

FITJEE COMMON TEST**PHYSICS, CHEMISTRY & MATHEMATICS****CODE:****Time Allotted: 3 Hours****Maximum Marks: 192**

- 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 Section.
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 & Part-B**
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 Three Parts.

- (i) **Part-A (01 – 8)** contains 8 multiple choice questions which have only one correct answer. Each question carries **+3 marks** for correct answer and **– 1 mark** for wrong answer.

PART – A (09 – 12) contains 4 Multiple Choice Questions which have **One or More Correct** answer.

For each question in the group **Q. 9 – 12** of **PART – A** you will be awarded

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 6 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 : _____

BATCHES – NWCM82201S, NWCM2022X1R, NWCM2022Y1R, NWCM2022A1R, NWCM2022A2R, NWCM2022A1W, NWCM2022A2W, NWCM2022A3W, NWCM2022A4W, NWCM2022X1W, NWCM2022Y1W, NWCM2022Z1W, NWCM2022X A1W, NWCM2022X A2W, PANINI2022-XI 1, PANINI2022-XI 2, & PANINI2022-G 1

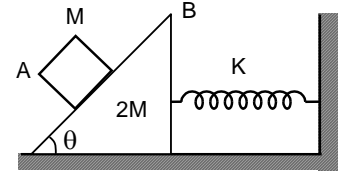
Section – I (Physics)

PART – A

(Single Correct Choice Type)

This section contains 8 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE** is correct.

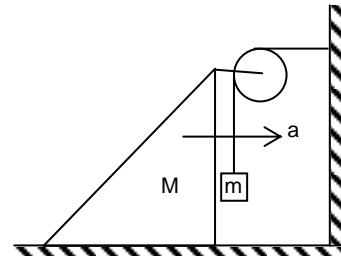
- 1 A block A of mass M rests on a wedge B of mass $2M$ of inclination θ . There is sufficient friction between A and B so that A does not slip on B. If there is no friction between B and ground, the compression in spring is



- (A) $\frac{Mg \cos \theta}{K}$ (B) $\frac{Mg \cos \theta \sin \theta}{K}$ (C) $\frac{Mg \sin \theta}{K}$ (D) zero

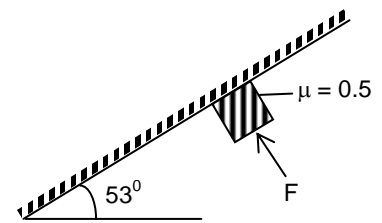
- 2 If wedge is moving with acceleration a as shown in the figure then value of net force on m is

- (A) ma (B) $\sqrt{2} ma$
(C) mg (D) zero



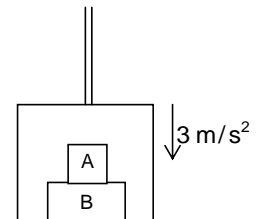
- 3 In the figure shown the minimum value of F to be applied perpendicular to the inclined so that the block of mass 10 kg does not slides and remains in contact with inclined plane is

- (A) 0 (B) 40 N
(C) 220 N (D) 200 N



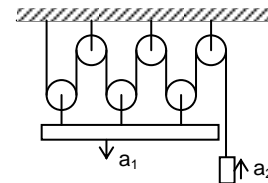
- 4 The elevator shown in figure is descending with an acceleration of 3 m/s^2 . The mass of the block A = 1 kg . The force exerted by the block B on A is

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



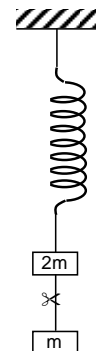
- 5 Strings and pulley are massless and frictionless. The relation in acceleration of the block as shown in the figure is

- (A) $a_2 = 6a_1$
(B) $a_1 = 6a_2$
(C) $a_1 = 3a_2$
(D) $a_2 = 3a_1$

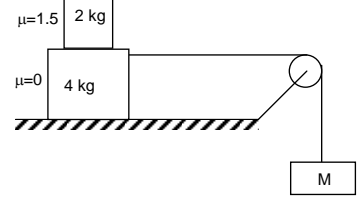


- 6 System shown in figure is in equilibrium and at rest. The spring and string are mass less, now the string is cut. The acceleration of mass $2m$ and m just after the string is cut will be

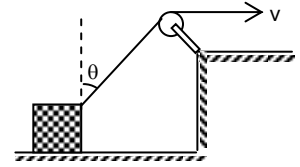
- (A) $g/2$ upwards, g downwards
(B) g upwards, $g/2$ downwards
(C) g upwards, $2g$ downwards
(D) $2g$ upwards, g downwards



