

FIITJEE INTERNAL TEST

COMMON TEST – II

Batches: One Year CRP(2122)

IIT- JEE 2022

Time: 3 hours

Maximum Marks: 186

- Please read the instructions carefully. You are allotted 5 minutes specially for this purpose.
- You are not allowed to leave the examination hall before end of the test.
- Use Blue/Black Ball Point Pen only for writing particulars on Side-1 and Side-2 of the Answer Sheet. Use to Pencil is strictly prohibited.

Instructions

Note:

1. The question paper contains 3 sections (Sec-1, Physics, Sec-II, Chemistry & Sec-III, Mathematics.)
2. Each section is divided into one part, **Part-A**.
3. **Part – A** contains 18 questions which are further divided as follows:
 - ❖ **Q. 1 – 6** are multiple choice questions. Each question has four choices (A), (B), (C) and (D), out of which **only one is correct**.
 - ❖ **Q. 7 – 14** are multiple correct answer type questions. Each question has four choices (A), (B), (C) and (D), out of which **one or more answer(s) is/are correct**.
 - ❖ **Q. 15 – 18** contains 2 Paragraphs. Based upon each paragraph, 2 Multiple Choice Questions have to be answered. Each question has **Only One Correct** answer.

Marking Scheme

1. For each question in the group **Q. 1 – 6 to Part – A** you will be awarded **3 marks** if you have darkened only the bubble corresponding to the answer and zero marks if no bubble is darkened. In all other cases, **minus one (-1) mark will be awarded**.
2. For each question in the group **Q. 7 – 14 of Part – A** contains 8 Multiple Choice Questions which have One or More Correct answer. Each question carries **+4 marks** for correct answer and **- 1 marks** for wrong answer.
For each question in the group **Q. 7 – 14 of PART – A** you will be awarded
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.
3. For each question in the group **Q. 15 – 18 of Part – A** you will be awarded **3 marks** if you have darkened all the bubble(s) corresponding to the correct answer and **zero marks** if no bubble is darkened. No negative marks will be awarded in this section.

Name of the Candidate :

Enrolment Number :

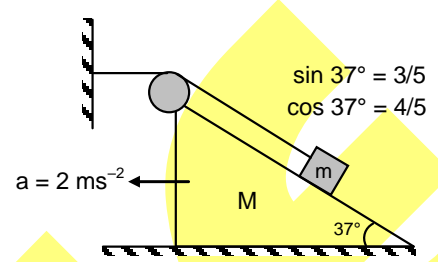
Section – I (Physics)

PART – A

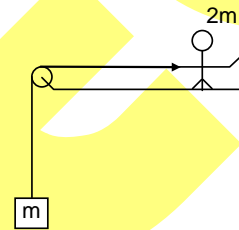
(Single Correct Choice Type)

This section contains 6 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which only **ONE** option is be correct.

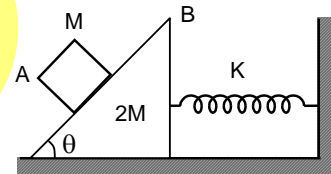
1. As shown in the figure, if acceleration of M with respect to ground is 2 ms^{-2} , then
 (A) Acceleration of m with respect to M is 5 ms^{-2}
 (B) Acceleration of m with respect to ground is 5 ms^{-2}
 (C) Acceleration of m with respect M is 2 ms^{-2}
 (D) Acceleration of m with respect to ground is 10 ms^{-2}



1. **C**
2. 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) $\frac{g}{2}$

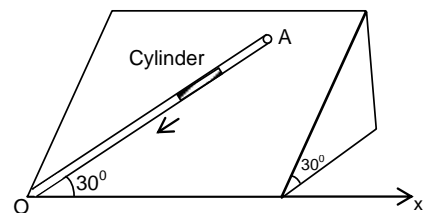


2. **D**
3. A block A of mass M rests on a wedge B of mass $2M$ of inclination θ . There is sufficient friction between A and B so that A does not slip on B. If there is no friction between B and ground, the compression in spring is



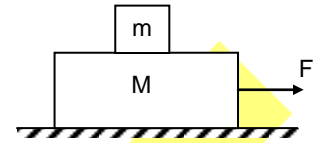
- (A) $\frac{Mg \cos \theta}{K}$ (B) $\frac{Mg \cos \theta \sin \theta}{K}$ (C) $\frac{Mg \sin \theta}{K}$ (D) zero

