

PHYSICS, CHEMISTRY & MATHEMATICS

CODE: 100719

Common Test - 1

Time Allotted: 3 Hours

Maximum Marks: 180

- 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 (01-04)** – Contains **FOUR (04)** 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 (05-10)** – 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 (01-08)** This section contains **EIGHT (08)** questions. The answer to each question is a **SINGLE DIGIT INTEGER ranging from 0 to 9, BOTH INCLUSIVE**. Each question carries **+3 marks** for correct answer and **-1 marks** for wrong answer.

Name of the Candidate: _____

Batch: _____ Date of Examination: _____

Enrolment Number: _____

SECTION – I: PHYSICS

PART – A: (Single Correct Answer Type)

This section contains **4 multiple choice questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE is correct**.

1. A gun is fired directly aiming at a target at a horizontal distance of d and height h from the gun. If v_0 is the velocity of the bullet by what vertical distance the bullet misses the target
 (A) $\frac{gd^3}{hv_0^2}$ (B) $\frac{g(d^2 + h^2)}{2v_0^2}$ (C) $\frac{g(d^2 - h^2)}{2v_0^2}$ (D) $\frac{gh^3}{2dv_0^2}$
2. The unit vector perpendicular to $\vec{i} - 2\vec{j} + \vec{k}$ and $3\vec{i} + \vec{j} - 2\vec{k}$ is
 (A) $\frac{5\vec{i} + 3\vec{j} + 7\vec{k}}{\sqrt{83}}$ (B) $\frac{3\vec{i} + 5\vec{j} + 7\vec{k}}{\sqrt{83}}$ (C) $\frac{5\vec{i} + 3\vec{j} - 7\vec{k}}{\sqrt{83}}$ (D) $\frac{3\vec{i} - 5\vec{j} + 7\vec{k}}{\sqrt{83}}$
3. A particle of mass M moves horizontally in a medium where the magnitude of resistance force is kMV (where k is a constant) and v is the velocity at time t , with the initial velocity u , what is the maximum distance of the particle from the starting point?
 (A) $9/k$ (B) $34/k$ (C) $24/k$ (D) none of these
4. 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) $\frac{7}{3}(\hat{i} + 2\hat{j} + 2\hat{k})$

PART – A: (One or more than one Options Correct Type)

This section contains **6 multiple choice questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONE or MORE THAN ONE is correct**.

5. If the resultant of three forces $\vec{F}_1 = p\hat{i} + 3\hat{j} - \hat{k}$, $\vec{F}_2 = -5\hat{i} + \hat{j} + 2\hat{k}$ and $\vec{F}_3 = 6\hat{i} - \hat{k}$ acting on a particle has magnitude equal to 5 unit, then the value(s) of p is (are)
 (A) -6 (B) -4 (C) 2 (D) 4
6. The vector $\hat{i} + x\hat{j} + 3\hat{k}$ is rotated through a certain angle and doubled in magnitude, then it becomes $4\hat{i} + (4x - 2)\hat{j} + 2\hat{k}$. The value of x may be
 (A) $-\frac{2}{3}$ (B) $\frac{1}{3}$ (C) $\frac{2}{3}$ (D) 2

Space For Rough Work

7. Two projectile are thrown at the same time from two different points. The projectile thrown from the origin has initial velocity $3\hat{i} + 3\hat{j}$ with respect to earth. The projectile has initial velocity $a\hat{i} + b\hat{j}$ with respect to earth thrown from the point (10, 5). (\hat{i} is a unit vector along horizontal, \hat{j} along vertical). If the projectile collides after two second, then the
- (A) value of a is -2 (B) value of a is $\frac{1}{2}$
 (C) value of b is $\frac{1}{2}$ (D) value of b is -2
8. 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 $t = 1\text{s}$ is $\hat{i} + \frac{1}{2}\hat{j}$
 (B) The velocity of particle at $t = 1\text{s}$ is $\frac{1}{2}\hat{i} + \hat{j}$
 (C) The acceleration of particle at $t = 1\text{s}$ is $2\hat{i} + \hat{j}$
 (D) The acceleration of particle at $t = 2\text{s}$ is $\hat{i} + 2\hat{j}$
9. A man who can swim at a speed v relative to the water wants to cross a river of width d, flowing with a speed u. The point opposite him across the river is P.
- (A) The minimum time in which he can cross the river is $\frac{d}{v}$.
 (B) He can reach the point P in time $\frac{d}{v}$.
 (C) He can reach the point P in time $\frac{d}{\sqrt{v^2 - u^2}}$
 (D) He cannot reach P if $u > v$.
10. It $\vec{A} = \sqrt{3}\hat{i} + \hat{j}$
 & $\vec{B} = \sqrt{3}\hat{i} - \hat{j}$
 and angle between \vec{A} & \vec{B} is θ then
- (A) $\theta = 60^\circ$ (B) $\theta = 90^\circ$
 (C) $\vec{A} \cdot \vec{B}$ (D) Component of \vec{A} along $\vec{B} = 1$

