

PHYSICS, CHEMISTRY & MATHEMATICS**QP CODE: 100867****Common Test – 2****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. All the section can be filled in **PART-A & B** of 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 **Blue/Black Ball Point Pen** 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 (05-07)** contains (3) Multiple Choice Questions which have **One or More Than One 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.
- (iii) **Part-B (01-06)** This section contains **SIX (06)** questions. The answer to each question is a **NON-NEGATIVE INTEGER**. For each question, enter the correct integer corresponding to the answer. Each question carries **+4 marks** for correct answer. **There is no negative marking.**
- (iv) **Part-B (07-10)** This section contains Two paragraphs. Each paragraph having TWO questions Numerical answer type with answer XXXX.XX. For each question, enter the correct numerical value. If the numerical value has more than two decimal places, **truncate/round-off** the value to **TWO** decimal places. Each question carries **+3 marks** for the correct answer. **There is no negative marking.**

Name of the Candidate: _____

Batch: _____ Date of Examination: _____

Enrolment Number: _____

BATCH – NWC MCF327G1W

SECTION – I: PHYSICS

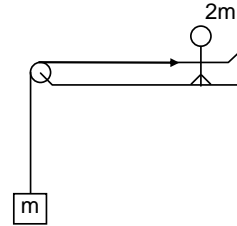
(PART – A)

(Single Correct Answer Type)

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

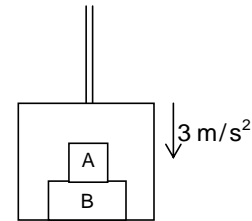
1. A man of mass $2m$ is pulling up a block of mass m with constant velocity. The acceleration of man is (neglect any friction).

(A) g (B) $2g$
(C) $3g$ (D) $\frac{g}{2}$



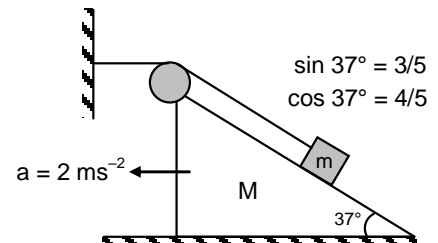
2. The elevator shown in figure is descending with an acceleration of 3 m/s^2 . The mass of the block A = 1 kg. The force exerted by the block B on A is

(A) 3 N (B) 4 N
(C) 6 N (D) 7 N



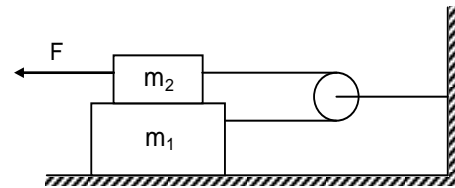
3. As shown in the figure, if acceleration of M with respect to ground is 2 ms^{-2} , then

(A) Acceleration of m with respect to M is 5 ms^{-2}
(B) Acceleration of m with respect to ground is 5 ms^{-2}
(C) Acceleration of m with respect to M is 2 ms^{-2}
(D) Acceleration of m with respect to ground is 10 ms^{-2}



4. Two blocks each of mass 1 kg are placed as shown. They are connected by a string which passes over a smooth (massless) pulley. There is no friction between m_1 and the ground and the coefficient of friction between m_1 and m_2 is 0.2. A force F is applied to m_2 . Which of the following statements is incorrect?

(A) The system will be in equilibrium if $F < 4\text{ N}$.
(B) If $F > 4\text{ N}$ the tension in the string will be 4 N .
(C) If $F > 4\text{ N}$ the frictional force between the block will be 2 N .
(D) If $F = 6\text{ N}$ the tension in the string will be 3 N .

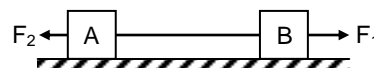


Space For Rough Work

(One or More Than One Options Correct Type)

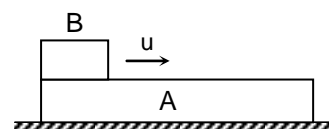
This section contains **3 multiple choice questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONE or MORE THAN ONE is correct**.

5. Two blocks A and B are placed rough horizontal surface and are connected by a string. If two unequal force F_1 & F_2 are applied ($F_1 > F_2$) on block A and B in opposite direction. Choose the correct alternatives.