3. **D**
4. An inclined plane makes an angle 30° with the horizontal. A groove (OA) of length = 5 m cut in the plane makes an angle 30° with OX. A short smooth cylinder is free to slide down under the influence of gravity. The time taken by the cylinder to reach from A to O is ($g = 10 \text{ m/s}^{-2}$)
 (A) 4 s (B) 2 s
 (C) 3 s (D) 1 s



4. **B**

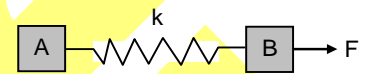
5. A block of mass m is placed on another block of mass M , which itself is lying on a horizontal surface. The coefficient of friction between two blocks is μ_1 and that between the block of mass M and horizontal surface is μ_2 . What maximum horizontal force can be applied to the lower block so that the two blocks move without separation?



- (A) $(M + m) (\mu_2 - \mu_1)g$
 (B) $(M - m) (\mu_2 - \mu_1)g$
 (C) $(M - m) (\mu_2 + \mu_1)g$
 (D) $(M + m) (\mu_2 + \mu_1)g$

5. **D**

6. Two identical particles A and B, each of mass m , are interconnected by a spring of stiffness k . If the particle B experiences a force F and the elongation of the spring is x , the acceleration of particle B relative to particle A is equal to



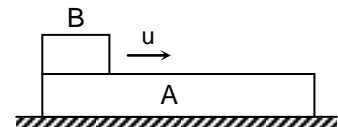
- (A) $\frac{F}{2m}$
 (B) $\frac{F - kx}{m}$
 (C) $\frac{F - 2kx}{m}$
 (D) $\frac{kx}{m}$

6. **C**

(Multiple 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.

7. 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 .

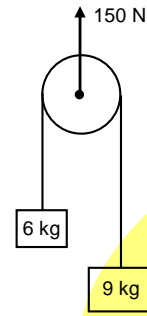


- (A) the blocks will reach a final common velocity $\frac{u}{3}$.
 (B) the time in which blocks reach a common velocity from just after projection is $\frac{2u}{3\mu g}$.
 (C) before the blocks reach a common velocity, the magnitude acceleration of A relative to B is $\frac{2}{3} \mu g$.
 (D) before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

7. **ABD**

8. 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.



8. **BD**

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

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



9. **BCD**

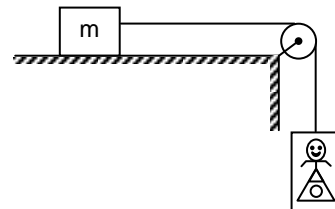
10. Which of the following are correct?

- (A) A parachutist of weight W strikes the ground with his legs and comes to rest with an upward acceleration of magnitude $3g$. Force exerted on him by ground during landing is $4W$.
 (B) Two massless spring balances are hung vertically in series from a fixed point and a mass M kg is attached to the lower end of the lower spring balance. Each spring balance reads M kgf.
 (C) A rough vertical board has an acceleration a along the horizontal direction so that a block of mass m pressing against its vertical side does not fall. The coefficient of friction between the block and the board is greater than g/a .
 (D) A man is standing at a weighing machine. If the man jumps away from it the reading of the weighing machine first increases and then decreases to zero.

10. **ABCD**

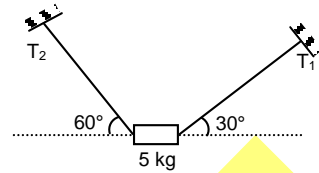
11. In the figure, a man of true mass M is standing on a weighing machine placed in a cabin. The cabin is joined by a string with a body of mass m . Assuming no friction, and negligible mass of cabin and weighing machine, the measured mass of man is (normal force between the man and the machine is proportional to the mass)

- (A) Measured mass of man is $\frac{Mm}{(M+m)}$
 (B) Acceleration of man is $\frac{mg}{(M+m)}$
 (C) Acceleration of man is $\frac{Mg}{(M+m)}$
 (D) Measured mass of man is M .



11. **AC**

12. 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) $T_2 = 25\sqrt{3} \text{ N}$

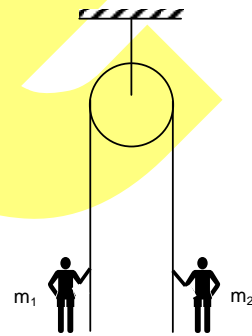


12. **AD**

13. The force exerted by the floor of an elevator on the foot of a person standing there is more than the weight of the person if the elevator is
 (A) going up and slowing down. (B) going up and speeding up.
 (C) going down and slowing down. (D) going down and speeding up.

