infty)$ (B) $x \in (-\infty, -1] \cup [3, \infty) \cup \{1\}$
 (C) $x \in (-\infty, -1] \cup \{1\}$ (D) none of these

2. If $y = \ln(\sin \sqrt{x})$, then its first derivative is
 (A) $\frac{1 \cot \sqrt{x}}{2 \sqrt{x}}$ (B) $\frac{1 \tan \sqrt{x}}{2 \sqrt{x}}$ (C) $\frac{1 \operatorname{cosec} \sqrt{x}}{2 \sqrt{x}}$ (D) $\frac{1 \cos \sqrt{x}}{2 \sqrt{x}}$

3. $\lim_{x \rightarrow 9} \frac{3 - \sqrt{x}}{\sqrt{x} - 5 - 2} =$
 (A) $\frac{2}{3}$ (B) $-\frac{2}{3}$ (C) $\frac{1}{3}$ (D) 3

4. $\int \left(5 \cos x - 4 \sin x + \frac{1}{\cos^2 x} \right) dx =$
 (A) $5 \sin x + 4 \cos x - \tan x + c$ (B) $5 \sin x + 4 \cos x + \tan x + c$
 (C) $5 \sin x - 4 \cos x + \tan x + c$ (D) None of these

5. If $\cos \alpha = \frac{3}{5}$ and $\cos \beta = \frac{5}{13}$ and $\alpha, \beta \in \left(\frac{3\pi}{2}, 2\pi \right)$ then correct option (s) is/are:
 (A) $\cos(\alpha + \beta) = -\frac{33}{65}$ (B) $\sin(\alpha + \beta) = \frac{56}{65}$
 (C) $\sin^2 \left(\frac{\alpha - \beta}{2} \right) = -\frac{1}{65}$ (D) $\cos(\alpha - \beta) = \frac{64}{65}$

6. Given that $\frac{\pi}{2} < \alpha < \pi$, then the expression $\sqrt{\frac{1 - \sin \alpha}{1 + \sin \alpha}} + \sqrt{\frac{1 + \sin \alpha}{1 - \sin \alpha}}$ is equal to:
 (A) $\frac{1}{\cos \alpha}$ (B) $\frac{2}{\cos \alpha}$ (C) $\frac{2}{\cos \alpha}$ (D) does not exist

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. The solution of the equation $3^{\log_{27} x} = 9^{\log_3 x}$ is given by
 (A) 2 (B) 3
 (C) 1 (D) integer between 0 and 2
8. Which of the following real numbers is (are) non – positive
 (A) $\log_2 \left(\frac{3}{4} \right)$ (B) $\log_7 \left(\frac{11}{13} \right)$ (C) $\log_2 \left(\frac{4}{3} \right)$ (D) $\log_7 \left(\frac{13}{11} \right)$
9. The value $\frac{(\cos 11^\circ + \sin 11^\circ)}{(\cos 11^\circ - \sin 11^\circ)}$ is
 (A) $-\tan 304^\circ$ (B) $\tan 56^\circ$ (C) $\cot 214^\circ$ (D) $\cot 34^\circ$
10. If $\sin t + \cos t = \frac{1}{5}$ then $\tan \frac{t}{2}$ is equal to:
 (A) -1 (B) $-\frac{1}{3}$ (C) 2 (D) $-\frac{1}{6}$
11. An extreme value of $1 + 4 \sin \theta + 3 \cos \theta$ is:
 (A) -3 (B) -4 (C) 5 (D) 6
12. If $a = \frac{1}{\sqrt{5 \cos x + 12 \sin x + 15}}$ then for all real x
 (A) the least value of a is $\frac{1}{\sqrt{28}}$ (B) the greatest value of a is $\frac{1}{\sqrt{2}}$
 (C) the least value of a is $\frac{1}{2\sqrt{7}}$ (D) the greatest value of a is $\frac{1}{\sqrt{3}}$

Space For Rough Work

PART – B
(Numerical based)

1. Find the value of x satisfying $\log_{10}(2^x - 62) = (1 - \log_{10} 5)$
2. The maximum value of $5 \cos \theta + 3 \cos\left(\theta + \frac{\pi}{3}\right) + 2$ is:
3. The expression $3 \left\{ \sin^4\left(\frac{3\pi}{2} - \alpha\right) + \sin^4(3\pi + \alpha) \right\} - 2 \left\{ \sin^6\left(\frac{\pi}{2} + \alpha\right) + \sin^6(5\pi - \alpha) \right\}$ is equal to:
4. The value of $\tan 1^\circ \tan 2^\circ \tan 3^\circ \dots \dots \tan 89^\circ$ _____
5. The value(s) of $2 \cos \frac{\pi}{7} \cdot \cos \frac{4\pi}{7} \cdot \cos \frac{5\pi}{7}$ is(are):
6. If $\sin \alpha \sin \beta - \cos \alpha \cos \beta + 1 = 0$, then $2 + \cot \alpha \tan \beta =$ _____

Space For Rough Work

QP Code: 100065

ANSWERS**SECTION-1 : PHYSICS****PART – A**

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

PART – B

- | | | | |
|------|------|---------|--------|
| 1. 4 | 2. 4 | 3. 1.73 | 4. 1.5 |
| 5. 5 | 6. 3 | | |

SECTION – 2 : CHEMISTRY**PART – A**

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

PART – B

- | | | |
|-----------------------------|----------------------------|---------|
| 1. 3.33 (Range 3.3 – 3.33) | 2. 2.5 | 3. 23.0 |
| 4. 3.57 (Range 3.56 – 3.58) | 5. 1.33 (Range 1.3 – 1.33) | |
| 6. 1.12 (Range 1.10 – 1.13) | | |

SECTION – 3 : MATHEMATICS**PART – A**

- | | | | |
|---------|--------|--------|---------|
| 1. B | 2. A | 3. B | 4. B |
| 5. A | 6. B | 7. CD | 8. AB |
| 9. ABCD | 10. BC | 11. BD | 12. ABC |

PART – B

- | | | | |
|---------|------|------|------|
| 1. 6 | 2. 9 | 3. 1 | 4. 1 |
| 5. 0.25 | 6. 1 | | |