- 7 Find the minimum value of mass of hanging block so 2 kg block slips over 4 kg block.
 (A) 30 kg
 (B) 20 kg
 (C) 10 kg
 (D) will not slip for any mass



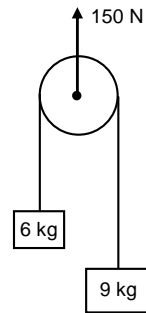
- 8 A block is dragged on a smooth plane with the help of a rope which moves with a velocity v as shown in figure. The horizontal velocity of the block is
 (A) v
 (B) $v/\sin\theta$
 (C) $v \sin\theta$
 (D) $v/\cos\theta$



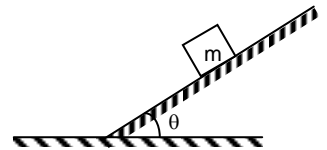
(Multi Correct Choice Type)

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

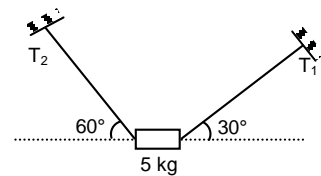
9. As situation shown in figure, choose the correct option(s) (take $g = 10 \text{ m/s}^2$ downward)
 (A) the acceleration of pulley is $\frac{5}{6} \text{ m/s}^2$ upward.
 (B) the acceleration of pulley is $\frac{5}{12} \text{ m/s}^2$ upward.
 (C) the acceleration of pulley is 0.
 (D) tension in the string which connects the masses is 75 N.



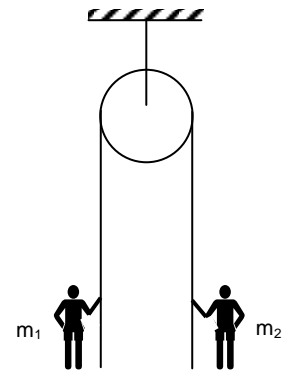
10. A block is stationary relative to a moving inclined plane. No other information is given. The frictional force on the block can be
 (A) zero
 (B) downward
 (C) upward
 (D) $>mg$



11. A body of mass 5 kg is suspended by the strings making angles 60° and 30° with the horizontal as shown in the figure ($g = 10 \text{ ms}^{-2}$). Then
 (A) $T_1 = 25 \text{ N}$
 (B) $T_2 = 25 \text{ N}$
 (C) $T_1 = 25\sqrt{3} \text{ N}$
 (D) $T_2 = 25\sqrt{3} \text{ N}$



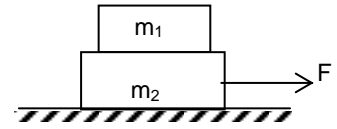
12. Two men of unequal masses hold on to the two sections of a light rope passing over a smooth light pulley. Which of the following are possible
 (A) The lighter man is stationary while the heavier man slides with some acceleration
 (B) The heavier man is stationary while the lighter man climbs with some acceleration
 (C) The two men slide with the same acceleration in the same direction
 (D) The two men slide with acceleration of the same magnitude in opposite direction



PART – B
(Numerical Based)

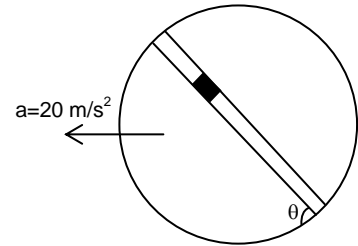
This section contains 06 Numerical based questions, the answer of which maybe positive or negative numbers or decimals (e.g. 6.25, 7.00, -0.33, -30, 30.27, -127.30)

1. 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 co-efficient 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 (take $g = 9.8 \text{ N/s}^2$)

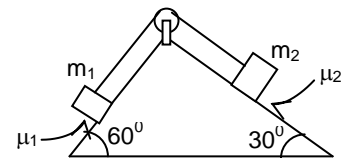


2. A spring of force constant K is cut into two pieces such that one piece is double the length of the other, then find out the force constant of the longer piece ($K = 5 \text{ N/m}$) in N/m .
3. A car driver applies the brakes which retards the car at a rate of 0.9 m/s^2 . If the initial velocity of the car is 10 m/s , the speed of the car after 6 sec will be
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 4.56 m/s^2 , then what frictional force acting on the block (in newton).

5. A circular disc with a groove along its diameter is placed horizontally. A block of mass 1 kg 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 ($\theta = 37^\circ$) take $g = 10 \text{ m/s}^2$.



