

FIITJEE - JEE (Main)

PHYSICS, CHEMISTRY & MATHEMATICS

BATCHES: NWCM123E1R+E1W_PT1

PHASE TEST – I

Q.P. CODE:

Time Allotted: 3 Hours

Maximum Marks: 300

- Do not open this Test Booklet until you are asked to do so.
- Please read the instructions carefully. You are allotted 5 minutes specifically for this purpose.

Important 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 & C** in the OMR. Part-B of OMR to be left unused
5. Rough spaces are provided for rough work inside the question paper. No additional sheets will be provided for rough work.
6. No candidate is allowed to carry any textual material, printed or written, bits of papers, clip boards, log tables, slide rule, calculator, cellular phones, pagers and electronic devices ext. except the Admit Card inside the examination hall / room.

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.
4. **Do not fold or make any stray marks on the Answer Sheet.**

C. Marking Scheme for All Two Parts:

- (i) **Part-A (01-20)** – Contains Twenty (20) multiple choice objective questions which have four (4) options each and only one correct option. Each question carries **+4 marks** which will be awarded for every correct answer and **-1 mark** will be deducted for every incorrect answer.
- (ii) **Part-B (01-05)** contains five (05) 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 : _____

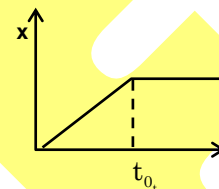
Physics

PART – A

Straight Objective Type

This part contains **20 multiple choice questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE** is correct.

1. Figure shows the displacement (x) – time (t) graph of a particle moving on the x -axis



- (A) The particle is at rest
 (B) The particle continuously going along x -direction
 (C) The velocity of particle increases up to time t_0 and then becomes constant
 (D) The particle moves at a constant velocity up to a time t_0 and then stops

1. **D**

2. If a unit vector is represented by $0.5\hat{i} + 0.8\hat{j} + c\hat{k}$, then the value of 'c' is

- (A) 1
 (B) $\sqrt{0.11}$
 (C) $\sqrt{0.01}$
 (D) $\sqrt{0.39}$

2. **B**

3. Two forces, each of magnitude F have a resultant of the same magnitude F . The angle between the two forces is

- (A) 45°
 (B) 120°
 (C) 150°
 (D) 60°

3. **B**

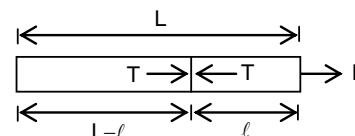
4. A person walking at the rate of 3 km/hr , the rain appears to fall vertically when he increase his to speed 6 km/hr it appears to meet him at angle of 45° with vertical. The speed of rain is

- (A) $3\sqrt{2}\text{ km/hr}$
 (B) $\frac{3}{\sqrt{2}}\text{ km/hr}$
 (C) $6\sqrt{2}\text{ km/hr}$
 (D) $2\sqrt{3}\text{ km/hr}$

4. **A**

5. A uniform rope of length L , resting on frictionless horizontal surface is pulled at one end by a force F . Find the tension in the rope at distance ℓ from the end where force F is applied.

- (A) $\frac{F\ell}{L}$
 (B) $\frac{F(L-\ell)}{L}$
 (C) $\frac{F\ell}{L+\ell}$
 (D) $\frac{F\ell}{L-1}$



5. **B**

6. A projectile is projected at an angle $\alpha (>45^\circ)$ with an initial velocity u ($t=0$). The time t at which its horizontal velocity will equal to the vertical velocity

(A) $t = \frac{u}{g}(\cos \alpha - \sin \alpha)$

(B) $t = \frac{u}{g}(\cos \alpha)$

(C) $t = \frac{u}{g}(\sin \alpha - \cos \alpha)$

(D) $t = \frac{u}{g}(\sin^2 \alpha - \cos^2 \alpha)$

6. **C**

7. An object of mass m is hanging by a string from the ceiling of an elevator. The elevator is moving upward but slowing down. What is the tension in the string