Space For Rough Work

PART – B
Integer Answer Type

This section contains **8 questions**. The answer to each of the questions is a single digit integer, ranging from **0 to 9**.

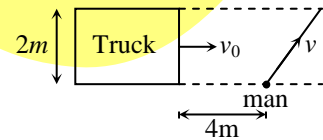
1. In vectors A and B be respectively equal to $3\hat{i} = 4\hat{j} + 5\hat{k}$ and $2\hat{i} + 3\hat{j} - 4\hat{k}$. The unit vector parallel to $A + B$ is $\frac{1}{\sqrt{27}}(5\hat{i} - a\hat{j} + \hat{k})$. Find the value of 'a'.

2. A passenger is standing 20m behind from a bus. The bus begins to move with constant acceleration 0.9m/s^2 . To catch the bus, the passenger runs at a constant speed v towards the bus. What must be the minimum speed (in m/s) of the passenger so that he may catch the bus?

3. How many unit vectors are there for which $\cos \alpha = \frac{1}{2}$ and $\cos \beta = \frac{1}{2}$, where α and β are angles made with X-axis and Y-axis, respectively.

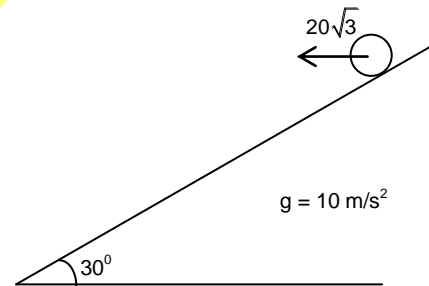
4. If a vector $r = x\hat{i} + y\hat{j} + z\hat{k}$, makes angle $\frac{\pi}{3}, \frac{\pi}{3}$ and $\frac{\pi}{n}$ with X-axis, Y-axis and Z-axis respectively. Find the value of 'n'.

5. A 2m wide truck is moving with a uniform speed $v_0 = 8 \text{ m/s}$ 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



6. A man is going up in an air balloon going up with an acceleration 2 m/s^2 . When he reaches to a ht. 100 m from ground, he drops a ball. The time taken by the ball to reach the ground is $x(1 + \sqrt{6})$. Value of x is

7. A particle is thrown horizontally with relative velocity 40 m/s from an inclined plane, which is also moving with acceleration 10 m/s^2 vertically upward. Find the time in sec. after which it lands on the plane (take $g = 10 \text{ m/s}^2$)



8. Given two vectors $\vec{A} = 2\hat{i} + 3\hat{j}$ and $\vec{B} = \hat{i} + \hat{j}$. The component of vector \vec{A} along vector \vec{B} is $\frac{x}{\sqrt{2}}$. Find the value of 'x'.

Space For Rough Work

SECTION – II: CHEMISTRY

PART – A: (Single Correct Answer Type)

This section contains **4 multiple choice questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE is correct**.

1. Let the energy of the first orbit of hydrogen atom is x eV per atom. The energy of other orbits of hydrogen is expressed as

$$E_n = -\frac{Z^2}{n^2}(x) \text{ eV}$$

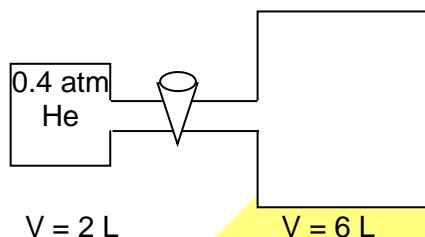
Z = Atomic number of hydrogen

n = Principal quantum number of the orbit

What is the energy difference between the second and first orbit of H-atom in eV unit?