13. **BC**

14. 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

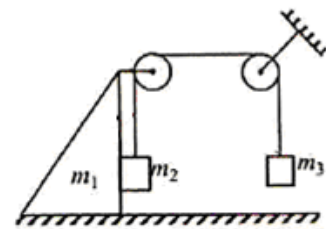


14. **ABD**

Comprehension Type
 Paragraph for question nos. 15 – 16

In the following figure both the pulleys and the string are massless and all the surfaces are frictionless.

Given: $m_1 = 1 \text{ kg}$, $m_2 = 2 \text{ kg}$, $m_3 = 3 \text{ kg}$



15. The tension in the string is:
 (A) $\frac{120}{7} \text{ N}$ (B) $\frac{240}{7} \text{ N}$ (C) $\frac{130}{7} \text{ N}$ (D) None of these

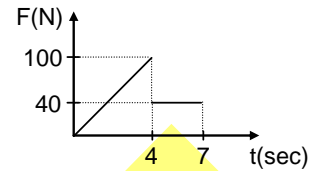
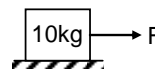
15. **A**

16. The acceleration of m_1 is:
 (A) $\frac{40}{7} \text{ m/s}^2$ (B) $\frac{30}{7} \text{ m/s}^2$ (C) $\frac{20}{7} \text{ m/s}^2$ (D) None of these

16. **A**

Paragraph for question nos. 17 – 18

The 10 kg block is resting on a horizontal surface when the force F is applied to it for 7 sec. The variation of force F with time is shown in the graph. The co-efficient of static and kinetic friction are both 0.50. ($g = 10 \text{ m/s}^2$)



17. The maximum velocity reached by block during motion is
 (A) 3 m/s (B) 20 m/s
 (C) 5 m/s (D) 16 m/s
17. **C**
18. The total time t during which the block is in motion
 (A) 5 sec (B) 7.4 sec
 (C) 7 sec (D) 3 sec
18. **B**

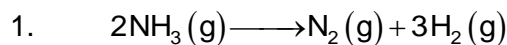
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Section – II (Chemistry)

PART – A

(Single Correct Choice Type)

This section contains 6 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which only ONE option is be correct.

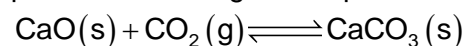


If the rate of above reaction is $0.4 \text{ mol L}^{-1}\text{s}^{-1}$ at a certain temperature, what will be the value of the rate of formation of H_2 gas in $\text{mol L}^{-1}\text{s}^{-1}$ unit?

- (A) 0.2 (B) $\frac{0.4}{3}$ (C) 1.2 (D) 0.6

1. **C**

2. If the equilibrium constant K_p of the following reaction is 0.2 atm^{-1} , what is the partial pressure of CO_2 gas at equilibrium?



- (A) 4 atm (B) 5 atm (C) 2 atm (D) 0.2 atm

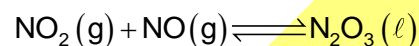
2. **B**

3. The half-life of a first order decomposition reaction is 8 min. What fraction of the reactant left undecomposed after 32 minutes from the start of the reaction?

- (A) $\frac{1}{4}$ (B) $\frac{1}{16}$ (C) $\frac{1}{32}$ (D) $\frac{1}{64}$

3. **B**

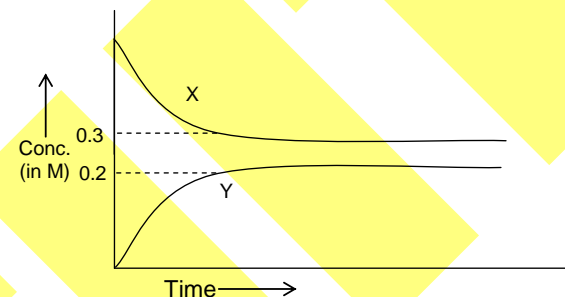
4. What is the unit of K_p of the following reaction?



- (A) atm (B) atm^{-2} (C) atm^2 (D) atm^{-1}

4. **B**

5.



What will be the value of equilibrium constant of the reaction for which graph is given above?



