

FIITJEE COMMON TEST – 5**PHYSICS, CHEMISTRY & MATHEMATICS****CODE:****Time Allotted: 3 Hours****Maximum Marks: 186**

- 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-C**
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 – 05)** contains 5 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 (06 – 13) contains 8 Multiple Choice Questions which have **One or More Correct** answer.

For each question in the group **Q. 6 – 13** 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.

- (iii) **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 **+3 marks** for correct answer and **there will be no negative marking**.

Name of the Candidate : _____

Batch : _____ **Date of Examination :** _____

Enrolment Number : _____

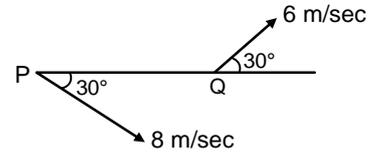
PART – I: PHYSICS

SECTION – A

(Single Correct Choice Type)

This section contains **5 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct**.

1. Two moving particles P and Q are 10 m apart at a certain instant. The velocity of P is 8 m/s making an angle of 30° with the line joining P and that of Q is 6 m/s making an angle 30° with PQ as shown in the figure. Then angular velocity of P with respect to Q is



- (A) 0 rad/s
(B) 0.1 rad/s
(C) 0.4 rad/s
(D) 0.7 rad/s

1. **D**

2. A rod collides elastically with smooth horizontal surface after falling from a height. For maximum angular speed of the rod just after impact, the rod should be released in such a way that it makes an angle α with horizontal, the value of α will be

- (A) 0° (B) $\cos^{-1} \frac{1}{\sqrt{2}}$ (C) $\cos^{-1} \frac{1}{\sqrt{3}}$ (D) $\cos^{-1} \frac{1}{\sqrt{6}}$

2. **C**

3. The moment of inertia of a rectangular lamina of mass 'm', length ' ℓ ' and width 'b' about an axis passing through its centre of mass, perpendicular to its diagonal and lies in the plane.

- (A) $m \left(\frac{\ell^2 + b^2}{12} \right)$ (B) $\frac{m}{12} \left[\frac{\ell^4 + b^4}{\ell^2 + b^2} \right]$ (C) $\frac{m}{6} \left[\frac{\ell^4 + b^4}{\ell^2 + b^2} \right]$ (D) none of these

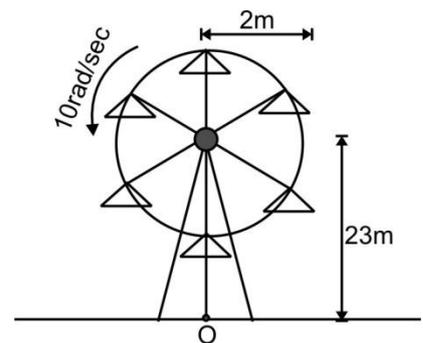
3. **B**

4. Moment of inertia of solid hemisphere of mass 'M' radius 'R' about an axis touching the curved surface and parallel to the base (circular and flat surface)

- (A) $\frac{7}{5} MR^2$ (B) $\frac{2}{5} MR^2$ (C) $\frac{13}{20} MR^2$ (D) $\frac{13}{10} MR^2$

4. **C**

5. In a swing, (as shown in figure), it rotates with constant angular velocity of 10 rad/sec. The length of the rods are 2m each. When a person sitting in one of the seat reaches the top, suddenly the rod connecting the seat cracks, so that the person starts falling in air, while the seat and rod still connected to swing. Find the distance on the ground from the foot of the swing at which the person will fall.



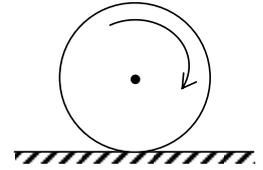
- (A) 22.4 m
(B) 44.8 m
(C) 67.2 m
(D) 11.2 m

5. **B**

(Multi Correct Choice Type)

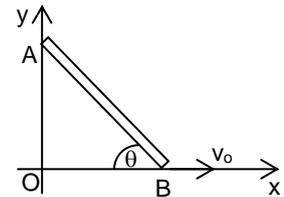
This section contains **8 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONE OR MORE** may be correct.