- (A) $\frac{5x}{4}$ (B) $\frac{x}{4}$ (C) $\frac{3x}{4}$ (D) $\frac{1.5x}{4}$
2. How much maximum quantity of CO_2 gas can be absorbed by 0.56 Kg of powder CaO according to the following reaction?
 $\text{CaO(s)} + \text{CO}_2(\text{g}) \longrightarrow \text{CaCO}_3(\text{s})$
- (A) 0.01 mole (B) 440 g
 (C) 4.4 Kg (D) 6.023×10^{22} molecules

3.



A certain quantity of helium gas is present in the smaller container at 0.4 atm. What will be the pressure of the gas in the larger container when the stop cock is opened at constant temperature and the gas is allowed to fill both the container uniformly.

(Assume the volume occupied by the pipe is negligible)

- (A) 0.1 atm (B) $\frac{2}{15}$ atm (C) 0.05 atm (D) $\frac{1}{15}$ atm
4. The electronic configuration of an atom is $[\text{Ar}]_{18}4s^23d^6$. How many maximum number of atomic orbital(s) of the atom contain one electron each?
- (A) 2 (B) 3 (C) 4 (D) 5

Space For Rough Work

PART – A: (One or more than one Options Correct Type)

This section contains **6 multiple choice questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONE or MORE THAN ONE is correct**.

5. Which of the following orbital(s) has(ve) the following set of quantum numbers?
($n = 3$, $\ell = 0$, $m = 0$)
(A) the orbital containing the valence electron of sodium
(B) the orbital of magnesium holding the highest energetic electron of the atom
(C) the spherical orbital holding the valence electron of aluminium
(D) the outermost orbital of chlorine that contains one electron
6. One litre aqueous solution contains the following substances
4 g NaOH
10.6 g Na_2CO_3
8.4 g NaHCO_3
The solution is to be titrated with 0.5 M HCl using phenolphthalein and methyl orange indicator.
(A) When the entire solution is titrated in presence of phenolphthalein indicator, 0.2 mole of HCl is needed.
(B) When the entire original solution is titrated in presence of methyl orange indicator, 800 mL of 0.5 M HCl solution is used.
(C) The molarity of Na^+ ion in the solution is 0.28 M, which was titrated in presence of phenolphthalein indicator assuming complete ionization of the salts.
(D) The molarity of Na^+ ions in the solution is 0.22 M, which was titrated using methyl orange indicator.
7. Gases having which of the following characteristic(s) are liquidified easily
(A) higher boyle temperature (B) higher critical temperature
(C) higher inversion temperature (D) higher ignition temperature
8. The empirical mass of a chemical compound is $x \text{ g mol}^{-1}$, which can be it's molar mass(es)?
(A) $4x$ (B) $3.8x$ (C) $8x$ (D) $6.2x$
9. Which characteristic(s) of a particular ideal gas increases by increasing temperature?
(A) Average kinetic energy of gas molecules.
(B) The root mean square velocity.
(C) Vapour density.
(D) Pressure of 2 moles of the gas at constant volume.
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Space For Rough Work

10. Which of the following electronic configuration(s) of the outermost orbital(s) of atom(s) is/are correct in ground state?

(A) $\begin{array}{|c|} \hline \uparrow \\ \hline 2s \\ \hline \end{array}$ $\begin{array}{|c|c|c|} \hline \uparrow & \uparrow & \uparrow \\ \hline 2p \\ \hline \end{array}$ (B) $\begin{array}{|c|} \hline \uparrow\downarrow \\ \hline 2s \\ \hline \end{array}$ $\begin{array}{|c|c|c|} \hline \uparrow & \uparrow & \uparrow \\ \hline 2p \\ \hline \end{array}$

(C) $\begin{array}{|c|} \hline \uparrow\downarrow \\ \hline 2s \\ \hline \end{array}$ $\begin{array}{|c|c|c|} \hline \uparrow\downarrow & \uparrow & \\ \hline 2p \\ \hline \end{array}$ (D) $\begin{array}{|c|} \hline \uparrow\downarrow \\ \hline 2s \\ \hline \end{array}$ $\begin{array}{|c|c|c|} \hline \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow \\ \hline 2p \\ \hline \end{array}$

PART – B

Integer Answer Type

This section contains **8 questions**. The answer to each of the questions is a single digit integer, ranging from **0 to 9**.