- (A) $\frac{1}{3}$ (B) $\frac{3}{2}$ (C) $\frac{2}{3}$ (D) $\frac{1}{2}$

5. **C**

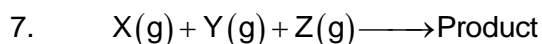
6. In the expression, $\ln \frac{K_{P_2}}{K_{P_1}} = \frac{X}{R} \left[\frac{T_2 - T_1}{T_1 T_2} \right]$, the term represented by 'X' is

- (A) entropy change (B) free energy change
(C) enthalpy change (D) work done

6. **C**

(Multiple 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.



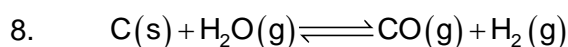
The rate equation of above reaction is expressed as:

$$\text{Rate} = \frac{k[X][Y]^2}{[Z]}$$

Choose correct statement(s) regarding the reaction.

- (A) The overall order of the reaction is two
 (B) The unit of rate constant is $\text{mol}^{-1} \text{L s}^{-1}$
 (C) The rate doubles if the concentration of 'X' is doubled keeping the conc. of other reactants fixed
 (D) the reaction rate increases by increasing the concentration of Z

7. **ABC**

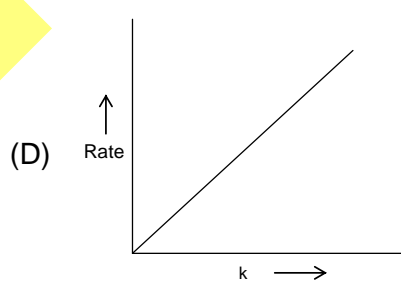
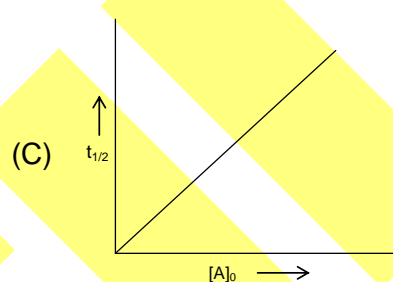
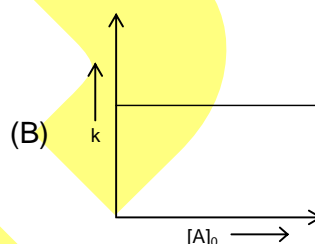
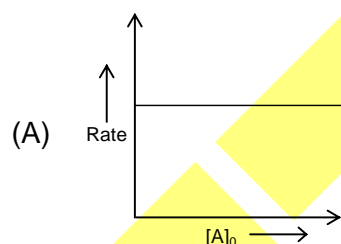


Under which of the following conditions the reaction will favour formation of CO and H₂ gases.

- (A) Decreasing pressure
 (B) Adding an inert gas at constant volume
 (C) Adding carbon
 (D) Removing H₂O(g)

8. **A**

9. Which of the following graph(s) is/are correct for a zero order reaction?



9. **ABCD**

10. For which of the following reaction $K_P = K_C$?

- (A) $S(s) + O_2(g) \rightleftharpoons SO_2(g)$
 (B) $3Fe(s) + 4H_2O(g) \rightleftharpoons Fe_3O_4(s) + 4H_2(g)$
 (C) $2Ca(s) + O_2(g) \rightleftharpoons 2CaO(s)$
 (D) $N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$

10. **ABD**

11. The correct statement(s) regarding a first order reaction is/are

- (A) $t_{75\%} = 2 \times t_{1/2}$
 (B) $t_{1/2}$ does not change as long as temperature is constant
 (C) rate constant and $t_{1/2}$ have same units
 (D) rate of reaction depends on concentration

11. **ABD**

12. NH_3 dissociates through the following reaction. $2\text{NH}_3(\text{g}) \rightleftharpoons \text{N}_2(\text{g}) + 3\text{H}_2(\text{g})$. Initially only NH_3 was taken in a container. When the reaction attained equilibrium, the molecular mass of the equilibrium mixture was found to be 11.33. The degree of dissociation (α) of NH_3 can be determined from the following relation.

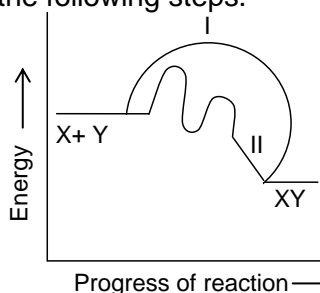
$$\alpha = \frac{D - d}{(n - 1)d}$$

'D' and 'd' are the initial and equilibrium vapour density terms respectively. Choose correct statements from the following.