6. A disc is given an initial angular velocity ω_0 and placed on rough horizontal surface as shown. The quantities which will not depend on the coefficient of friction is/ are
 (A) The time until rolling begins
 (B) The displacement of centre of mass of the disc until rolling begins
 (C) The velocity when rolling begins
 (D) Angular velocity when rolling begins



6. **CD**

7. The end B of the rod AB which makes angle θ with the floor is being pulled with a constant velocity v_0 as shown. The length of the rod is ℓ . At the instant when $\theta = 37^\circ$



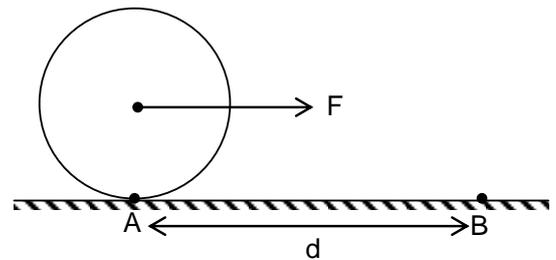
- (A) velocity of end A is $\frac{4}{3} v_0$ downwards
 (B) angular velocity of rod is $\frac{5 v_0}{3 \ell}$
 (C) angular velocity of rod is constant
 (D) velocity of end A is constant

7. **AB**

8. A solid cylinder of mass 'm' and radius 'r' is rolling on a rough inclined plane of inclination θ . The coefficient of friction between the cylinder and the incline is μ . Then
 (A) frictional force is always $\mu Mg \cos\theta$
 (B) friction is a dissipative force
 (C) by decreasing θ , frictional force decreases
 (D) friction opposes translation and supports rotation

8. **CD**

9. A uniform ring is connected to a light axle with light spokes so as to form a wheel. The wheel is placed on a horizontal surface with its plane vertical and a constant horizontal force F is applied to the axle. Surface AB is rough and surface right to B is smooth. The wheel does not slip when it moves from A to B and takes time T to move the distance d between A and B.

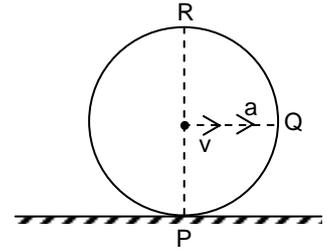


- (A) rotational KE remains constant right of B
 (B) energy is dissipated from A to B
 (C) linear acceleration of centre of mass of the ring right of B is more than linear acceleration left of B
 (D) linear acceleration of centre of mass of the wheel undergoes constant non zero acceleration to the right of B

9. **ACD**

COMMON TEST # 5 – C-XI-4

10. A uniform wheel is rolling without slipping on a horizontal surface. At a certain instant, its centre of mass has velocity 'v' and acceleration 'a'. P, Q and R are three points on the rim of the disc as shown in the figure.



- Acceleration of
 (A) P is vertically upwards
 (B) Q may be vertically downwards
 (C) R cannot be horizontal
 (D) Some point on the rim may be horizontal leftwards

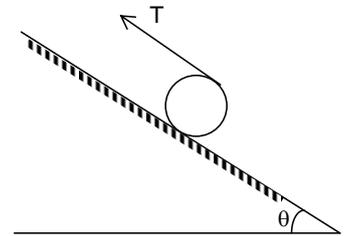
10. **ABCD**

11. The linear velocity of a particle moving with angular velocity $\vec{\omega} = 2\hat{k}$ at position vector $\vec{r} = 2\hat{i} + 2\hat{j}$ is

- (A) $4\hat{i}$ (B) $4(\hat{j} - \hat{i})$
 (C) has magnitude 4 (D) has magnitude $4\sqrt{2}$

11. **BD**

12. A sphere kept on a rough inclined plane is in equilibrium by a string wrapped over it. If angle of inclination is θ . Let tension in string be T and friction on sphere be f, then



- (A) $T = mg \sin \theta$ (B) $T = \frac{mg \sin \theta}{2}$
 (C) $f = 0$ (D) $f = \frac{mg \sin \theta}{2}$