- What is the sum of the principal quantum number(s) of two orbits of hydrogen atom, between which the electronic transition forms the first line of Balmer series?
- The radius of the n th orbit of H or H-like atoms like He^+ , Li^{2+} etc is given as $r_n = \frac{n^2}{Z} a_0$
If the simplest ratio of the radii of the 2nd and 4th orbits of He^+ ion is expressed as $a : b$, what is the value of $(a + b)$?
- The root mean square velocity of NO (an ideal gas) at 400 K is equal to the most probable velocity of an unknown ideal gas at 120 K. What is the molar mass of the unknown gas at 120 K in g mol^{-1} unit?
- $\text{COCl}_2 \longrightarrow \text{CO} + \text{Cl}_2$
If $+x$ = oxidation number of carbon in the reactant
 $-y$ = oxidation number of 'Cl' in reactant
 $+z$ = sum of the oxidation numbers of carbon in the product and Cl in the product, then the value of $(x + y + z)$ is
- 400 mL of 0.4 M acidified KMnO_4 solution oxidizes x equivalents of $\text{C}_2\text{O}_4^{2-}$ ions. What is the value of $10x$?
 $\text{MnO}_4^- + \text{C}_2\text{O}_4^{2-} + \text{H}^+ \longrightarrow \text{Mn}^{2+} + \text{CO}_2 + \text{H}_2\text{O}$
- $\text{Mg} + 2\text{HCl} \longrightarrow \text{MgCl}_2 + \text{H}_2$
One gram each of Mg and HCl are taken for reaction according to above equation. If the moles of H_2 formed in the reaction is expressed as $\frac{1}{10x+3}$? What is the value of 'x'?
- How many radial node(s) is/are associated with 4s orbital of an atom?
- What is the translational kinetic energy in Kcal per mole of 8 g of dioxygen(O_2) gas at 8000 K? [$R = 2 \text{ cal K}^{-1} \text{ mol}^{-1}$]

space for rough work

SECTION – III: MATHEMATICS

PART – A: (Single Correct Answer Type)

This section contains **4 multiple choice questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE is correct**.

1. Solve $|x - 3| + |x^2 + x + 1| = x^2 + 4$.
 (A) (5, ∞) (B) [0, 2] (C) [4, 5] (D) none of these
2. The complete solution of the inequality $(x - 1)(x - 3)(x - 7) \geq 0$ is
 (A) $x \in [1, 3] \cup [7, \infty)$ (B) $x \in [7, \infty)$
 (C) $x \in [1, \infty) - \{4, 5, 6\}$ (D) None of these
3.
$$\frac{\tan\left(x - \frac{\pi}{2}\right) \cdot \cos\left(\frac{3\pi}{2} + x\right) - \sin^3\left(\frac{7\pi}{2} - x\right)}{\cos\left(x - \frac{\pi}{2}\right) \cdot \tan\left(\frac{3\pi}{2} + x\right)}$$
 when simplified reduces to:
 (A) $\sin x \cos x$ (B) $-\sin^2 x$ (C) $-\sin x \cos x$ (D) $\sin^2 x$
4. The value of the expression $\left(1 + \cos \frac{\pi}{10}\right)\left(1 + \cos \frac{3\pi}{10}\right)\left(1 + \cos \frac{7\pi}{10}\right)\left(1 + \cos \frac{9\pi}{10}\right)$ is
 (A) $\frac{1}{8}$ (B) $\frac{1}{16}$ (C) $\frac{1}{4}$ (D) 0

PART – A: (One or more than one Options Correct Type)

This section contains **6 multiple choice questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONE or MORE THAN ONE is correct**.