6. Two particles of masses m_1 and m_2 connected by an inextensible mass less string are kept on a fixed wedge. If $\mu_1 = \frac{1}{2}, \mu_2 = \frac{1}{3}, m_1 = 1 \text{ kg}, m_2 = 2 \text{ kg}$. Find the acceleration of the particles



space for rough work

Section – II (Chemistry)

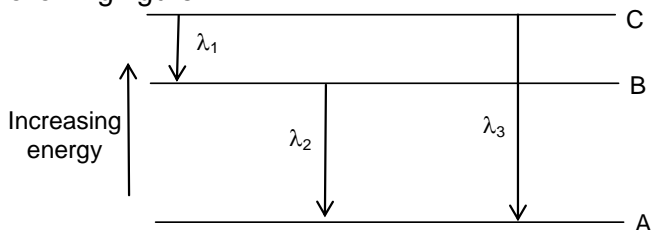
PART – A

(Single Correct Choice Type)

This section contains 8 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE** is correct.

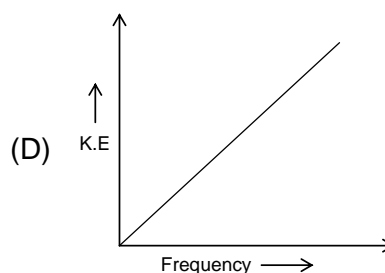
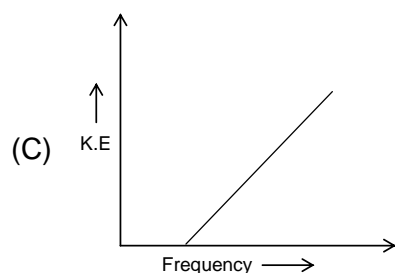
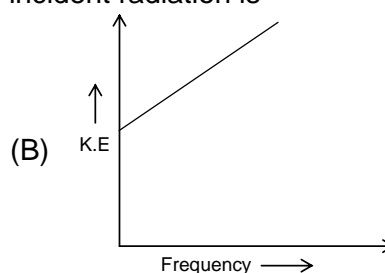
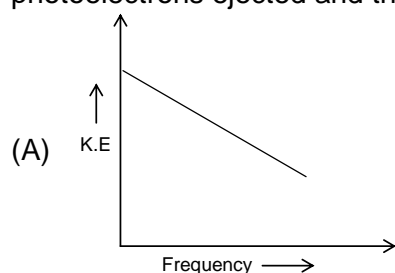
- If traveling at same speeds, which of the following matter waves have the shortest wavelength?
(A) Electron (B) Alpha particle(He^{2+}) (C) Neutron (D) Proton
- For the electrons of oxygen atom, which of the following statements is correct?
(A) Z_{eff} for an electron in a 2s orbital is the same as Z_{eff} for an electron in a 2p orbital.
(B) An electron in the 2s orbitals has the same energy as an electron in the 2p orbital.
(C) Z_{eff} for an electron in 1s orbital is the same as Z_{eff} for an electron in a 2s orbital.
(D) The two electrons present in the 2s orbital have spin quantum numbers m_s but of opposite sign.
- The first ionisation enthalpies of Na, Mg, Al and Si are in the order:
(A) $\text{Na} < \text{Mg} > \text{Al} < \text{Si}$ (B) $\text{Na} > \text{Mg} > \text{Al} > \text{Si}$
(C) $\text{Na} < \text{Mg} < \text{Al} < \text{Si}$ (D) $\text{Na} > \text{Mg} > \text{Al} < \text{Si}$

- Three energy levels and the wavelength of the lines produced by transitions are shown in the following figure



Which of the following relationship is correct?

- $\lambda_3 = \lambda_1 + \lambda_2$ (B) $\lambda_3^2 = \lambda_1^2 + \lambda_2^2$
 - $\lambda_3 = \frac{\lambda_1 \lambda_2}{\lambda_1 + \lambda_2}$ (D) $\lambda_1 + \lambda_2 + \lambda_3 = 0$
- According to Einstein's photoelectric equation, the graph between the kinetic energy of photoelectrons ejected and the frequency of incident radiation is



6. Among the following transition metal ions, the one where all the metal ions have $3d^2$ electronic configuration is:
 (A) Ti^{3+} , V^{2+} , Cr^{3+} , Mn^{4+} (B) Ti^{4+} , V^{4+} , Cr^{6+} , Mn^{7+}
 (C) Ti^{4+} , V^{3+} , Cr^{2+} , Mn^{3+} (D) Ti^{2+} , V^{3+} , Cr^{4+} , Mn^{5+}
 [Atomic No. Ti = 22, V = 23, Cr = 24, Mn = 25]
7. Which of the following orbital(s) is/are associated with more than one radial nodes?
 (A) 3s (B) 3d (C) 3p (D) 4f
8. The electronic configuration of two elements X and Y are given below:
 $X = 1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$
 $Y = 1s^2 2s^2 2p^6 3s^2 3p^5$
 The formula of the ionic compound that can be formed between these elements is
 (A) XY (B) XY_2 (C) X_2Y (D) XY_3