12. **BD**

13. The unit of moment of inertia is

- (A) Joule/sec (B) $\text{Nm sec}^2/\text{rad}$
 (C) $\text{Joule second}^2/\text{rad}^2$ (D) kg m^2

13. **BCD**

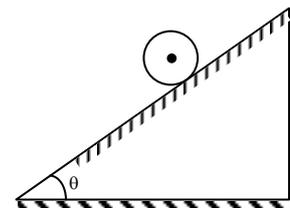
SECTION – C
(Integer Type)

This section contains **5 questions** 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. A disc of radius 4m rolls on a horizontal surface with linear velocity $4\hat{i}$ and angular velocity $2(-\hat{k})$. There is a particle p on the circumference of the disc which has velocity in vertical direction. The height of that particle from the ground will be

1 **2**

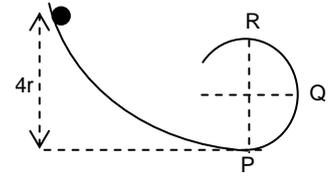
2. A uniform disc of mass m and radius R is rolling without slipping up a rough inclined plane which makes an angle 30° with the horizontal. If the coefficient of static and kinetic friction are each equal to μ and the only force acting on the disc are gravitational and frictional force then if frictional force acting on it is $\frac{mg}{x}$ up the incline, find x.



2. **6**

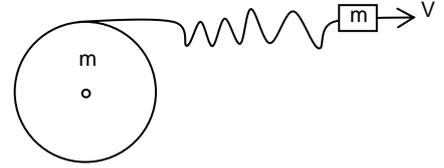
COMMON TEST # 5 – C-XI-5

3. A solid sphere of mass m is released from the height $4r$ above the ground level on a smooth track shown in the figure. The track ends in the form of a circular arc of radius r . The speed of the sphere when it reaches the point Q is $\sqrt{x \frac{6gr}{7}}$. Find 'x'.



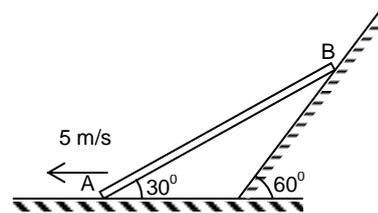
3. **5**

4. A block of mass m is attached to a pulley disc of equal mass m and radius r by means of a slack string as shown. The pulley is hinged about its centre on a horizontal table and the block is projected with an initial velocity of 5 m/s . Its velocity when the string becomes taut is $x \frac{20}{9} \text{ m/s}$. Find x .



4. **1.5**

5. In the figure shown, the instantaneous speed of end A of the rod is 5 m/s to the left. Find angular velocity of the rod of length 1 m .
(In rad/s) is $\frac{2x}{3}$ then the value of 'x' will be



5. **7.5**

PART – II: CHEMISTRY**SECTION – A****(Single Correct Choice Type)**

This section contains **5 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct**.

1. On diluting a buffer solution, its pH

(A) increases	(B) decreases
(C) remains same	(D) cannot be predicted

1. C

2. The pH of a solution containing 0.1 mol of CH₃COOH 0.2 mol of CH₃COONa and 0.05 mol of NaOH in 1 L. (pK_a of CH₃COOH = 4.74) is

(A) 5.44	(B) 5.20
(C) 5.04	(D) 4.74

2. A

3. If the salts M₂X, QY₂ and PZ₃ have the same solubilities $\left(< \frac{4}{27} \right)$, their K_{sp} values are related

(A) K _{sp} (M ₂ X) = K _{sp} (QY ₂) > K _{sp} (PZ ₃)	(B) K _{sp} (M ₂ X) > K _{sp} (QY ₂) = K _{sp} (PZ ₃)
(C) K _{sp} (M ₂ X) = K _{sp} (QY ₂) = K _{sp} (PZ ₃)	(D) K _{sp} (M ₂ X) > K _{sp} (QY ₂) > K _{sp} (PZ ₃)

3. A

4. Adiabatic expansion of an ideal gas is accompanied by

(A) increase in temperature
(B) decrease in ΔS
(C) decrease in ΔU
(D) no change in any one of the above properties

