

## JEE Main 30 January 2023 Shift 2 Memory-Based Questions



- $\lim_{n \rightarrow \infty} \frac{3}{n} \left( 4 + \left( 2 + \frac{1}{n} \right)^2 + \left( 2 + \frac{2}{n} \right)^2 + \dots + \left( 3 - \frac{1}{n} \right)^2 \right) = ?$
- A common tangent is drawn to  $y^2 = 16x$  and  $x^2 + y^2 = 8$ . Find the square of the distance between the points of contact of the common tangent on both the curves.
- If  $|a| = 1$ ,  $|b| = 2$ , scalar product  $a \cdot b = 4$ , and  $c = 2(a \times b) \cdot 3b$ , then find the scalar product of  $b$  and  $c$ .
- What is the number of 7-digit odd numbers that can be formed using these seven digits: 1, 2, 2, 2, 3, 3, 5
- 50th root of  $x$  is 12 and 50th root of  $y$  is 18. If  $x + y$  is divided by 25, what will be the remainder?
- What is the maximum number of electrons in  $n = 4$  shell?
- BOD of a water sample is 4 ppm. Select the correct option about the given sample of water:
  - It is highly polluted water.
  - It is clean water.
  - The concentration of oxygen in the given sample is very less.
  - None of these.
- Which of the following chloride is more soluble in organic solvent?  
Be, K, Ca, Mg
- Two Arithmetic Progressions are given as follows:  
3, 7, 11, ... and 1, 6, 11, 16, ...  
Find the 8th common term that appears in both the series.
- A car travels 4 km distance with a speed of 3 km/hr and the next 4 km with a speed of 5 km/hr. Find the average speed of the car.
- A circuit was given and the resistance between the two terminals was asked. There were a total of 10 resistances arranged in series as well as parallel.
- A current 2A is flowing through the sides of an equilateral triangular loop of side  $4\sqrt{3}$ . Find the magnetic field induction at the centroid of the triangle.
- A particle is released from a height equal to the radius of the earth above the surface of the earth. Find its velocity when it hits the surface of the earth.
- A faulty scale reads  $5^\circ\text{C}$  at the melting point and  $95^\circ\text{C}$  at the steam point. Find the original temperature if this faulty scale reads  $41^\circ\text{C}$ .
- A pulley is fixed horizontally on a wall. The string carrying a mass of  $\sqrt{3}$  kg passing over the pulley makes an angle of  $30^\circ$  with the wall. If the mass stays in an equilibrium position in this arrangement, find the tension in the string.

16. Two waves of the same intensity from sources in phase are made to superimpose at a point. If the path difference between these two coherent waves is zero, then the resultant intensity is  $I_0$ . If this path difference is  $\lambda/2$  where  $\lambda$  is the wavelength of these waves, then the resultant intensity  $I_1$  and if this difference is  $\lambda/4$ , then the resultant intensity is  $I_2$ . Find the value of  $[ I_0 / ( I_1 + I_2 ) ]$
17. A point charge  $Q$  is placed inside a cavity made in a uniform conducting solid sphere. If  $E_A$ ,  $E_B$ , and  $E_C$  are electric charges at points A (inside the cavity), B (outside the cavity but inside the conducting sphere) and C (outside the conducting sphere). Then, state if  $E_A$ ,  $E_B$ , and  $E_C$  are equal to zero or not.
18. A mass  $m$  is connected by a spring with spring constant  $k$  on a smooth horizontal surface. When it is set into oscillations along the spring, it has an angular frequency of  $\omega_1$  if  $m = 1$  kg and  $\omega_2$  if  $m = 2$  kg. Find the value of  $\omega_1/\omega_2$ .
19. Arrange the following compounds in the correct order of their bond strength.  
 $H_2O$ ,  $H_2S$ ,  $H_2Se$ ,  $H_2Te$
20. Find the correct order of the acidic strength of the given compounds. (The compounds were diagrammatically represented.)
21. What is Cl-O-Cl bond angle in  $[CO(NH_3)Cl_3]$ ?
22. Arrange the following compounds in the decreasing order of their stability. (The compounds were diagrammatically represented.)
23. Arrange the following compounds in the decreasing order of their  $S_N1$  reactions. (The compounds were diagrammatically represented.)
24. A lead storage battery has 38% (w/w)  $H_2SO_4$ . Find the temperature at which the liquid of the battery will freeze if  $i = 2.67$  and  $k_f$  of water = 1.86 K kg/mol.
25. If  $KMnO_4$  oxidizes  $I^-$  in acidic and neutral mediums, then which products are formed?
26. Which of the following equation is correct?  
 i.  $LiNO_3 \rightarrow Li + NO_2 + O_2$   
 ii.  $LiNO_3 \rightarrow LiNO_2 + O_2$   
 iii.  $LiNO_3 \rightarrow Li_2O + NO_2 + O_2$   
 iv.  $LiNO_3 \rightarrow Li_2O + N_2O_4 + O_2$
27. Match the following.

$Ni(CO)_4$	$sp^3$
$[Ni(CN)_4]^{2-}$	$sp^3d^2$
$[Cu(H_2O)_6]^{2+}$	$d^2sp^3$
$[Fe(CN)_6]^{4-}$	$dsp^2$

28. Let  $f(x) = \sqrt{3-x} + \sqrt{x+2}$ . Find the range of  $f(x)$ .
29. If  $\frac{dy}{dx} = -\frac{3x^2+y^2}{3y^2+x^2}$  and  $y(1) = 0$ , then find  $f(x)$ .
30. If  $A = \{2, 4, 6, 8, 10\}$ , then the total number of functions defined on  $A$  such that  $F(m \cdot n) = F(m) \cdot F(n)$ ,  $m, n \in A$  are ...?

31. If the area bounded by the curves  $y = x^2$ ,  $y = (1 - x)^2$ , and  $y = 2x(1 - x)$  is  $A$ , then find the value of  $540A$ .
32. If  $a_1 = 1$  and  $a_i$  are consecutive natural numbers, find:  $\tan^{-1} [ 1 / (1 + a_1 a_2) ] + \tan^{-1} [ 1 / (1 + a_2 a_3) ] + \dots + \tan^{-1} [ 1 / (1 + a_{2021} a_{2022}) ]$ .
33. Let  $p = I$  am well;  $q = I$  will not take rest; and  $r = I$  will not sleep properly, then what is the logical equivalent of "If I am not well then I will not take rest properly and I will not sleep properly."
34.  $q$  is the maximum value of  $P$  lying in the interval  $[0, 10]$ . The roots of  $x^2 - Px + 5P/4 = 0$  has rational roots. Find the area of the region  $S: \{ 0 \leq y \leq (x - q)^2 \}$ .
35. Let  $a = \{ 1, 3, 5, \dots, 99 \}$  and  $b = \{ 2, 4, 6, \dots, 100 \}$ . Find the number of ordered pairs  $(a, b)$  such that  $a + b$  when divided by 23 leaves remainder 2.