(Multi Correct Choice Type)

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

9. Out of the following pairs of electrons. Identify the pairs of electrons present in degenerate orbitals:
 (A) (i) $n = 3, l = 2, m_l = -2, m_s = -\frac{1}{2}$, (ii) $n = 3, l = 2, m_l = -1, m_s = -\frac{1}{2}$
 (B) (i) $n = 3, l = 1, m_l = 1, m_s = +\frac{1}{2}$, (ii) $n = 3, l = 2, m_l = 1, m_s = +\frac{1}{2}$
 (C) (i) $n = 4, l = 1, m_l = 1, m_s = +\frac{1}{2}$, (ii) $n = 3, l = 2, m_l = 1, m_s = +\frac{1}{2}$
 (D) (i) $n = 3, l = 2, m_l = +2, m_s = -\frac{1}{2}$, (ii) $n = 3, l = 2, m_l = +2, m_s = +\frac{1}{2}$
10. Which of the following elements can show covalency greater than 4?
 (A) Be (B) P (C) S (D) B
11. Which of the following sequences contain atomic numbers of only representative elements?
 (A) 3, 33, 53, 87 (B) 2, 10, 22, 36 (C) 7, 17, 25, 37, 48 (D) 9, 35, 51, 88
12. Ionic radii vary in
 (A) inverse proportion to the effective nuclear charge
 (B) inverse proportion to the square of effective nuclear charge
 (C) direct proportion to the screening effect
 (D) direct proportion to the square of screening effect

PART – B
(Numerical Based)

This section contains 06 Numerical based questions, the answer of which may be positive or negative numbers or decimals (e.g. 6.25, 7.00, -0.33, -30, 30.27, -127.30)

1. When an electron is accelerated from rest through a potential difference of 1 Kilo Volt. The de-Broglie wavelength associated with electron is $x \times 10^{-11}$. What is the value of x.
2. Calculate the wavelength of the spectral line in Lyman series corresponding to $n_2 = 3$. Report your answer in nanometer(nm).
3. What is the orbital angular momentum of the electron of hydrogen in ground state?

4. A golf ball has a mass of 40 g and a speed of 45 m/s. If the speed can be measured within accuracy of 2%. Its uncertainty in position is represented as $Z \times 10^{-33}$ m. What is the value of Z.
5. Half of the number of spectral lines obtained when an electron jumps from $n = 5$ to ground state for a sample of hydrogen atom such that no spectral lines in Balmer series is
6. The first five ionization energies of an element are 9.1, 16.2, 24.5, 35 and 205.7 eV respectively. Then number of valence electron in the atom is

space for rough work

Section – III (Mathematics)**PART – A****(Single Correct Choice Type)**

This section contains 8 **multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE** is correct.

- $$\frac{\cos 9^\circ + \sin 9^\circ}{\cos 9^\circ - \sin 9^\circ} =$$

(A) $\tan 54^\circ$ (B) $\tan 36^\circ$ (C) $\tan 18^\circ$ (D) none of these
- Value of $\tan 15^\circ$ is

(A) $2 + \sqrt{3}$ (B) $2 - \sqrt{3}$ (C) $\sqrt{3} - 2$ (D) $\sqrt{3}$
- The value of $\sin(45^\circ + A) \cdot \sin(45^\circ - A)$ is equal to

(A) $\cos 2A$ (B) $2\cos 2A$ (C) $\frac{1}{2}\cos 2A$ (D) $\sin 2A$
- A point moves such that its distance from the point $(4, 0)$ is half that of its perpendicular distance from the line $x = 16$. The locus of this point is

(A) $3x^2 + 4y^2 = 192$ (B) $4x^2 + 3y^2 = 192$
(C) $x^2 + y^2 = 192$ (D) None of these
- If $\operatorname{cosec} A + \cot A = \frac{11}{2}$, then $\tan A$ is equal to

(A) $\frac{111}{44}$ (B) $\frac{44}{117}$ (C) $\frac{44}{125}$ (D) $\frac{117}{125}$
- The set of lines $ax + by + c = 0$ where $6a + 7b - 9c = 0$ is concurrent at the point