4. C

5. 10 mol of an ideal gas confined to a volume of 10 L is released into atmosphere at 300 K where the pressure is 1 bar. The work done by the gas is (R = 0.083 L bar K⁻¹ mol⁻¹)

(A) 249 L bar	(B) 259 L bar
(C) 239 L bar	(D) 220 L bar

5. C

(Multi Correct Choice Type)

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

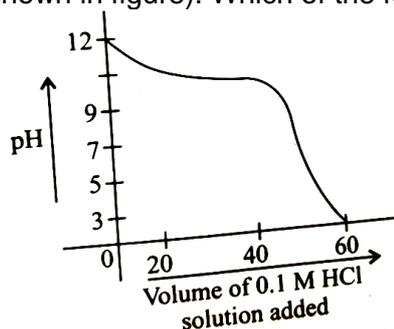
6. An acid-base indicator has K_a = 3.0 × 10⁻⁵. The acid form of the indicator is red and the basic form is blue. Then

(A) pH is 4.04 when indicator is 75% red	(B) pH is 5.00 when indicator is 75% blue
(C) pH is 5.00 when indicator is 75% red	(D) pH is 4.05 when indicator is 75% blue

6. AB

COMMON TEST # 5 – C-XI-7

7. When weak base solution (50 mL of 0.1 N NH_4OH) is titrated with strong acid (0.1 N HCl), the pH of the solution initially decrease fast and then decreases slowly till near the equivalent point (as shown in figure). Which of the following is/are correct.



- (A) The slow decrease of pH is due to the formation of an acidic buffer solution after the addition of some HCl .
 (B) The slope of shown graph will be minimum when 25 mL of 0.1 N HCl is added
 (C) The slow decreases of pH is due to the formation of basic buffer solution
 (D) The initial fast decreases in pH is due to fast consumption of OH^- ions of HCl .
7. BCD
8. A solution of 0.01 M Fe^{2+} in a saturated H_2S solution and (i) 0.2 M of H^+ (ii) 0.001 M of H^+ . ($K_1 \times K_2$ of $\text{H}_2\text{S} = 10^{-21}$ K), K_{sp} $\text{FeS} = 3.7 \times 10^{-19}$
 Which of the following statement is/are correct?
 (A) FeS will precipitate in solution(i) (B) FeS will not precipitate in solution(i)
 (C) FeS will precipitate in solution(ii) (D) FeS will not precipitate in solution(ii)
8. BC
9. Which of the following is(are) correct when 0.1 L of 0.0015 M MgCl_2 and 0.1 L of 0.025 M NaF are mixed together?
 (K_{sp} of $\text{MgF}_2 = 3.7 \times 10^{-8}$)
 (A) MgF_2 remains in solution (B) MgF_2 precipitates out
 (C) MgCl_2 precipitates out (D) Cl^- ions remains in solution
9. BD
10. A solution containing a mixture of 0.05 M NaCl and 0.05 M NaI is taken. (K_{sp} of $\text{AgCl} = 10^{-10}$ and K_{sp} of $\text{AgI} = 4 \times 10^{-16}$). When AgNO_3 is added to such a solution:
 (A) The concentration of Ag^+ required to precipitate Cl^- is 2×10^{-9} mol L^{-1} .
 (B) The concentration of Ag^+ required to precipitate I^- is 8×10^{-15} mol L^{-1} .
 (C) AgCl and AgI will be precipitate together
 (D) First AgI will be precipitated
10. ABD
11. If w_1 , w_2 , w_3 and w_4 are work done in isothermal, adiabatic, isobaric and isochoric reversible expansion for an ideal gas, respectively then
 (A) $w_3 > w_1$ (B) $w_1 > w_2$
 (C) $w_2 > w_4$ (D) $w_4 > w_2$
11. ABC

COMMON TEST # 5 – C-XI-8

12. The intensive property/properties is/are
(A) temperature (B) pressure
(C) internal energy (D) heat capacity
12. AB
13. Select the correct statements
(A) the magnitude of work involved in an intermediate irreversible expansion is less than that involved in reversible expansion.
(B) heat absorbed during intermediate reversible expansion is more than that in intermediate reversible expansion.
(C) the magnitude of work involved in an intermediate reversible compression is more than that involved in intermediate irreversible compression.
(D) heat released during intermediate irreversible compression is more than that in intermediate reversible compression.
13. ABCD