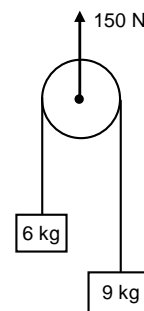
- (A) friction on both the blocks act leftward
 (B) friction on B always act leftward
 (C) friction on A may have any direction i.e. left or right
 (D) tension on the string may be zero

6. A long block A is at rest on a smooth horizontal surface. A small block B, whose mass is half of A, is placed on A at one end and projected along A with velocity u . The coefficient of friction between the blocks is μ .



- (A) the blocks will reach a final common velocity $\frac{u}{3}$.
 (B) the time in which blocks reach a common velocity from just after projection is $\frac{2u}{3\mu g}$.
 (C) before the blocks reach a common velocity, the magnitude acceleration of A relative to B is $\frac{2}{3}\mu g$.
 (D) before the blocks reach a common velocity, the magnitude acceleration of A relative to B is $\frac{3}{2}\mu g$.

7. As situation shown in figure, choose the correct option(s) (take $g = 10 \text{ m/s}^2$ downward)

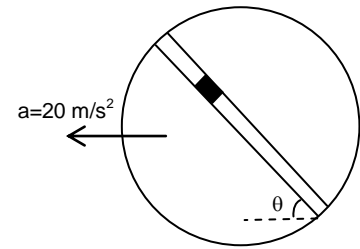


- (A) the acceleration of pulley is $\frac{5}{6} \text{ m/s}^2$ upward.
 (B) the acceleration of pulley is $\frac{5}{12} \text{ m/s}^2$ upward.
 (C) the acceleration of pulley is 0.
 (D) tension in the string which connects the masses is 75 N.

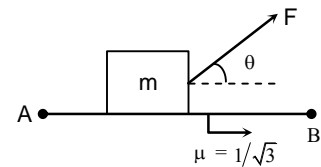
Space For Rough Work

(PART – B)
(Non – Negative Integer)

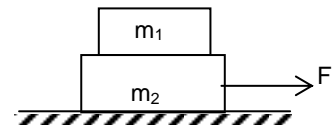
1. A circular disc with a groove along its diameter is placed horizontally. A block of mass 1kg is placed as shown. The coefficient of friction between the block and all surfaces of groove in contact is $\mu = \frac{2}{5}$. The disc has an acceleration of 20 m/s^2 . Then acceleration of the block w.r.t disc will be in nearest integer. ($\theta = 37^\circ$)



2. Value of θ for which force required to move the block along the line AB is minimum is $30n^\circ$. Find the value of 'n'.



3. Two blocks of masses $m_1 = 1 \text{ kg}$ and $m_2 = 2 \text{ kg}$ are placed on each other as shown in the figure. All the surfaces in contact are rough coefficient of static friction $\mu_s = 0.6$ and coefficient of kinetic friction is $\mu_k = 0.5$ for all the surfaces. A force $F = 24 \text{ N}$ acts on lower block in horizontal direction. Then find out friction force acting on upper block.



4. A spring of force constant K is cut into two pieces such that one piece is double the length of the other, then find out the force constant of the longer piece ($K = 6 \text{ N/m}$) in N/m .
5. A car driver applies the brakes which retards the car at a rate of 8 m/s^2 . If the initial velocity of the car is 10 m/s , the speed of the car after 5 s will be
6. A block of mass 1 kg lies on a horizontal surface in a truck. The coefficient of static friction between the block and the surface is 0.6 . If the acceleration of the truck is 5 m/s^2 , then what frictional force acting on the block (in newton.)

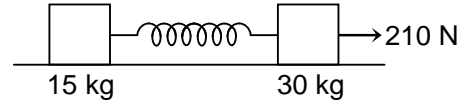
Space For Rough Work

(PART – B)

This section contains Two paragraphs. Each paragraph having TWO questions Numerical answer type with answer XXXX.XX. For each question, enter the correct numerical value. If the numerical value has more than two decimal places, **truncate/round-off** the value to **TWO** decimal places.

Paragraph for Question no. 7 to 8

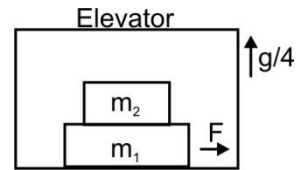
In the system shown in the figure, the mass 30 kg is pulled by a force of 210 N. Answer the following questions at the instant when the 15 kg mass has acceleration 6 m/s^2 . Assume the spring to be mass less and spring constant is 100 N/m . The surface of ground is smooth.