(A) less than mg

(B) exactly mg

(C) greater than mg

(D) zero

7. **A**

8. Power applied to a particle varies with time as $P = (3t^2 - 2t + 1)$ watt, where t is in second.

Find the change in its kinetic energy between $t = 2$ sec and $t = 4$ sec

(A) 32J

(B) 46J

(C) 61J

(D) 100J

8. **B**

9. 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

(A) $\frac{3}{\sqrt{13}}$

(B) $\frac{3}{\sqrt{26}}$

(C) $\sqrt{\frac{3}{26}}$

(D) $\sqrt{\frac{3}{13}}$

9. **B**

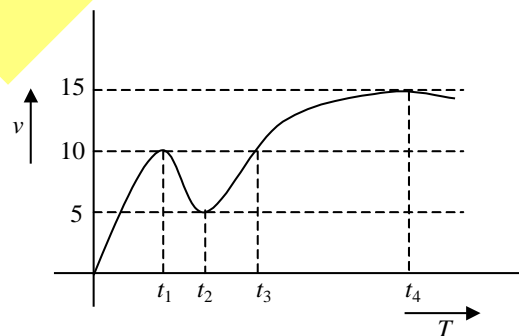
10. Velocity time graph of a particle undergoing rectilinear motion is plotted upto $T = t_4$ as shown in the figure. Average acceleration of the particle is zero in the time interval between

(A) 0 and t_1

(B) t_1 and t_2

(C) t_1 and t_3

(D) t_2 and t_4



10. **C**

11. A projectile is throw horizontally from a big tower with a speed of 20 ms^{-1} . If $g = 10 \text{ ms}^{-2}$, the speed of the projectile after 5 second will be nearly,

(A) 0.5 ms^{-1}

(B) 5 ms^{-1}

(C) 54 ms^{-1}

(D) 500 ms^{-1}

11. **C**

12. The unit vector perpendicular to $\vec{i} - 2\hat{j} + \hat{k}$ and $3\vec{i} + \hat{j} - 2\hat{k}$ is

- (A) $\frac{5\vec{i} + 3\hat{j} + 7\hat{k}}{\sqrt{83}}$ (B) $\frac{3\vec{i} + 5\hat{j} + 7\hat{k}}{\sqrt{83}}$
 (C) $\frac{5\vec{i} + 3\hat{j} - 7\hat{k}}{\sqrt{83}}$ (D) $\frac{3\vec{i} - 5\hat{j} + 7\hat{k}}{\sqrt{83}}$

12. **B**

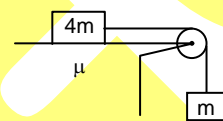
13. Which of the rectangular pair may be the components of a 13 N force?

- (A) 5 N, 12 N (B) 10 N, 11 N
 (C) 6.5 N, 6.5 N (D) 9 N, 12 N

13. **A**

14. The minimum value of μ required to keep the system in equilibrium is

- (A) 0.25 (B) 0.75
 (C) 1 (D) 0.5



14. **A**

15. A particle of mass 2kg is moving under the influence of a force which always acts towards the centre and whose potential energy is given by $v_r = 2r^3$ J. If the body is moving in a circular orbit of radius 5m then its mechanical energy will be

- (A) 625 J (B) 5 J
 (C) 250 J (D) none of these

15. **A**

16. A stone is dropped in to a well in which the level of water is h metre below the top of the well. If v is velocity of sound, the time T after which the splash is heard is given by

- (A) $T = \frac{2h}{v}$ (B) $T = \sqrt{\frac{2h}{g}} + \frac{h}{v}$
 (C) $T = \sqrt{\frac{2h}{v}} + \frac{h}{g}$ (D) $T = \sqrt{\frac{h}{2g}} + \frac{2h}{v}$

16. **B**

17. Two constant forces \vec{F}_1 and \vec{F}_2 act on a body of mass 8 kg. These forces displace the body from point P(1,-2,3) to Q(2,3,7) in 2s starting from rest. Force \vec{F}_1 is of magnitude 9 N and is acting along vector $(2\hat{i} - 2\hat{j} + \hat{k})$. Work done by the force \vec{F}_2 is