SECTION – C
(Integer Type)

This section contains **5 questions** 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. A sample of ideal gas ($\gamma = 1.4$) is heated at constant pressure. If 140 J of heat is supplied to gas, find $\Delta U/10$.
1. 6
2. The solubility product of lead sulphate is 1.3×10^{-8} . The number of moles of PbSO_4 that can be dissolved in 5 litre of 1.0×10^{-3} M Na_2SO_4 is 6.5×10^{-x} where x is.
2. 5
3. The solubility product of $\text{Mg}(\text{OH})_2$ is 10^{-14} . The molar solubility of $\text{Mg}(\text{OH})_2$ in a buffer solution of $\text{pH} = 8$ is $x \times 10^{-2}$ mol L^{-1} where x is.
3. 1
4. K_{a_1} and K_{a_2} of a dibasic acid H_2XO_3 are respectively 10^{-6} and 10^{-10} . What is the pH of 0.001 M NaHXO_3 solution?
4. 8
5. The heat of formation of ethane and ethene are respectively -40 and -32 KCal mol^{-1} at a certain temperature. If the heat of hydrogenation of ethene is $-x$ KCal mol^{-1} , the value of x is:
5. 8

Space for rough work

PART – III: MATHEMATICS**SECTION – A****(Single Correct Choice Type)**

This section contains **5 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct**.

1. If $c^2 = 4d$ and the two equations $x^2 - ax + b = 0$ are $x^2 - cx + d = 0$ have one common root then the value of $2(b + d)$ is equal to
- (A) $\frac{a}{c}$ (B) ac
 (C) $2ac$ (D) $a + c$
1. B
2. If $\log_y x + \log_x y = 7$, then the value of $(\log_y x)^2 + (\log_x y)^2$, is
- (A) 43 (B) 45
 (C) 47 (D) 49
2. C
3. The range of the expression $y = \frac{x^2 - 6x - 5}{x - 2}$ where $x \in \mathbb{R} - \{2\}$, is
- (A) $(-\infty, \infty)$ (B) null set
 (C) $(-\infty, 4] \cup [14, \infty)$ (D) $(-\infty, 7] \cup [8, \infty)$
3. A
4. If $\log_a b + \log_b c + \log_c a = 0$ where a, b and c are positive reals different than unity then the value of $(\log_a b)^3 + (\log_b c)^3 + (\log_c a)^3$ is
- (A) an odd prime (B) an even prime
 (C) an odd composite (D) an irrational number
4. A
5. The range of $p \in \mathbb{R}$ for which the equation $2x^2 - 2(2p + 1)x + p(p + 1) = 0$ have one root less than p and other root greater than p , is
- (A) $-1 < p < 0$ (B) $p < -1$ or $p > 0$
 (C) $p \geq 0$ (D) $p = 0$
5. B

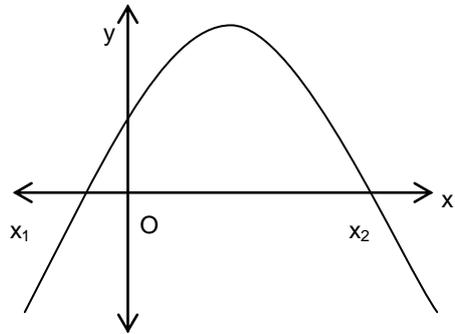
(Multi Correct Choice Type)

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

6. If $\log_4 5 = x$ and $\log_5 6 = y$ then
- (A) $\log_4 6 = xy$ (B) $\log_6 4 = xy$
 (C) $\log_3 2 = \frac{1}{2xy - 1}$ (D) $\log_2 3 = \frac{1}{2xy - 1}$
6. AC