- (A) The value of D is 17
 (B) The value of d is 5.665
 (C) ' α ' is 0.5
 (D) All the terms like D, d and α are unit less

12. **BCD**

13. The reaction between reactants X and Y produces product XY. The reaction can take place in the following steps.



Choose correct statement(s) regarding the reaction.

- (A) The rate of reaction is very slow through path – I as compared to other paths
 (B) Path – II has one intermediate
 (C) Path- II, is exothermic
 (D) Path – I is followed with the lowest activation energy

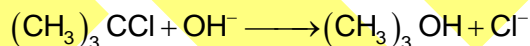
13. **ABC**

14. How does the direction of a reversible reaction change with ΔG ?

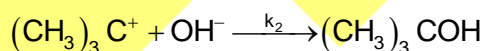
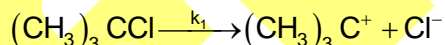
- (A) If $\Delta G < 0$, reaction proceeds along forward direction.
 (B) If $\Delta G > 0$, reaction proceeds towards backward direction.
 (C) If $\Delta G = 0$, reaction proceeds towards both direction with same rate.
 (D) If $\Delta G \gg 0$, $K_{\text{equ}^m} = 1$

14. **ABC**

Comprehension Type
 Paragraph for question nos. 15 – 16



The mechanism of above reaction is given below



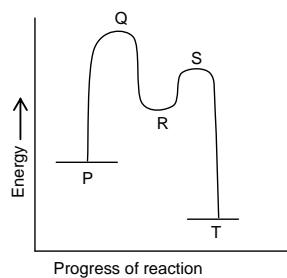
Answer the following questions on the basis of above write up.

15. Which of the following has the lowest value?

- (A) $\frac{d[(\text{CH}_3)_3\text{COH}]}{dt}$ (B) $\frac{d[(\text{CH}_3)_3\text{C}^+]}{dt}$ (C) $\frac{d[\text{OH}^-]}{dt}$ (D) All are equal

15. **B**

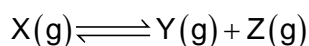
16.



What position will $(\text{CH}_3)_3\text{C}^+$ occupy in the above energy profile of above reaction?

16. (A) P (B) Q (C) R (D) S
C

Paragraph for question nos. 17 – 18



Above reaction takes place in a one litre vessel at a certain temperature.

The equilibrium constant K_c is 8 mol L^{-1} .

17. If two moles of X, two moles of Y and 4 moles of Z are taken in a one litre vessel, the reaction will proceed
 (A) towards forward direction (B) towards backward direction
 (C) towards both direction (D) unpredictable
17. **A**
18. What will be the concentration of X (approximately) at equilibrium is
 (A) 1.5 (B) 3 (C) 6 (D) 8
18. **A**

space for rough work

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

This section contains 6 **multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which only **ONE** option is be correct.

1. The equation of the tangent to the curve $y = 4 + \sin^2 x$ at $x = 0$ is

- (A) $y = 2$ (B) $y = 3$
(C) $y = 4$ (D) $y = 6$

1. **C**

2. The function $f(x) = 2x^3 - 9x^2 + 12x + 4$ is decreasing in the interval(s)

- (A) $(-\infty, 1)$ and $(2, \infty)$ (B) $(-\infty, 1)$ only
(C) $(1, 2)$ (D) $(2, \infty)$ only

2. **C**

3. The angle of intersection of the curves $y = x^2$ and $6y = 7 - x^3$ at $(1, 1)$ is

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

3. **C**

4. Let $f(x) = x^3 + 3x^2 + 3x + 2$. Then at $x = -1$

- (A) $f(x)$ has a local maximum (B) $f(x)$ has a local minimum
(C) $f'(x)$ has a local maximum (D) $f'(x)$ has a local minimum

4. **D**

5. Let $f'(x) > 0$ and $g'(x) < 0$ for all $x \in \mathbb{R}$, then:

- (A) $f\{g(x)\} > f\{g(x+1)\}$ (B) $f\{g(x)\} > f\{g(x-1)\}$
(C) $g\{f(x)\} < g\{f(x+1)\}$ (D) $g\{f(x)\} > g\{f(x-1)\}$

5. **A**

6. The necessary condition for $x = a$ to be local extremum for a differentiable function $f(x)$ is

- (A) $f'(a) = 0$ and it is sufficient (B) $f''(a) = 0$ and it is sufficient
(C) $f'(a) = 0$ but it is not sufficient (D) $f'(a) = 0$ and $f''(a) < 0$

6. **C**

(Multiple 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.