- (A) 80J (B) -80J
 (C) -180J (D) 180J

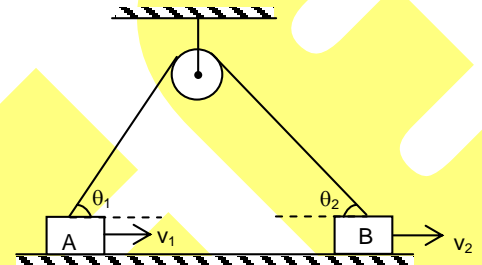
17. **D**

18. A body is projected from the top of a tower with an initial velocity of 10 ms^{-1} horizontally (Assume $g = 10 \text{ ms}^{-2}$). The distance of the body from the point of projection after two seconds is (in m):
 (A) 20 (B) 40
 (C) 28.3 (D) 14.4

18. C

19. Block are moving as shown. The ratio v_1/v_2 is

- (A) $\frac{\sin \theta_1}{\sin \theta_2}$ (B) $\frac{\sin \theta_2}{\sin \theta_1}$
 (C) $\frac{\cos \theta_2}{\cos \theta_1}$ (D) $\frac{\cos \theta_1}{\cos \theta_2}$



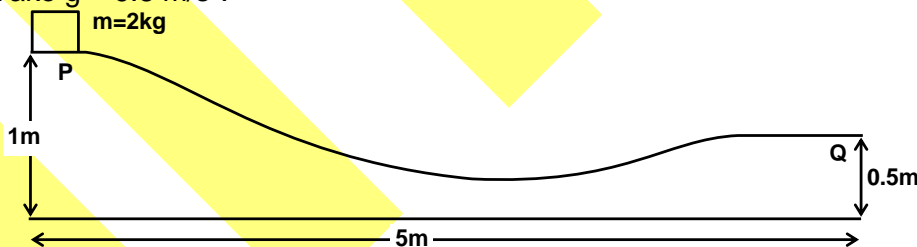
19. C

20. 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

20. C

PART-B
Numerical Type

1. Find the horizontal velocity of the particle when it reach the point Q. Assume there is no friction. Take $g = 9.8 \text{ m/s}^2$.



1. **3.13**
 Range: 3.12 to 3.17

2. A 40 kg slab rests on a frictionless floor. A 10kg block rests on top of the slab. The static coefficient of friction between the block and the slab is 0.70 while the kinetic coefficient is 0.50. The 10 kg block is acted upon by a horizontal force of 100N, the resulting acceleration of the slab will be



2. **1.25**

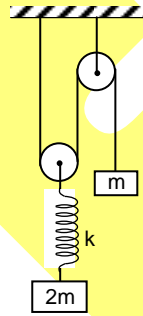
3. A boat which has a speed of 5 km/h in still water crosses a river of width 1 km along the shortest possible path in 15 min. The velocity of the river water in km/h is

3. **3**

4. A body starts from rest with constant acceleration, what is the ratio of the distance traveled by the body during the 4th and 3rd second?

4. 1.4

5. For a system in equilibrium as shown in figure elongation in spring will be $\frac{n mg}{k}$. Find the value of 'k'.



5. 2

Chemistry

PART – A

Straight Objective Type

This part contains **20 multiple choice questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE** is correct.