COMMON TEST # 5 – C-XI-10

7. If the vertex of the parabola $y = 3x^2 - 12x + 9$ is (a, b) then the parabola whose vertex is (b, a) is (are)
 (A) $y = x^2 + 6x + 11$ (B) $y = x^2 - 7x + 3$
 (C) $y = -2x^2 - 12x - 16$ (D) $y = -2x^2 + 16x - 13$
7. AC
8. In which of the following case(s) the real number 'm' is greater than the real number 'n'?
 (Use $\log_{10} 2 = 0.3$ if needed)
 (A) $m = (\log_2 5)^2$ and $n = \log_2 20$
 (B) $m = \log_{10} 2$ and $n = \log_{10} \sqrt[3]{10}$
 (C) $m = \log_{10} 5 \cdot \log_{10} 20 + (\log_{10} 2)^2$ and $n = \frac{1}{2}$
 (D) $m = \log_{1/2} \left(\frac{1}{3}\right)$ and $n = \log_{1/3} \left(\frac{1}{2}\right)$
8. ACD
9. If a, b, c, d are non-zero real numbers such that c, d are the roots of the equation $x^2 + ax + b = 0$ and a, b are the roots of the equation $x^2 + cx + d = 0$, then which of the following relation is (are) correct?
 (A) $a^2 + c^2 = 2$ (B) $b^2 + d^2 = 4$
 (C) $a - b + c - d = 6$ (D) $bd - ac = 1$
9. AC
10. Consider the graph of quadratic trinomial $y = ax^2 + bx + c$ as shown below where x_1 and x_2 are the roots of the equation $ax^2 + bx + c = 0$. Which of the following statement (s) is (are) correct?
 (A) $a - b - c < 0$
 (B) $bc < 0$
 (C) $b > 0$
 (D) b and c have the same sign and different from a



10. ACD
11. If the quadratic polynomial $(p - 3)x^2 - 2px + 3p - 6$ is non-negative for every $x \in \mathbb{R}$, then the value of p can be
 (A) $\frac{3}{2}$ (B) 4
 (C) 6 (D) 7
11. CD
12. The value of k for which both roots of the equation $4x^2 - 2x + k = 0$ lie in the interval $(-1, 1)$ may be equal to
 (A) -1 (B) 0
 (C) 2 (D) -3

COMMON TEST # 5 – C-XI-11

12. AB

13. If α, β are the roots of the equation $ax^2 + bx + c = 0$, $a, b, c \in \mathbb{R}$, $a, c \neq 0$, then which of the following is correct?

(A) $\alpha^2 + \beta^2 = \frac{b^2 - 2ac}{a^2}$

(B) $\frac{1}{\alpha^2} + \frac{1}{\beta^2} = \frac{b^2 - 2ac}{c^2}$

(C) $\frac{1}{\alpha^3} + \frac{1}{\beta^3} = \frac{abc - b^3}{c^3}$

(D) $\alpha\beta(\alpha + \beta) = -\frac{bc}{a^2}$

13. ABD

SECTION – C
(Integer Type)

This section contains **5 questions** 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 a, b, c and d are positive integers, then find the value of

$$\log_{10} \left(\frac{2a}{b} \right) - \log_{10} \left(\frac{c}{2b} \right) + \log_{10} \left(\frac{5c}{d} \right) - \log_{10} \left(\frac{a}{5d} \right).$$

1. 2

2. Let α and β be the roots of a quadratic equation $4x^2 - (5p + 1)x + 5p = 0$ if $\beta = 1 + \alpha$, then find the integral value of p.

2. 3

3. Consider the equation $x^2 + 2(a - 1)x + a + 5 = 0$. Then the number of integral values of the parameter "a" for which both roots of the equation are positive is

3. 4

4. If $\log_{\sqrt{2}} \sqrt{x} + \log_2 x + \log_4 (x^2) + \log_8 (x^3) + \log_{16} (x^4) = 0$ then x is equal to

4. 1

5. The minimum value of the quadratic expression $x^2 - 3x + 5$, $x \in [-4, 1]$ is

5. 3

Space for rough work

FIITJEE COMMON TEST - V

BATCHES – 2022 X & A-Lot

ANSWERS KEY

QP Code:

Physics
SECTION – A

SECTION – C

Chemistry
SECTION – A

SECTION – C

MATHEMATICS

SECTION – A

SECTION – C