5. If $\log_8 \left(\frac{8}{x^2}\right) = 3(\log_8 x)^2$ then x equals
 (A) 1/8 (B) 3 (C) 4 (D) 2
6. If $\frac{(x - 2)(2x - 2)^2(x - 6)^3}{(x + 5)} < 0$, then
 (A) (2, 6) (B) $(-\infty, -7)$
 (C) $(-\infty, -5) \cup (2, 6)$ (D) none of these

Space For Rough Work

7. Which of the following is/are **INCORRECT**?
- (A) $\lim_{x \rightarrow \pi} \frac{\sin x}{x} = 1$ (B) $\lim_{x \rightarrow \infty} \frac{\sin x}{x} = 1$ (C) $\lim_{x \rightarrow 0} \frac{\sin x}{x} = 1$ (D) $\lim_{x \rightarrow \pi} \frac{1 - \cos x}{x^2} = \frac{1}{2}$
8. Which of the following, when simplified, reduces to unity?
- (A) $\log_3 \log_{27} \log_4 64$ (B) $2 \log_{18} (\sqrt{2} + \sqrt{8})$
 (C) $\log_2 \sqrt{10} + \log_2 \left(\frac{2}{\sqrt{5}} \right)$ (D) $-\log_{\sqrt{2}-1} (\sqrt{2} + 1)$
9. 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) $-\frac{1}{6}$
10. An extreme value of $1 + 4 \sin \theta + 3 \cos \theta$ is:
- (A) -3 (B) -4 (C) 5 (D) 6

PART – B
Integer Answer Type

This section contains **8 questions**. The answer to each of the questions is a single digit integer, ranging from **0 to 9**.

1. $\int \tan^5 x \, dx + \int \tan^7 x \, dx = f(x) + c$, then $f\left(\frac{\pi}{4}\right) - f\left(-\frac{\pi}{4}\right)$
2. If $\log_7 \left(\log_5 (\sqrt{x+5} + \sqrt{x}) \right) = 0$, then x equals _____
3. $\lim_{x \rightarrow 0} \frac{(1+2x+x^2) - e^x}{x}$ is equal to _____
4. If $\int_0^{\pi/2} \sin^2 x \cos x \, dx = 1/k$ then k equals _____
5. Find the sum of all values of x satisfying the equation $\log_4 (x-1) = \log_2 (x-3)$.
6. If $\tan(\alpha - \beta) = \sin 2\beta$, then value of $\frac{\tan \alpha + \tan \beta}{\tan 2\beta}$ equals _____
7. If $\sin \theta_1 + \sin \theta_2 + \sin \theta_3 = 3$, then $\cos \theta_1 + \cos \theta_2 + \cos \theta_3 =$ _____
8. If $90^\circ < A < 180^\circ$ and $\sin A = \frac{4}{5}$, then $\tan\left(\frac{A}{2}\right)$ is equal to: _____

Space For Rough Work

FIITJEE INTERNAL TEST

BATCHES: Two Year CRP426-B-lot

Common Test – 1

QP Code: 100719

ANSWER KEY

SECTION – I (PHYSICS)

PART-A

- | | | | |
|--------|--------|-------|-------|
| 1. B | 2. B | 3. D | 4. D |
| 5. BC | 6. AD | 7. AC | 8. AC |
| 9. ACD | 10. AD | | |

PART-B

- | | | | |
|------|------|------|------|
| 1. 1 | 2. 6 | 3. 2 | 4. 4 |
| 5. 4 | 6. 2 | 7. 2 | 8. 5 |

SECTION – II (CHEMISTRY)

PART-A

- | | | | |
|--------|---------|--------|-------|
| 1. C | 2. B | 3. A | 4. C |
| 5. ABC | 6. ABCD | 7. ABC | 8. AC |
| 9. ABD | 10. BD | | |

PART-B

- | | | | |
|------|------|------|------|
| 1. 5 | 2. 5 | 3. 6 | 4. 7 |
| 5. 8 | 6. 7 | 7. 3 | 8. 6 |

SECTION – III (MATHEMATICS)

PART-A

- | | | | |
|-------|--------|--------|-------|
| 1. B | 2. A | 3. D | 4. B |
| 5. AD | 6. ABC | 7. ABD | 8. BD |
| 9. BC | 10. BD | | |

PART-B

- | | | | |
|------|------|------|------|
| 1. 0 | 2. 4 | 3. 1 | 4. 3 |
| 5. 5 | 6. 2 | 7. 0 | 8. 2 |