7. Find the acceleration of 30 kg mass (in m/sec^2)
8. Find the elongation in the string at this instant (in m)

Paragraph for Question no. 9 to 10

A plank of mass $m_1 = 8 \text{ kg}$ with a bar of mass $m_2 = 2 \text{ kg}$ placed on its rough surface, lie on a smooth floor of elevator ascending with an acceleration $g/4$. The coefficient of friction is $\mu = 0.2$ between m_1 and m_2 . A horizontal force $F = 30 \text{ N}$ is applied to the plank.



9. Find the acceleration of the plank in the reference frame of elevator (m/sec^2)
10. The acceleration of the bar in the reference frame of elevator (in m/sec^2) is

Space For Rough Work

SECTION – II: CHEMISTRY

(PART – A)

(Single Correct Answer Type)

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

- The frequency of the revolution of electron in a Bohr's orbit is directly proportional to (Z = Atomic number of the species, n = Principal quantum number of the orbit)

(A) $\frac{Z^3}{n^2}$	(B) $\frac{Z^3}{n^3}$
(C) $\frac{Z^2}{n^3}$	(D) $\frac{Z}{n^3}$
- For electrons in f-orbitals, the orbital angular momentum is

(A) $\sqrt{3} \frac{h}{2\pi}$	(B) $\sqrt{9} \frac{h}{2\pi}$
(C) $\sqrt{12} \frac{h}{2\pi}$	(D) $\sqrt{15} \frac{h}{2\pi}$
- The principal quantum number of an atomic orbital is 4. What should be its azimuthal quantum number so that the angular component of its wave function will be zero?

(A) Zero	(B) One
(C) Two	(D) Three
- The $(n + \ell)$ value for 4f-electron is

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

(One or More Than One Options Correct Type)

This section contains **3 multiple choice questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONE or MORE THAN ONE is correct**.

- The energy of which atomic orbital(s) of multielectron atoms (represented by wave functions) is/are greater than that of the $3p_z$ orbital?

(A) $\Psi_{4,0,0}$	(B) $\Psi_{3,1,-1}$
(C) $\Psi_{3,2,0}$	(D) $\Psi_{2,0,0}$

Space For Rough Work

$$6. \quad \psi = \frac{1}{162} \left(\frac{1}{\pi a_0^3} \right)^{1/2} P^2 e^{-P/3} \sin^2 \theta e^{i2\phi}$$

Where $P = \frac{r}{a_0}$ and $a_0 =$ Bohr radius

Correct statement about above schrodinger wave equation

- (A) for 'p' subshell (B) for 'd' sub-shell
 (C) total no. of angular nodes will be 2 (D) it has no radial node

7. Correct properties of wave function(Ψ) is/are
 (A) Ψ must be continuous
 (B) Ψ must be finite
 (C) Ψ must be single valued
 (D) The probability of finding the electron overall the space from + infinity to – infinity must be equal to 1

(PART – B)
(Non – Negative Integer)

- How many maximum number of electrons will have the following set of quantum numbers
 $n = 4, s = \pm \frac{1}{2}$?
- What is the sum of principal quantum number(n) and azimuthal quantum number(ℓ) of the unpaired electron of chlorine?
- The de-Broglie wavelength of a particle of mass 18×10^{-30} kg is 2 \AA . If the kinetic energy of the particle is expressed as ' y ' $\times 10^{-20}$ joule, what is the value of ' y '? [$h = 6 \times 10^{-34}$ Js]
- The threshold wavelength for the photoelectric emission of tungsten is 2300 \AA . What is the wavelength of light in \AA unit which will be required to release the electrons with the maximum kinetic energy 2 eV?
- Maximum number of electrons with $n + \ell = 5, |m| = 1$ and $s = \pm \frac{1}{2}$.
- If magnetic moment of Cr^{x+} ion is 1.73 B.M. Value of x is

Space For Rough Work

(PART – B)

This section contains Two paragraphs. Each paragraph having TWO questions Numerical answer type with answer XXXX.XX. For each question, enter the correct numerical value. If the numerical value has more than two decimal places, **truncate/round-off** the value to **TWO** decimal places.

Paragraph for Question no. 7 to 8

A vehicle of mass 2.9×10^3 Kg is moving with a velocity which can be measured with an accuracy of ± 0.004 Km h^{-1} . The position of the vehicle can be determined with an accuracy of ± 0.02 Km.