- 0.1 mole of atoms of an element weigh 2.4 g. What is the atomic mass of the element?
(A) 2.4 (B) 24
(C) 240 (D) 20.4
- B
- A 400 L container contains an ideal gas at 10 atm and 100 K temperature. What will be the pressure if the gas is completely transferred to a 40 L container at constant temperature?
(A) 1000 atm (B) 10 atm
(C) 100 atm (D) 1 atm
- C
- 400 mL of 0.4 M NaOH solution is completely neutralized by 200 mL of HCl solution. What is the concentration of the HCl solution?
(A) 1.6 M (B) 0.8 N
(C) 2.4 g/L (D) 0.4 mol/L
- B
- Under which of the following conditions, an ideal gas will have maximum density?
(A) 10^{-2} atm, 200K (B) 10^{-2} atm, 600K
(C) 0.1 atm, 200K (D) 0.1 atm, 600K
- C
- Which orbit of He^+ has the same energy as the first orbit of hydrogen atom?
(A) First orbit ($n = 1$) (B) Second orbit ($n = 2$)
(C) Third orbit ($n = 3$) (D) Fourth orbit ($n = 4$)
- B
- Which of the following does not take place by nitrogen atom in the process of formation of NH_3 ?
(A) Excitation of electrons
(B) Hybridization of atomic orbitals
(C) Overlapping of hybridized orbitals with atomic orbitals of hydrogen
(D) Repulsion between lone pair and bond pair of electrons
- A
- What is the hybridization of carbon in CF_4 ?
(A) sp^4 (B) sp^3
(C) sp^2d (D) sp^3d
- B

8. What is the oxidation number of carbon in CH_2Cl_2 ?
(Electronegativity order: $\text{Cl} > \text{C} > \text{H}$)
(A) +2 (B) -2
(C) +4 (D) None of these
8. D
9. Which of the following term in van der Waal's equation represents interparticle force of attraction?
(A) $\frac{n^2a}{v^2}$ (B) a
(C) b (D) $V-b$
9. B
10. Which of the following element is diagonally related to magnesium in the periodic table?
(A) Sodium (B) Lithium
(C) Beryllium (D) Boron
10. B
11. $2\text{NaOH} + \text{H}_3\text{PO}_4 \longrightarrow \text{Na}_2\text{HPO}_4 + 2\text{H}_2\text{O}$
What is the equivalent mass of H_3PO_4 in the above reaction?
[At. wt. of P = 31]
(A) 98 (B) 49
(C) 32.66 (D) 196
11. B
12. $\text{Mg} \xrightarrow[\Delta]{\text{air}} (\text{X}) \xrightarrow{\text{H}_2\text{O}} (\text{Y}) + (\text{Z}) \uparrow$
(Mixture of compounds) (Solution) (gas)
- The gas 'Z' in the above reaction is:
(A) NH_3 (B) N_2
(C) O_2 (D) H_2
12. A
13. If the radius of the first orbit of hydrogen atom is a_0 , what will be the radius of second orbit of He^+ ion?
(A) $2a_0$ (B) $4a_0$
(C) $a_0/2$ (D) $a_0/4$
13. A
14. Which of the following statement is correct regarding the molecule PCl_3F_2 ?
(A) 'F' atoms are present at the equatorial position of the Trigonal bipyramidal geometry.
(B) 'Cl' atoms are present at the axial positions
(C) The dipole moment of the molecule is zero
(D) All are correct
14. C
15. In aqueous solution, BeSO_4 exists as:
(A) $[\text{Be}(\text{H}_2\text{O})_4]\text{SO}_4$ (B) $[\text{Be}(\text{H}_2\text{O})_6]\text{SO}_4$
(C) $[\text{Be}(\text{H}_2\text{O})_2]\text{SO}_4$ (D) $[\text{Be}(\text{H}_2\text{O})_3]\text{SO}_4$

15. A
16. Which of the following set of quantum numbers does not represent any atomic orbital?
 (A) $n = 4, \ell = 2, m = -1$ (B) $n = 3, \ell = 0, m = 1$
 (C) $n = 2, \ell = 1, m = 0$ (D) $n = 4, \ell = 1, m = 1$
16. B
17. How many electron(s) is/are present in the valence shell of the atom which has maximum value of electron gain enthalpy in the periodic table?
 (A) 3 (B) 6
 (C) 7 (D) 5
17. C
18. Which of the following gas(es) is/are evolved on thermal decomposition of lithium nitrate?
 (A) O_2 (B) NO
 (C) NO_2 and O_2 (D) NO and O_2
18. C
19. NH_3 and BF_3 form adduct readily through
 (A) Ionic bond between BF_3 and NH_3
 (B) co-ordinate bond between B and N
 (C) Covalent bond between B and N
 (D) H - bonds between F atoms of BF_3 and H atom of NH_3
19. B
20. Ortho and para hydrogen differ
 (A) in the number of protons (B) in the molecular mass
 (C) in the nature of spin of protons (D) in the nature of spin of electrons
20. C

