

PHYSICS, CHEMISTRY & MATHEMATICS**QP CODE: 100767****Paper – 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.
- * **In multiple choice questions the options are given as F,T,R & E which correspond to the options A,B,C & D respectively in the 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 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.
- (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: _____

**Forthcoming
Exam – FTRE on
15th Sept. 2024.****BATCHES – NWCM426B1R & B1W – PT – 1**

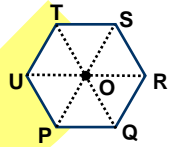
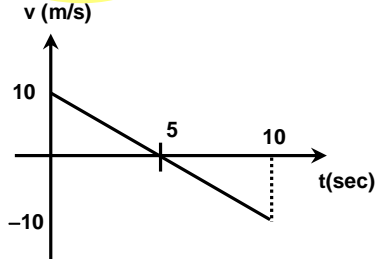
- * In multiple choice questions the options are given as F,T,R & E which correspond to the options A,B,C & D respectively in the OMR sheet.

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. If \vec{a}_1 and \vec{a}_2 are two non-collinear unit vectors and if $|\vec{a}_1 + \vec{a}_2| = \sqrt{3}$, then the value of $(\vec{a}_1 - \vec{a}_2) \cdot (2\vec{a}_1 + \vec{a}_2)$ is:
 (F) 2 (T) $\frac{3}{2}$ (R) $\frac{1}{2}$ (E) 1
2. Figure shows regular hexagon PQRSTU. Find the value of $\vec{PQ} + \vec{PR} + \vec{PS} + \vec{PT} + \vec{PU}$.
 (F) \vec{PO} (T) $2\vec{PO}$
 (R) $4\vec{PO}$ (E) $6\vec{PO}$
- 
3. 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
 (F) 300 J (T) - 300 J
 (R) zero (E) - 400 J
- 
4. When a body of mass M slides down an inclined plane of inclination θ , through a distance s, the work done by normal reaction is: (μ is coefficient of friction)
 (F) zero (T) $\mu Mg \sin \theta s$
 (R) $Mg (\mu \cos \theta - \sin \theta)s$ (E) None of the above

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**.

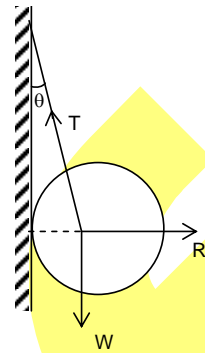
5. A metallic sphere is hung by a string fixed to a wall. The forces acting on the sphere are shown in figure. Which of the following statement is correct

(F) $\vec{R} + \vec{T} + \vec{W} = 0$

(T) $T^2 = R^2 + W^2$

(R) $T = R + W$

(E) $R = W \tan \theta$



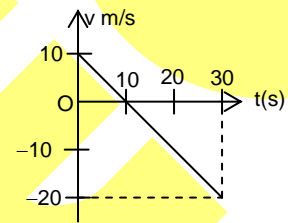
6. The velocity-time graph for a particle moving on a straight line is shown in figure.

(F) the particle has constant acceleration.

(T) the particle has never turned around.

(R) the particle has zero displacement.

(E) 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.



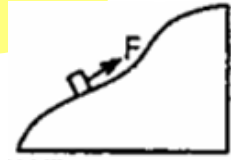
7. A body of mass m was slowly hauled up the rough hill by a force F which at each point was directed along tangent to the hill. Work done by the force

(F) Is independent of shape of trajectory.

(T) Depends upon vertical component of displacement but independent of horizontal component.

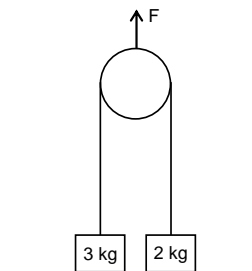
(R) Depends upon both the components of displacement.

(E) Does not depend upon coefficient of friction.