7. If the uncertainty in velocity of the particle(Δu) is expressed as $x \times 10^{-3}$ ms^{-1} , what is the value of 'x'?
8. What is the uncertainty in momentum of the vehicle in $Kg\ ms^{-1}$ unit?

Paragraph for Question no. 9 to 10

The hydrogen-like species Li^{2+} is in a spherically symmetric state S_1 with one radial node. Upon absorbing light the ion undergoes transition to a state S_2 . The state S_2 has one radial node and its energy is equal to the ground state energy of the hydrogen atom.

9. Energy of the state S_1 in units of the hydrogen atom ground state energy is
 10. The orbital angular momentum of quantum number of the state S_2 is x, what is the value of $x/2$?
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Space For Rough Work

SECTION – III: MATHEMATICS

(PART – A)

(Single Correct Answer Type)

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

1. The equations of L_1 and L_2 are $y = mx$ and $y = nx$, respectively. Suppose L_1 makes twice as large of an angle with the horizontal (measured counter-clockwise from the positive x-axis) as does L_2 and that L_1 has 4 times the slope of L_2 . If L_1 is not horizontal, then the value of the product (mn) equals:

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

2. Two points A (x_1, y_1) and B (x_2, y_2) are chosen on the graph of $f(x) = \ln x$ with $0 < x_1 < x_2$. The points C and D trisect line segment AB with $AC < CB$. Through C a horizontal line is drawn to cut the curve at E (x_3, y_3) . If $x_1 = 1$ and $x_2 = 1000$ then the value of x_3 equals :

(A) 10	(B) $\sqrt{10}$
(C) $(10)^{2/3}$	(D) $(10)^{1/3}$

3. Let A $(5, 12)$, B $(-13 \cos \theta, 13 \sin \theta)$ and C $(13 \sin \theta, -13 \cos \theta)$ are angular points of $\triangle ABC$ where $\theta \in \mathbb{R}$. The locus of orthocentre of $\triangle ABC$ is:

(A) $x - y + 7 = 0$	(B) $x - y - 7 = 0$
(C) $x + y - 7 = 0$	(D) $x + y + 7 = 0$

4. The area of the triangular region in the first quadrant bounded on the left by the y-axis, bounded above by the line $7x + 4y = 168$ and bounded below by the line $5x + 3y = 121$, is:

(A) $\frac{50}{3}$ sq. units	(B) $\frac{52}{3}$ sq. units
(C) $\frac{53}{3}$ sq. units	(D) 17 sq. units

(One or More Than One Options Correct Type)

This section contains **3 multiple choice questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONE or MORE THAN ONE is correct**.

5. Straight lines $2x + y = 5$ and $x - 2y = 3$ intersect at the point A. Points B and C are chosen on these two lines such that $AB = AC$. Then the equation of a line BC passing through the point $(2, 3)$ is:

(A) $3x - y - 3 = 0$	(B) $x + 3y - 11 = 0$
(C) $3x + y - 9 = 0$	(D) $x - 3y + 7 = 0$

Space For Rough Work

6. The diagonals of a rhombus ABCD intersect at the point M (1, 2) and its sides are parallel to the lines $x - \sqrt{3}y + 2\sqrt{3} = 0$ and $\sqrt{3}x - y + 3 = 0$. If the vertex A is situated on x-axis, then possible co-ordinates of vertex C are:
 (A) (-3, 4) (B) (3, 4)
 (C) (-1, 4) (D) (-1, -4)
7. The line $3x + 6y = k$ intersect the curve $2x^2 + 2xy + 3y^2 = 1$ at points A and B. The circle on AB as diameter passes through the origin. The possible value of k is:
 (A) 3 (B) 4
 (C) -4 (D) -3

(PART – B)
(Non – Negative Integer)

1. Number of straight line(s) passing through the point P (4, 3) whose x-intercept is a prime number and whose y-intercept is a positive integer, is equal to:
2. The number of possible straight lines, passing through (2, 3) and forming a triangle with coordinate axes, whose area is 12 sq. units, is:
3. P is a point inside the triangle ABC. Lines are drawn through P, parallel to the sides of the triangle. The three resulting triangles with the vertex at P have areas 4, 9 and 49 sq. units. The area of the triangle ABC is:
4. The area of the triangle formed by two rays whose combined equation is $y = |x|$ and the line $x + 2y = 2$, is $\frac{a}{k}$ sq. units where a, k are coprime then $a + k = ?$
5. A straight line L with negative slope passes through the point (8, 2) and cuts the positive co-ordinate axes at points P and Q. As L varies, the absolute minimum value of OP + OQ is (O is origin):
6. The line $x + y = a$ meets the axis of x and y at A and B respectively. A triangle AMN is inscribed in the triangle OAB, O being the origin, with right angle at N. M and N lie respectively on OB and AB. If the area of the triangle AMN is $\frac{3}{8}$ of the area of the triangle OAB, then AN/BN is equal to:

Space For Rough Work

(PART – B)

This section contains Two paragraphs. Each paragraph having TWO questions Numerical answer type with answer XXXX.XX. For each question, enter the correct numerical value. If the numerical value has more than two decimal places, **truncate/round-off** the value to **TWO** decimal places.

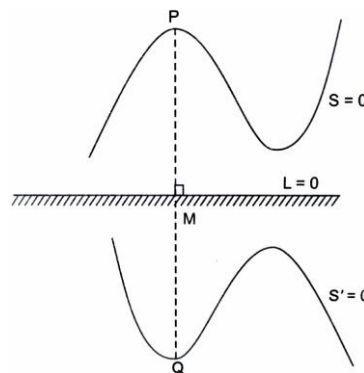
Paragraph for Question no. 7 to 8

Let L be the line belonging to the family of the straight lines $(a + 2b)x + (a - 3b)y + a - 8b = 0$, $a, b \in \mathbb{R}$, which is farthest from the point $(2, 2)$.

7. The equation of line L is $\lambda x + \mu y + 7 = 0$ where $\lambda, \mu \in \mathbb{N}$, then $\lambda^2 + \mu^2 = ?$
8. Area formed by the line L with co-ordinate axes is $\frac{p}{q}$, where p, q are written in simplest form then $p + q = ?$

Paragraph for Question no. 9 to 10

Let $S' = 0$ be the image or reflection of the curve $S=0$ about line mirror $L = 0$. Suppose P be any point on the curve $S = 0$ and Q be the image or reflection about the line mirror $L = 0$, then Q will lie on $S' = 0$.



9. The image of the line $3x - y = 2$ in the line $y = x - 1$ is $px - qy = 2$ where $p, q \in \mathbb{N}$. then $p^3 + q^3 = ?$
10. The image of the circle $x^2 + y^2 = 4$ in the line $x + y = 2$ is $x^2 + y^2 - \lambda x - \mu y + \psi = 0$, where $\lambda, \mu, \psi \in \mathbb{N}$, then $(\lambda + \mu + \psi)^2 = ?$

Space For Rough Work

FIITJEE INTERNAL TEST

BATCH – NWCDCF327G1W

COMMON TEST– 2

Code: 100867

JEE ADVANCED LEVEL

ANSWER KEY

ANSWER KEYS

Physics

PART – A

- | | | | |
|--------|--------|-------|------|
| 1. D | 2. D | 3. C | 4. B |
| 5. BCD | 6. ABD | 7. BD | |

PART – B

- | | | | |
|-------------------------------|----------|------|---------|
| 1. 7 | 2. 1 | 3. 3 | 4. 9 |
| 5. 0 | 6. 5 | 7. 4 | 8. 0.90 |
| 9. 3.13 (range: 3.12 to 3.13) | 10. 2.50 | | |

Chemistry

PART – A

- | | | | |
|-------|--------|---------|------|
| 1. C | 2. C | 3. A | 4. C |
| 5. AC | 6. BCD | 7. ABCD | |

PART – B

- | | | | |
|----------------------------|---------|---------------------------|---------|
| 1. 32 | 2. 4 | 3. 25 | 4. 1682 |
| 5. 8 | 6. 5 | 7. 1.11(range 1.1 to 1.2) | |
| 8. 3.22 (range 3.2 to 3.3) | 9. 2.25 | 10. 0.5 | |

Mathematics

PART – A

- | | | | |
|--------|--------|--------|------|
| 1. C | 2. A | 3. A | 4. A |
| 5. A,B | 6. B,C | 7. A,D | |

PART – B

- | | | | |
|-------|---------|--------|-------|
| 1. 2 | 2. 3 | 3. 144 | 4. 7 |
| 5. 18 | 6. 3 | 7. 17 | 8. 57 |
| 9. 28 | 10. 144 | | |