7. Which of the following statements is/are correct?
 (A) $x + \sin x$ is an increasing function
 (B) $\sec x$ is neither increasing nor decreasing
 (C) $x + \sin x$ is decreasing function
 (D) $\sec x$ is an increasing function

7. **AB**

8. If $f(x) = \tan^{-1} x - \left(\frac{1}{2}\right) \ln x$. Then

- (A) the greatest value of $f(x)$ on $\left[\frac{1}{\sqrt{3}}, \sqrt{3}\right]$ is $\frac{\pi}{6} + \left(\frac{1}{4}\right) \ln 3$
 (B) the least value of $f(x)$ on $\left[\frac{1}{\sqrt{3}}, \sqrt{3}\right]$ is $\frac{\pi}{3} - \left(\frac{1}{4}\right) \ln 3$
 (C) $f(x)$ decreases on $(0, \infty)$
 (D) $f(x)$ increases on $(-\infty, 0)$

8. **ABC**

9. The critical points of the function $f(x) = (x - 2)^{2/3} (2x + 1)$ occur when the value of x is
 (A) -1 (B) 2
 (C) $-\frac{1}{2}$ (D) 1

9. **BD**

10. Which of the following is correct?

- (A) $e^2 > 2^e$ (B) $e^3 > 3^e$
 (C) $e^\pi > \pi^e$ (D) $\sqrt{e^\pi} > \left(\frac{\pi}{2}\right)^e$

10. **ABCD**

11. The angle between tangents to the curves $y = x^2$ and $x = y^2$ at $(1, 1)$ is:

- (A) $\cos^{-1} \frac{4}{5}$ (B) $\sin^{-1} \frac{3}{5}$
 (C) $\tan^{-1} \frac{3}{4}$ (D) $\tan^{-1} \frac{1}{3}$

11. **ABC**

12. Let $f(x)$ be an increasing function defined on $(0, \infty)$. If $f(2a^2 + a + 1) > f(3a^2 - 4a + 1)$, then the possible integers in the range of a is/are:
 (A) 1 (B) 2
 (C) 3 (D) 4

12. **BCD**

13. If the line $ax + by + c = 0$ is a normal to the curve $xy = 1$. Then:
 (A) $a > 0, b > 0$ (B) $a > 0, b < 0$
 (C) $a < 0, b > 0$ (D) $a < 0, b < 0$

13. **BC**

14. Which of the following functions are decreasing on $\left(0, \frac{\pi}{2}\right)$ entirely?
 (A) $\cos x$ (B) $\cos 2x$
 (C) $\cos 3x$ (D) $\tan x$

14. **AB**

Comprehension Type
Paragraph for question nos. 15 – 16

Let $f(x)$ is a cubic polynomial which has local maximum at $x = -1$, $f(2) = 18$, $f(1) = -1$ and $f'(x)$ has local minima at $x = 0$.

15. The cubic polynomial $f(x)$ is

- (A) $\frac{1}{8}(x^3 + 45x - 54)$ (B) $(x^3 - x - 1)$
 (C) $x^3 + x^2 + 9x - 12$ (D) $\frac{1}{4}(19x^3 - 57x + 34)$

15. **D**

16. $f(x)$ has local minimum at

- (A) $x = 0$ (B) $x = 1$
 (C) $x = 2$ (D) $x = -\sqrt{2}$

16. **B**

Paragraph for question nos. 17 – 18

Let $g(x)$ be a non – constant twice differentiable function defined on \mathbb{R} (the set of all real numbers) such that $y = g(x)$ is symmetric about the line $x = 2$ and $g(-2) = g'\left(\frac{1}{2}\right) = g'(1) = 0$.

17. The value of $g(6)$ equals:

- (A) $\frac{1}{2}$ (B) 1
(C) 2 (D) 0

17. **D**

18. The minimum number of roots of the equation $g''(x) = 0$ in the interval $(0, 4)$ equals:

- (A) 4 (B) 6
(C) 8 (D) 10

18. **A**

space for rough work

FIITJEE INTERNAL TEST

COMMON TEST – II

Batches:

IIT- JEE 2022

ANSWERS

SECTION – I (Chemistry)
Part – A

SECTION – II (Physics)
Part – A

SECTION – III (Mathematics)
Part – A