PART-B
Numerical Type

1. The pressure of the gas mixture when 0.5 L of H_2 at 0.8 bar and 2.0 L of oxygen at 0.7 bar are introduced in 1 L vessel at $27^\circ C$ is found to be $0.9 X$ bar. Find out the value of X.
1. 2
2. How many of the following species has bond order equal to 2.
 $N_2, O_2^{2+}, NO^+, CN^-$
 $O_2, N_2^{2-}, NO^-, NO_2^+$
 $NO, N_2^0, O_2^+, NO^{2+}$
2. 4
3. How many maximum number of electrons of an atom will have $(n + \ell) = 4$.
 n = Principal quantum number
 ℓ = Azimuthal quantum number

3. 8
4. One litre of a solution of H_2O_2 produces 11.2 litre of O_2 gas according to the following decomposition reaction.
$$2\text{H}_2\text{O}_2 \longrightarrow 2\text{H}_2\text{O} + \text{O}_2$$

What is the normality of the H_2O_2 solution?
4. 2
5. The de-Broglie wavelength of a helium atom is 0.3 \AA . What will be it's velocity in ms^{-1} unit?
[Hint: $h = 6.6 \times 10^{-34} \text{ j s}$, $N_A = 6 \times 10^{23}$]
5. 3.3

Space For Rough Work

Mathematics

PART – A

Straight Objective Type

This part contains **20 multiple choice questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE** is correct.

1. Lines $ax + by + c = 0$ where $3a + 2b + 4c = 0$ $a, b, c \in \mathbb{R}$ are concurrent at the point.

- (A) (3, 2) (B) (2, 4)
(C) (3, 4) (D) $\left(\frac{3}{4}, \frac{1}{2}\right)$

1. D

2. $\int \frac{\sin^2 x}{1 + \cos x} dx =$

- (A) $x + \sin x + c$ (B) $x - \sin x + c$
(C) $-x + \sin x + c$ (D) $2x - \sin x + c$

2. B

3. If $2x + y = 1$ intersects $3x^2 + 4xy - 4x + 1 = 0$ at A and B then $\angle AOB =$.

- (A) $\frac{\pi}{4}$ (B) $\frac{\pi}{3}$
(C) $\frac{\pi}{2}$ (D) none of these

3. C

4. Orthocentre of the triangle whose circumcentre and centroid are (0, 0) and (1, 1) is

- (A) (3, 3) (B) (2, 2)
(C) $\left(\frac{3}{2}, \frac{3}{2}\right)$ (D) none of these