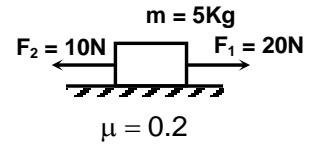
(PART – B)
(Non – Negative Integer)

1. For the give figure, the acceleration of the 3 kg block when $F = 50$ N. (Both string and pulley are ideal).



Space For Rough Work

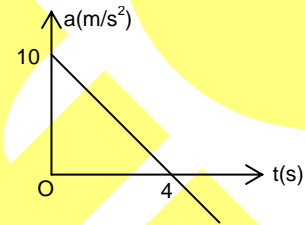
2. In the adjacent figure initially block is at rest and two horizontal forces F_1 and F_2 of magnitudes 20N and 10N respectively are applied simultaneously at time $t = 0$. The coefficient of friction between the block and the ground is $\mu = 0.2$. Calculate the work done by friction force on the block in first two second.



3. 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?

4. 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).

5. The acceleration-time graph of a particle moving along a straight line is as shown in figure. At what time (in sec) the particle acquires its initial velocity?



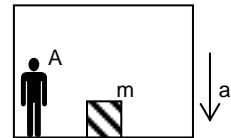
6. A block of mass 10 kg accelerates uniformly from rest to a speed of 2 m/s in 20 sec. The average power developed in time interval of 0 to 20 sec (in W) is _____.

(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 block of mass m is kept in an elevator which starts moving downward with an acceleration a as shown in figure. The block is observed by two observers A and B for a time interval t_0 .



7. The observer B finds that the work done by gravity on the block is $k(mg at_0^2)$ then the value of 'k' is _____.

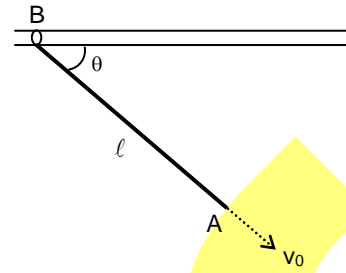


8. The observer A finds that the work done by Pseudo force on the block is _____.

Space For Rough Work

Paragraph for Question no. 9 to 10

A bead B of mass $m = 0.5$ kg which can slide along a smooth horizontal rod is attached to one end of a light inextensible string of length $\ell = 1$ m as shown. The other end 'A' of the string is pulled with a constant speed $v_0 = 2$ m/s always directed along the length of the string. Then answer the following question:



9. The velocity of the bead at $\theta = 60^\circ$ (in m/s) is_____.
10. The tension in the string at $\theta = 60^\circ$ (in N) is_____.

Space For Rough Work

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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.

1. How many sulphur atoms are present in one mole of sodium sulphate?
 (F) $2 \times 6.023 \times 10^{23}$ (T) 6.023×10^{23}
 (R) $4 \times 6.023 \times 10^{23}$ (E) $\frac{1}{2} \times 6.023 \times 10^{23}$
2. Which of the following has the highest value of first ionization energy?
 (F) Na (T) N
 (R) O (E) Mg
3. Which of the following has angular shape?
 (F) I_3^- (T) ICl_2^+
 (R) ICl_2^- (E) Br_3^-
4. $BrO_3^- + Br^- + H^+ \longrightarrow Br_2 + H_2O$
 What is the equivalent mass of BrO_3^- in the above reaction if its molecular mass is M?
 (F) $\frac{M}{10}$ (T) $\frac{M}{2}$
 (R) M (E) $\frac{M}{5}$

(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. Which of the following change(s) is/are oxidation half reaction(s)?
 (F) $SO_3^{2-} \longrightarrow SO_3$ (T) $Cr_2O_7^{2-} \longrightarrow CrO_4^{2-}$
 (R) $NH_3 \longrightarrow N_2$ (E) $CO_2 \longrightarrow CO$

Space For Rough Work

6. Which of the following species contain(s) eight electrons in its/their outermost orbit(s)?
[At. No. of Na = 11, S = 16, Mg = 12 & C = 6]
(F) Na^+ (T) S^{2-}
(R) Mg^{2+} (E) C^{4-}
7. Which of the following electron(s) has/have zero orbital angular momentum?
(F) The valence electron of potassium (At. No = 19)
(T) The unpaired electron of phosphorus (At. No = 15)
(R) The most energetic electron of aluminium (At. No = 13)
(E) The lowest energetic electron of sodium (At. No = 11)

(PART – B)
(Non – Negative Integer)