(A) $\left(\frac{2}{3}, 9\right)$ (B) $(-6, -7)$
(B) $\left(-\frac{2}{3}, -\frac{7}{9}\right)$ (D) none of these
- The sum of slopes of the lines represented by the equation $14x^2 + 2hxy - 7y^2 = 0$ is equal to the product of slopes then h is equal to

(A) 7 (B) -7
(C) 14 (D) -14
- The value of $6(\sin^6 \theta + \cos^6 \theta) - 9(\sin^4 \theta + \cos^4 \theta) + 4$ is:

(A) -3 (B) 0 (C) 1 (D) 3

(Multi Correct Choice Type)

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

- Suppose ABCD (in order) is a quadrilateral inscribed in a circle. Which of the following is/are always true?

(A) $\sec B = \sec D$ (B) $\cot A + \cot C = 0$
(C) $\operatorname{cosec} A = \operatorname{cosec} C$ (D) $\tan B + \tan D = 0$

10. The lines L_1 and L_2 denoted by $3x^2 + 10xy + 8y^2 + 14x + 22y + 15 = 0$ intersect at the point P and have slopes m_1 and m_2 respectively. The acute angle between them is θ . Which of the following relations hold good?
- (A) $m_1 + m_2 = 5/4$
 (B) $m_1 m_2 = 3/8$
 (C) Acute angle between L_1 and L_2 is $\tan^{-1} \frac{2}{11}$
 (D) Sum of the abscissa and ordinate of the point P is -1
11. If $\cos \alpha = \frac{3}{5}$ and $\cos \beta = \frac{5}{13}$ then
- (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) $\cos(\alpha - \beta) = \frac{63}{65}$
12. If $\cos(A - B) = \frac{3}{5}$ and $\tan A \tan B = 2$, then
- (A) $\cos A \cos B = 1/5$ (B) $\sin A \sin B = -2/5$
 (C) $\cos(A + B) = -1/5$ (D) $\sin A \cos B = 4/5$

PART – B
(Numerical Based)

This section contains 06 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)

1. If $\tan(\alpha - \beta) = \sin 2\beta$, then value of $\frac{\tan \alpha + \tan \beta}{\tan 2\beta}$ equals _____
2. The value of $\tan 1^\circ \cdot \tan 2^\circ \cdot \tan 3^\circ \dots \dots \dots \tan 89^\circ$ is
3. If $90^\circ < A < 180^\circ$ and $\sin A = \frac{4}{5}$, then $\tan\left(\frac{A}{2}\right)$ is equal to:
4. $(2\cos A + 1)(2\cos A - 1) - 2\cos 2A$ is equal to
5. The straight lines joining the origin to the points of intersection of the line $2x + y = 1$ and curve $3x^2 + 4xy - 4x + 1 = 0$ include an angle $\frac{\pi}{k}$, where the integer k is
6. For an acute angle α , the value of $\sin \alpha + \sin\left(\alpha + \frac{2\pi}{3}\right) + \sin\left(\alpha + \frac{4\pi}{3}\right)$ is

space for rough work

FITJEE INTERNAL TEST

BATCHES – NWCM822O1S, NWCM2022X1R, NWCM2022Y1R, NWCM2022A1R, NWCM2022A2R, NWCM2022A1W, NWCM2022A2W, NWCM2022A3W, NWCM2022A4W, NWCM2022X1W, NWCM2022Y1W, NWCM2022Z1W, NWCM2022XA1W, NWCM2022XA2W, PANINI2022-XI 1, PANINI2022-XI 2, & PANINI2022-G 1

COMMON TEST – II

ANSWER KEY

QP Code:

Physics (Section -I)							
PART – A							
1	D	2	B	3	C	4	D
5	A	6	A	7	D	8	B
9.	BD	10.	AD	11.	AD	12.	ABD
PART – B							
1.	3.10	2.	7.50	3.	4.60	4.	4.56
5.	7.20	6	0				

Chemistry (Section-II)							
PART – A							
1.	B	2.	D	3.	A	4.	C
5.	C	6.	D	7.	A	8.	B
9.	AD	10.	BC	11.	AD	12.	AC
PART – B							
1.	3.87	2.	102.6 nm	3.	Zero	4.	1.46
5.	3.5	6.	4				

Mathematics (Section -III)							
PART – A							
1.	A	2.	B	3.	C	4.	A
5.	B	6.	B	7.	D	8.	C
9.	BC	10.	BCD	11.	BCD	12.	AC
PART – B							
1.	2	2.	1	3.	2	4.	1
5.	2	6.	0				