4. A

5. If S is the director circle of S_1 and S_1 is director circle of $x^2 + y^2 = 8$ then radius of S is

- (A) 4 (B) $4\sqrt{2}$
(C) 8 (D) None

5. B

6. The number of solutions of $\log(2x) = 2\log(4x - 15)$ is

- (A) 1 (B) 2
(C) 3 (D) infinite

6. A

7. If $y = (1 + x^{1/4})(1 + x^{1/2})(1 - x^{1/4})$ then $\frac{dy}{dx} =$

- (A) 1 (B) -1
(C) x (D) \sqrt{x}

7. B
8. If $A(1,1), B(\sin t, \cos t), C(\cos t, -\sin t)$ then locus of centroid of ΔABC is
 (A) $(3x-1)^2 + (3y-1)^2 = 1$ (B) $(3x-1)^2 + (3y-1)^2 = 2$
 (C) $(3x-1)^2 + (3y+1)^2 = 4$ (D) None
8. B
9. How many values of x will satisfy $||x+3|-4|-6|=5$
 (A) 4 (B) 6
 (C) 8 (D) 5
9. B
10. The value of $\sin 10^\circ \sin 30^\circ \sin 50^\circ \sin 70^\circ$ is
 (A) $\frac{1}{36}$ (B) $\frac{1}{32}$
 (C) $\frac{1}{18}$ (D) $\frac{1}{16}$
10. D
11. If $\tan(\alpha + \beta) = \frac{5}{12}$ and $\cot(\alpha - \beta) = \frac{4}{3}$, then $\tan 2\beta$ is equal to
 (A) $-\frac{16}{63}$ (B) $\frac{12}{35}$
 (C) $-\frac{9}{28}$ (D) none of these
11. A
12. If $\sin(\theta + 28^\circ) = \cos(3\theta - 75^\circ)$ then the value of acute θ are
 (A) 46° or 7° (B) 36° or 9°
 (C) 35° or 8° (D) none of these
12. C
13. If $\sin 2\theta(4\cos^2\theta - 3)(3 - 4\sin^2\theta) = \frac{1}{\sqrt{2}}$ then least positive value of θ is equal to
 (A) $\frac{\pi}{4}$ (B) $\frac{\pi}{12}$
 (C) $\frac{\pi}{24}$ (D) None
13. C
14. $\cos\left(\frac{\pi}{15}\right) \cdot \cos\left(\frac{2\pi}{15}\right) \cdot \cos\left(\frac{4\pi}{15}\right) \cdot \cos\left(\frac{8\pi}{15}\right)$ is
 (A) $\frac{1}{8}$ (B) $\frac{1}{4}$
 (C) $\frac{1}{16}$ (D) $-\frac{1}{16}$

14. D
15. If angle between pair of lines $2x^2 + 10xy + 8y^2 + ax + by + c = 0$ is θ then $\tan\theta$ equal to
(A) $\frac{1}{5}$ (B) $\frac{2}{5}$
(C) $\frac{3}{5}$ (D) None
15. C
16. If $\log_4 5 = a$ and $\log_5 6 = b$, then $\log_3 2 =$
(A) $\frac{1}{2a+1}$ (B) $\frac{1}{2b+1}$
(C) $2ab+1$ (D) $\frac{1}{2ab-1}$
16. D
17. The total number of real solution of $x^2 + 5|x| + 6 = 0$ will be
(A) 4 (B) 2
(C) 1 (D) 0
17. D
18. The value of x for which $\frac{1}{3-x} > 1$
(A) $(-\infty, -3)$ (B) $(2, \infty)$
(C) $(2, 3)$ (D) None of these
18. C
19. If the line $y = mx$ meets the lines $x + 2y - 1 = 0$ and $2x - y + 3 = 0$ at the same point, then m is equal to
(A) 1 (B) -1
(C) 2 (D) -2
19. B
20. The points $(k, 2 - 2k)$, $(-k + 1, 2k)$ and $(-4 - k, 6 - 2k)$ are collinear for
(A) all values of k (B) $k = 0$
(C) $k = \frac{1}{2}$ (D) no value of k
20. C

PART-B
Numerical Type

1. The lines $3x - 4y + 4 = 0$ and $6x - 8y - 7 = 0$ are tangents to the same circle with radius r . Find value of $4r$.
1. 3
2. If $y = (1 + 4x^2)(3 - 2x^3)$ then $\frac{dy}{dx}$ at $x = 1$ is
2. -22
3. If $\operatorname{cosec} \theta - \cot \theta = \frac{1}{3}$ then $\cos \theta$ is
3. 0.8
4. Area of triangle formed by $(1,2)$, $(3,4)$ and $(5,8)$ is
4. 2
5. If $\sin(A - B) = \frac{1}{\sqrt{10}}$, $\cos(A + B) = \frac{2}{\sqrt{29}}$ then $\tan 2A$ equal to $\left(0 < A, B < \frac{\pi}{4}\right)$
5. 17

Space For Rough Work

FIITJEE INTERNAL TEST

BATCHES: NWCM123E1R+E1W_PT1

PHYSICS, CHEMISTRY & MATHEMATICS

JEE MAIN-PHASE-I

Paper Code

ANSWER KEY

SECTION – I
(PHYSICS)

PART – A

PART – B

JEEM
(CHEMISTRY)

PART – A

PART – B

SECTION – III
(MATHEMATICS)

PART – A

PART – B