1. What is the sum of $(n + \ell)$ for the valence electron of lithium atom?
2. What is the n-factor of H_3PO_4 in the following reaction?
 $\text{H}_3\text{PO}_4 + 3\text{NaOH} \longrightarrow \text{Na}_3\text{PO}_4 + 3\text{H}_2\text{O}$
3. 300 mL of 9 M NaOH solution requires 1350 mL of HCl solution for complete neutralization. What is the molarity of the HCl solution?
4. What is the sum of the principal quantum numbers of the orbits of hydrogen atom between which an electronic transition produces the first line of Balmer series?
5. The molecular orbital electronic configuration of F_2 molecule is given below:
 $\sigma_{1s}^2 \sigma_{1s}^{*2} \sigma_{2s}^2 \sigma_{2s}^{*2} \sigma_{2p_z}^2 \pi_x^2 = \pi_y^2 \pi_y^{*2} = \pi_z^{*2}$
If x = number of antibonding electrons
y = bond order of F_2
What is the value of $(x + y)$?
6. The atomic number of an atom is 19. How many electrons with $\ell = 0$ are present in the atom?

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

The values of van der Waal's constants a and b of four gases are given as follows:

Gases	'a' in $\text{atm L}^2 \text{mol}^{-2}$	'b' in L mol^{-1}
P	73.3	0.4
Q	89.2	0.6
R	72.3	0.5
S	68.4	0.3

Answer the following questions on the basis of above write up.

7. What is the value of 'a' of the gas which has the strongest intermolecular force of attraction?
8. What is the 'b' value of the gas which can be easily liquefied?

Paragraph for Question no. 9 to 10

Some salts when crystallized from their saturated aqueous solution, it is observed that they are associated with some water molecules. Such salts are called hydrated salts. They can be made anhydrous by heating or in some other methods. Examples of such salts include, $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$, $\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$, $\text{MgCl}_2 \cdot 6\text{H}_2\text{O}$ etc.

When magnesium sulphate is crystallized, a hydrated salt is obtained. It is made anhydrous by heating. When the hydrated salt of MgSO_4 is heated, it becomes anhydrous and there takes place a loss of mass of 51.22%(mass) in the form of water.

Answer the following questions on the basis of above write up.

9. If the number of water molecules associated with the molecule of the hydrated salt is X . what is $\frac{X}{5}$?
10. If the molecular mass of the hydrated salt is X , what is the value of $\frac{X}{10}$?

Space For Rough Work

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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 expression $\frac{\cos 6x + 6\cos 4x + 15\cos 2x + 10}{\cos 5x + 5\cos 3x + 10\cos x}$ is equal to
 (F) $\cos 2x$ (T) $2\cos x$
 (R) $\cos^2 x$ (E) $1 + \cos x$
2. If the equation $4y^3 - 8a^2yx^2 - 3ay^2x + 8x^3 = 0$ represent three straight lines, two of them are perpendicular then sum of all possible values of 'a' is equal to:
 (F) $\frac{3}{8}$ (T) $\frac{-3}{4}$
 (R) $\frac{1}{4}$ (E) -2
3. If $2\log(x + y) = \log x + \log y + 4\log 2$, then $x^2 + y^2 =$
 (F) $14xy$ (T) $12xy$
 (R) $2xy$ (E) $7xy$
4. Tangents drawn from the point P (1, 8) to the circle $x^2 + y^2 - 6x - 4y - 11 = 0$ touch the circle at the points A and B. The equation of the circumcircle of the triangle PAB is
 (F) $x^2 + y^2 + 4x - 6y + 19 = 0$ (T) $x^2 + y^2 - 4x - 10y + 19 = 0$
 (R) $x^2 + y^2 - 2x + 6y - 29 = 0$ (E) $x^2 + y^2 - 6x - 4y + 19 = 0$

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. The solution set of $\frac{|x|-1}{|x|-2} \geq 0$ includes the set
- (F) $(-\infty, -2)$ (T) $[-2, -1]$
 (R) $[-1, 1]$ (E) $(2, \infty)$
6. Consider an equation $3^{x^2} - 2(3^{x^2+1}) - 7^{\log_7 3^{x^2-2}} + k = 0$, identify which of the following statement(s) is/are correct
- (F) If $k = 46$, then equation has exactly two solutions
 (T) If $k = \frac{46}{9}$, then equation has exactly one solution
 (R) If $k = 0$, then equation has no solution
 (E) If $k = -1$, then equation has exactly two solutions
7. Let RS be the diameter of the circle $x^2 + y^2 = 1$ where S is the point $(1, 0)$. Let P be a variable point (other than R and S) on the circle and tangents to the circle at S and P meet at the point Q. The normal to the circle at P intersects a line drawn through Q parallel to RS at point E. Then the locus of E passes through the point(s)
- (F) $\left(\frac{1}{3}, \frac{1}{\sqrt{3}}\right)$ (T) $\left(\frac{1}{4}, \frac{1}{2}\right)$
 (R) $\left(\frac{1}{3}, \frac{-1}{\sqrt{3}}\right)$ (E) $\left(\frac{1}{4}, \frac{-1}{2}\right)$

(PART – B)
(Non – Negative Integer)

1. If $\log_{27} \left(\sqrt{\sin^4 \theta + 4 \cos^2 \theta} + \sqrt{\cos^4 \theta + 4 \sin^2 \theta} \right) = \lambda$, then the value of ' 6λ ' is
2. Find the sum of all the integral solution(s) of the equation $3^{|x|} = \left(\frac{3}{(\sqrt{3})^{|x-2|}} \right)^2$.

Space For Rough Work

3. A ray of light is sent along the line which passes through the point (2, 3). The ray is reflected from the point P on x – axis. If the reflected ray passes through the point (6, 4), and the coordinates of P are $\left(\frac{\alpha}{7}, 0\right)$ then the value of ' α ' is
4. If $\int_0^{\frac{\pi}{4}} (\tan^5 x + \tan^7 x) dx = \frac{1}{\lambda}$ then the value of ' λ ' is
5. The number of common tangents to the circle $x^2 + y^2 = 4$ and $x^2 + y^2 - 6x - 8y = 24$ is
6. Find the area of the triangle formed by the line $x + y = 3$ and the angle bisectors of pair of straight lines $x^2 - y^2 + 2y = 1$.

(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 $f : \mathbb{R} \rightarrow \mathbb{R}$; $f(x) = x^3 + x^2 f'(1) + x f''(2) + f'''(3)$ for all $x \in \mathbb{R}$.

7. The value of $f(1)$ is:
8. The value of $f'(1) + f''(2) + f'''(3)$

Paragraph for Question no. 9 to 10

If $y = 1 + \sin\left(\frac{\pi}{4} + \theta\right) + 2\cos\left(\frac{\pi}{4} - \theta\right)$; then:

9. The maximum possible value of 'y' is
10. If minimum possible value of 'y' is ' λ ' then $|\lambda|$ is

Space For Rough Work

FIITJEE INTERNAL TEST

BATCHES: NWCM426B1R & B1W

Phase Test – 1

Paper – 2

Code:

JEE ADVANCED LEVEL

ANSWER KEY

ANSWER KEYS

Physics

PART – A

- | | | | |
|--------|-------|-------|------|
| 1. R | 2. E | 3. R | 4. F |
| 5. FTE | 6. FE | 7. FR | |

PART – B

- | | | | |
|------|--------|--------|------|
| 1. 0 | 2. 0 | 3. 6 | 4. 5 |
| 5. 8 | 6. 1 | 7. 0.5 | 8. 0 |
| 9. 4 | 10. 24 | | |

Chemistry

PART – A

- | | | | |
|-------|---------|-------|------|
| 1. T | 2. T | 3. T | 4. E |
| 5. FR | 6. FTRE | 7. FE | |

PART – B

- | | | | |
|--------|----------|---------|--------|
| 1. 2 | 2. 3 | 3. 2 | 4. 5 |
| 5. 9 | 6. 7 | 7. 89.2 | 8. 0.3 |
| 9. 1.4 | 10. 24.6 | | |

Mathematics

PART – A

- | | | | |
|--------|--------|-------|------|
| 1. T | 2. T | 3. F | 4. T |
| 5. FRE | 6. FTR | 7. FR | |

PART – B

- | | | | |
|---------|----------|---------|---------|
| 1. 2 | 2. 3 | 3. 26 | 4. 6 |
| 5. 1 | 6. 2 | 7. 4.00 | 8. 3.00 |
| 9. 4.00 | 10. 2.00 | | |